The U. S. Geological Survey, Digital Spectral Library: Version 1: 0.2 to 3.0 μm

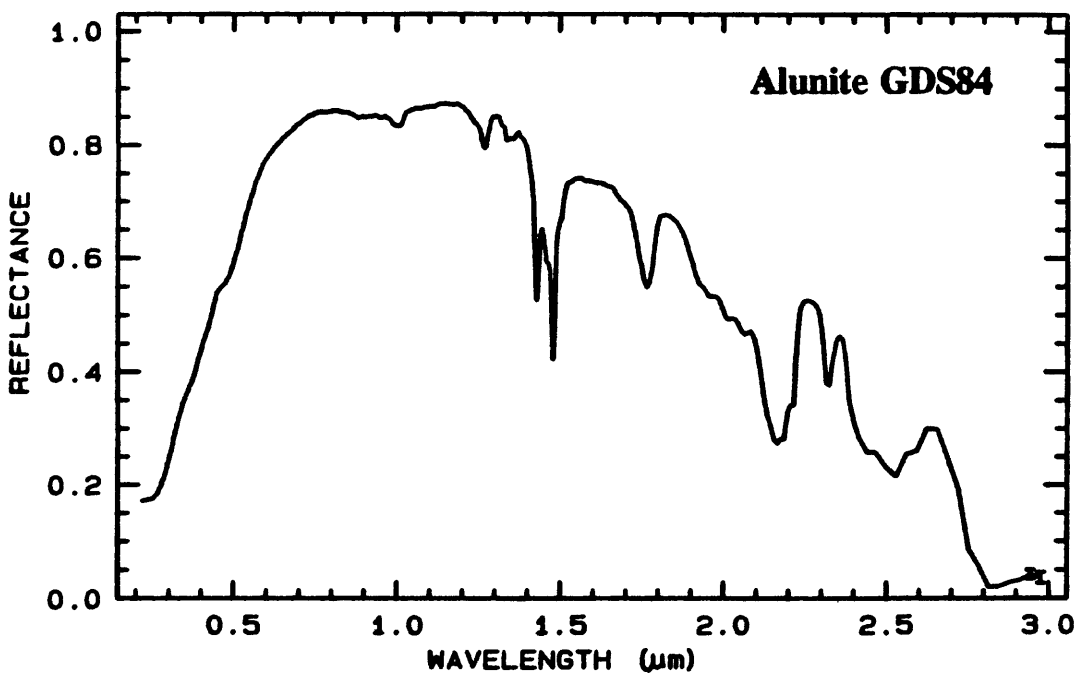
Roger N. Clark, Gregg A. Swayze, Andrea J. Gallagher,

Trude V.V. King, and Wendy M. Calvin

U.S. Geological Survey

Open File Report 93-592

1993



Volume 1: A - C

The U. S. Geological Survey, Digital Spectral Library: Version 1: 0.2 to 3.0 μm

Roger N. Clark[1], Gregg A. Swayze[1], Andrea J. Gallagher[1],

Trude V.V. King[1], and Wendy M. Calvin[2]

U.S. Geological Survey, Open File Report 93-592

1326 Pages
499 Figures
5 Tables

[1] U.S. Geological Survey, MS 964
Box 25046 Federal Center
Denver, CO 80225-0046

[2] U.S. Geological Survey
2255 N. Gemini Dr.
Flagstaff, AZ 86001

For further information, contact:

Roger N. Clark at (303) 236-1332 (office)
(303) 236-1425 (FAX)
rclark@speclab.cr.usgs.gov (Internet mail)

Labradorite HS105 Plagioclase	L1
Labradorite HS17	L4
Laumontite GDS5 Zeolite	L7
Lazurite HS418	L9
Lepidocrosite GDS80 (Sy)	L11
Lepidolite HS167	L14
Lepidolite NMNH105538	L17
Lepidolite NMNH105543	L19
Lepidolite NMNH88526-1	L21
Lepidolite NMNH105541	L23
Limonite HS41	L25
Lizardite NMNHR4687	L28
Maghemite GDS81 Sy	M1
Magnesite+Hydromagnesite HS47	M4
Magnetite HS195	M7
Magnetite HS78	M10
Malachite HS254	M13
Manganite HS138	M16
Margarite GDS106	M18
Marialite NMNH126018-2	M20
Mascagnite GDS65 Ammon Sulfate	M23
Meionite WS700	M27
Meionite WS701	M30
Mesolite+Hydroxyapophyll. GDS6	M33
Microcline HS82	M35
Microcline HS103 Feldspar	M38
Microcline HS107 Feldspar	M41
Microcline HS108 Feldspar	M44
Microcline HS151 Feldspar	M47
Microcline NMNH135231	M50
Mirabilite GDS150	M52
Mizzonite NMNH113775-1	M55
Mizzonite BM1931,12 Scapolite	M58
Mizzonite HS350 Scapolite	M61
Mizzonite HS351 Scapolite	M64
Monazite HS255	M67
Monticellite HS339	M70
Montmorillonite SWy-1	M73
Montmorillonite SAz-1	M76
Montmorillonite SCa-2	M79
Montmorillonite CM27	M83
Montmorillonite CM20	M86
Montmorillonite CM26	M89
Montmorillonite STx-1	M92
Montmorillonite+Illite CM37	M95
Montmorillonite+Illite CM42	M98
Mordenite GDS18	M101
Mordenite+Clinopt. GDS151	M103
Muscovite GDS107	M105
Muscovite GDS108	M107
Muscovite GDS111	M110
Muscovite GDS113	M113

Muscovite GDS114	M116
Muscovite GDS116	M119
Muscovite GDS117	M122
Muscovite GDS118	M125
Muscovite GDS119	M128
Muscovite GDS120	M131
Muscovite HS146	M134
Muscovite HS24	M137
Muscovite IL107	M140
Nacrite GDS88	N1
Natrolite HS169	N4
Natrolite+Zeolites HS168	N7
Natrolite NMNH83380 Zeolite	N10
Neodymium_Oxide GDS34	N12
Nepheline HS19	N15
Nephrite HS296 Amphibole	N18
Niter GDS43	N21
Nontronite GDS41	N23
Nontronite NG-1	N26
Nontronite SWa-1	N30
Oligoclase HS110 Plagioclase	O1
Oligoclase HS143 Plagioclase	O4
Olivine NMNH137044 Fo92	O6
Olivine GDS70 Fo89	O10
Olivine HS285 Fo80	O16
Olivine HS420	O19
Olivine KI3005 Fo11	O22
Olivine KI3054 Fo66	O25
Olivine KI3188 Fo51	O28
Olivine KI3189 Fo60	O31
Olivine KI3291 Fo29	O34
Olivine KI3377 Fo18	O37
Olivine KI4143 Fo41	O40
Olivine GDS71 Fo91	O43
Opal WS732	O47
Opal (Hyalite) TM8896	O49
Orthoclase NMNH113188	O52
Orthoclase NMNH142137	O54
Orthoclase HS13	O56
Palygorskite CM46 Attapulgite	P1
Palygorskite PFL-1 Attapulgite	P4
Paragonite GDS109	P6
Pectolite NMNH94865	P9
Perthite HS415	P13
Phlogopite GDS20	P16
Phlogopite HS23	P19
Phlogopite WS496	P22
Phlogopite WS675	P25
Pigeonite HS199	P27
Pinnoite NMNH123943	P30

Vermiculite VTx-1	V3
Vermiculite WS681	V7
Vesuvianite HS446 Idocrase	V9
Witherite HS273	W1
Wollastonite HS348	W4
Zincite+Franklinite HS147	Z1
Zircon WS522	Z4
Zoisite HS347	Z6
Aspen_Leaf-A DW92-2	PLANT1
Aspen_Leaf-B DW92-3	PLANT3
Blackbrush ANP92-9A	PLANT5
Blue_Spruce DW92-5	PLANT7
Cheatgrass ANP92-11A	PLANT9
Dry_Long_Grass AV87-2 (Brown)	PLANT11
Fir_Tree IH91-2	PLANT13
Juniper_Bush IH91-4B	PLANT15
Lawn_Grass GDS91	PLANT17
Maple_Leaves DW92-1	PLANT19
Pinon_Pine ANP92-14A	PLANT21
Rabbitbrush ANP92-27	PLANT23
Russian_Olive DW92-4	PLANT25
Sage_Brush IH91-1B	PLANT27
Saltbrush ANP92-31A	PLANT29
Tumbleweed ANP92-2C	PLANT31
Walnut_Leaf SUN	PLANT33

ABSTRACT

We have developed a digital reflectance spectral library, with management and spectral analysis software. The library includes 498 spectra of 444 samples (some samples include a series of grain sizes) measured from approximately 0.2 to 3.0 μm. The spectral resolution (Full Width Half Maximum) of the reflectance data is $\leq$ 4 nm in the visible (0.2-0.8 μm) and $\leq$ 10 nm in the NIR (0.8-2.35 μm). All spectra were corrected to absolute reflectance using an NIST Halon standard. Library management software lets users search on parameters (e.g. chemical formulae, chemical analyses, purity of samples, mineral groups, etc.) as well as spectral features.

Minerals from borate, carbonate, chloride, element, halide, hydroxide, nitrate, oxide, phosphate, sulfate, sulfide, sulfosalt, and the silicate (cyclosilicate, inosilicate, nesosilicate, phyllosilicate, sorosilicate, and tectosilicate) classes are represented. X-Ray and chemical analyses are tabulated for many of the entries, and all samples have been evaluated for spectral purity. The library also contains end and intermediate members for the olivine, garnet, scapolite, montmorillonite, muscovite, jarosite, and alunite solid-solution series. We have included representative spectra of H_2O ice, kerogen, ammonium-bearing minerals, rare-earth oxides, desert varnish coatings, kaolinite crystallinity series, kaolinite-smectite series, zeolite series, and an extensive evaporite series. Because of the importance of vegetation to climate-change studies we have include 17 spectra of tree leaves, bushes, and grasses.

The library and software are available as a series of U.S.G.S. Open File reports. PC user software is available to convert the binary data to ascii files (a separate U.S.G.S. open file report). Additionally, a binary data files are on line at the U.S.G.S. in Denver for anonymous ftp to users on the Internet. The library search software enables a user to search on documentation parameters as well as spectral features. The analysis system includes general spectral analysis routines, plotting packages, radiative transfer software for computing intimate mixtures, routines to derive optical constants from reflectance spectra, tools to analyze spectral features, and the capability to access imaging spectrometer data cubes for spectral analysis. Users may build customized libraries (at specific wavelengths and spectral resolution) for their own instruments using the library software.

We are currently extending spectral coverage to 150 μm. The libraries (original and convolved) will be made available in the future on a CD-ROM.

INTRODUCTION

Analysis of spectroscopic data from the laboratory, from aircraft, and from spacecraft requires a knowledge base. The spectral library discussed here forms a knowledge base for the spectroscopy of minerals and related materials of importance to a variety of research programs being conducted at the U. S. Geological Survey. Much of this library grew out of the need for spectra to support imaging spectroscopy studies of the Earth and Planets.

Imaging spectrometers, such as the Airborne Visible/Infra-Red Imaging Spectrometer (AVIRIS), have narrow band widths in many contiguous spectral channels that permit accurate definition of absorption features from a variety of materials. Identification of materials from such data requires a knowledge base: a comprehensive spectral library of minerals, vegetation, man-made materials, and other subjects in the scene.

Our research involves the use of the spectral library to identify the components in a spectrum of an unknown. Therefore, the quality of the library must be very good. However, the quality required in a spectral library to successfully perform an investigation depends on the scientific questions to be answered and the type of algorithms to be used. For example, to map a mineral using imaging spectroscopy and the Clark et al. (1990) mapping algorithm, one simply needs a diagnostic absorption band. Such a feature can be obtained from a spectrum of a sample containing large amounts of contaminants, including those that add other spectral features, as long as the shape of diagnostic feature of interest is not modified. If, however, the data are needed for radiative transfer models to derive mineral abundances from reflectance spectra, then completely uncontaminated spectra are required. This library contains spectra that span a range of quality, with purity indicators to flag spectra for (or against) particular uses.

Acquiring spectral measurements and sample characterizations for this library has taken about 8 years. This first release contains 498 spectra of 444 samples. Software to manage the library and provide scientific analysis capability is also provided (Clark, 1980, 1993, Gorelick and Clark, 1993). A personal computer (PC) reader for the library is also available (Livo et al., 1993).

This document describes the contents of the library and presents a paper copy of the spectra in the form of plots and written text showing the documentation. The intent of the paper copy is as a reference document. You can look up specific documentation, or examine and compare plots of various spectra. It is not intended to be completely cross referenced and easily searchable--that is what computers are for. This paper copy is a print-out of the digital data set. However, this is a *digital* spectral library; searches for spectra and information should be carried out with the aid of a computer and not on the paper copy. The section on availability describes the details for obtaining digital data.

WHAT IS AN IDEAL SPECTRAL LIBRARY?

In our view, an ideal spectral library consists of pure samples, covering a very wide range of materials, a large wavelength range with very high precision, and sample analysis and documentation to establish the quality of the spectra. Budgets, time, and available equipment limit what can be achieved.

Ideally, for minerals, the sample analysis would include X-ray diffraction (XRD), electron microprobe (EM) or X-ray Fluorescence (XRF), and petrographic microscopic analyses. For some minerals, like iron oxides, additional analyses, such as Mossbauer, would be helpful. We have found that to make the basic spectral measurements, provide XRD, EM or XRF, microscopic analysis, document the results, and complete an entry of one spectral library sample, takes about one person-week. Additional spectra of the same sample (e.g. a grain size series) increases the time, but usually not an additional week per spectrum, but more like 0.5 day per spectrum (mostly sample preparation). We had hoped as our experience increased this time would decrease, but it did not.

Thus an ideal spectral library with 498 spectra of 444 samples would take on the order of 444 person-weeks, or about 8.9 person-years. Our budgets and time commitment have not allowed this level of effort, so this release of the library does not have all samples completely characterized. We estimate, however, that this release represents about 7.5 person-years of effort. The characterization of samples will continue as our budgets allow, and results will be added in future releases of the database. Latest updates on the characterization (e.g. new XRD analyses and spectral purity revisions) will be kept online for anonymous ftp on the Internet.

The ideal spectral coverage depends on the desired research. This release covers the range 0.2 to 3.0 μm. Future releases will include coverage to 150 μm for many of the samples listed here.

THE SPECTRAL LIBRARY

The spectral library contains spectra of 423 minerals, 17 plants and some miscellaneous materials (Table 1, 2, and 3). In some cases, several spectra were measured to span a solid solution series and/or a grain size series. We tried to include spectra of all mineral classes, particularly those important to imaging spectroscopy remote sensing. In other cases, we have studied particular solid solution series because we are mapping them in the field with imaging spectroscopy or studying that mineral in detail. This explains, for example, why there are so many alunite, olivine, and topaz samples in the database. Future releases of the database will likely include additional spectra of solid solution series.

All spectra were run on a modified Beckman 5270 spectrometer (Clark *et al.*, 1990b) from 0.2 to 3.0 μm and corrected to absolute reflectance. They were run with a signal-to-noise of at least 500 at a reference reflectance level of 1.0. A few minerals were also run over a slightly smaller wavelength range because of sample size limitations. For example, small sample quantities, necessary for purity, were measured using apertures in the beam to restrict the spot size of the spectrometer. This reduced light made integration times longer and the achievable range was sometimes reduced, typically to 0.3 to 2.7 μm. This also, in some cases, limited the signal to noise that was achievable. It is not possible with the current instrumentation to substantially improve the spectral data on small volume samples. The ice sample, measured at 77K, only includes the infrared range, 0.8 to 3.0 μm.

Sample Documentation

Each sample has a text entry describing the mineral, its composition, its formula, sample description, and pointers to corresponding spectra in the digital data file. The text entry is coded by keywords for computer program searching. Each spectrum has a pointer to the documentation, so that all related data are properly cross-referenced and can be found by a computer program as well as manually.

The sample documentation is organized by keyword so that it is computer readable. The program spsearch (Gorelick and Clark, 1993) may be used to search entries in the database. With this software, it is possible to do searches such as: show me all the entries whose sample formulae have OH (hydroxyl), whose compositions contain from 20 to 30% SiO_2, and have a 2.2-μm band in their spectra.

The sample documentation includes extensive analyses such as X-ray diffraction, electron microprobe or XRF, X-ray fluorescence, and petrographic microscope examination. Not all analyses have been completed for all samples, but most samples have at least one analysis.

Sample Naming

The mineral name for each sample occurs in 3 places: 1) the specpr title field for the spectrum, 2) the specpr title field for the description entry, and 3) after the "MINERAL:" keyword in the description. We have tried to use only proper mineral names as given in Fleischer 1980, and Klein and Hurlbut, 1985. Some users of the library may be unfamiliar with all the mineral names. For example, if you want to find all scapolites, you would have to know that Dipyre was a scapolite if you only looked at the specpr title fields. Because of the 40 character limit in a specpr title field, we could not include all common names there. However, use the "MINERAL:" keyword in the description for each sample. Here you could search for scapolite and you would find all entries in the "scapolite group" (Dipyre, Marialite, Meionite, and Mizzonite).

We have used specific mineral names except in a few cases where we still do not have sufficient data. For example, technically, there is no "hornblende," only ferro-hornblende and magnesio-hornblende. We have two samples where we can't make the distinction, so they are labeled hornblende.

The Digital Data File

The digital spectral library data are all included in one file in "specpr" format (see Clark, 1993). This file, splib04a, has been assembled and managed using specpr and is 8.2 megabytes in size (3.9 megabytes when compressed with the Unix compress command). The data are in IEEE binary floating point format. The entire library is assembled, plotted and printed by command files consisting of 1300 Unix shell commands, which in turn generate an additional 100 Unix shell commands which generate about 44,000 specpr commands plus about 6000 specpr commands for each instrument convolved library.

Specpr runs on Unix workstations. If the binary file is read on an IBM-PC compatible machine, the floating point numbers need their bytes swapped (this is done in the Livo et al., 1993 program). An ascii version is 15.8 megabytes uncompressed, or about 5.4 megabytes when compressed with the unix compress command.

The organization of the binary data file, in the form of a specpr listing, is shown in Table 4. The listing shows the record number, title, length of the data set (number of channels for spectra; number of bytes for text), and the time and date of data acquisition. Record 6 contains the wavelength set for the spectra, and record 8 contains the the spectral resolution data set. The resolution is shown in Figure 1. Entries with the keyword "DESCRIPT" are sample description records, and contain all the sample documentation. After the DESCRIPT are (usually) two empty records (title ..) for future expansion of the description. Next comes the reflectance data, with the keyword "ABS REF." The identifier "W1R1Bx," which signifies the wavelength range, resolution, spectrometer, and spectral purity which is described below (the "x" is a lower case spectral purity letter code). This release of the spectral library has only one spectral region (W1), resolution (R1) and spectrometer (B). After the reflectance record is the "errors to previous data" record. These are the standard deviation of the mean for each reflectance value. The next record in the listing contains the feature analysis for the spectrum. This feature analysis was done using the specpr f45 special function and is described in Clark et al. (1987), Clark (1993).

In the spectral library, any value of -1.23×10^{34} is considered a deleted point. Because of the inherent floating point inaccuracies of single precision numbers on various computers, values in the range -1.23001×10^{34} to -1.22999×10^{34} should be considered deleted points.

Table 1: Spectral Library Entries

Minerals:

1 Acmite	1 Elbaite	2 Oligoclase
5 Actinolite	1 Endellite	12 Olivine
1 Adularia	1 Enstatite	2 Opal
3 Albite	2 Epidote	3 Orthoclase
1 Allanite	1 Epsomite	2 Palygorskite
6 Almandine	2 Erionite	1 Paragonite
6 Alunite	1 Eugsterite	1 Pectolite
1 Ammonioalunite	1 Europium	4 Phlogopite
1 Ammoniojarosite	1 Fassaite	1 Pigeonite
1 Ammonium_Chloride	1 Ferrihydrite	1 Pinnoite
1 Ammonium_Illite/Smectite	1 Ferro-Hornblende	1 Pitch
1 Ammonium_Smectite	2 Ferroan Clinochlore	1 Plumbojarosite
1 Amphibole	1 Fluorapatite	1 Polyhalite
1 Analcime	6 Galena	1 Praseodymium
1 Andalusite	1 Gaylussite	1 Prochlorite
1 Andesine	2 Gibbsite	1 Psilomelane
5 Andradite	1 Glauconite	5 Pyrite
1 Anhydrite	1 Glaucophane	1 Pyrope
2 Annite	4 Goethite	2 Pyrophyllite
3 Anorthite	5 Grossular	1 Pyrrhotite
1 Anthophyllite	2 Gypsum	4 Quartz
2 Antigorite	1 Halite	2 Rectorite
1 Arsenopyrite	5 Halloysite	2 Rhodochrosite
4 Augite	1 Hectorite	2 Rhodonite
1 Axinite	2 Hedenbergite	2 Richterite
1 Azurite	6 Hematite	2 Riebeckite
1 Barite	2 Heulandite	1 Rivadavite
1 Bassanite	1 Holmquistite	1 Roscoelite
2 Beryl	2 Hornblende	2 Rutile
1 Biotite	1 Howlite	1 Samarium
1 Bloedite	1 Hydrogrossular	2 Sanidine
1 Bronzite	1 Hydroxylapatite	1 Saponite
1 Brookite	2 Hypersthene	1 Sauconite
1 Brucite	1 Ice (water)	1 Scolecite
2 Buddingtonite	4 Illite	2 Sepiolite
1 Butlerite	1 Ilmenite	2 Serpentine
1 Bytownite	1 Jadeite	1 Siderite
3 Calcite	7 Jarosite	1 Siderophyllite
1 Carbon	1 Kainite	1 Sillimanite
2 Carnallite	8 Kaolinite	1 Smaragdite
1 Carphosiderite	5 Kaolinite/Smectite	1 Sodium
1 Cassiterite	2 Labradorite	4 Spessartine
1 Celestite	1 Laumontite	5 Sphalerite
1 Celsian	1 Lazurite	1 Spodumene
1 Chabazite	1 Lepidocrosite	1 Staurolite
1 Chalcedony	5 Lepidolite	2 Stilbite
2 Chalcopyrite	1 Limonite	1 Strontianite
1 Chert	1 Lizardite	1 Sulfur
1 Chlorapatite	1 Maghemite	1 Syngenite
2 Chlorite	1 Magnesio-Hornblende	4 Talc
1 Chromite	1 Magnesite	1 Teepleite

1 Chrysocolla	2 Magnetite	1 Tephroite
1 Chrysotile	1 Malachite	2 Thenardite
1 Cinnabar	1 Manganite	1 Thuringite
2 Clinochlore	1 Margarite	1 Tincalconite
2 Clinoptilolite	1 Marialite	1 Titanite
1 Clinozoisite	1 Mascagnite	18 Topaz
1 Clintonite	2 Meionite	1 Tourmaline
1 Cobaltite	1 Mesolite	2 Tremolite
1 Colemanite	1 Mg-Clinochlore	1 Trona
1 Cookeite	7 Microcline	2 Ulexite
1 Copiapite	1 Mirabilite	1 Uralite
1 Coquimbite	4 Mizzonite	1 Uvarovite
1 Cordierite	1 Monazite	3 Vermiculite
1 Corrensite	1 Monticellite	1 Vesuvianite
1 Corundum	9 Montmorillonite	1 Witherite
1 Covellite	1 Mordenite	1 Wollastonite
1 Cronstedtite	1 Mordenite+Clinoptilolite	1 Zincite
1 Cummingtonite	13 Muscovite	1 Zircon
1 Cuprite	1 Nacrite	1 Zoisite
2 Datolite	3 Natrolite	
1 Diaspore	1 Neodymium	
2 Dickite	1 Nepheline	Other:
3 Diopside	1 Nephrite	3 Desert_Varnish
1 Dipyre	1 Niter	1 Kerogen
2 Dolomite	3 Nontronite	17 Plants
1 Dumortierite		

Table 2

Minerals in the Spectral Library by Group

16 Alunite group	22 Garnet group
21 Amphibole group	8 Hematite group
3 Apatite group	23 Kaolinite-Serpentine group
2 Aragonite group	30 Mica group
1 Arsenopyrite group	17 Montmorillonite group
1 Axinite group	1 Nepheline group
2 Barite group	13 Olivine group
5 Calcite group	5 Pyrite group
2 Chalcopyrite group	16 Pyroxene group
9 Chlorite group	2 Rutile group
1 Cobaltite group	8 Scapolite group
1 Copiapite group	1 Sodalite group
2 Dolomite group	3 Spinel group
4 Epidote group	2 Tourmaline group
28 Feldspar group	16 Zeolite group

Table 3

Spectral Library Entries by Type

Minerals:		Other:	
1	Borate	3	Desert Varnish
21	Carbonate	1	Organic (Kerogen)
1	Chloride		
7	Cyclosilicate		
2	Element		
4	Halide		
13	Hydroxide	17	Plants:
45	Inosilicate		
63	Nesosilicate	3	Grass
1	Nitrate	6	Shrub
24	Oxide	8	Tree
4	Phosphate		
108	Phyllosilicate		
5	Sorosilicate		
33	Sulfate		
23	Sulfide		
2	Sulfosalt		
64	Tectosilicate		

Table 4

Sample Specpr Listing of the beginning of splib04a

Record	Title	Size	Note or Date
1	USGS Digital Spectral Library: splib04a	436	Characters of TEXT
2	**********	41	Characters of TEXT
3	**********	41	Characters of TEXT
4	**********	41	Characters of TEXT
5	..	41	Characters of TEXT
6	USGS Denver Beckman STD wavelengths 1x	512	02:57:26.00 10/15/1985
8	USGS Denver Beckman STD resolution 1x	512	02:57:26.00 10/15/1985
10	----------	41	Characters of TEXT
11	Acmite NMNH133746 Pyroxene DESCRIPT	3136	Characters of TEXT
14	..	41	Characters of TEXT
15	..	41	Characters of TEXT
16	Acmite NMNH133746 W1R1Ba ABS REF	480	15:18:47.00 03/23/1988
18	errors to previous data	480	15:18:47.00 03/23/1988
20	Acmite NMNH133746 W1R1Ba FEATANL	324	15:18:47.00 03/23/1988
22	----------	41	Characters of TEXT
23	Actinolite HS116 DESCRIPT	3367	Characters of TEXT
26	..	41	Characters of TEXT
27	..	41	Characters of TEXT
28	Actinolite HS116.3B W1R1Bb ABS REF	480	08:41:01.00 07/11/1991
30	errors to previous data	480	08:41:01.00 07/11/1991
32	Actinolite HS116.3B W1R1Bb FEATANL	396	08:41:01.00 07/11/1991
34	----------	41	Characters of TEXT
35	Actinolite HS22 DESCRIPT	3130	Characters of TEXT
38	..	41	Characters of TEXT
39	..	41	Characters of TEXT
40	Actinolite HS22.3B W1R1Bb ABS REF	480	12:06:59.00 03/16/1987
42	errors to previous data	480	12:06:59.00 03/16/1987
44	Actinolite HS22.3B W1R1Bb FEATANL	297	12:06:59.00 03/16/1987
46	----------	41	Characters of TEXT
47	Actinolite HS315 DESCRIPT	2913	Characters of TEXT
49	..	41	Characters of TEXT
50	..	41	Characters of TEXT
51	Actinolite HS315.4B W1R1Bb ABS REF	480	11:47:02.00 10/31/1986
53	errors to previous data	480	11:47:02.00 10/31/1986
55	Actinolite HS315.4B W1R1Bb FEATANL	522	11:47:02.00 10/31/1986

Size is the number of data channels for spectra and FEATANL results
and number of bytes for text records.

Table 5

Specpr Format Digital Spectral Library Versions

splib04a	master spectral library (Beckman range and resolution)
splib04b	interpolated splib04a spectra to 950 channels for use in convolutions.
splib04c	AVIRIS 1990 convolution 224 channels. (e.g. Cuprite)
splib04d	AVIRIS 1990 convolution 208 channels
splib04e	AVIRIS 1991 convolution 224 channels.
splib04f	AVIRIS 1991 convolution 208 channels.
splib04g	AVIRIS 1992 convolution 224 channels.
splib04h	AVIRIS 1992 convolution 197 channels.
splib04i	AVIRIS 1993 convolution 224 channels.
splib04j	AVIRIS 1993 convolution 197 channels.
splib04k	TM
splib04m	Galileo NIMS
splib04n	Cassini VIMS proposed

note: the letter l was skipped in the designation splib04_ to avoid confusion with the number 1.

SPECTRAL PURITY

Each spectrum has a purity code in its header. In this version of the spectral library, the code is:

W1R1Bx

The "W" stands for wavelength region followed by the region measured. All spectra in this version cover the nominal range of 0.2 to 3.0 μm which is region 1. The digital data for the wavelength set are located in splib04a, record 6.

The "R" stands for resolution, followed by the resolution index. All spectra in this version of the library were measured using resolution set 1 in wavelength region 1. Figure 1 shows the resolution function, and the digital data for the resolution are located in splib04a, record 8.

The next letter signifies the instrument used. All spectra in this version of the library were measured on the USGS, Denver Spectroscopy Laboratory, Beckman 5270 spectrometer, and are designated by the letter "B".

Following the instrument letter is a lower case letter signifying the spectral purity of the spectrum for this wavelength range and resolution (the "x" in the above example is one of the following letters).

a: The spectrum and sample are pure based on significant supporting data available to the authors. The sample purity from other methods (e.g. XRD, microscopic examination) indicates essentially no other contaminants.

b: The spectrum appears spectrally pure. However, other sample analyses indicate the presence of other minerals that probably affect the absolute reflectance level to a small degree, but do not add any spectral features. The spectral features of the primary minerals may be slightly less intense, but the feature positions and shapes should be representative. For example, in this wavelength region (W1), quartz would tend to increase the reflectance level and decrease absorption band strength, but would not add any measurable features to the spectrum. Such a sample would rate a "b." In a few cases, where we have little support data, but the spectra for that mineral are well known, we assigned the spectral purity based on the spectra data along with a microscopic examination of the sample. There are a few "b" classes done this way.

c: The spectrum is spectrally pure except for some weak features with depths of a few percent or less caused by other contaminants. For example, some minerals may have some slight alteration that is apparent. Spectroscopic detection of alteration is easier for more transparent

minerals. For example, some of the albite spectra show weak 2.2-μm features due to alteration. From the knowledge of the mineral formula, you can often tell which features do not belong to the mineral. Albite, for instance does not have OH in the formula, so water features (1.4, 1.9, 2.2 μm) are not due to albite. However, you could argue that incipient alteration due to weathering is common in minerals at the Earth's surface. Thus, spectral bands due to weathering are somewhat characteristic of many samples (e.g. feldspars), even if they are not a property of the pure mineral. Thus these alteration spectral features might be useful in some cases.

d: Significant spectral contamination. The spectrum is included in the library only because it is the best sample of its type currently available and the primary spectral features can still be recognized. However, the spectrum should be used with care. The sample description should be consulted as a guide to what features are a part of the actual mineral. This sample may be purged from the database in future releases as better samples become available.

?: There are insufficient analyses and/or knowledge of the spectral properties of this material to evaluate its spectral purity. In general we have included such samples because we believe their spectra to be representative. These are samples for which we are concentrating future analyses in order to resolve the purity issue. Updates to the spectral purity and sample documentation will be placed online for anonymous ftp as the information becomes available. (See the section below on availability on how to electronically access the data and obtain further information.)

Commenting on the spectra in general, reflectance tends to decrease in the UV and beyond about 2.7 μm. Some of the spectra show minima in the UV. We have taken careful measurements of scattered light and believe all these features are real. Beyond 2.7 μm, even anhydrous minerals show absorption due to water adsorbed onto the surfaces of the mineral grains. Our experience has shown that these water absorptions are still present in dry nitrogen purged environments, although slightly weaker. Spectra of similar samples obtained at other facilities, like those in Hawaii or the east coast of the US. have shown us that the water absorptions in the spectra from relatively dry Colorado are really quite small in comparison. Placing the sample in a dry nitrogen atmosphere or a vacuum oven has little effect on the water absorption as water from the atmosphere will readsorb onto the sample by the time it reaches the spectrometer. Experiments by the senior author when he was at the University of Hawaii have also shown that most of the adsorbed water remains even under a strong vacuum at room temperatures. We

decided in general not to heat our samples in order to avoid any temperature induced alteration.

The overall spectral purity is high for this library. Seventy-one percent of the spectra have a purity code of either a or b (36% a, and 35% b), while only 17% have c, and 2% have d. Ten percent are yet to be classified.

WAVELENGTH PRECISION

The wavelength precision of our custom-modified, computer-controlled Beckman spectrometer was checked using Holmium Oxide filters in the visible and the positions of known mineral bands in the near infrared. In particular, we developed pyrophyllite as a wavelength standard because of its many narrow absorption bands (Clark et al., 1990b). The positions of the absorption bands have been checked, using the same pyrophyllite standard, on two FTIR spectrometers. In general, the wavelength accuracy is on the order of 0.0005 μm (0.5 nm) in the near-IR and 0.0002 μm (0.2 nm) in the visible, always a small fraction of the spectral resolution.

SPECTRAL PLOTS AND DATA PRECISION

Plots of the spectra presented here are limited to one of seven vertical scales (0.0 to 1.03, 0.8, 0.6, 0.5, 0.4, 0.3, or 0.2) and the same horizontal range for easy comparison. The error bars are plotted only when they are above a threshold that allows them to be distinguished on the plot. Most error bars are too small to be distinguished. At the bottom of each plot is the specpr title, date and time of acquisition, file name and record number and the specpr plot options.

Each spectrum was run with a desired signal-to-noise of at least 500 relative to unity reflectance. In practice, it would take too long a time to obtain such a signal-to-noise in regions where the signal is low, so an upper limit to the integration time per channel was also specified. Thus, typically at the ends of the spectra, the precision drops slightly. Refer to the error bars for each spectrum to determine the precision at a given wavelength for any individual spectral channel. The error bars are located in the records labeled "errors to previous data" and represent one standard deviation of the mean.

Each spectrum was measured relative to Halon, and then corrected to absolute reflectance as described in Clark et al. (1990b). That paper also describes the details of the spectrometer, and the viewing geometry of the system.

INSTRUMENT SPECTRAL LIBRARIES

The intent of the spectral library is to serve as a knowledge base for spectral analysis. Comparison of spectral data is best done when the spectral resolutions of the knowledge base and the spectra undergoing analysis are identical. The specpr software has tools for convolving the spectral library to the resolution and sampling interval of any instrument. The native (laboratory) spectral library will also be convolved to AVIRIS and TM resolution and sampling for the terrestrial instruments, and to NIMS and VIMS for the planetary imaging spectrometer instruments. See Table 5 for a listing of instrument spectral libraries. These convolved data files, as well as specpr command files for convolving the database to your own instruments will be made available in the anonymous ftp directory (see below).

Each instrument convolved library requires about 0.8 megabyte of specpr-format disk space if the instrument has less than 256 channels. The proposed VIMS has 320 channels and its spectral library will be about 1.6 megabytes. The convolution to any other instrument (laboratory, or flight) is a simple matter of changing pointers in a command file to the custom resolution and sampling data sets and running the specpr command file. (Specpr runs on many Unix workstations; there is not a PC version at this time; a PC version might be difficult due to the large volume of code, over 60,000 lines.)

The convolution routine used to create the instrument spectral libraries is that in specpr. The specpr routine uses a trapezoidal integration over each bandpass. To make this integration more accurate, the original spectral library is resampled to 950 channels (splib04b) and the convolutions done on these spectra. The convolutions appear to be excellent, and tests with AVIRIS data have shown that very subtle spectral differences can be distinguished, like that between the 2.2-μm doublet in kaolinite and halloysite.

MINERAL MIXTURES

This spectral library is largely a pure material library (except for a few cases where minerals tend to exist with other minerals). For computing intimate mineral mixtures (e.g. rocks or soils), radiative transfer algorithms using the Hapke reflectance model (Hapke, 1981) are part of the specpr package. To compute mixture or pure end-member spectra, a set of optical constants are required as a function of wavelength. The algorithms use the model at the optical constant level so spectra can be calculated as a function of grain size, abundance in the mixture, and viewing geometry. Reflectance spectra of grain size distributions can also be simulated by computing a mixture of the same mineral (or even several minerals) at several grain sizes. A future release of the library will include optical constants for the spectra in the library. Optical constant libraries will also be computed for the same flight instrument spectral resolutions and wavelengths shown in Table 5.

We included one mixture of hematite and quartz because we have found it useful in mapping hematite with imaging spectroscopy data. Usually, a pure hematite spectrum has bands that are too strong and saturated compared to that typically found in spectra of the Earth's surface. The mixture of hematite plus quartz simulates to some degree cases closer to those encountered in field data.

AVAILABILITY

The software and spectral libraries are published as a series of USGS Open File Reports. The hardcopy spectral library, and users manuals are available from:

USGS/Dept. of the Interior
Books and Open-File Reports Section
U.S. Geological Survey
Box 25425, Federal Center
Denver, CO 80225

USGS Books, Open File Reports and Maps:
Phone number: (303) 236-7476

The relevant Open-File documents are:

93-592 Spectral Library paper version (this document), 1326 pages.

93-595 Specpr users manual, approximately 210 pages. (Clark, 1993)

93-594 Spsearch users manual, approximately 30 pages. (Gorelick and Clark, 1993)

93-593 Spview manual, approximately 15 pages. (Includes the digital spectral library and spectral library reader software on 3.5-inch floppy disks for IBM-PC compatible computers.) (Livo et al., 1993)

The digital data for the spectral library, software, and above manuals are available via anonymous ftp on the internet:

```
ftp speclab.cr.usgs.gov

login as anonymous
password is your userid@machine

cd pub/spectral.library

get README
```

Follow instructions in the README file for obtaining the data. The pub/spectral.library directory will contain all the different versions listed in Table 5, as well as additional ones as they become available (again see the README file for details).

Similarly, obtain the specpr and spsearch software in the

pub/specpr and pub/spsearch directories. The specpr distribution also includes an independent Fortran program, spprint, that reads a specpr format file and prints titles. For independent subroutines in C that read a specpr file, see the README file.

After you have retrieved the library, please send mail to rclark@speclab.cr.usgs.gov with your name, address, phone number and email address. We will put you on a mailing list for future announcements and updates.

Alternatively, contact any of the authors at their address, or send electronic (internet) mail to:

rclark@speclab.cr.usgs.gov

if you have questions.

A CD-ROM version will be available in the future.

ACKNOWLEDGEMENTS

A successful spectral library has extensive sample documentation. We are indebted to J. S. Huebner, and Judy Konnert of the USGS for their support in analyzing the X-ray diffraction data on minerals for the last couple of years. We thank the late Norma Vergo for many of the earlier X-ray analyses. Norma's attention to detail has certainly made this spectral library a quality product, and we miss her. Without these dedicated people providing superb analysis and feedback, this library would not have been possible.

Of course, a spectral library needs quality samples. We are indebted to Jim Crowley, Jim Post, Fred Kruse, and Jack Salisbury for donating excellent samples. Thanks to the British Museum and the National Museum of Natural History for mineral samples.

Several additional people worked on entering documentation for this database; a task that didn't seem to have an end. We thank Barry Middlebrook for completing some of the documentation on samples in the early stages, and Shelly Moore helped considerable entering data in the later stages of the project. Melissa Cowoski helped with the optical examination of the samples.

We thank Jim Crowley and Eric Livo for excellent reviews; they certainly helped improve the final version.

This project has been funded by the USGS DAT program, and the NASA HIRIS, Cassini VIMS, Mars Observer TES, and the canceled Mars Observer VIMS, and CRAF VIMS teams.

FUTURE PLANS

The senior author (RNC) is a team member on the EOS HIRIS flight investigation team and is developing spectral libraries for the team. He is also a team member on Mars Observer Thermal Emission spectrometer, and Cassini (mission to Saturn) VIMS teams. To satisfy the requirements of all these missions, the mineral spectral library will be extended to cover the spectral range 0.2 to 150 μm and include many more minerals. For the HIRIS team, spectral libraries will be developed for all disciplines represented by team members.

REFERENCES

Clark, R.N., 1980. A Large Scale Interactive One Dimensional Array Processing System, *Pub. Astron. Soc. Pac.*, **92**, 221-224.

Clark, R.N., T.V.V. King, and N.S. Gorelick, 1987. Automatic Continuum Analysis of Reflectance Spectra: *Proceedings of the Third Airborne Imaging Spectrometer Data Analysis Workshop*, JPL Publication 87-30, 138-142.

Clark, R.N., A.J. Gallagher, and G.A. Swayze: 1990a. Material Absorption Band Depth Mapping of Imaging Spectrometer Data Using a Complete Band Shape Least-Squares Fit with Library Reference Spectra, .I Proceedings of the Second Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) Workshop. JPL Publication 90-54, 176-186.

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990b. High Spectral Resolution Reflectance Spectroscopy of Minerals: *J. Geophys Res.* **95**, 12653-12680.

Clark, R.N.: 1993. SPECtrum Processing Routines User's Manual Version 3 (program SPECPR): U.S. Geological Survey, Open File Report 93-595, 210 pages.

Fleischer, M.: 1980. Glossary of Mineral Species: Mineralogical Record, Tucson, 192pp.

Gorelick, N, and Clark, R.N.: 1993. Spsearch: a program for relational database queries of the digital spectral library: U.S. Geological Survey, Open File Report 93-594, (software complete, documentation in preparation).

Hapke, B., 1981. Bidirectional reflectance spectroscopy 1. Theory, *J. Geophys. Res.* **86**, 3039-3054.

Klein, C. and Hurlbut, Jr., C.S. Manual of Mineralogy: John Wiley and Sons, 596pp, 1985

Livo et al. 1993: PC Reader for the U.S. Geological Survey Digital Spectral Library: U.S. Geological Survey, Open File Report 93-593,

FIGURE CAPTION

Figure 1. The spectral resolution of the spectra in this release of the spectral library. The resolution is expressed as the Full Width at Half Maximum (FWHM) in micrometers. The spectral sampling is equal to the FHWM spacing. The sampling is one half Nyquist, such that if the response functions of the spectrometer were plotted for each wavelength, the half-maximum points would overlap the half-maximum points of the adjacent spectral channels. The FWHM rises where there is relatively low signal from the detector near the ends of the detector range. The spectral resolution is better than AVIRIS 1992 at all wavelengths except for a few channels near 0.87 μm and beyond 2.39 μm. The difference is so slight at 0.87 μm (12 nm versus 9 nm for AVIRIS) that for the spectral features encountered in this spectral library, there are no practical differences in AVIRIS convolved spectra. Beyond 2.39 μm, the Beckman rises to 22 nm at 2.42 μm and 32 nm at 2.50 μm compared to AVIRIS at a resolution of 14.6 nm in the 2.3 to 2.49-μm region. However, AVIRIS data are strongly affected by atmospheric absorption beyond 2.43 μm, so this difference is small in practice. Also, our future spectral library covering 2 to 150 μm will have resolution better than 2.5 nm in the 2 to 2.5-μm wavelength region.

The spectral resolution plotted here is our "standard 1x" resolution. Spectra are often obtained at higher resolution (1.5x, 2x, 3x, 4x, and 8x the standard). Some of these results have been reported in Clark et al. (1990b).

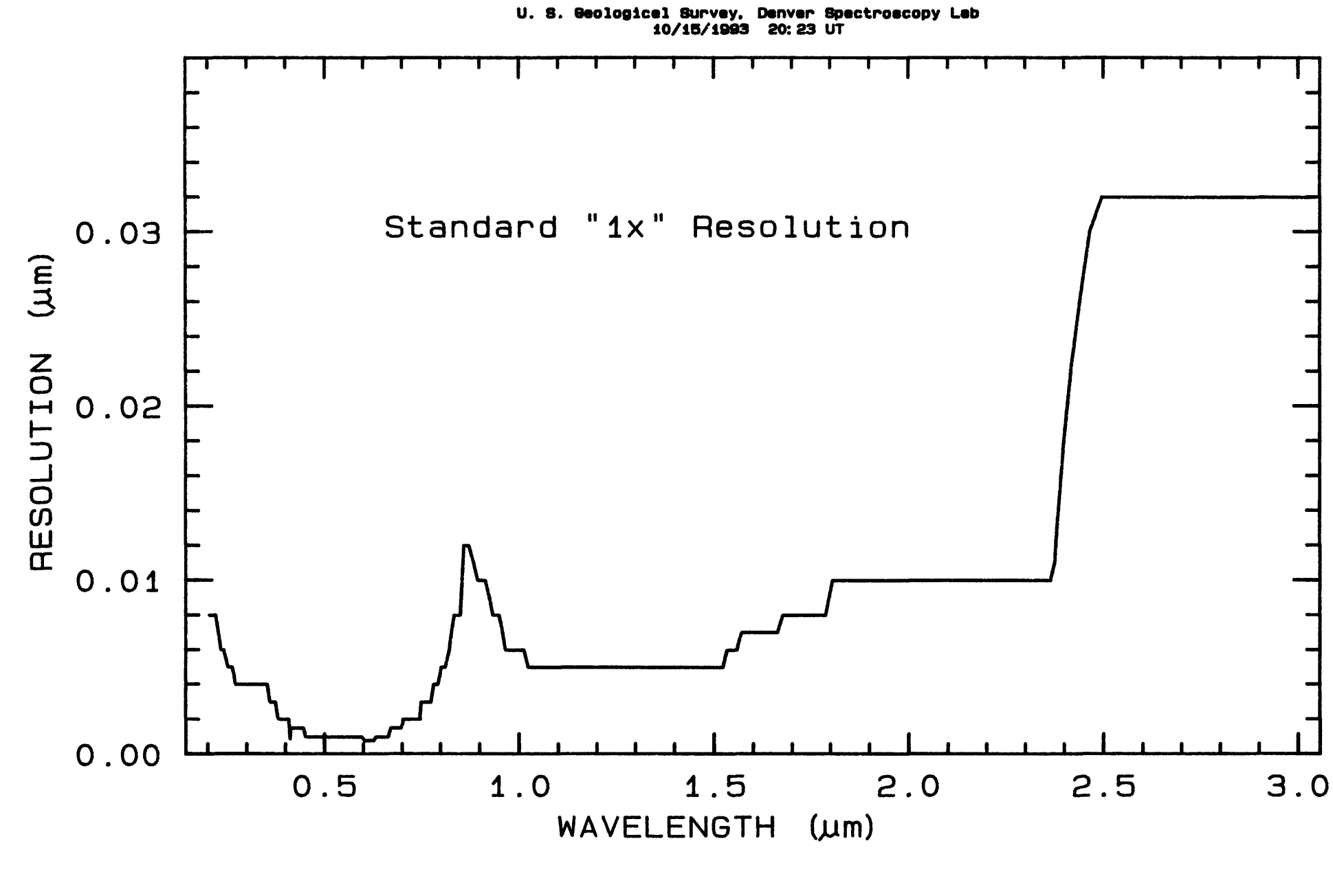

U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 20:23 UT
Standard "1x" Resolution
RESOLUTION (μm)
0.00
0.01
0.02
0.03
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
USGS Denver Beckman STD resolution 1x
10/15/1985 02:57 splib04a r 8 &Cp013t

Figure 1

TITLE: Acmite NMNH133746 Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH133746

MINERAL_TYPE: Inosilicate

MINERAL: Acmite (Aegirine)(Pyroxene group)

FORMULA: NaFeSi2O6

FORMULA_NROFF: $NaFeSi_2O_6$

COLLECTION_LOCALITY: Kangerdluarssuk, Narssaq (near), Greenland

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

This sample was obtained by John W. Salisbury, and the original sample analysis and mid-infrared spectra were published in:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

"Original sample was large (up to 2cm), very dark green prismatic crystals of acmite intergrown with albite(?). Material was crushed and hand picked by J. Salisbury for grinding."

Sieve interval is: 74-250 μm

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

The 74-250 μm grains were x-rayed by Norma Vergo. The resulting pattern showed acmite and an unidentified peak of trace proportions at 4.48 angstroms.

see:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	52.08 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.56 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.98 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	29.22 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.24 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.06 wt%	NROFF:	MgO
COMPOSITION:	CaO:	3.84 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	11.87 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.02 wt%	NROFF:	K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	98.87 wt%		
COMPOSITION:	O=Cl,F,S:	wt%		
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

From:
Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Microprobe analysis showed that one grain out of four examined had about 2 wt % more CaO and correspondingly less Na_2O. Otherwise, homogeneous, especially within grains. Average of 13 analyses, which indicates close to end member composition.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

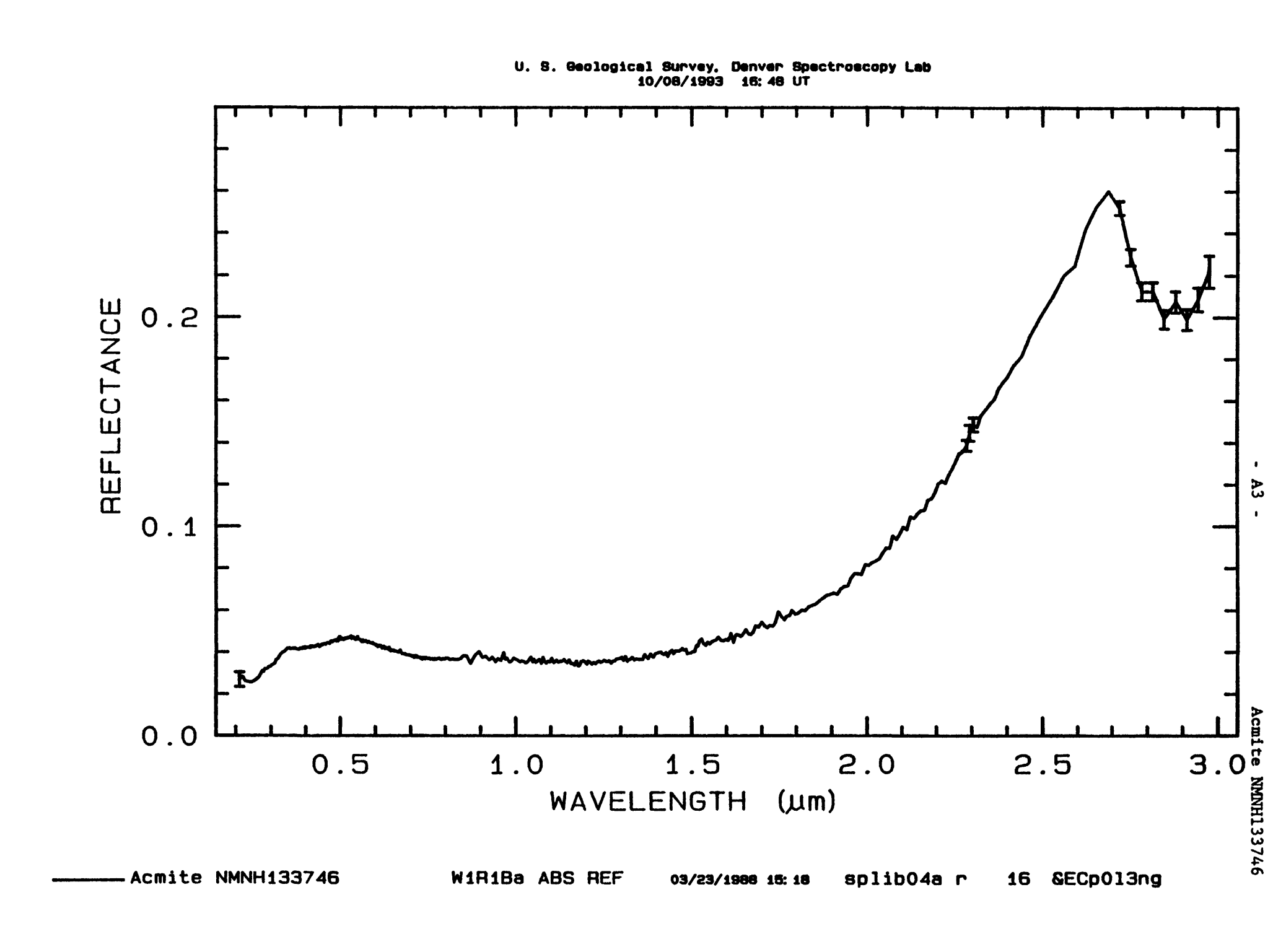
av gr sz = 265μm

Mostly clean cleavage surfaces of prismatic grains. Trace of quartz or plagioclase. Prismatic grains are length fast, have straight extinction, prismatic habit and yellow-green pleochroism, all consistent with Acmite. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 16	0.2-3.0μm	200	g.s.= 265 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A3 -
Acmite NMNH133746
Acmite NMNH133746 W1R1Ba ABS REF 03/23/1988 15:18 splib04a r 16 &ECp013ng

TITLE: Actinolite HS116 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS116

MINERAL_TYPE: Inosilicate

MINERAL: Actinolite (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)5Si8O22(OH)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: San Bernadino, CA

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms a serites with Tremolite and Ferro-actinolite.

Original spectrum published in:

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, vol. 1, pp283-300.

With the note that this sample lacks the contamination by opaque inclusions that is seen in the actinolite sample HS22.

A spectrum of this sample is also published in:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

Where it is noted that although XRD indicates chlorite, but no chlorite bands are seen spectrally. Microscope analysis indicated ~1% opaque and ~5 volume% chlorite as contaminants. The sample measured was HS116.3B which was dry sieved to the grain size interval 74-250 μm.

Analysis of cation proportions indicates that this actinolite is low enough in iron to border on being called a tremolite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates Actinolite + Chlorite

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	57.78 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.02 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.22 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.06 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	4.38 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.12 wt%	NROFF:	MnO
COMPOSITION:	MgO:	22.39 wt%	NROFF:	MgO
COMPOSITION:	CaO:	12.13 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.38 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.07 wt%	NROFF:	K_2O
COMPOSITION:	----------			
COMPOSITION:	Total:	97.55 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

EM analysis by Gregg A. Swayze at USGS Branch of Geophysics, Denver.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

Bimodal grain size distribution:

population 1 av gr sz = 325 μm 99 vol%
population 2 av gr sz = 15 μm <1 vol%

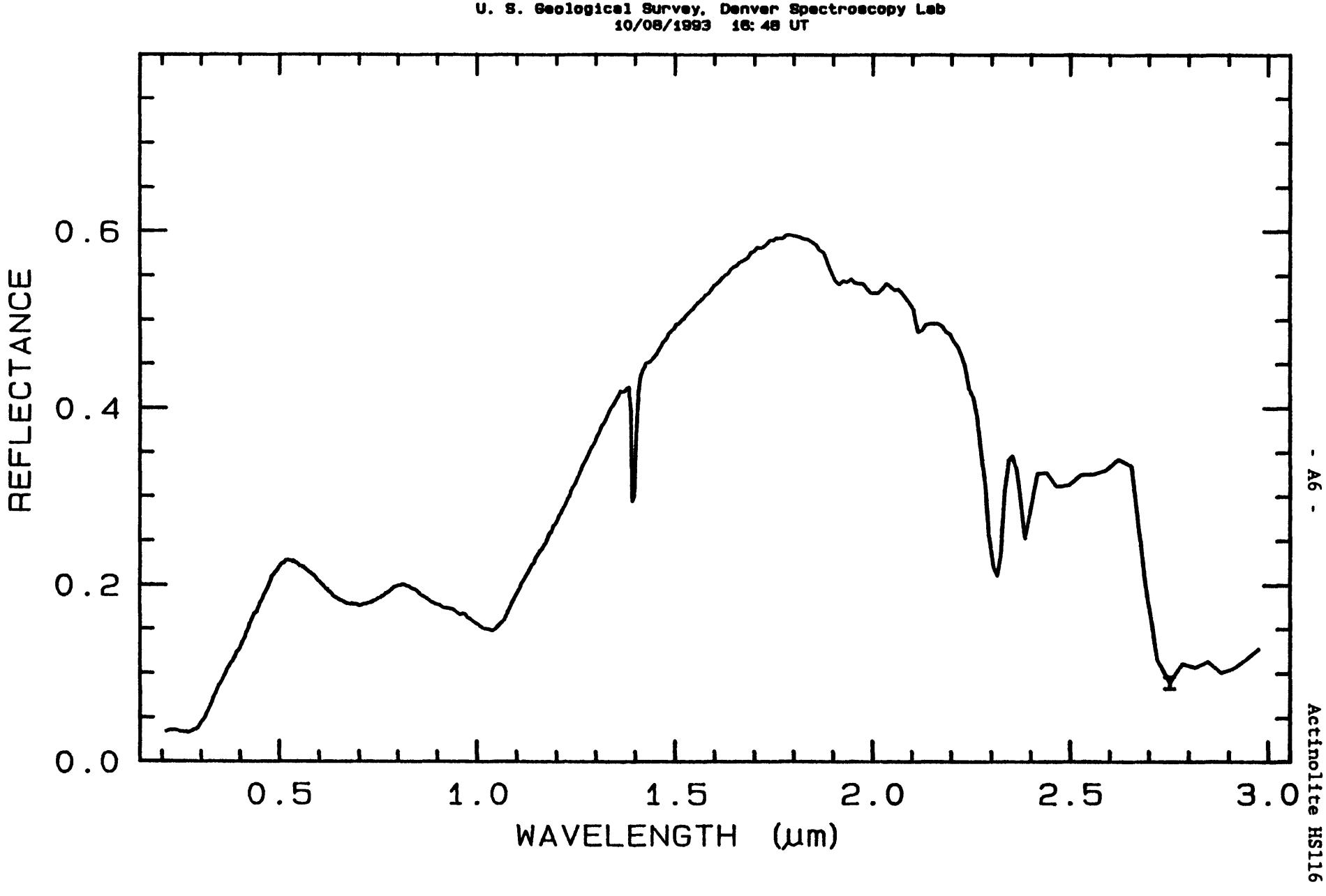
av gr sz for entire populations = 325 μm

Note the presence of ~1% opaque and ~5 volume% chlorite as inclusions. Actinolite prisms bounded by cleavage surfaces. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 28	0.2-3.0μm	200	g.s.= 325μm



Actinolite HS116

TITLE: Actinolite HS22 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS22

MINERAL_TYPE: Inosilicate

MINERAL: Actinolite (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)5Si8O22(OH)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Chester, VT

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms a series with Tremolite and Ferro-actinolite.

Original spectrum published in:

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, vol. 1, pp283-300.

With the note: "The flattening of the spectral curve of the finest size range near 2 μm, which produces a cross-over of the spectra, is apparently due to a very slight contamination of the sample by opaque inclusions of pyrite (?)."

A spectrum of this sample is also published in:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

Who note that the sample is spectrally pure. The sample measured was HS22.3B which was dry sieved to the grain size interval 74-250 μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION: SiO2: 54.53 wt% NROFF: SiO_2
COMPOSITION: TiO2: 0.04 wt% NROFF: TiO_2
COMPOSITION: Al2O3: 1.64 wt% NROFF: Al_2O_3
COMPOSITION: Cr2O3: 0.27 wt% NROFF: Cr_2O_3
COMPOSITION: FeO: 5.46 wt% NROFF: FeO
COMPOSITION: MnO: 0.21 wt% NROFF: MnO
COMPOSITION: MgO: 21.69 wt% NROFF: MgO
COMPOSITION: CaO: 12.01 wt% NROFF: CaO
COMPOSITION: Na2O: 0.41 wt% NROFF: Na_2O
COMPOSITION: K2O: 0.03 wt% NROFF: K_2O
COMPOSITION: ----------
COMPOSITION: Total: 96.28 wt%
COMPOSITION: O=Cl,F,S: wt% #correction for Cl, F, S
COMPOSITION: New Total: wt%

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

EM analysis by Gregg A. Swayze at USGS Branch of Geophysics, Denver, indicates stoichiometric actinolite.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination give the following mineral mode:

91.5 vol% actinolite
8.0 vol% wh. mica or calcite
0.5 vol% opaque inclusions

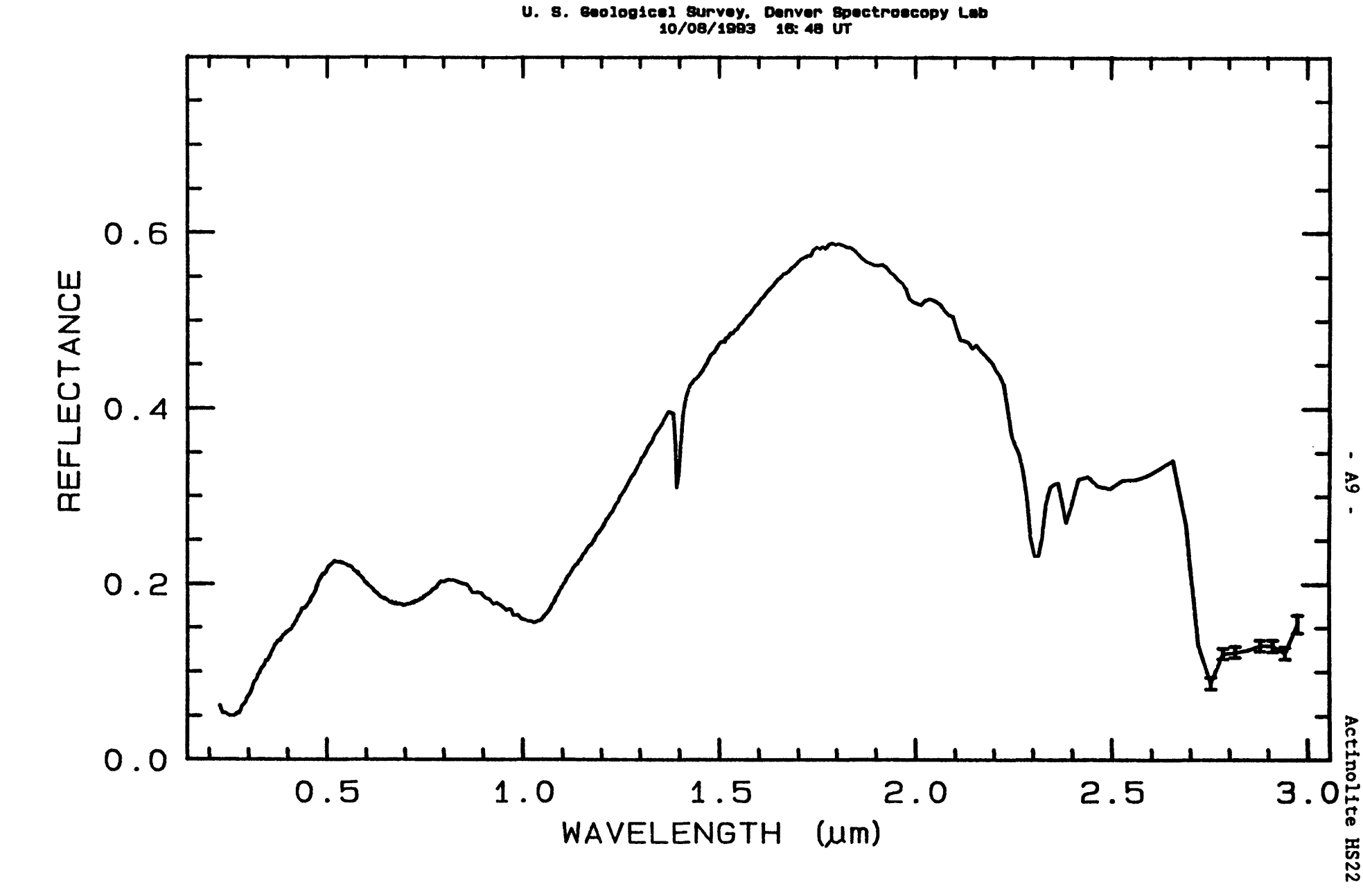
av gr sz = 290μm

Mostly pure, highly fractured green actinolite grains (occasionally some with opaque inclusions). Platey translucent mica? grains intermixed with actinolite. Continuous grain size distribution with little coating of larger grains by smaller grains. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	40	0.2-3.0μm	200	g.s.= 290μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Actinolite HS22
Actinolite HS22.3B W1R1Bb ABS REF 03/16/1987 12:06 splib04a r 40 GECp013ng

TITLE: Actinolite HS315 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS315

MINERAL_TYPE: Inosilicate

MINERAL: Actinolite (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)5Si8O22(OH)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Colorado

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Tremolite and Ferro-actinolite.

Original spectrum published in:

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

With the note: "The very weak band near 0.63 μm indicates the presence of some ferric iron, which is often abundant in actinolites"

The spectrum in the library is sample HS315.4B which was dry sieved to the grain size interval 250-1200 μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION: SiO2: 57.72 wt% NROFF: SiO_2
COMPOSITION: TiO2: 0.01 wt% NROFF: TiO_2
COMPOSITION: Al2O3: 1.38 wt% NROFF: Al_2O_3
COMPOSITION: Cr2O3: 0.02 wt% NROFF: Cr_2O_3
COMPOSITION: FeO: 1.37 wt% NROFF: FeO
COMPOSITION: MnO: 0.33 wt% NROFF: MnO
COMPOSITION: MgO: 24.58 wt% NROFF: MgO
COMPOSITION: CaO: 13.27 wt% NROFF: CaO
COMPOSITION: Na2O: 0.37 wt% NROFF: Na_2O
COMPOSITION: K2O: 0.09 wt% NROFF: K_2O
COMPOSITION: ----------
COMPOSITION: Total: 99.14 wt%
COMPOSITION: O=Cl,F,S: wt% #correction for Cl, F, S
COMPOSITION: New Total: wt%

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

EM analysis by Gregg A. Swayze at USGS Branch of Geophysics, Denver.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

96 vol% actinolite
3 vol% talc or mica
1 vol% Fe-stained pyrite?

Bimodal grain size distribution:

population 1 av gr sz = 1000μm 99.9 vol%
population 2 av gr sz = 30μm 0.1 vol%

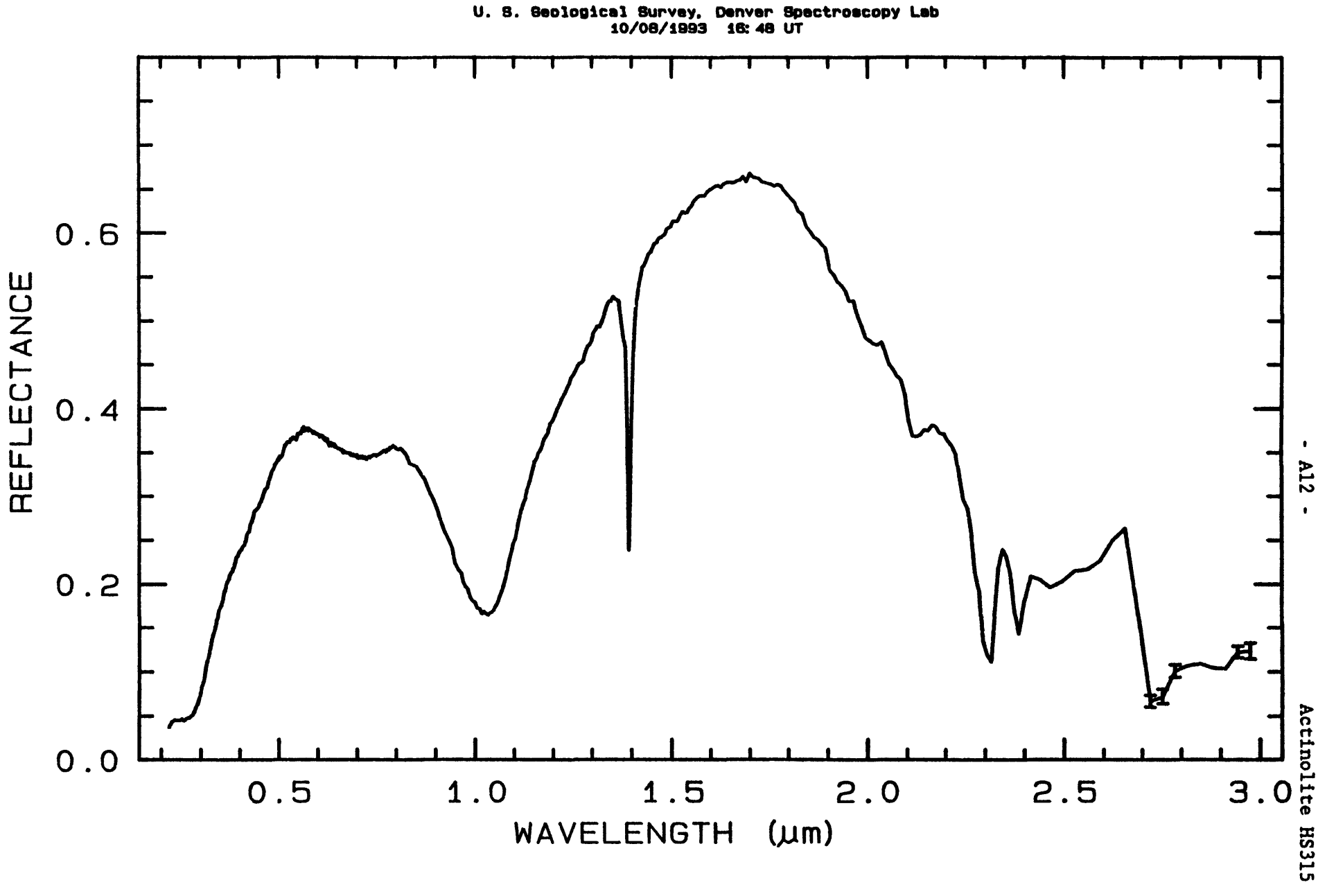
av gr sz all populations = 1000μm

Prismatic actinolite crystals with occasional pyrite? inclusions altered to limonite and staining surrounding actinolite. Bundles of micaceous soft mineral resemble talc. Some actinolite grains (about 10 vol%) are polygranular, while most are single prisms bounded by cleavage faces. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	51	0.2-3.0μm	200	g.s.= 1000μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Actinolite HS315.4B W1R1Bb ABS REF 10/31/1986 11:47 splib04a r 51 GECp013ng

TITLE: Actinolite NMNH80714 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH80714

MINERAL_TYPE: Inosilicate

MINERAL: Actinolite (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)5Si8O22(OH)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Cumberland, Rhode Island

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Tremolite and Ferro-actinolite.

Sample was seived to ~<250μm.
It probably contains enough iron to be considered a ferro-actinolite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	54.28 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.02 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	2.81 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.00 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	8.60 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.59 wt%	NROFF:	MnO
COMPOSITION:	MgO:	18.53 wt%	NROFF:	MgO
COMPOSITION:	CaO:	13.04 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.74 wt%	NROFF:	Na_2O
COMPOSITION:	----------			
COMPOSITION:	Total:	98.61 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

EM analysis by Gregg A. Swayze at USGS Branch of Geophysics, Denver.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mineral mode:

90 vol%	Actinolite	pop1 av gr sz = 255μm 25% coated with smaller actinolite grains
2 vol%	Actinolite	pop2 av gr sz = 30μm
8 vol%	Biotite?	pop3 av gr sz = 230μm coated with small actinolite grains

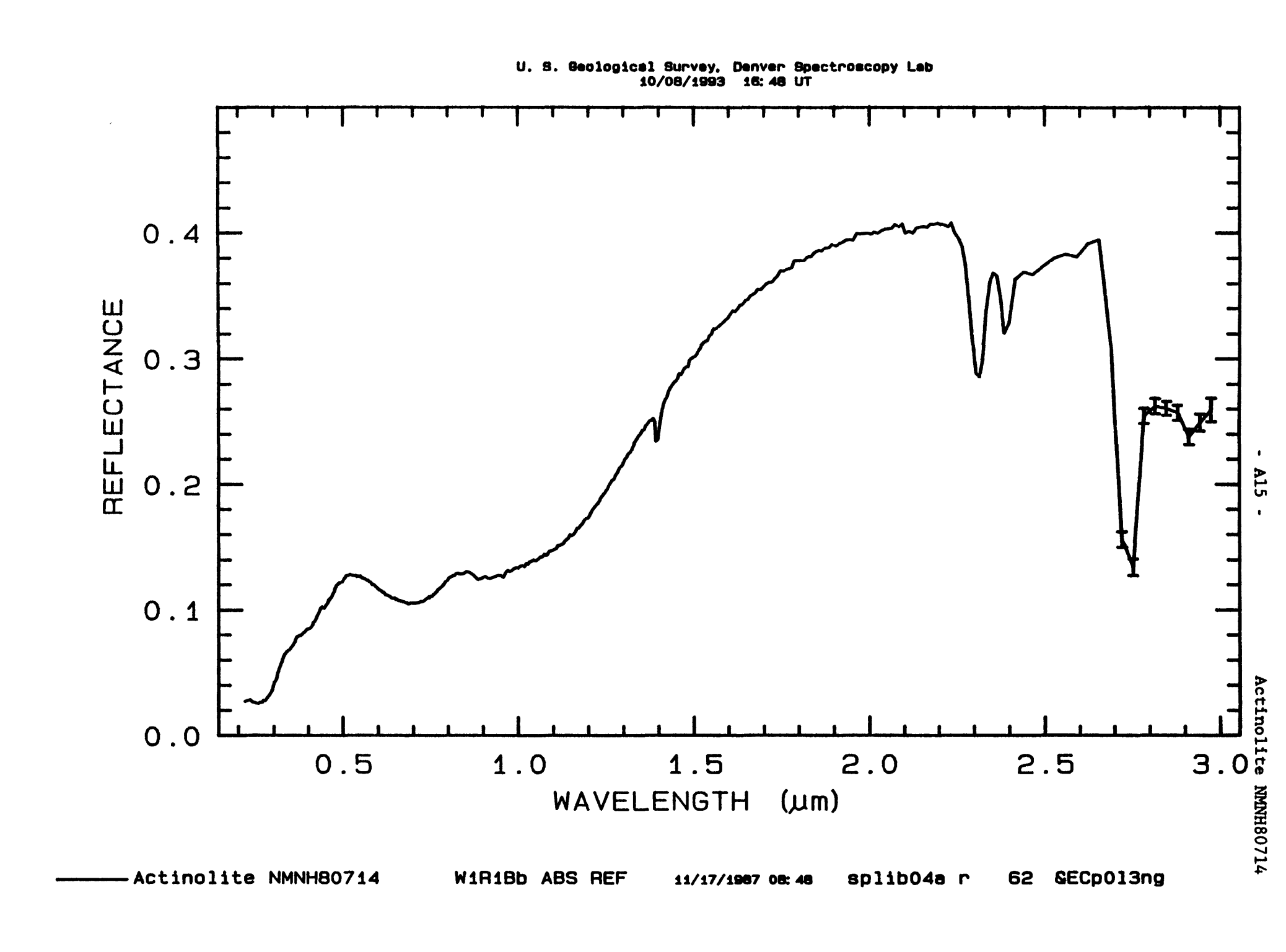
av gr sz of populations = 250μm

Pure sample of prismatic green-blue fibers. Slight pleochroism, biaxial (-), two good cleavages, high birefringence, inclined extinction with angle = 12 degrees. All this is consistent with actinolite. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	62	0.2-3.0μm	200	g.s.= 250 μm



Actinolite NMNH80714

TITLE: Actinolite NMNHR16485 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNHR16485

MINERAL_TYPE: Inosilicate

MINERAL: Actinolite (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)5Si8O22(OH)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Unknown.

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Actinolites are the intermediate members of a complete solid solution series with tremolite, $Ca_2Mg_5Si_8O_{22}(OH)_2$, and ferroactinolite, $Ca_2Fe_5Si_8O_{22}(OH)_2$, as end members. Actinolite is a characteristic mineral of the greenschist facies of metamorphism.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Tremolite + talc + 2.878. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

av gr sz = 35μm

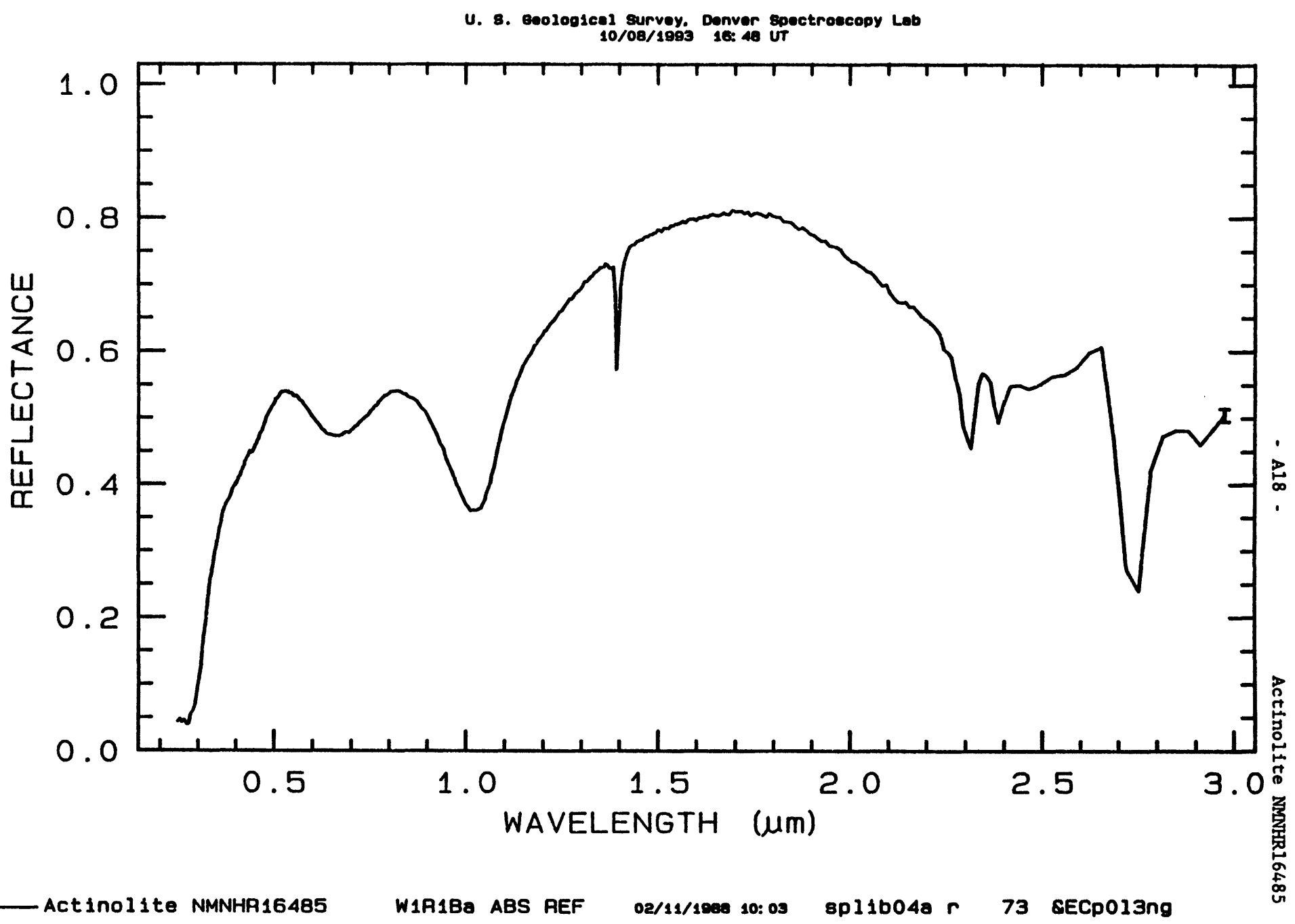
Mostly prismatic fibrous grains partially coated with smaller grains. These grains have inclined extinction, prismatic cleavage, and slight green color indicating presence of Fe. Grains are length slow, with angle between Z and C axes (OAP 11 (010)') = 16-20 degrees. This falls into the tremolite range according to D. Shelly (1985, Optical Mineralogy, 2nd Ed., Elsevier, New York, Table 9.1, p214.) G. Swayze

Spectroscopic data in the .5 to 2.5 μm indicate a low iron actinolite, confirming the above micropscpic examination. Roger N. Clark

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	73	0.2-3.0μm	200	g.s.= 35 μm



Actinolite NMNHR16485

TITLE: Adularia GDS57 (Orthoclase) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS57

MINERAL_TYPE: Tectosilicate

MINERAL: Adularia (Orthoclase)(Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Floestenthal Tyrol, Austria

ORIGINAL_DONOR: Colorado School of Mines

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

K-feldspar commonly found in psuedo-orthorhombic crystals. It occurs mainly in low-temperature veins in gneisses and schists.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Feldspar of orthoclase subgroup.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:

population 1 = 650μm 99 vol%
population 2 = 40μm 1 vol%

av gr sz of populations = 648μm

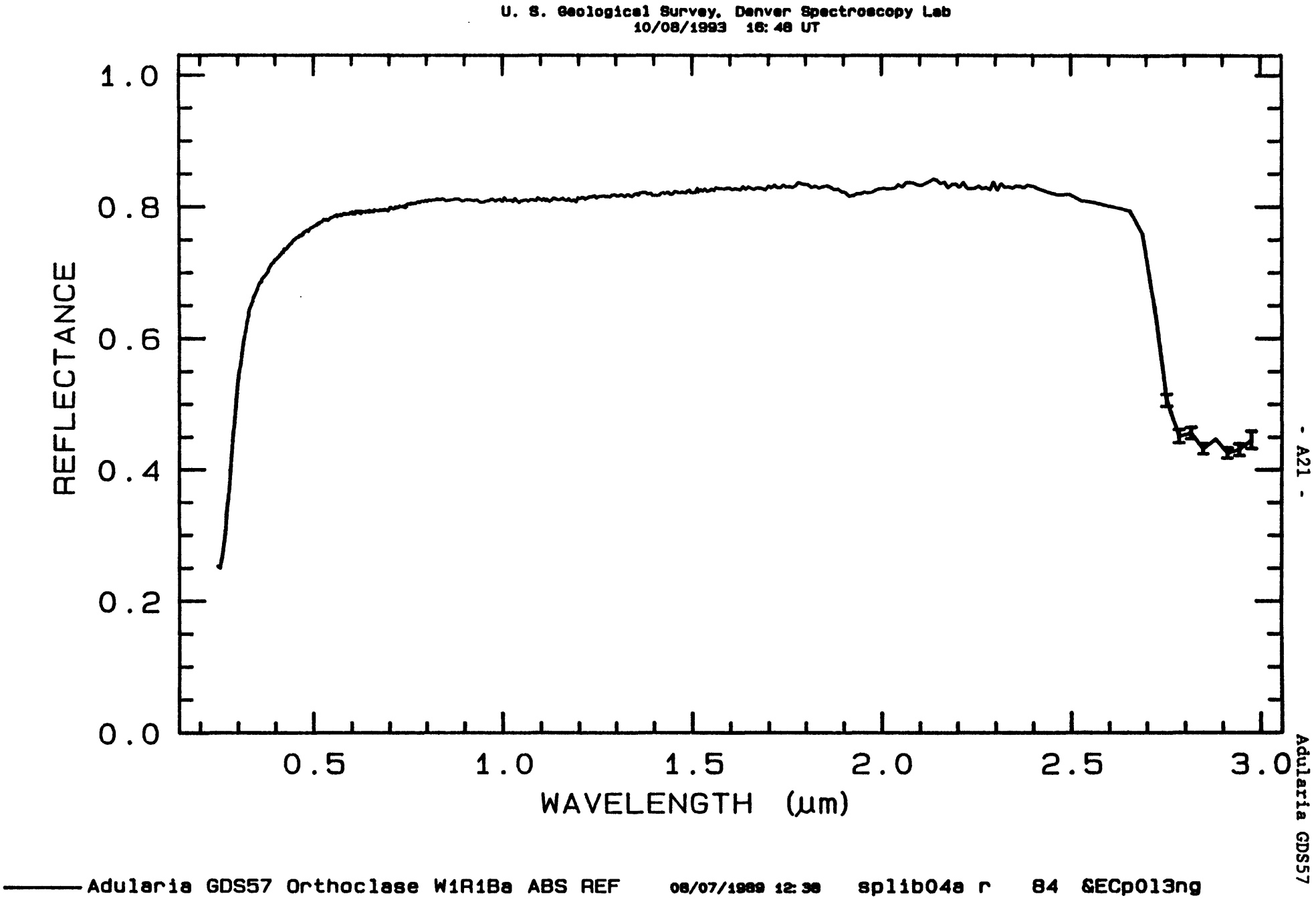
Smaller grains cover 20% of larger tabular grains. Grains have low relief, first order gray interference color, no visible twins, refractive

index close to 1.51 oil. This sample was ground from a single k-feldspar crystal. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	84	0.2-3.0μm	200	g.s.= 648 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Adularia GDS57 Orthoclase W1R1Ba ABS REF 08/07/1989 12:38 splib04a r 84 &ECp013ng
Adularia GDS57

TITLE: Albite GDS30 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS30 and NMNH C5390

MINERAL_TYPE: Tectosilicate

MINERAL: Albite (Plagioclase, Na end member)(Feldspar group)

FORMULA: NaAlSi3O8

FORMULA_NROFF: $NaAlSi_3O_8$

COLLECTION_LOCALITY: Rutherford, VA

ORIGINAL_DONOR: Jack Salisbury

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spectra from 2.5 to 25 μm for this sample are published in:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

"Sample is translucent and light gray to white in color. This is the classic Amelia albite. Hand specimen is large (2 cm) fragment of twinned crystal. Appears very fresh. Is translucent and light gray to white in color."

Sample measured for the library is the 74-250μm interval.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure albite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	68.18 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.01 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	20.07 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.01 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.01 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.02 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.02 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	10.37 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.20 wt%	NROFF:	K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.88 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

"Flame photometry and atomic absorption analysis of samples from the same location (not the same sample) show 98.42 mole percent albite. Microprobe analysis shows sample to be homogeneous within and between grains. Ten analyses indicate pure albite end member compostion."

Analsis from Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25 μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

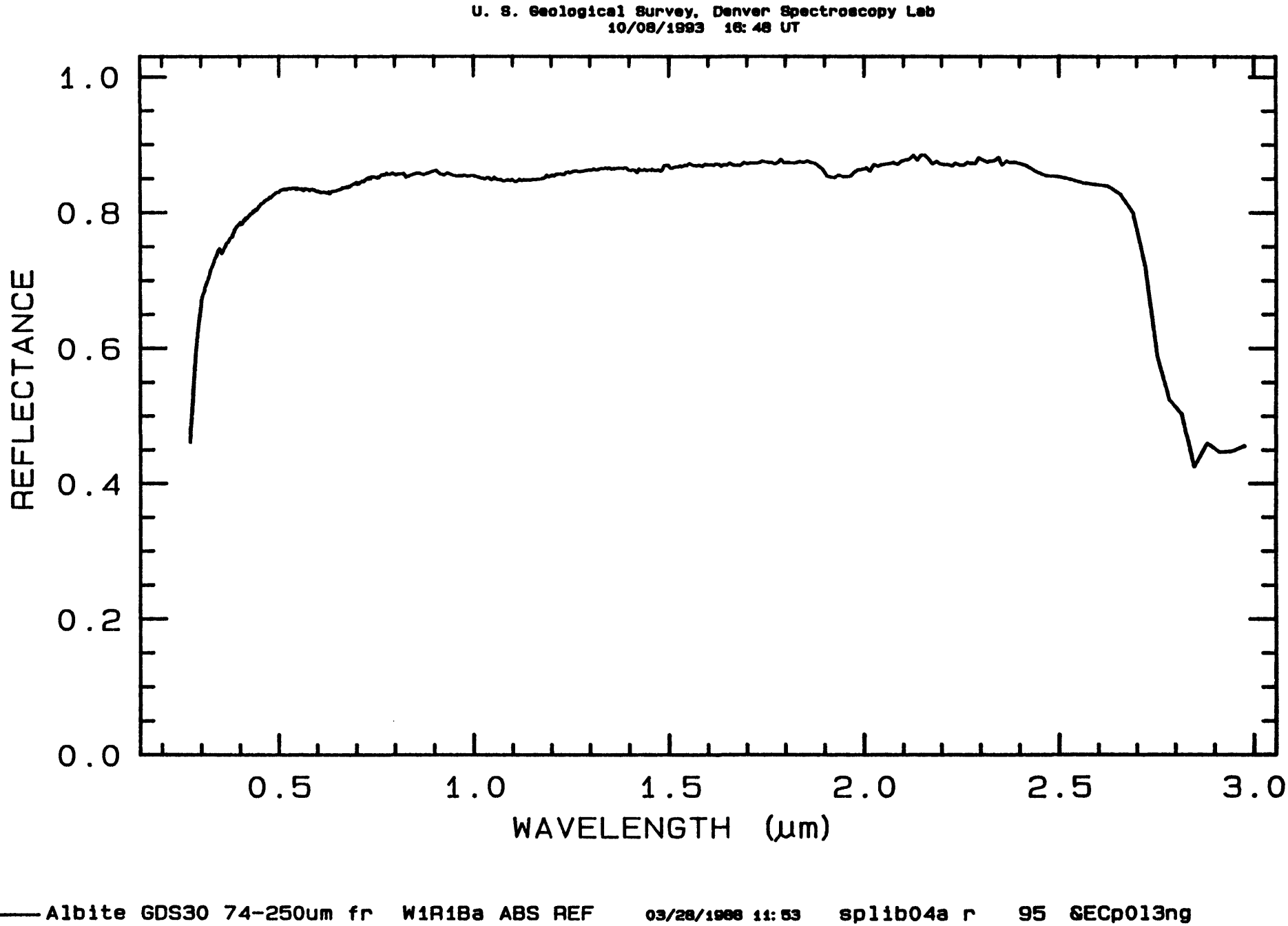
av gr sz = 190μm

Clear tabular grains, mostly cleavage bound grains. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	95	0.2-3.0μm	200	g.s.= 190 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Albite GDS30 74-250um fr W1R1Ba ABS REF 03/28/1988 11:53 splib04a r 95 &ECp013ng

TITLE: Albite HS324 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS324

MINERAL_TYPE: Tectosilicate

MINERAL: Albite (Plagioclase, Na end member)(Feldspar group)

FORMULA: NaAlSi3O8

FORMULA_NROFF: $NaAlSi_3O_8$

COLLECTION_LOCALITY: South Dakota

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"This is the sodium end member of the albite-anorthite series and is composed of 90 to 100% albite. Its spectrum shows weak features near 0.65 μ (very broad) and near 1.0 μ, suggesting the presense of small amounts of both Fe^{+3} and Fe^{+2}. The Fe^{+3} substitutes for aluminum, and the Fe^{+2} substitutes for the calcium, the latter in whatever anorthite is present. Hydroxyl and water bands are seen near 1.4 and 1.9 μ, and the AlOH bend OH combination feature near 2.2 μ is evident. The strength of this last band suggests incipient alteration of the sample, which is not apparent in hand specimen."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, vol. 4, pp 85-106.

White color, 74-250μm sieve interval.

Note: the spectrum of this sample shows a significant 2.2-μm band apparently due to alteration although (see microscopic examination below) it can not be seen by visual examination. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Albite + 3.18(s) anorthite?? (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No compositional analyses available

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

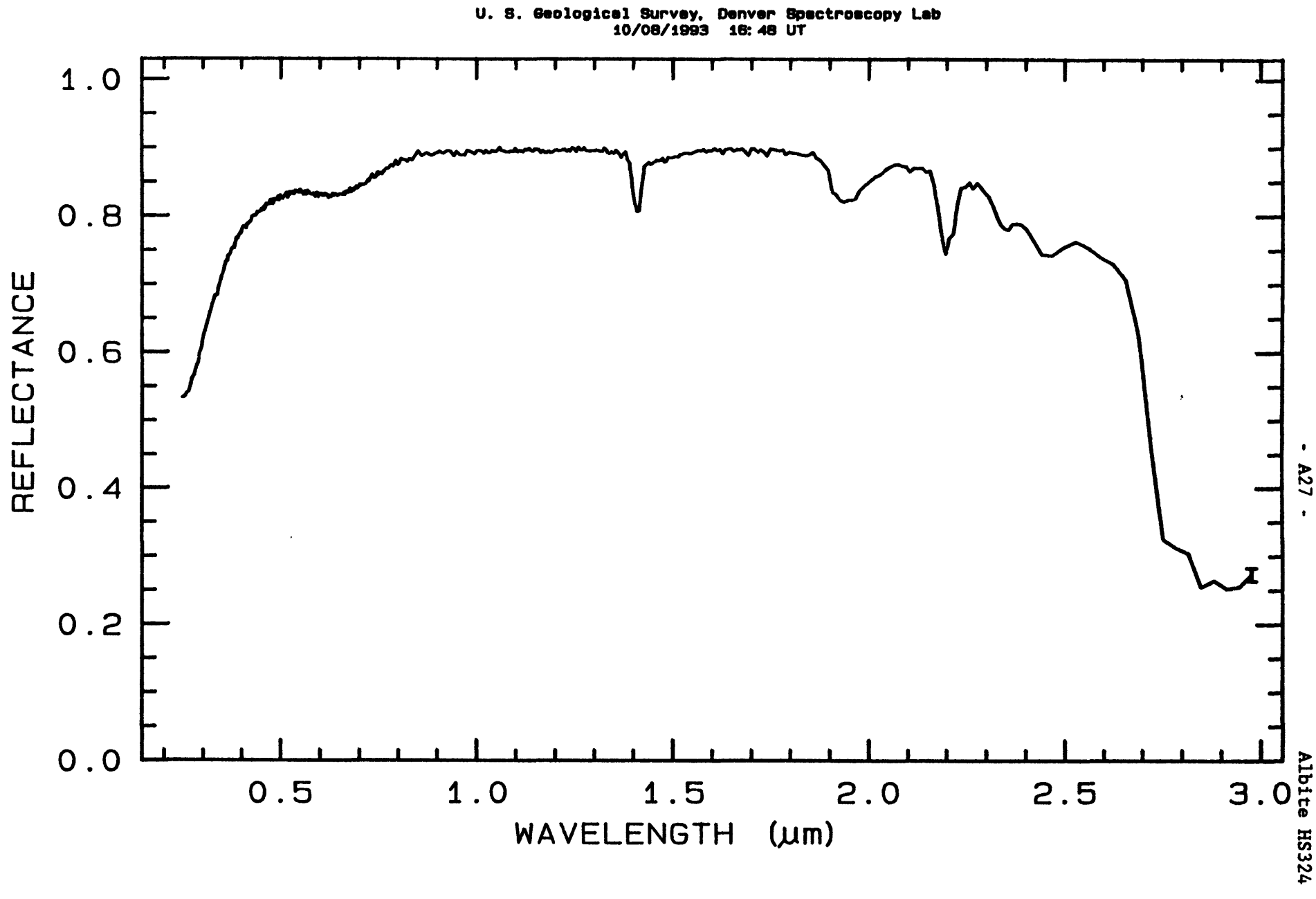
av gr sz = 265μm

Pure sample no visible alteration or contamination, clear cleavage bounded crystals. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 106	0.2-3.0μm	200	g.s.= 265 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Albite HS324
Albite HS324.3B W1R1Bc ABS REF 11/14/1986 09:36 splib04a r 106 &ECp013ng

TITLE: Albite HS66 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS66

MINERAL_TYPE: Tectosilicate

MINERAL: Albite (Plagioclase, Na end member)(Feldspar group)

FORMULA: NaAlSi3O8

FORMULA_NROFF: $NaAlSi_3O_8$

COLLECTION_LOCALITY: Amelia, Virginia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"This sample of albite is quite pure, and consequently has a high reflectivity throughout this wavelength range (.4-2.5 μm). The only two bands displayed (near 1.4 and 1.9 μm) are due to water in fluid inclusions."

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, vol. 1, pp 283-300.

White color, 74-250μm sieve interval. This is the sodium end member of the albite-anorthite series.

Also apparent in the spectrum is a weak 2.2-μm absorption, apparently due to some alteration that is not detectable under microscopic examination. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Albite + trace mica. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No compositional analyses available

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:

population 1 = 190μm 99 vol%
population 2 = 8μm 1 vol%

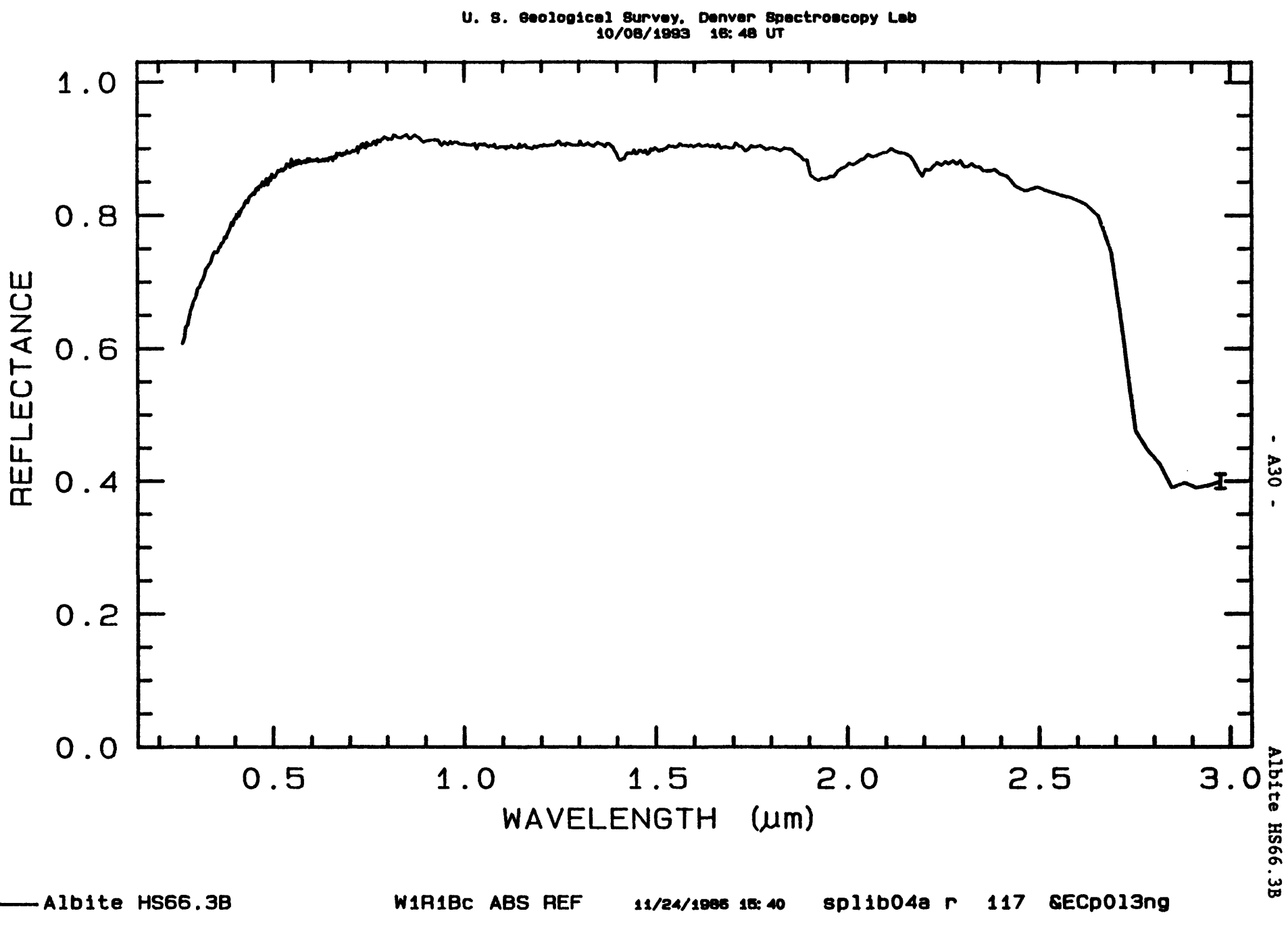
av gr sz of populations = 189μm

Pure feldspar. Larger grains cleavge and fracture bounded with 20% of their surfaces covered by smaller grains. No mica visible in either grains size fraction. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	117	0.2-3.0μm	200	g.s.= 189 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A30 -
Albite HS66.3B
Albite HS66.3B
W1R1Bc ABS REF
11/24/1986 15:40
splib04a r 117 &ECp013ng

TITLE: Allanite HS293 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS293

MINERAL_TYPE: Sorosilicate

MINERAL: Allanite (Orthite)(Epidote Group)

FORMULA: (Ce,Ca,Y)2(Al,Fe+3)3(SiO4)3(OH)

FORMULA_NROFF: $(Ce,Ca,Y)_2(Al,Fe^{3+})_3(SiO_4)_3(OH)$

COLLECTION_LOCALITY: Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Allanite is an accesory mineral in many granites, grandiorites, monzonites, and syenites, and occurs in large amounts in some limestone skarns and pegmatites. It is typically a very dark mineral, and this sample is no exception. The high ferric iron and rare earth metal content reduces the reflectivity throughtout the visible and very near infrared. The high metal ion content also quenches the hydroxyl bands."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, vol. 4, pp 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mineral mode:

92 vol% Allanite, dark brown translucent, conchoidally fractured surfaces, lacks any good cleavage
5 vol% Fe-stained, conchoidally fractured, possibly quartz or sphene??
3 vol% White plagiclase, with 90 degree cleavage angle

population 1 Allanite: av gr sz = 300μm
population 2 qtz-plag: av gr sz = 290μm

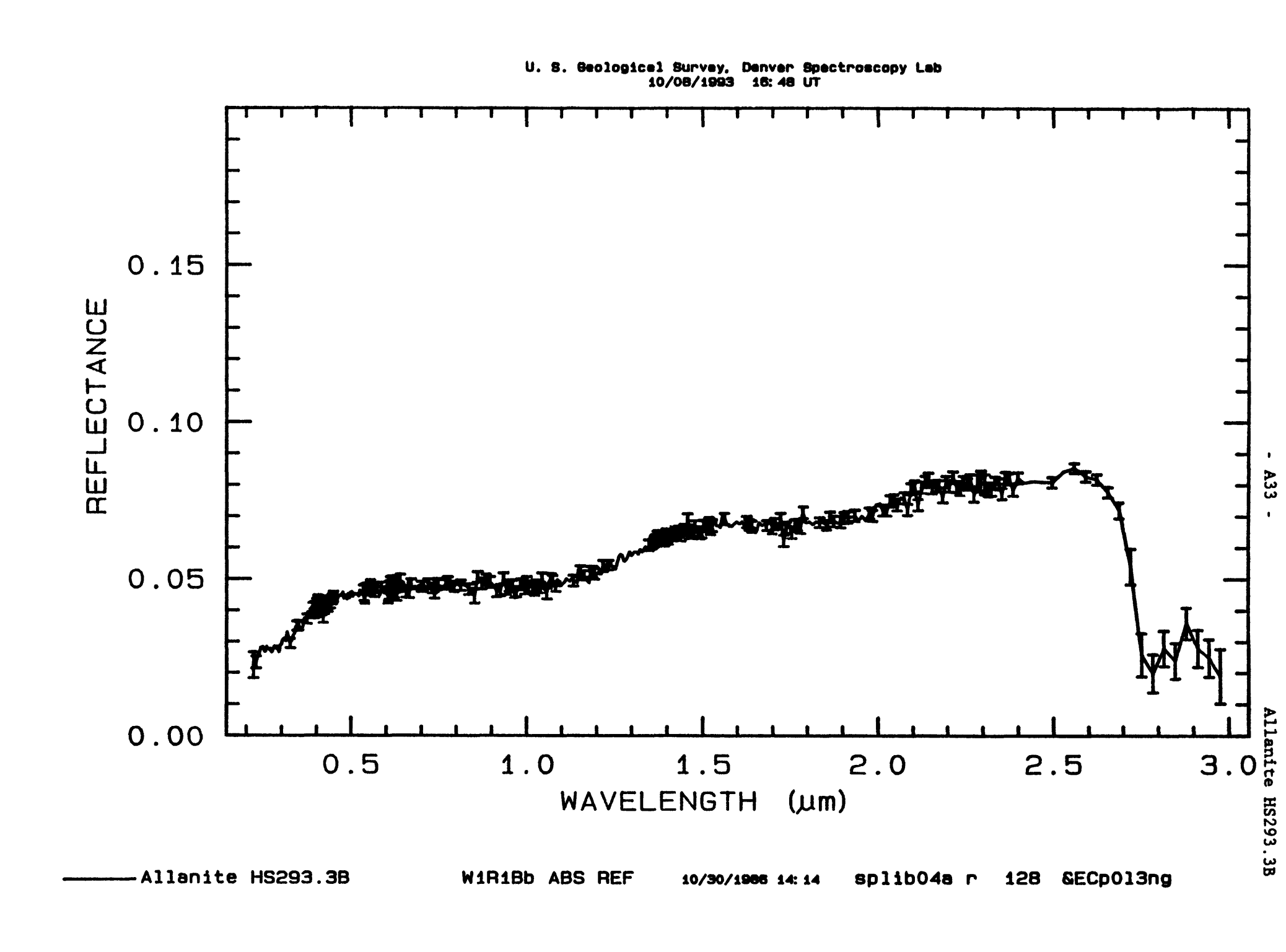
av gr sz of populations = 299μm

Dark brown grains are pleochroic, biaxial (-), lack good cleavage, have anomalous blue interference colors, and have high relief. All these are characteristic of Allanite. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	128	0.2-3.0μm	200	g.s.= 299 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A33 -
Allanite HS293.3B
Allanite HS293.3B
W1R1Bb ABS REF
10/30/1986 14:14
splib04a r 128 &ECp013ng

TITLE: Almandine HS114 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS114

MINERAL_TYPE: Nesosilicate

MINERAL: Almandine (Garnet group)

FORMULA: (Fe+2)3Al2(SiO4)3

FORMULA_NROFF: $Fe^{+2}_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Warren County, New York

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Pyrope and with Spessartine.

"This is a common garnet of schists and gneisses and also occurs in intermediate to acidic igneous rocks. It is the most widespread variety of garnet found as a detrital mineral in sedimentary rocks. Again, this spectrum is dominated by the intense absorption at 1.28 μ and 1.7 μ due to the ferrous iron in eight-fold coordination. Also, there is a rapid fall off to the blue caused by both ferrous and ferric ion absorptions. The well defined band at 0.7 μ confirms the presence of Fe^{+3} substituted for Al^{+3}, and the suggestion of a band near 0.85μ in the smallest particle size is consistent with this - even though the combination of the visible and near-infrared intense absorptions provide a well-resolved maximum near 0.85 μm, especially in the larger particle size samples. The visible spectrum shows features at 0.37, 0.43, 0.51, and 0.57 μ, which is quite similar to the spectrum of spessartine, with the exception of the very sharp 0.41 μ Mn^{+2} band, which is absent."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION: SiO2: 40.40 wt% NROFF: SiO_2
COMPOSITION: TiO2: 0.07 wt% NROFF: TiO_2
COMPOSITION: Al2O3: 22.97 wt% NROFF: Al_2O_3
COMPOSITION: Cr2O3: 0.01 wt% NROFF: Cr_2O_3
COMPOSITION: V2O3: 0.01 wt% NROFF: V_2O_3
COMPOSITION: FeO: 22.45 wt% NROFF: FeO
COMPOSITION: NiO: 0.02 wt% NROFF: NiO
COMPOSITION: MnO: 0.53 wt% NROFF: MnO
COMPOSITION: MgO: 11.05 wt% NROFF: MgO
COMPOSITION: CaO: 4.27 wt% NROFF: CaO
COMPOSITION: ----------
COMPOSITION: Total: 101.79 wt%
COMPOSITION: O=Cl,F,S: wt% #correction for Cl, F, S
COMPOSITION: New Total: 101.79 wt%

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

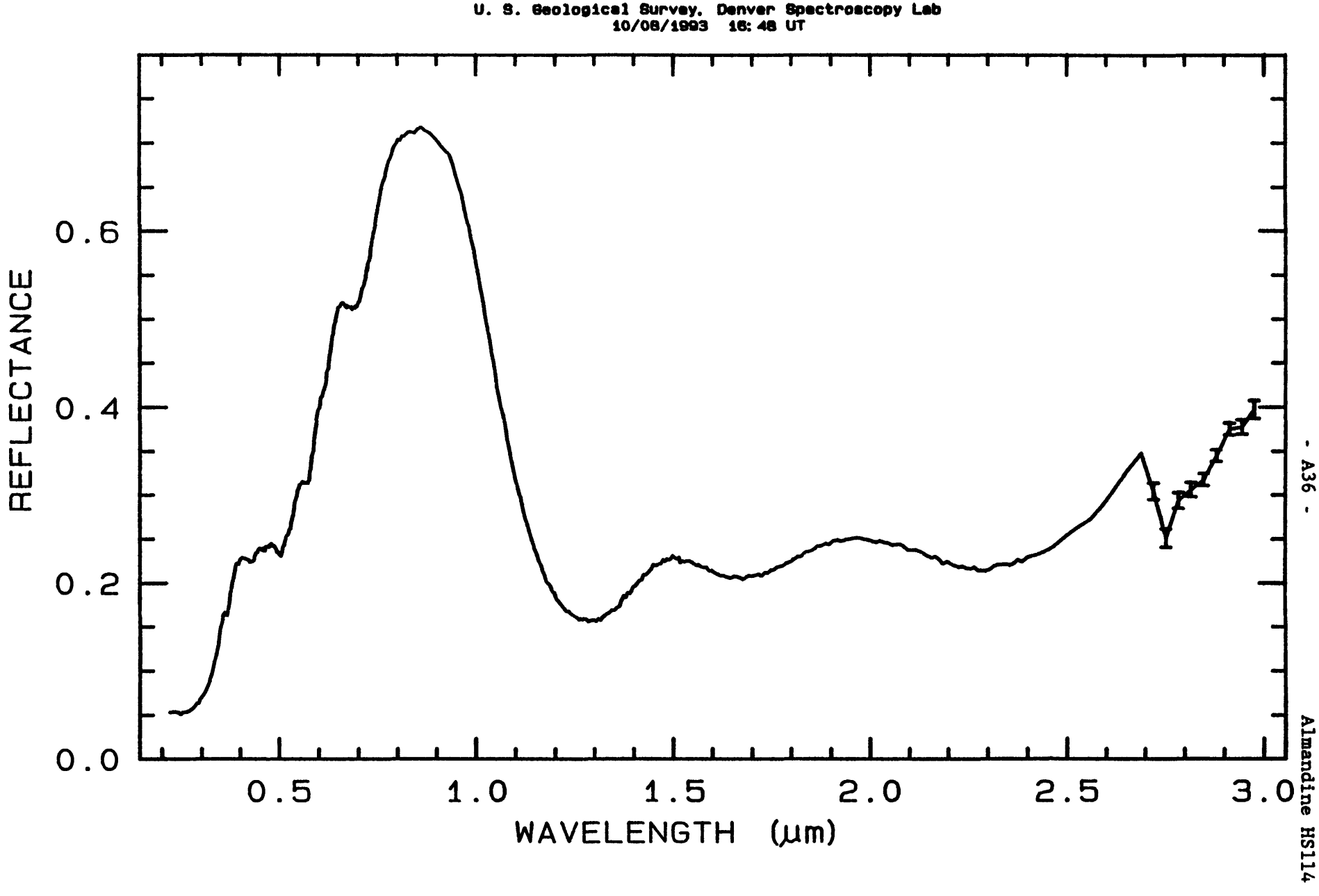
av gr sz = 260μm

Conchoidally fractured grains, isotropic under cross-polarized light. About 3% thin fibrous inclusions. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 140	0.2-3.0μm	200	g.s.= 260 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A36 -
Almandine HS114
Almandine HS114.3B
W1R1B? ABS REF
08/27/1986 16:48
splib04a r 140 &ECp013ng

TITLE: Almandine WS475 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS475

MINERAL_TYPE: Nesosilicate

MINERAL: Almandine (Garnet group)

FORMULA: (Fe+2)3Al2(SiO4)3

FORMULA_NROFF: $Fe^{+2}_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Jackson Co., North Carolina

ORIGINAL_DONOR: Wards Science

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Pyrope and with Spessartine.

Optical examination gives the following mode:

95 vol% almandine
4 vol% biotite
1 vol% magnetite

Rose pink color in hand sample, original sample was a almandine-biotite schist. Sample was hand-picked and sieved so that current sample consists of < 250-μm grain fraction. Sample could benefit from more handpicking under a microscope. Biotite forms almandine coated flakes.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(CDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	37.98 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.00 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	22.14 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.01 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3:	0.01 wt%	NROFF:	V_2O_3
COMPOSITION:	FeO:	29.83 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.01 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.47 wt%	NROFF:	MnO
COMPOSITION:	MgO:	7.35 wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.71 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	99.52 wt%		
COMPOSITION:	O=Cl,F,S:	wt%		#correction for Cl, F, S
COMPOSITION:	New Total:	99.52 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analyses are average of five spot locations done on different grains. All Fe is expressed as FeO, and the Fe_2O_3 content was not determined.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

95 vol% pyrope
4 vol% biotite
1 vol% magnetite or other opaque

This sample has a bimodal grainsize distribution:

1st population: avg grain size = 200 μm
2nd population: avg grain size = 25 μm

avg. grain size = 199 μm

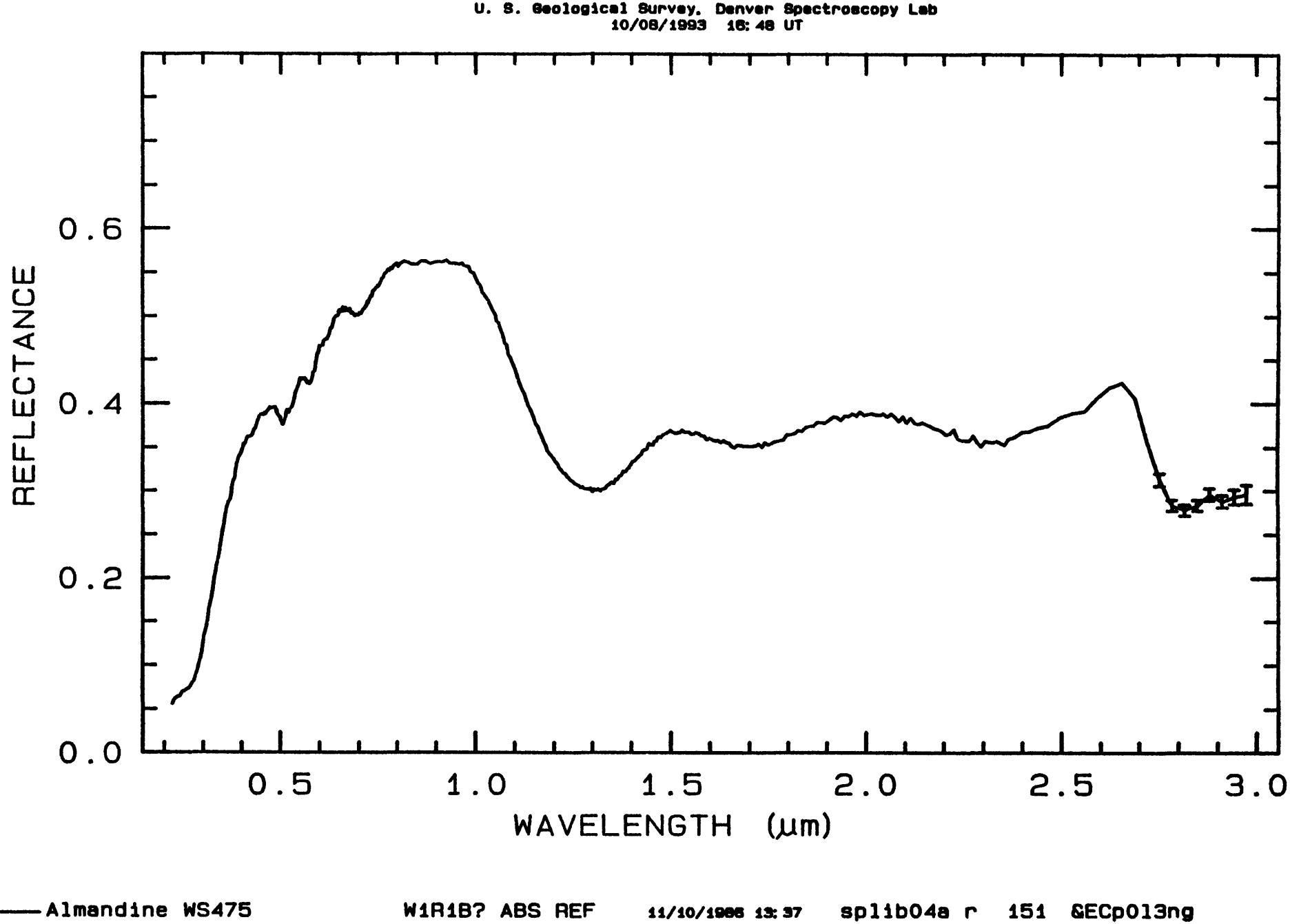
Smaller grains partially coat larger grains. G. Swayze

Fine pyrope grains adhere to biotite contaminant surfaces. Some pyrope grains (~10%) have dark honey color perhaps due to mafic inclusions. Most grian surfaces have concoidal fractures since garnet has no cleavage; parting surfaces not apparent in this sample.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: gswayze@speclab (Gregg A. Swayze)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	151	0.2-3.0μm	200	g.s.=199 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Almandine WS475
W1R1B? ABS REF
11/10/1986 13:37
splib04a r 151 &ECp013ng
Almandine WS475

TITLE: Almandine WS476 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS476

MINERAL_TYPE: Nesosilicate

MINERAL: Almandine (Garnet group)

FORMULA: (Fe+2)3Al2(SiO4)3

FORMULA_NROFF: $Fe^{+2}_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Gore Mountain, Warren County, New York

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Pyrope and with Spessartine.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	39.84 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.08 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	22.04 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.01 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3:	0.01 wt%	NROFF:	V_2O_3
COMPOSITION:	FeO:	22.01 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.01 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.56 wt%	NROFF:	MnO
COMPOSITION:	MgO:	10.69 wt%	NROFF:	MgO
COMPOSITION:	CaO:	4.93 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	100.18 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	101.18 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

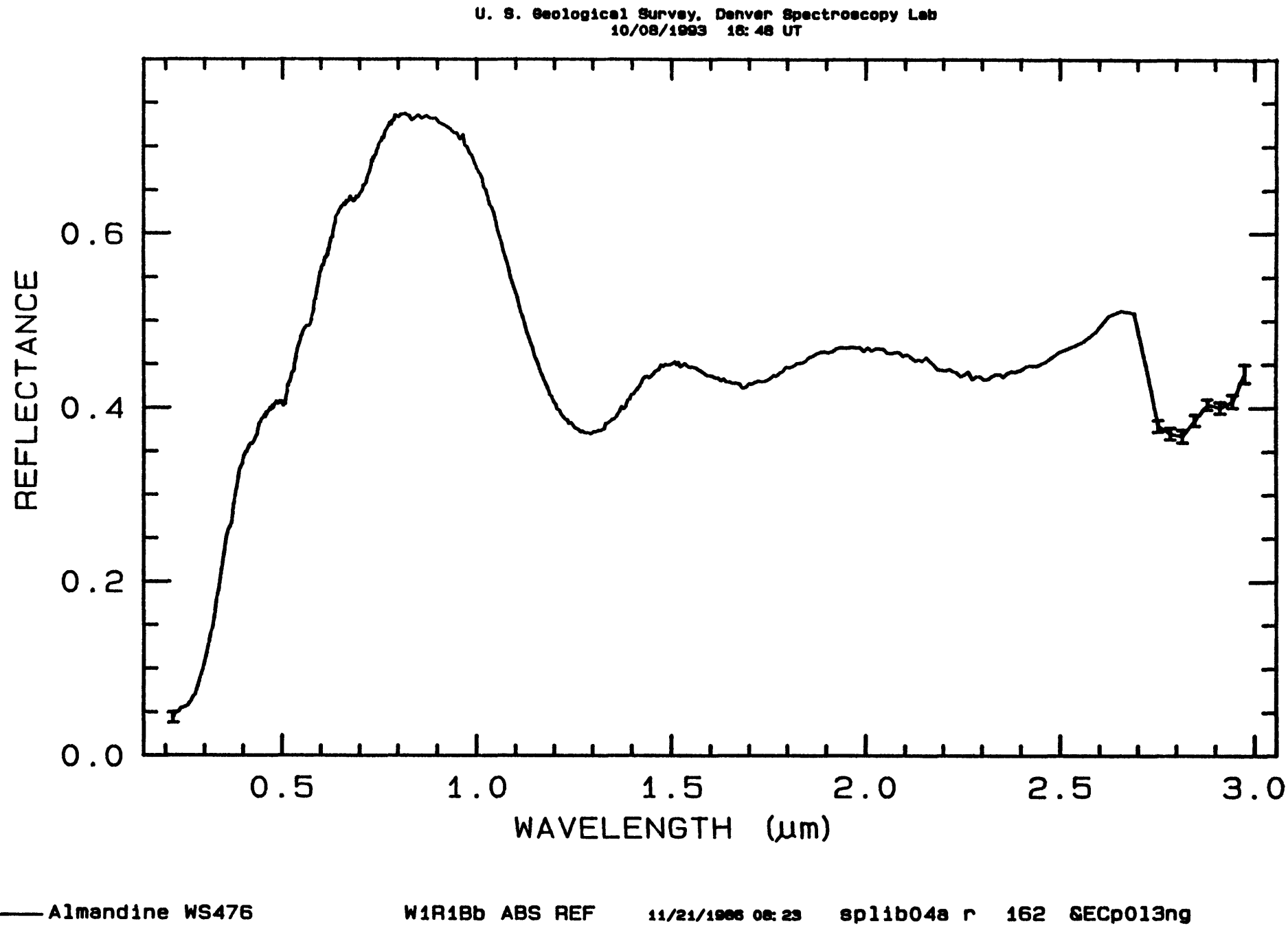
av gr sz = 125μm Range = 5 - 200μm

Uniform grain size distribution. Trace limonite? Garnet isotropic under cross-polarized light. Conchoidally fractured grains. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 162	0.2-3.0μm	200	g.s.= 125 μm



Almandine WS476

TITLE: Almandine WS477 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS477

MINERAL_TYPE: Nesosilicate

MINERAL: Almandine (Garnet group)

FORMULA: (Fe+2)3Al2(SiO4)3

FORMULA_NROFF: $Fe^{+2}_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Pyrope and with Spessartine.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mineral mode:

85 vol% Almandine
15 vol% limonite stained almandine grains

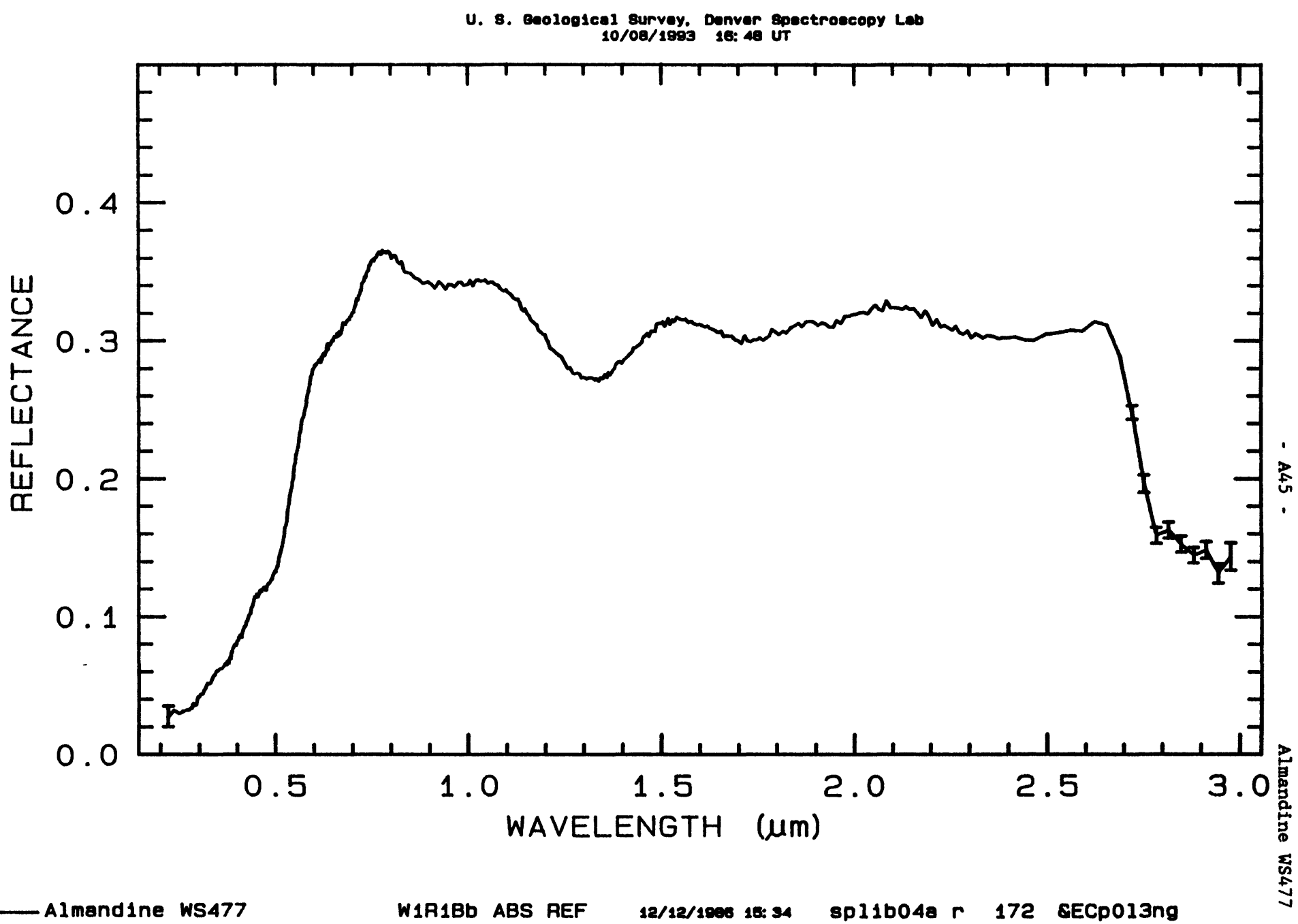
av gr sz = 50μm Range = 5 - 200μm

Trace amphibole? All other grains isotropic under cross-polarized light. Conchoidal fracture in almandine. Limonite staining and limonite grains embedded in almandine grains. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a_	r 172	0.2-3.0μm	200	g.s.= 50 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Almandine WS477
Almandine WS477 W1R1Bb ABS REF 12/12/1986 15:34 splib04a r 172 &ECp013ng

TITLE: Almandine WS478 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS478

MINERAL_TYPE: Nesosilicate

MINERAL: Almandine (Garnet group)

FORMULA: (Fe+2)3Al2(SiO4)3

FORMULA_NROFF: $Fe^{+2}_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Wrangell, Alaska

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Pyrope and with Spessartine.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	39.09 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.00 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	22.05 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.02 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3:	0.01 wt%	NROFF:	V_2O_3
COMPOSITION:	FeO:	33.10 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.01 wt%	NROFF:	NiO
COMPOSITION:	MnO:	1.73 wt%	NROFF:	MnO
COMPOSITION:	MgO:	5.74 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.57 wt%	NROFF:	CaO
COMPOSITION:	---	---		
COMPOSITION:	Total:	101.32 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	101.32 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

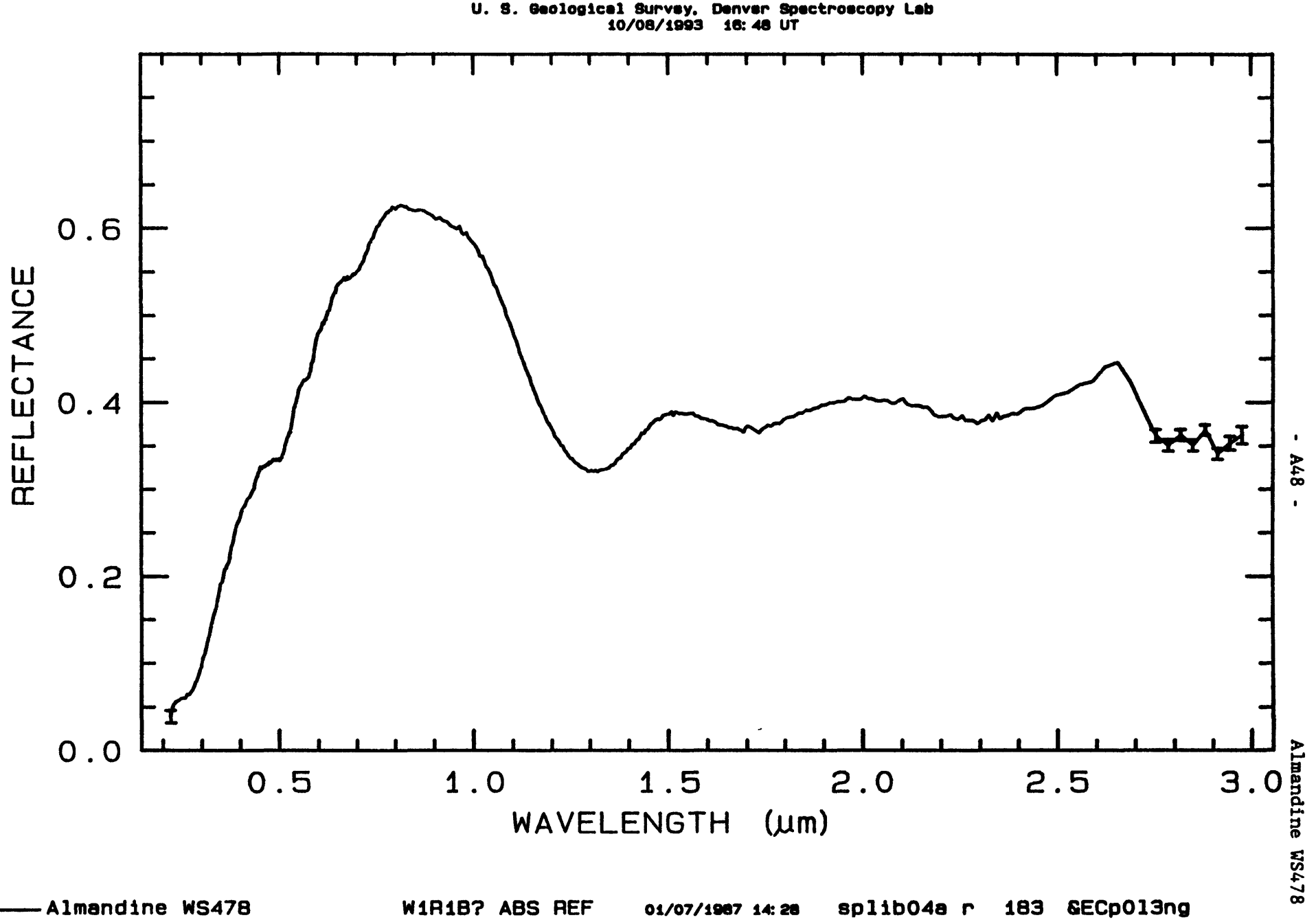
av gr sz = 125μm Range = 5-325μm

Smaller grains adhere to larger ones. Trace of limonite staining and individual limonite grains. Garnet has conchoidal fractured surfaces, and is mostly isotropic under cross-polarized light. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 183	0.2-3.0μm	200	g.s.= 125 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Almandine WS478
W1R1B? ABS REF 01/07/1987 14:28 splib04a r 183 &ECp013ng

TITLE: Almandine WS479 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS479

MINERAL_TYPE: Nesosilicate

MINERAL: Almandine (Garnet group)

FORMULA: (Fe+2)3Al2(SiO4)3

FORMULA_NROFF: $Fe^{+2}_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Ampandrambaika, Malagasy

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Pyrope and with Spessartine.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	37.34 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.08 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	21.93 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.02 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3:	0.02 wt%	NROFF:	V_2O_3
COMPOSITION:	FeO:	32.23 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.01 wt%	NROFF:	NiO
COMPOSITION:	MnO:	1.70 wt%	NROFF:	MnO
COMPOSITION:	MgO:	8.83 wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.62 wt%	NROFF:	CaO
COMPOSITION:	---	---		
COMPOSITION:	Total:	103.78 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	103.78 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

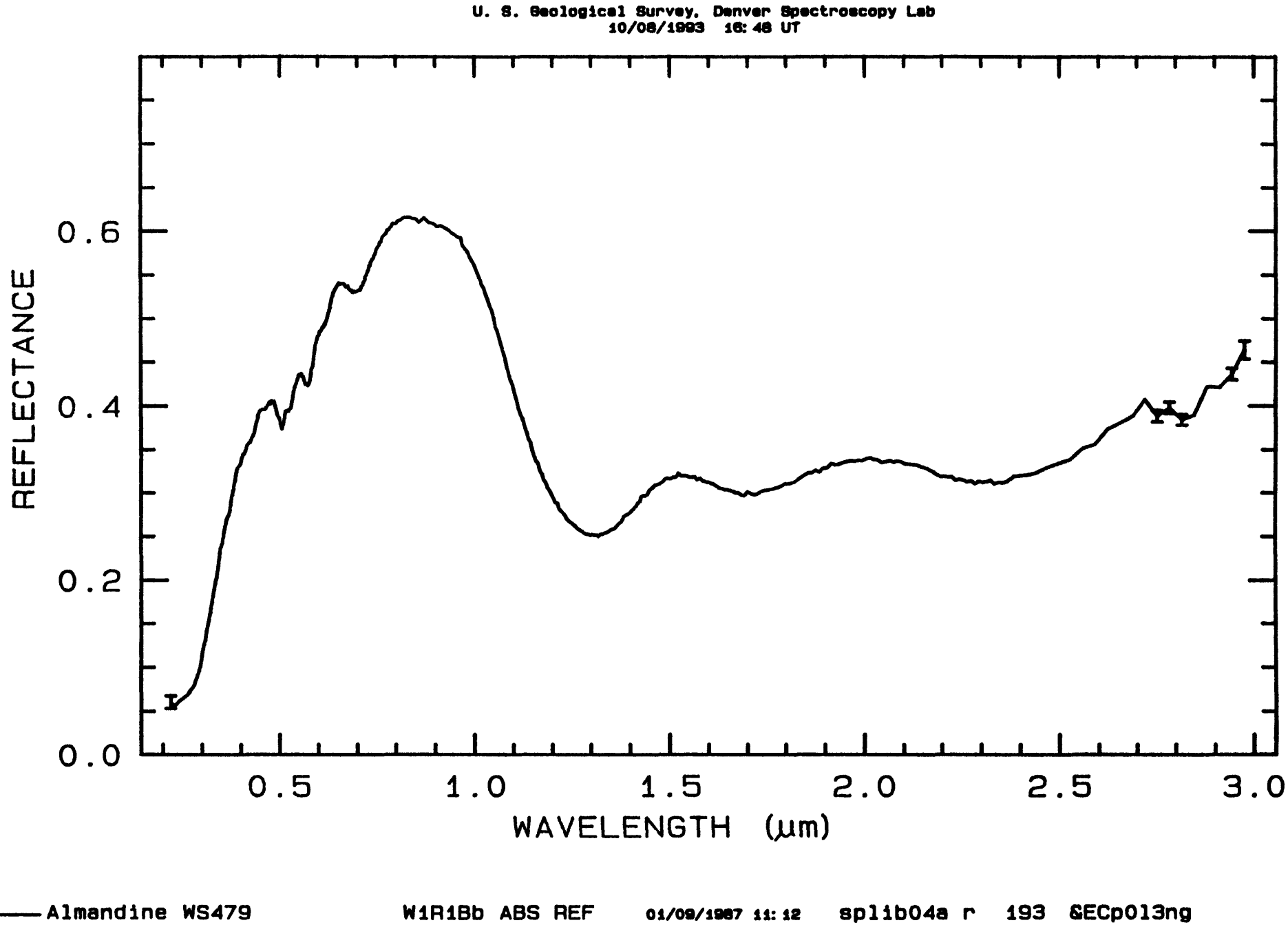
av gr sz = 125μm Range = 10 - 295μm

Trace of opaques, conchoidal fractured garnet grains, with 15% of garnet grains containing non-isotropic inclusions. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 193	0.2-3.0μm	200	g.s.= 125 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Almandine WS479
W1R1Bb ABS REF 01/09/1997 11:12 splib04a r 193 &ECp013ng

TITLE: Alunite GDS84 (K) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS84

MINERAL_TYPE: Sulfate

MINERAL: Alunite (Na03) (Alunite group)

FORMULA: KAl3(SO4)2(OH)6 Na03

FORMULA_NROFF: $KAl_3(SO_4)_2(OH)_6$ (Na_{03})

COLLECTION_LOCALITY: Marysvale, UT

ORIGINAL_DONOR: Roger Stoffregen, SMU

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This alunite sample is from a high temperature, coarse vein deposit.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Standard used by Stoffregen et al.

Stoffregen, R., and Alpers, C., 1992, Observations on the unit-cell dimensions, H2O contents and del D values of natural and synthetic alunite: American Mineralogist, v.77, p. 1092-1098.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal Grain size distribution:
mode 1: 400 μm @ 65 vol%
mode 2: 40 μm @ 35 vol%

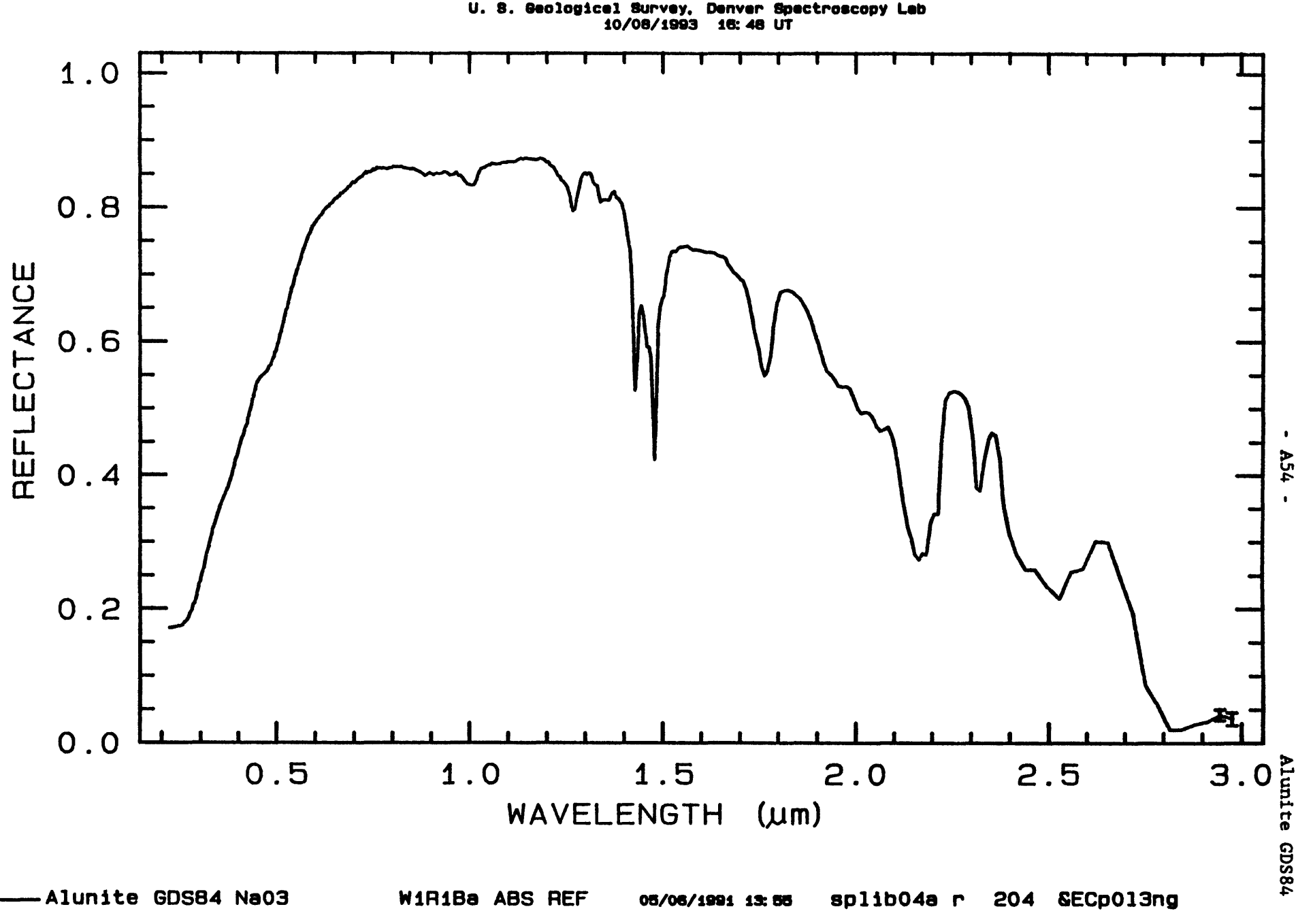
avg gr sz = 260 μm

Trace of Fe-staining on larger gtrains as discontinuous crust covering or clouding 5-10% of grains. Uniaxial (+), good basal cleavage, all consistent with alunite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 204	0.2-3.0μm	200	g.s.= 260 μm



Alunite GDS84

TITLE: Alunite GDS83 (Na) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS83

MINERAL_TYPE: Sulfate

MINERAL: Alunite (Na63)(Alunite group)

FORMULA: (Na,K)Al3(SO4)2(OH)6 Na63

FORMULA_NROFF: $(Na,K)Al_3(SO_4)_2(OH)_6$ (Na_{63})

COLLECTION_LOCALITY: Komatsuga, Japan

ORIGINAL_DONOR: Roger Stoffregen, SMU

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This alunite sample is from a high temperature, coarse vein deposit.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV (n65alnt.out)
References: JCPDS #41-1467; Parker (1962)
Found: alunite and a major unidentified phase
Comment: The alunite closely matches natroalunite; its sharp reflections indicate good crystallinity and compositional homogeneity. The additional phase(s) has some strong lines (d in angstroms / intensity): 2.81/100, 2.253/100, 2.002/2, 1.877/50, 1.575/10, 1.473/100. I have been unable to identify this phase. Where not obscured by the alunite, peaks of this unidentified phase "tail off" toward larger d, suggesting compositional zoning."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Standard used by Stoffregen et al.

Stoffregen, R., and Alpers, C., 1992, Observations on the unit-cell dimensions, H2O contents and del D values of natural and synthetic

alunite: American Mineralogist, v.77, p. 1092-1098.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

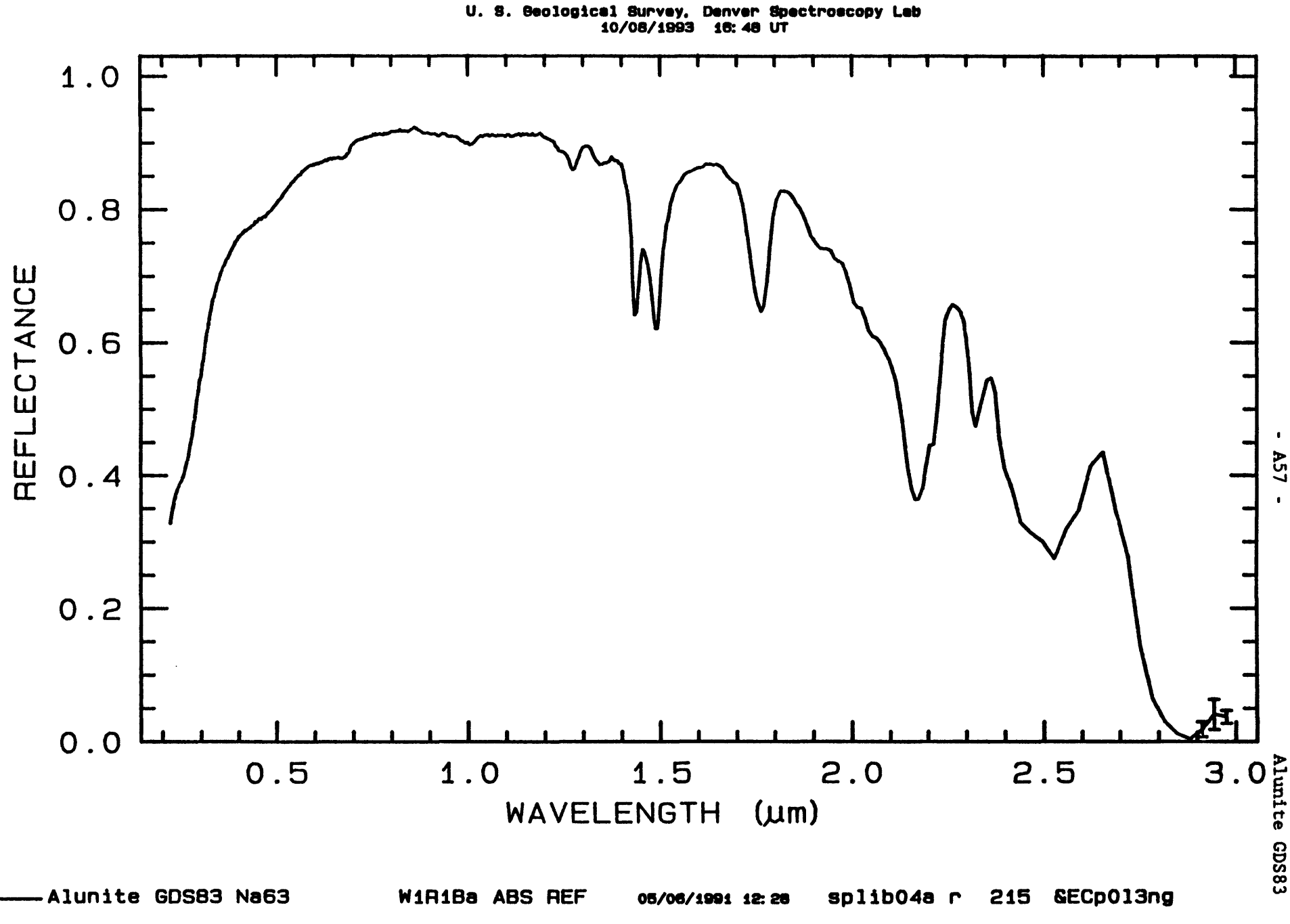
avg gr sz = 35 μm

Uniaxial (+), low birefringence, length fast, basal cleavage, all consistent with alunite. Very little contamination. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 215	0.2-3.0μm	200	g.s.= 35 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 15:48 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Alunite GDS83
Alunite GDS83 Na63 W1R1Ba ABS REF 05/06/1991 12:26 splib04a r 215 GECp013ng

TITLE: Alunite GDS82 (Natroalunite) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS82

MINERAL_TYPE: Sulfate

MINERAL: Alunite (Na82) (Natroalunite) (Alunite group)

FORMULA: (Na,K)Al3(SO4)2(OH)6 Na82

FORMULA_NROFF: $(Na,K)Al_3(SO_4)_2(OH)_6$ (Na_{82})

COLLECTION_LOCALITY: Sadler, TX

ORIGINAL_DONOR: Roger Stoffregen, SMU

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This is a low temperature, diagentic variety of alunite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV (n80alnt.out)
References: JCPDS #41-1467; Huebner's reference patterns
Found: alunite, quartz, very very weak reflections at 2.38
and 1.720 .
Comment: the alunite is probably a single phase; its lattice
spacings match those of natroalunite. The alunite has
sharp peaks, indicating good crystallinite and
compositional homogeneity"

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Sample is a standard used by:

Stoffregen, R., and Alpers, C., 1992, Observations on the unit-cell dimensions, H2O contents and del D values of natural and synthetic alunite: American Mineralogist, v.77, p. 1092-1098.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:
mode 1: 70 μm @ 55 vol%
mode 2: 3 μm @ 45 vol%

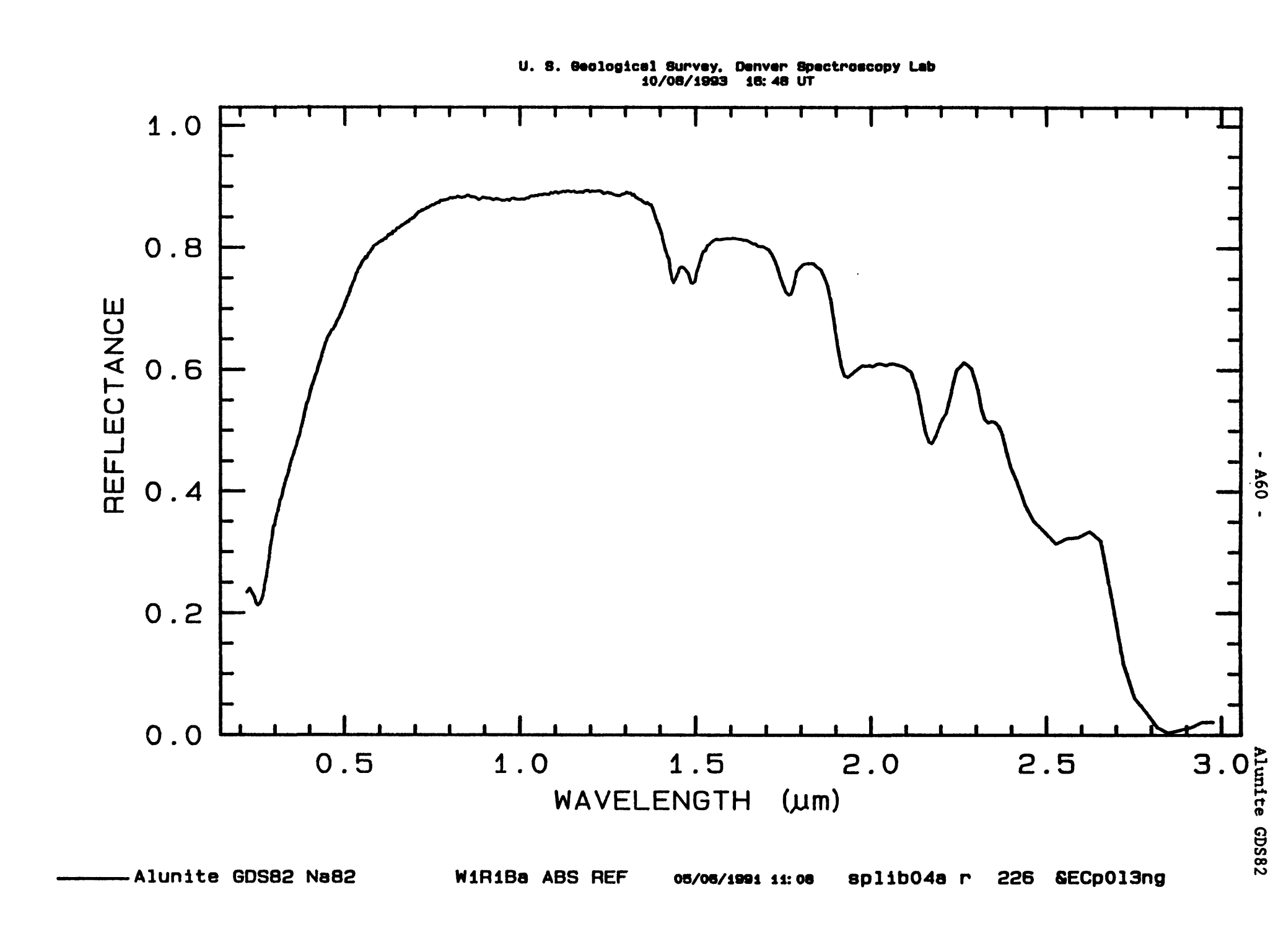
avg gr sz = 50 μm

Larger grains have extinction characteritic of very fine grained aggregates. I cannot determine the optical properties because of small grain size. Trace opaques. Purity confirmed by XRD by Roger Stoffregen. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 226	0.2-3.0μm	200	g.s.= 50 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A60 -
Alunite GDS82
Alunite GDS82 Na82 W1R1Ba ABS REF 05/06/1991 11:08 splib04a r 226 &ECp013ng

TITLE: Alunite AL706 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: AL706

MINERAL_TYPE: Sulfate

MINERAL: Alunite (Alunite group)

FORMULA: (Na,K)Al3(SO4)2(OH)6

FORMULA_NROFF: $(Na,K)Al_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Sulfur, Nevada

ORIGINAL_DONOR: Ron Lyon, Stanford University

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Alunite
Contaminant phases: smectite, quartz, minor amounts.

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUSG/UNESCO, Special Publication, 211p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

avg gr sz = 15 μm
Length fast, 1st order grey, sample looks pure but small grain size prevents determination of optical sign. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 239	0.2-3.0μm	200	g.s.= 15 μm

TITLE: Alunite HS295 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS295

MINERAL_TYPE: Sulfate

MINERAL: Alunite (Alunite group)

FORMULA: KAl3(SO4)2(OH)6

FORMULA_NROFF: $KAl_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Utah

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Original spectrum published in:

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: IV. Sulphides and sulphates. Modern Geology, vol. 3, pp 1-14.

With the following comment: "Alunite is white when pure ... This particular sample is pink, presumably because of a small amount of iron which causes the fall-off in reflectivity toward the blue. No iron bands are seen in the near-infrared ..."

A spectrum for this sample is also published in:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

The only sample measured was HS295.3B which was dry sieved to the grain size interval 74-250 μm.

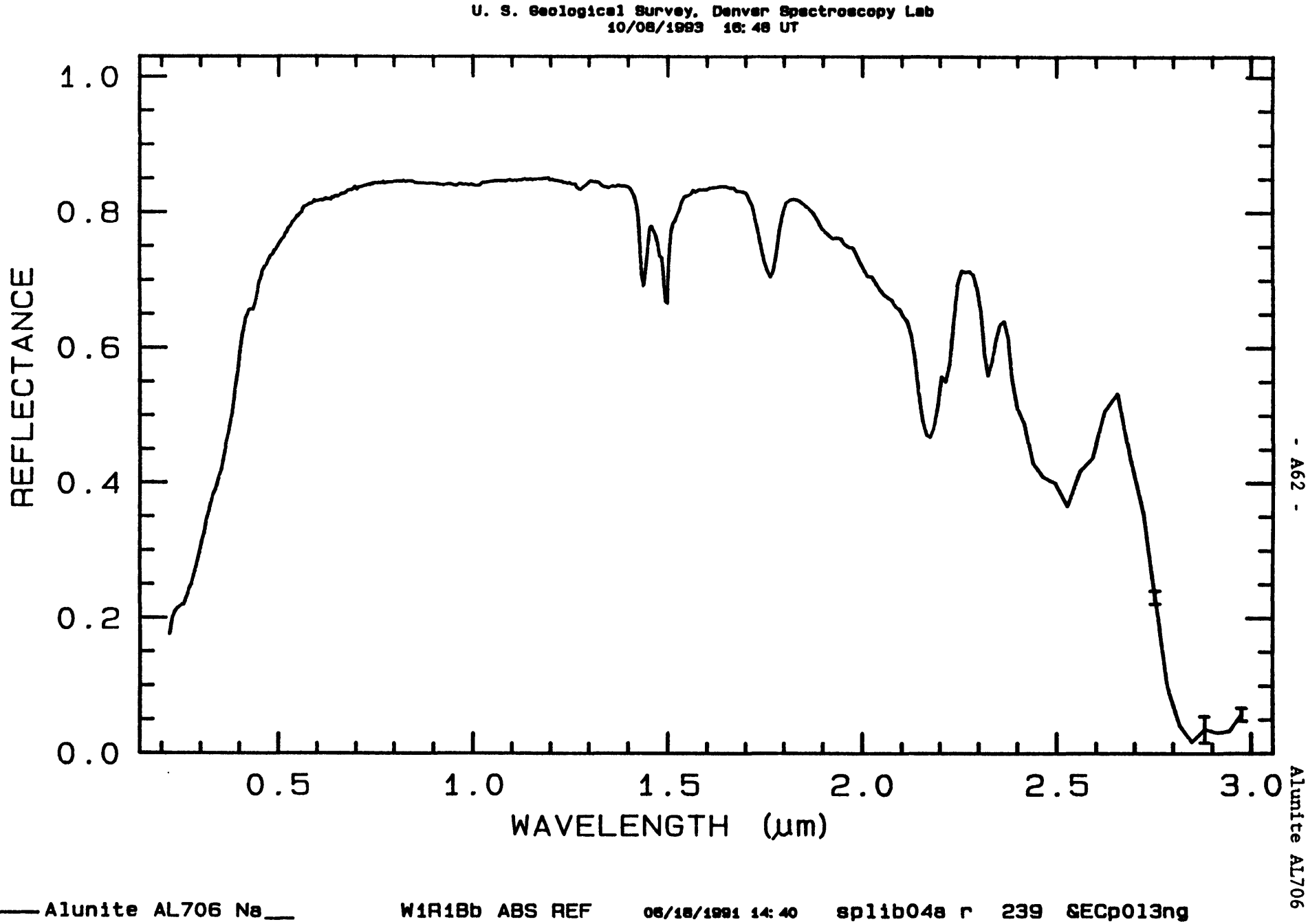
END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates pure Alunite

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem



Alunite AL706

COMPOSITION:	SiO2:	0.17	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	<0.02	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	35.6	wt%	NROFF: Al_2O_3
COMPOSITION:	Fe2O3:	0.14	wt%	NROFF: Fe_2O_3
COMPOSITION:	MnO:	<0.02	wt%	NROFF: MnO
COMPOSITION:	MgO:	<0.1	wt%	NROFF: MgO
COMPOSITION:	CaO:	<0.02	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.34	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	10.2	wt%	NROFF: K_2O
COMPOSITION:	P2O5:	0.75	wt%	NROFF: P_2O_5
COMPOSITION:	LOI:	44.2	wt%	NROFF: LOI
COMPOSITION:	---	---		
COMPOSITION:	Total:	91.56	wt%	
COMPOSITION:	O=Cl,F,S:		wt%	
COMPOSITION:	New Total:		wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

XRF analysis by Foggert, Bartel, and Stewart USGS Branch of Analytic Chemistry, Denver from:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Sulfur was not included in analysis and probably accounts for the missing 8%.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

This reference notes that the sample is slightly pink in color, appears pure.

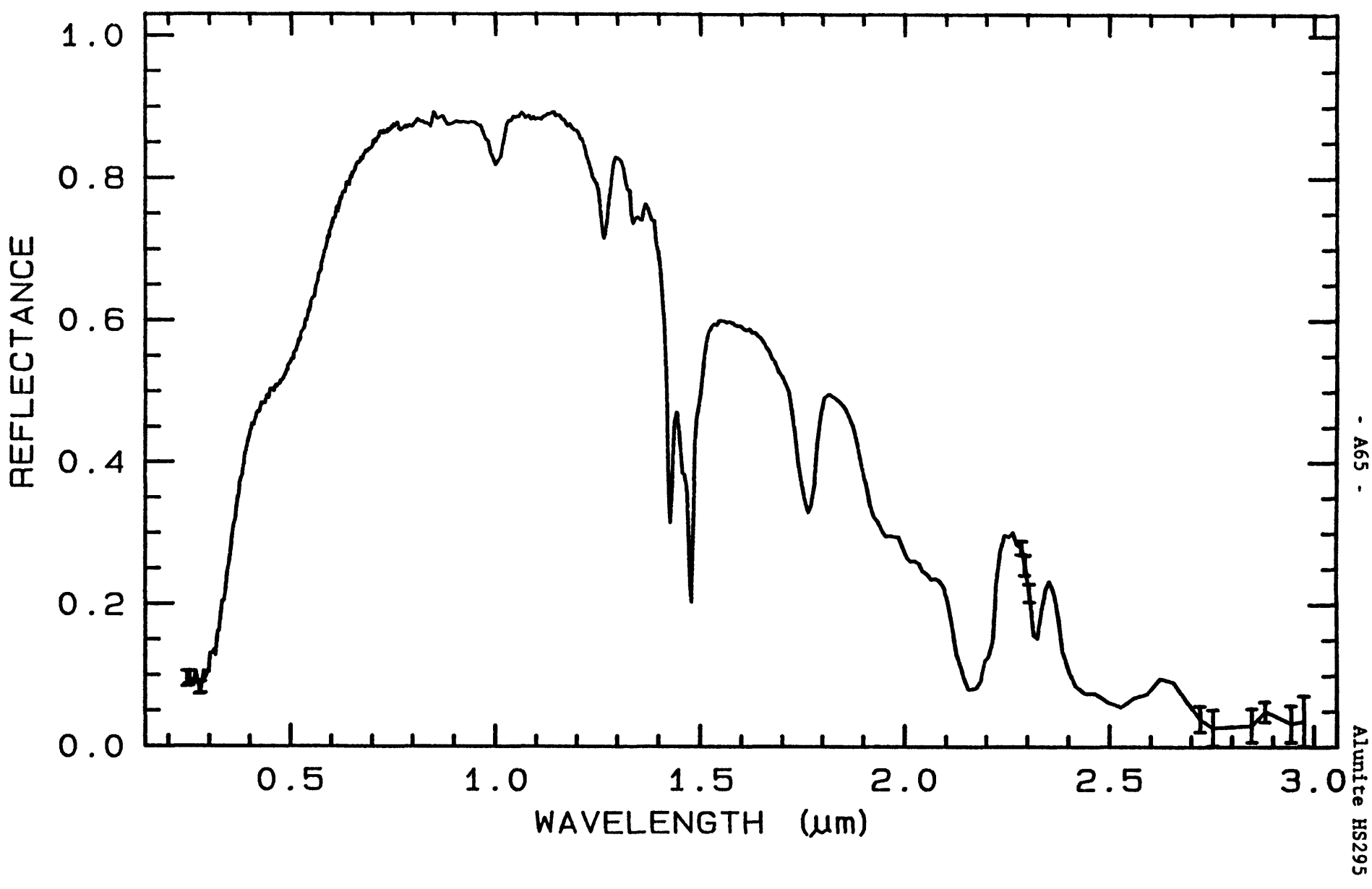
av gr sz = 300μm

Grains have straight extinction, length fast, uniaxial (+). G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 251	0.2-3.0μm	200	g.s.= 300 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:48 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A65 -
Alunite HS295
Alunite HS295.3B
W1R1Ba ABS REF
11/22/1985 10:03
splib04a r 251 &ECp013ng

TITLE: Alunite SUSTDA-20 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SUSTDA-20

MINERAL_TYPE: Sulfate

MINERAL: Alunite (Alunite group)

FORMULA: KAl3(SO4)2(OH)6

FORMULA_NROFF: $KAl_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Sulfur, NV

ORIGINAL_DONOR: Ron Lyon at Stanford University

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample was sieved to the grain size interval ~<250 μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

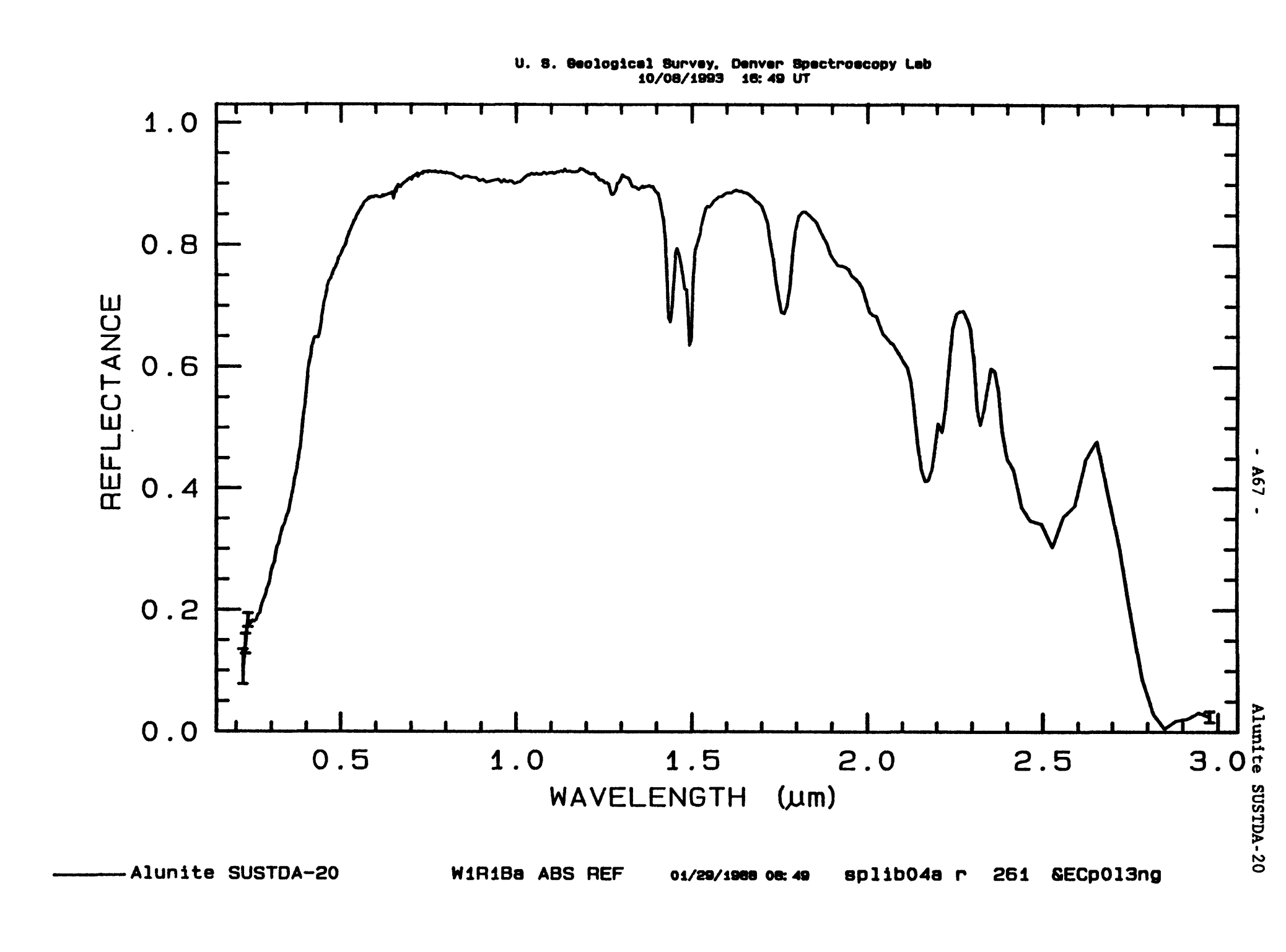
Pure sample. Clear elongated grains with parallel extinction along cleavage traces. Also length fast, and of low birefringence. This is all consistent with alunite.

Avg. grain size = 19μm

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	261	0.2-3.0μm	200	g.s.= 19 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Alunite SUSTDA-20
W1R1Ba ABS REF
01/29/1988 08:49
splib04a r 261 &ECp013ng

COMPOSITION_TRACE:	Ag	25	ppm
COMPOSITION_TRACE:	As	750	ppm
COMPOSITION_TRACE:	Au	0.040	ppm
COMPOSITION_TRACE:	Cd	<10	ppm
COMPOSITION_TRACE:	Cr	300	ppm
COMPOSITION_TRACE:	Cu	800	ppm
COMPOSITION_TRACE:	Hg	0.14	ppm
COMPOSITION_TRACE:	Mn	5	ppm
COMPOSITION_TRACE:	Ni	60	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	<25	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.11	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	25	ppm
COMPOSITION_TRACE:	Zn	150	ppm

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	5.5
Sph	
Cpy	
Py	84.0
Qtz	10.5

Assay	wt%
Cu	0.10
Fe	39.20
Pb	4.77
Zn	0.02
S	41.7

For specific sample information refer to the following reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

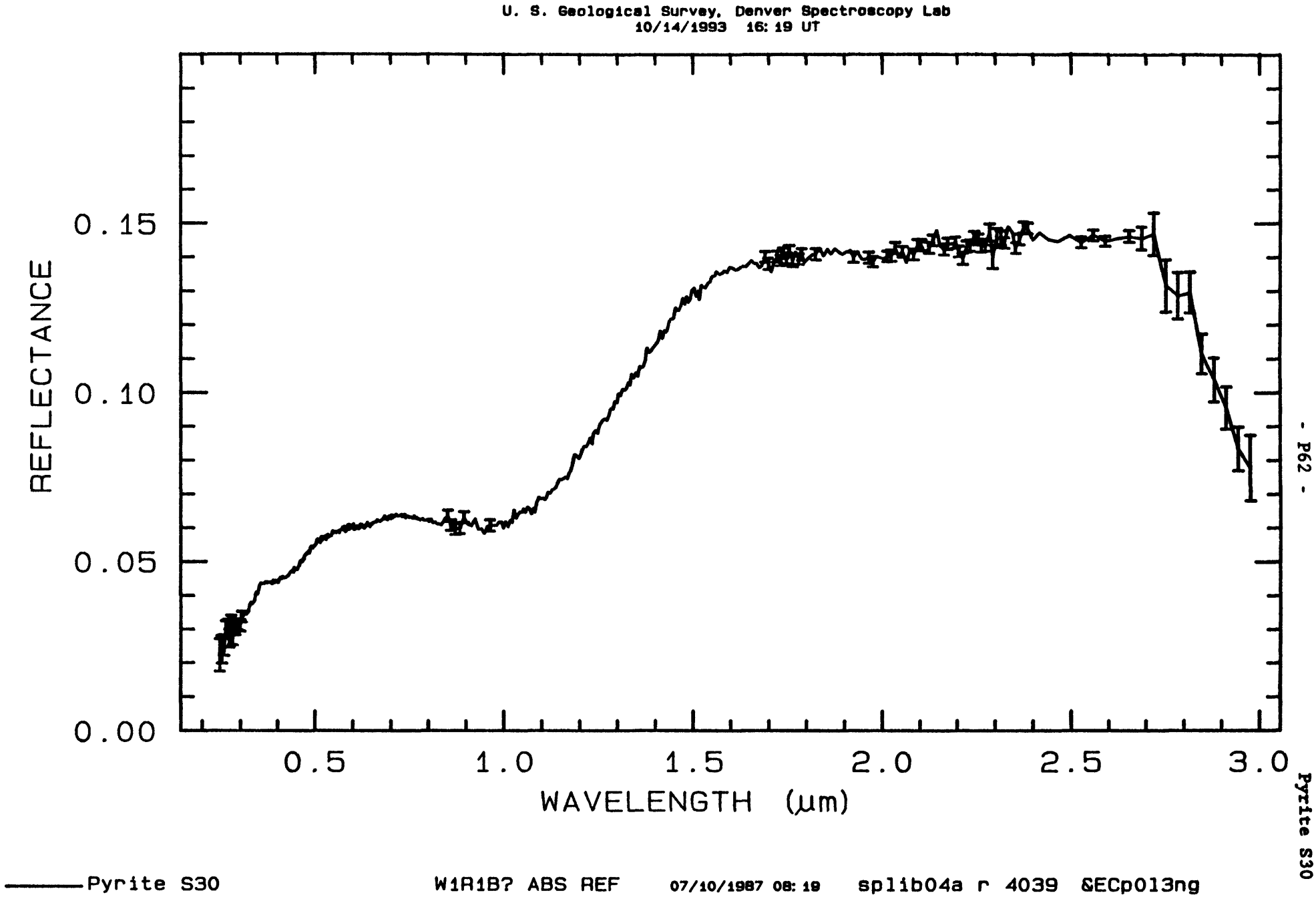
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4039	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P62 -
Pyrite S30
Pyrite S30
W1R1B? ABS REF
07/10/1987 08:19
splib04a r 4039 &ECp013ng

TITLE: Pyrope WS474 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS474

MINERAL_TYPE: Nesosilicate

MINERAL: Pyrope (Garnet group)

FORMULA: Mg3Al2(SiO4)3

FORMULA_NROFF: $Mg_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Navajo Reservation, Arizona

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Almandine and with Knorringite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2: 35.855	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2: 0.033	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3: 0.085	wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3: 0.011	wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3: 0.011	wt%	NROFF:	V_2O_3
COMPOSITION:	FeO: 30.817	wt%	NROFF:	FeO
COMPOSITION:	NiO: 0.014	wt%	NROFF:	NiO
COMPOSITION:	MnO: 0.676	wt%	NROFF:	MnO
COMPOSITION:	MgO: 0.041	wt%	NROFF:	MgO
COMPOSITION:	CaO: 33.509	wt%	NROFF:	CaO
COMPOSITION:	---			
COMPOSITION:	Total: 101.06	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

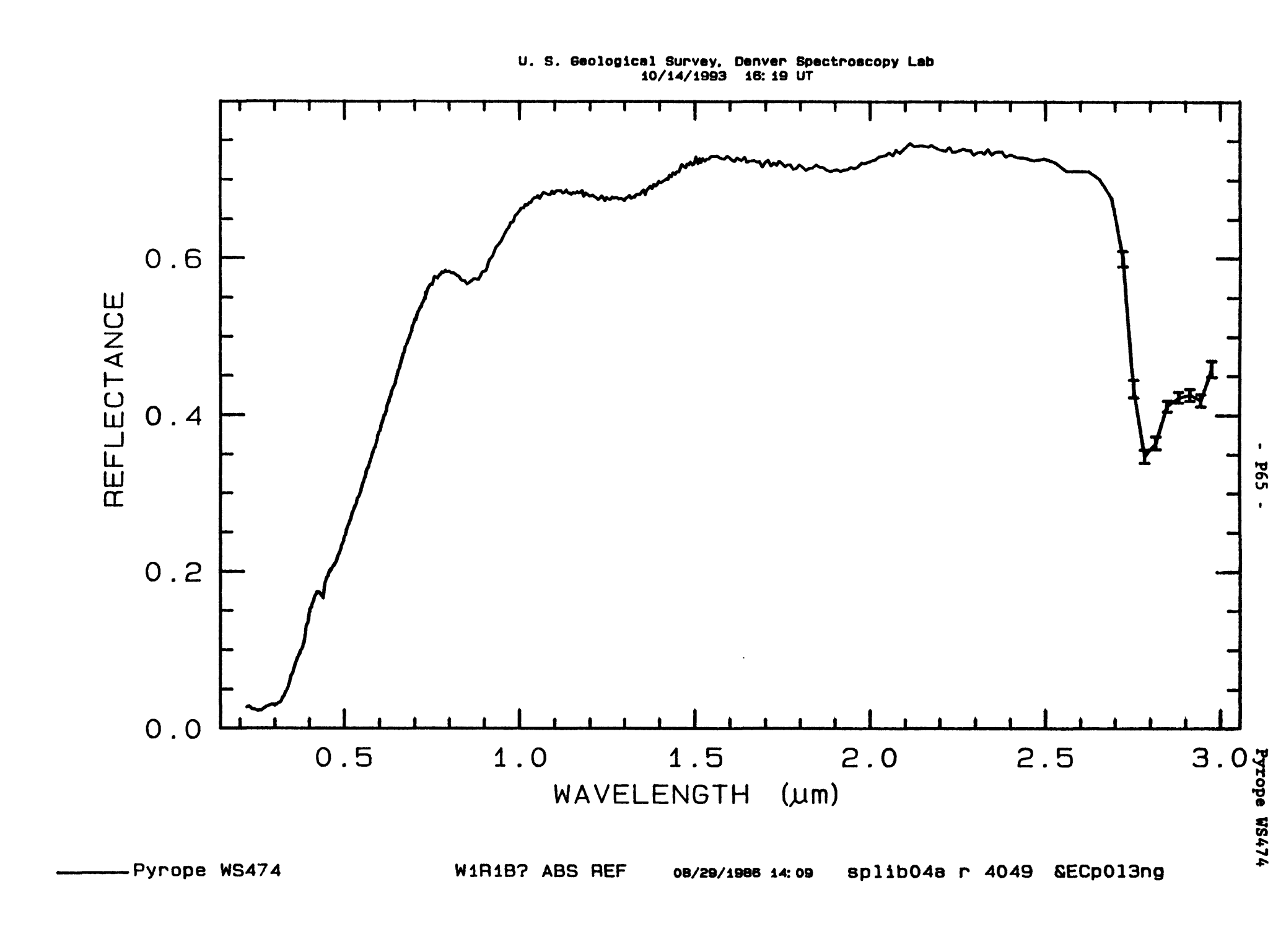
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 4049	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 965 -
Pyrope WS474
Pyrope WS474
W1R1B? ABS REF
08/29/1986 14:09
splib04a r 4049 &ECp013ng

TITLE: Pyrophyllite PYS1A DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: PYS1A GDS29

MINERAL_TYPE: Phyllosilicate

MINERAL: Pyrophyllite

FORMULA: Al2Si4O10(OH)2

FORMULA_NROFF: $Al_2Si_4O_{10}(OH)_2$

COLLECTION_LOCALITY: Staley, NC

ORIGINAL_DONOR: Bruce Hemingway

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Hand samples are clusters of white radiating acicular crystals which appear pure.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure pyrophyllite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	66.32 wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.01 wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	28.27 wt%	NROFF: Al_2O_3
COMPOSITION:	Fe2O3:	0.32 wt%	NROFF: Fe_2O_3
COMPOSITION:	FeO:	0.03 wt%	NROFF: FeO
COMPOSITION:	MgO:	0.07 wt%	NROFF: MgO
COMPOSITION:	Na2O:	0.05 wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.02 wt%	NROFF: K_2O
COMPOSITION:	H2O+:	4.94 wt%	NROFF: H_2O^+
COMPOSITION:	----------		
COMPOSITION:	Total:	100.03 wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

See additional discussion in:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

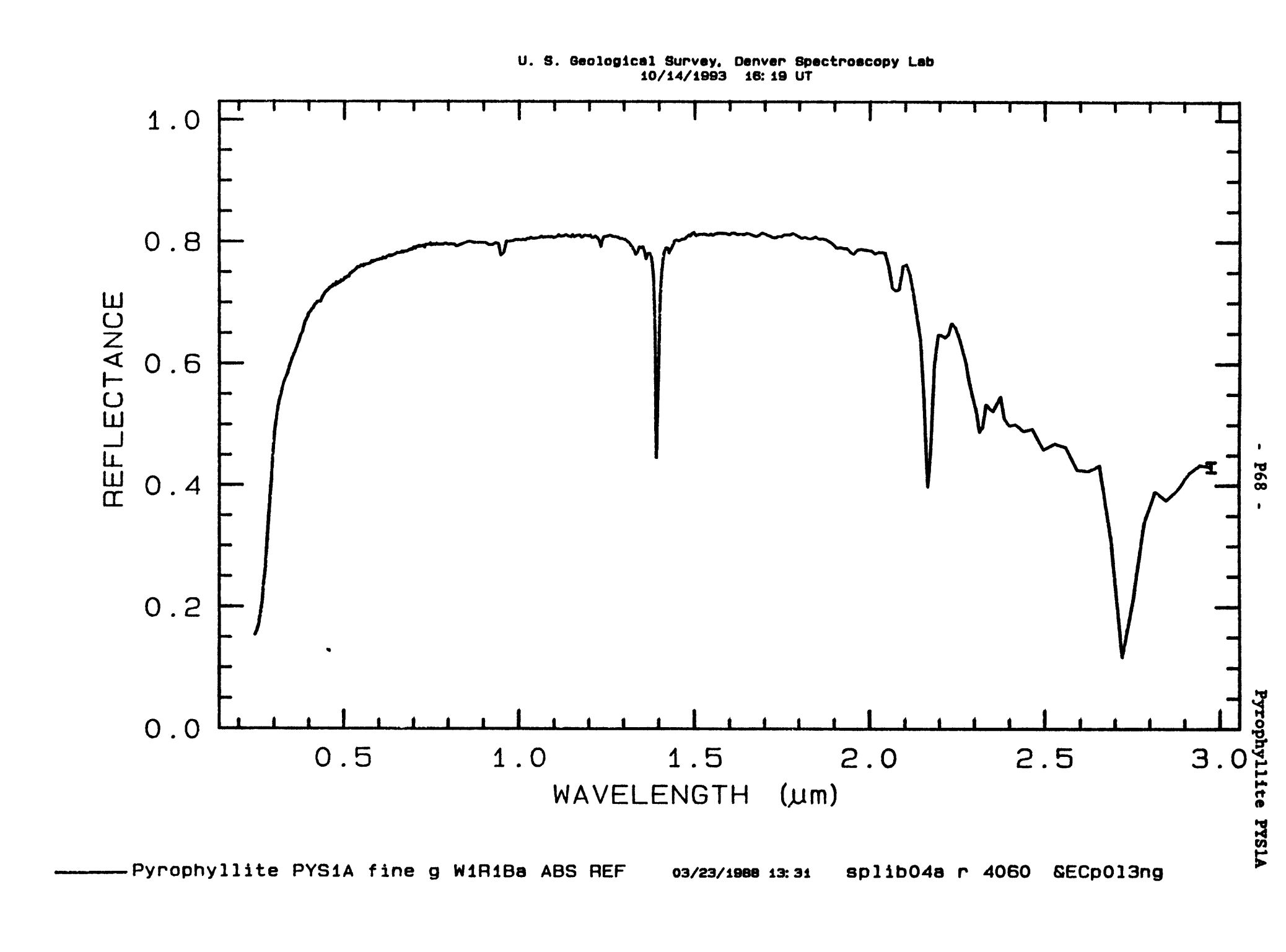
END_COMPOSITION_DISCUSSION.

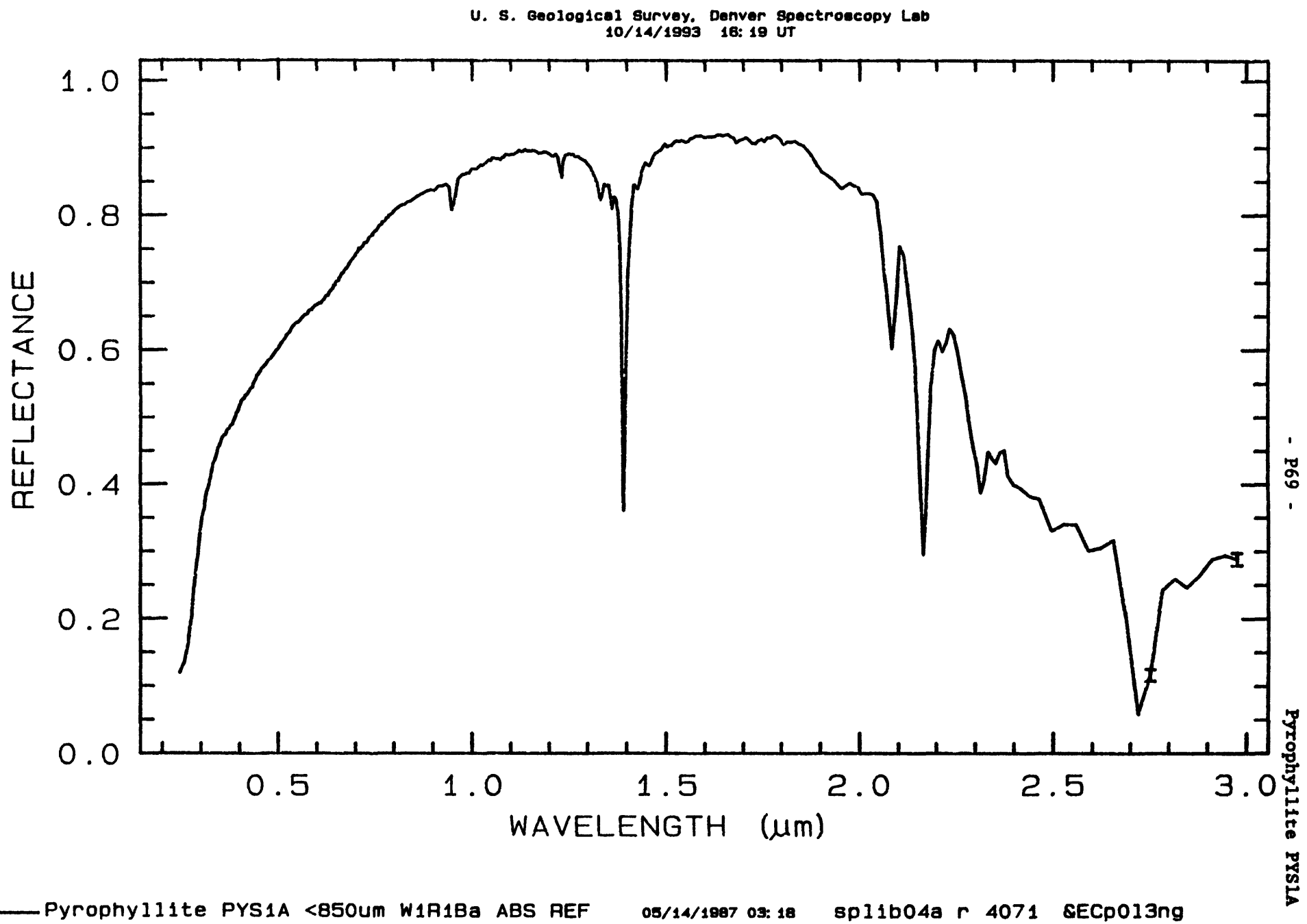
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4060	0.2-3.0μm	200	g.s.= 25μm
LIB_SPECTRA:	splib04a r 4071	0.2-3.0μm	200	g.s.=125μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P68 -
Pyrophyllite PYS1A
Pyrophyllite PYS1A fine g W1R1B8 ABS REF 03/23/1988 13:31 splib04a r 4060 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Pyrophyllite PYS1A
- P69 -
Pyrophyllite PYS1A <850um W1R1Ba ABS REF 05/14/1997 03:18 splib04a r 4071 &ECp013ng

TITLE: Pyrophyllite SU1421 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SU1421

MINERAL_TYPE: Phyllosilicate

MINERAL: Pyrophyllite

FORMULA: Al2Si4O10(OH)2

FORMULA_NROFF: $Al_2Si_4O_{10}(OH)_2$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Ron Lyons, Stanford University

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4081	0.2-3.0μm	200	

TITLE: Ammonioalunite NMNH145596 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH145596

MINERAL_TYPE: Sulfate

MINERAL: Ammonioalunite

FORMULA: NH4Al3(SO4)2(OH)6

FORMULA_NROFF: $NH_4Al_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample is a physical mixute of ammonioalunite, ammoniojarosite and amorphous silica. Grains for the spectrum were hand-picked by G. Swayze.

The spectrum shows beautiful ammonium bands in the 2-2.2 μm region. There are weak bands due to Jarosite at 0.6, 0.9, and 2.26 μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

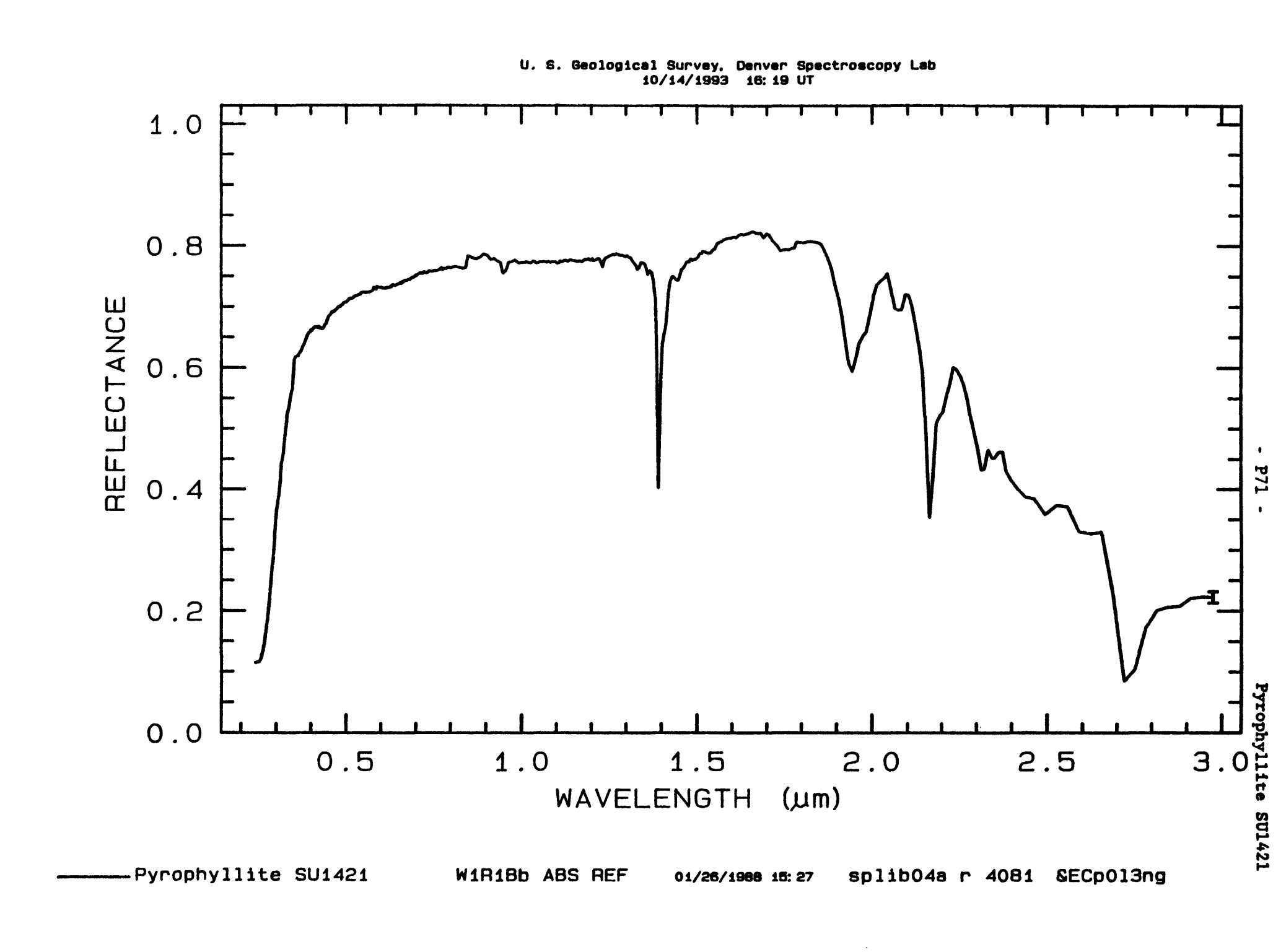
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 271	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P71 -
Pyrophyllite SU1421
Pyrophyllite SU1421 W1R1Bb ABS REF 01/26/1988 15:27 splib04a r 4081 &ECp013ng

TITLE: Pyroxene HS119 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS119

MINERAL_TYPE: Inosilicate

MINERAL: Augite (Pyroxene group)

FORMULA: (Ca,Mg,Fe2+,Fe3+,Ti,Al)2(Si,Al)2O6

FORMULA_NROFF: $(Ca,Mg,Fe^{2+},Fe^{3+},Ti,Al)_2(Si,Al)_2O_6$

COLLECTION_LOCALITY: Oaxaca, Mexico

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"I-4 Augite 119B-Oaxaca, Mexico. (Ca, Mg, Fe^{2+}, Fe^{3+}, Ti, $Al)_2(Si, Al)_2O_6$: Augite is an important ferromagnesian mineral of igneous rocks, and is particularly common in basic rocks. It occurs, but less frequently, in intermediate and ultrabasic rocks. The spectrum is dominated by both Fe^{2+} and Fe^{3+} absorptions, which produce a very general broad band centered near 1.0μ. The faint bands near 2.3μ are probably due to hydroxyl combinations even though the 1.4μ band is indiscernible."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:	
100 vol%	Clinopyroxene
tr	Calcite (fizz with HCl)

tr Plagioclase?

bimodal grain size:
mode 1: 270μm @ 99 vol%
mode 2: 7μm @ 1 vol%

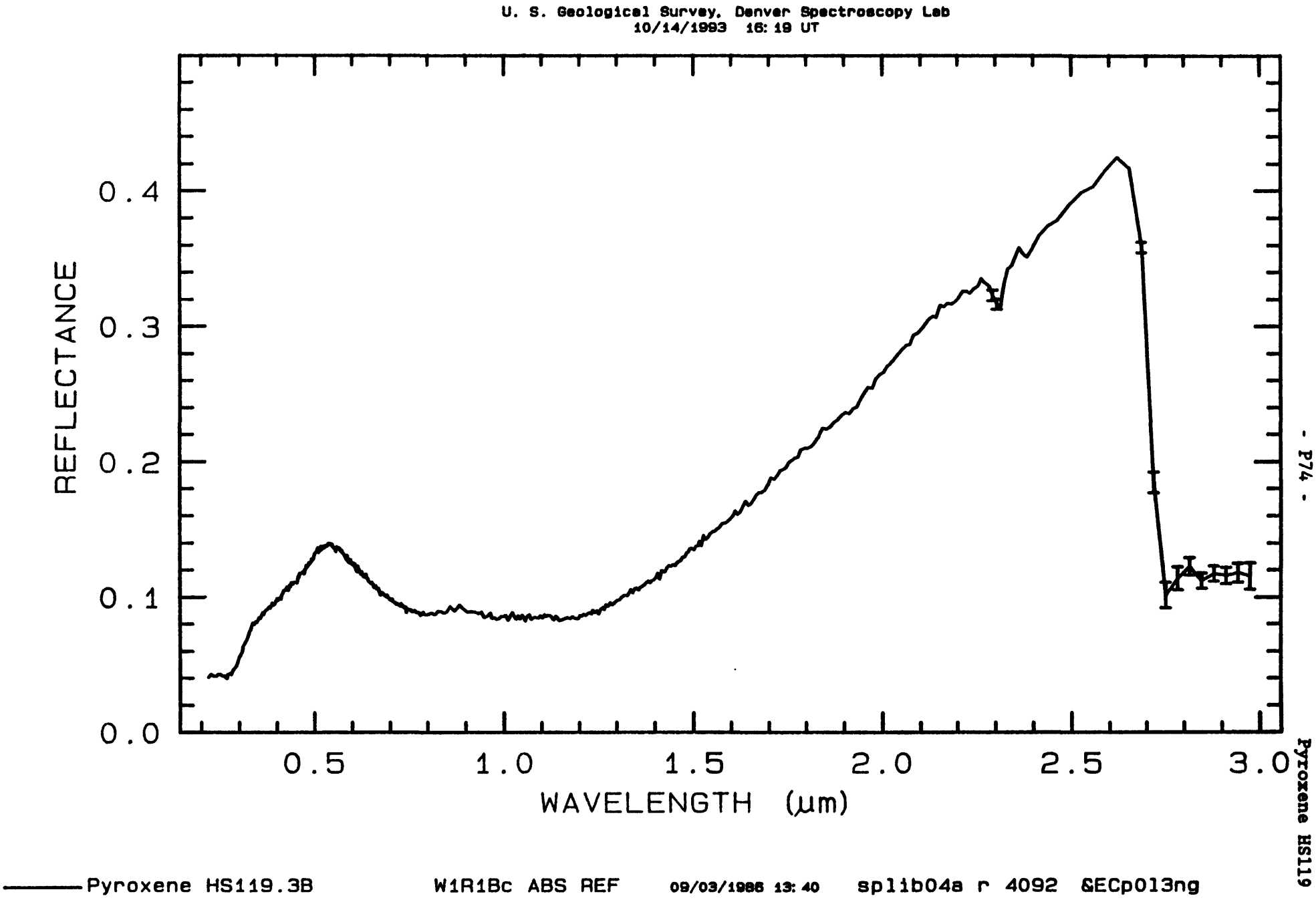
avg grain size = 270 μm Smaller grains coat 20% area lg grains

Prismatic grains have two cleavages at nearly 90 deg angles, inclined extinction, slight green-blue pleochroism, 2V= 70-85 deg, biaxial (+), twinning, length slow. All these properties are consistent with this sample being a clinopyroxene (either augite, omphacite, or fassaite). G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4092	0.2-3.0μm	200	g.s.= 270μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Pyroxene HS119.3B
W1R1Bc ABS REF
09/03/1986 13:40
splib04a r 4092 &ECp013ng
Pyroxene HS119

TITLE: Pyrrhotite HS269 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS269

MINERAL_TYPE: Sulfide

MINERAL: Pyrrhotite (Nickeliferous)

FORMULA: Fe1-xS

FORMULA_NROFF: $Fe_{1-x}S$

COLLECTION_LOCALITY: Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"SS-20. Pyrrhotite. Ontario (269B). Pyrrhotite, $Fe_{1-x}S$, is a common accessory mineral of igneous rocks, particularly basic ones. It is often found in high temperature veins and occasionally in pegmatities. It occurs in large masses associated with other sulphides, especially nickel suphides, of uncertain origin. This sample is nickeliferous, containing a small amount of pentlandite (?), together with a very small amount of anhydrite. It diplays opaque and spectrally featureless behavior throughout this spectral range."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: IV. Sulphides and sulphates. Modern Geology, v. 3, p. 1-14.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

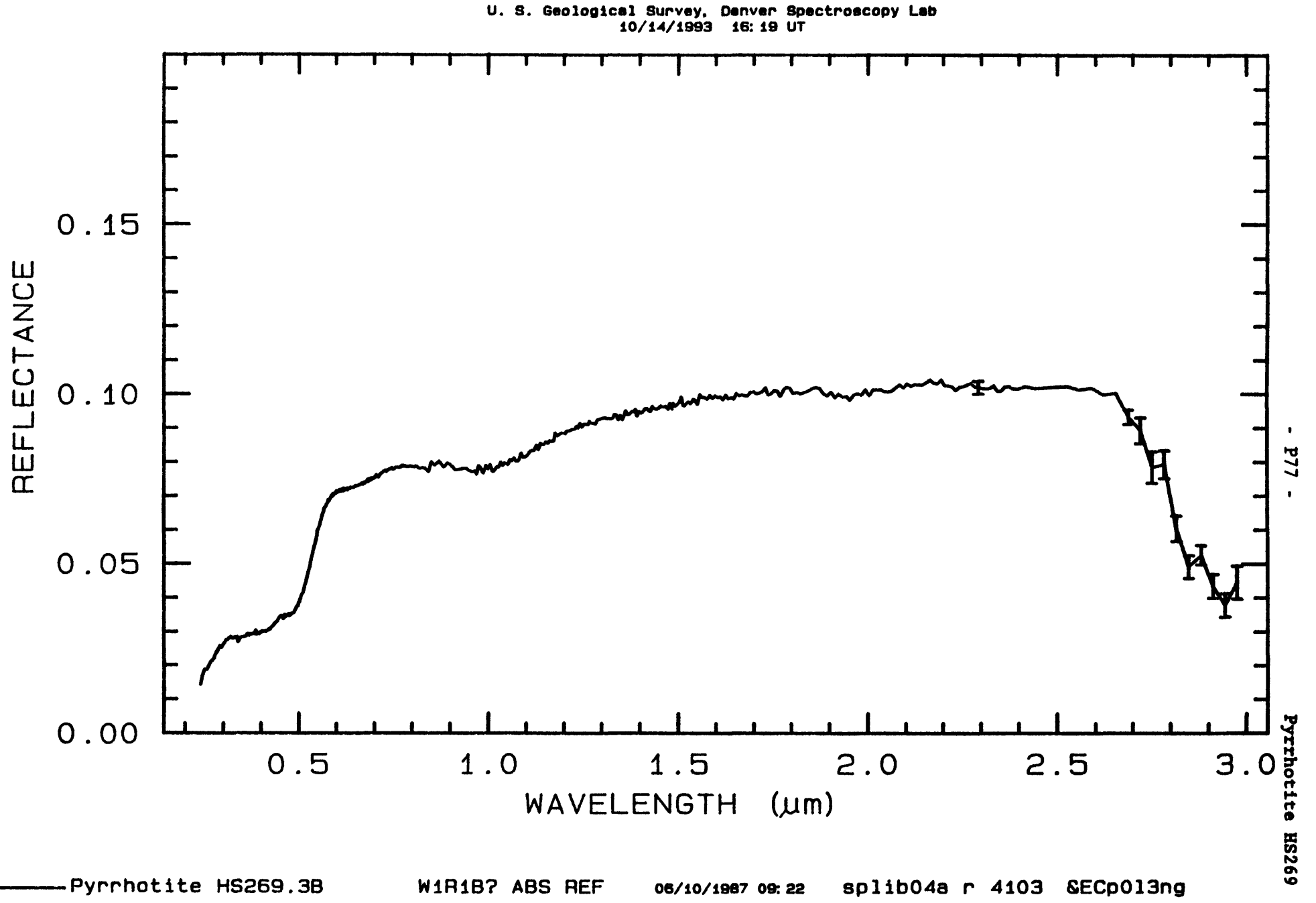
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 4103	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Pyrrhotite HS269.3B W1R1B? ABS REF 06/10/1987 09:22 splib04a r 4103 &ECp013ng
Pyrrhotite HS269

The U. S. Geological Survey, Digital Spectral Library: Version 1: 0.2 to 3.0 μm

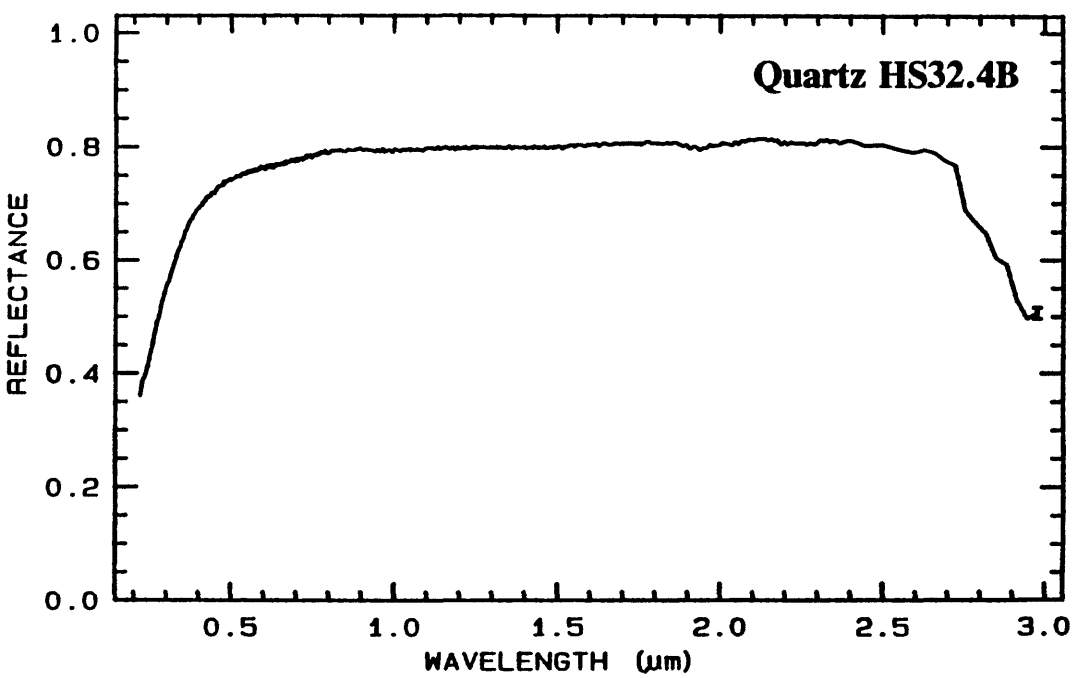
Roger N. Clark, Gregg A. Swayze, Andrea J. Gallagher,

Trude V.V. King, and Wendy M. Calvin

U.S. Geological Survey

Open File Report 93-592

1993



Volume 4: Q - Z, Plants

TITLE: Aspen_Leaf-A DW92-2 DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: DW92-2

PLANT_TYPE: Tree

PLANT: Aspen

LATIN_NAME: Populous tremuloides

COLLECTION_LOCALITY: Denver West Office Complex, Golden, CO

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Fresh leaf from tree, 1 thick over deep black sample holder. Average of 3 spectra

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

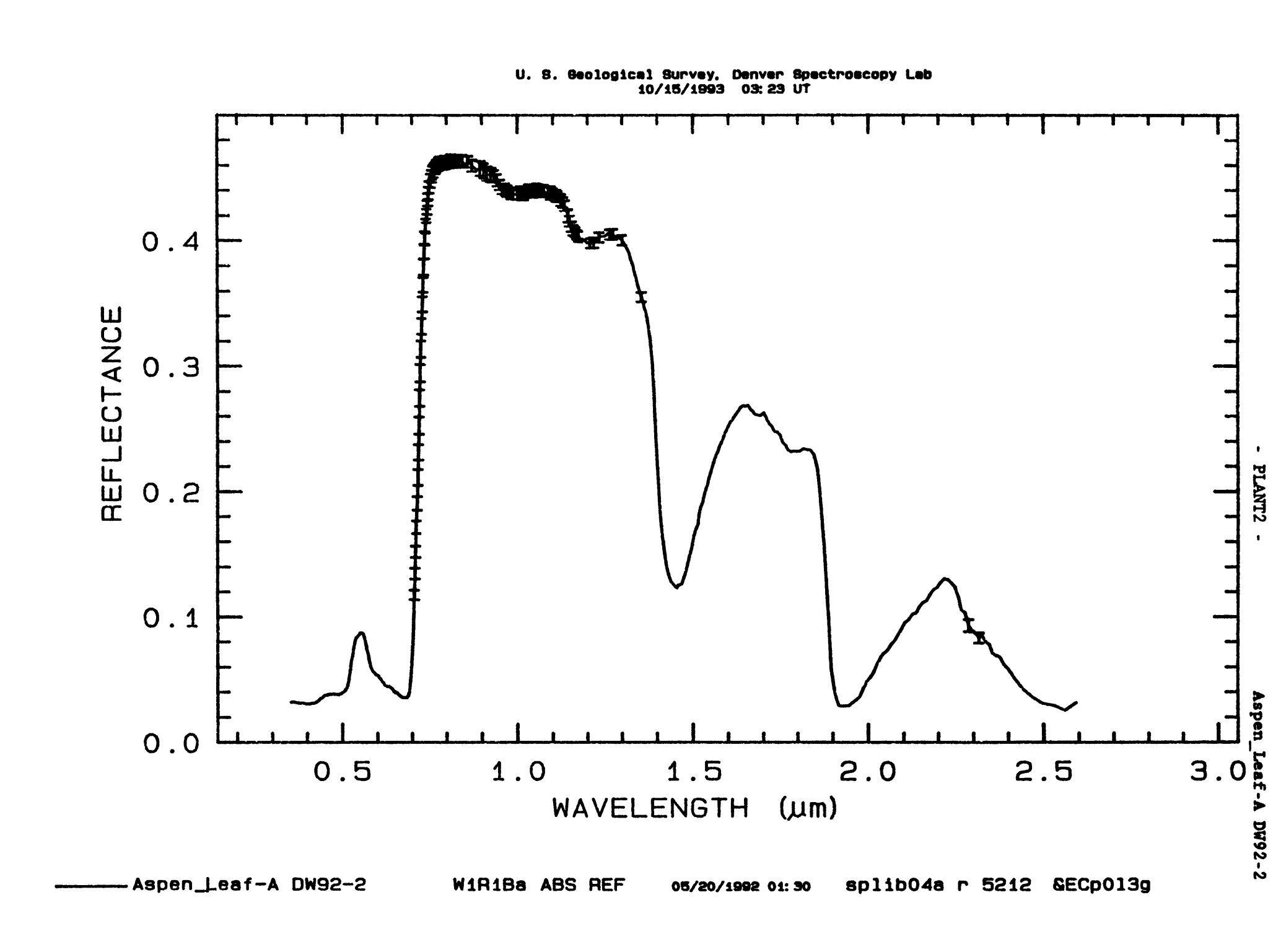
TRACE_ELEMENT_ANALYSIS:

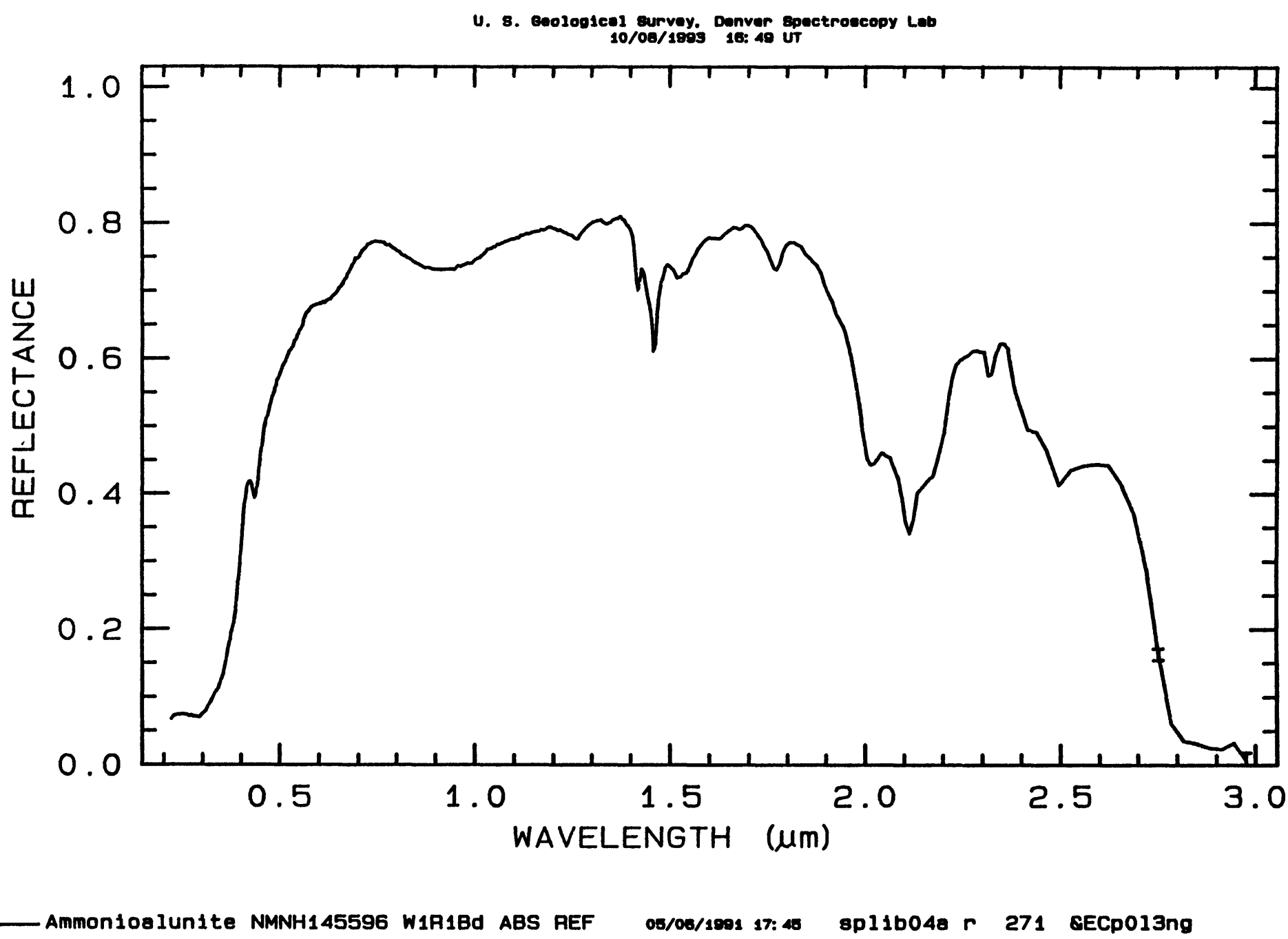
TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5212	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:29 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT2 -
Aspen_Leaf-A DW92-2
Aspen_Leaf-A DW92-2 W1R1Ba ABS REF 05/20/1992 01:30 splib04a r 5212 &ECp013g



Ammonioalunite NMNH145596

TITLE: Aspen_Leaf-B DW92-3 DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: DW92-3

PLANT_TYPE: Tree

PLANT: Aspen

LATIN_NAME: Populous tremuloides

COLLECTION_LOCALITY: Denver West Office Complex, Golden, CO

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Fresh leaf from tree, 1 thick over deep black sample holder. Average of 3 spectra

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

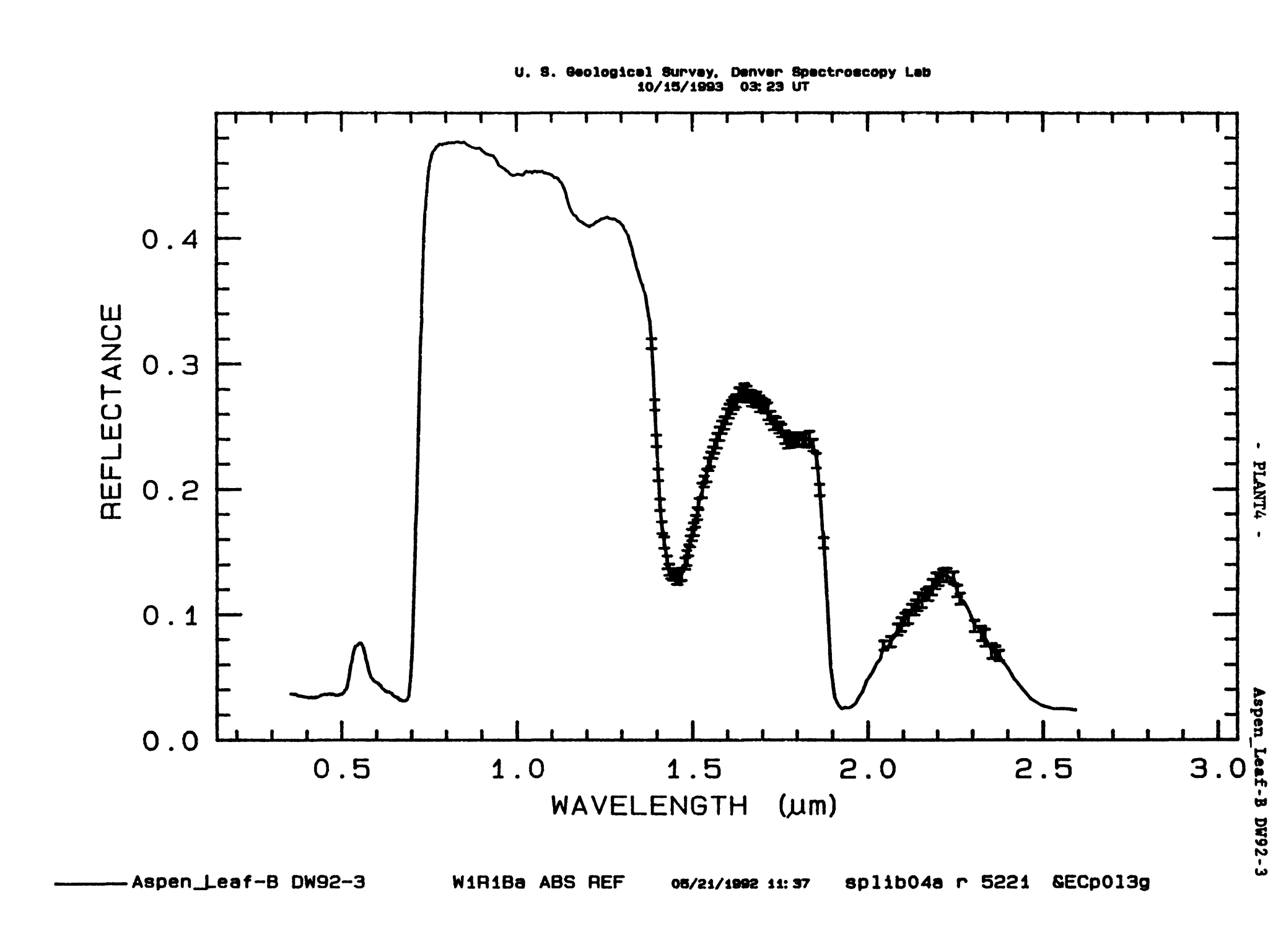
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5221	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT4 -
Aspen_Leaf-B DW92-3
Aspen_Leaf-B DW92-3 W1R1Ba ABS REF 05/21/1992 11:37 splib04a r 5221 &ECp013g

TITLE: Blackbrush ANP92-9A DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: ANP92-9A

PLANT_TYPE: Shrub

PLANT: Blackbrush

LATIN_NAME: Coleogyne ramosissima

COLLECTION_LOCALITY: Salt Valley, Arches National Park, UT

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Green leaves and flowers.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

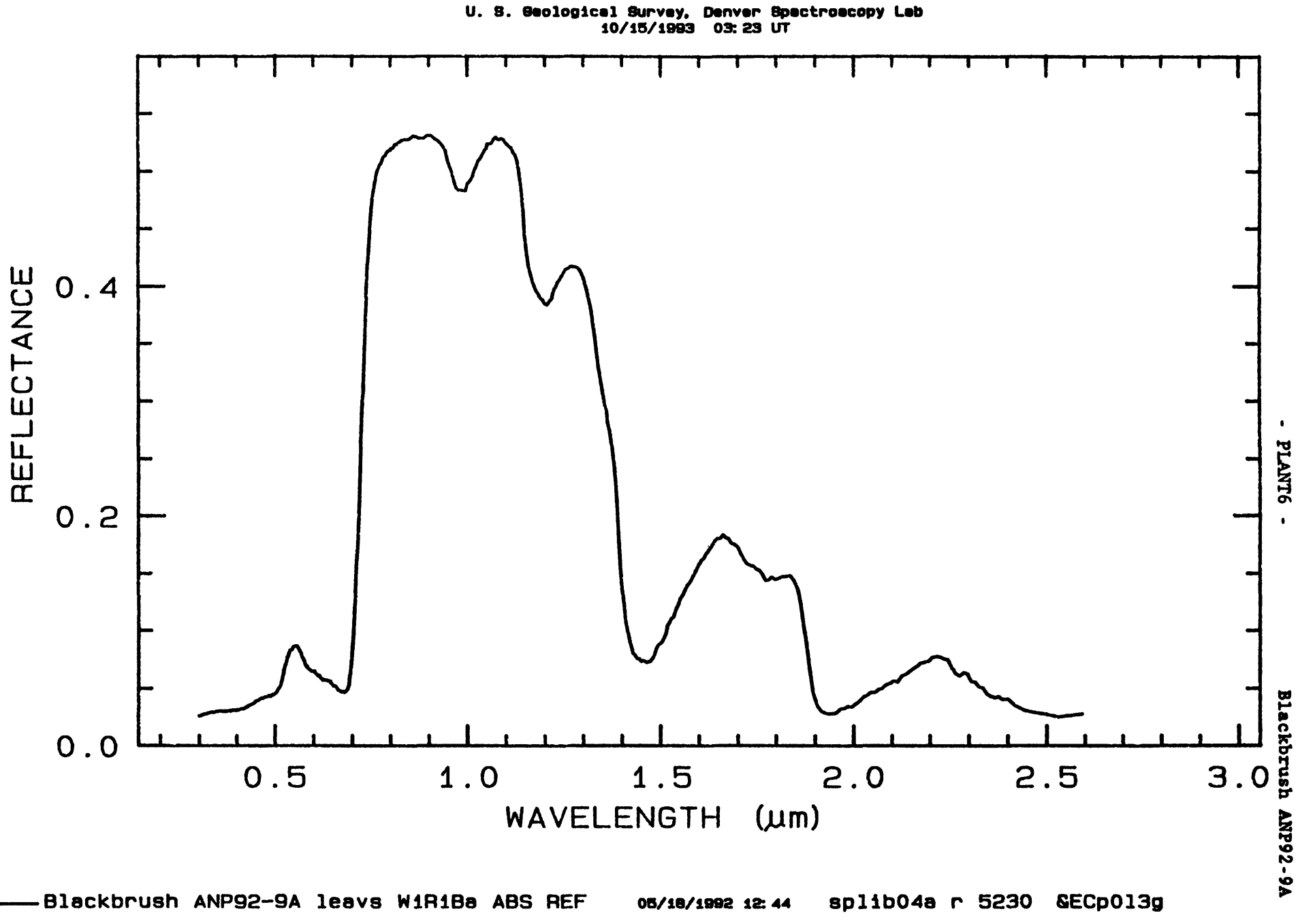
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5230	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT6 -
Blackbrush ANP92-9A
Blackbrush ANP92-9A leavs W1R1B8 ABS REF 05/18/1992 12:44 spl1b04a r 5230 &ECp013g

TITLE: Blue_Spruce DW92-5 DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: DW92-5

PLANT_TYPE: Tree

PLANT: Blue Spruce

LATIN_NAME:

COLLECTION_LOCALITY: Denver West Office Complex, Golden, CO

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Fresh Blue spruce needles, cut from branch. New growth only.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION: Cellulose: wt%
COMPOSITION: Lignin: wt%
COMPOSITION: Chlorophyll_A: wt%
COMPOSITION: Chlorophyll_B: wt%
COMPOSITION: Nitrogen: wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

TRACE_ELEMENT_ANALYSIS:

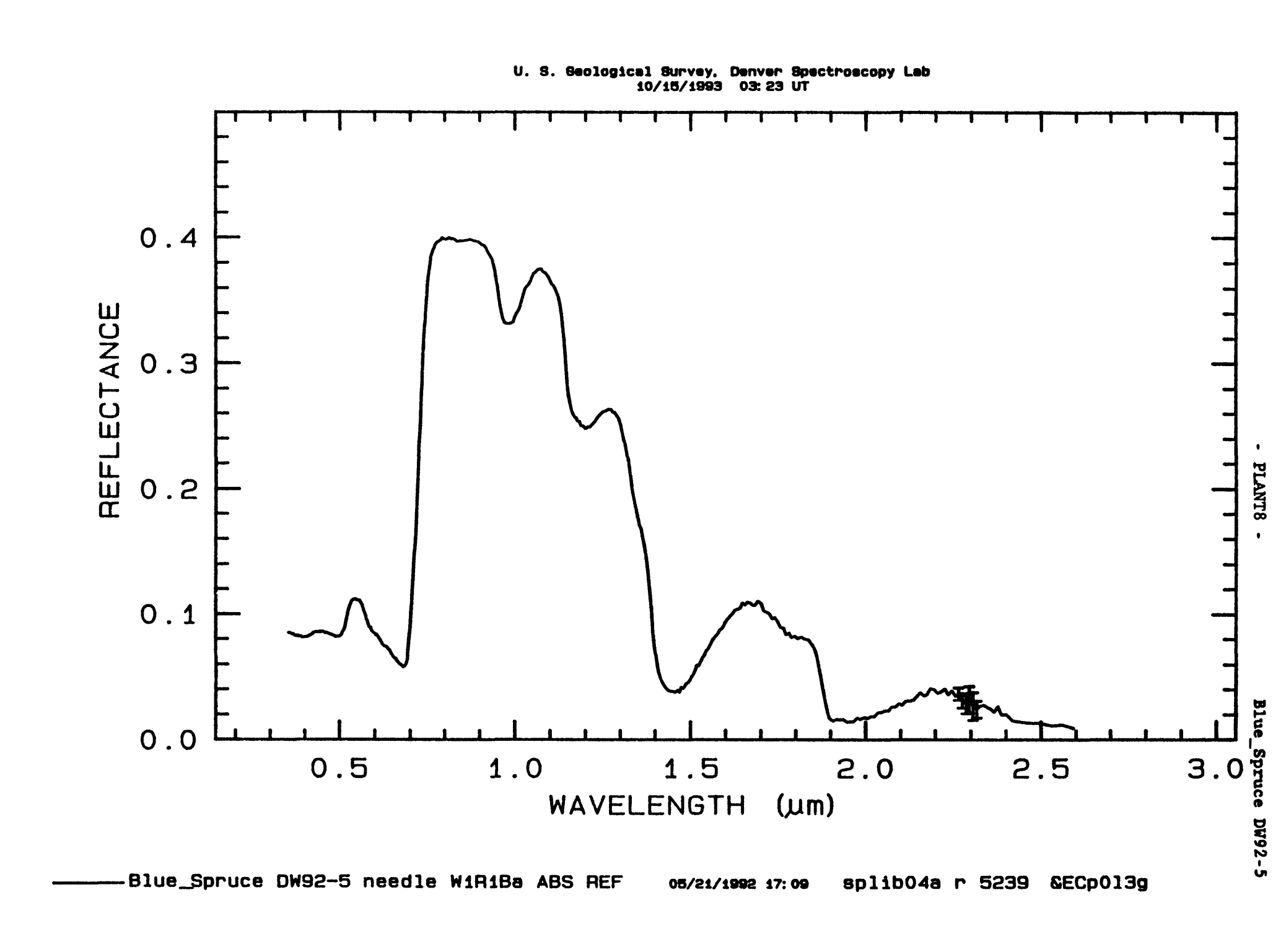
TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 5239 0.2-3.0μm 200


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT8 -
Blue_Spruce DW92-5
Blue_Spruce DW92-5 needle W1R1Ba ABS REF 05/21/1992 17:09 splib04a r 5239 &ECp013g

TITLE: Cheatgrass ANP92-11A DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: ANP92-11A

PLANT_TYPE: Grass

PLANT: Cheatgrass

LATIN_NAME: Bromus tectorum

COLLECTION_LOCALITY: Arches National Park, UT

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Dry leaves, stems and seeds

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION: Cellulose: wt%
COMPOSITION: Lignin: wt%
COMPOSITION: Chlorophyll_A: wt%
COMPOSITION: Chlorophyll_B: wt%
COMPOSITION: Nitrogen: wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

TRACE_ELEMENT_ANALYSIS:

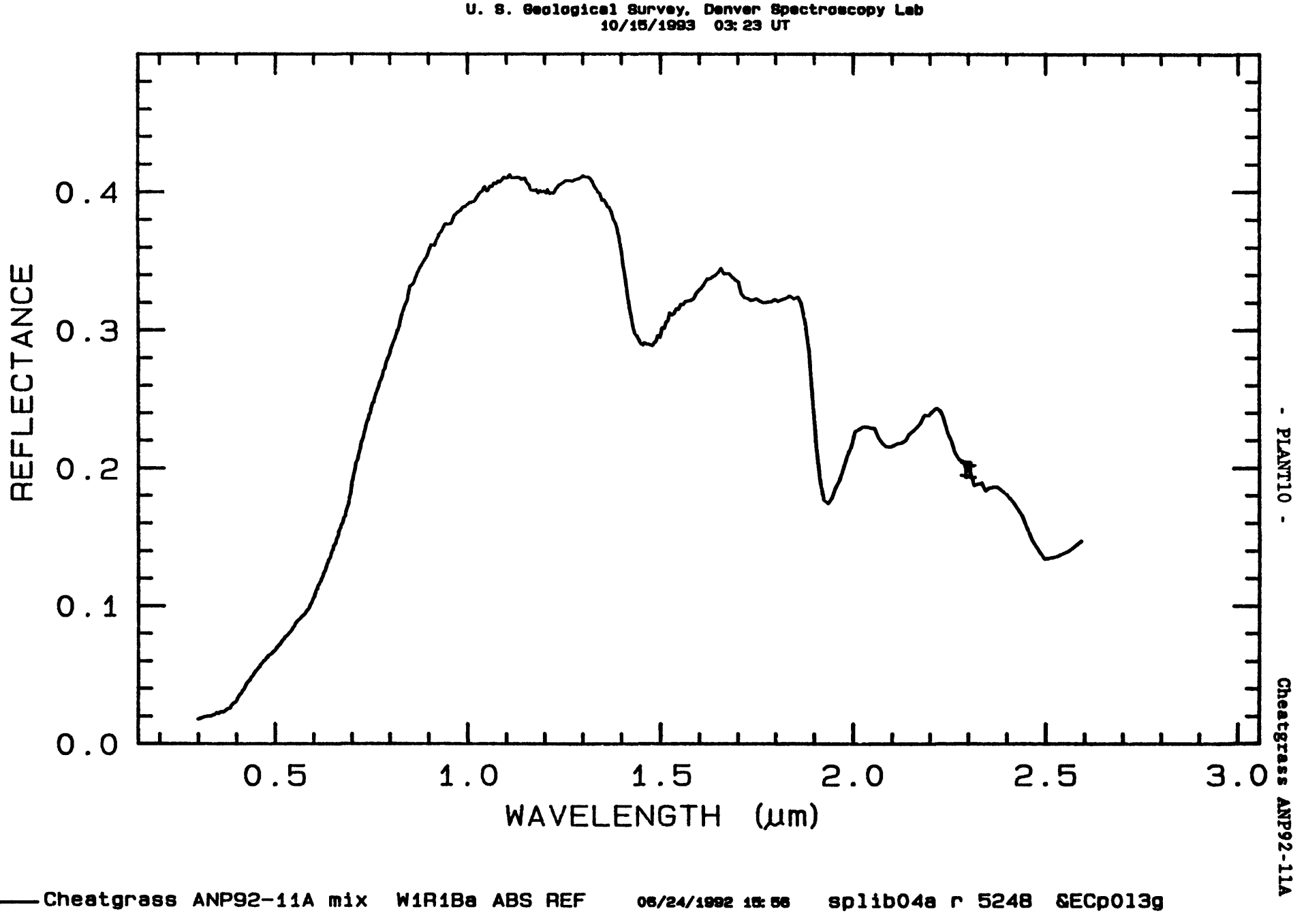
TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 5248 0.2-3.0μm 200


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT10 -
Cheatgrass ANP92-11A
Cheatgrass ANP92-11A mix W1R1Ba ABS REF 06/24/1992 15:56 splib04a r 5248 &ECp013g

TITLE: Dry_Long_Grass AV87-2 (Brown) DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: AV87-2

PLANT_TYPE: Grass

PLANT: Dry Long Grass

LATIN_NAME:

COLLECTION_LOCALITY: Canon City, Colorado

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Dry long grass from the Pierre shale. Collected early August.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION: Cellulose: wt%
COMPOSITION: Lignin: wt%
COMPOSITION: Chlorophyll_A: wt%
COMPOSITION: Chlorophyll_B: wt%
COMPOSITION: Nitrogen: wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

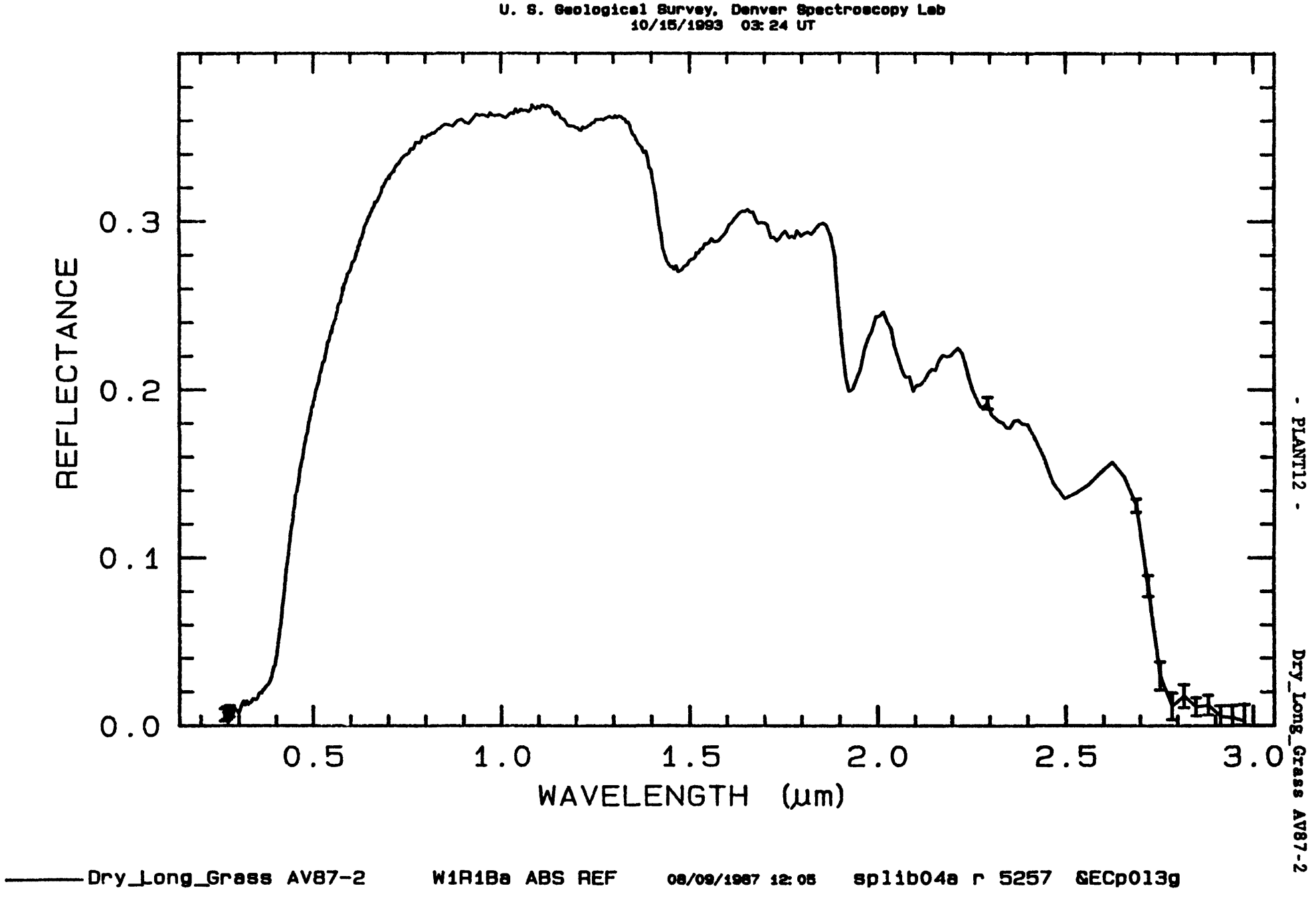
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5257	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:24 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT12 -
Dry_Long_Grass AV87-2
Dry_Long_Grass AV87-2 W1R1Ba ABS REF 08/09/1987 12:05 splib04a r 5257 &ECp013g

TITLE: Ammonium_Chloride GDS77 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS77

MINERAL_TYPE: Chloride

MINERAL: Ammonium_Chloride

FORMULA: NH4Cl

FORMULA_NROFF: NH_4Cl

COLLECTION_LOCALITY: Baker Analyzed Reagent

ORIGINAL_DONOR: Baker Chemical

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	281	0.2-3.0μm	200	g.s.=

TITLE: Fir_Tree IH91-2 DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: IH91-2

PLANT_TYPE: Tree

PLANT: Fir Tree

LATIN_NAME: Abies lasiocarpa (?)

COLLECTION_LOCALITY: Iron Hill, Colorado

ORIGINAL_DONOR: Larry Rowan and Jim Crowley, USGS Reston

SAMPLE_DESCRIPTION:

Weighted average of needles and woody material.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

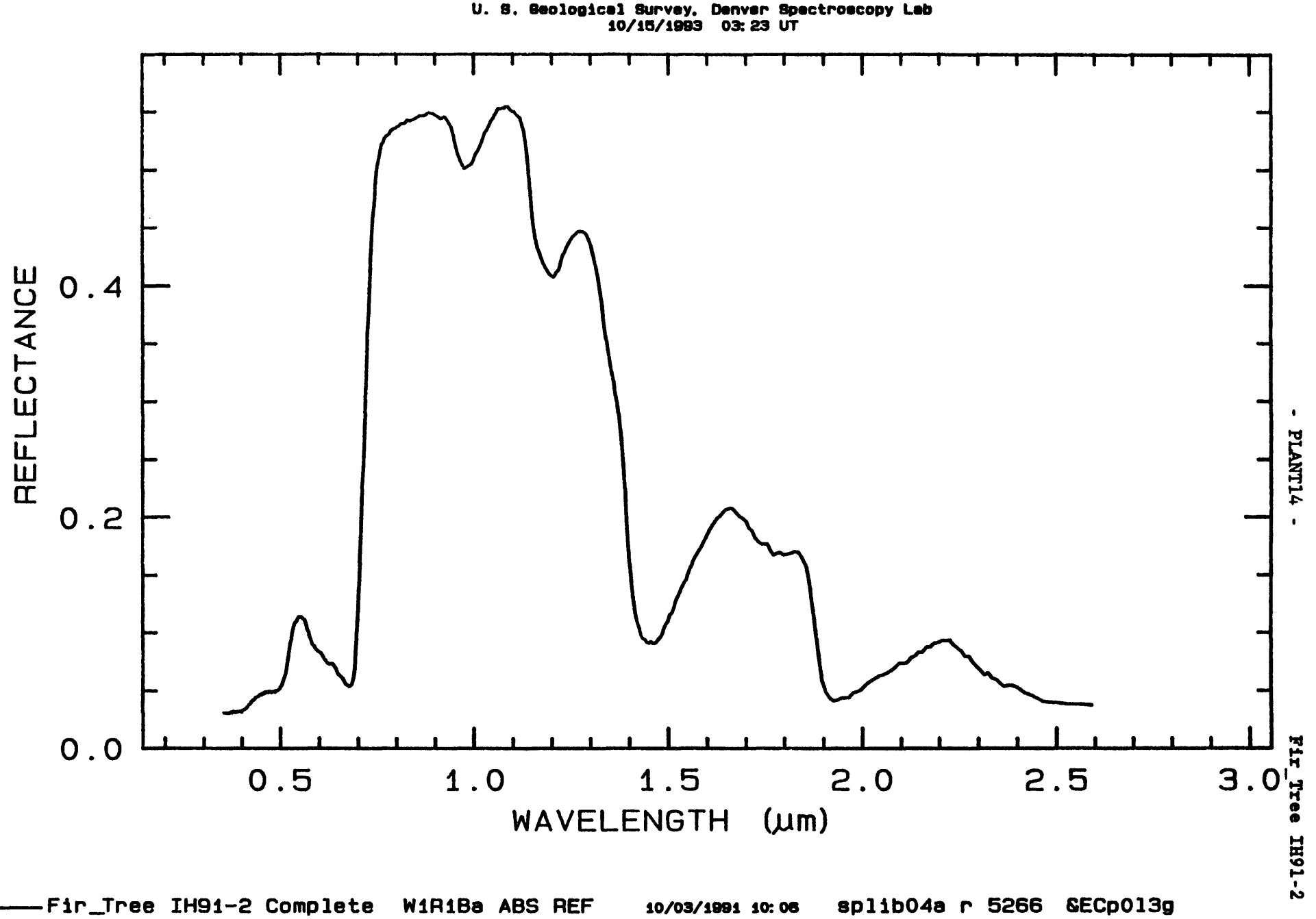
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5266	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT4 -
Fir_Tree IH91-2
Fir_Tree IH91-2 Complete W1R1Ba ABS REF 10/03/1991 10:06 splib04a r 5266 &ECp013g

TITLE: Juniper_Bush IH91-4B DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: IH91-4B

PLANT_TYPE: Shrub

PLANT: Juniper

LATIN_NAME:

COLLECTION_LOCALITY: Iron Hill, CO

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Juniper bush with berries
Needles, stem and berries run

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

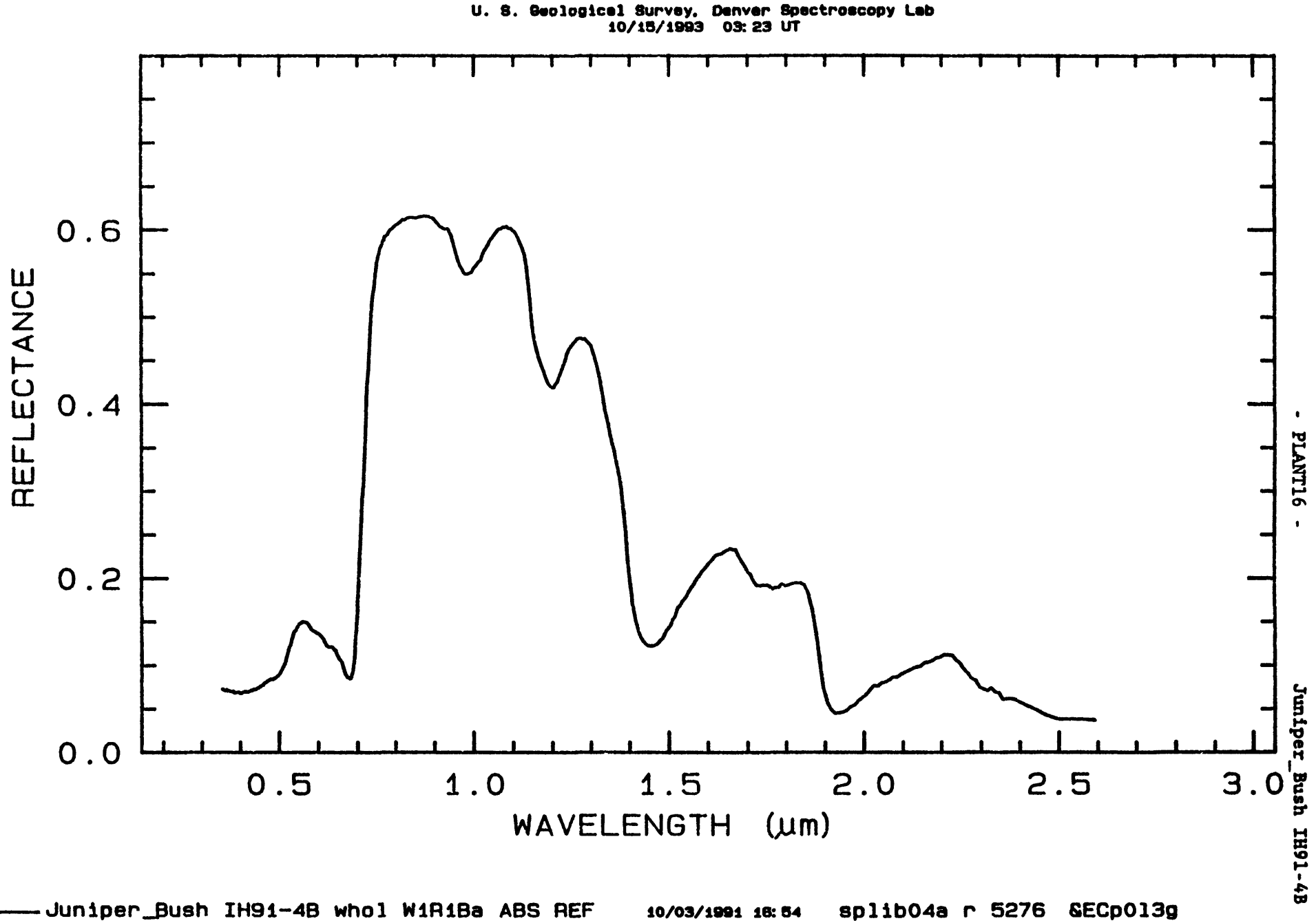
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5276	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT16 -
Juniper_Bush IH91-4B
Juniper_Bush IH91-4B who1 W1R1Ba ABS REF 10/03/1991 16:54 splib04a r 5276 &ECp013g

TITLE: Lawn_Grass GDS91 DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: GDS91

PLANT_TYPE: Grass

PLANT: Lawn Grass

LATIN_NAME:

COLLECTION_LOCALITY: Denver West Building #2, Golden, CO

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Generic lawn grass. Run immediately after picking.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

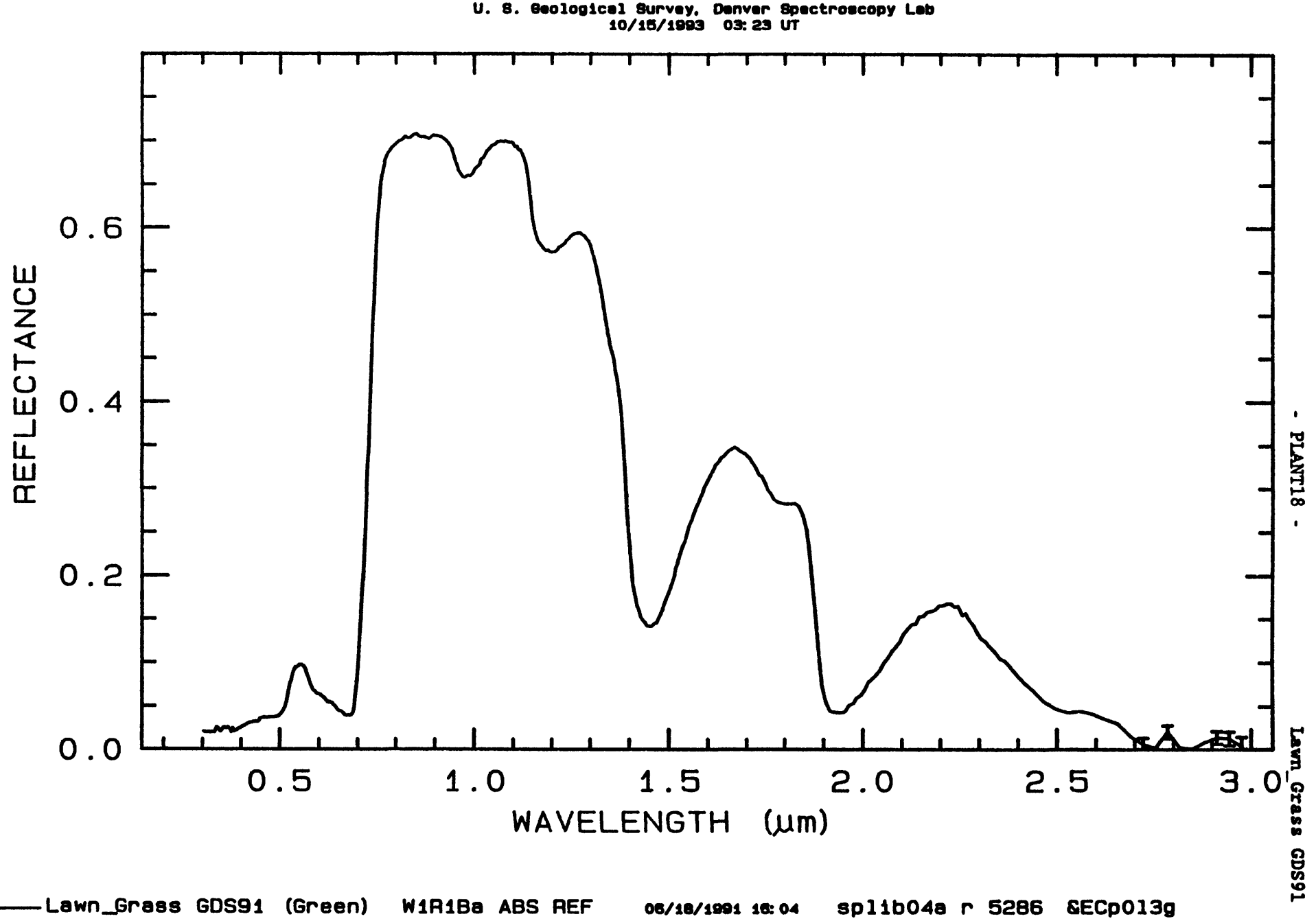
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5286	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- PLANT18 -
Lawn_Grass GDS91
Lawn_Grass GDS91 (Green) W1R1Ba ABS REF 06/18/1991 16:04 splib04a r 5286 &ECp013g

TITLE: Maple_Leaves DW92-1 DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: DW92-1

PLANT_TYPE: Tree

PLANT: Maple

LATIN_NAME: Acer (unknown species)

COLLECTION_LOCALITY: Denver West Office Complex, Golden, CO

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Fresh leaves from tree, three thick over a deep black sample holder.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

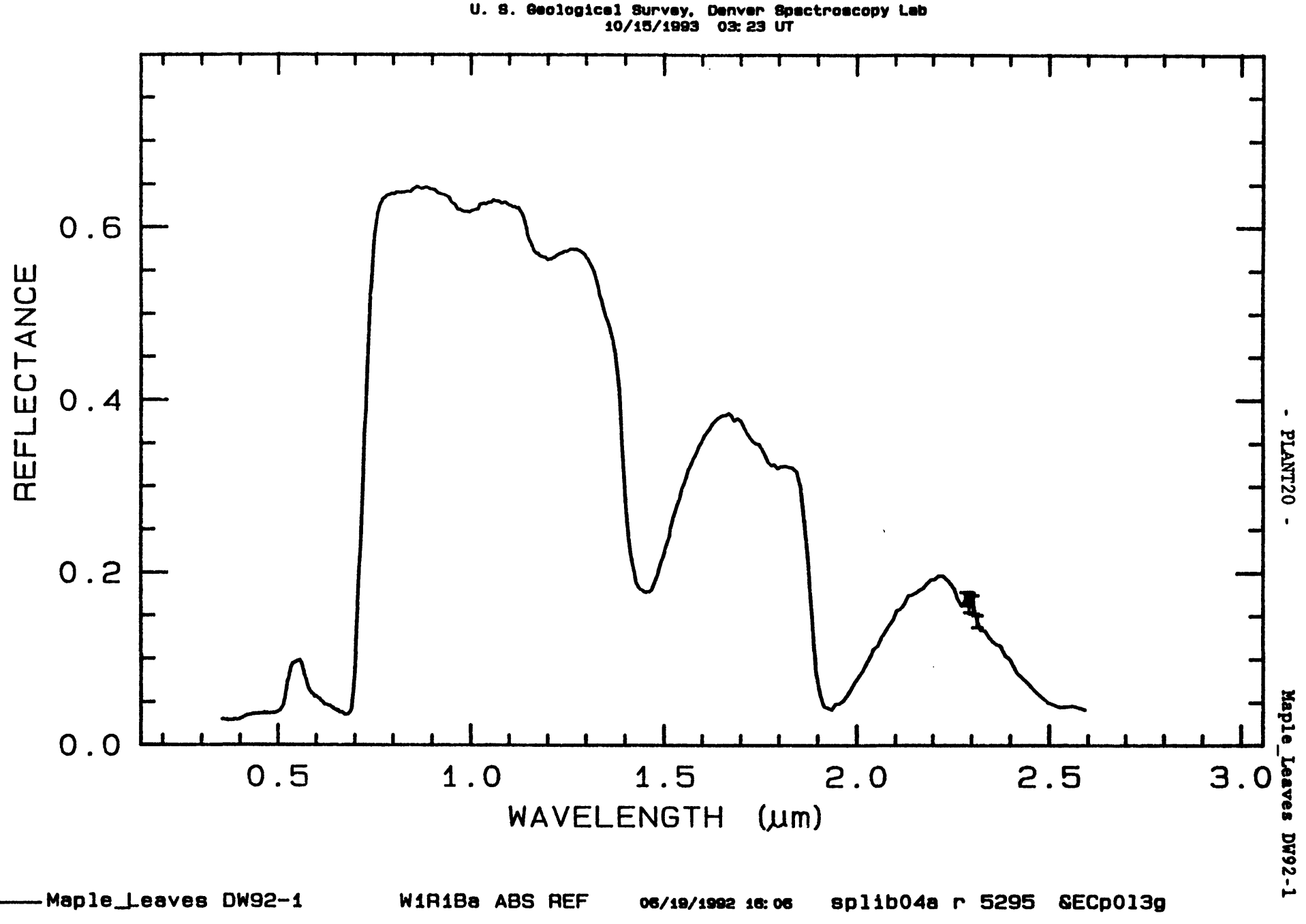
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5295	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
PLANT20 - Maple_Leaves DW92-1
Maple_Leaves DW92-1 W1R1Ba ABS REF 06/19/1992 16:06 splib04a r 5295 &ECp013g

TITLE: Pinon_Pine ANP92-14A DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: ANP92-14A

PLANT_TYPE: Tree

PLANT: Pinon Pine

LATIN_NAME: Pinus edulis

COLLECTION_LOCALITY: Arches National Park, UT

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Green needles with correct percentage of new growth.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

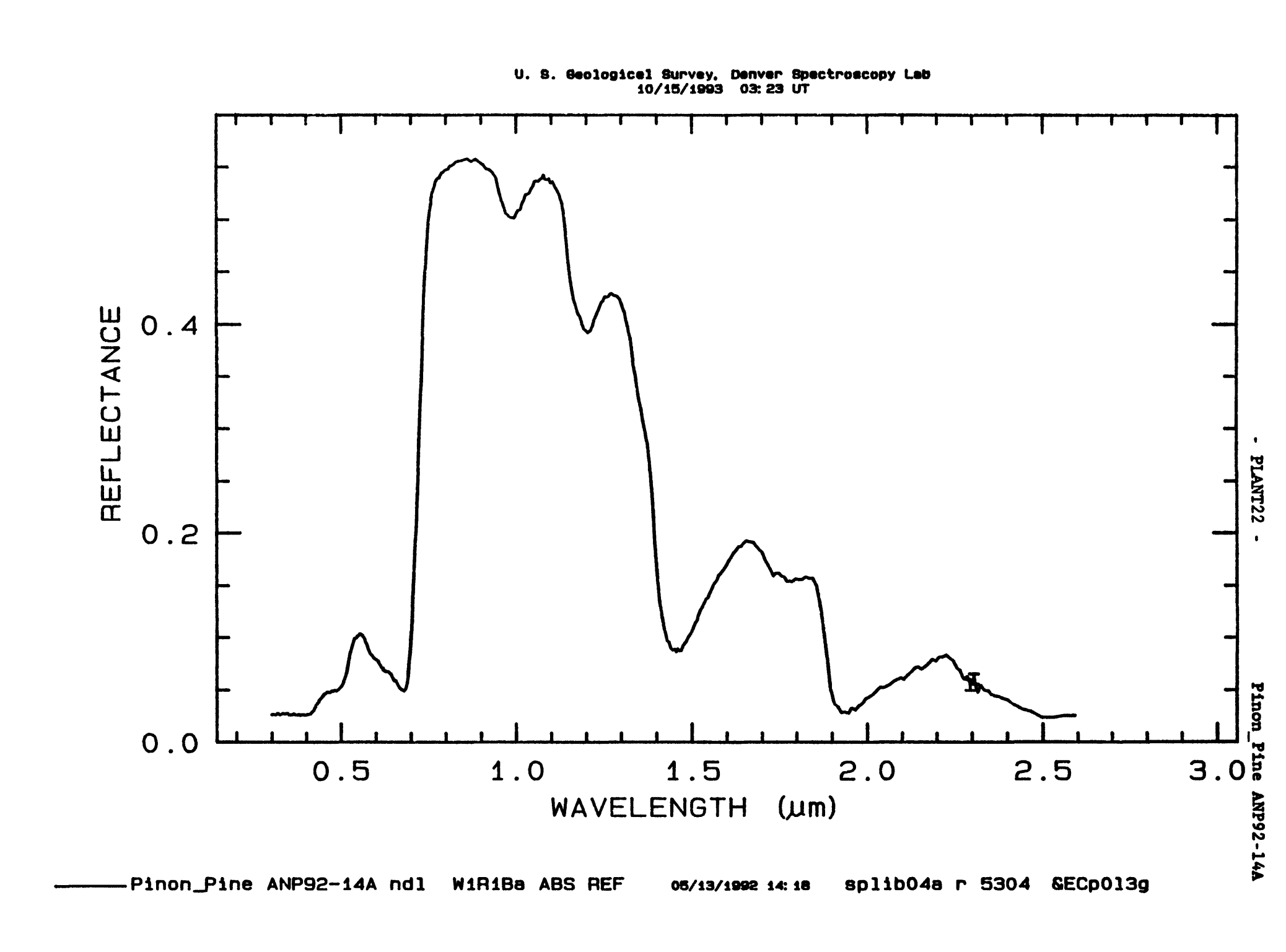
TRACE_ELEMENT_ANALYSIS:

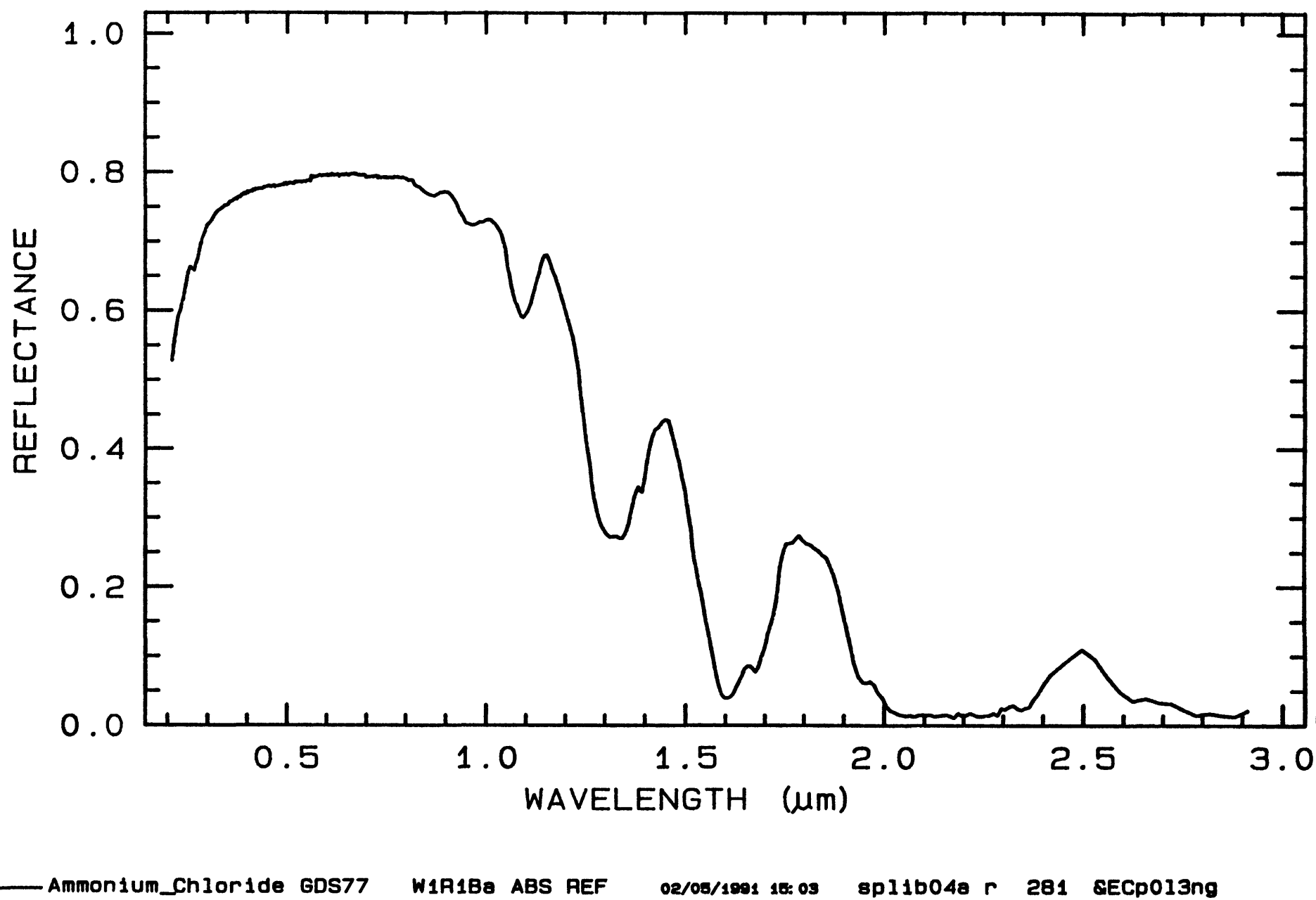
TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5304	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT22 -
Pinon_Pine ANP92-14A
Pinon_Pine ANP92-14A ndl W1R1Ba ABS REF 05/13/1992 14:18 splib04a r 5304 &ECp013g


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Ammonium_Chloride GDS77 W1R1Ba ABS REF 02/05/1991 15:03 splib04a r 281 &ECp013ng

TITLE: Rabbitbrush ANP92-27 DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: ANP92-27

PLANT_TYPE: Shrub

PLANT: Rubber Rabbitbrush

LATIN_NAME: Chrysothamnus nauseosus

COLLECTION_LOCALITY: Arches National Park, UT

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Whole plant

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

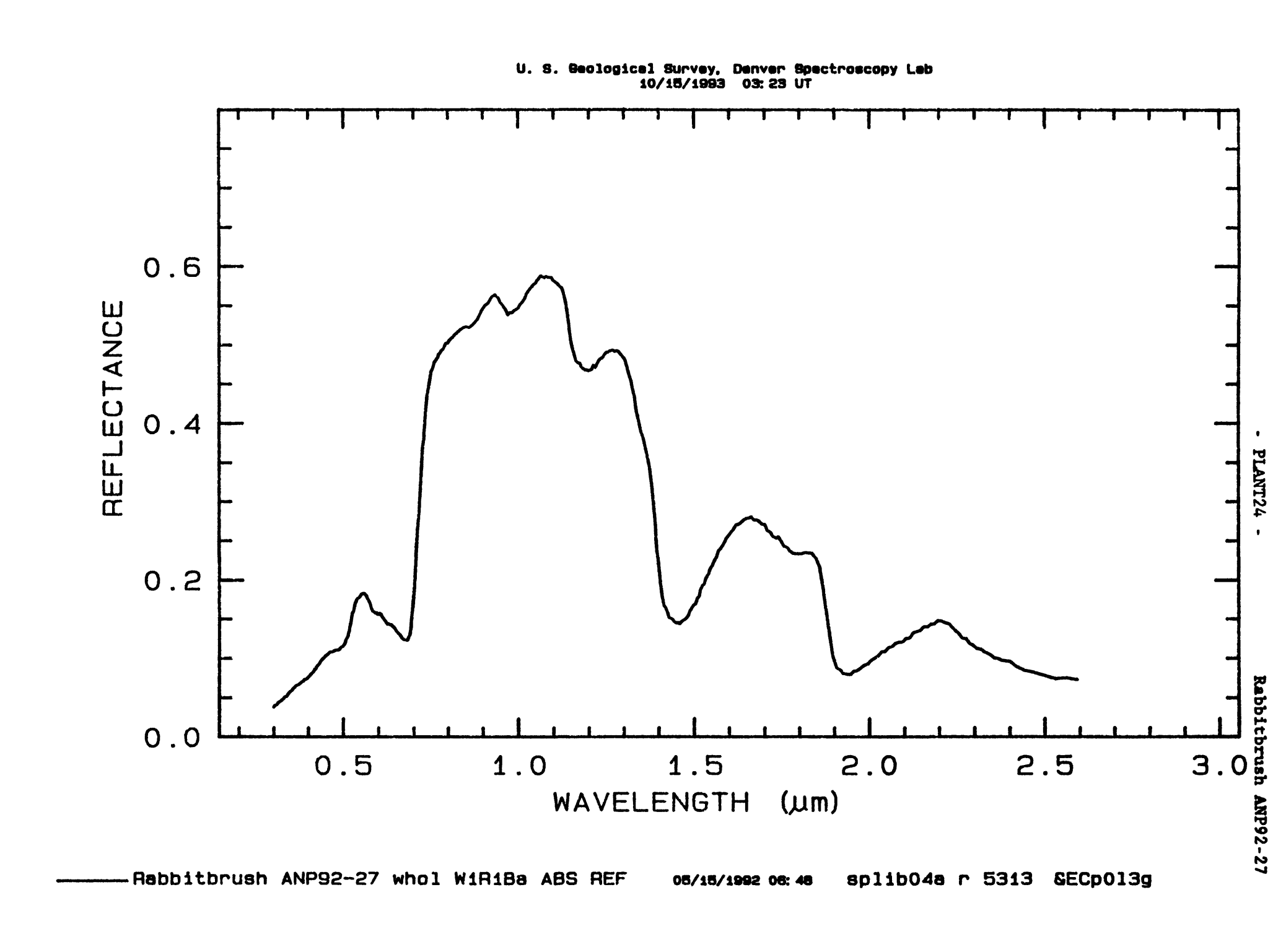
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5313	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT24 -
Rabbitbrush ANP92-27
Rabbitbrush ANP92-27 whol W1R1Ba ABS REF 05/15/1992 06:48 spl1b04a r 5313 &ECp013g

TITLE: Russian_Olive DW92-4 DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: DW92-4

PLANT_TYPE: Tree

PLANT: Russian Olive

LATIN_NAME:

COLLECTION_LOCALITY: Denver West Office Complex,

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Fresh leaves, stacked two on bottom, one on top, over a deep black sample cup.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

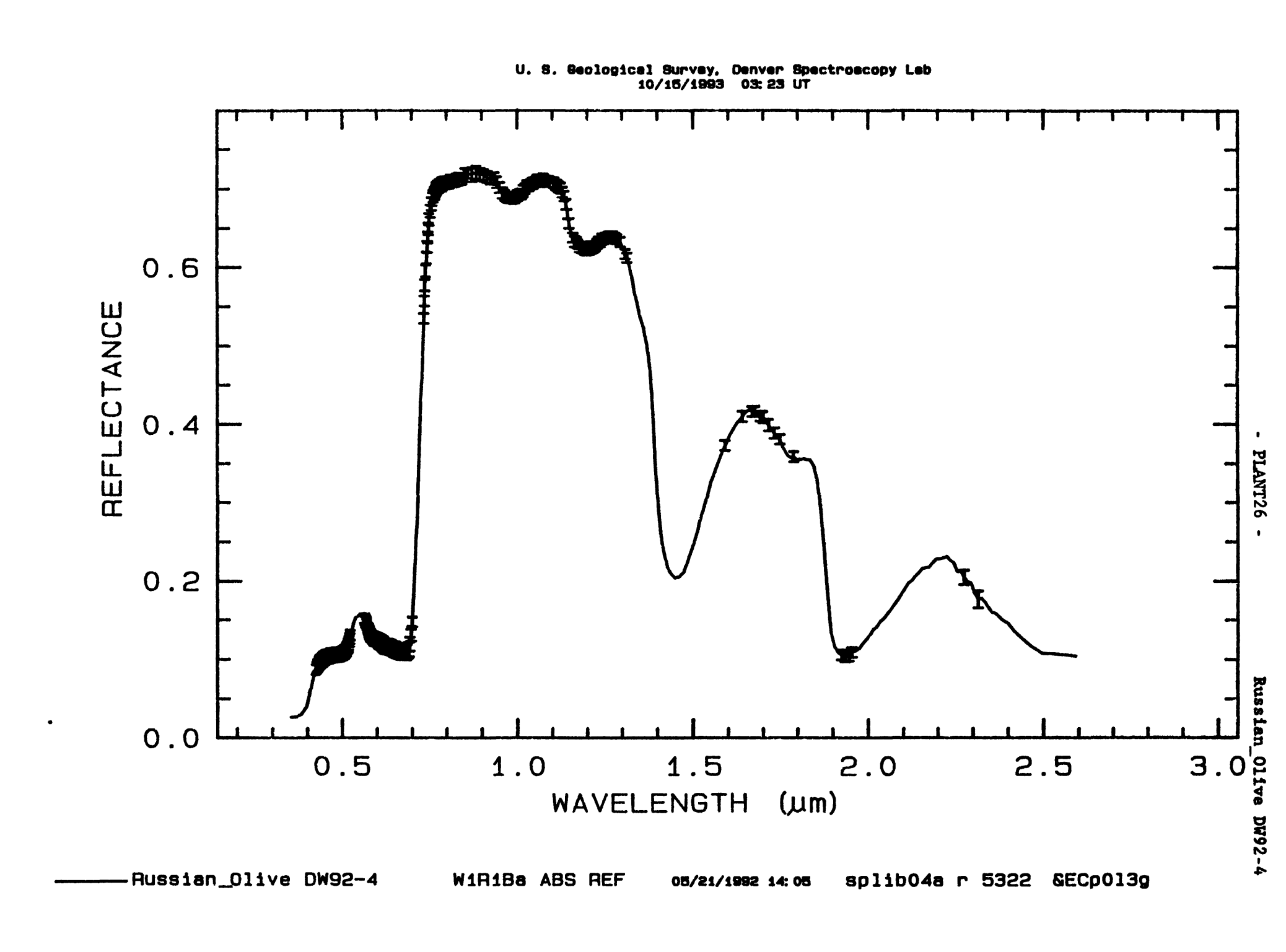
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5322	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT26 -
Russian_Olive DW92-4
Russian_Olive DW92-4 W1R1B8 ABS REF 08/21/1992 14:05 splib04a r 5322 GECp013g

TITLE: Sage_Brush IH91-1B DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: IH91-1B

PLANT_TYPE: Shrub

PLANT: Sage Brush

LATIN_NAME:

COLLECTION_LOCALITY: Iron Hill, CO

ORIGINAL_DONOR: Larry Rowan and Jim Crowley

SAMPLE_DESCRIPTION:

Leaves cut from stem with profile sideways and cut woody stems run side profile. Weighted average of two spectra.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

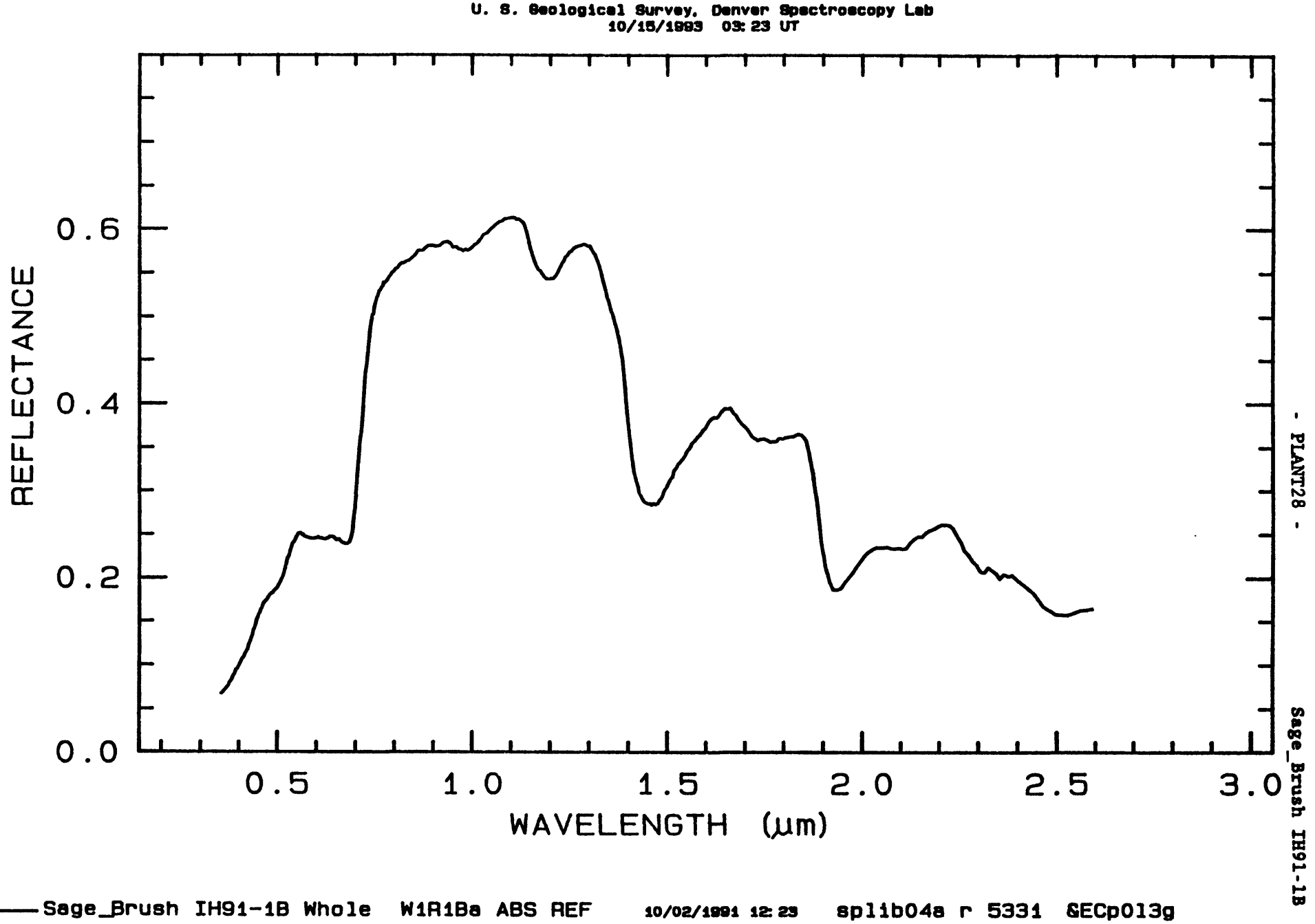
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5331	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT28 -
Sage_Brush IH91-1B
Sage_Brush IH91-1B Whole W1R1Ba ABS REF 10/02/1991 12:29 spl1b04a r 5331 &ECp013g

TITLE: Saltbrush ANP92-31A DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: ANP92-31A

PLANT_TYPE: Shrub

PLANT: Garrett Saltbrush

LATIN_NAME: Atriplex garrettii

COLLECTION_LOCALITY: Arches National Park, UT

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Green leaves. From Mancos shale near Wolf Ranch.

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

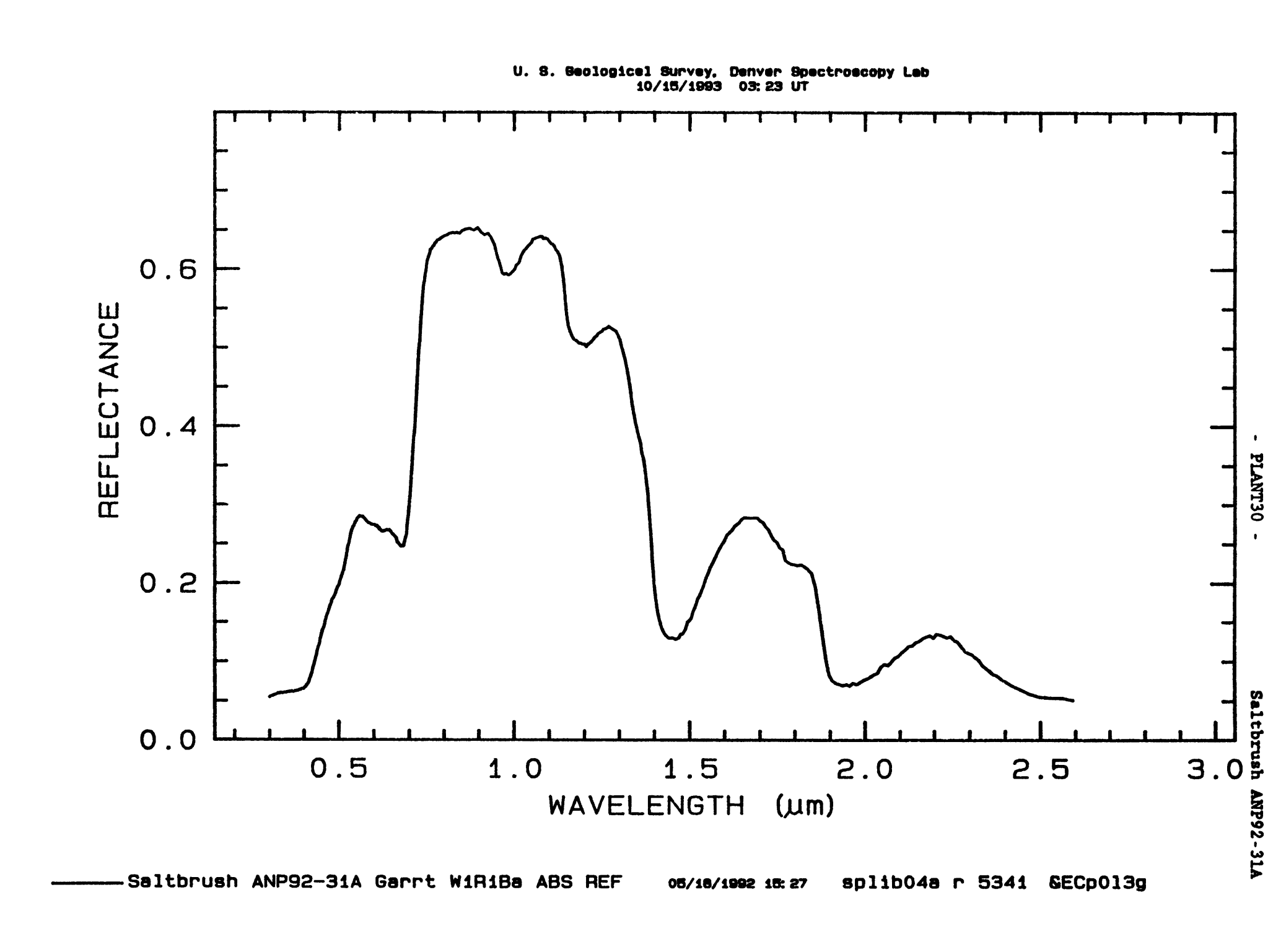
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5341	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT30 -
Saltbrush ANP92-31A
Saltbrush ANP92-31A Garrt W1R1Ba ABS REF 05/18/1992 15:27 splib04a r 5341 &ECp013g

TITLE: Tumbleweed ANP92-2C DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: ANP92-2C

PLANT_TYPE: Shrub

PLANT: Tumbleweed

LATIN_NAME: Salsola iberica

COLLECTION_LOCALITY: Arches National Park, UT

ORIGINAL_DONOR:

SAMPLE_DESCRIPTION:

Dried tumbleweed

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

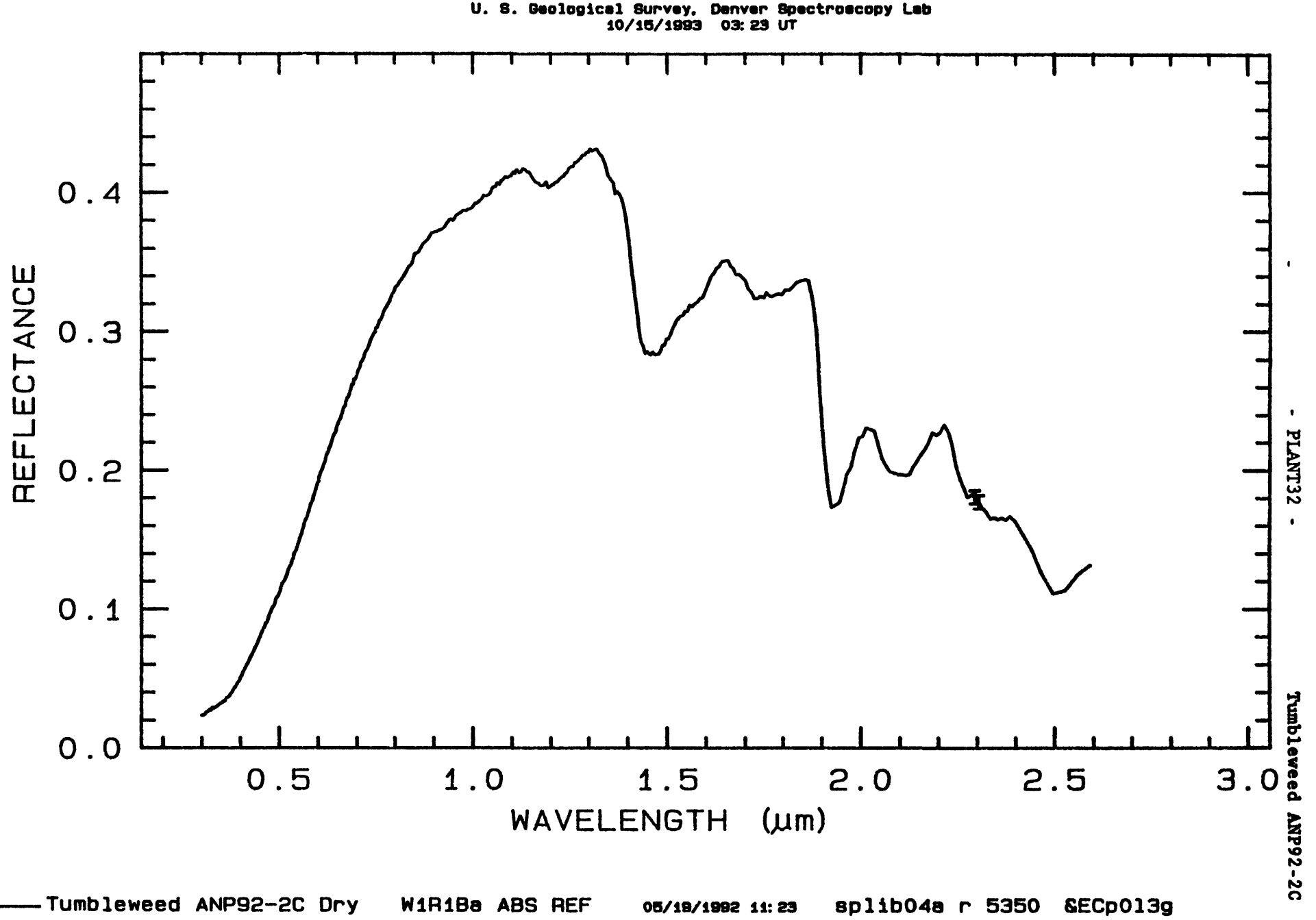
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5350	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- PLANT32 -
Tumbleweed ANP92-2C
Tumbleweed ANP92-2C Dry W1R1Ba ABS REF 05/19/1992 11:23 splib04a r 5350 &ECp013g

TITLE: Ammonio-jarosite SCR-NHJ DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SCR-NHJ

MINERAL_TYPE: Sulfate

MINERAL: Ammoniojarosite (Alunite group)

FORMULA: (NH4)(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $(NH_4)Fe^{+3}_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY:

ORIGINAL_DONOR:

CURRENT_SAMPLE_LOCATION:

ULTIMATE_SAMPLE_LOCATION:

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 291	0.2-3.0μm	200	g.s.=

TITLE: Walnut_Leaf SUN DESCRIPT

DOCUMENTATION_FORMAT: PLANT

SAMPLE_ID: SUN

PLANT_TYPE: Tree

PLANT: Walnut

LATIN_NAME: Juglans regia

COLLECTION_LOCALITY: Davis, California (Susan Ustin's backyard)

ORIGINAL_DONOR: Susan Ustin

SAMPLE_DESCRIPTION:

Green healthy leaves from the sunny side of the tree. Average of 5 spectra

END_SAMPLE_DESCRIPTION.

COMPOSITIONAL_ANALYSIS_TYPE:

COMPOSITION:	Cellulose:	wt%
COMPOSITION:	Lignin:	wt%
COMPOSITION:	Chlorophyll_A:	wt%
COMPOSITION:	Chlorophyll_B:	wt%
COMPOSITION:	Nitrogen:	wt%

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

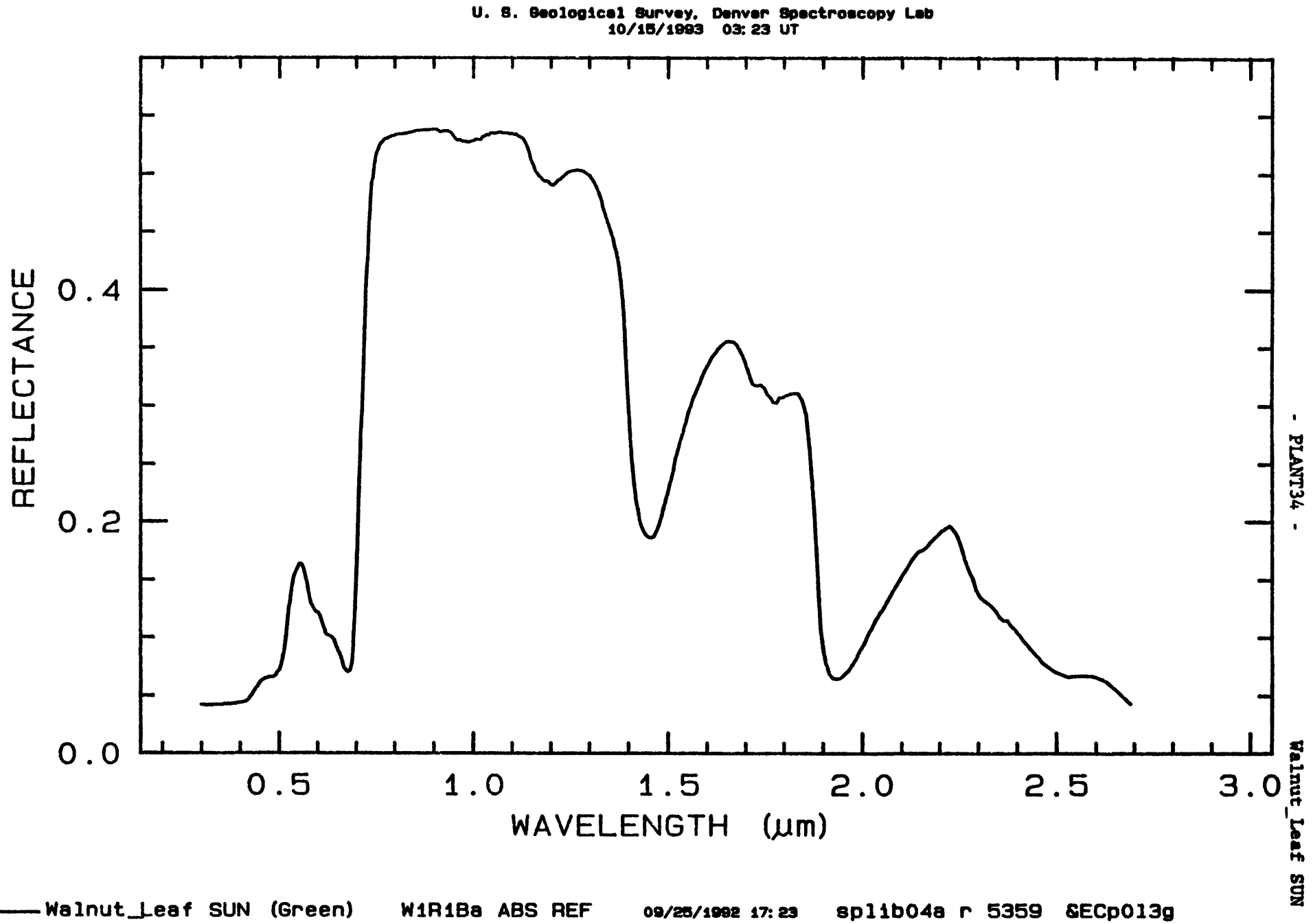
TRACE_ELEMENT_ANALYSIS:

TRACE_ELEMENT_DISCUSSION:

END_TRACE_ELEMENT_DISCUSSION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5359	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/15/1993 03:23 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- PLANT34 -
Walnut_Leaf SUN
Walnut_Leaf SUN (Green) W1R1Ba ABS REF 09/25/1992 17:23 spl1b04a r 5359 &ECp013g

TITLE: Quartz HS117 Aventurine DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS117

MINERAL_TYPE: Tectosilicate

MINERAL: Quartz

FORMULA: SiO2

FORMULA_NROFF: SiO_2

COLLECTION_LOCALITY: India

ORIGINAL_DONOR: Hunt and Salisbury collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"S-18C. Aventurine Quartz. India (117B). Aventurine quartz is a rare variety that has brilliant scales of mica or hematite distributed within it. This particular sample has mica inclusions, as can be seen by comparing the hydroxyl bands near 1.4μ and between 2.2 and 2.6μ with those of muscovite. The very strong band near 0.6 is not due to the muscovite. We do not know the origin of this band. Some blue quartz which has been analyzed yields Fe_2O_3 (0.5%) and small amounts of TiO_2 as impurities. A band has been observed in some blue Beryls at 0.62μ, but its origin has been attributed to Fe^{+2} in axial channels, and definitely not to Fe^{+2} or Fe^{+3} in the Si tetrahedral site."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

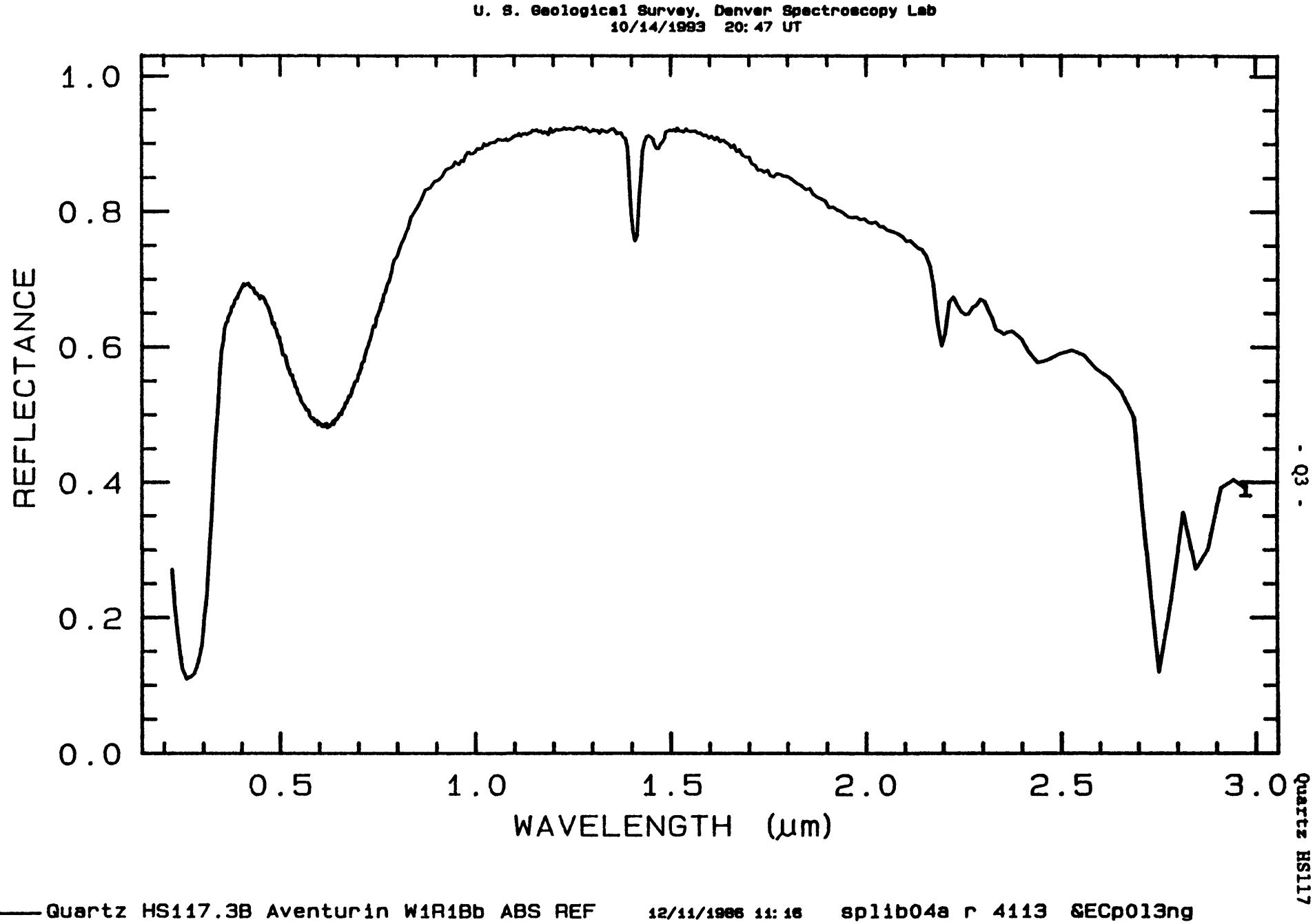
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4113	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:47 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 93 -
Quartz HS117
Quartz HS117.3B Aventurin W1R1Bb ABS REF 12/11/1986 11:16 splib04a r 4113 &ECp013ng

TITLE: Quartz GDS31 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS31

MINERAL_TYPE: Tectosilicate

MINERAL: Quartz

FORMULA: SiO2

FORMULA_NROFF: SiO_2

COLLECTION_LOCALITY: Brazil

ORIGINAL_DONOR: Bruce Hemingway

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Tridymite, Cristobalite, Coesite and Stishovite.

Quartz (SiO_2) is an important constituent of igneous rocks which have an excess of silica, such as granite, rhyolite or pegmatite. Because it is extremely resistant to both mechanical and chemical attack, it usually survives the weathering process. Quartz is an extremely difficult mineral to grind without contamination, because of its hardness.

"Results of petrographic examination: Hand sample appears entirely pure, being a clear and transparent fragment of a single crystal. Under petrographic microscope, sample also pure and clear."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure quartz. (Jack Salibury)
Pure quartz. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Results of XRF or other compositional analysis: Essentially pure SiO_2 within the limits of microprobe error.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

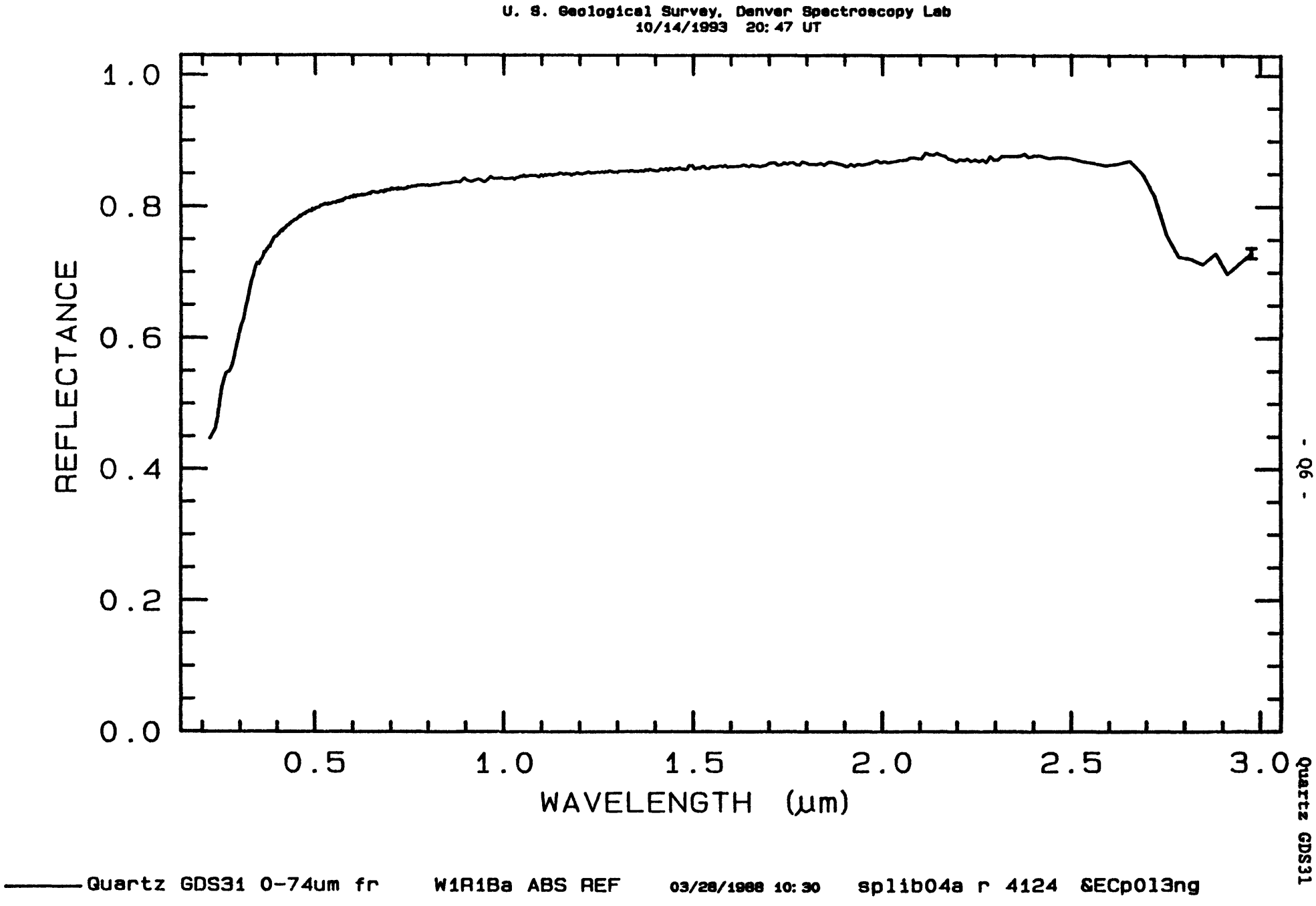
MICROSCOPIC_EXAMINATION:

Colorless transparent. No contamination visually apparent.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4124	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:47 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 06 -
Quartz GDS31
Quartz GDS31 0-74um fr W1R1Ba ABS REF 03/28/1988 10:30 splib04a r 4124 &ECp013ng

TITLE: Quartz HS32 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS32

MINERAL_TYPE: Tectosilicate

MINERAL: Quartz

FORMULA: SiO2

FORMULA_NROFF: SiO_2

COLLECTION_LOCALITY: Rock Springs, Arkansas

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This particular sample is a very pure variety of clear cyrstal quartz, and careful grinding has produced a sample with very high reflectivity and almost devoid of spectral features. There are only two very weak features at 2.3 and 2.5μm in the finest grain sizes. Because there are no bands at 1.4μm or 1.9μm, these features cannot be attributed to water or hydroxyl groups in the quartz. The cross-overs of the two very fine grain sizes with the others is not significant.

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

Sieve interval 74-250μm.

Results of petrographic examination: Crystal clear quartz.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure. (Norma Vergo)

Pure quartz.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Results of XRF or other compositional analysis: Essentially pure SiO_2 within the limit of microprobe error.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

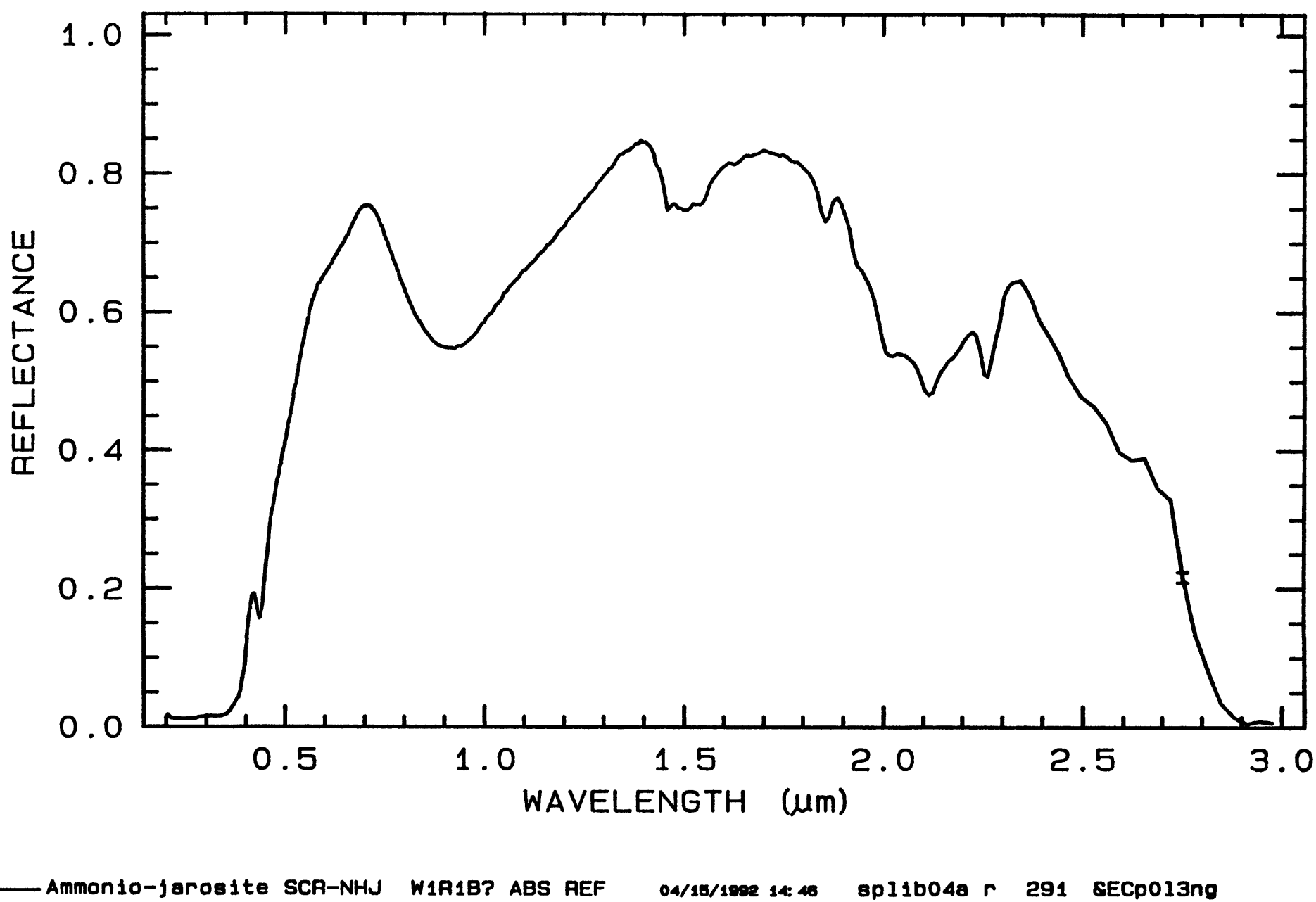
MICROSCOPIC_EXAMINATION:

Colorless transparent. No contamination visually apparent.

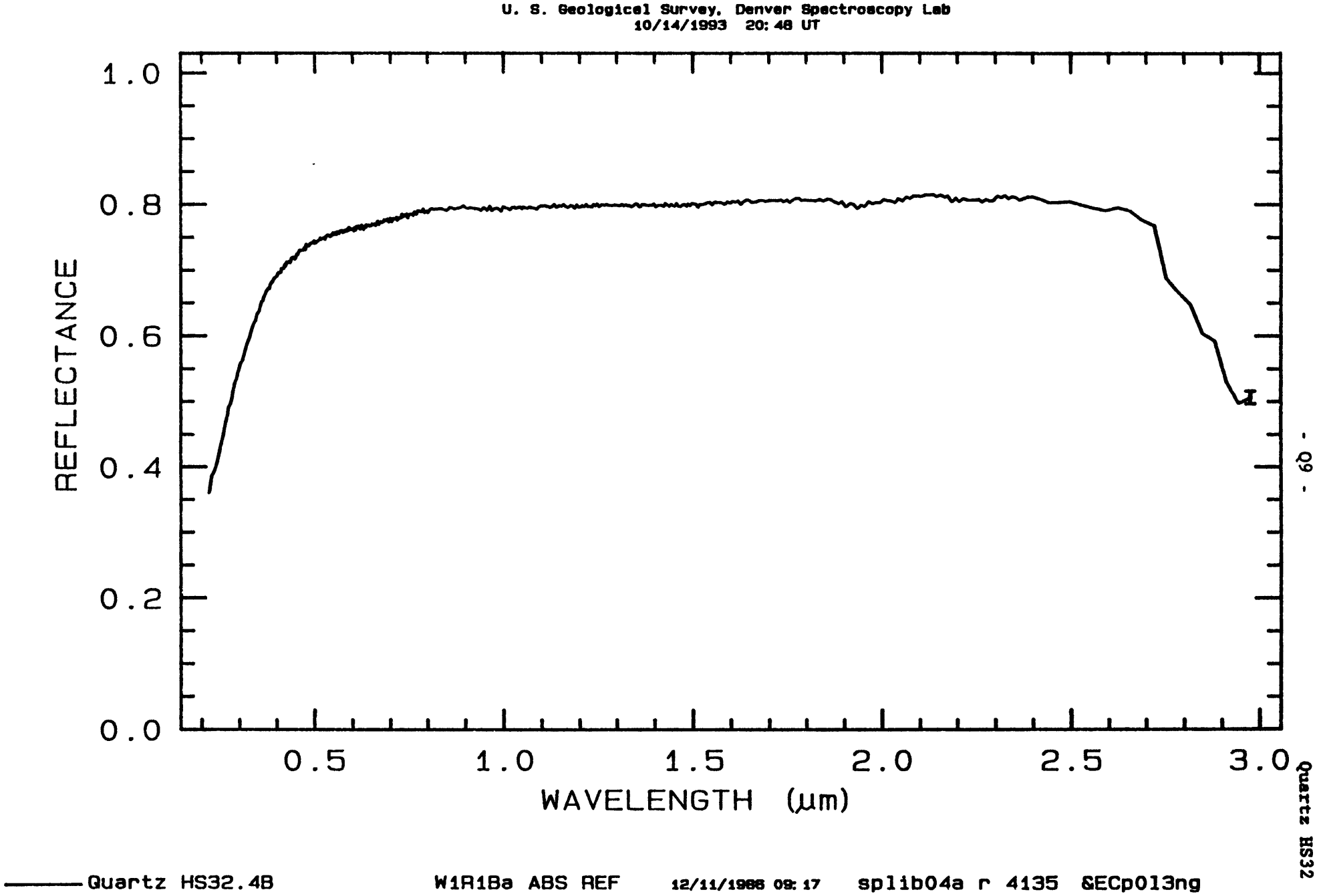
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4135	0.2-3.0μm	200	g.s.=



Ammonio-jarosite SCR-NHJ


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:48 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Quartz HS32
Quartz HS32.4B
W1R1Ba ABS REF
12/11/1986 09:17
splib04a r 4135 &ECp013ng

TITLE: Quartz GDS74 (Sand) Ottawa DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS74

MINERAL_TYPE: Tectosilicate

MINERAL: Quartz

FORMULA: SiO2

FORMULA_NROFF: SiO_2

COLLECTION_LOCALITY: Ottawa, Canada

ORIGINAL_DONOR: Dennis Capron

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Pure commercial quartz sand.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

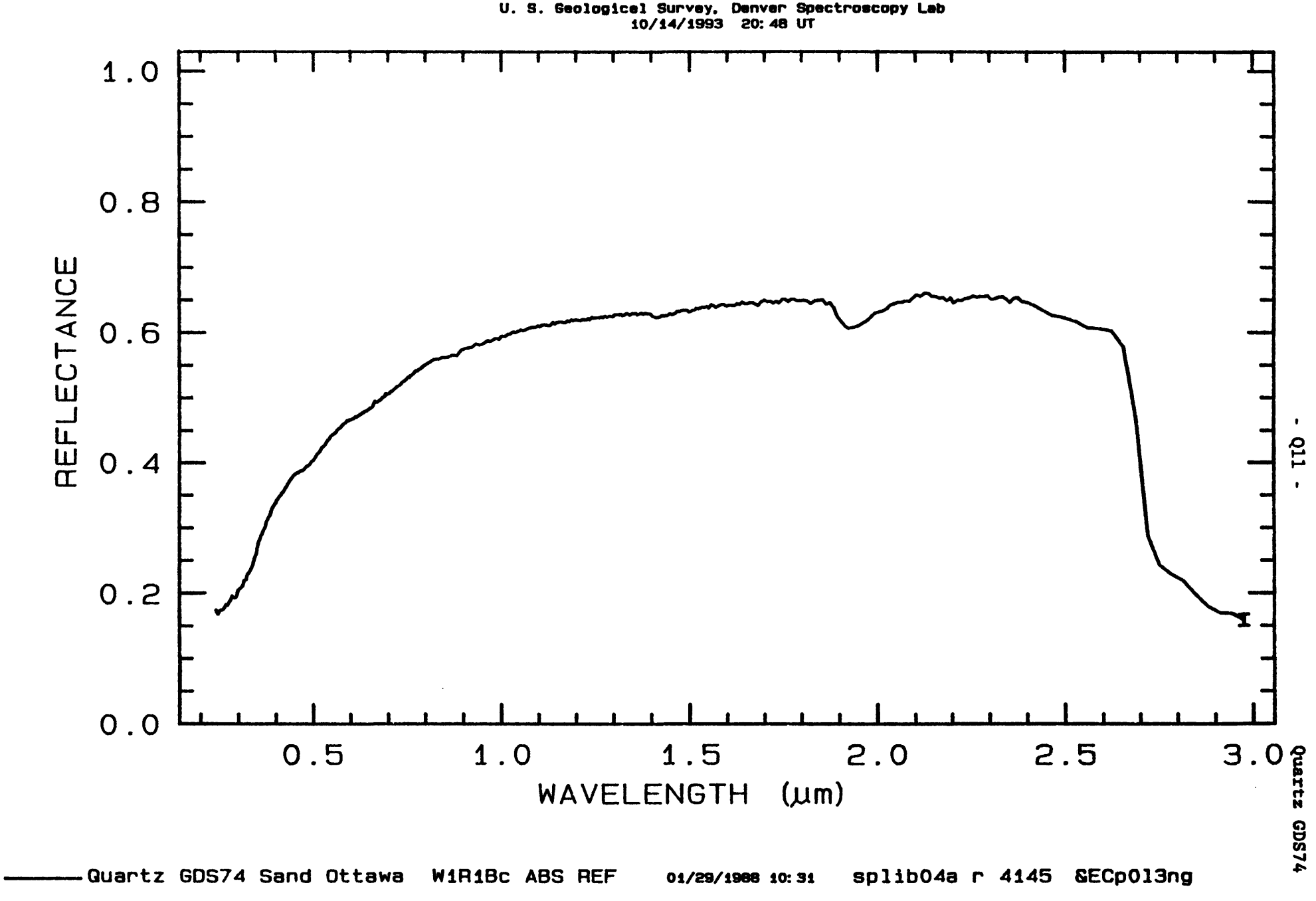
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4145	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:48 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 011 -
Quartz GDS74
Quartz GDS74 Sand Ottawa W1R1Bc ABS REF 01/29/1988 10:31 splib04a r 4145 &ECp013ng

TITLE: Rectorite ISR202 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: ISR202

MINERAL_TYPE: Phyllosilicate

MINERAL: Rectorite

FORMULA: Al2Si4O10(OH)2 + (Mg,Fe+2,Al)3(Al,Si)4O10(OH)2*4H2O

FORMULA_NROFF: $Al_2Si_4O_{10}(OH)_2$ + $(Mg,Fe^{+2},Al)_3(Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Garland County, Arizona

ORIGINAL_DONOR:

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Rectorite, a clay mineral, is a regular interstratification of a dioctahedral mica and a dioctahedral smectite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
Rectorite dominates
20 vol% quartz
muscovite & chlorite undetermined

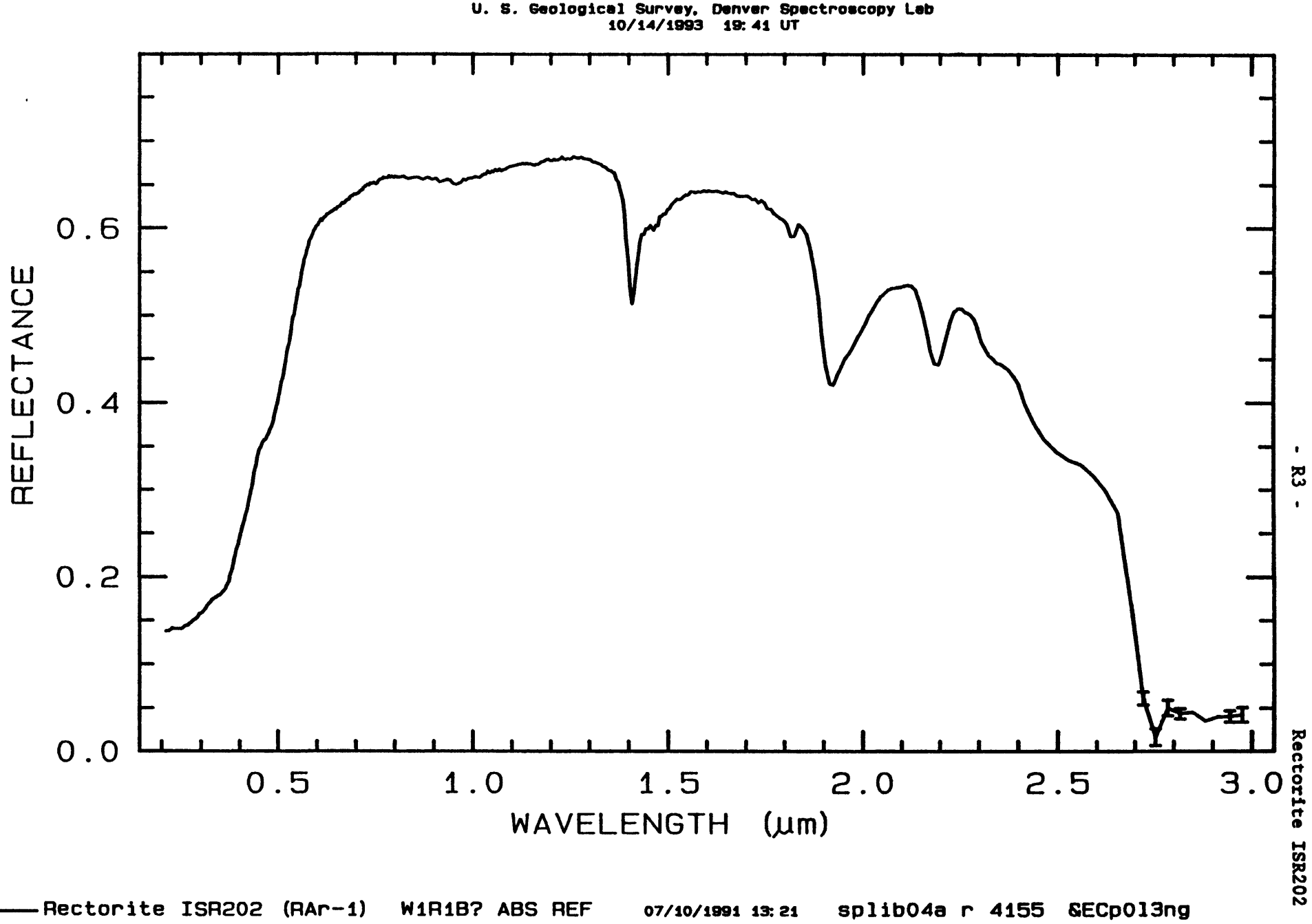
quartz avg gr sz = 300 μm
all others avg gr sz = 35 μm

Rectorite forms fine intergrowths with muscovite & chlorite

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4155	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R3 -
Rectorite ISR202
Rectorite ISR202 (RAr-1) W1R1B? ABS REF 07/10/1991 13:21 splib04a r 4155 &ECp013ng

TITLE: Rectorite RAr-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: RAr-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Rectorite

FORMULA: Al2Si4O10(OH)2 + (Mg,Fe+2,Al)3(Al,Si)4O10(OH)2*4H2O

FORMULA_NROFF: $Al_2Si_4O_{10}(OH)_2$ + $(Mg,Fe^{+2},Al)_3(Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Garland County, Arizona

ORIGINAL_DONOR: Grim Collection?

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Rectorite, a clay mineral, is a regular interstratification of a dioctahedral mica and a dioctahedral smectite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Rectorite + chlorite + muscovite; < 2μm cut rectorite + tr. chlorite + tr. muscovite M: 10-15% quartz, 2% chlorite, 2% opaque, no HCl fizz (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	72.8	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.31	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	16.9	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.22	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.38	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.26	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.09	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	1.11	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.45	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.07	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	4.75	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	1.49	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	6.24	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	6.16	wt%	NROFF:	LOI
COMPOSITION:	---	---	---		
COMPOSITION:	Total:		wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysts: E. Brandt, H. H. Christie

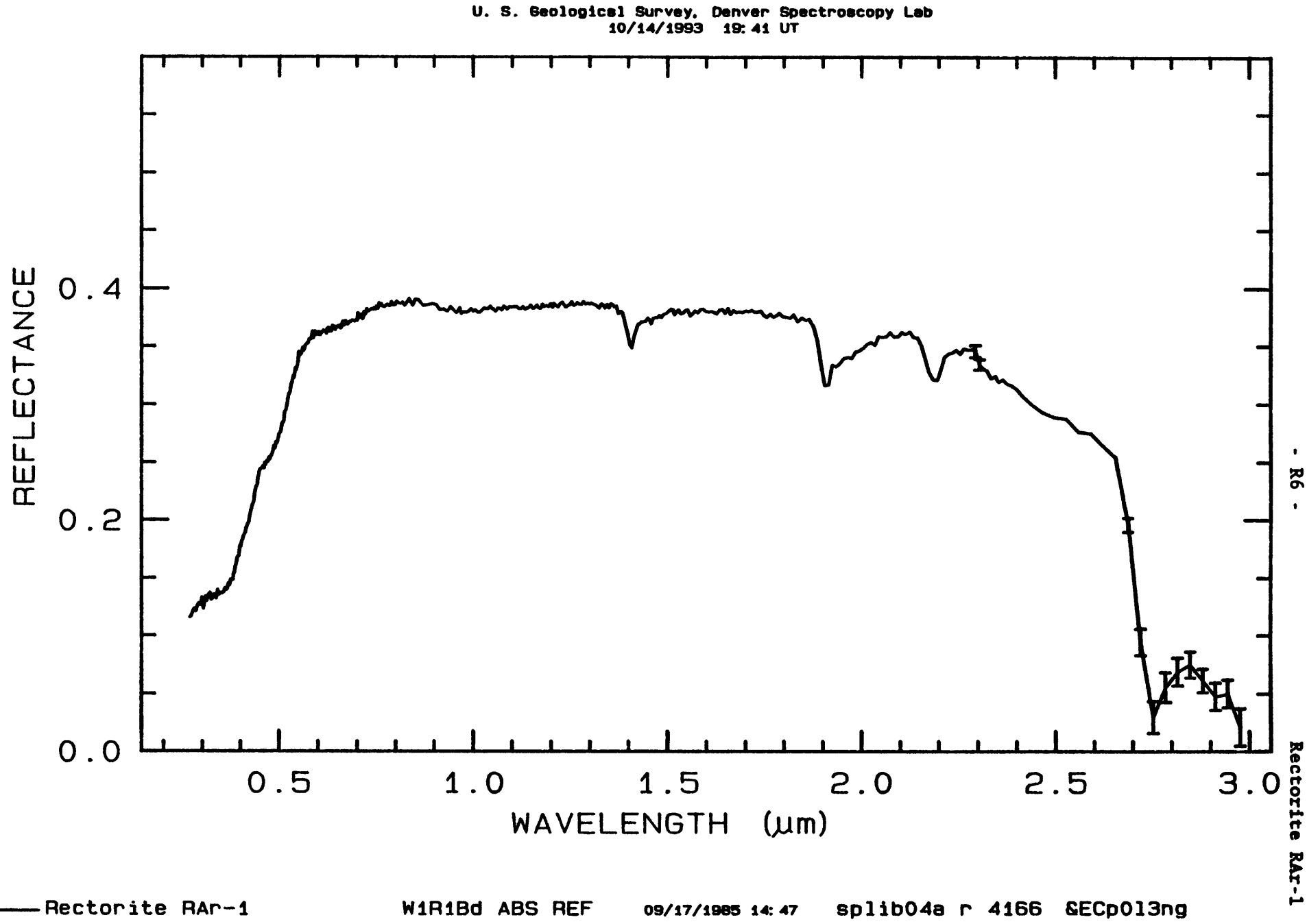
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4166	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R6 -
Rectorite RAr-1
Rectorite RAr-1
W1R1Bd ABS REF
09/17/1985 14:47
splib04a r 4166 &ECp013ng

TITLE: Rhodochrosite HS338 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS338

MINERAL_TYPE: Carbonate

MINERAL: Rhodochrosite

FORMULA: MnCO3

FORMULA_NROFF: $MnCO_3$

COLLECTION_LOCALITY: Montana

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Rhodochrosite, $MnCO_3$, is a comparatively rare carbonate mineral, usually occurring in hydrothermal veins with ores of silver, lead and copper, and with other manganese minerals. Divalent iron and calcium substitute for manganese, and a complete solid solution series appears to extend to siderite and calcite.

Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4176	0.2-3.0μm	200	g.s.-

TITLE: Ammonio-Illite/Smectite GDS87 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS87

MINERAL_TYPE: Phyllosilicate

MINERAL: Ammonium_Illite/Smectite (Synthetic)

FORMULA: NH4Al2(Si3Al)O10(OH)2 + (NH4)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $NH_4Al_2(Si_3Al)O_{10}(OH)_2 + (NH4)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Dennis Krohn, USGS Reston

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

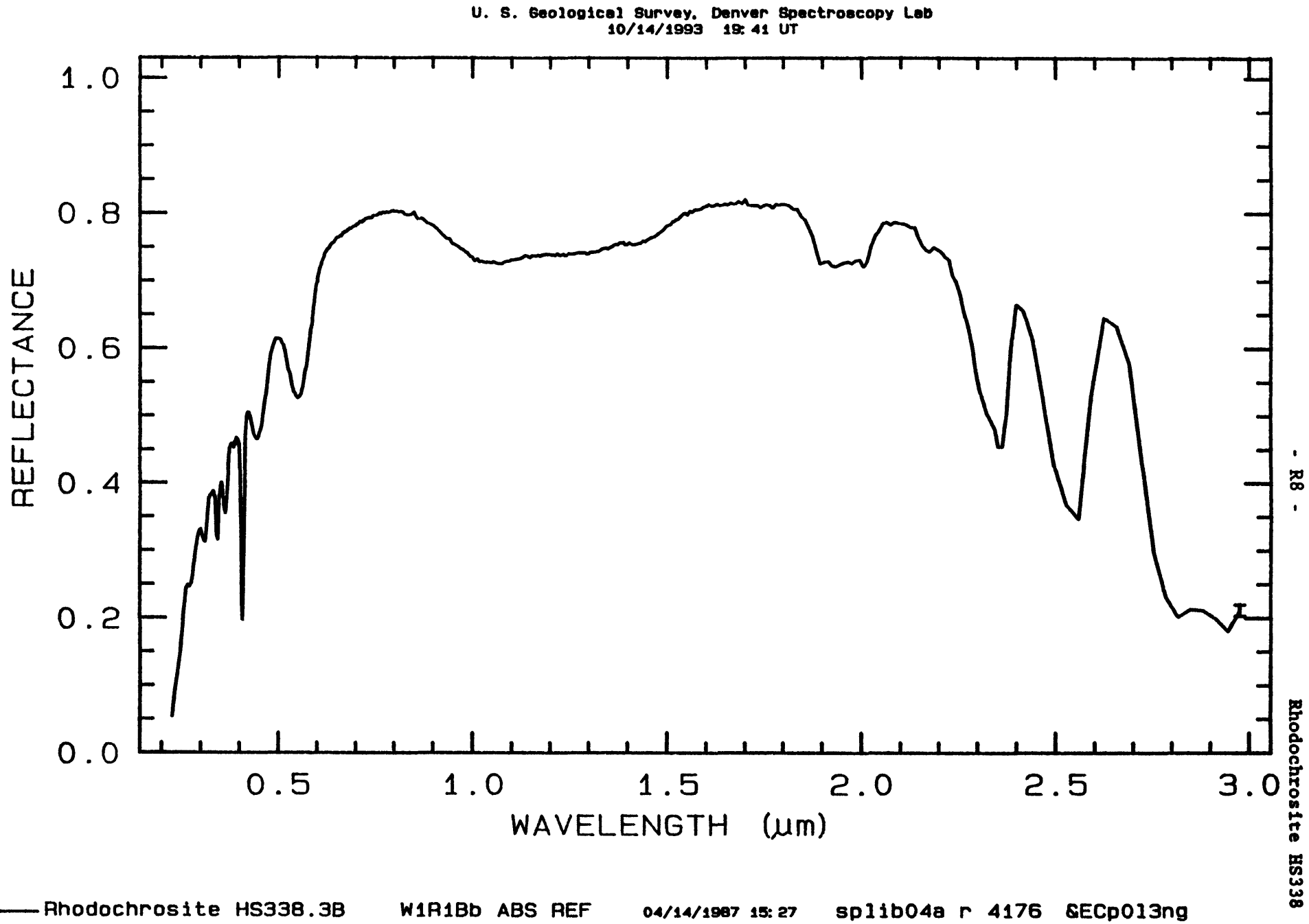
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a	r 301	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R8 -
Rhodochrosite HS338
Rhodochrosite HS338.3B W1R1Bb ABS REF 04/14/1987 15:27 splib04a r 4176 &ECp013ng

TITLE: Rhodochrosite HS67 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS67

MINERAL_TYPE: Carbonate

MINERAL: Rhodochrosite

FORMULA: MnCO3

FORMULA_NROFF: $MnCO_3$

COLLECTION_LOCALITY: Catamarca Provenee, Argentina

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"C-6. Rhodochrosite. Catamarca Provenee, Argentina (67, hand-ground). Rhodochrosite, $MnCO_3$, is a comparatively rare carbonate mineral, usually occurring in hydrothermal veins with ores of silver, lead and copper, and with other manganese minerals. Divalent iron and calcium substitute for manganese, and a complete solid solution series appears to extend to siderite and calcite. This particular sample displays the rich pink color in hand specimen that is typical of pure rhodochrosite. It is, however, very rare to find rhodochrosite free of iron, and this sample is no exception. It does, in fact, contain 1% iron, and displays a fairly strong ferrous ion band near 1.1μ, in addition to the typical near-infrared carbonate bands. The bands in the visible, on the other hand, are due to the manganese ion, and are unusually sharp electronic transition bands, as discussed and assigned in the previous section, entitled "Spectral Features of Carbonates"."

Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

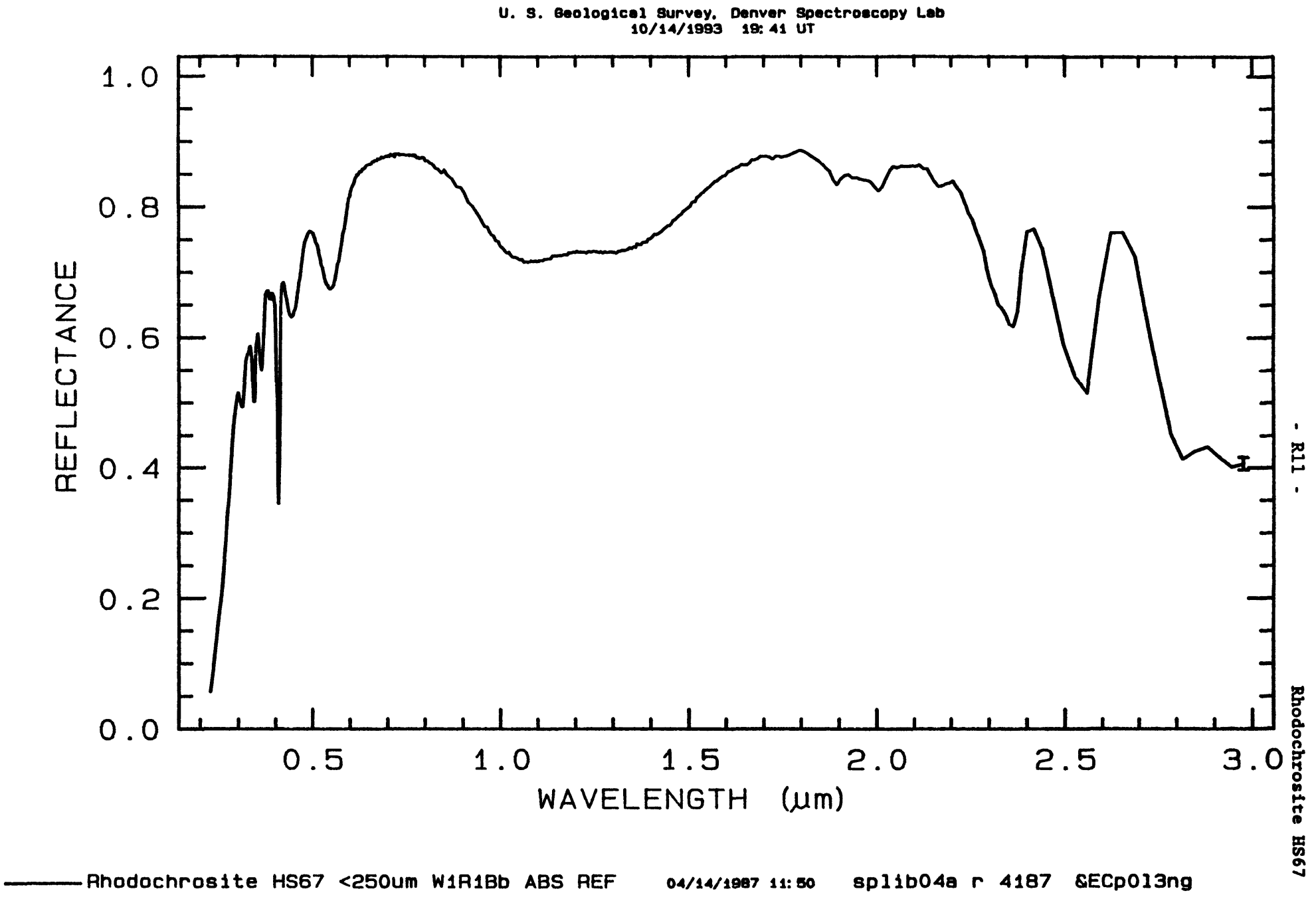
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4187	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R11 -
Rhodochrosite HS67
Rhodochrosite HS67 <250um W1R1Bb ABS REF 04/14/1987 11:50 splib04a r 4187 &ECp013ng

TITLE: Rhodonite NMNHC6148 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNHC6148

MINERAL_TYPE: Inosilicate

MINERAL: Rhodonite

FORMULA: (Mn+2,Fe+2,Mg,Ca)SiO3

FORMULA_NROFF: $(Mn^{+2},Fe^{+2},Mg,Ca)SiO_3$

COLLECTION_LOCALITY: Franklin, New Jersey

ORIGINAL_DONOR: Smithsonian Institution

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Results of petrographic examination: Hand sample is composed of two fragments, each about 2cm x 2cm x 1cm. About one third of each is host rock on which the rhodonite crystals grow. This was removed by sawing to free pure rhodonite. Under petrogrphic microscope, many other grains show a small degree of alteration (not identified)."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure rhodonite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Pure (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	46.30	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.07	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	0.05	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	0.50	wt%	NROFF: FeO
COMPOSITION:	MnO:	40.17	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.41	wt%	NROFF: MgO
COMPOSITION:	CaO:	8.27	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.28	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.04	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	96.09	wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

"Results of XRF or other compositional analysis: Microprobe analysis shows sample is homogeneous between and within grains. Average of six analyses."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

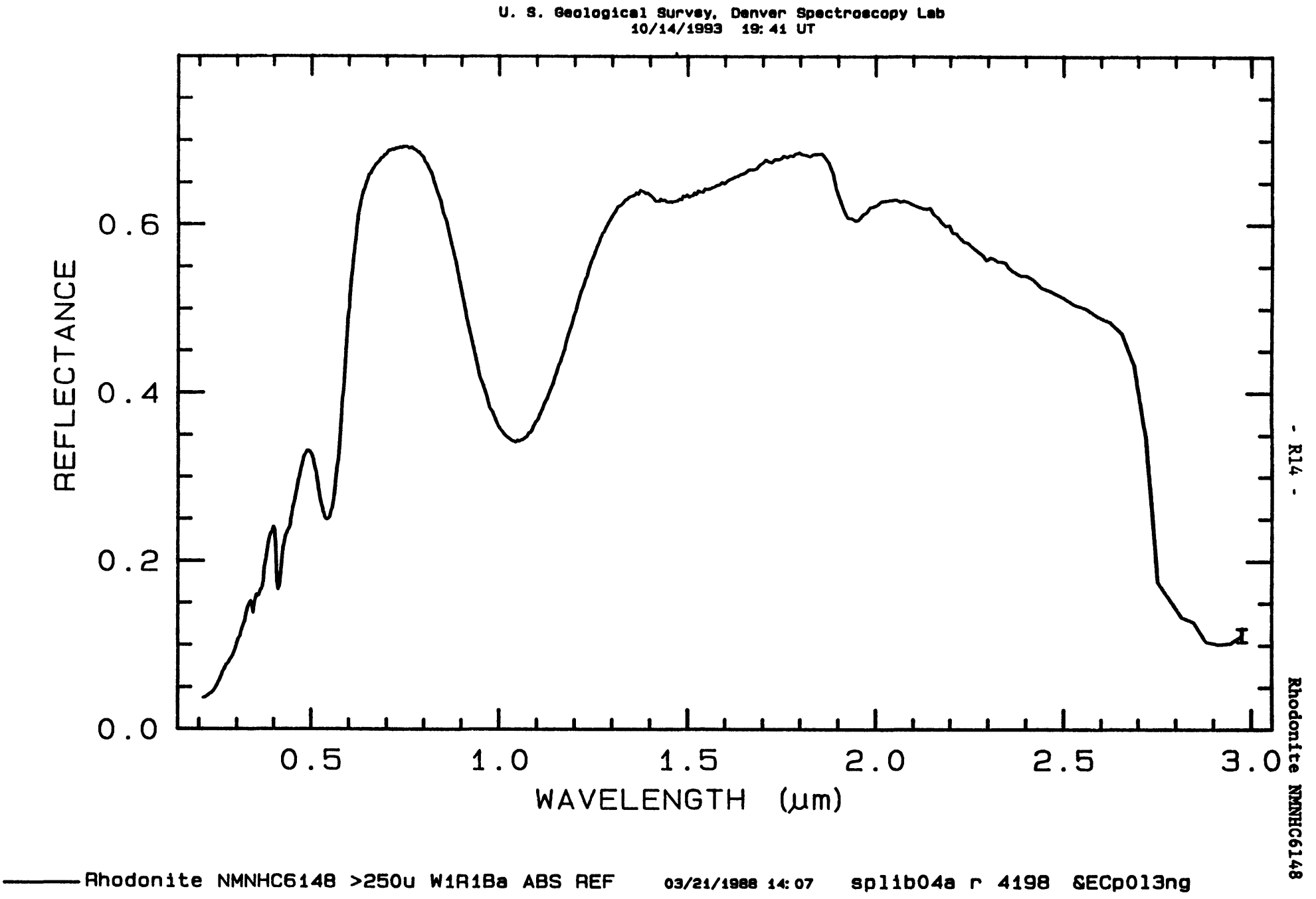
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4198	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R14 -
Rhodonite NMNHC6148
Rhodonite NMNHC6148 >250u W1R1Ba ABS REF 03/21/1988 14:07 splib04a r 4198 &ECp013ng

TITLE: Rhodonite HS325 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS325

MINERAL_TYPE: Inosilicate

MINERAL: Rhodonite

FORMULA: MnSiO3

FORMULA_NROFF: $MnSiO_3$

COLLECTION_LOCALITY: Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample contains very small amounts of magnetite, pyrolusite and calcite. The visible spectrum is dominated by features typical of Mn^{2+} transitions, displaying bands at 0.35 μ, 0.37 μ, 0.42 μ, and 0.55 μ, resulting in the characteristic pink color of this mineral. The strong broad band near 1.04 μ and 1.9 μ features are typical of molecular water, probably in fluid inclusions.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

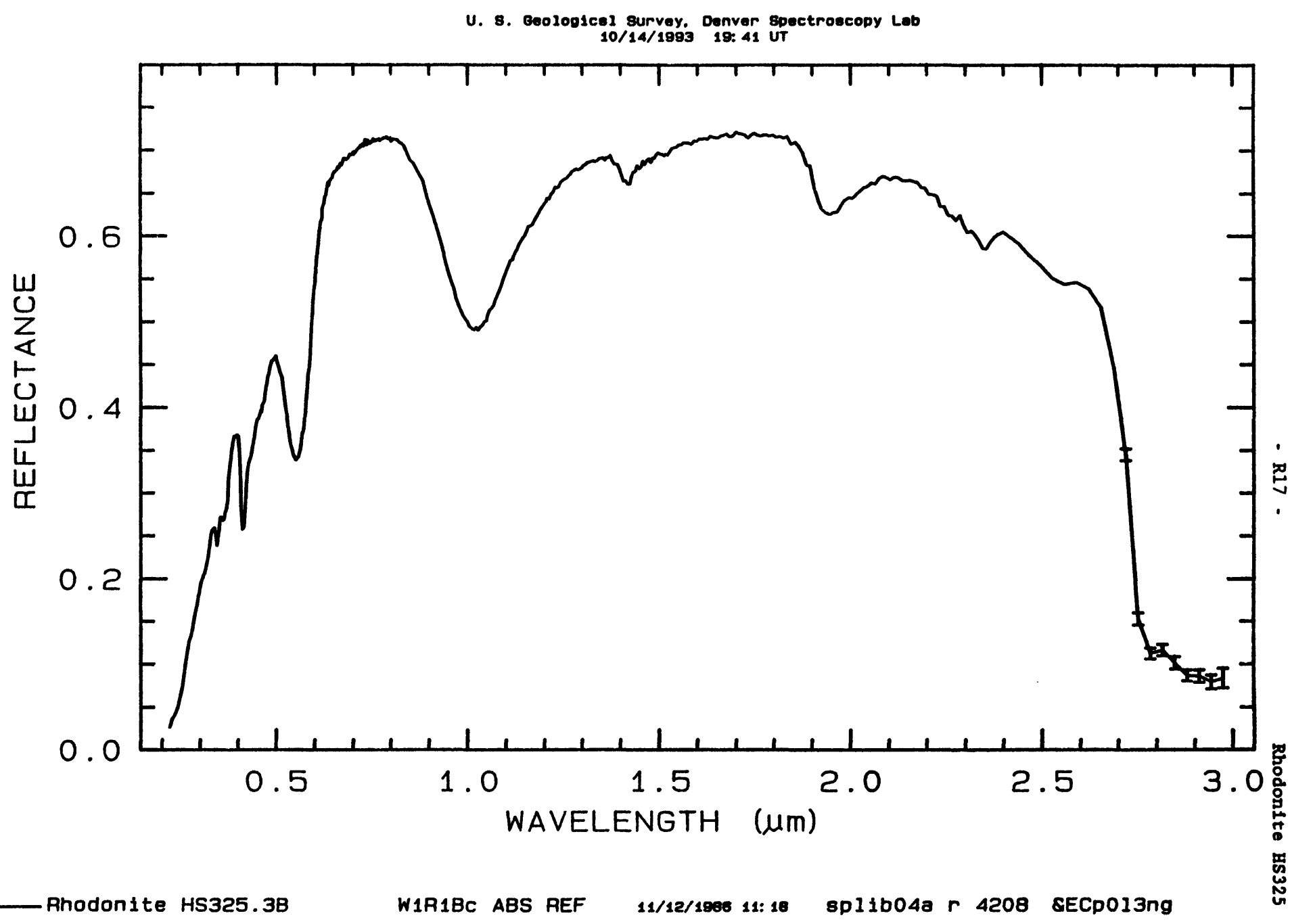
MICROSCOPIC_EXAMINATION:

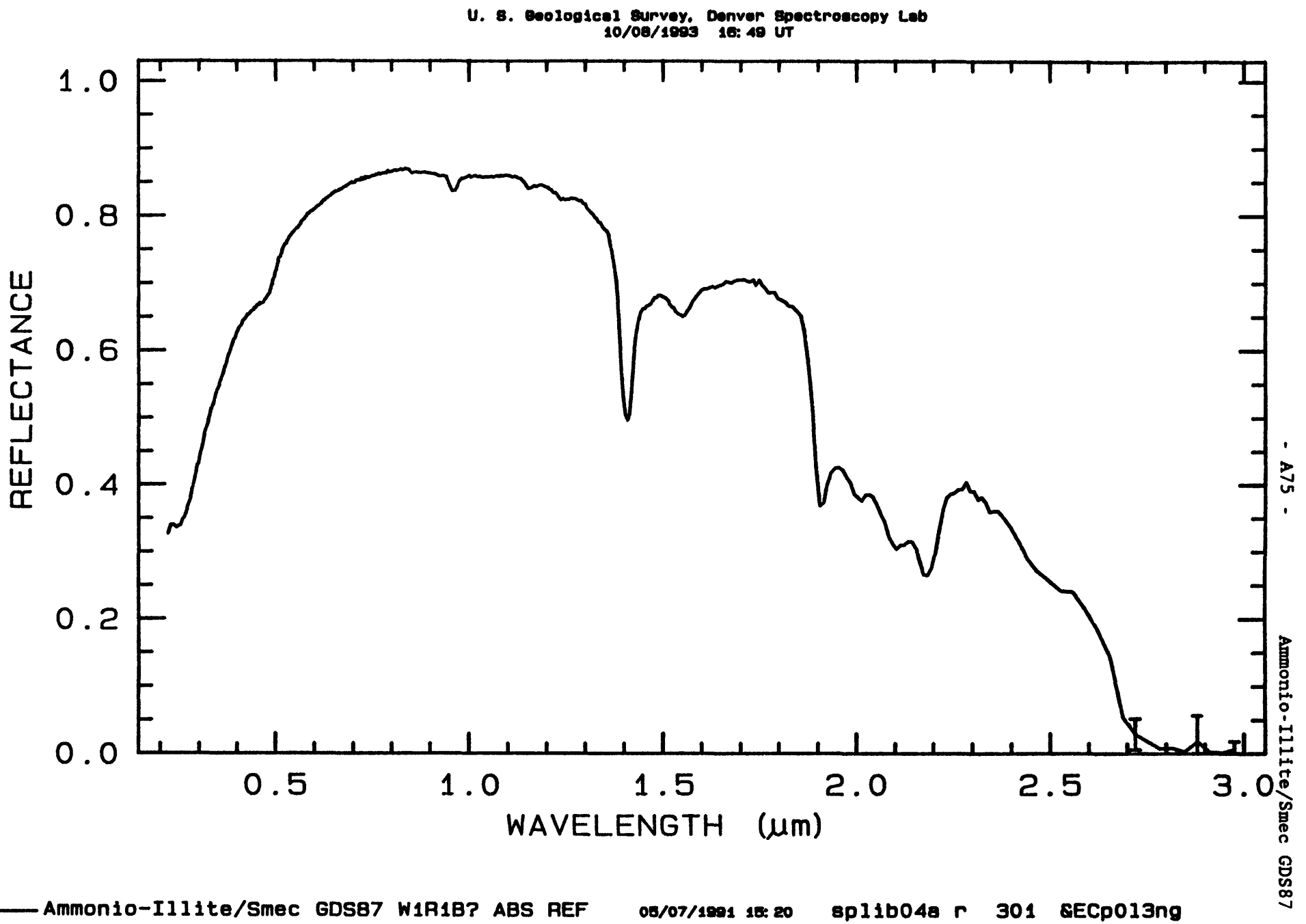
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 4208 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Rhodonite HS325.3B W1R1Bc ABS REF 11/12/1986 11:18 splib04a r 4208 &ECp013ng
Rhodonite HS325


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A75 -
Ammonio-Illite/Smec GDS87
Ammonio-Illite/Smec GDS87 W1R1B? ABS REF 08/07/1991 15:20 splib04a r 301 &ECp013ng

TITLE: Richterite HS336 Amphibole DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS336

MINERAL_TYPE: Inosilicate

MINERAL: Richterite (Amphibole group)

FORMULA: Na2Ca(Mg,Fe2+,Mn,Fe3+,Al)5(Si8O22)(OH,F)2

FORMULA_NROFF: $Na_2Ca(Mg,Fe^{2+},Mn,Fe^{3+},Al)_5(Si_8O_{22})(OH,F)_2$

COLLECTION_LOCALITY: Sweden

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"I-21 Richterite 336B--Sweden. $Na_2Ca(Mg, Fe^{2+}, Mn, Fe^{3+}, Al)_5(Si_8O_{22})(OH, F)_2$: This mineral occurs in thermally metamorphosed limestones and skarns, and is also found as a hydrothermal product in veins in alkaline igneous rocks. This sample is contaminated with 30% magnetite, which reduces the overall reflectivity. It would also serve to quench the iron bands, were any displayed. However, the curve shown is for a sample cleaned of all magnetite, and it is still surprisingly free of electronic transition bands for an amphibole. The only well defined features are the 1.4μ OH band, which is clearly doubled, and the two OH bands near 2.32μ and 2.38μ."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

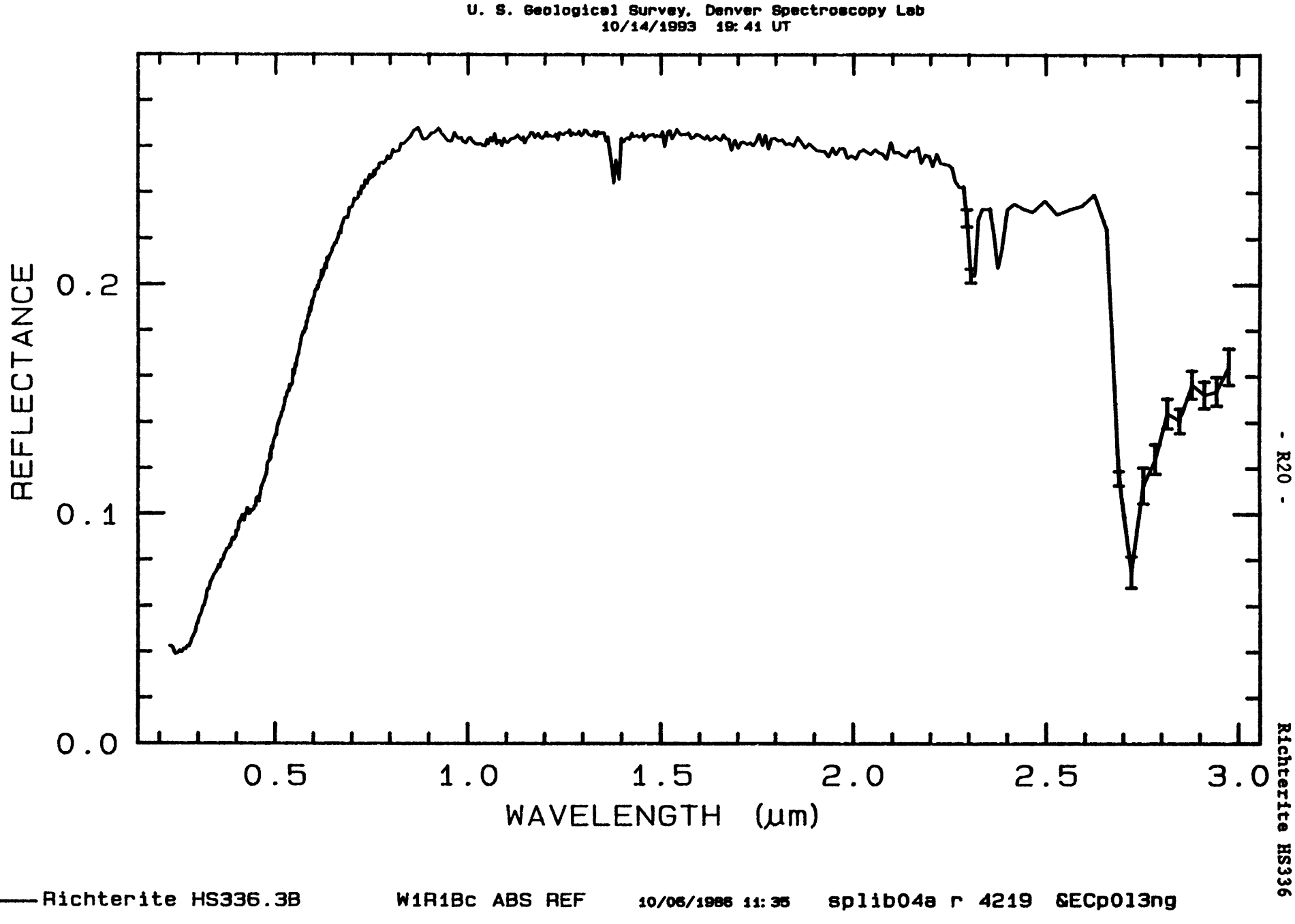
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 4219	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R20 -
Richterite HS336
Richterite HS336.3B
W1R1Bc ABS REF
10/06/1986 11:35
splib04a r 4219 &ECp013ng

TITLE: Richterite NMNH150800 Amphibole DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH150800

MINERAL_TYPE: Inosilicate

MINERAL: Richterite (Amphibole group)

FORMULA: Na2Ca(Mg,Fe2+,Mn,Fe3+,Al)5(Si8O22)(OH,F)2

FORMULA_NROFF: $Na_2Ca(Mg,Fe^{2+},Mn,Fe^{3+},Al)_5(Si_8O_{22})(OH,F)_2$

COLLECTION_LOCALITY: Wilberforce, Ontario, Canada

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Results of petrographic examination: Two large (6.49 and 6.45 g) pieces and 2 fragments (4.18 b), black in color. Parts of single crystals. One fragment has large white (calcite) contamination. Crystals also have generally small blotchy inclusions of calcite. Crushed sample treated with HCl. Under the microscope, individual crystals before treatment appear clean and pure except for about 1% calcite impurities."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Richterite plus a trace of mica. Infrared spectra do not show a mica hydroxyl band.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Richterite plus a trace of mica (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	54.87	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.39	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	1.97	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	2.40	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.20	wt%	NROFF: MnO
COMPOSITION:	MgO:	22.92	wt%	NROFF: MgO
COMPOSITION:	CaO:	9.09	wt%	NROFF: CaO
COMPOSITION:	Na2O:	4.32	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	1.48	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	97.65	wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analysis by L. Walter shows sample to be homogeneous within and between grains, with a composition tyical of richterite. Average of 9 analyses.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

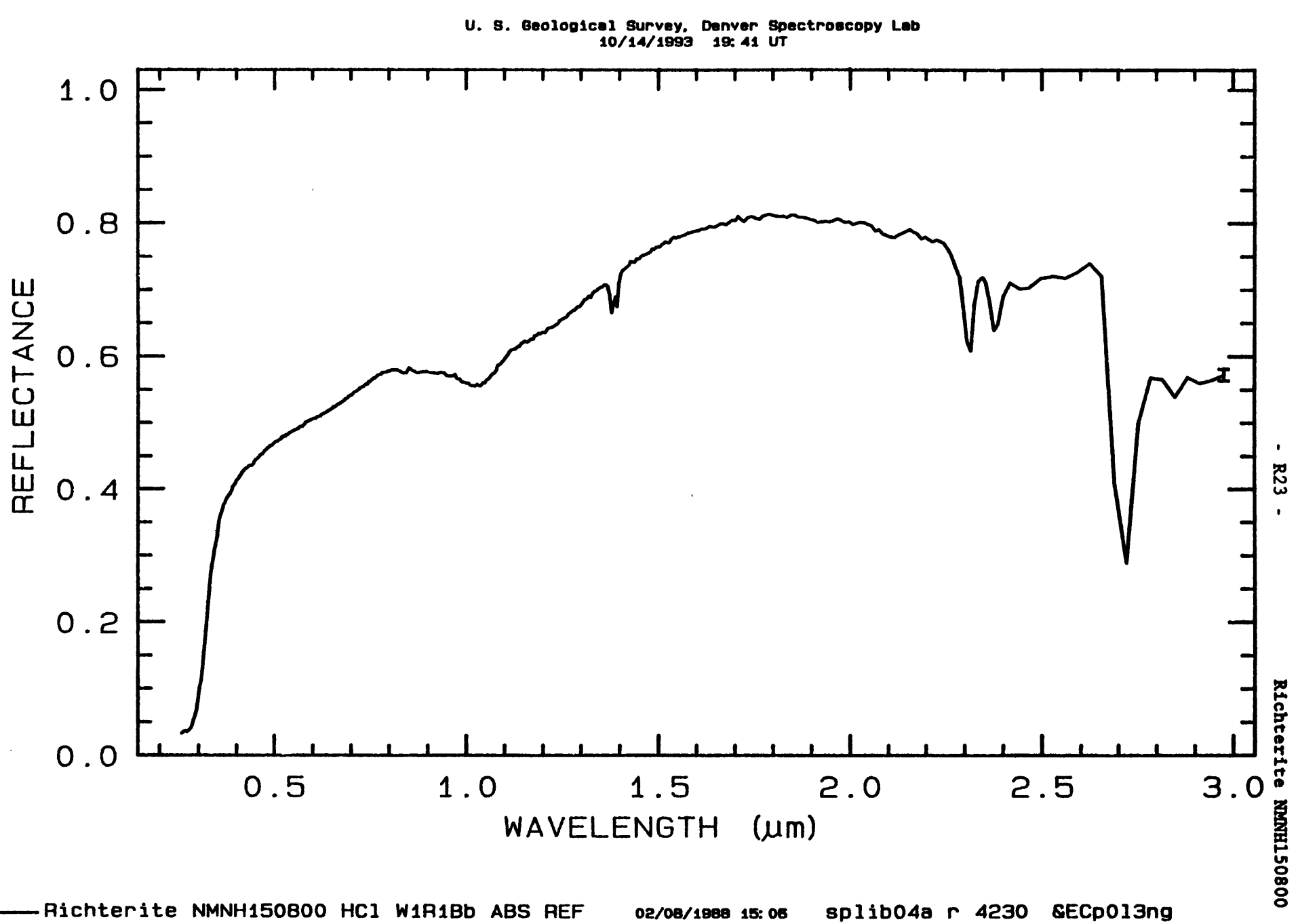
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4230	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R23 -
Richterite NMNH150800
Richterite NMNH150800 HCl W1R1Bb ABS REF 02/08/1988 15:06 splib04a r 4230 &ECp013ng

TITLE: Riebeckite NMHN122689 Amphibole DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMHN122689

MINERAL_TYPE: Inosilicate

MINERAL: Riebeckite (Amphibole group)

FORMULA: Na2Fe(+2)3Fe(+3)2Si8O22(OH)2

FORMULA_NROFF: $Na_2Fe_3^{+2}Fe_2^{+3}Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Hurricane Mountain, Conway, New Hampshire

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Individual grains of riebeckite appear very pure under the microscope (<1% impurities).

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure reibeckite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	50.32	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.53	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	0.86	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	35.27	wt%	NROFF: FeO
COMPOSITION:	MnO:	1.12	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.07	wt%	NROFF: MgO
COMPOSITION:	CaO:	0.08	wt%	NROFF: CaO
COMPOSITION:	Na2O:	7.95	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	1.41	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	97.61	wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analysis of hand-picked smaple shows it to be homogeneous within and between grains, with typical riebeckite composition. Average of 10 samples.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

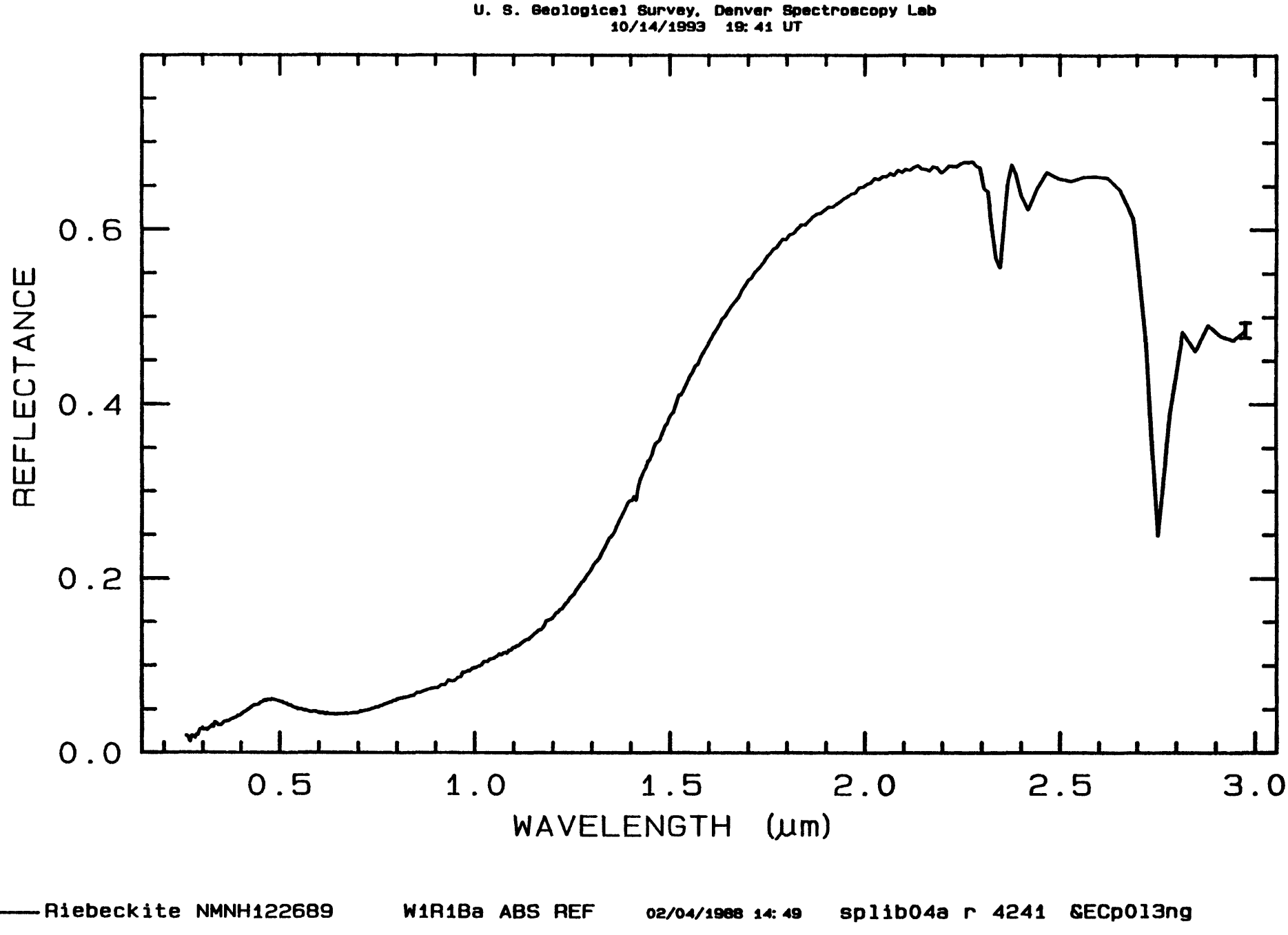
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4241	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R26 -
Riebeckite NMNH122689
Riebeckite NMNH122689 W1R1Ba ABS REF 02/04/1988 14:49 splib04a r 4241 &ECp013ng

TITLE: Riebeckite HS326 Amphibole DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS326

MINERAL_TYPE: Inosilicate

MINERAL: Riebeckite (Amphibole group)

FORMULA: Na2Fe(+2)3Fe(+3)2Si8O22(OH)2

FORMULA_NROFF: $Na_2Fe_3^{+2}Fe_2^{+3}Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"I-17 Riebeckite 326B--Colorado. $Na_2Fe_3^{2+}Fe_2^{3+}$- $(Si_8O_{22})(OH, F)_2$: Riebeckite occurs in primary igneous rocks of acidic and intermediate composition. Ferric and ferrous iron produce the bands near 0.7μ and 0.975μ, and OH features appear at 1.4 and 2.35μ (again, there is a carbonate contribution to the latter band from slight calcite contamination). The small feature near 2.2μ is a hydroxyl-lattice combination band."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

TITLE: Ammonio-Smectite GDS86 (Sy) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS86

MINERAL_TYPE: Phyllosilicate

MINERAL: Ammonium_Smectite (Synthetic)

FORMULA: (NH4)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $(NH_4)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Dennis Krohn, USGS Reston

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

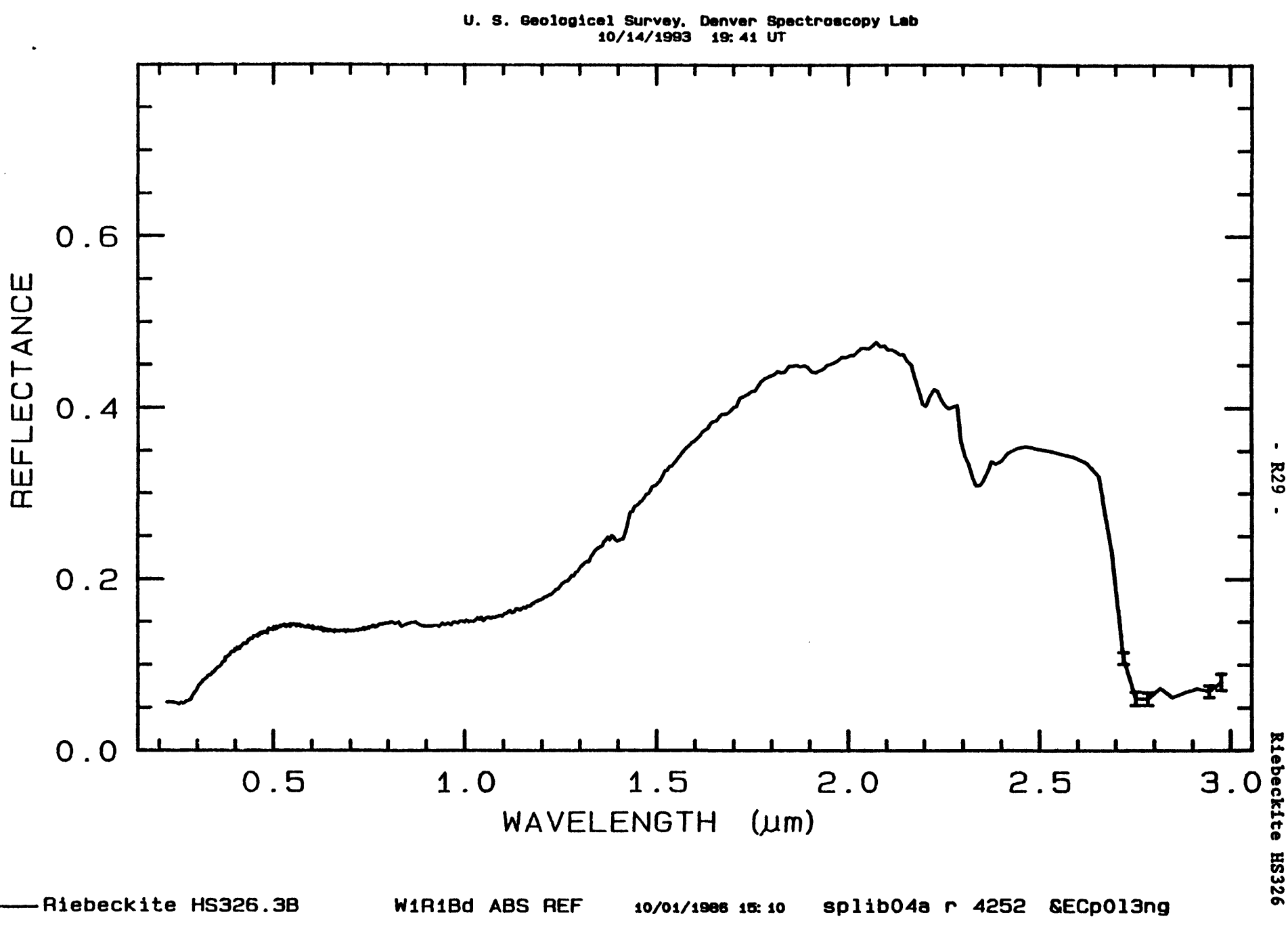
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 311	0.2-3.0μm	200	g.s.=

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4252	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Riebeckite HS326.3B W1R1Bd ABS REF 10/01/1986 15:10 splib04a r 4252 &ECp013ng

TITLE: Rivadavite NMNH170164 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH170164

MINERAL_TYPE: Hydrous Borate

MINERAL: Rivadavite

FORMULA: Na6MgB24O40*22H2O

FORMULA_NROFF: $Na_6MgB_{24}O_{40}\bullet 22H_2O$

COLLECTION_LOCALITY: Argentina

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1993, Mapping playa evaporite minerals with AVIRIS data: A first Report from Death Valley, California: Remote Sensing of Environment, vol 44, p 337-356.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure rivadavite.

Crowley, J.K., 1993, Mapping playa evaporite minerals with AVIRIS data: A first Report from Death Valley, California: Remote Sensing of Environment, vol 44, p 337-356.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

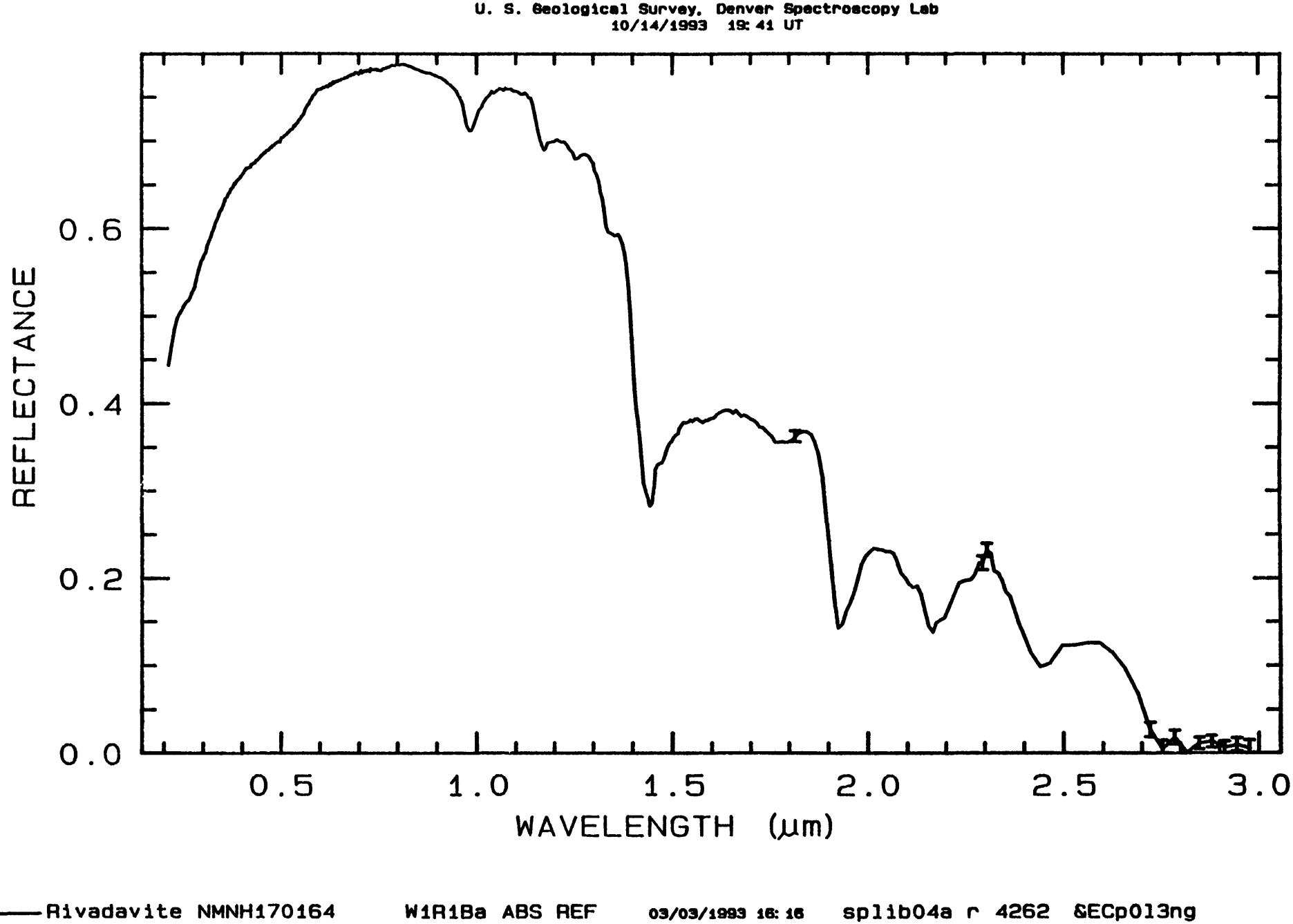
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 4262	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R32 -
Rivadavite NMNH170164
Rivadavite NMNH170164 W1R1Ba ABS REF 03/03/1993 16:16 splib04a r 4262 &ECp013ng

TITLE: Roscoelite EN124 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: EN124

MINERAL_TYPE: Phyllosilicate

MINERAL: Roscoelite (vanadium mica) (Mica group)

FORMULA: KV2(AlSi3O10)(OH)2

FORMULA_NROFF: $KV_2(AlSi_3O_{10})(OH)_2$

COLLECTION_LOCALITY: Carpenter Mine, along Bear Creek in SW Colorado, Sec 33 T43N R10W, Long 107 58' 45" Lat 37 56' 40" 600 feet from the portal of the Carpenter Mine

ORIGINAL_DONOR: George Breit

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Less than 2 μm clay seperate prepared from a sample of V-U ore from the Late Jurassic Entrada Sandstone.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Illite and illite-smectite with < 15% smectite interlayers. No other minerals were detected (personal communication from G. Breit, 1990)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: Unknown # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	TiO2:	0.12 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	27.2 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	<0.02 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3:	10.0 wt%	NROFF:	V_2O_3
COMPOSITION:	Fe2O3:	*0.66 wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	0.01 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.64 wt%	NROFF:	MgO
COMPOSITION:	Na2O:	0.04 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	9.07 wt%	NROFF:	K_2O
COMPOSITION:	----------			
COMPOSITION:	Total:	47.76 wt%		

COMPOSITION_TRACE: Ca < 20 ppm

COMPOSITION_DISCUSSION:

* All Fe reported given as total Fe wt% (includes both FeO and Fe_2O_3.

Done by George Breit.

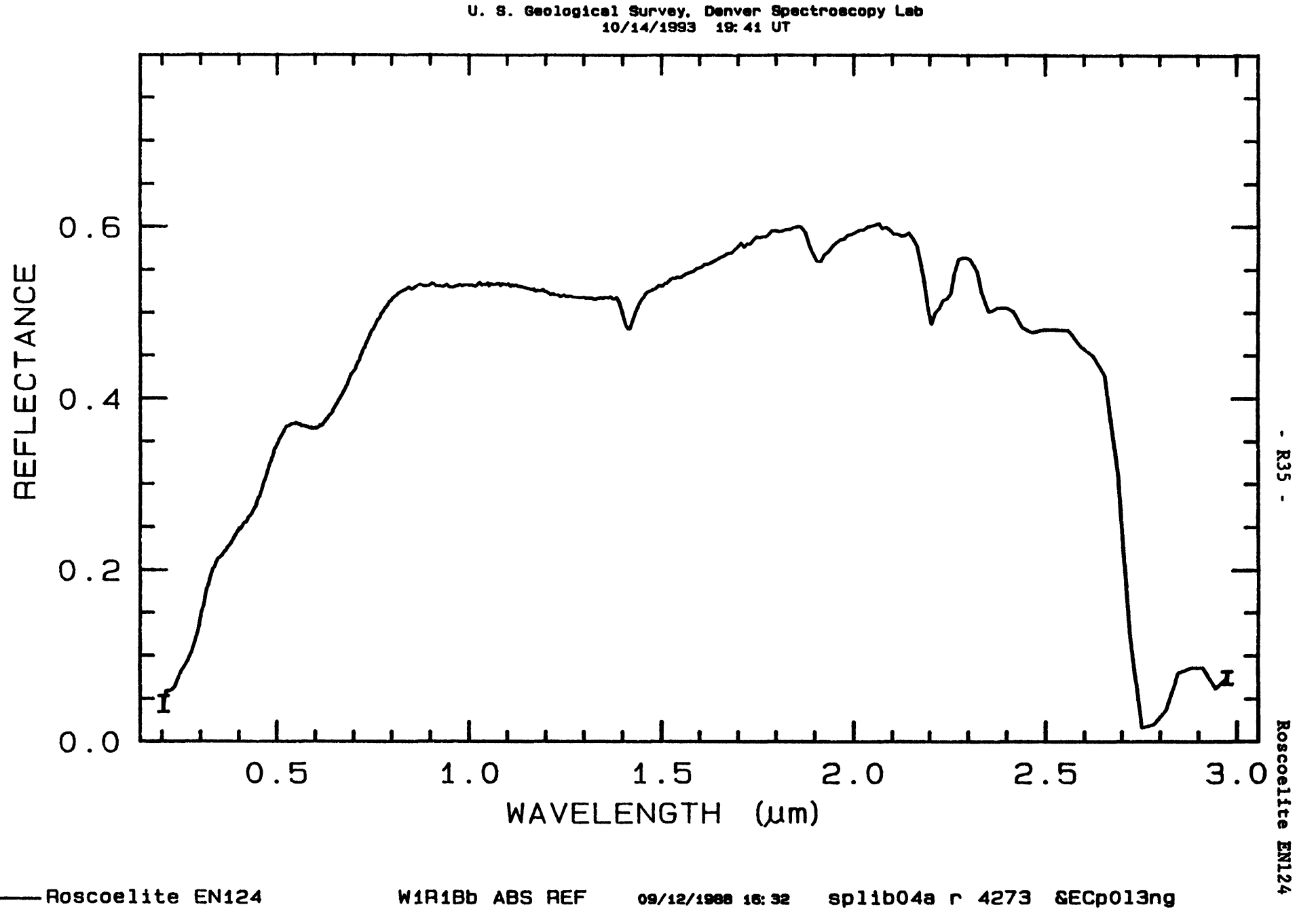
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4273	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R35 -
Roscoelite EN124
Roscoelite EN124
W1R1Bb ABS REF
09/12/1988 16:32
splib04a r 4273 &ECp013ng

TITLE: Rutile HS126 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS126

MINERAL_TYPE: Oxide

MINERAL: Rutile

FORMULA: TiO2

FORMULA_NROFF: TiO_2

COLLECTION_LOCALITY: Oaxaca, Mexico

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"0-15A. Rutile. Oaxaca, Mex. (126B). Rutile, TiO_2, is not a major rock-forming mineral, but is the commonest form of TiO_2 in nature, and is very widely distributed as minute grains in many igneous and metamorphic rocks. Because of its resistance to weathering, it is also common in beach and river sands. TiO_2 has a $3d^0$ configuration, so that if a 3d band exists, it will normally be empty. It is possible to supply electrons to the 3d band by excitation from impurities, imperfections, or from the filled 2p band. The intense absorption in the blue is ascribed by Bevan et al. (1958) as an exciton band arising from the transfer of an electron from an oxygen to a titanium. This sample contains 0.3% Fe, which does not appear to be located in a crystal field capable of producing the typical ferrous or ferric iron features near 1.0μ or 0.8μ. The steep fall-off in reflectivity toward the blue, which results in the reddish brown color common to rutile, is thus probably caused both by extrinsic absorption in the ferric ion and a sloping of the normal absorption edge in TiO_2 because of defects and edge effects. Increasing amounts of ferric iron, niobium, and tantalum, which also enter the TiO_2 lattice, result in deeper and deeper color, some varieties being almost opaque. The weak but sharp feature near 2.3μ must be due to some hydroxyl combination tone in this sample of rutile. It is an usual band because no corresponding band near 1.4μ is apparent, and because chemical analysis of this sample yielded no measurable water. We conclude that a hydroxylated impurity is present in very small amount, and perhaps not at all in the portion of the sample analyzed."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

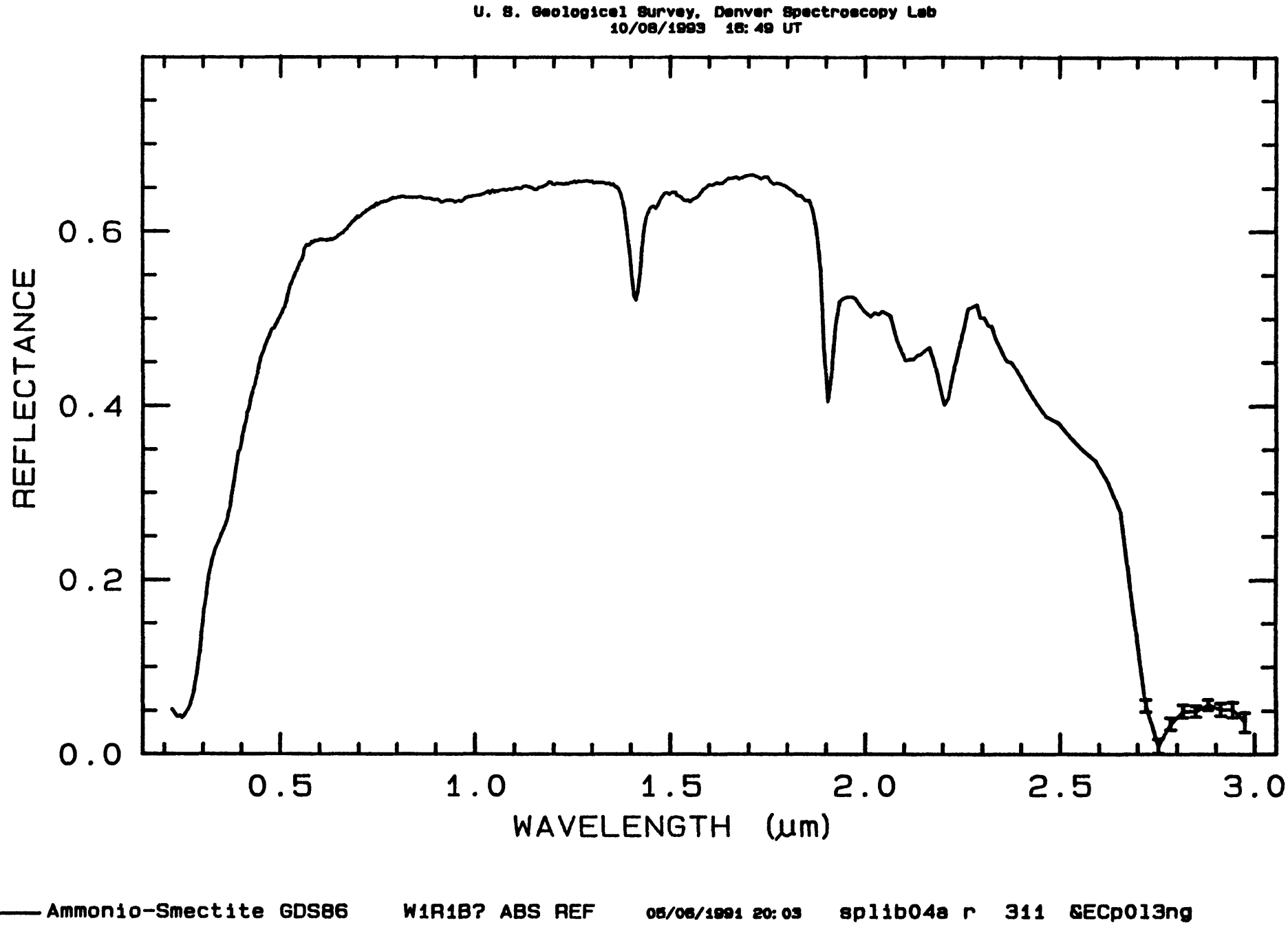
END_COMPOSITION_DISCUSSION.

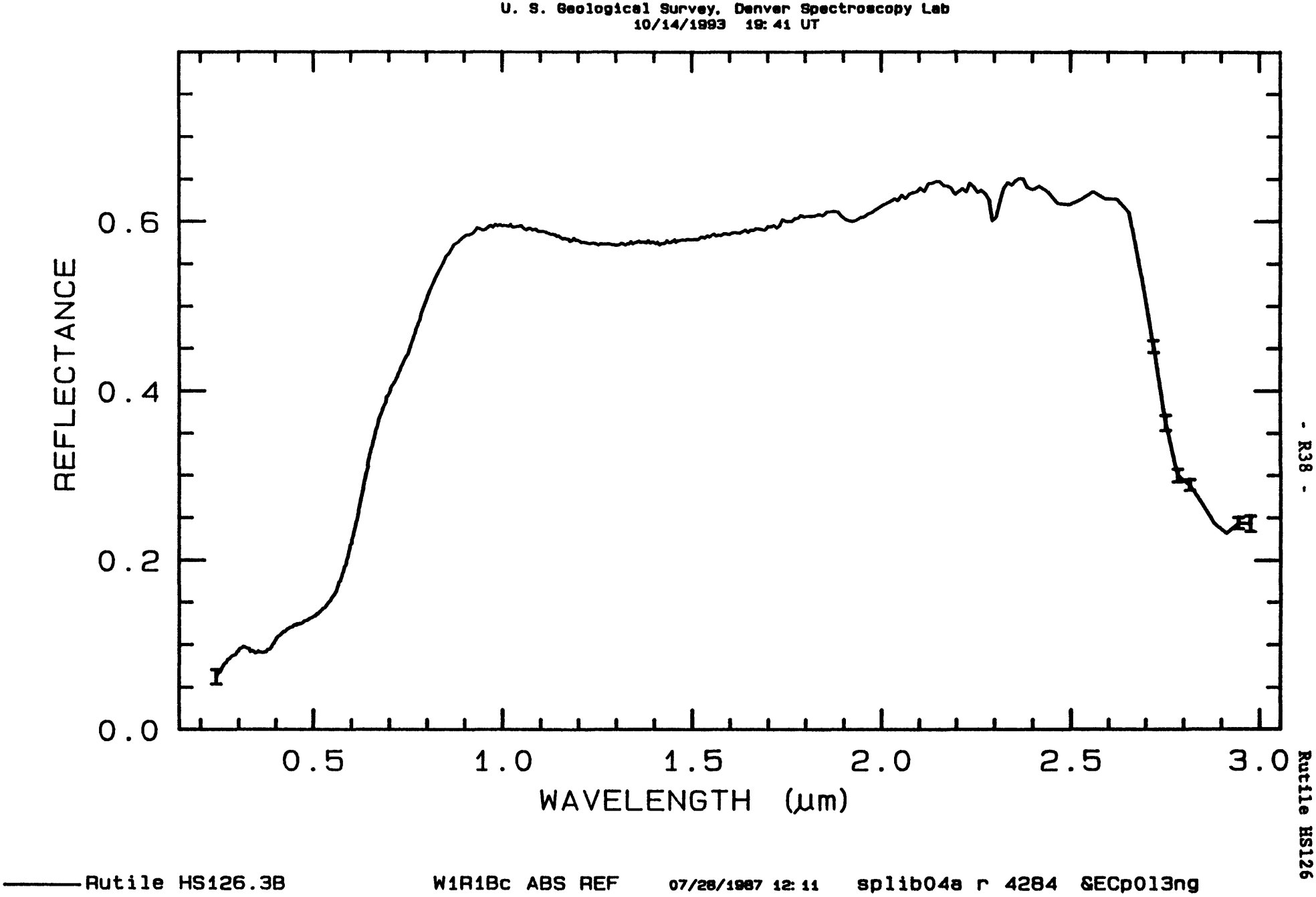
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4284	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Ammonio-Smectite GDS86
Ammonio-Smectite GDS86 W1R1B? ABS REF 05/06/1991 20:03 splib04a r 311 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- R38 -
Rutile HS126
Rutile HS126.3B
W1R1Bc ABS REF
07/28/1987 12:11
splib04a r 4284 &ECp013ng

TITLE: Rutile HS137 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS137

MINERAL_TYPE: Oxide

MINERAL: Rutile

FORMULA: TiO2

FORMULA_NROFF: TiO_2

COLLECTION_LOCALITY: Graves Mountain, Georgia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"O-15B. Rutile. Graves Mt., Ga. (137B). This sample was ground from a single crystal of rutile, which was, unfortunately, coated on the surface and within microfractures with limonite. We were unable to completely remove this by acid leaching. The effect of the ferric ion is seen even more strongly here than in the previous sample. In the near-infrared, the ferric ion band near 0.9μ is well displayed in the finest size fraction and the general sloping off to the blue due to extrinsic absorption and tailing of the TiO_2 absorption edge is even more evident. Water bands in the limonite are weakly displayed near 1.4, 1.9 and near 2.3μ. The ferric ion bands may be due in part to ferric ion in the rutile lattice, and in part to ferric ion in the limonite coating."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

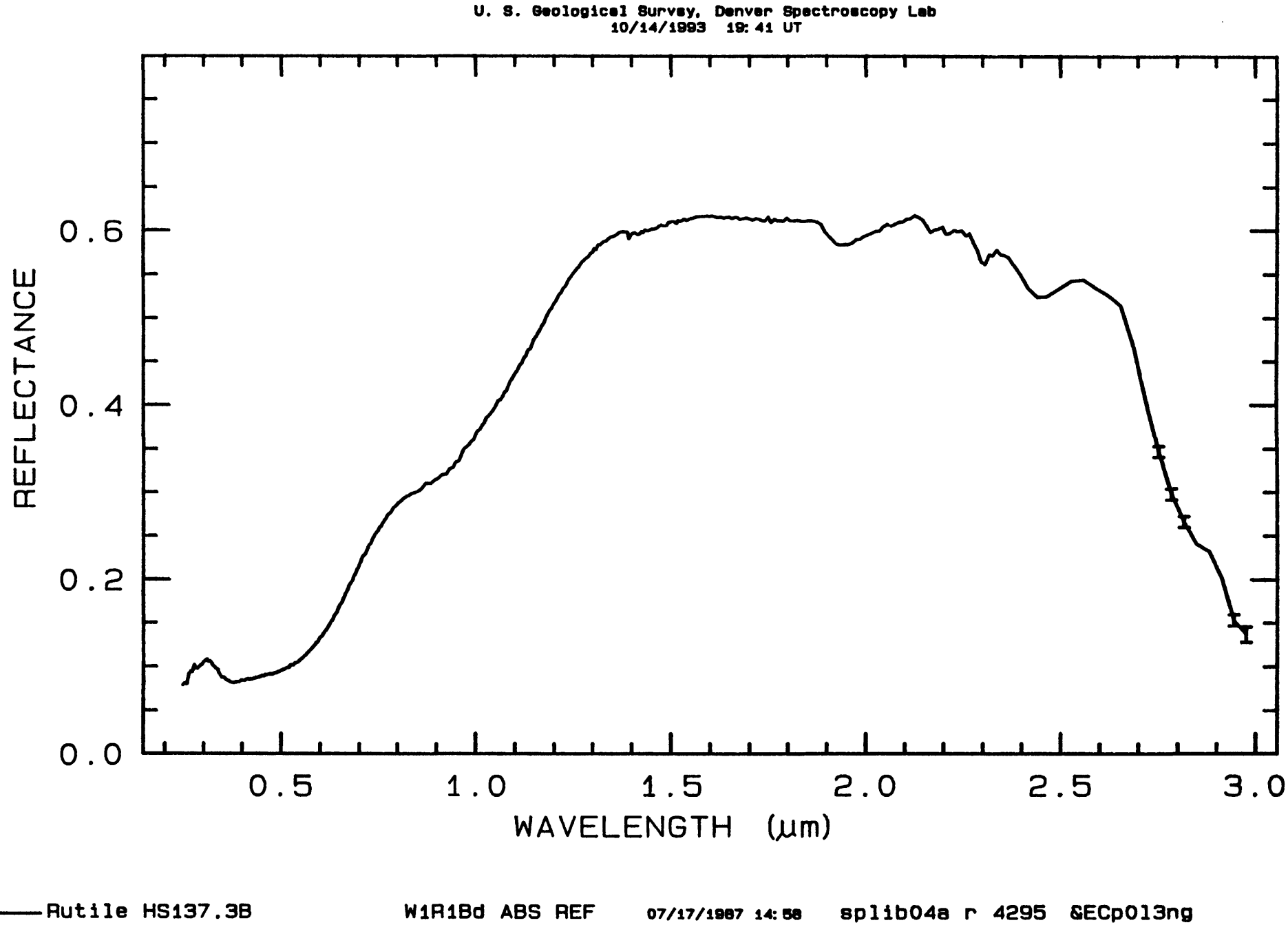
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4295	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Rutile HS137
Rutile HS137.3B W1R1Bd ABS REF 07/17/1987 14:58 splib04a r 4295 &ECp013ng

TITLE: Samarium_Oxide GDS36 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS36

MINERAL_TYPE: Oxide

MINERAL: Samarium_Oxide

FORMULA: Sm2O3

FORMULA_NROFF: Sm_2O_3

COLLECTION_LOCALITY: REE Standard

ORIGINAL_DONOR: None

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spex standard 85.2% Sm Lot No. 07791

For a detailed discussion see: Rowan, Lawrence C., Kingston, Marguerite J., Crowley, James K., Spectral Reflectance of Carbonatites and Related Alkalic Igneous Rocks: Selected Samples from Four North American Localities, Economic Geology, Vol 81, 1986, pp. 857-871.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

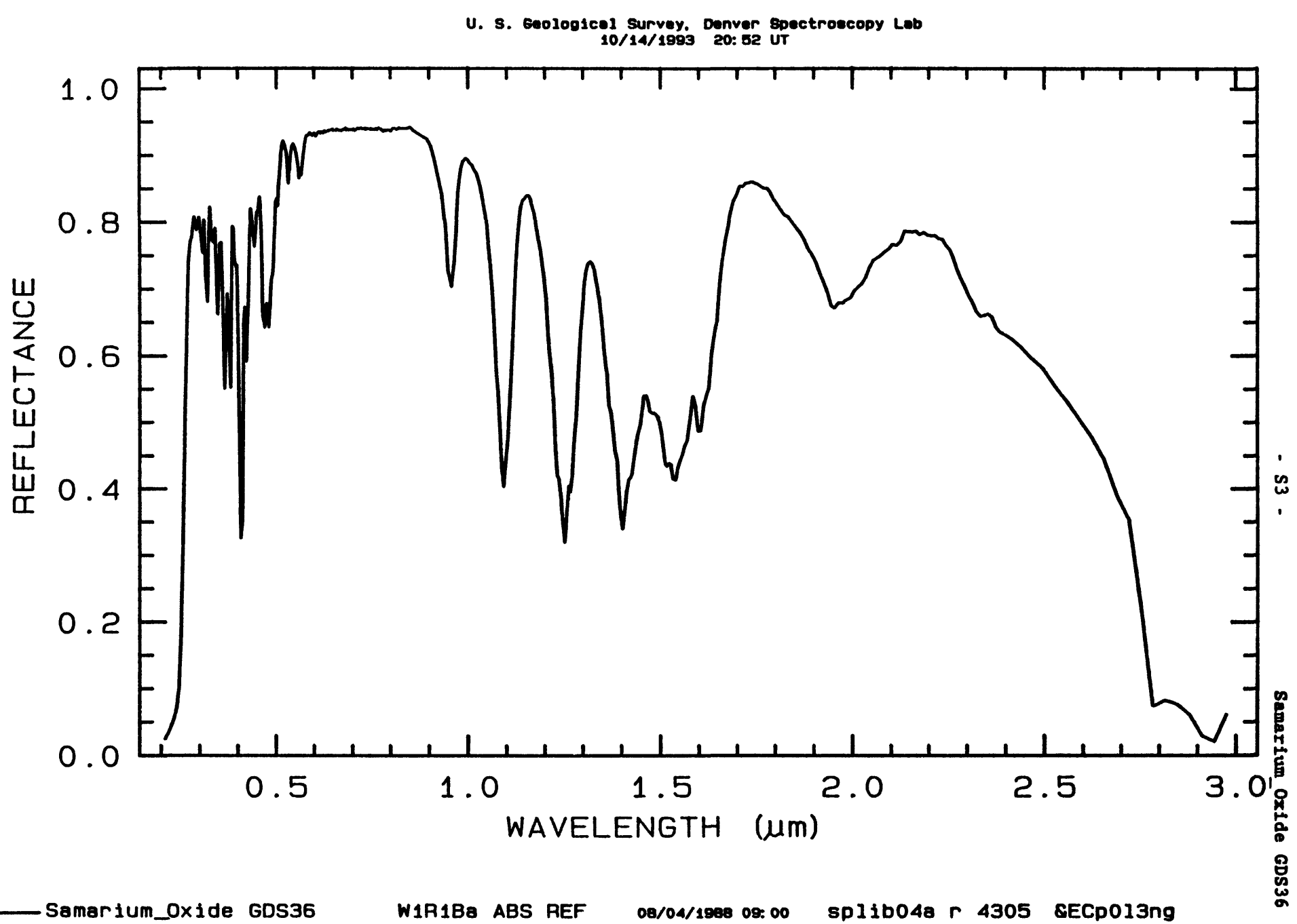
No observed impurities. G. Swayze.

avg gr sz = 4 μm

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4305	0.2-3.0μm	200	g.s.= 4 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Samarium_Oxide GDS36 W1R1Ba ABS REF 08/04/1988 09:00 splib04a r 4305 &ECp013ng
Samarium Oxide GDS36

TITLE: Sanidine GDS19 Feldspar DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS19

MINERAL_TYPE: Tectosilicate

MINERAL: Sanidine (Feldspar group)

FORMULA: (K,Na)AlSi3O8

FORMULA_NROFF: $(K,Na)AlSi_3O_8$

COLLECTION_LOCALITY: Volkesfeld bei kempenick, Eifel, Rheinland, Germany

ORIGINAL_DONOR: Dave Stewart

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Results of petrographic examination: Hand sample is large (56.16g) fragment of what appears to be a badly fractured single crystal. Small fragments are transparent, but "smoky", Shows no significant contamination under the microscope."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure sanidine. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	64.53	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.03	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	18.76	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	0.17	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.04	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.04	wt%	NROFF: MgO
COMPOSITION:	CaO:	0.02	wt%	NROFF: CaO
COMPOSITION:	Na2O:	1.30	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	13.96	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	98.86	wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis showed sample to be homogeneous within and between grains, and to be of typical sanidine composition except for the unusually low albite content. Average of 10 samples.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

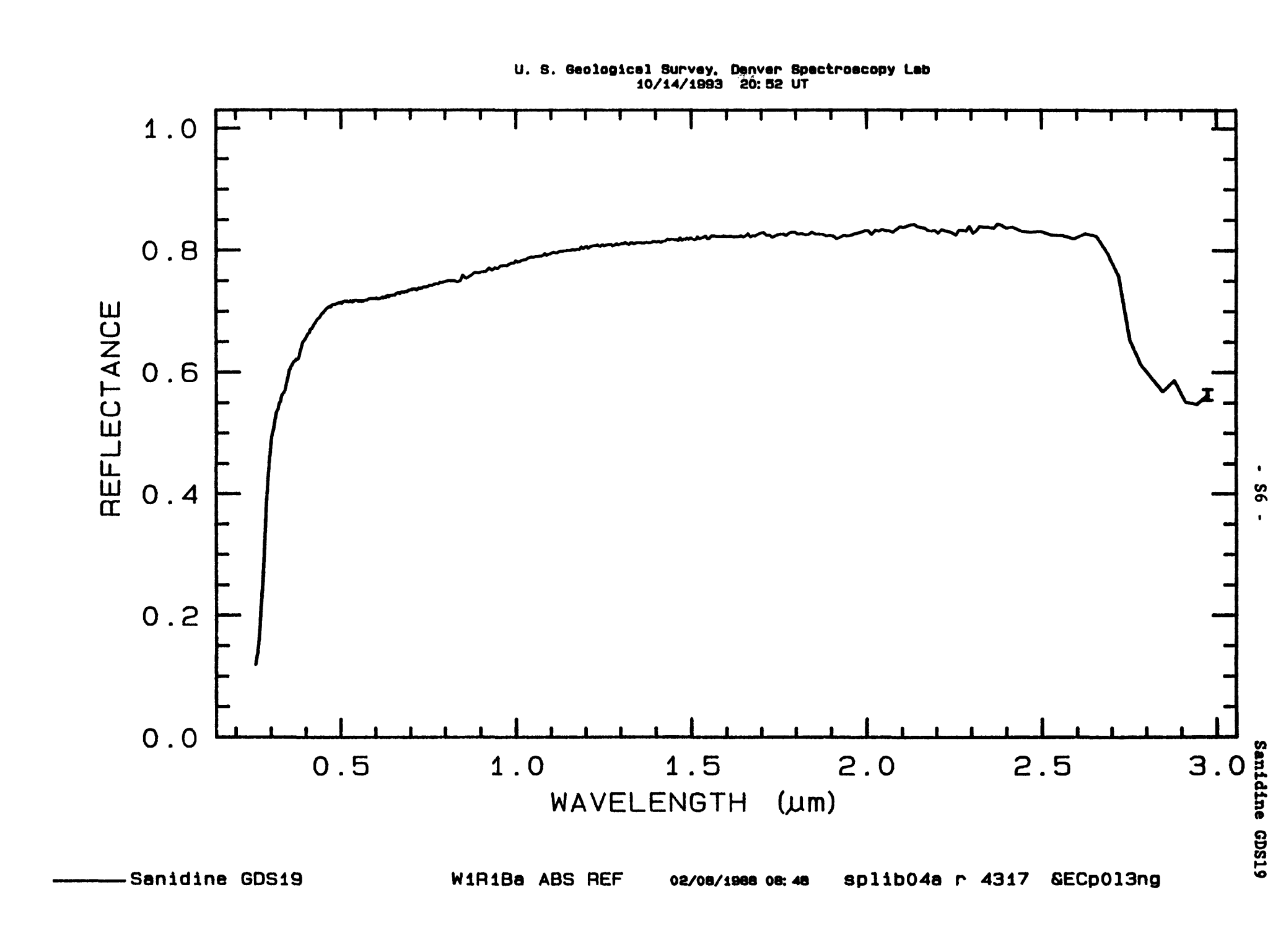
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4317	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Sanidine GDS19
W1R1Ba ABS REF
02/08/1988 08:48
splib04a r 4317 &ECp013ng
Sanidine GDS19

TITLE: Amphibole NMNH78662 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH78662

MINERAL_TYPE: Inosilicate

MINERAL: Amphibole (specific unknown: either Na-Edenite or Mg-Hastingsite)

FORMULA: A0-1B2Y8Z8O22(OH,F,Cl)2 (A=Ca,Na,K; B=Ca,Fe+2,Li,Mg,Mn+2,Na; Y=Al,Cr,Fe+2,Fe

FORMULA_NROFF: $A_{0-1}B_2Y_8Z_8O_{22}(OH,F,Cl)_2$

COLLECTION_LOCALITY: Canada

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample is 0-74μm sieve interval, pale green in color.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by N. Vergo indicates, yes it is an amphibole and it looks pure. She suggests either Na-Edenite or Mg-Hastingsite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

av gr sz = 20μm Range = 1 - 110μm

Prismatic grains, inclined extinction, length slow, biaxial, amphibole cleavage. All this is consistent with this sample being an amphibole. Suggest microprobe analysis to determine composition. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

TITLE: Sanidine NMNH103200 Feldspar DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH103200

MINERAL_TYPE: Tectosilicate

MINERAL: Sanidine (Feldspar group)

FORMULA: (K,Na)AlSi3O8

FORMULA_NROFF: $(K,Na)AlSi_3O_8$

COLLECTION_LOCALITY: Higasinuiro-gun, Taiji, Wakayama, Japan

ORIGINAL_DONOR: Smithsonian Institution

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Result of petrographic examination: Many small (0.5cm) euhedral crystals totaling 6.49 g. almost all have some adhering clay/limonite, to be removed by brushing or ultrasonic cleaning. Under the microscope, a very, very few acicular inclusions (rutile?) can be seen. Otherwise, very pure."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sanidine plus a moderate amount of albite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	67.43	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.03	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	18.65	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	0.59	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.02	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.03	wt%	NROFF: MgO
COMPOSITION:	CaO:	0.02	wt%	NROFF: CaO
COMPOSITION:	Na2O:	5.38	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	7.38	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.97	wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

"Microprobe analysis shows homogeneity within and between grains. This is typical sanidine with about as much soda as potash, but the albite present is cryptoperthic. Average of 10 analyses."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

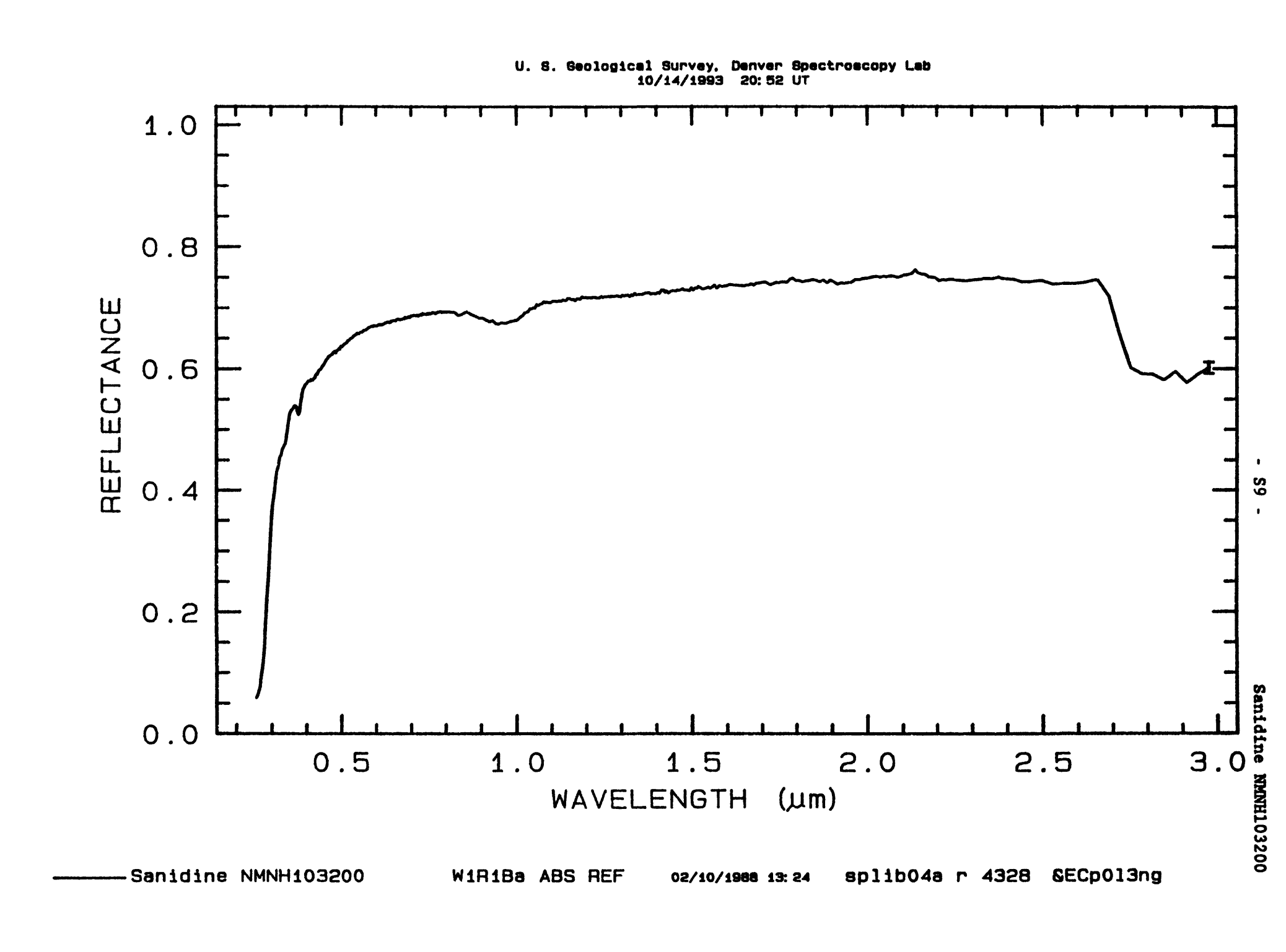
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4328	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Sanidine NMNH103200
W1R1Ba ABS REF
02/10/1988 13:24
splib04a r 4328 GECp013ng
Sanidine NMNH103200

TITLE: Saponite SapCa-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Ca-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Saponite (Montmorillonite group)

FORMULA: (1/2Ca,Na)0.33(Mg,Fe+2)3(Si,Al)4O10(OH)2*4H2O

FORMULA_NROFF: $(½Ca,Na)_{0.33}(Mg,Fe^{+2})_3(Si,Al)_4O_{10}(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Ballarat, California

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Less than 2μ size fraction is saponite with a trace of unknown material with x-ray peaks at 8.6, 3.26 and 3.14 angstroms. Coarser fraction contains quartz.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	51.9	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.54	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	3.66	wt%	NROFF: Al_2O_3
COMPOSITION:	Fe2O3:	0.88	wt%	NROFF: Fe_2O_3
COMPOSITION:	MnO:	<0.02	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.88	wt%	NROFF: MgO
COMPOSITION:	CaO:	4.68	wt%	NROFF: CaO
COMPOSITION:	Na2O:	1.94	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.41	wt%	NROFF: K_2O
COMPOSITION:	LOI:	11.5	wt%	NROFF: LOI
COMPOSITION:	---	---		
COMPOSITION:	Total:		wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysis done by USGS OMR Branch of Analytical Chemistry, Lakewood, Colorado: J. Taggart, Ardith J. Bartel, K. Stewart

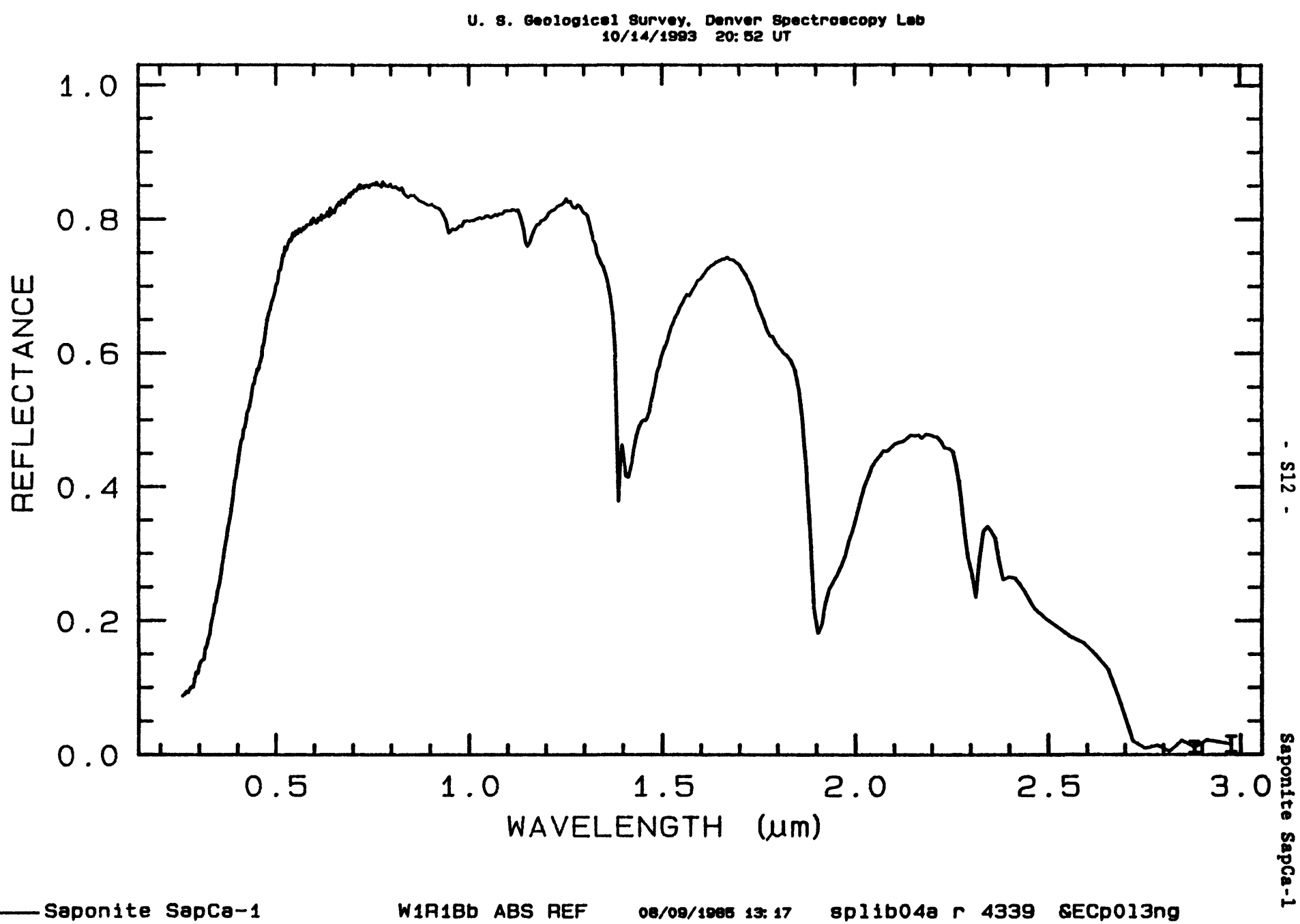
END_COMPOSITION_DISCUSSION.

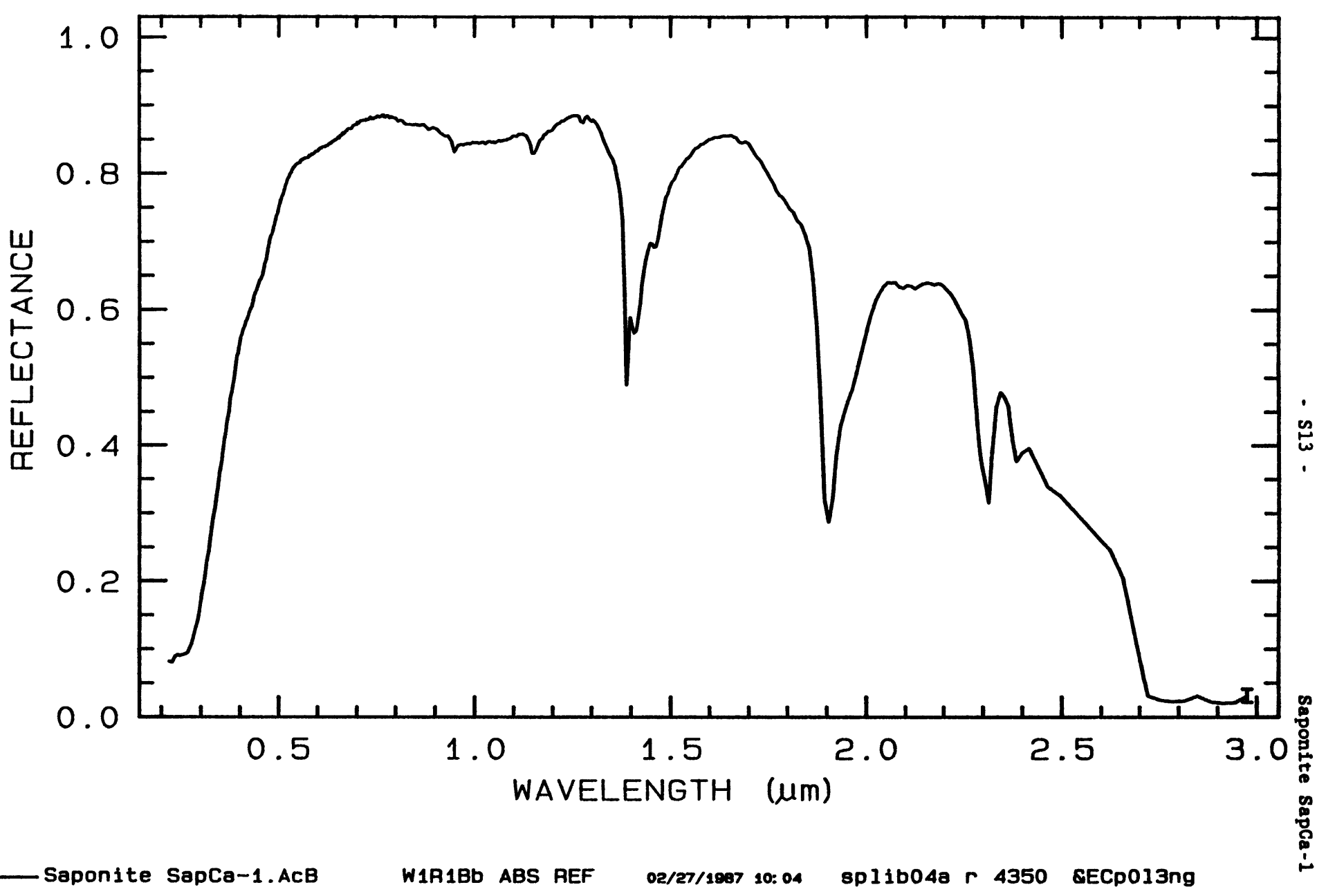
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4339	0.2-3.0μm	200	g.s.=
LIB_SPECTRA:	splib04a r 4350	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- S12 -
Saponite SapCa-1
Saponite SapCa-1 W1R1Bb ABS REF 08/09/1985 13:17 splib04a r 4339 &ECp013ng



Saponite SapCa-1

TITLE: Sauconite GDS135 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS135

MINERAL_TYPE: Phyllosilicate

MINERAL: Sauconite (Montmorillonite group)

FORMULA: Na0.33Zn3(Si,Al)4O10(OH)2*4H2O

FORMULA_NROFF: $Na_{0.33}Zn_3(Si,Al)_4O_{10}(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Coon Hollow Mine, Zinc, Boone Co. Arkansa

ORIGINAL_DONOR: Dave Sherman

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

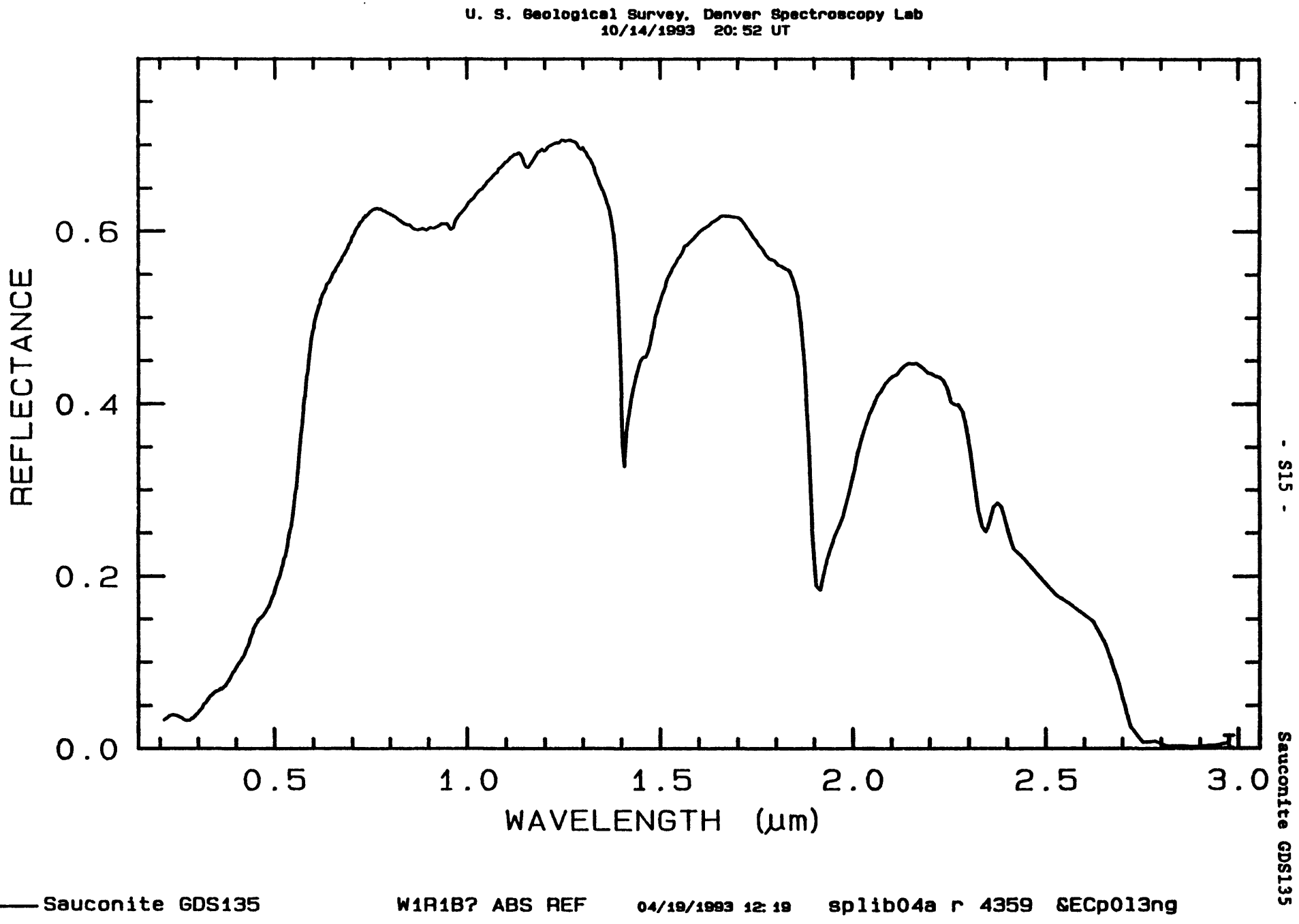
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4359	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- S15 -
Sauconite GDS135
Sauconite GDS135 W1R1B? ABS REF 04/19/1993 12:19 splib04a r 4359 &ECp013ng

TITLE: Scolecite GDS7 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS7

MINERAL_TYPE: Tectosilicate

MINERAL: Scolecite (Zeolite group)

FORMULA: CaAl2Si3O10*3H2O

FORMULA_NROFF: $CaAl_2Si_3O_{10} \bullet 3H_2O$

COLLECTION_LOCALITY: Narayngaon, India

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample appears white and to be spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Scolecite - major component, probably mixed with other natrolite-type zeolites. Other components in small amounts, possibly including gibbsite, akermanite.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

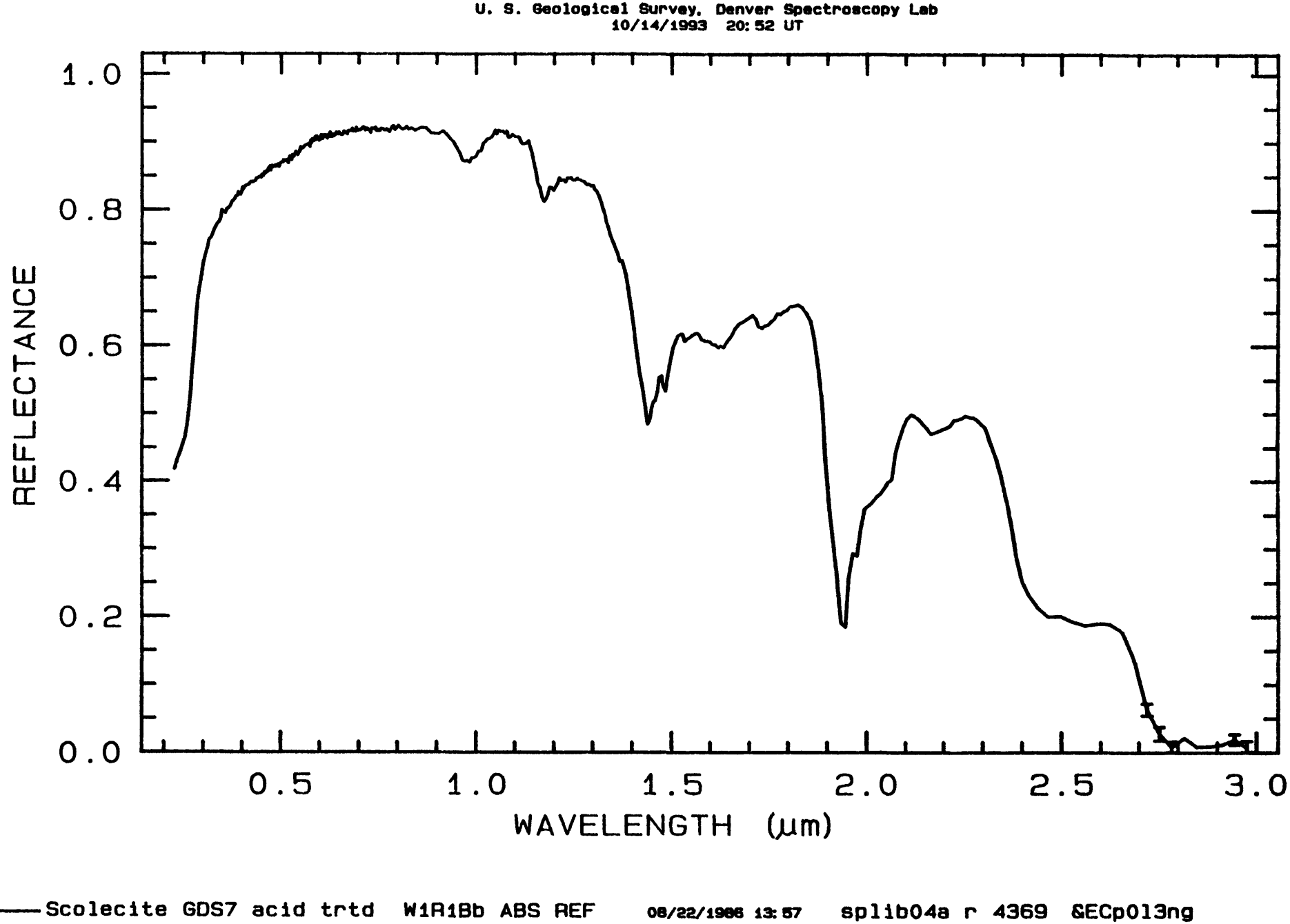
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4369	0.2-3.0μm	200	g.s.=

LIB_SPECTRA_HED: where			Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	322	0.2-3.0μm	200	g.s.= 20 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 517 -
Scolecite GDS7
Scolecite GDS7 acid trtd W1R1Bb ABS REF 08/22/1988 13:57 splib04a r 4369 &ECp013ng

TITLE: Sepiolite SepNev-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SepNev-1 (1-26-87)

MINERAL_TYPE: Phyllosilicate

MINERAL: Sepiolite (Meerschaum)

FORMULA: Mg4Si6O15(OH)2*H2O

FORMULA_NROFF: $Mg_4Si_6O_{15}(OH)_2 \bullet H_2O$

COLLECTION_LOCALITY: Two Crows, Nevada

ORIGINAL_DONOR: Source Clay Mineral Repository

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sepiolite is a hydrous magnesium silicate, claylike and a secondary mineral associated with serpentine.

Sample is white in color.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Spectrally pure: no dolomite dolomite affects the continuum only; confirmed by Na-acetate buffer purification. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	50.9	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	<0.02	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.45	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.08	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	<0.01	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	22.3	wt%	NROFF:	MgO
COMPOSITION:	CaO:	2.45	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	1.12	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.17	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	10.6	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	8.05	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	18.6	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	20.0	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	97.56	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	97.56	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysis by E. Brandt, J.H. Christie, J. Taggart, Ardith J. Bartel, K. Stewart

Exists but needs to be included.

Trace analysis exists.

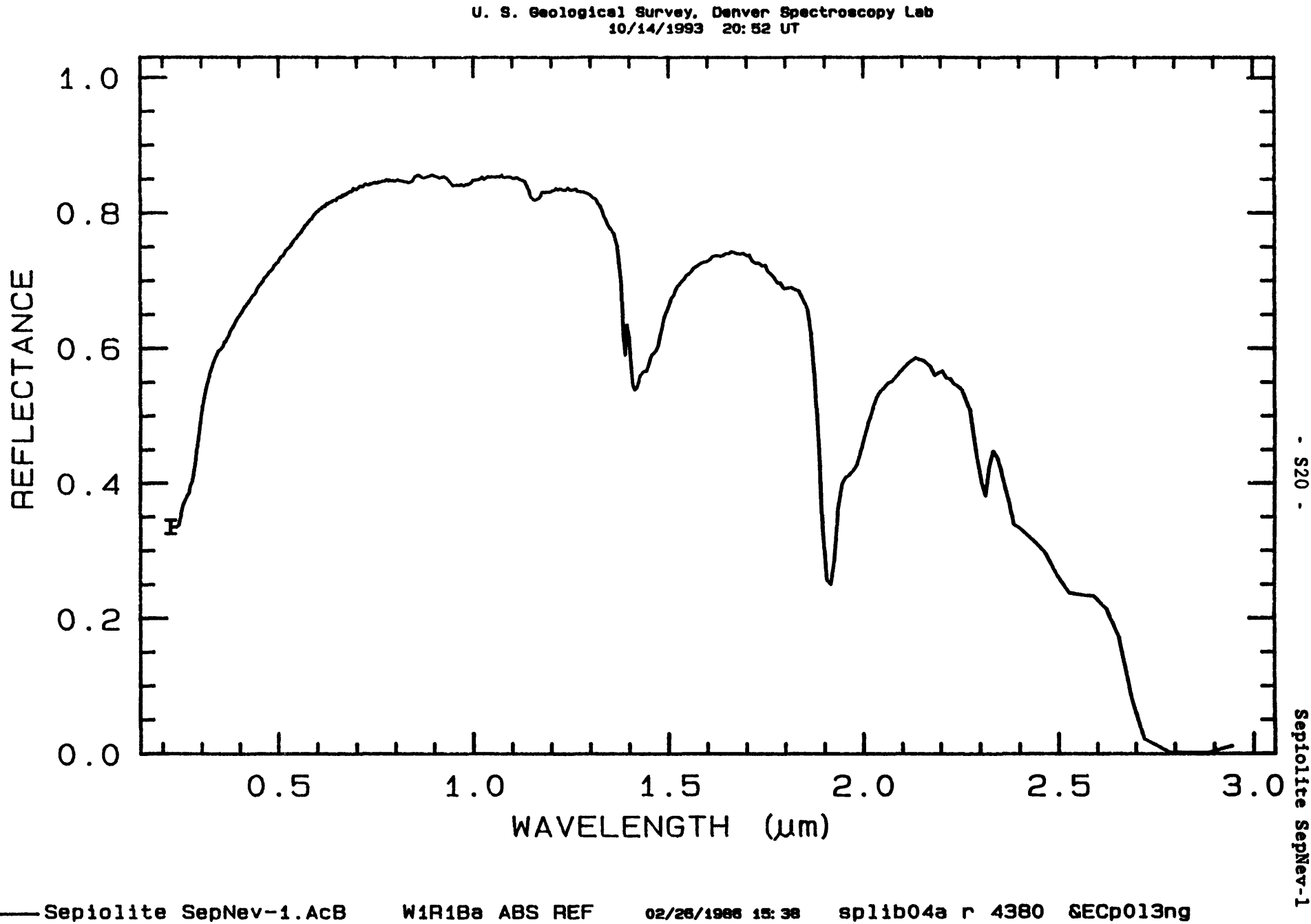
END_COMPOSITION_DISCUSSION.

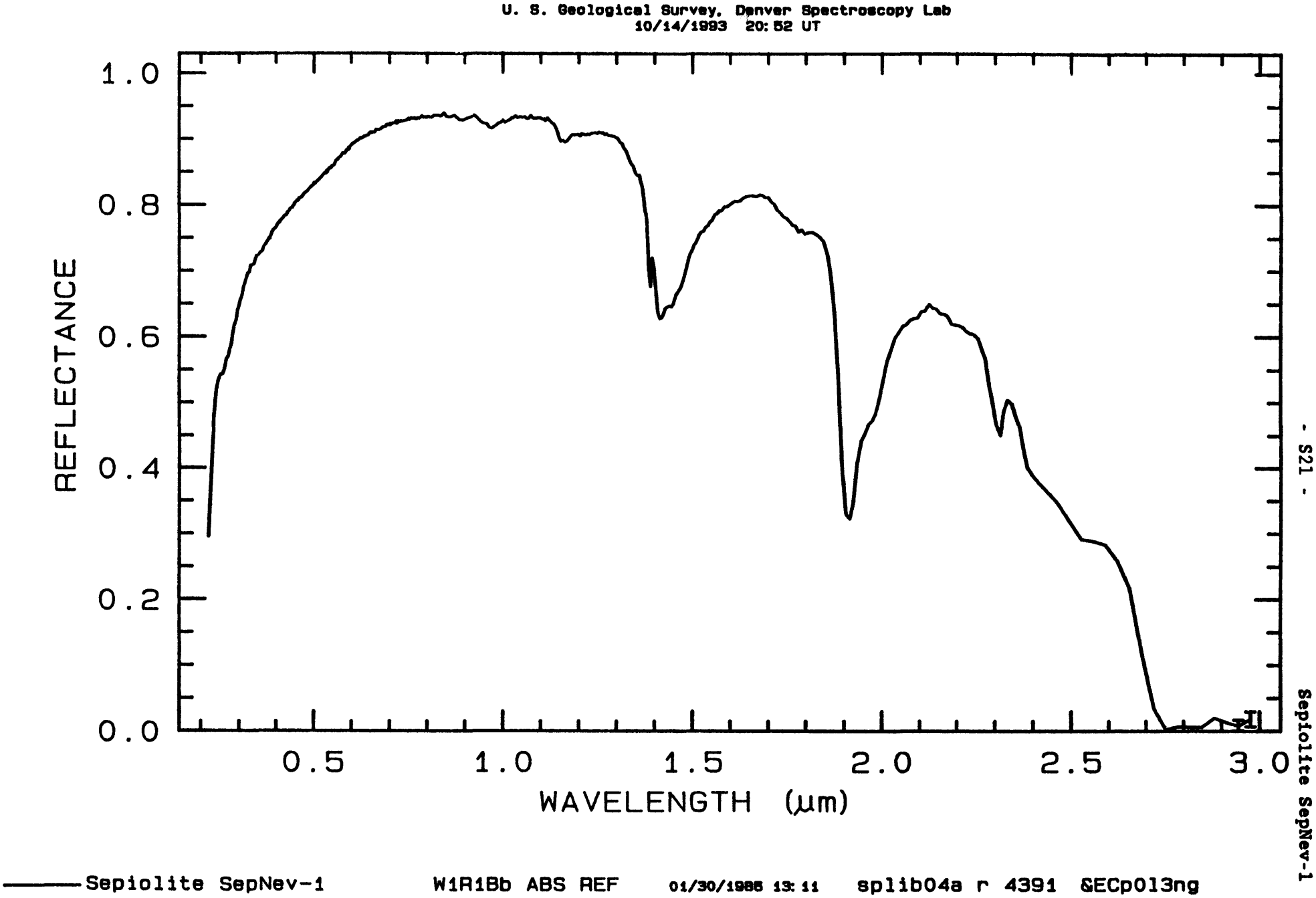
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4380	0.2-3.0μm	200	g.s.=
LIB_SPECTRA:	splib04a r 4391	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- S20 -
Sepiolite SepNev-1
Sepiolite SepNev-1.AcB W1R1Ba ABS REF 02/26/1986 15:38 splib04a r 4380 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 521 -
Sepiolite SepNev-1
Sepiolite SepNev-1 W1R1Bb ABS REF 01/30/1986 13:11 splib04a r 4391 &ECp013ng

TITLE: Sepiolite SepSp-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SepSp-1 (1-26-87)

MINERAL_TYPE: Phyllosilicate

MINERAL: Sepiolite (meerschaum)

FORMULA: Mg4Si6O15(OH)2*H2O

FORMULA_NROFF: $Mg_4Si_6O_{15}(OH)_2 \bullet H_2O$

COLLECTION_LOCALITY: Valdemoro, Spain

ORIGINAL_DONOR: Source Clay Mineral Repository

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sepiolite is a hydrous magnesium silicate, claylike and a secondary mineral associated with serpentine.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sepiolite plus calcite (Norma Vergo).

Spectrally pure: no calcite bands. Calcite affects the continuum only; confirmed by Na-acetate buffer purification (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	54.8	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.04	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	1.39	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.40	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.02	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	22.3	wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.07	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.20	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	11.4	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	7.36	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	18.8	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	18.1	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	98.72	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	98.72	wt%		

COMPOSITION_TRACE: Exists but needs to be included.

COMPOSITION_DISCUSSION:

Analysis by E. Brandt, J.H. Christie, J. Taggart, Ardith J. Bartel, K. Stewart

Induced Coupled Plasma trace analysis exists but is not included yet.

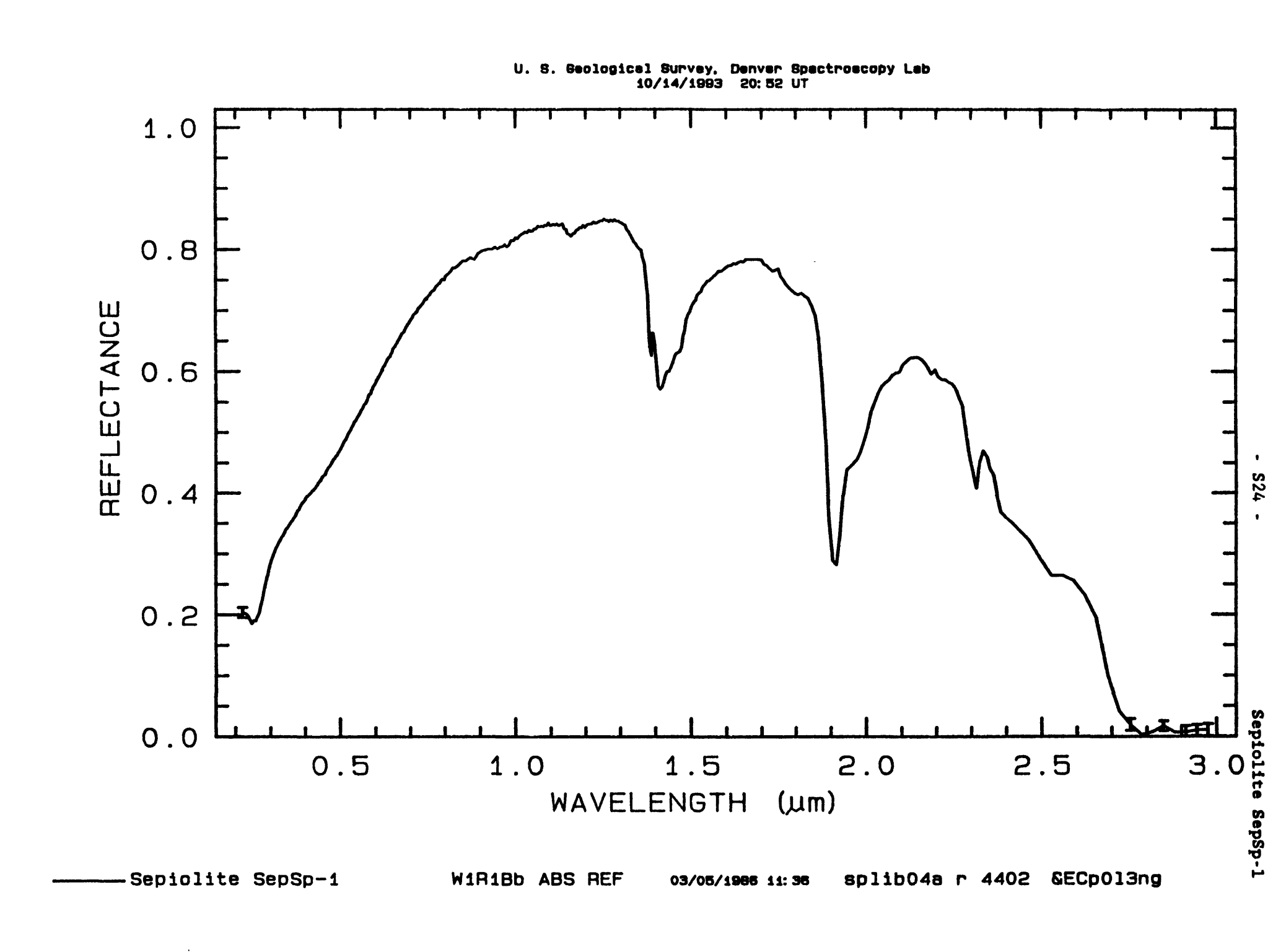
END_COMPOSITION_DISCUSSION.

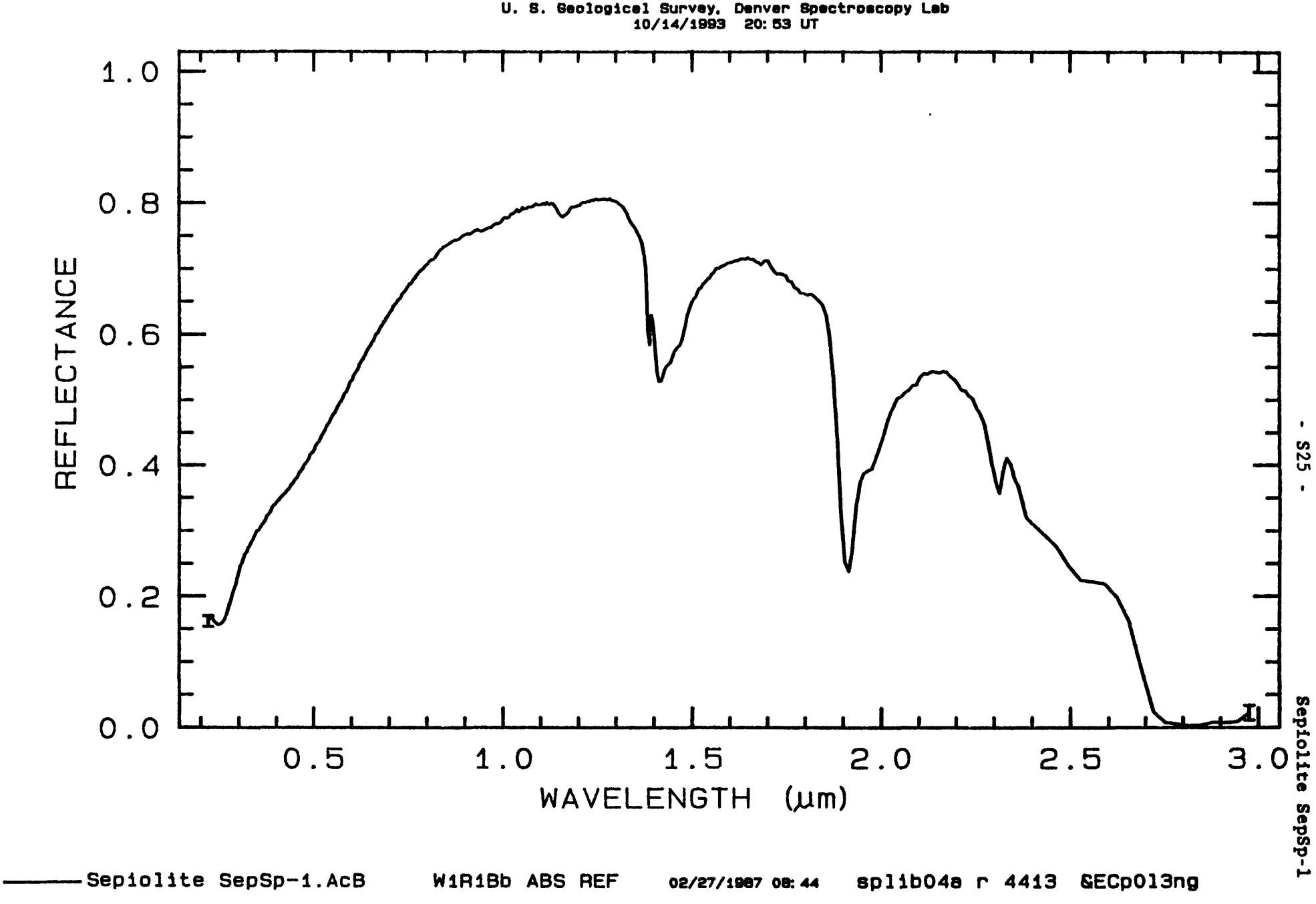
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4402	0.2-3.0μm	200	g.s.-
LIB_SPECTRA:	splib04a r 4413	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:52 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 524 -
Sepiolite SepSp-1
Sepiolite SepSp-1 W1R1Bb ABS REF 03/05/1986 11:36 splib04a r 4402 &ECp013ng



Sepiolite SepSp-1

TITLE: Serpentine HS318 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS318

MINERAL_TYPE: Phyllosilicate

MINERAL: Serpentine

FORMULA: Mg3Si2O5(OH)4

FORMULA_NROFF: $Mg_3Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"P-11 Serpentine 318B--Colorado. $Mg_3(Si_2O_5)$- $(OH)_4$: The principal occurrences of serpentine are those in which they are derived by alteration of ultrabasic rocks. Serpentine specimens, like talc, deviate little from the ideal composition. However, also like talc, small amounts of aluminum and iron may replace silicon and magnesium. This particular sample is burdened with magnetite contamination, but still displays ferric ion bands at 0.65 and 0.45μ as well as clearly visible OH features at 1.4μ and 2.34μ. This latter feature is attributed to a combination of the OH stretch with the Mg-OH bend."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

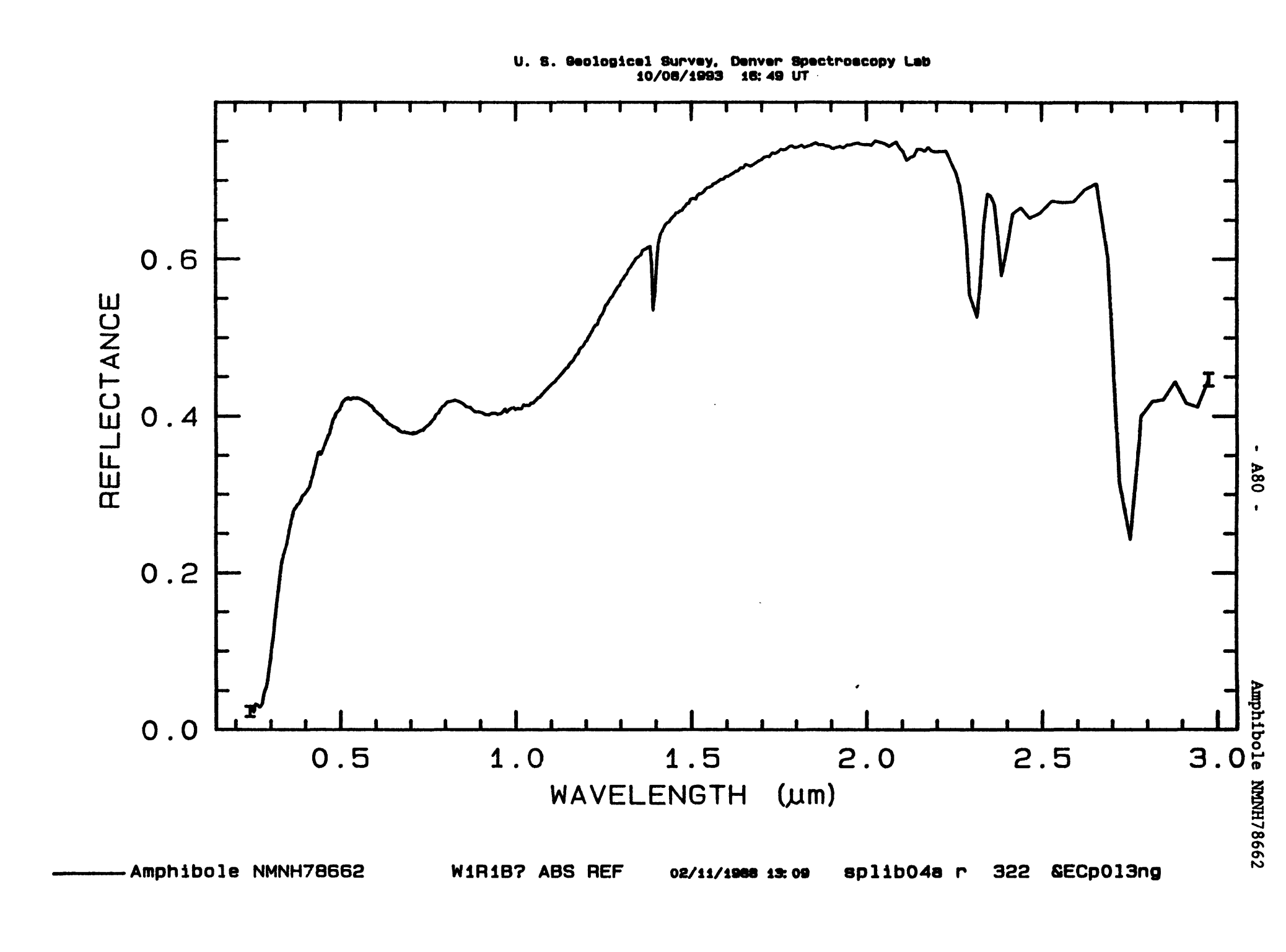
COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

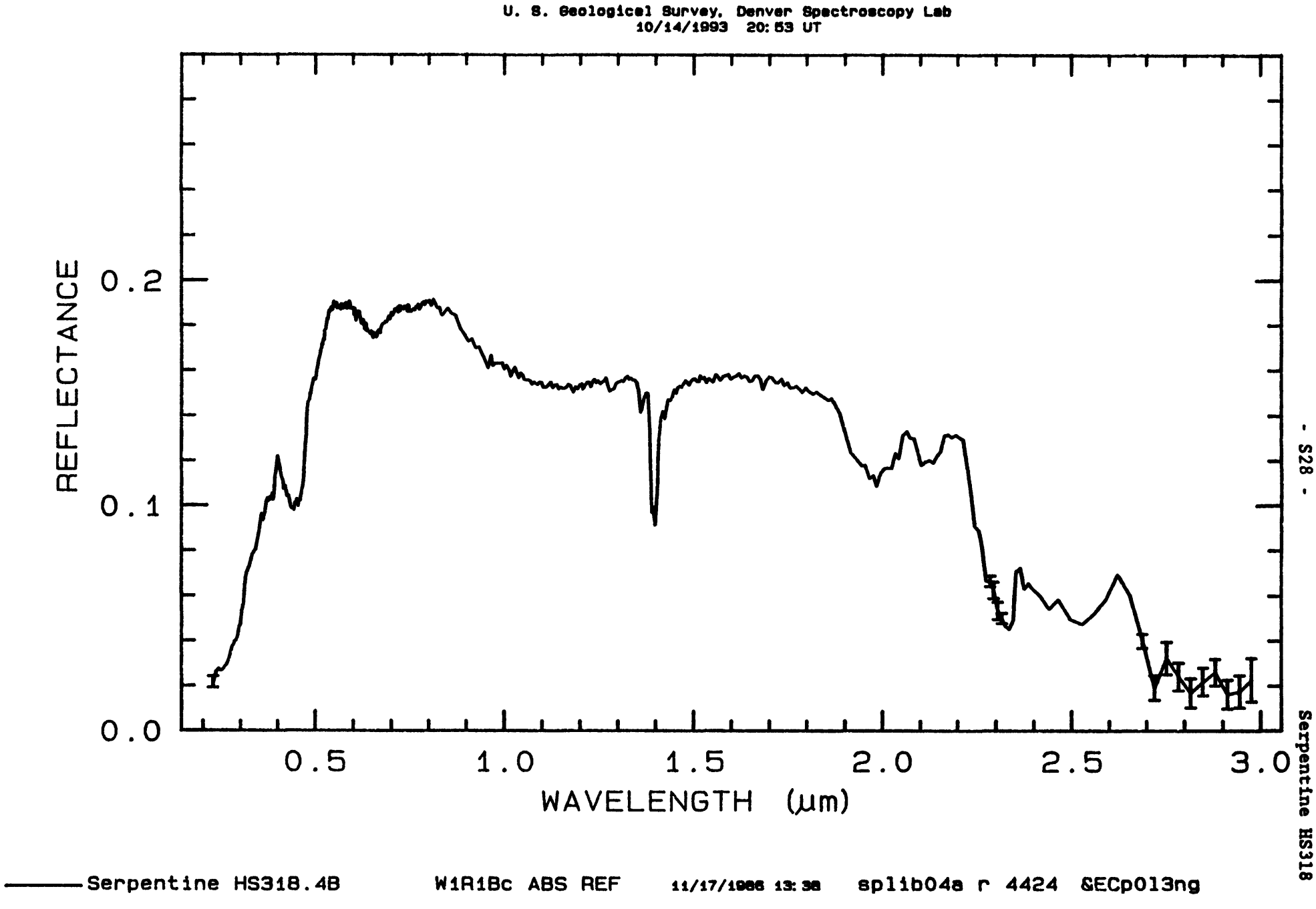
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A80 -
Amphibole NMNH78662
Amphibole NMNH78662 W1R1B? ABS REF 02/11/1998 13:09 splib04a r 322 &ECp013ng

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4424	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- S28 -
Serpentine HS318
Serpentine HS318.4B
W1R1Bc ABS REF
11/17/1986 13:38
splib04a r 4424 &ECp013ng

TITLE: Serpentine HS8 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS8

MINERAL_TYPE: Phyllosilicate

MINERAL: Serpentine

FORMULA: Mg3Si2O5(OH)4

FORMULA_NROFF: $Mg_3Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Cardiff, Missouri

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"S-19. Serpentine. Cardiff, Mo. (8). Serpentine is a hydrous secondary mineral, typically an alteration product of olivine, pyroxene, or amphibole. Its compostion is $Mg_3Si_2O_5(OH)_4$, but ferrous iron and nickel may be present in small amount. Weak ferric and ferrous ion bands are displayed by this sample near 0.7 and 1.0μ respectively, which may be original, or due to the presence of a small amount of unaltered amphibole. The bands near 1.4μ and longward of 1.9μ are hydroxyl bands. As in the case of some amphiboles and pyroxenes, this sample displays a peak near 0.5μ in the visible due to the combined effect of the ferric ion band in the near-infrared and the fall-off in the blue."

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

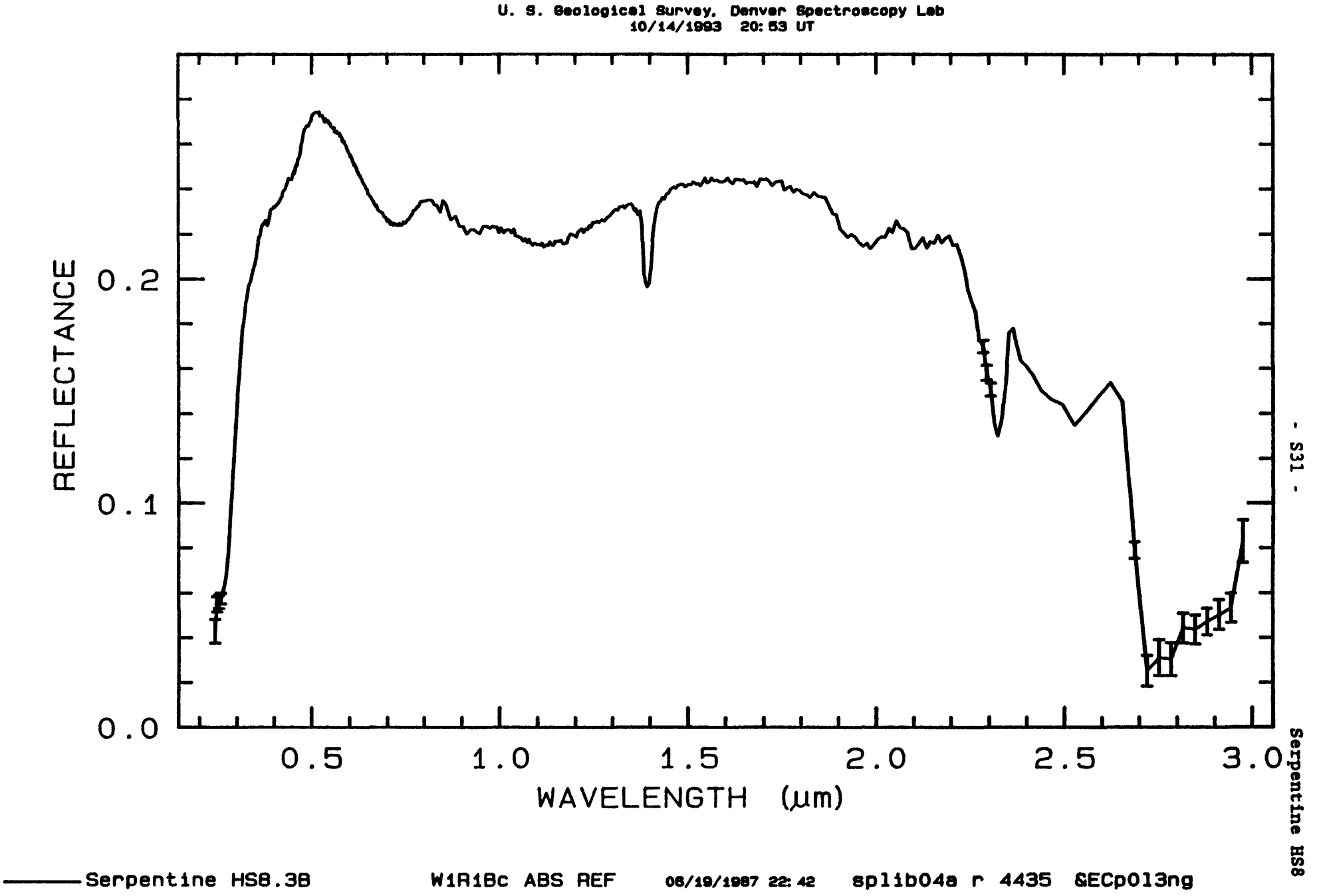
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4435	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- S31 -
Serpentine HS8
Serpentine HS8.3B W1R1Bc ABS REF 06/19/1987 22:42 splib04a r 4435 &ECp013ng

TITLE: Siderite HS271 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS271

MINERAL_TYPE: Carbonate

MINERAL: Siderite (Calcite group)

FORMULA: FeCO3

FORMULA_NROFF: $FeCO_3$

COLLECTION_LOCALITY: Roxbury, Connecticut

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Magnesite and with Rhodochrosite.

"C-7. Siderite. Roxbury, Conn. (68, hand-ground). Siderite, $FeCO_3$, is found in extensive sedimentary beds, frequently contaminated with clay or organic matter. It is also commonly deposited in veins by hydrothermal solutions. Both magnesium and manganese commonly substitute for the iron. This particular sample is coarsely crystalline and medium brown in color. It is high in iron, as indicated by the strong ferrous ion band near 1.1μ. It is also slightly contaminated with magnetite. Being an opaque material, the magnetite lowers the overall reflectivity of the sample, makes the carbonate bands less prominent, and causes the crossover of the spectral curves in the visible. Analysis shows that this sample contains 0.98% Mg^{2+} and 7.03% Mn^{+2}. However, the electronic transitions of iron dominate the spectrum to such an extent that none of the sharp features due to Mn^{++} are apparent in the visible spectrum." NOTE: This a different sample number than this sample (271) but the collection locality is the same. Possibly a mislabeled sample.

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure siderite Possibly some manganoan siderite also - patterns too similar to differentiate.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

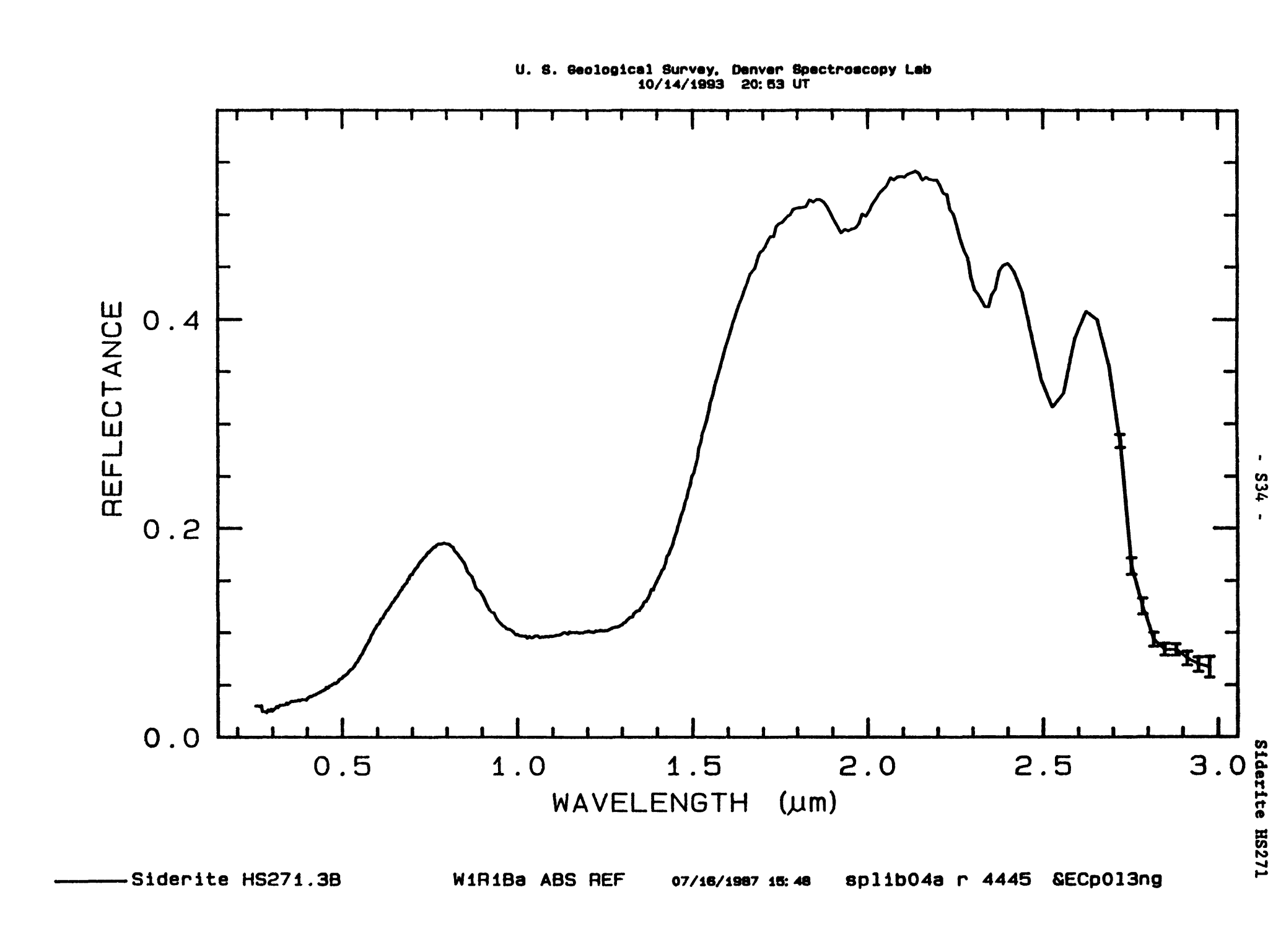
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4445	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Siderite HS271.3B W1R1Ba ABS REF 07/16/1987 15:48 splib04a r 4445 &ECp013ng
Siderite HS271

TITLE: Siderophyllite NMNH104998 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH104998

MINERAL_TYPE: Phyllosilicate

MINERAL: Siderophyllite (Mica group)

FORMULA: K(Fe+2)2Al(Al2Si2)O10(F,OH)2

FORMULA_NROFF: $KFe^{+2}_2Al(Al_2Si_2)O_{10}(F,OH)_2$

COLLECTION_LOCALITY: Brooks Mtns. Seward Peninsula, AK

ORIGINAL_DONOR: National Musuem of Natural History (Jim Crowley USGS)

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

40 kV - 30 mA and 6.5-9.5 keV (sidphyl.out, smear mount); 45 kV - 35mA and 7.3-9.5 keV (siphyl2.out, random or bulk mount)
References: Pattern for siderophyllite 1M in MSA Rev. Min. 13, p. 581; Huebner's reference pattterns for micas
Found: trioctahedral 1M mica, subordinate chlorite and calcite (X-ray); immersion oil examination chlorite >= mica >>> carbonate
Sought: quartz [(101) reflection obscured; a very weak peak observed in the position of the quartz (100)]
Comments: At least three phases present. The mica pattern is consistent with siderophylllite. Sharp reflections suggest mica is well crystallized and compositionally homogenous. The mica has a relatively large (002) spacing at 17.8, suggesting the presence of a large cation such as K. The chlorite (001) reflection is anomalously weak relative to the other chlorite reflections observed. Observed eigth weak calcite reflections but found only a trace of carbonate in immersion oil, suggesting that the carbonate may not be homogenously distributed.

J.S. Huebner and J. Pickrell, unpublished data, written communication, USGS, Reston, VA (1993)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Since siderophyllite is volumetrically dominant according to my optical examination, I think it spectral signature will dominate over the chlorite. This is also so for calcite. However, it spectrum looks strikingly similar to thuringite SMR-15 shortward of 2.0μm. The 2.3-μm region has small band that are slightly shifted from thuringite (chlorite). This similarity may be coincidental, however, they may not be spectrally distinguishable shortward of 2.0μm. G. Swayze.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:

70 vol%	Siderophyllite
15 vol%	Chlorite
10 vol%	Calcite
5 vol%	Quartz
tr	Fe-staining

Siderophyllite is biaxial (-) with small 2V angle and has a dark green color in plain polarized light. Other gains with basal cleavage have a lighter 1st order gray interference color and also are biaxial (-) with a small 2V. Calcite and quartz are also present in minor amounts. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4456	0.2-3.0μm	200	g.s.=

TITLE: Analcime GDS1 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS1

MINERAL_TYPE: Tectosilicate

MINERAL: Analcime (Zeolite group)

FORMULA: NaAlSi2O6*H2O

FORMULA_NROFF: $NaAlSi_2O_6 \bullet H_2O$

COLLECTION_LOCALITY: Mount Saint Hilaire, Quebec

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The original sample description and vis-NIR spectrum was published in:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

The sample appears to be mineralogically and spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

pure Analcime - by Norma Vero

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

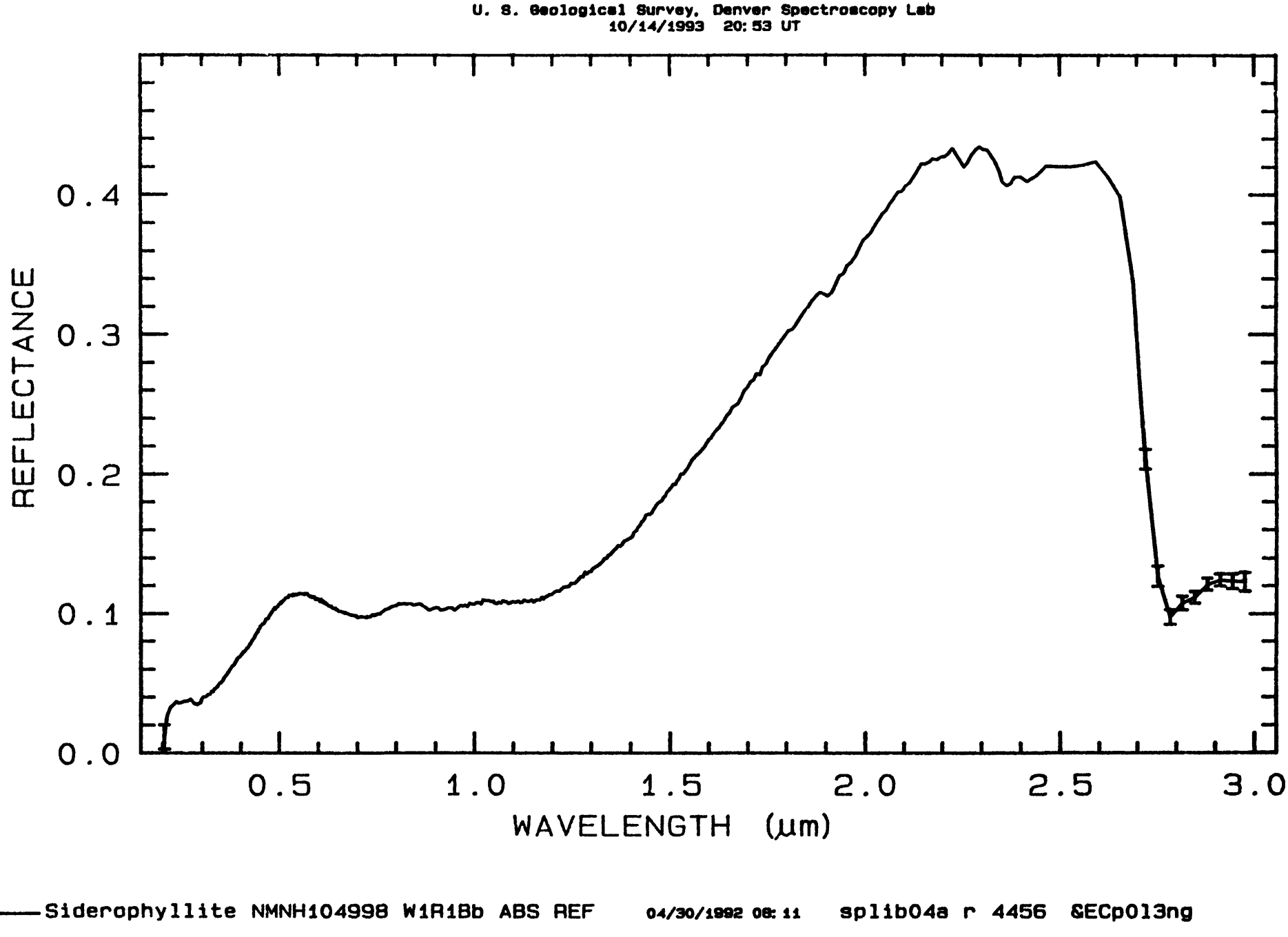
None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

av gr sz = 120μm

Smaller analcime grains adhere to larger grains. Uneven fracture, lacks good cleavage, clear grains, twinning, isotropic , anomalously biaxial in some cases, all characteristic of analcime. G. Swayze



Siderophyllite NMNH104998

TITLE: Sillimanite HS186 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS186

MINERAL_TYPE: Nesosilicate

MINERAL: Sillimanite

FORMULA: Al2SiO5

FORMULA_NROFF: Al_2SiO_5

COLLECTION_LOCALITY: Australia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"This comparatively rare mineral is found in high grade metamorphic rocks, particularly gneiss and schist. Its spectrum shows a rapid fall off in intensity to the blue, which is probably due to the trace of ferric ion replacing aluminum. This sample is slightly altered to montmorillonite, which accounts for the strong hydroxyl (1.4 and 2.2μm) and weaker water (1.9μm) bands. The 2.2μm feature is probably a combination of the OH stretch with the AlOH bend."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sillimanite plus small amount of quartz, trace amount of pyrophyllite. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

No compositional analyses.

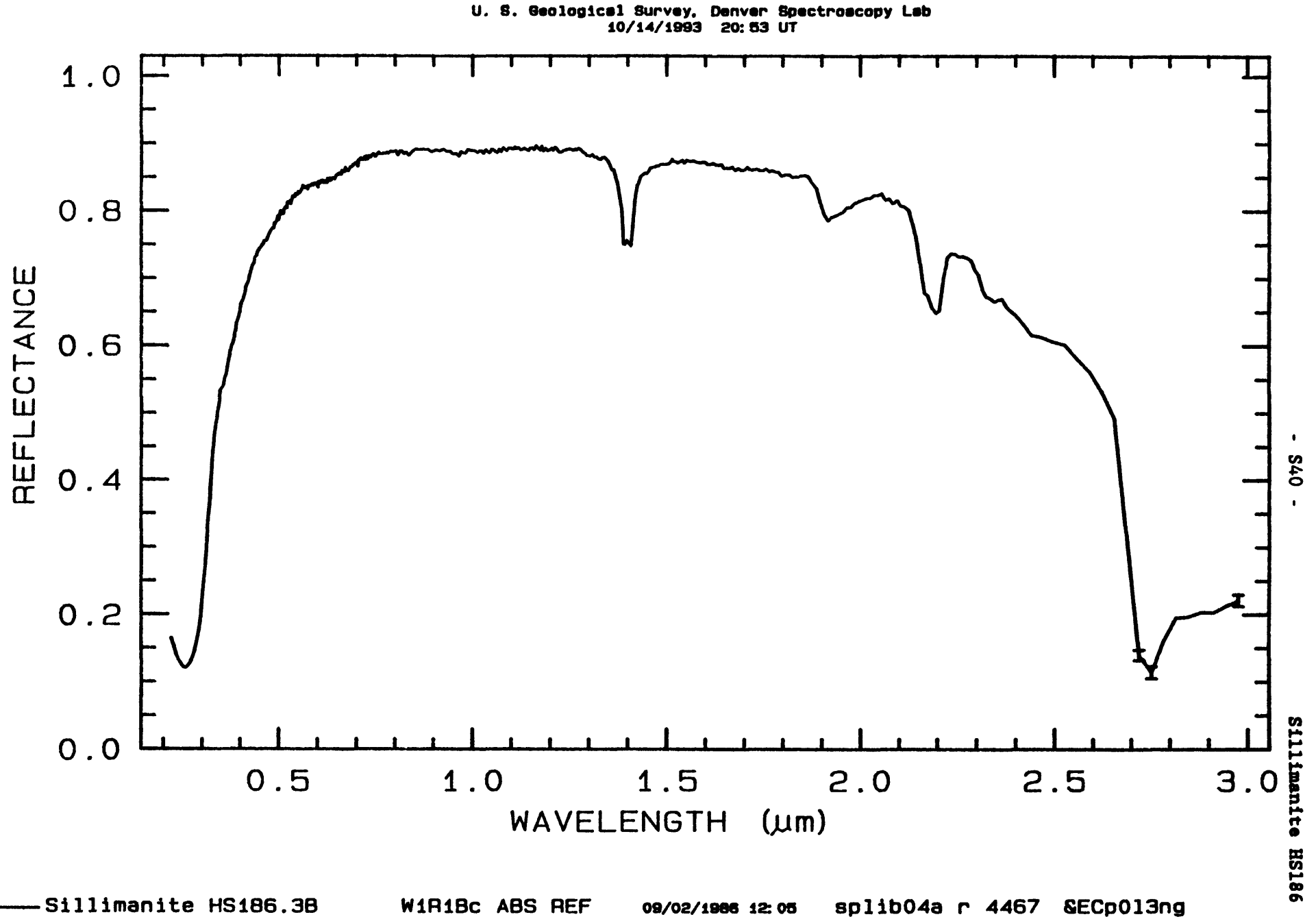
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 4467	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- S40 -
Sillimanite HS186
Sillimanite HS186.3B W1R1Bc ABS REF 09/02/1986 12:05 splib04a r 4467 &ECp013ng

TITLE: Smaragdite HS290 Amphibole DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS290

MINERAL_TYPE: Inosilicate

MINERAL: Smaragdite (Actinolitic Amphibole)

FORMULA: Ca2(Mg,Fe+2)5Si8O22(OH)2 (see sample description)

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Clay County, North Carolina

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The general formula for members of the amphibole group is $W_{0-1}X_2Y_5Z_8O_{22}(OH,F)_2$, where W represents Na and K in the A site, X denotes Ca^{+2}, Na^{+}, Mn^{+2}, Fe^{+2}, Mg^{+2}, and Li^{+} in the M4 sites, Y represents Mn^{+2}, Fe^{+2}, Mg^{+2}, Fe^{+3}, Al^{+3}, and Ti^{+4} in the M1, M2 and M3 sites and Z refers to Si^{+4} and Al^{+3} in the tetrahedral sites. This sample's composition is probably similar to ferroactinolite, $Ca_2(Fe^{+2},Mg)_5Si_8O_{22}(OH)_2$.

"I-16 Smaragdite 290B--Clay Co., N. Carolina: Smaragdite is also a name sometimes given to actinolitic amphibole derived from pyroxene by alteration. Like uralite, it typically contains Al, for which Fe^3 can substutute. This sample shows both ferrous and ferric iron bands at 1.0μ and 0.7μ in its spectrum, as well as the hydroxyl features at 1.4, 2.32, and 2.38μ. Other weaker features between 2.1 and 2.3μ are hydroxyl-lattice combination bands. Some included water is again indicated by the band at 1.9μ."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

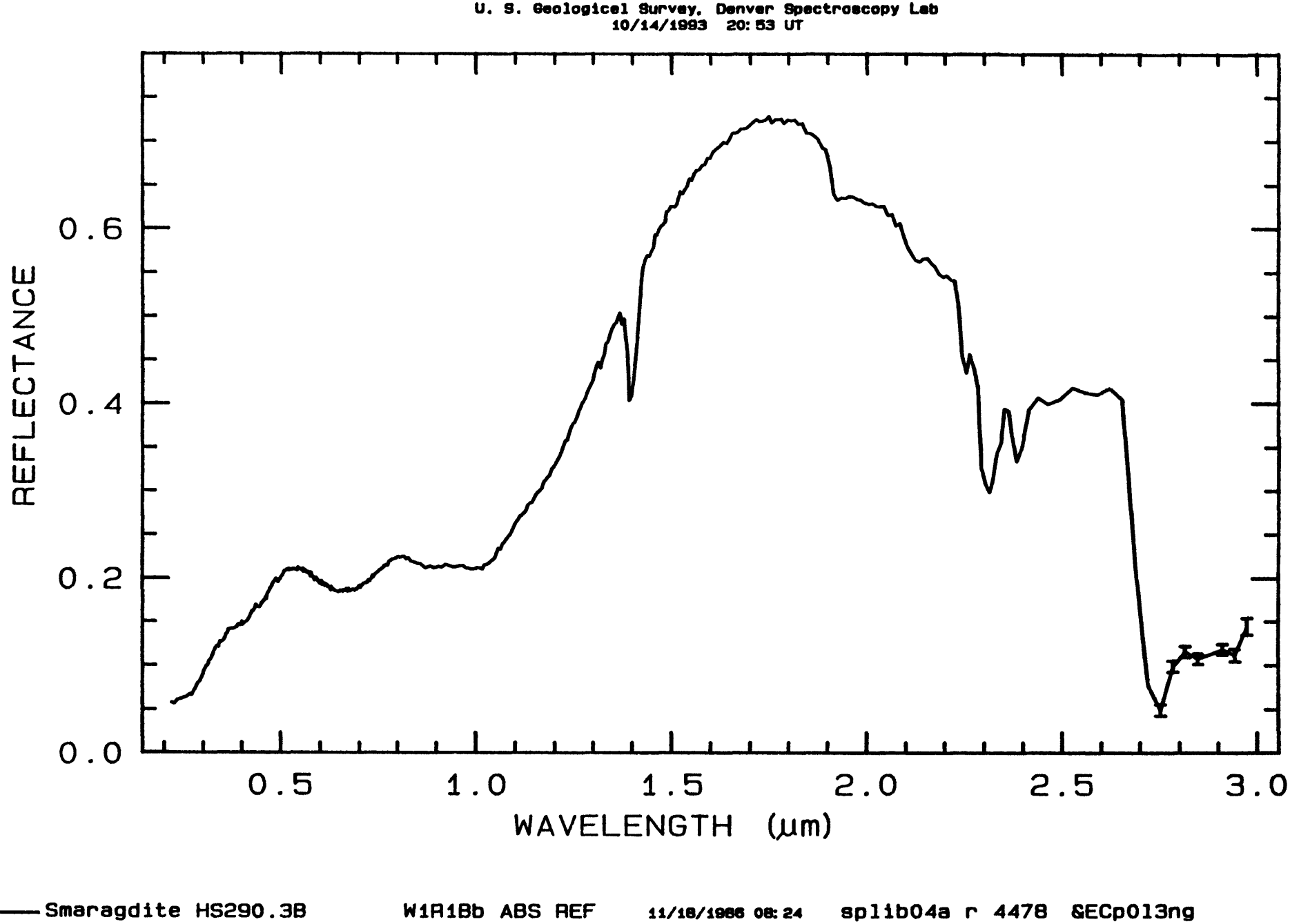
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4478	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Smaragdite HS290
Smaragdite HS290.3B W1R1Bb ABS REF 11/18/1986 08:24 splib04a r 4478 &ECp013ng

TITLE: Sodium_Bicarbonate GDS55 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS55

MINERAL_TYPE: Carbonate

MINERAL: Sodium Bicarbonate

FORMULA: NaHCO3

FORMULA_NROFF: $NaHCO_3$

COLLECTION_LOCALITY: Baker Chemical Reagent

ORIGINAL_DONOR: Baker Chemical

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

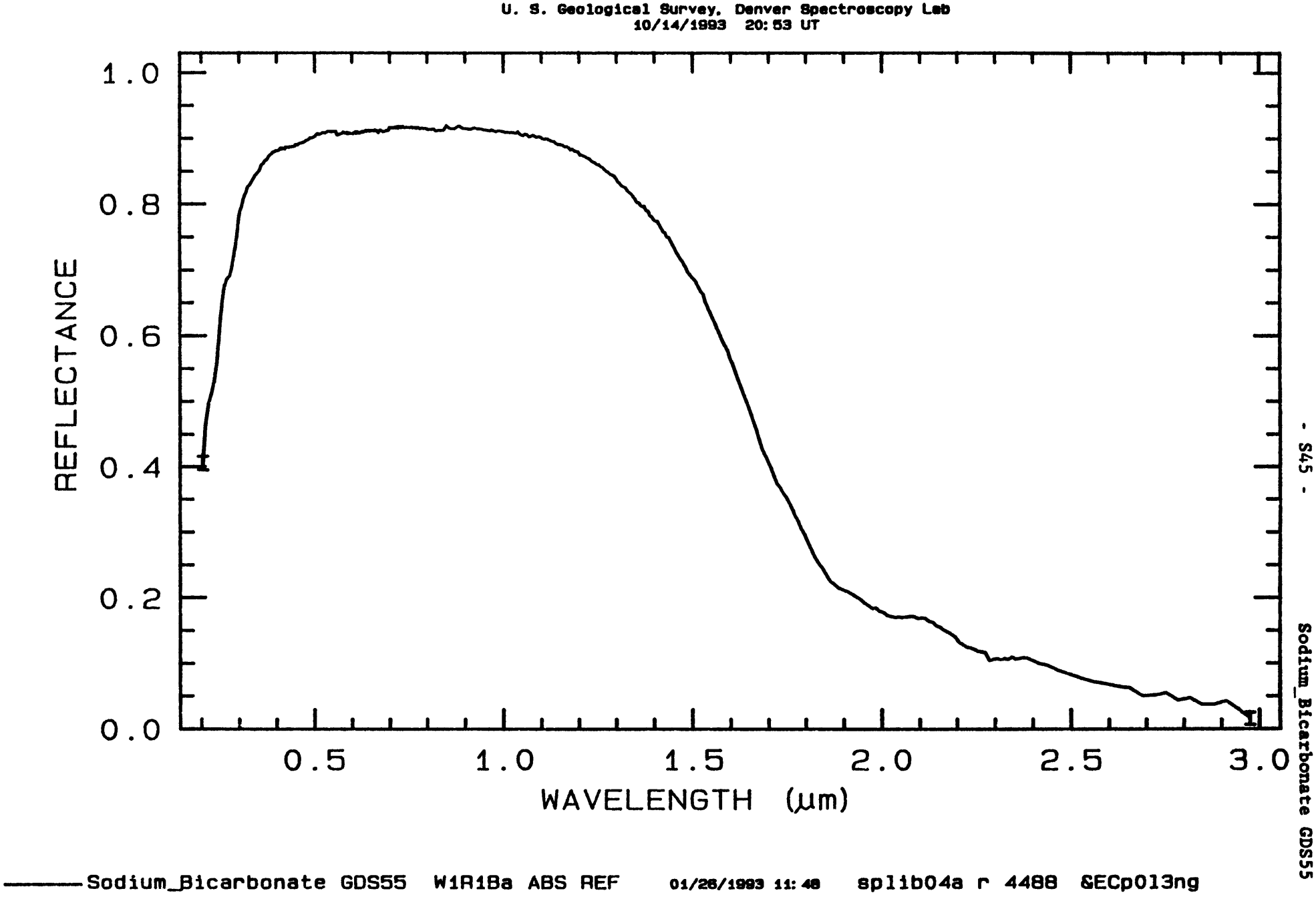
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4488	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Sodium_Bicarbonate GDS55
Sodium_Bicarbonate GDS55 W1R1Ba ABS REF 01/26/1993 11:48 splib04a r 4488 &ECp013ng

TITLE: Spessartine NMNH14143 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH114143

MINERAL_TYPE: Nesosilicate

MINERAL: Spessartine (Garnet group)

FORMULA: Mn3Al2(SiO4)3

FORMULA_NROFF: $Mn_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Rutherford #2 Mine, Amelia, Amelia County, Virginia

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Almandine.

"Results of petrographic examination: A group of 3mm and smaller diameter reddish crystals. Seem to be a few clear crystals adhering to the grains that were picked off; otherwise appears pure. Under petrographic microscope, sample appears pure."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure spessartine.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Pure spessartine (Norma Vergo).

END_XRD_ANALYSIS.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	333	0.2-3.0μm	200	g.s.= 120 μm

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	35.02	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.07	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	20.74	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	10.40	wt%	NROFF: FeO
COMPOSITION:	MnO:	30.82	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.04	wt%	NROFF: MgO
COMPOSITION:	CaO:	1.61	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.09	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.03	wt%	NROFF: K_2O
COMPOSITION:	---	---	---	
COMPOSITION:	Total:	98.81	wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis found one heterogeous area where all oxides, including silica, summed to only 27 wt% (this is probably a flaw in carbon coating). Otherwise, FeO varies from 7.5 to 12%, with inverse variation in MnO. Average of 10 analyses (other than anomalous point). Analyst: Lou Walter (done on Smithsonian microprobe using WDS?)

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

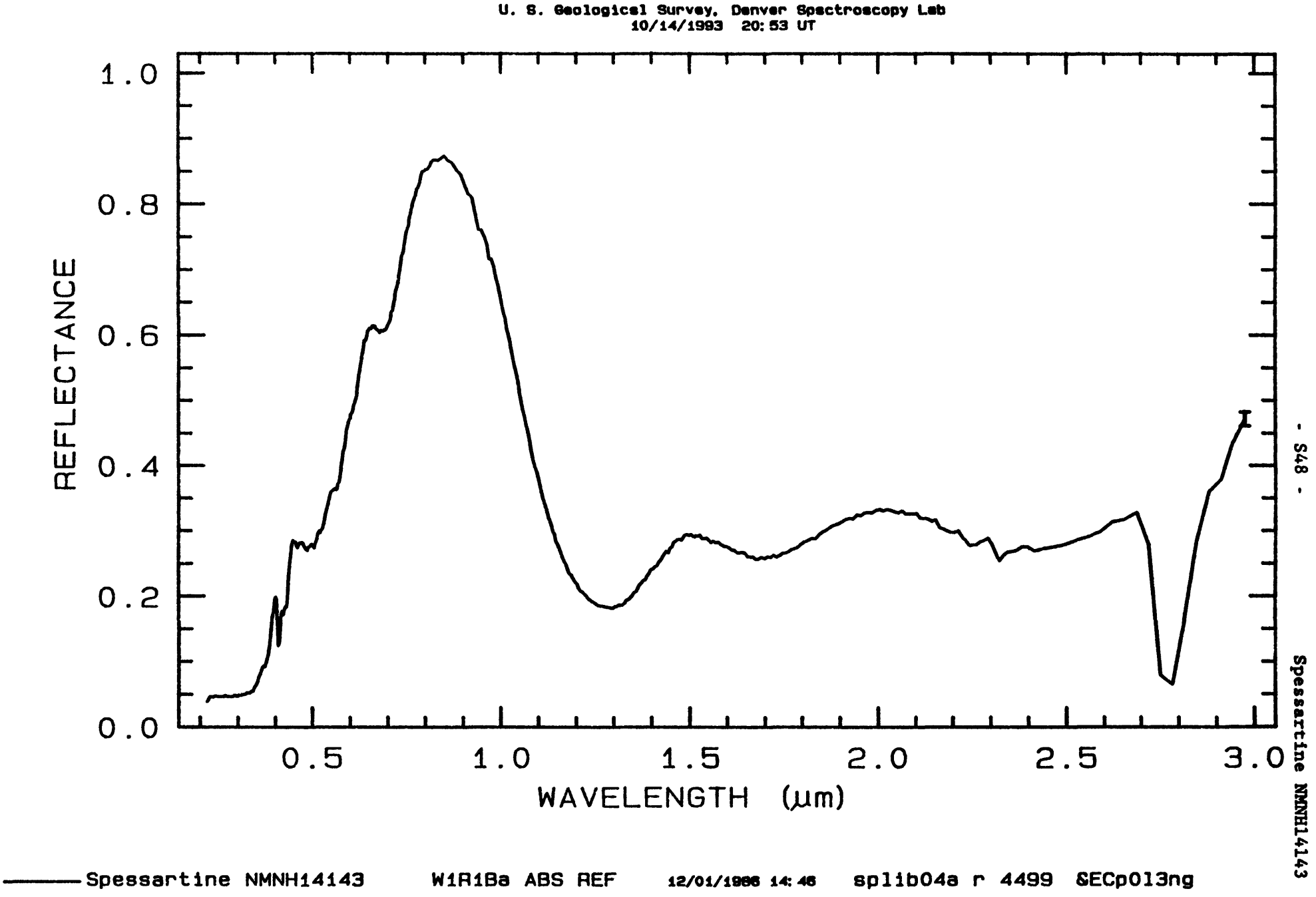
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4499	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Spessartine NMNH14143
W1R1Ba ABS REF
12/01/1986 14:46
splib04a r 4499 &ECp013ng
Spessartine NMNH14143

TITLE: Spessartine HS112 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS112

MINERAL_TYPE: Nesosilicate

MINERAL: Spessartine (Garnet group)

FORMULA: Mn3Al2(SiO4)3

FORMULA_NROFF: $Mn_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Haddon, Connecticut

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Almandine.

"Spessartite 112B--Haddon, Conn. $Mn_3Al_2(SiO_4)_3$: Spessartite is less common than many garnets, occurring primarily in metamorphic rocks and granite pegmatites. The dominant features in the spectrum are the intense bands at 1.275 and 1.7 μ due to the presence of ferrous iron in eight-fold coordination, as discussed above. The visible spectrum falls off sharply to the blue producing a maximum near 0.8 μ. In the larger particle sizes this feature shows a shoulder near 0.9 μ, indicating the presence of Fe^{3+}. While the visible spectrum displays the very sharp feature at 0.41 μ characteristic of Mn^{2+} absorption, the rest of its usually distinctive spectrum is degraded by the presence of absorptions by both Fe^{3+} and Fe^{2+}. Together these 3 ions can account for the bands at 0.37, 0.43 μ, the broad general absorption centered near 0.55 μ, and the fall off to the blue."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

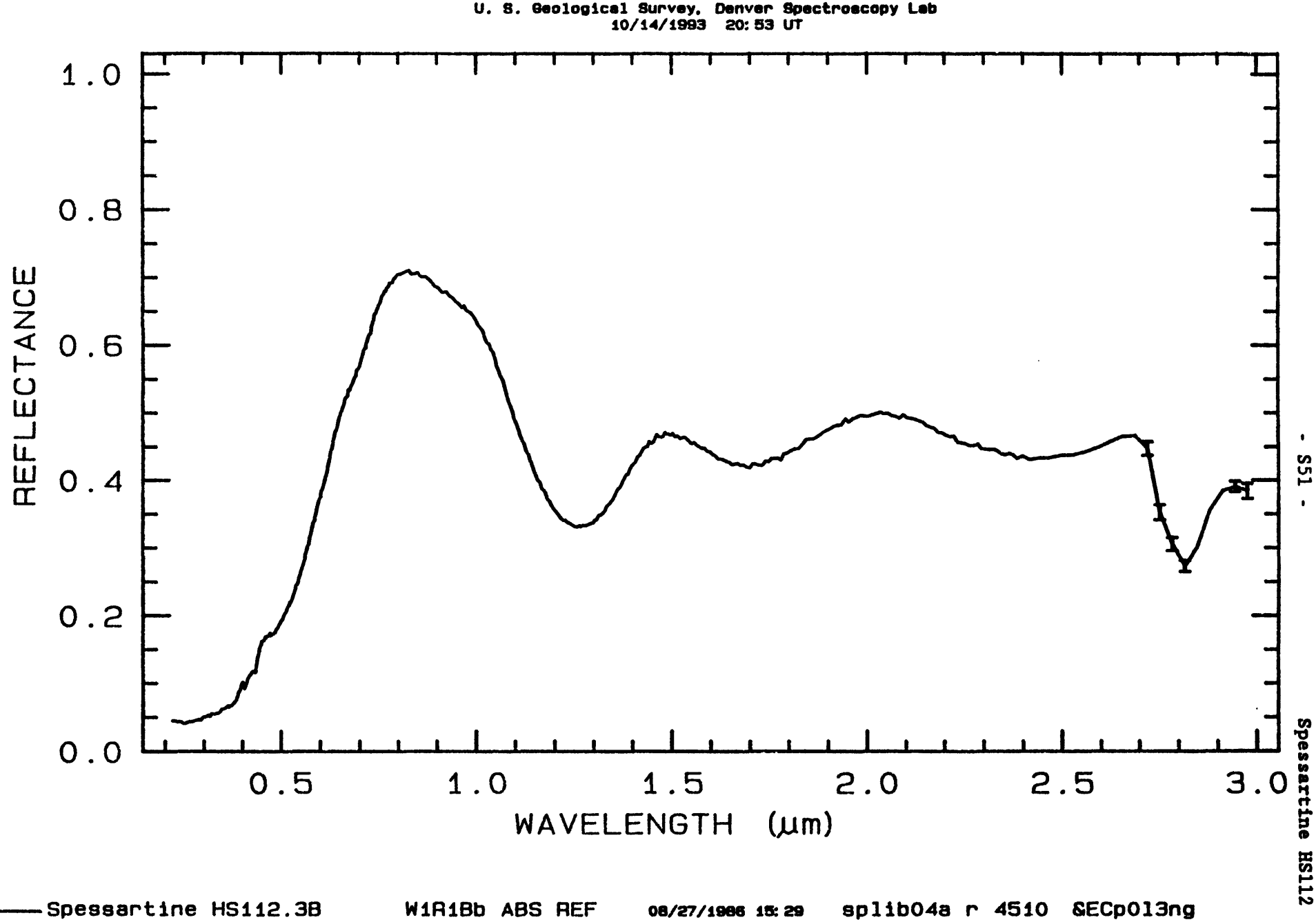
MICROSCOPIC_EXAMINATION:

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4510	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Spessartine HS112.3B W1R1Bb ABS REF 08/27/1986 15:29 splib04a r 4510 &ECp013ng
Spessartine HS112

TITLE: Spessartine WS480 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS480

MINERAL_TYPE: Nesosilicate

MINERAL: Spessartine (Garnet group)

FORMULA: Mn3Al2(SiO4)3

FORMULA_NROFF: $Mn_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Ely, Nevada

ORIGINAL_DONOR: Ward Natural Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Almandine.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

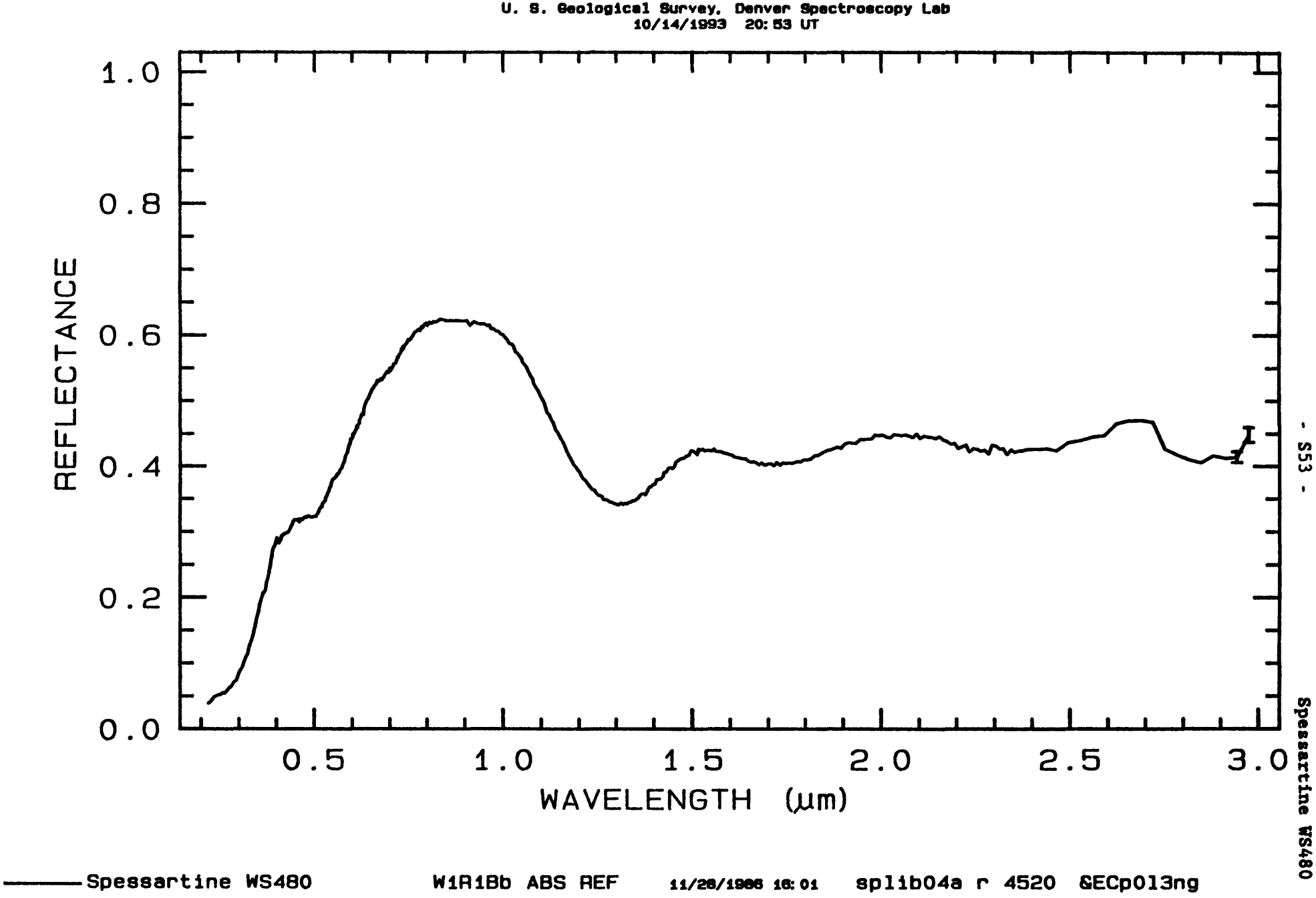
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4520	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Spessartine WS480
W1R1Bb ABS REF
11/28/1986 16:01
splib04a r 4520 &ECp013ng

TITLE: Spessartine WS481 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS481

MINERAL_TYPE: Nesosilicate

MINERAL: Spessartine (Garnet group)

FORMULA: Mn3Al2(SiO4)3

FORMULA_NROFF: $Mn_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Shamburu, Kenya

ORIGINAL_DONOR: Ward Natural Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Almandine.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

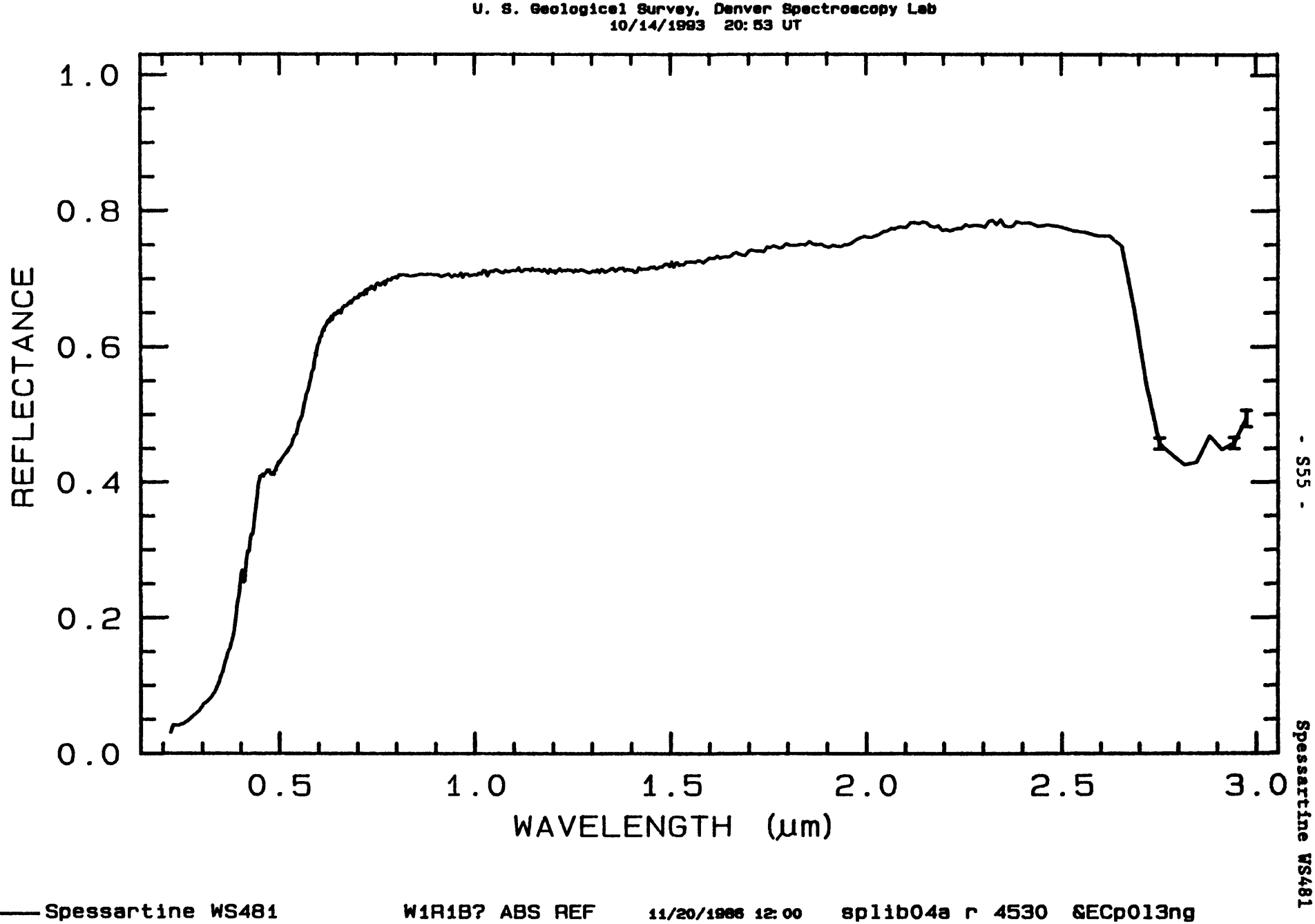
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4530	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Spessartine WS481
W1R1B? ABS REF
11/20/1986 12:00
splib04a r 4530 &ECp013ng
Spessartine WS481

TITLE: Sphalerite HS136 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS136

MINERAL_TYPE: Sulfide

MINERAL: Sphalerite

FORMULA: ZnS

FORMULA_NROFF: ZnS

COLLECTION_LOCALITY: Summit County, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

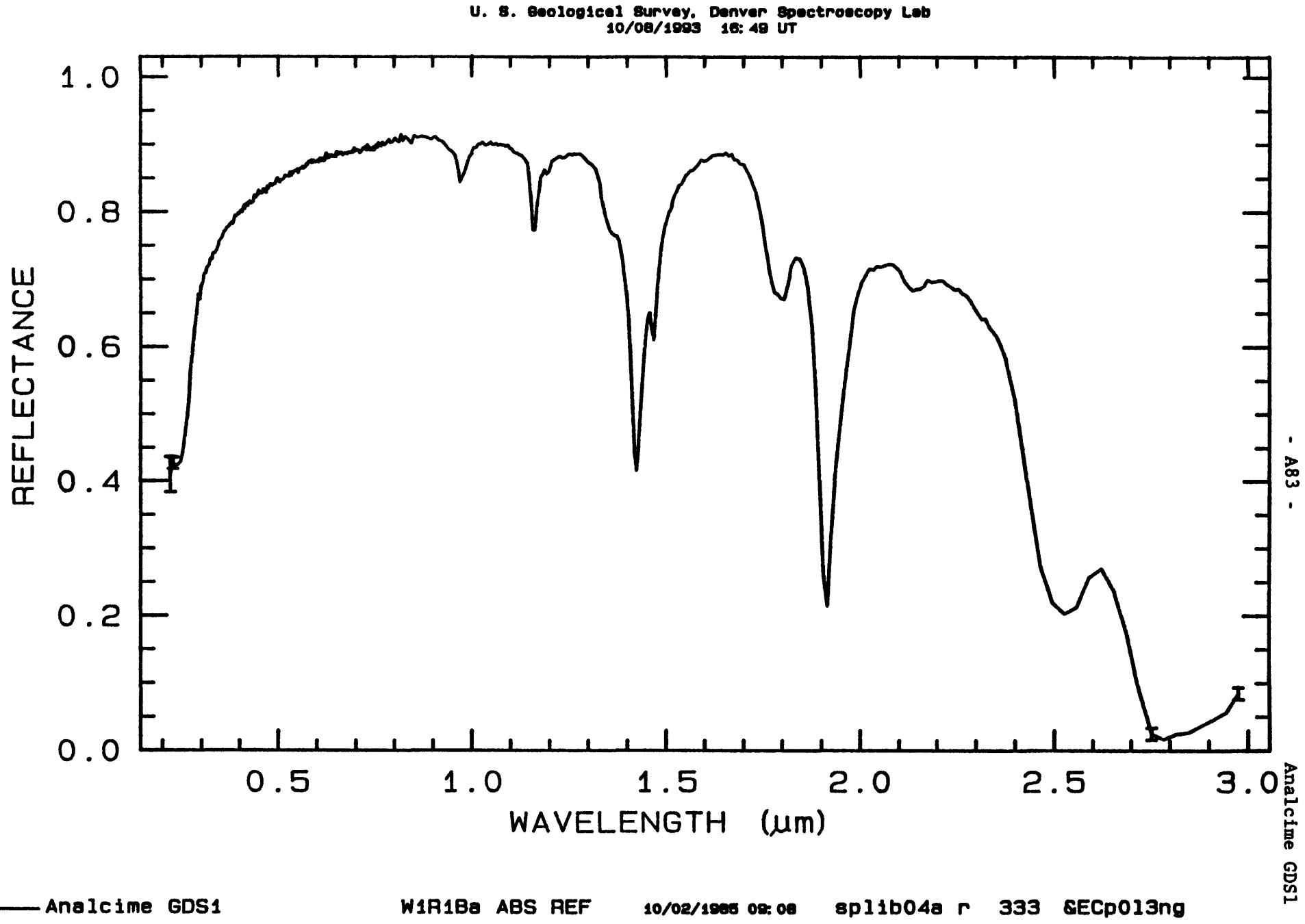
SAMPLE_DESCRIPTION:

"SS-22. Sphalerite. Summit County, Colorado (136B). Sphalerite, ZnS, is the most important ore of zinc. It is typically deposited in veins by low temperature hydrothermal solutions. Sphalerite is colorless when pure, but naturally occurring samples are usually brown or black, the darkening occurring as iron substitues for zinc. This sample is a resinous brown color, typical of sphalerites. Zinc sulphide is a well known semiconductor material and, when doped with impurity ions, is a conventional phosphor. Doping with copper produces blue and /or green luminescence centers, while manganese produces orange-yellow centers. The presence of iron in the zinc sulphide acts as a luminescence killer. The macroscopic pure zinc sulphide lattice displays negligible absorption down to about 0.35μ, where the sharp absorption edge indicates the beginning of the conduction band. This sample of sphalerite does not display the near-infrared bands typical of either ferrous or ferric ions in other samples, because the iron is not in an octahedral site. It does show a rapid fall-off in reflectivity between 0.6μ and 0.35μ. This tail to the absorption edge of pure ZnS is probably caused by defects in the periodic lattice and boundary effects, as well as to some extrinsic absorption due to the impurity iron. The fall-off in reflectivity beween 2.0 and 2.5μ is an unusual feature, which we have only noticed before in aluminum compounds. The explanation given there cannot be applied here. The valence band of zinc sulphide does not extend to such short wavelength and so we tentatively suggest that it may be due to the excitation of electrons from the valence band to some fundamental level of an impurity ion."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: IV. Sulphides and sulphates. Modern Geology, v. 3, p. 1-14.

END_SAMPLE_DESCRIPTION.


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A83 -
Analcime GDS1
Analcime GDS1
W1R1Ba ABS REF
10/02/1995 09:08
splib04a r 333 &ECp013ng

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

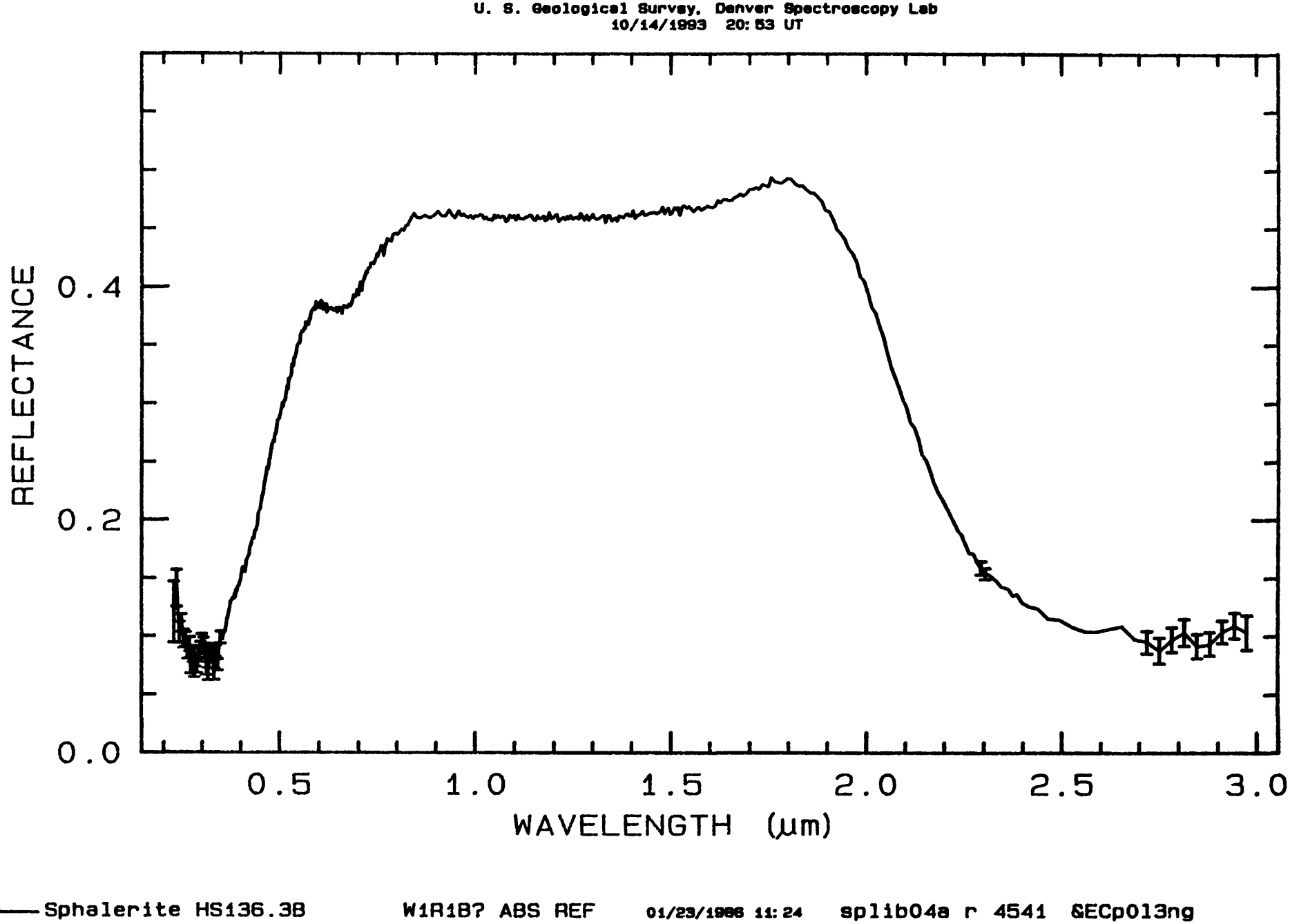
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4541	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Sphalerite HS136.3B W1R1B? ABS REF 01/23/1986 11:24 splib04a r 4541 &ECp013ng
Sphalerite HS136

TITLE: Sphalerite S102-7 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S102-7

MINERAL_TYPE: Sulfide

MINERAL: Sphalerite

FORMULA: ZnS

FORMULA_NROFF: ZnS

COLLECTION_LOCALITY: Guymard Mine, Guymard, Orange County, New York

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Field sample from a study of the Shawangunk Region of New York.

For more information on this sample reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	27	ppm
COMPOSITION_TRACE:	As	50	ppm
COMPOSITION_TRACE:	Au	0.010	ppm
COMPOSITION_TRACE:	Cd	300	ppm
COMPOSITION_TRACE:	Cr	450	ppm
COMPOSITION_TRACE:	Cu	1050	ppm
COMPOSITION_TRACE:	Hg	48.0	ppm
COMPOSITION_TRACE:	Mn	15	ppm
COMPOSITION_TRACE:	Ni	10	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	35	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.27	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	<5	ppm
COMPOSITION_TRACE:	Zn		

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	6.5
Sph	63.0
Cpy	0.3
Py	
Qtz	30.0

Assay	wt%
Cu	0.12
Fe	3.65
Pb	7.35
Zn	38.63
S	20.6

Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

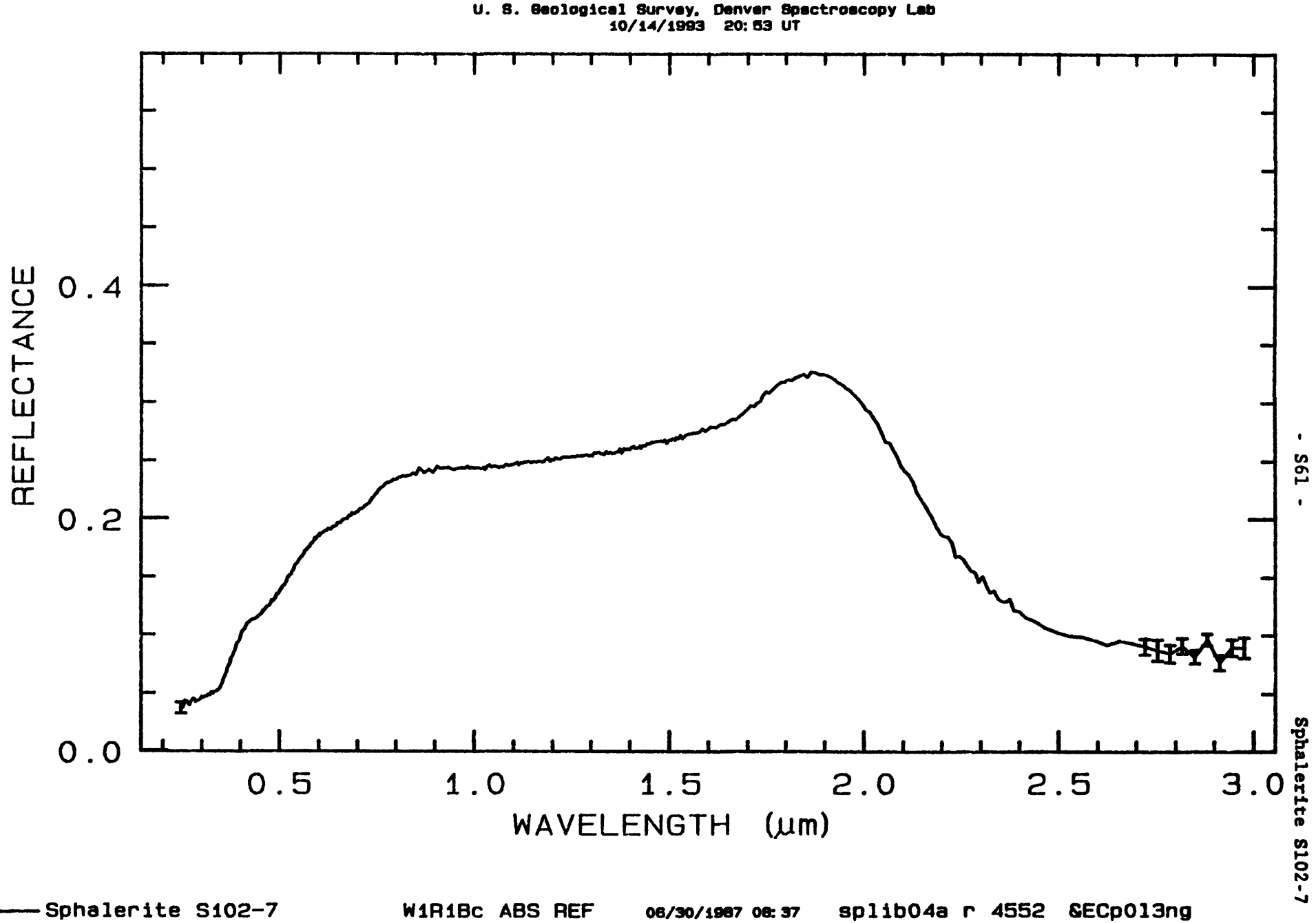
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4552	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Sphalerite S102-7
W1R1Bc ABS REF
06/30/1987 08:37
splib04a r 4552 &ECp013ng

TITLE: Sphalerite S102-8 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S102-8

MINERAL_TYPE: Sulfide

MINERAL: Sphalerite

FORMULA: ZnS

FORMULA_NROFF: ZnS

COLLECTION_LOCALITY: Guymard Mine, Guymard, Orange County, New York

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Field sample from a study of the Shawangunk Region of New York.

For more information on this sample reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	12	ppm
COMPOSITION_TRACE:	As	35	ppm
COMPOSITION_TRACE:	Au	0.005	ppm
COMPOSITION_TRACE:	Cd	450	ppm
COMPOSITION_TRACE:	Cr	50	ppm
COMPOSITION_TRACE:	Cu	500	ppm
COMPOSITION_TRACE:	Hg	78.0	ppm
COMPOSITION_TRACE:	Mn	5	ppm
COMPOSITION_TRACE:	Ni	5	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	<25	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.53	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	<5	ppm
COMPOSITION_TRACE:	Zn		

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	4.0
Sph	90.0
Cpy	
Py	
Qtz	6.0

Assay	wt%
Cu	0.06
Fe	4.25
Pb	3.35
Zn	56.06
S	29.1

Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

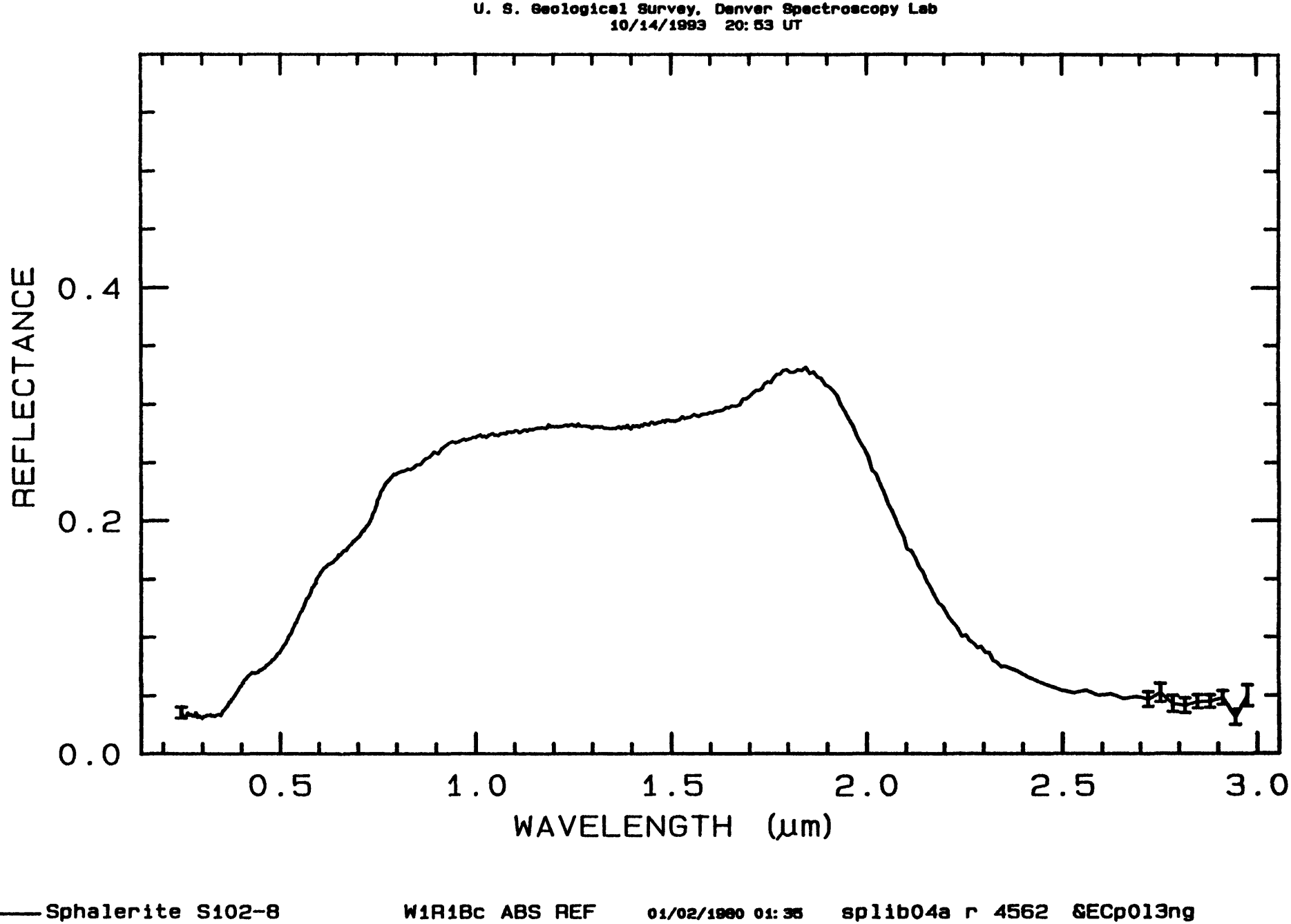
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4562	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Sphalerite S102-8
Sphalerite S102-8 W1R1Bc ABS REF 01/02/1980 01:35 splib04a r 4562 &ECp013ng

TITLE: Sphalerite S26-34 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S26-34

MINERAL_TYPE: Sulfide

MINERAL: Sphalerite

FORMULA: ZnS

FORMULA_NROFF: ZnS

COLLECTION_LOCALITY: Ellenville (Ulster) Mine, Ellenville, Ulster County, New York

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Field sample from a study of the Shawangunk Region of New York.

For more information on this sample reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	3.5	ppm
COMPOSITION_TRACE:	As	<25	ppm
COMPOSITION_TRACE:	Au	<0.005	ppm
COMPOSITION_TRACE:	Cd	1000	ppm
COMPOSITION_TRACE:	Cr	10	ppm
COMPOSITION_TRACE:	Cu	200	ppm
COMPOSITION_TRACE:	Hg	210.0	ppm
COMPOSITION_TRACE:	Mn	25	ppm
COMPOSITION_TRACE:	Ni	<5	ppm
COMPOSITION_TRACE:	Pb	<25	ppm
COMPOSITION_TRACE:	Sb	50	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.53	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	<5	ppm
COMPOSITION_TRACE:	Zn		

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	
Sph	97.0
Cpy	
Py	
Qtz	2.0

Assay	wt%
Cu	0.03
Fe	5.27
Pb	<0.01
Zn	59.42
S	30.5

Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4572	0.2-3.0μm	200	g.s.=

TITLE: Andalusite NMNHR17898 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH17898

MINERAL_TYPE: Nesosilicate

MINERAL: Andalusite

FORMULA: Al2SiO5

FORMULA_NROFF: Al_2SiO_5

COLLECTION_LOCALITY: St. Theresa, Espirito Santo, Brazil

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Kanonaite. Trimorphous with Kyanite and Sillimanite.

The structure consists of chains of AlO_6 octahedra parallel to c, cross-linked by SiO_4 tetrahedra and AlO_5 polyhedra. Andalusite is typically formed in the contact aureoles of igneous intrusions in argillaceous rocks.

"Results of petrographic examination: Sample is composed of two crystals, one clear and one pale pink. Both appear pure, both 1 x 0.5 cm. Examination under petrographic microscope indicates pure and clean sample. Sample grains chosen for microprobe analysis are clear but with poor polish in part. "

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

There are weak absorption features near 2.2 and 2.35 μm due to trace alteration not seen by other methods. -Roger N. Clark

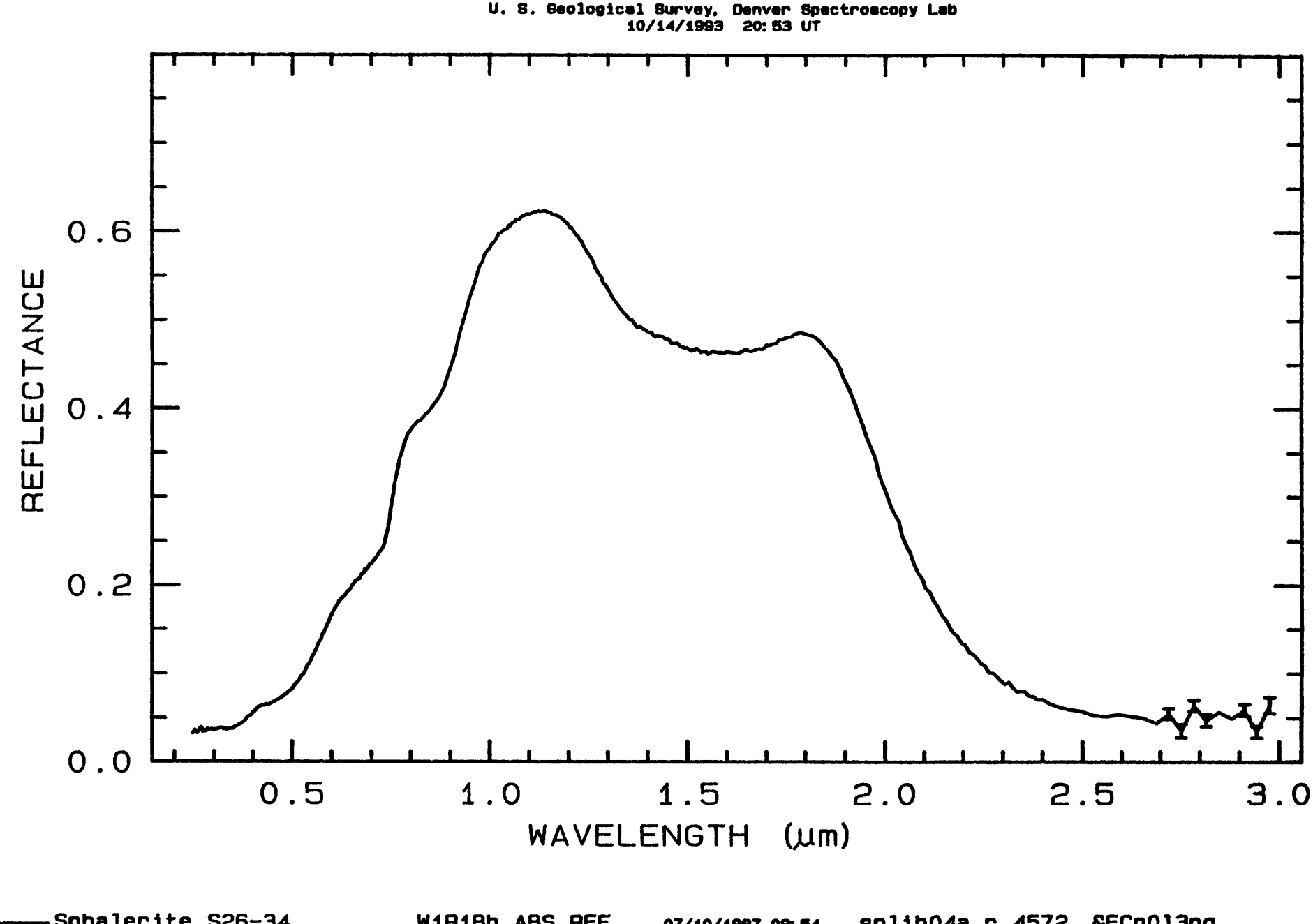
END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure. (Norma Vergo)

Pure.:
Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Sphalerite S26-34
Sphalerite S26-34 W1R1Bb ABS REF 07/10/1987 09:54 splib04a r 4572 &ECp013ng

TITLE: Sphalerite S26-35 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S26-35

MINERAL_TYPE: Sulfide

MINERAL: Sphalerite

FORMULA: ZnS

FORMULA_NROFF: ZnS

COLLECTION_LOCALITY: Ellenville (Ulster) Mine, Ellenville, Ulster County, New York

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston,. VA

SAMPLE_DESCRIPTION:

Field sample from a study of the Shawangunk Region of New York.

For more information on this sample reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	4.5	ppm
COMPOSITION_TRACE:	As	<25	ppm
COMPOSITION_TRACE:	Au	0.025	ppm
COMPOSITION_TRACE:	Cd	1100	ppm
COMPOSITION_TRACE:	Cr	50	ppm
COMPOSITION_TRACE:	Cu	450	ppm
COMPOSITION_TRACE:	Hg	220.0	ppm
COMPOSITION_TRACE:	Mn	25	ppm
COMPOSITION_TRACE:	Ni	<5	ppm
COMPOSITION_TRACE:	Pb	30	ppm
COMPOSITION_TRACE:	Sb	70	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.57	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	10	ppm
COMPOSITION_TRACE:	Zn		

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	
Sph	95.0
Cpy	
Py	1.0
Qtz	3.0

Assay	wt%
Cu	0.08
Fe	8.20
Pb	<0.01
Zn	55.51
S	31.9

Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

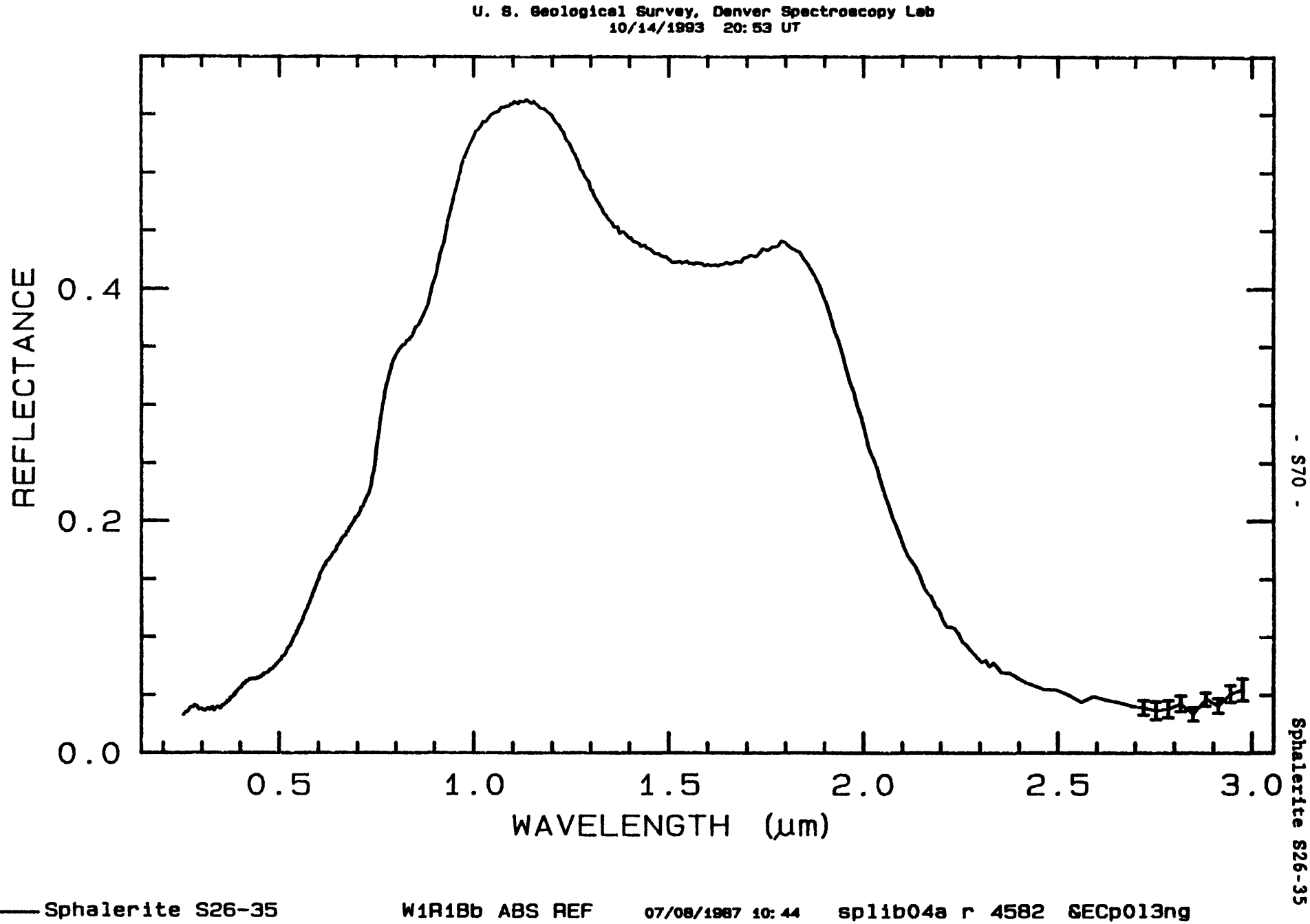
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4582	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Sphalerite S26-35
Sphalerite S26-35 W1R1Bb ABS REF 07/08/1987 10:44 splib04a r 4582 GECp013ng

TITLE: Sphene, Titanite HS189 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS189

MINERAL_TYPE: Nesosilicate

MINERAL: Titanite (Sphene)

FORMULA: CaTiSiO5

FORMULA_NROFF: $CaTiO(SiO_4)$

COLLECTION_LOCALITY: Ontario, Canada

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"N-16 Sphene 189B--Ontario. $CaTiO(SiO_4)$: Sphene is a widespread accessory mineral in igneous and metamorphic rocks. Calcium may be replaced partially by strontium and barium, or by the rare earths and thorium, the higher valencies of the latter being balanced by the entry of trivalent iron and aluminum into the titanium position. The titanium may be partially replaced by Sn, Nb and Ta, with possible compensation of Na replacing Ca. Finally, one O may be replaced by OH or F. This particular sample is a dark reddish brown, apparently due primarily to both the ferric iron and titanium, as described for rutile (see Part III, p. 204, spectrum O-15A). The presence of about 5 percent opaque magnetite lowers the overall reflectivity of this sample."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

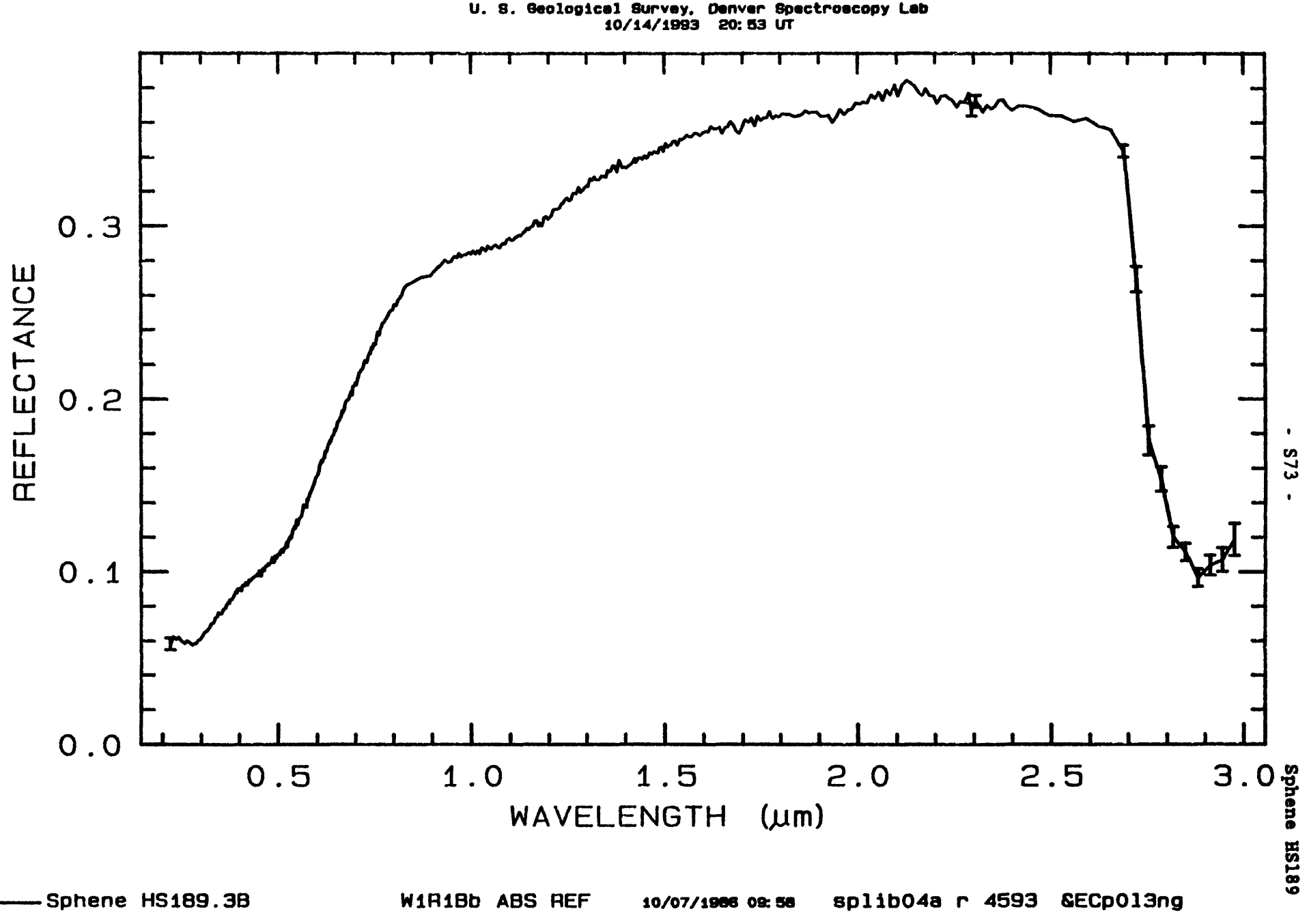
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4593	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Sphene HS189
Sphene HS189.3B
W1R1Bb ABS REF
10/07/1986 02:58
splib04a r 4593 &ECp013ng

TITLE: Spodumene HS210 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS210

MINERAL_TYPE: Inosilicate

MINERAL: Spodumene (Pyroxene group)

FORMULA: LiAlSi2O6

FORMULA_NROFF: $LiAlSi_2O_6$

COLLECTION_LOCALITY: Afghanistan

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"I-7 Spodumene 210B-Afganistan. $LiAlSi_2O_6$: Spodumene is a characteristic mineral of lithium-rich granite pegmatites. It usually does not have a wide range of composition, but this sample contains enough ferrous iron to provide the broad weak band near 1.0μ and the fall off to the blue in the visible. In addition, water bands at 1.4μ and 1.9μ are evident, and the quite sharp feature near 2.2μ is a combination band of the OH stretching mode. These bands are due to a surprising small amount of clay mineral deposited in microfractures in the spodumene."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Spodumene + quartz + trace muscovite (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

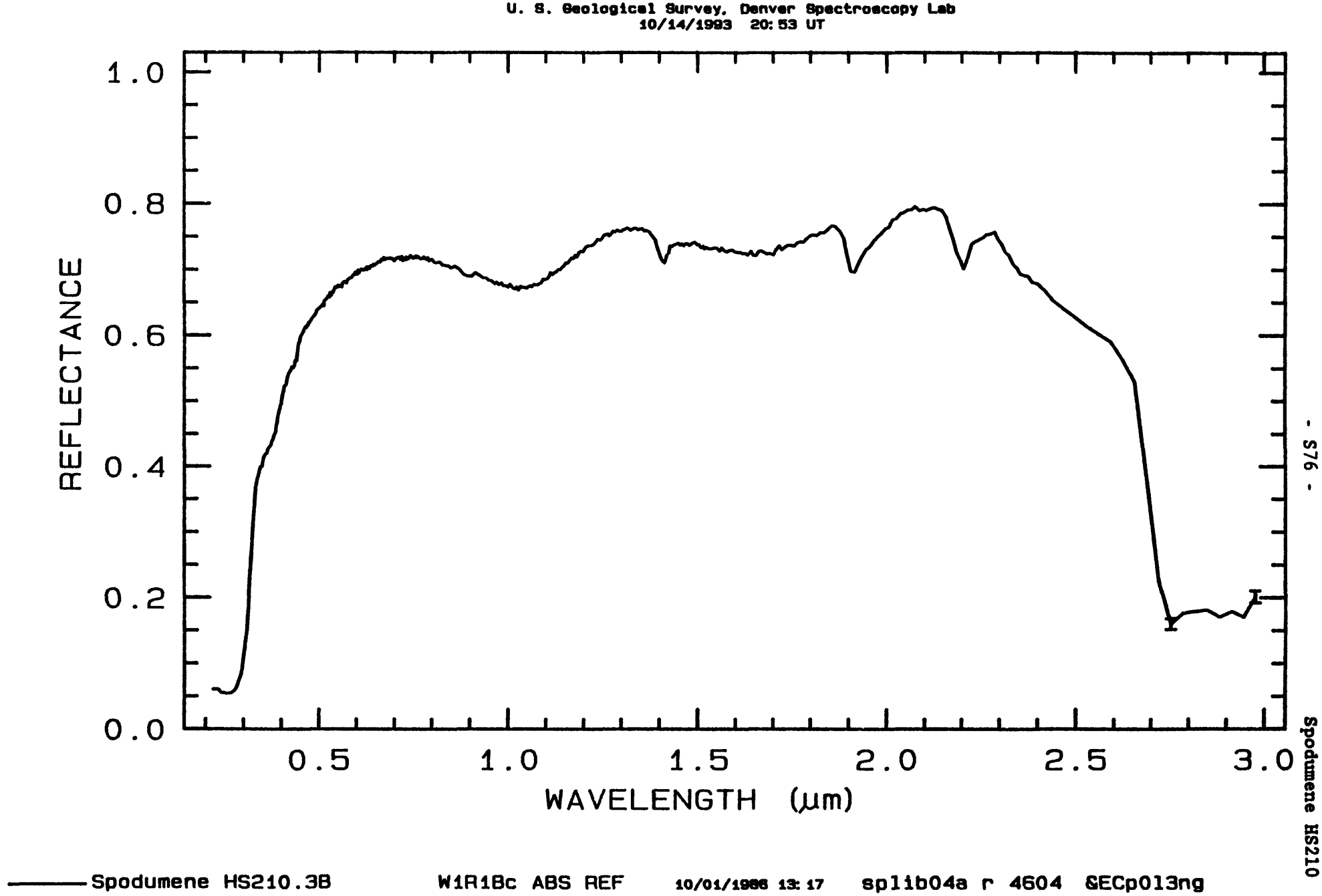
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4604	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Spodumene HS210.3B
W1R1Bc ABS REF
10/01/1986 13:17
splib04a r 4604 &ECp013ng
Spodumene HS210

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	37.19	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.03	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	63.62	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	0.26	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.01	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.06	wt%	NROFF: MgO
COMPOSITION:	CaO:	0.02	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.02	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.01	wt%	NROFF: K_2O
COMPOSITION:	----------			
COMPOSITION:	Total:	101.22	wt%	
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S
COMPOSITION:	New Total:		wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

"Microprobe analysis shows the sample to be homogeneous within and between grains. Average of 10 analyses, indicating close to end member composition."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

av gr sz = 245μm

Mixed pink & clear grains, mostly chonchoidal fracture, some cleavage planes, length fast, high relief, moderate 2V, biaxial (-), pink pleochroism. All this is consistent with andalusite. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	345	0.2-3.0μm	200	g.s.= 245 μm

TITLE: Staurolite HS188 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS188

MINERAL_TYPE: Nesosilicate

MINERAL: Staurolite

FORMULA: Fe(+2)2Al9O6(SiO4)4(O,OH)2

FORMULA_NROFF: $Fe_2^{+2}Al_9O_6(SiO_4)_4(O,OH)_2$

COLLECTION_LOCALITY: Fannin County, Georgia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

N-14 Staurolite 188B--Fannin Co., Georgia. $(Fe^{2+}, Mg)_2(Al, Fe^{3+})_9O_6(SiO_4)_4(O, OH)_2$: Staurolite, like kyanite and sillimanite is a typical mineral found in medium grade metamorphosed argillaceous rocks. It is produced at a lower temperature-pressure than is kyanite. This spectrum shows strong general absorption to both long and short wavelengths which produces an apparent reflectivity maximum near 1.05 μ. The fall off to longer wavelengths must be due to generalized hydroxyl and water absorptions and is quite similar in appearance to the spectrum of diaspore (see Part III, p. 200, spectrum (-6). The fall off in the visible must be due to absorptions by ferrous and ferric iron.

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

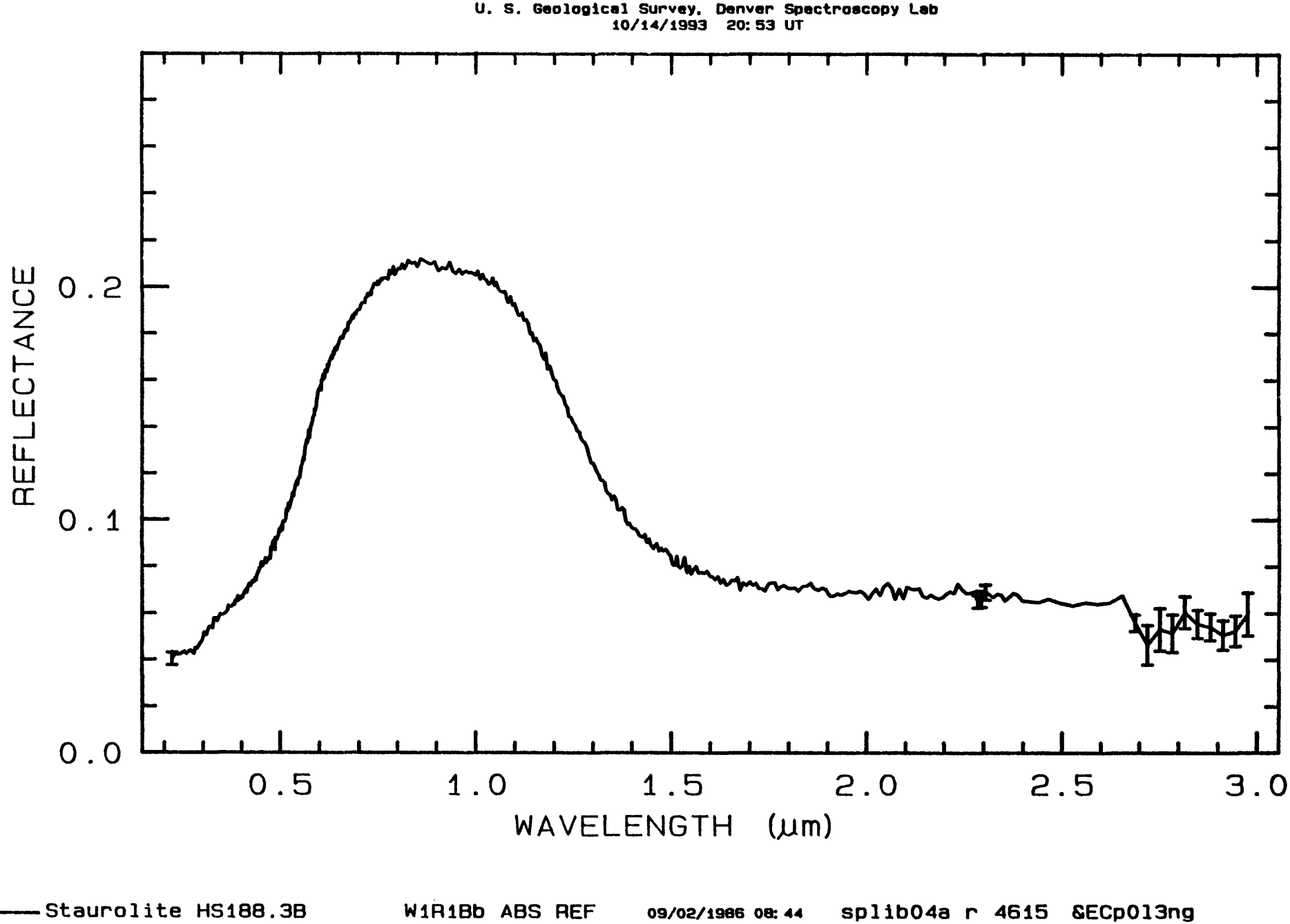
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4615	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Staurolite HS188
Staurolite HS188.3B W1R1Bb ABS REF 09/02/1986 08:44 splib04a r 4615 &ECp013ng

TITLE: Stilbite GDS8 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS8

MINERAL_TYPE: Tectosilicate

MINERAL: Stilbite (Zeolite group)

FORMULA: NaCa2Al5Si13O36*14H2O

FORMULA_NROFF: $NaCa_2Al_5Si_{13}O_{36} \bullet 14H_2O$

COLLECTION_LOCALITY: Nasik, India

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample appears white and to be spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Primarily a zeolite of the heulandite group - best match is stellerite, but this isn't definitive

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

Stilbite is also a member of the heulandite group.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

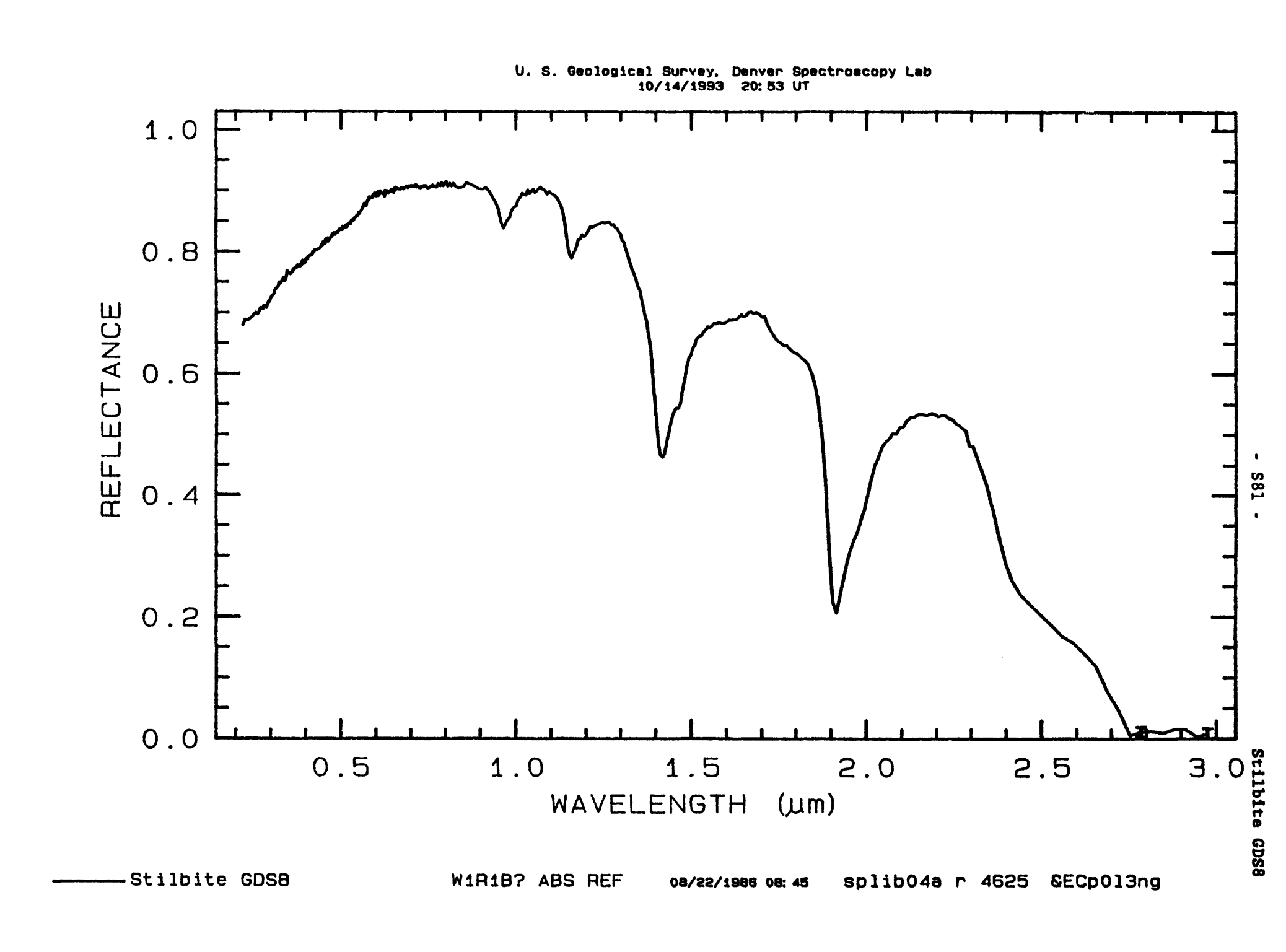
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 4625	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 581 -
Stilbite GDS8
Stilbite GDS8
W1R1B? ABS REF
08/22/1986 08:45
splib04a r 4625 &ECp013ng

TITLE: Stilbite HS482 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS482

MINERAL_TYPE: Tectosilicate

MINERAL: Stilbite (Zeolite Group)

FORMULA: NaCa2Al5Si13O36*14H2O

FORMULA_NROFF: $NaCa_2Al_5Si_{13}O_{36} \bullet 14H_2O$

COLLECTION_LOCALITY: Nova Scotia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

With the note: "The major water features occur at 0.985, 1.17, 1.44, 1.92μm and the bands are generally broad and not well resolved. The reflectivities for sizes I through IV are 98, 91, 79, and 62% at 1.1μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

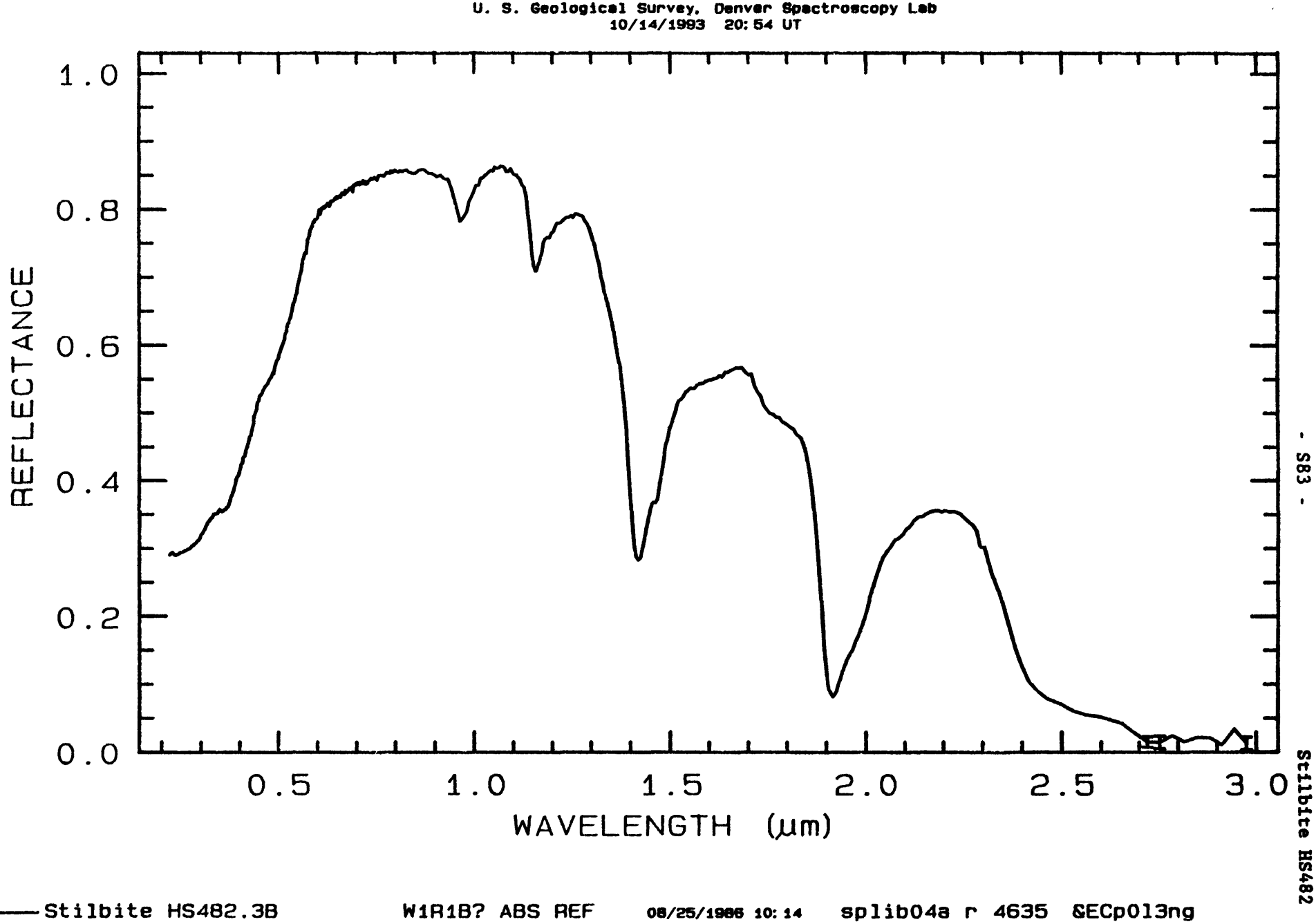
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4635	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:54 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- S83 -
Stilbite HS482
Stilbite HS482.3B
W1R1B? ABS REF
08/25/1986 10:14
splib04a r 4635 &ECp013ng

TITLE: Strontianite HS272 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS272

MINERAL_TYPE: Carbonate

MINERAL: Strontianite (Aragonite group)

FORMULA: SrCO3

FORMULA_NROFF: $SrCO_3$

COLLECTION_LOCALITY: Germany

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

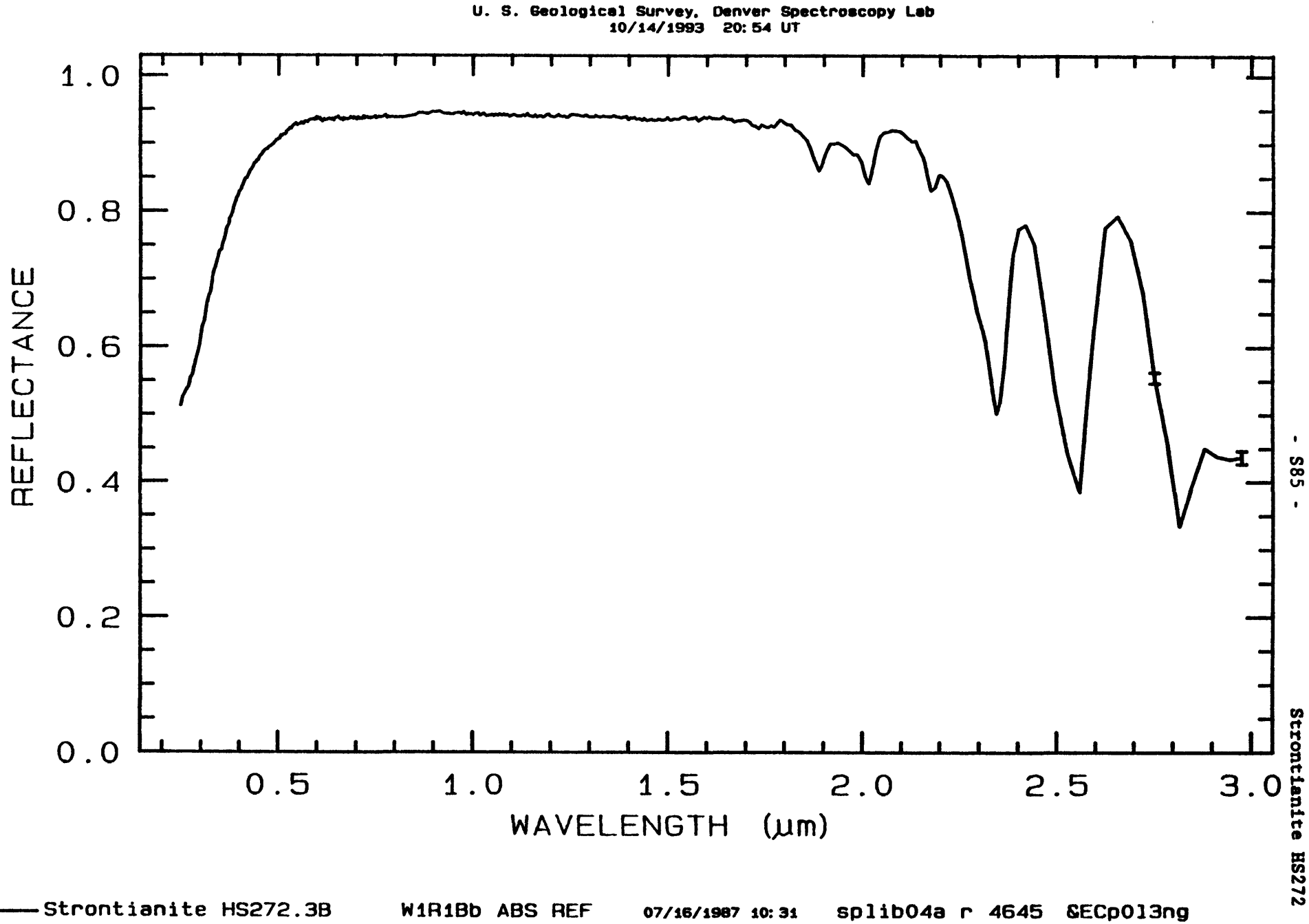
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4645	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:54 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- S85 -
Strontianite HS272
Strontianite HS272.3B W1R1Bb ABS REF 07/16/1987 10:31 splib04a r 4645 &ECp013ng

TITLE: Sulfur GDS94 DESCRIPT

DOCUMENTATION_FORMAT: ELEMENT

SAMPLE_ID: GDS94

MINERAL_TYPE: Element

MINERAL: Sulfur

FORMULA: S

FORMULA_NROFF: S

COLLECTION_LOCALITY: Reagent grade

ORIGINAL_DONOR:

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Reagent grade sulfur.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:         S:  100.0  wt%    NROFF: S
COMPOSITION:  volatile:         wt%    NROFF: volatile
COMPOSITION:   unknown:         wt%    NROFF: unknown
COMPOSITION: ----------------------
COMPOSITION:     Total:  100.0  wt%
```

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

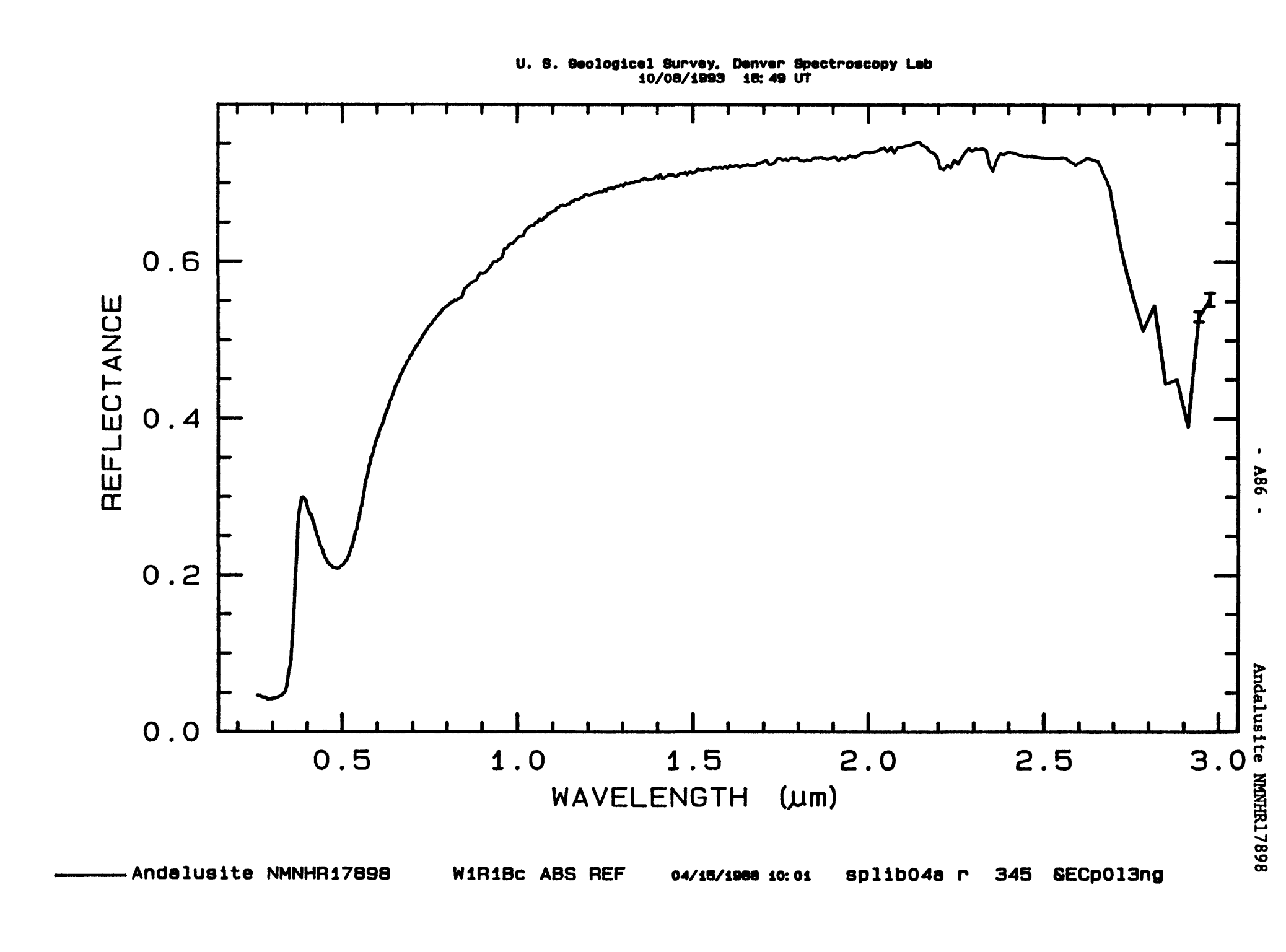
MICROSCOPIC_EXAMINATION:

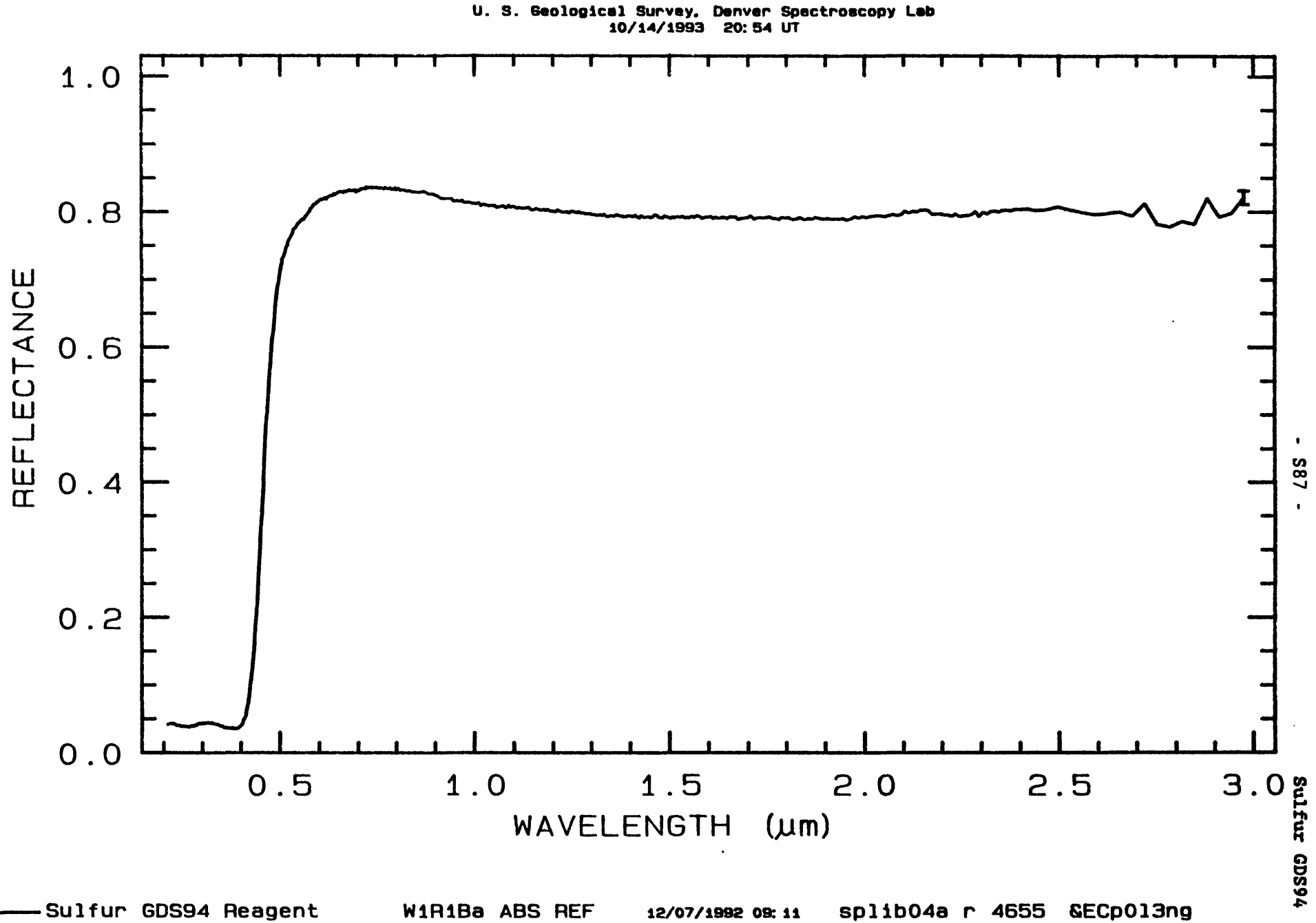
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 4655 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 15:49 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A86 -
Andalusite NMNHR17898
Andalusite NMNHR17898 W1R1Bc ABS REF 04/15/1988 10:01 splib04a r 345 SECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:54 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Sulfur GDS94 Reagent W1R1Ba ABS REF 12/07/1992 09:11 splib04a r 4655 &ECp013ng
Sulfur GDS94

TITLE: Syngenite GDS139 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS139

MINERAL_TYPE: Hydrous Sulfate

MINERAL: Syngenite

FORMULA: K2Ca(SO4)2*H2O

FORMULA_NROFF: $K_2Ca(SO_4)_2 \bullet H_2O$

COLLECTION_LOCALITY: X-rayed (Synthetic)

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

evaporation of K_2SO_4 + $CaSO_4$ solution at room temperature

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure syngenite. (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

evaporation of K_2SO_4 + $CaSO_4$ solution at room temperature

END_COMPOSITION_DISCUSSION.

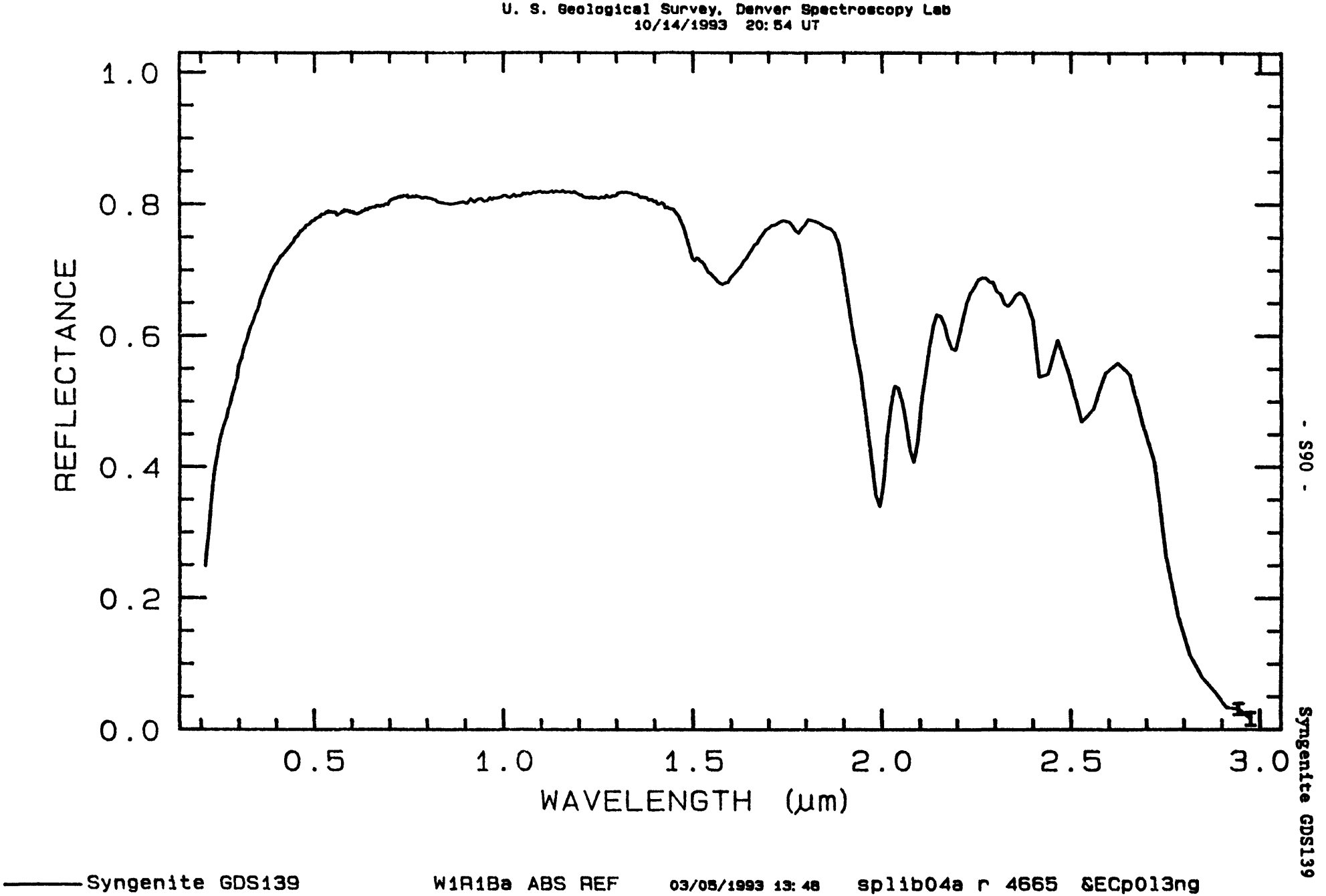
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 4665 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 20:54 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 590 -
Syngenite GDS139
Syngenite GDS139
W1R1Ba ABS REF
03/05/1993 13:48
splib04a r 4665 &ECp013ng

TITLE: Talc GDS23 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS23

MINERAL_TYPE: Phyllosilicate

MINERAL: Talc

FORMULA: Mg3Si4O10(OH)2

FORMULA_NROFF: $Mg_3Si_4O_{10}(OH)_2$

COLLECTION_LOCALITY: Feiser Mine, Ruby Mountains, Montana

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Petrographic examination: Hand sample is massive, fine-grained and slightly greenish in color. Under microscope, sample is cryptocrystalline."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure talc.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

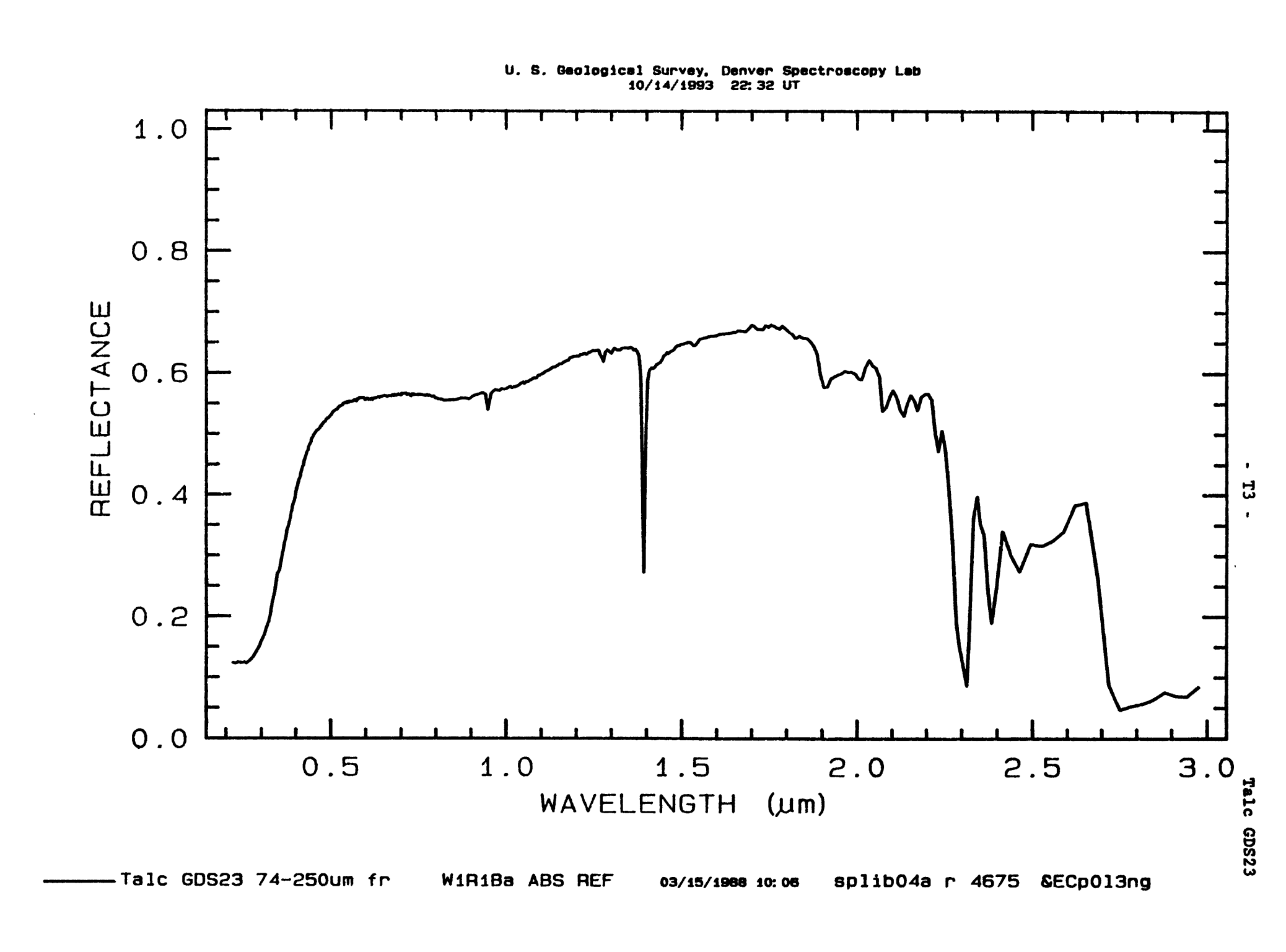
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4675	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 13 -
Talc GDS23
Talc GDS23 74-250um fr W1R1Ba ABS REF 03/15/1988 10:06 splib04a r 4675 &ECp013ng

TITLE: Talc HS21 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS21

MINERAL_TYPE: Phyllosilicate

MINERAL: Talc

FORMULA: Mg3Si4O10(OH)2

FORMULA_NROFF: $Mg_3Si_4O_{10}(OH)_2$

COLLECTION_LOCALITY: Swain County, North Carolina

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"S-20. Talc. Swain Co., N.C. (21B). Talc is a hydrous magnesium silicate, essentially $Mg_3Si_4O_{10}(OH)_2$, of secondary origin. It may be found in altered igneous rocks, but is more typical of metamorphic varieties. It is formed by alteration of magnesian silicates such as olivine, pyroxenes and amphiboles. Talc may bear a little iron, aluminum or nickel, and ferrous ion in this talc probably accounts for the iron bands on either side of 1μ. The sample appears uncontaminated by unaltered pyroxene, which might otherwise contribute these bands. Hydroxyl bands are particularly strong and sharp in this sample, which displays them near 1.4μ and 2 to 2.6 μ. The extremely sharp, but weak feature at 0.95μ must also be due to OH."

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Talc + med. amount chlorite; M: ~2% chlorite, <<2% magnetite (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM (WSA) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	60.47	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.04	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	0.12	wt%	NROFF: Al_2O_3
COMPOSITION:	Fe2O3:	0.87	wt%	NROFF: Fe_2O_3
COMPOSITION:	FeO:	0.10	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.01	wt%	NROFF: MnO
COMPOSITION:	MgO:	30.29	wt%	NROFF: MgO
COMPOSITION:	ZnO:	0.00	wt%	NROFF: ZnO
COMPOSITION:	BaO:	0.01	wt%	NROFF: BaO
COMPOSITION:	CaO:	0.05	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.04	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.00	wt%	NROFF: K_2O
COMPOSITION:	P2O5:	0.27	wt%	NROFF: P_2O_5
COMPOSITION:	Cl:	0.01	wt%	NROFF: Cl
COMPOSITION:	F:	0.51	wt%	NROFF: F
COMPOSITION:	LOI:	5.31	wt%	NROFF: LOI
COMPOSITION:	---	---		
COMPOSITION:	Total:	92.31	wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Because of variability in the analyses, most Fe is probably Fe^{+2}. Average of 6 point analysis.

NOTE: Conversion of Fe_2O_3 to FeO. This sample has too much chlorite. Therefore, Fe ratios are unusable.

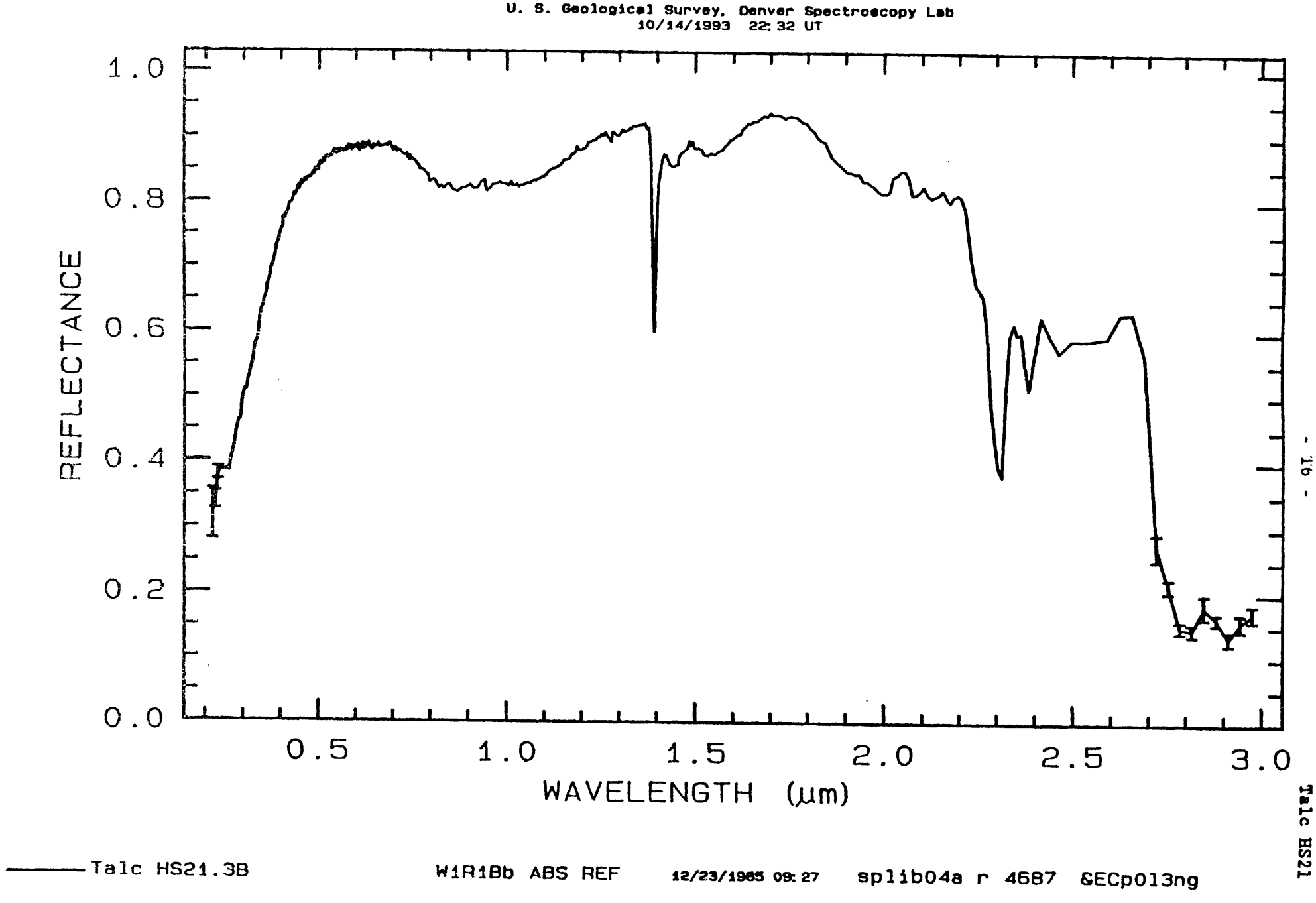
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4687	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Talc HS21.3B
W1R1Bb ABS REF
12/23/1985 09:27
splib04a r 4687 &ECp013ng
Talc HS21

TITLE: Andesine HS142 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS142

MINERAL_TYPE: Tectosilicate

MINERAL: Andesine (Plagioclase)(Feldspar group)

FORMULA: (Na,Ca)Al(Al,Si)Si2O8

FORMULA_NROFF: $(Na,Ca)Al(Al,Si)Si_2O_8$

COLLECTION_LOCALITY: Montana

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Andesine is a plagioclase feldspar series mineral whose end members are albite (Na) and anorthite (Ca). Andesine falls into the 30-50% anorthite category in this series.

This sample is a mixture of different phases and was labeled andesine porphyry. The mineral mode confirms this. Average grain size is 40um. This sample could benefit from magnetic separation.

74-250μm sieve interval.

The spectrum indicates a weak absorption band near 2.2-2.3 μm, apparently due to trace alteration not detected by other methods. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No compositional analyses available

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

TITLE: Talc WS659 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS659

MINERAL_TYPE: Phyllosilicate

MINERAL: Talc

FORMULA: Mg3Si4O10(OH)2

FORMULA_NROFF: $Mg_3Si_4O_{10}(OH)_2$

COLLECTION_LOCALITY: Fowler, New York

ORIGINAL_DONOR: Ward Natural Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM (WSA) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	58.38	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.03	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.18	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.22	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.56	wt%	NROFF:	MnO
COMPOSITION:	MgO:	31.90	wt%	NROFF:	MgO
COMPOSITION:	ZnO:	0.03	wt%	NROFF:	ZnO
COMPOSITION:	BaO:	0.00	wt%	NROFF:	BaO
COMPOSITION:	CaO:	0.65	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.17	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.01	wt%	NROFF:	K_2O
COMPOSITION:	Cl:	0.01	wt%	NROFF:	Cl
COMPOSITION:	F:	0.25	wt%	NROFF:	F
COMPOSITION:	---	---			
COMPOSITION:	Total:	92.29	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Tom's Fe^{+2} Fe^{+3} program made all Fe as Fe^{+3} unlikely for talcs. That option was ignored for this sample. Average of six point analysis.

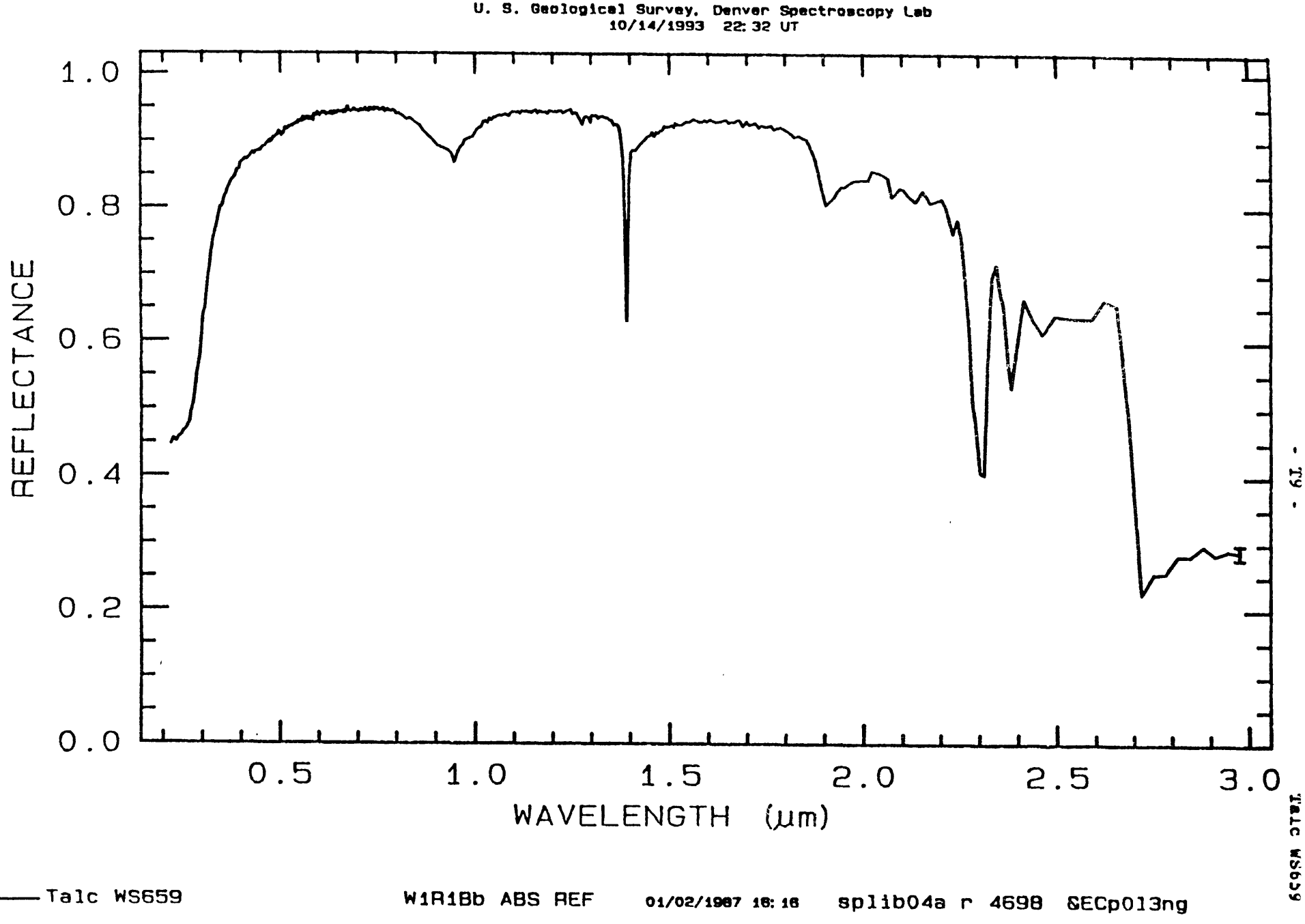
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 4698	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Talc WS659
W1R1Bb ABS REF 01/02/1987 16:16 splib04a r 4698 &ECp013ng

TITLE: Talc TL2702 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: TL2702

MINERAL_TYPE: Phyllosilicate

MINERAL: Talc

FORMULA: Mg3Si4O10(OH)2

FORMULA_NROFF: $Mg_3Si_4O_{10}(OH)_2$

COLLECTION_LOCALITY: Colorado

ORIGINAL_DONOR: Colorado School of Mines

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure (?).

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:
mode 1: 550 μm @ 90 vol%
mode 2: 15 μm @ 10 vol%

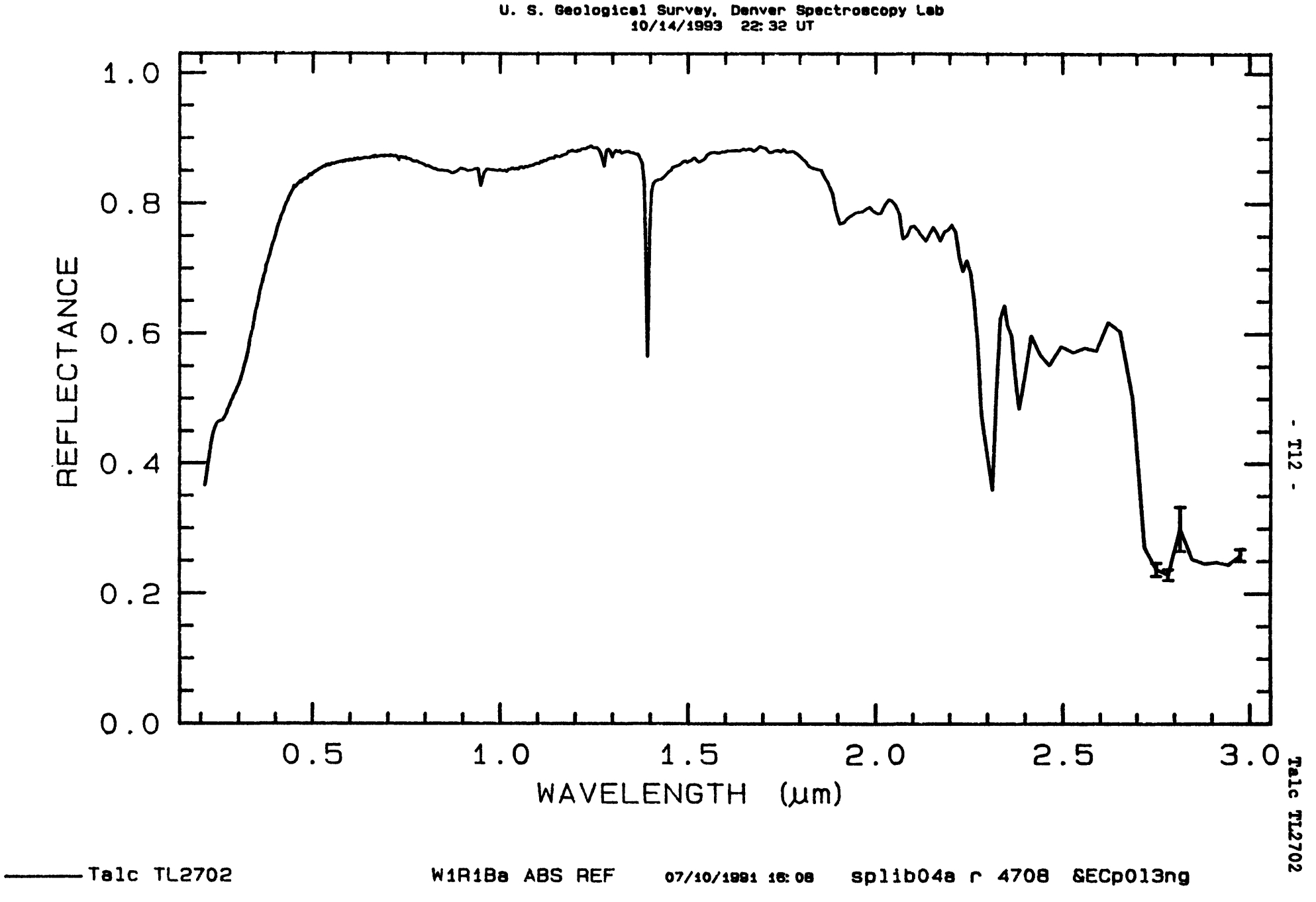
avg gr sz = 522 μm

Mottled extinction, very soft, no visible impurities, all consistent with this sample being talc. Smaller grains coat 30% surface of larger grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 4708	0.2-3.0μm	200	g.s.= 520 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- Tl2 -
Talc TL2702
Talc TL2702
W1R1Ba ABS REF
07/10/1991 16:08
splib04a r 4708 &ECp013ng

TITLE: Teepleite+Trona NMNH102798 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH102798

MINERAL_TYPE: Hydrous Borate

MINERAL: Teepleite

FORMULA: Na2(BO2)Cl*2H2O

FORMULA_NROFF: $Na_2(BO_2)Cl \bullet 2H_2O$

COLLECTION_LOCALITY: Borax Lake, California

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Teepleite, sample contains moderate amount of trona. (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Trona also present as contaminant

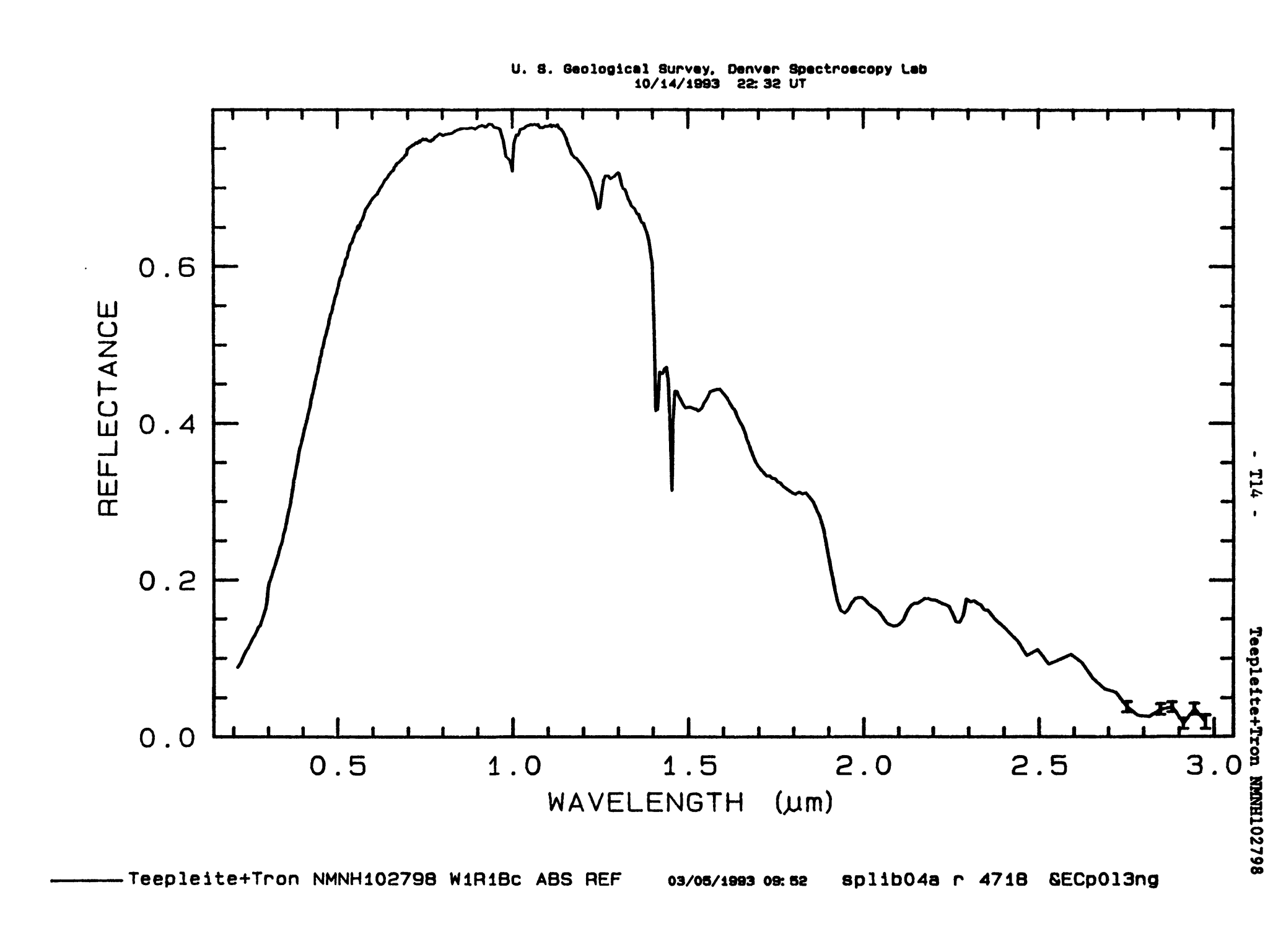
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4718	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T14 -
Teepleite+Tron NMNH102798
Teepleite+Tron NMNH102798 W1R1Bc ABS REF 03/05/1993 09:52 splib04a r 4718 &ECp013ng

TITLE: Tephroite HS419 Olivine DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS419

MINERAL_TYPE: Nesosilicate

MINERAL: Tephroite (Olivine group)

FORMULA: Mn2Si04

FORMULA_NROFF: Mn_2SiO_4

COLLECTION_LOCALITY: Japan

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Fayalite.

"N-5 Tephroite 419B--Japan: Ostensibly a manganese silicate, $Mn_2[SiO_4]$, tephroite typically contains up to 10 percent iron. This sample is also contaminated with magnetite, which lowers its overall reflectivity. The manganese ion produces distinctive bands at 0.37, 0.415, 0.45, and 0.55 μ, which are subdued by the presence of the opaque magnetite, but are faintly discernible in the IV size range. The broad band near 1.0 μ, which continues out to near 1.7 μ, is due to the ferrous ion in substitution for Mn^{2+}; (see rhodochrosite, Part II, p. 28, spectrum C-6 for typical manganese-iron, p. 28, spectrum C-6 for typical manganese-iron spectra). The combination of the manganese and iron absorptions results in a well-defined reflectivity maximum near 0.73 μ."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4729	0.2-3.0μm	200	g.s.=

Optical examination gives the following mineral mode:

66 vol% andesine
25 vol% quartz
8 vol% altered andesine (Fe-stained)
1 vol% hornblend

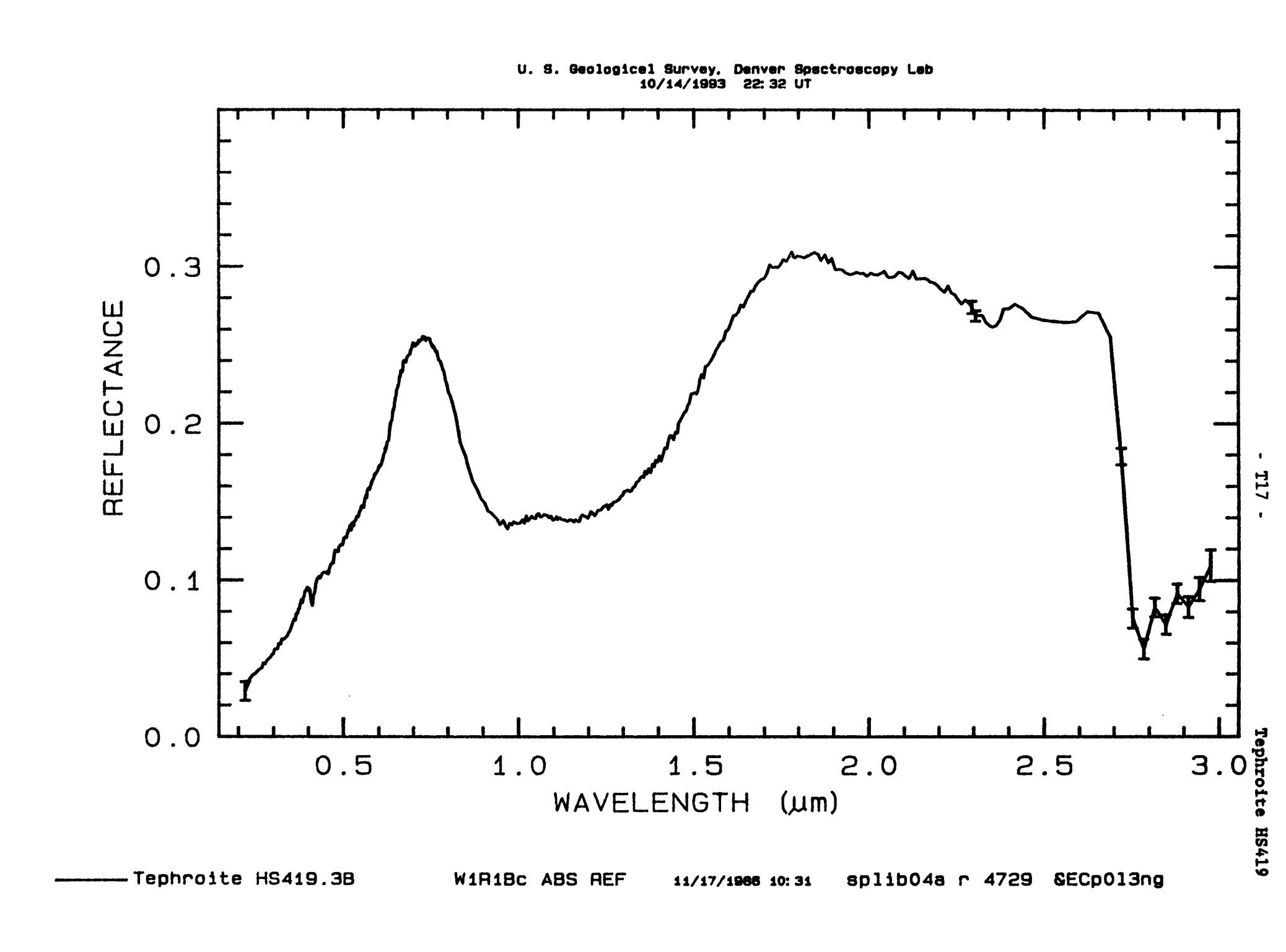
av gr sz plag = 290μm
av gr sz qtz = 270μm
av gr sz populations = 285μm

This sample is a mixture of different phases and was labeled andesine porphyry. The mineral mode confirms this. This sample could benefit from magnetic separation. Plagioclase has low relief and synthetic twining. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 356	0.2-3.0μm	200	g.s.= 285 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Tephroite HS419.3B W1R1Bc ABS REF 11/17/1986 10:31 splib04a r 4729 &ECp013ng
Tephroite HS419

TITLE: Thenardite GDS146 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS146

MINERAL_TYPE: Sulfate

MINERAL: Thenardite

FORMULA: Na2SO4

FORMULA_NROFF: Na_2SO_4

COLLECTION_LOCALITY: Saline Valley, California

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Presence of features at 1.5 and 2.1 μm indicates the contamination of this sample. Ideally thenardite Na2SO4 should be anhydrous. The spectral features at these positions may be due to different mineral phases or partial hydration of this sample. G. Swayze.

END_COMPOSITION_DISCUSSION.

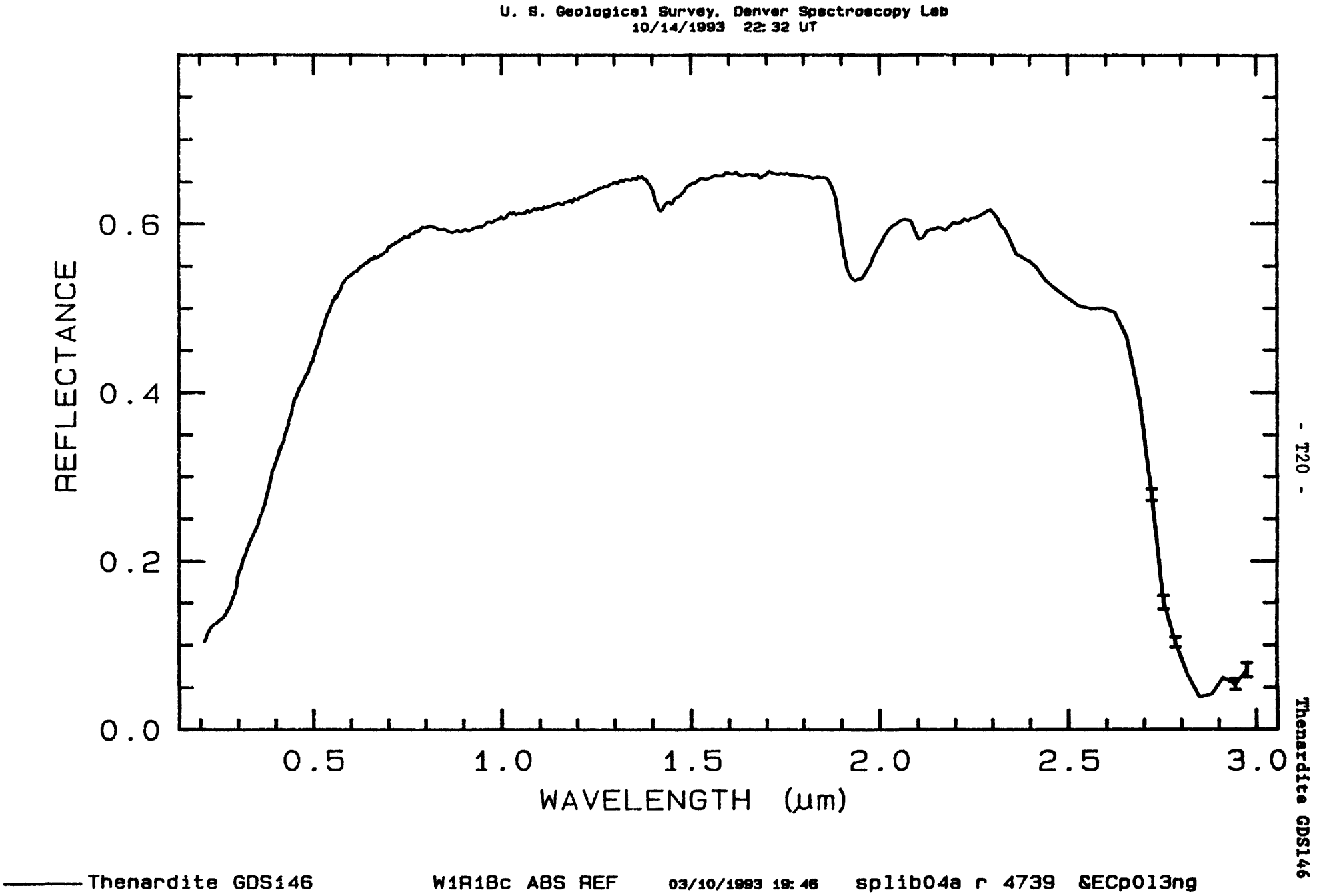
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 4739 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T20 -
Thenardite GDS146
Thenardite GDS146 W1R1Bc ABS REF 03/10/1993 19:46 splib04a r 4739 &ECp013ng

TITLE: Thenardite HS450 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS450

MINERAL_TYPE: Sulfate

MINERAL: Thenardite

FORMULA: Na2SO4

FORMULA_NROFF: Na_2SO_4

COLLECTION_LOCALITY: Camp Verde, California

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"This sample is transparent in hand specimen and appears unusually pure."

Hunt, G.R., Salisbury, J.W., and Lenhoff, C.J., 1971, Visible and Near-Infrared spectra of minerals and rocks: IV. Sulphides and Sulphates: Modern Geology, V. 3, p 1-14.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

40 kV - 30 mA, 6.5-9.5 keV
Reference : JCPDS #5-631
Found: Thenardite
Comment: One phase observed in routine work. Sharp peaks indicate good crystallinity and compositional homogeneity. A great match with the JCPDS pattern.

J.S. Huebner and J. Pickrell, unpublished data, written communication, USGS, Reston, VA (1993)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

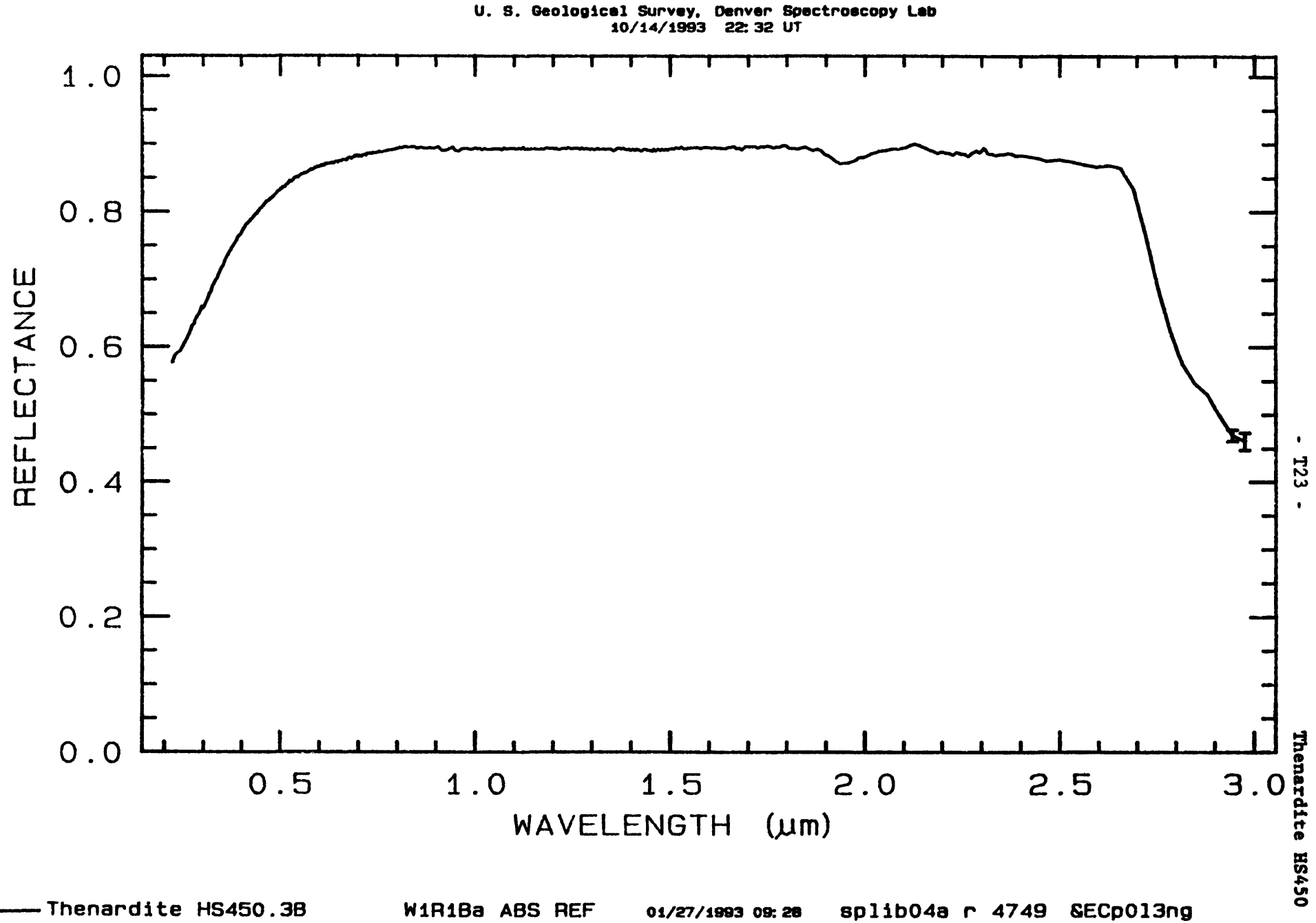
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4749	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T23 -
Thenardite HS450
Thenardite HS450.3B
W1R1Ba ABS REF
01/27/1993 09:28
splib04a r 4749 &ECp013ng

TITLE: Thuringite SMR-15 Chlorite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SMR-15

MINERAL_TYPE: Phyllosilicate

MINERAL: Thuringite (Chlorite Group)

FORMULA: (Mg,Fe)3(Si,Al)4O10(OH)2-(Mg,Fe)3(OH)6

FORMULA_NROFF: $(Mg,Fe)_3(Si,Al)_4O_{10}(OH)_2$-$(Mg,Fe)_3(OH)_6$

COLLECTION_LOCALITY: unknown

ORIGINAL_DONOR: Gene Whitney, USGS, Denver

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample was ground in an alumina mortar and pestle and wet sieved with methanol into <30μm, 30-45μm, 60-104μm, and 104-150μm size fractions.

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sample is representative of its structural classification. (King and Clark, 1989).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	24.70 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.69 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3	21.10 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	37.50 wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	0.72 wt%	NROFF:	MnO
COMPOSITION:	MgO:	16.80 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.40 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.32 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.03 wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.30 wt%	NROFF:	P_2O_5
COMPOSITION:	LOI:	7.50 wt%	NROFF:	LOI
COMPOSITION:	---	---		
COMPOSITION:	Total:	101.00 wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Compositional data provided by Gene Whitney, USGS, Denver, CO

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_COMPOSITION_DISCUSSION.

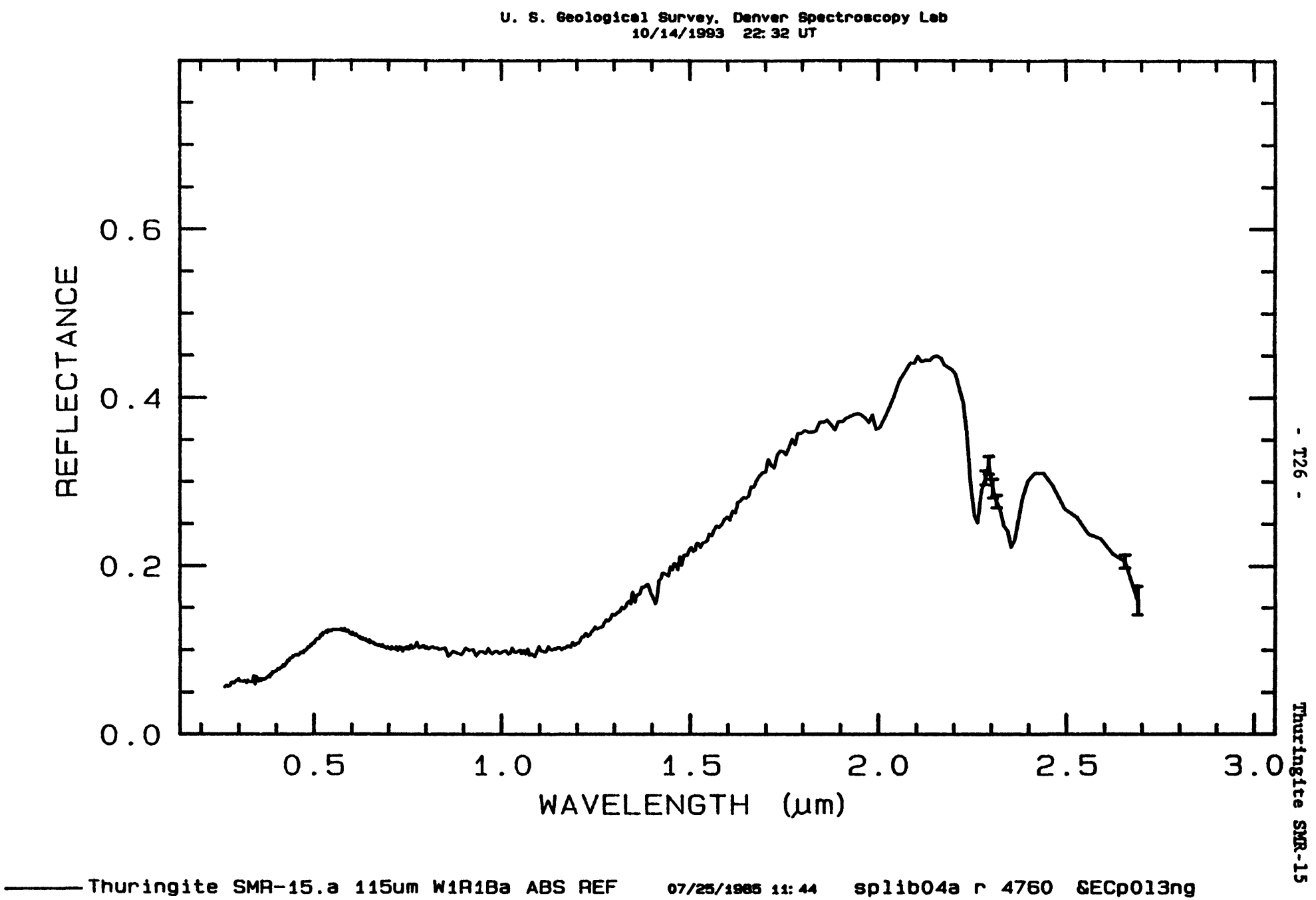
MICROSCOPIC_EXAMINATION:

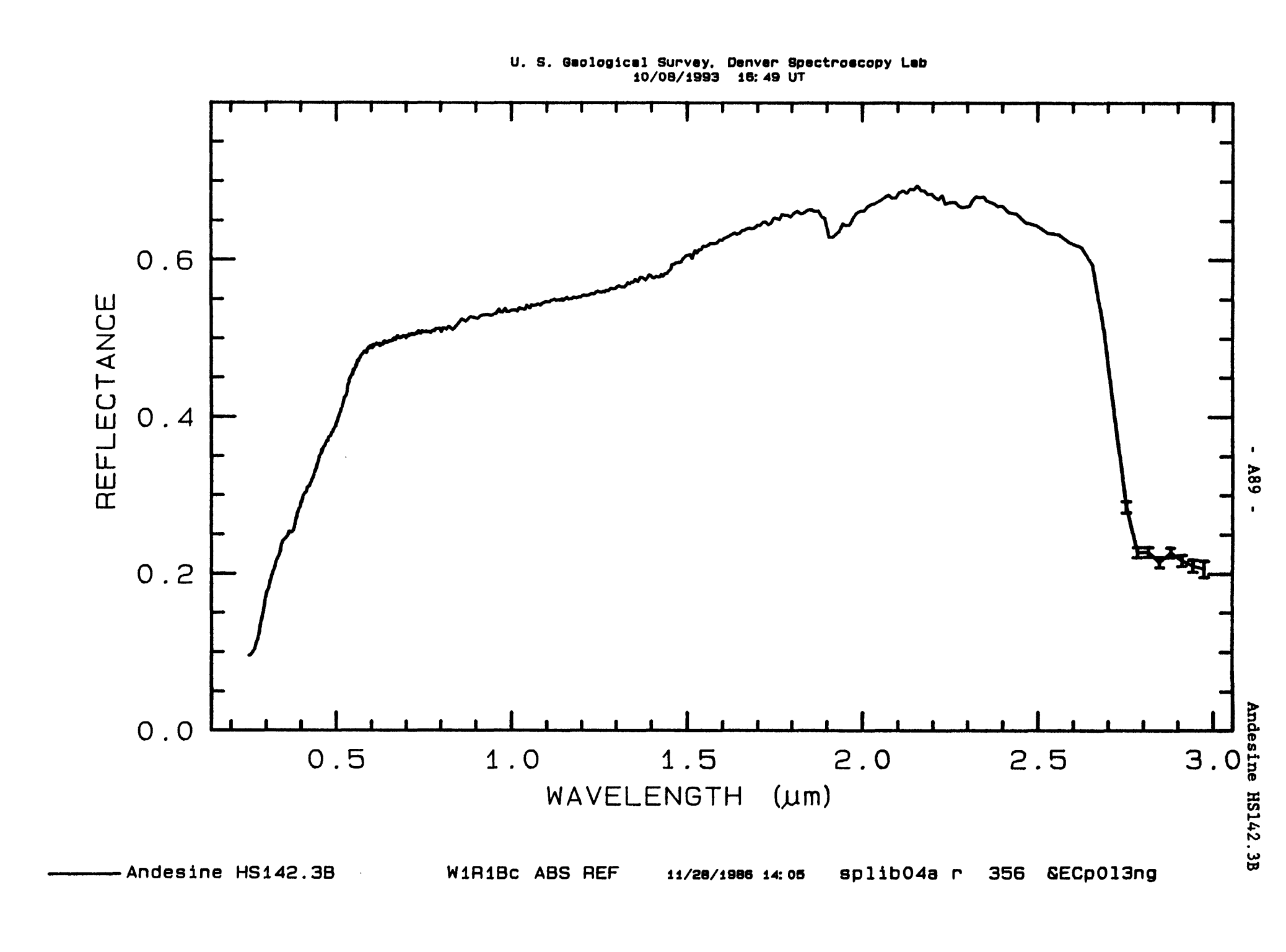
Microscopically this appears to be pure thuringite. All size fractions were examined visually and by energy dispersive methods to ensure chemical homogenity as a function of grain size interval.

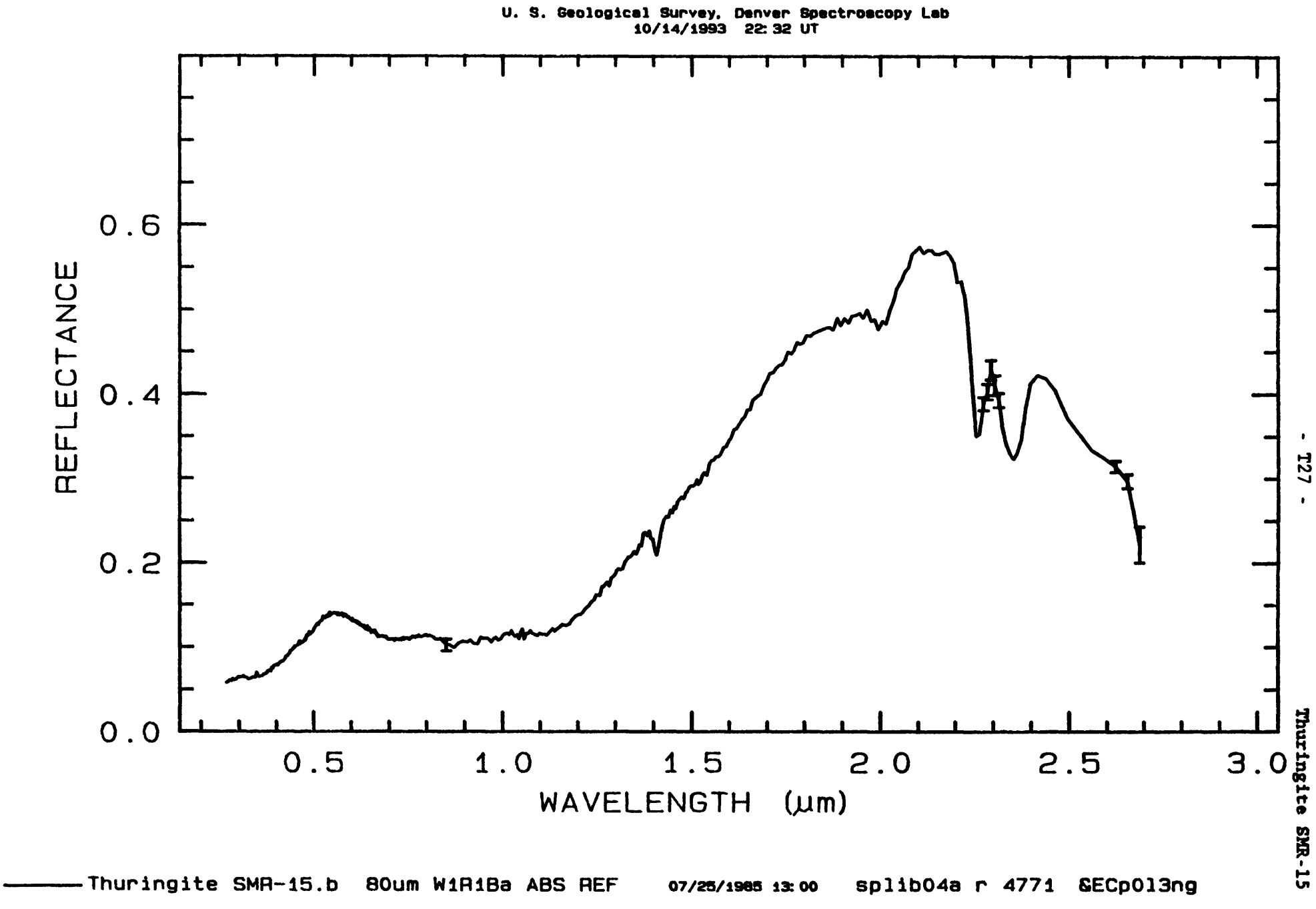
END_MICROSCOPIC_EXAMINATION.

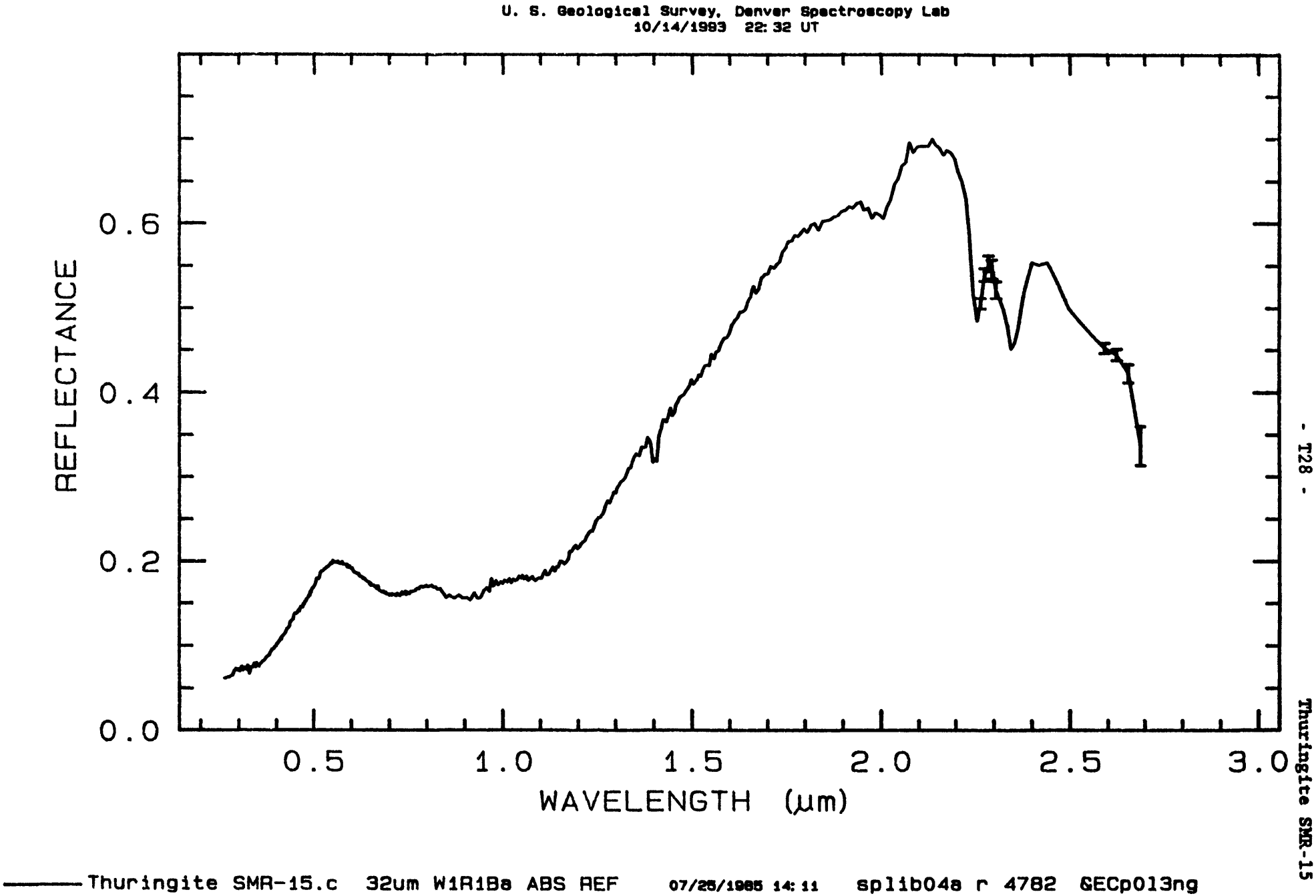
DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4760	0.2-2.7μm	200	g.s.=115μm
LIB_SPECTRA:	splib04a r 4771	0.2-2.7μm	200	g.s.=80μm
LIB_SPECTRA:	splib04a r 4782	0.2-2.7μm	200	g.s.=32μm
LIB_SPECTRA:	splib04a r 4793	0.2-2.7μm	200	g.s.=15μm

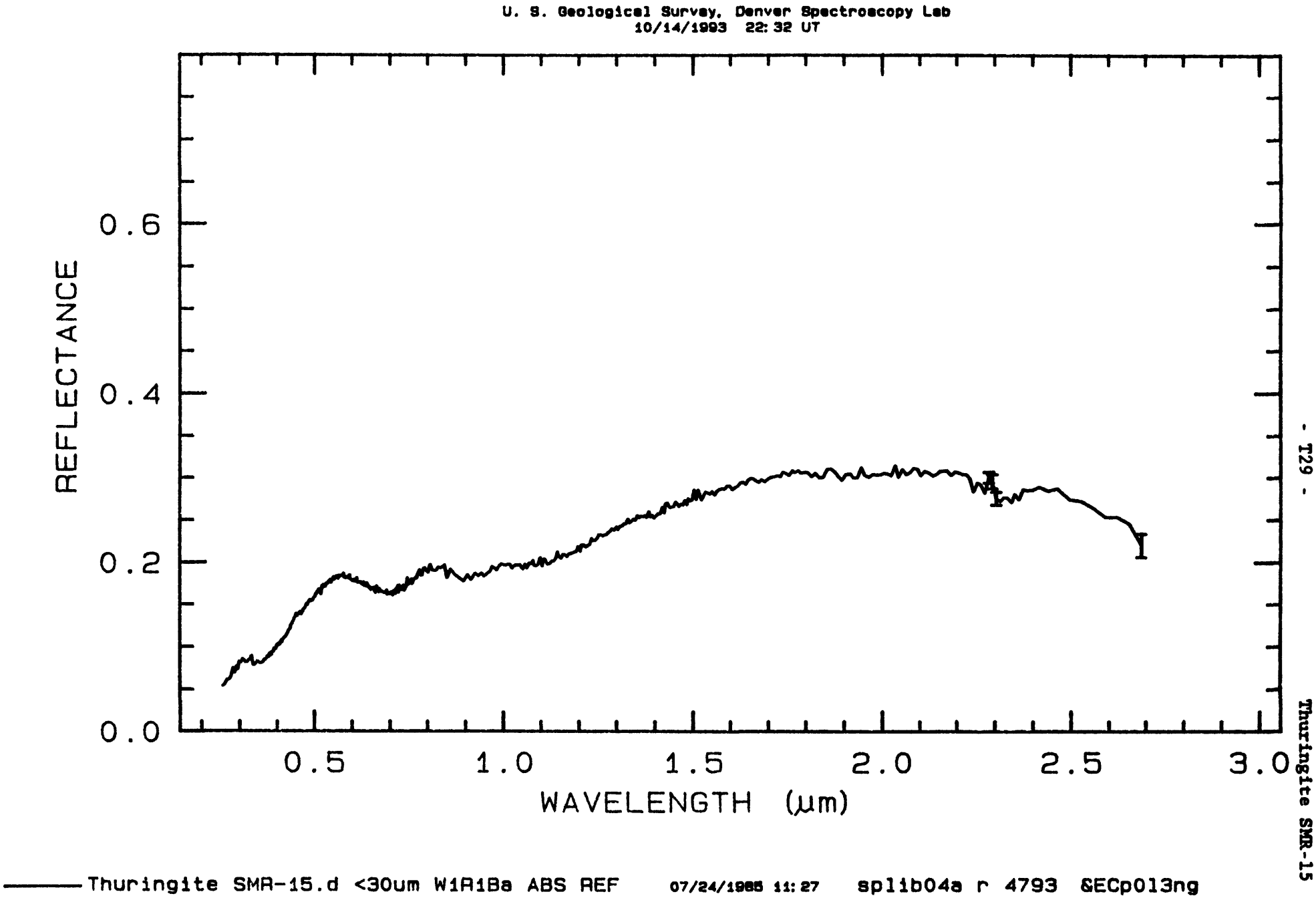

U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Thuringite SMR-15.a 115um W1R1Ba ABS REF 07/25/1985 11:44 splib04a r 4760 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A89 -
Andesine HS142.3B
Andesine HS142.3B W1R1Bc ABS REF 11/28/1986 14:05 splib04a r 356 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Thuringite SMR-15
Thuringite SMR-15.b 80um W1R1Ba ABS REF 07/25/1985 13:00 splib04a r 4771 &ECp013ng



Thuringite SMR-15



Thuringite SMR-15

TITLE: Tincalconite GDS142 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS142

MINERAL_TYPE: Hydrous Borate

MINERAL: Tincalconite

FORMULA: Na2B4O7*5H2O

FORMULA_NROFF: $Na_2B_4O_7 \bullet 5H_2O$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

"Twenty Mule Team" commercial borax

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None done on this sample after dehydration.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

"Twenty Mule Team" commercial borax. Sample appears to be dehydrated borax which is Tincalconite.

END_COMPOSITION_DISCUSSION.

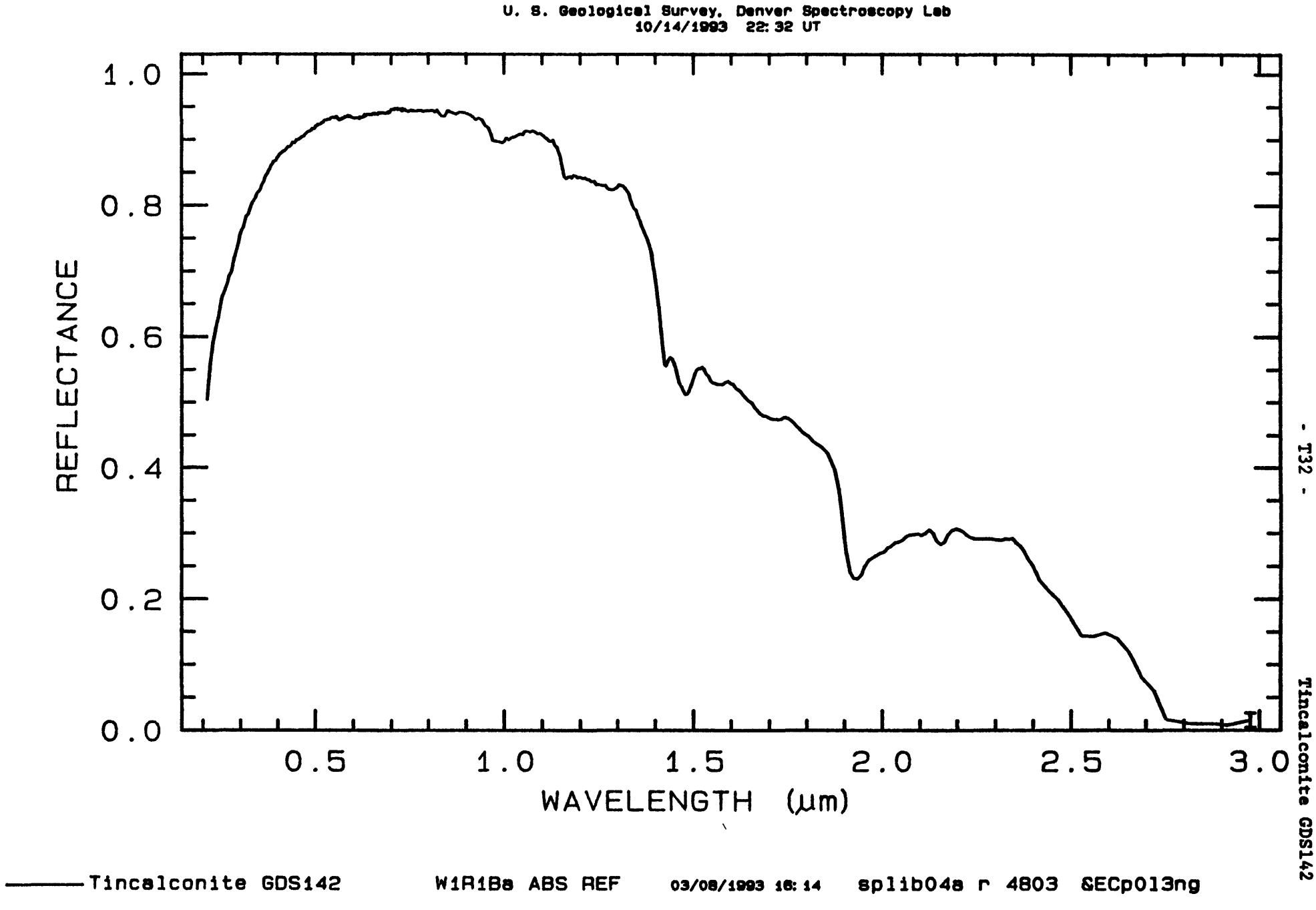
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 4803 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T32 -
Tincalconite GDS142
Tincalconite GDS142 W1R1B8 ABS REF 03/08/1993 16:14 splib04a r 4803 &ECp013ng

TITLE: Topaz Wigwam_Area_A_#10 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Wigwam_Area_A_#10

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Wigwam Creek, Colorado, Area A

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.01, H_2O^+= 0.26

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

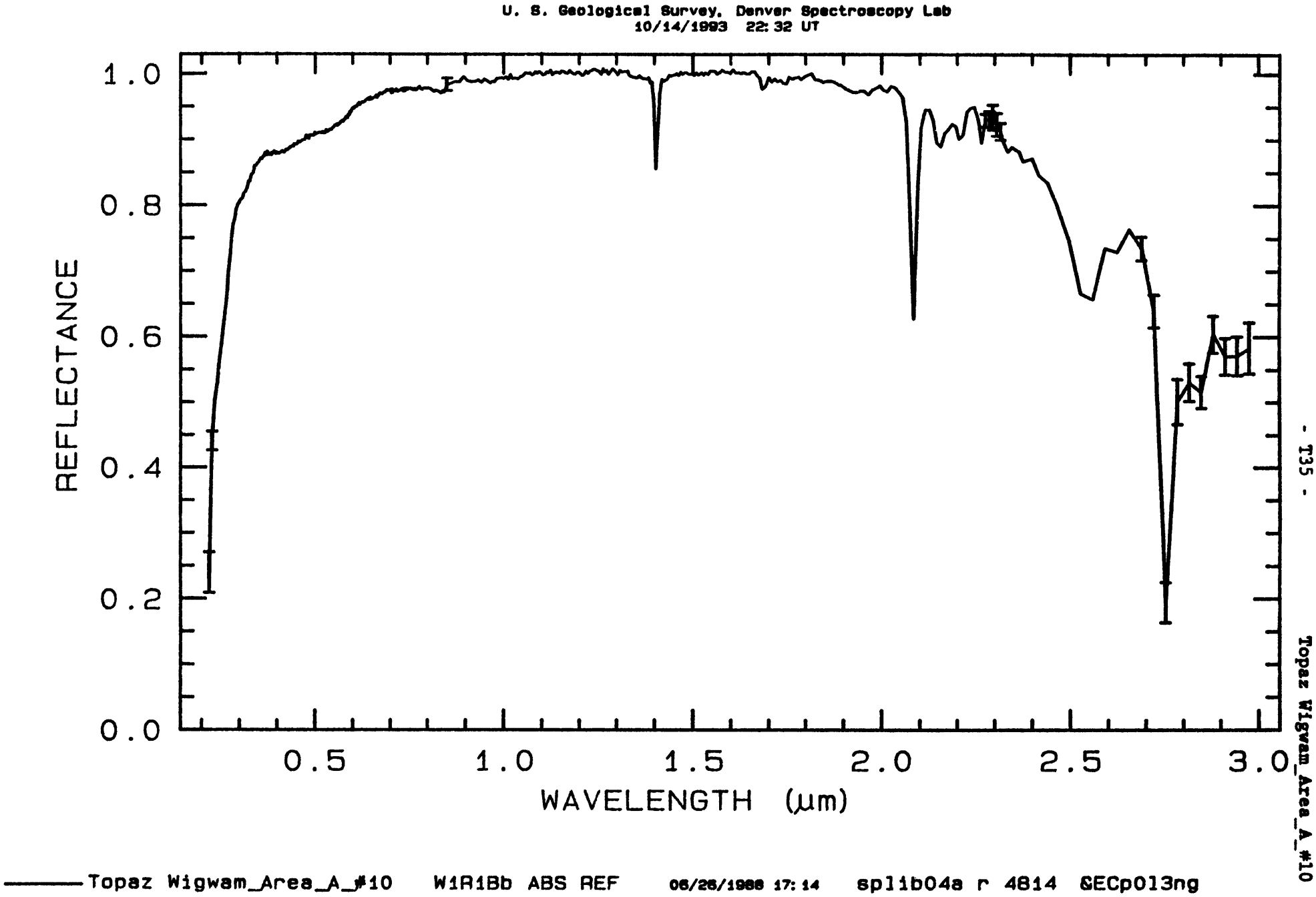
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4814	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T35 -
Topaz Wigwam_Area_A_#10
Topaz Wigwam_Area_A_#10 W1R1Bb ABS REF 06/26/1998 17:14 splib04a r 4814 &ECp013ng

TITLE: Topaz Wigwam_Area_2_#12 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Wigwam_Area_2_#12

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Wigwam Creek, Colorado, #1

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.02, H_2O^+= 0.34

Compositions of the 65 topaz samples are distincly grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is

TITLE: Andradite GDS12 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS12

MINERAL_TYPE: Nesosilicate

MINERAL: Andradite (Garnet Group)

FORMULA: Ca3(Fe+3)2(SiO4)3

FORMULA_NROFF: $Ca_3Fe^{+3}_2(SiO_4)_3$

COLLECTION_LOCALITY: Esmerald Co., Nevada

ORIGINAL_DONOR: Fred Kruse, University of Colorado

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Grossular and with Schorlomite.

Sample is ground and sieved to <250μm. Compare with other Andradite samples in library because spectral differences do exist between samples.

Spectral features near 2.3 μm indicate trace spectral contamination. From the analyses below and the band position and shape, this appears to be calcite. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	36.78 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.14 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3	6.62 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	21.50 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.98 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.05 wt%	NROFF:	MgO
COMPOSITION:	CaO:	33.89 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	99.96 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

inversely related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

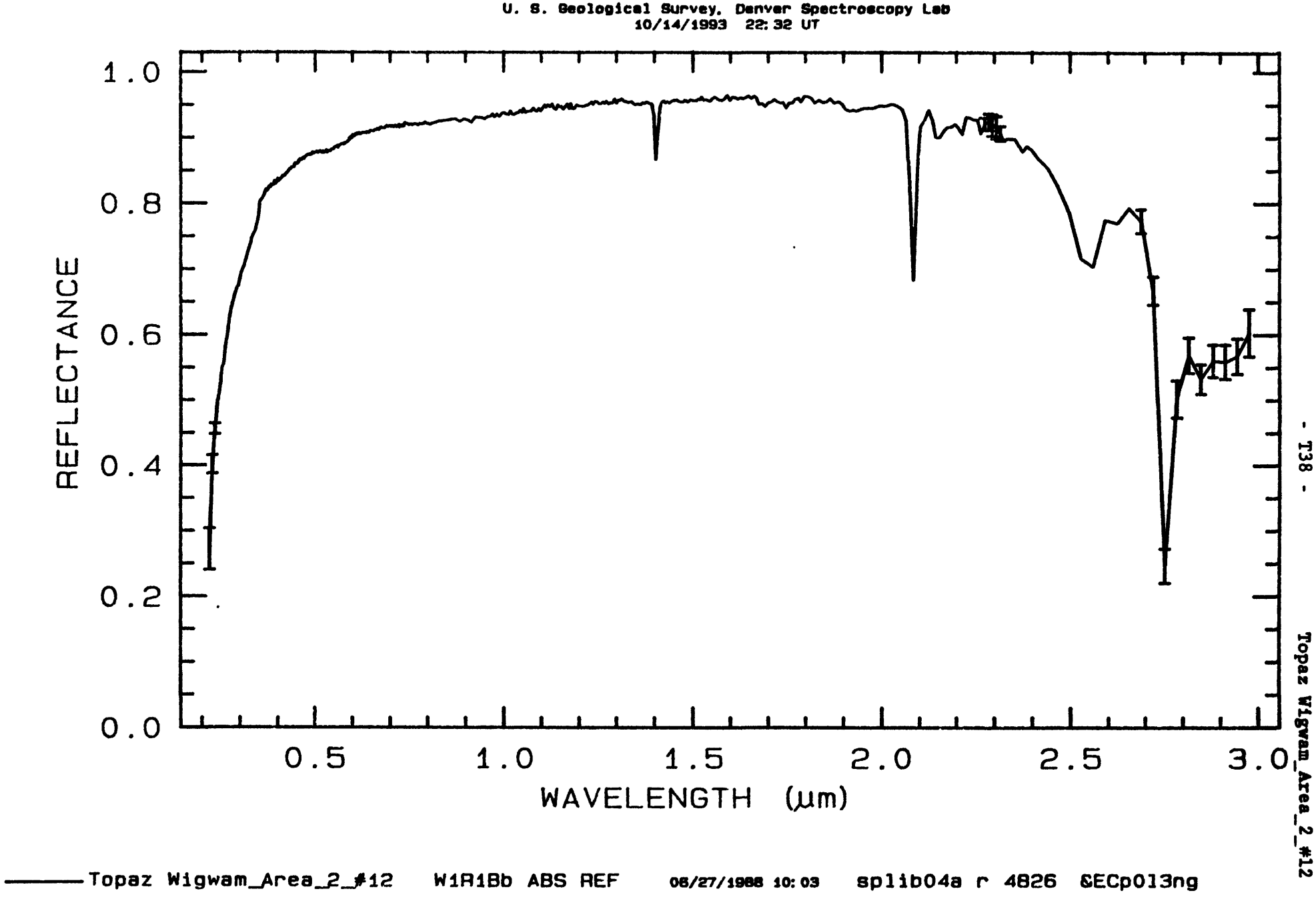
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4826	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Topaz Wigwam_Area_2_#12 W1R1Bb ABS REF 06/27/1988 10:03 splib04a r 4826 &ECp013ng
- T38 -
Topaz Wigwam_Area_2_#12

TITLE: Topaz Wigwam_Area_3_#13 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Wigwam_Area_3_#13

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Wigwam Creek #3, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.03, H_2O^+= 0.32

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

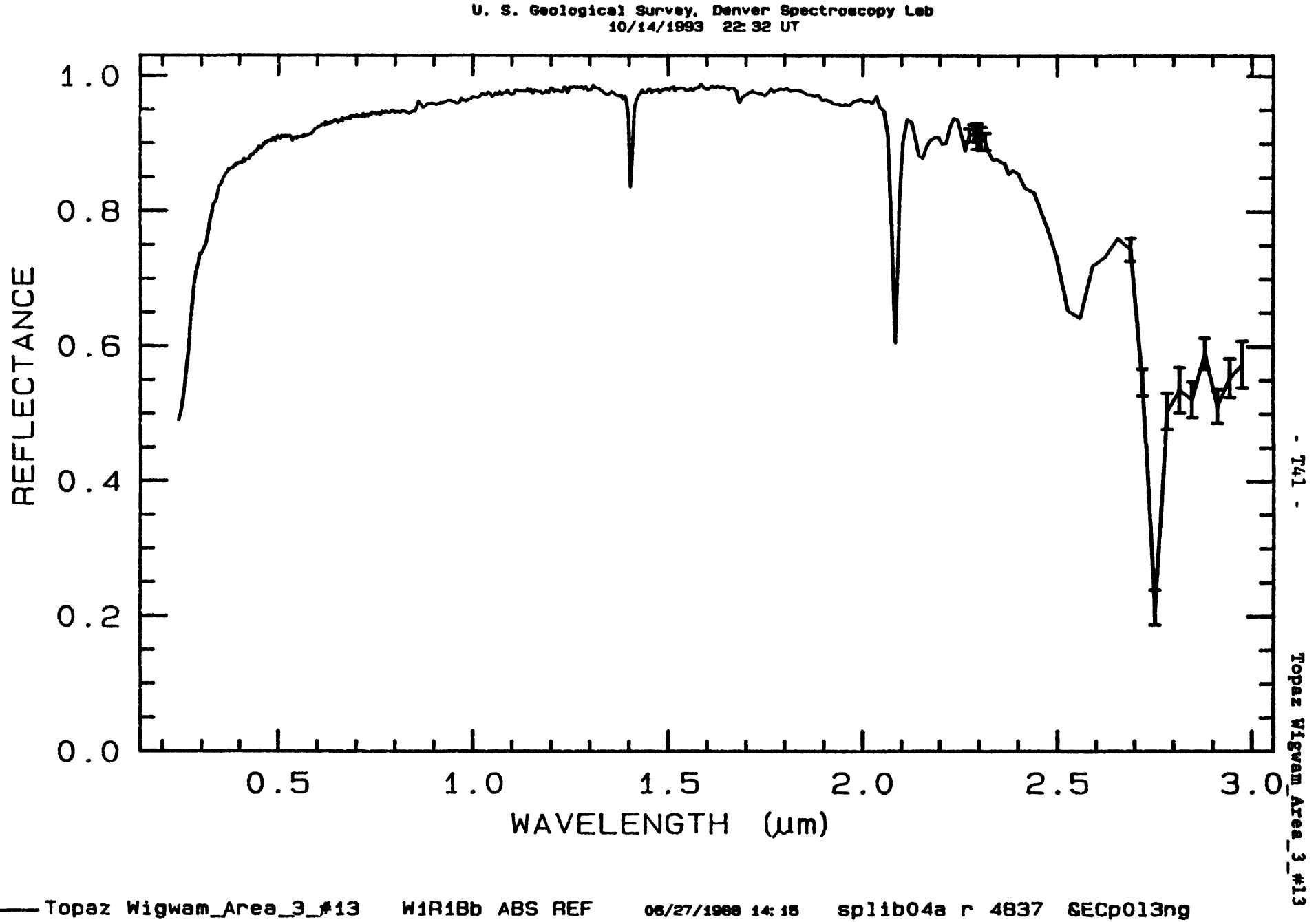
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4837	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- T41 -
Topaz Wigwam_Area_3_#13
Topaz Wigwam_Area_3_#13 W1R1Bb ABS REF 06/27/1988 14:15 splib04a r 4837 &ECp013ng

TITLE: Topaz Wigwam_Area_4_#14 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Wigwam_Area_4_#14

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Wigwam Creek #4, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.02, H_2O^+= 0.33

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

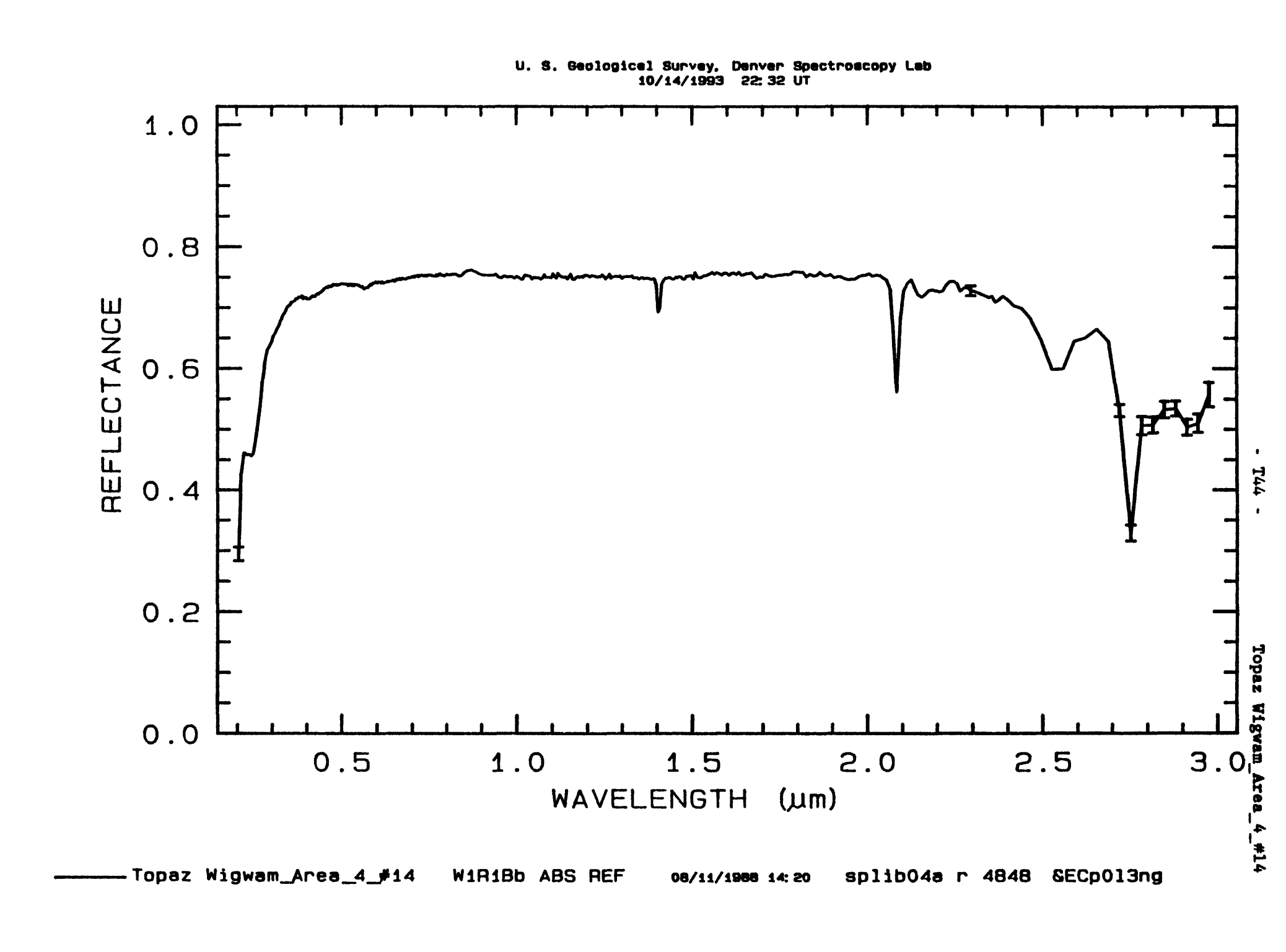
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4848	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- T44 -
Topaz Wigwam_Area_4_#14
Topaz Wigwam_Area_4_#14 W1R1Bb ABS REF 08/11/1988 14:20 splib04a r 4848 SECp013ng

TITLE: Topaz Wigwam_Area_5_#15 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Wigwam_Area_5_#15

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Wigwam Creek #5, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.01, H_2O^+= 0.32

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4859	0.2-3.0μm	200	g.s.=

COMPOSITION_DISCUSSION:

Al may replace Fe^{+3}; Fe^{+2}, Mn^{+2} and Mg may replace Ca.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy. John Wiley, New York, 532p.

Compositional data compiled by G. Swayze, Branch of Geophysics, USGS Denver

END_COMPOSITION_DISCUSSION.

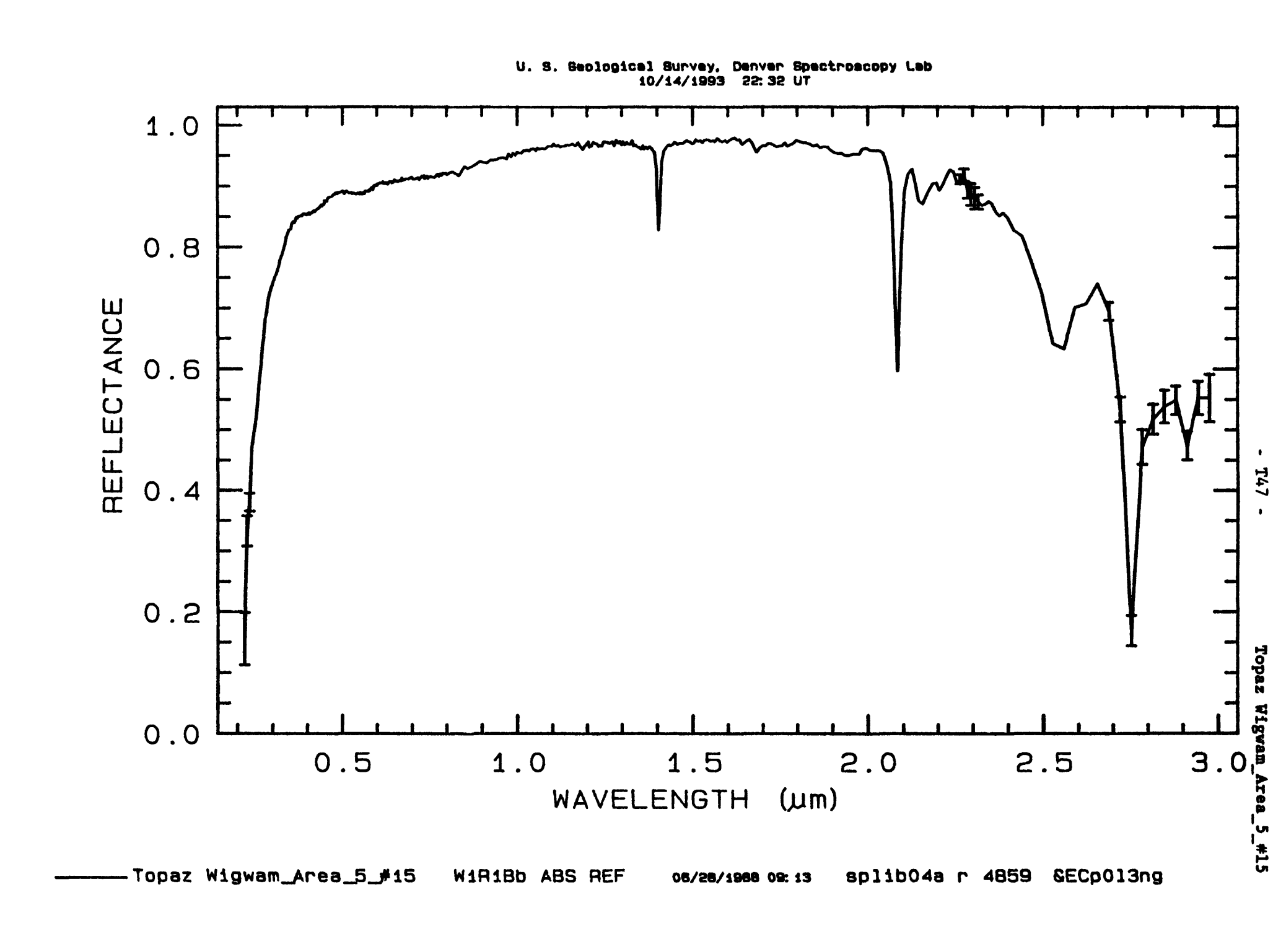
MICROSCOPIC_EXAMINATION:

Conchoidally fractured grains, trace of opaques, under optical scope significant calcite contamination (10-20 vol%) and sample fizzes in dilute HCl acid. Grain size range 5-250 μm. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a	r 367	0.2-3.0μm	200	g.s.= 110 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Topaz Wigwam_Area_5_#15 W1R1Bb ABS REF 06/28/1988 09:13 splib04a r 4859 GECp013ng
Topaz Wigwam_Area_5_#15

TITLE: Topaz Wigwam_Area_6_#16 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Wigwam_Area_6_#16

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Wigwam Creek #6, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.01, H_2O^+= 0.28

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

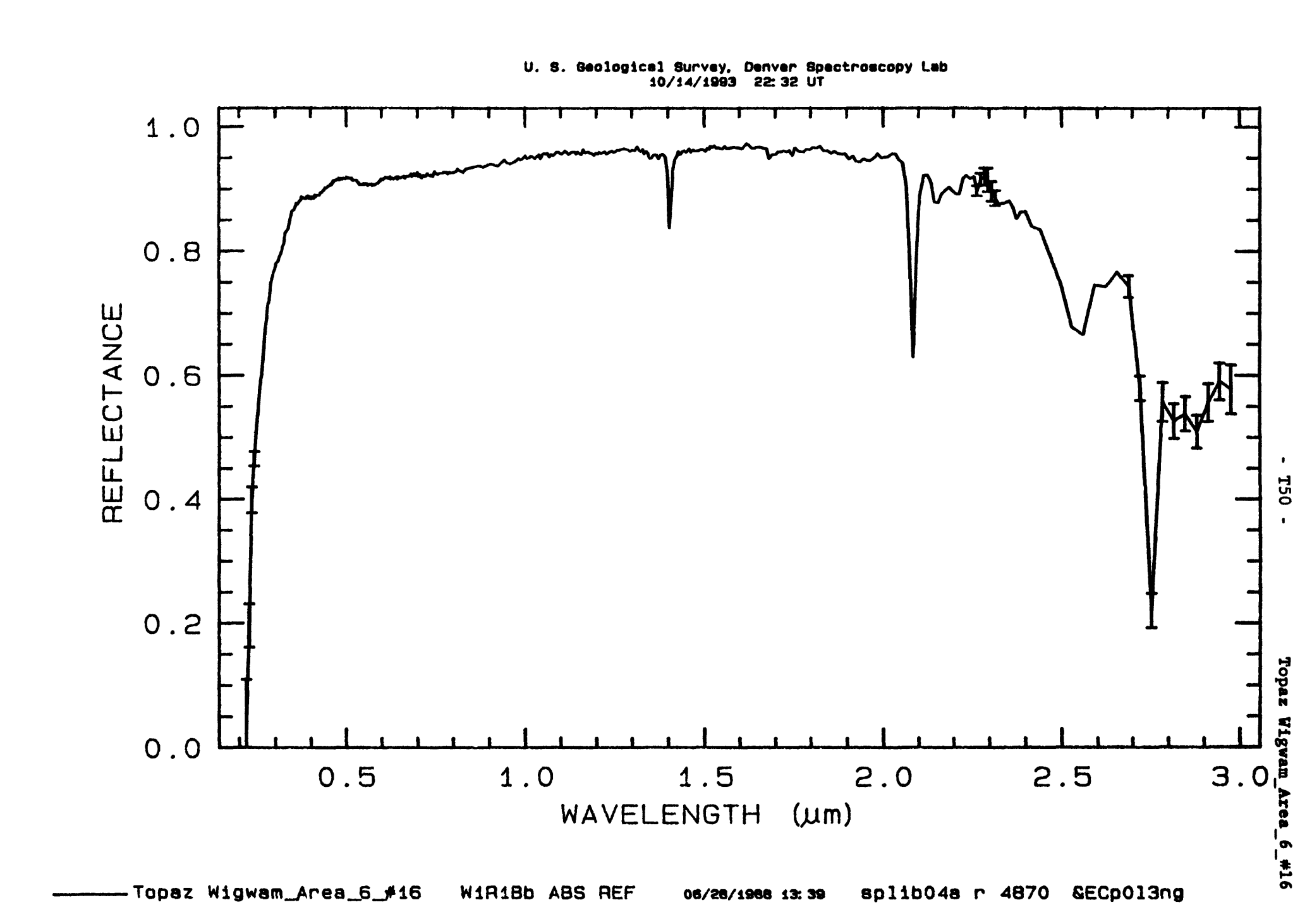
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4870	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:32 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 150 -
Topaz Wigwam_Area_6_#16
Topaz Wigwam_Area_6_#16 W1R1Bb ABS REF 06/26/1998 13:39 splib04a r 4870 &ECp013ng

TITLE: Topaz Harris_Park_#17 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Harris_Park_#17

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Harris Park, Colorado

ORIGINAL_DONOR: T. Michalski

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.02, H_2O^+= 0.31

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

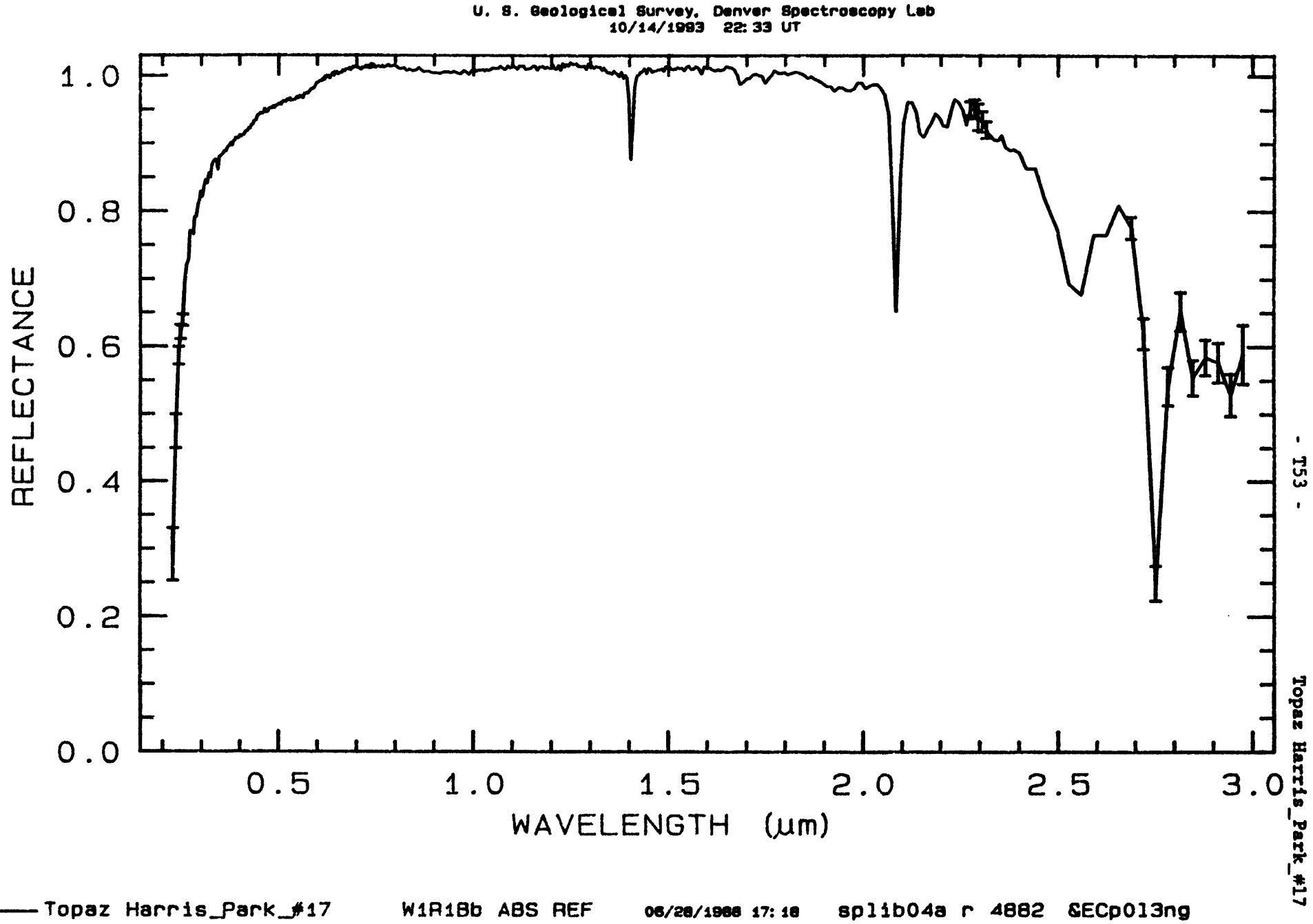
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4882	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Topaz Harris_Park_#17
W1R18b ABS REF
06/28/1988 17:18
splib04a r 4882 &ECp013ng

TITLE: Topaz Crystal_Park_#2 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Crystal_Park_#2

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Crystal Park, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.02, H_2O^+= 0.21

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

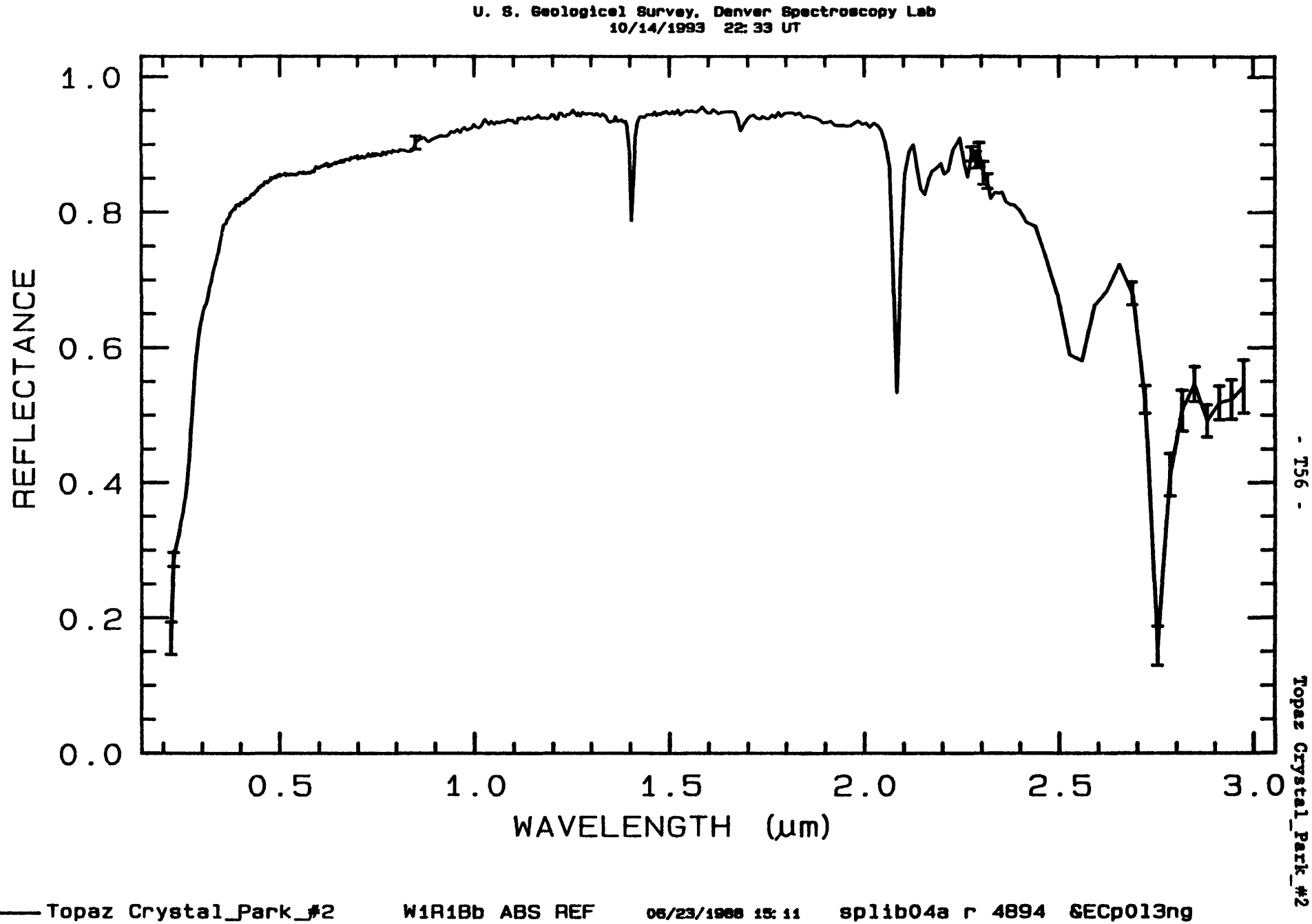
END_COMPOSITION_DISCUSSION.

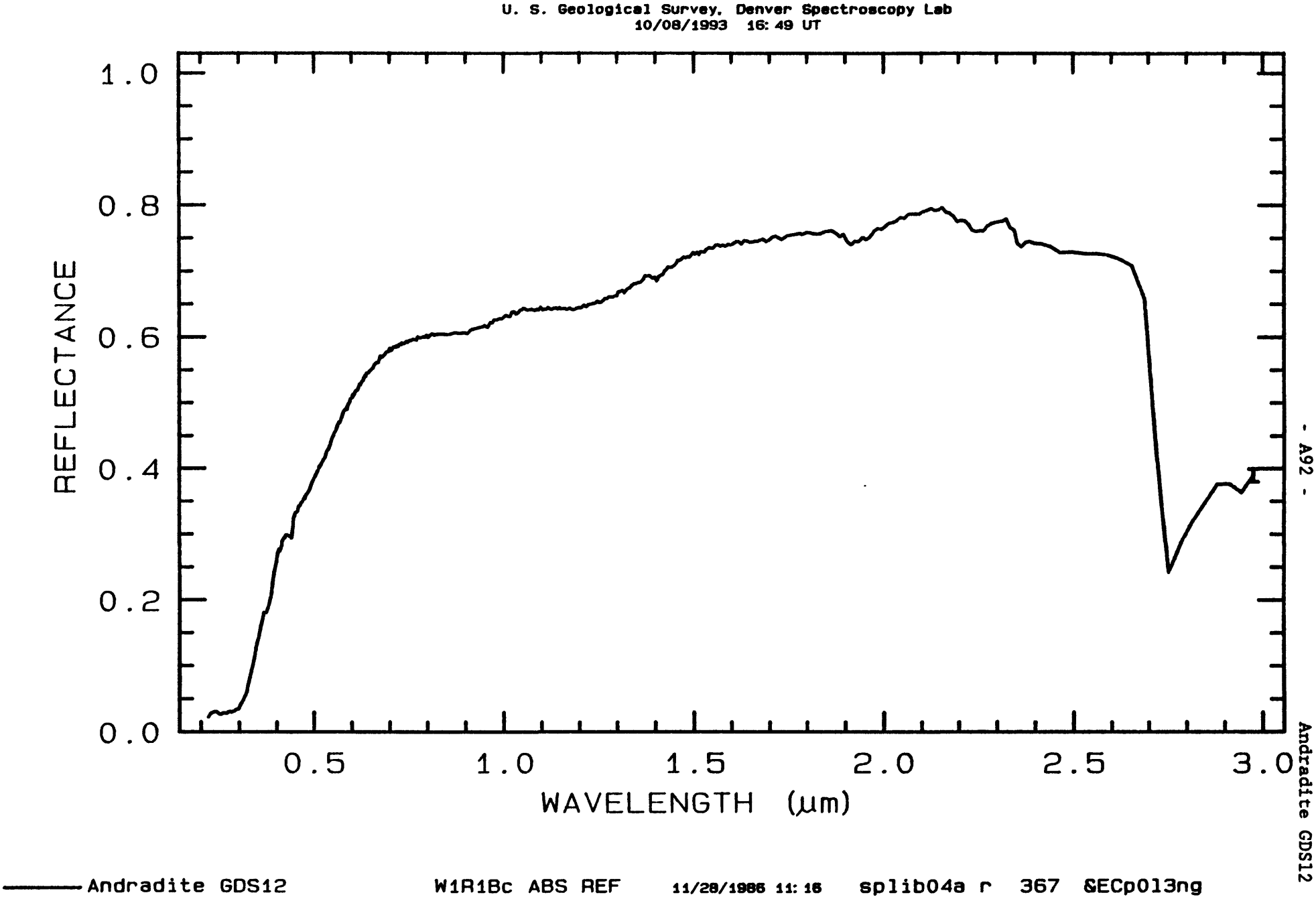
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4894	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T56 -
Topaz Crystal_Park_#2
Topaz Crystal_Park_#2 W1R1Bb ABS REF 06/23/1988 15:11 splib04a r 4894 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Andradite GDS12
Andradite GDS12 W1R1Bc ABS REF 11/28/1986 11:16 splib04a r 367 &ECp013ng

TITLE: Topaz Jos_#22 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Jos_#22

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Jos, Nigeria

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.02, H_2O^+= 0.44

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

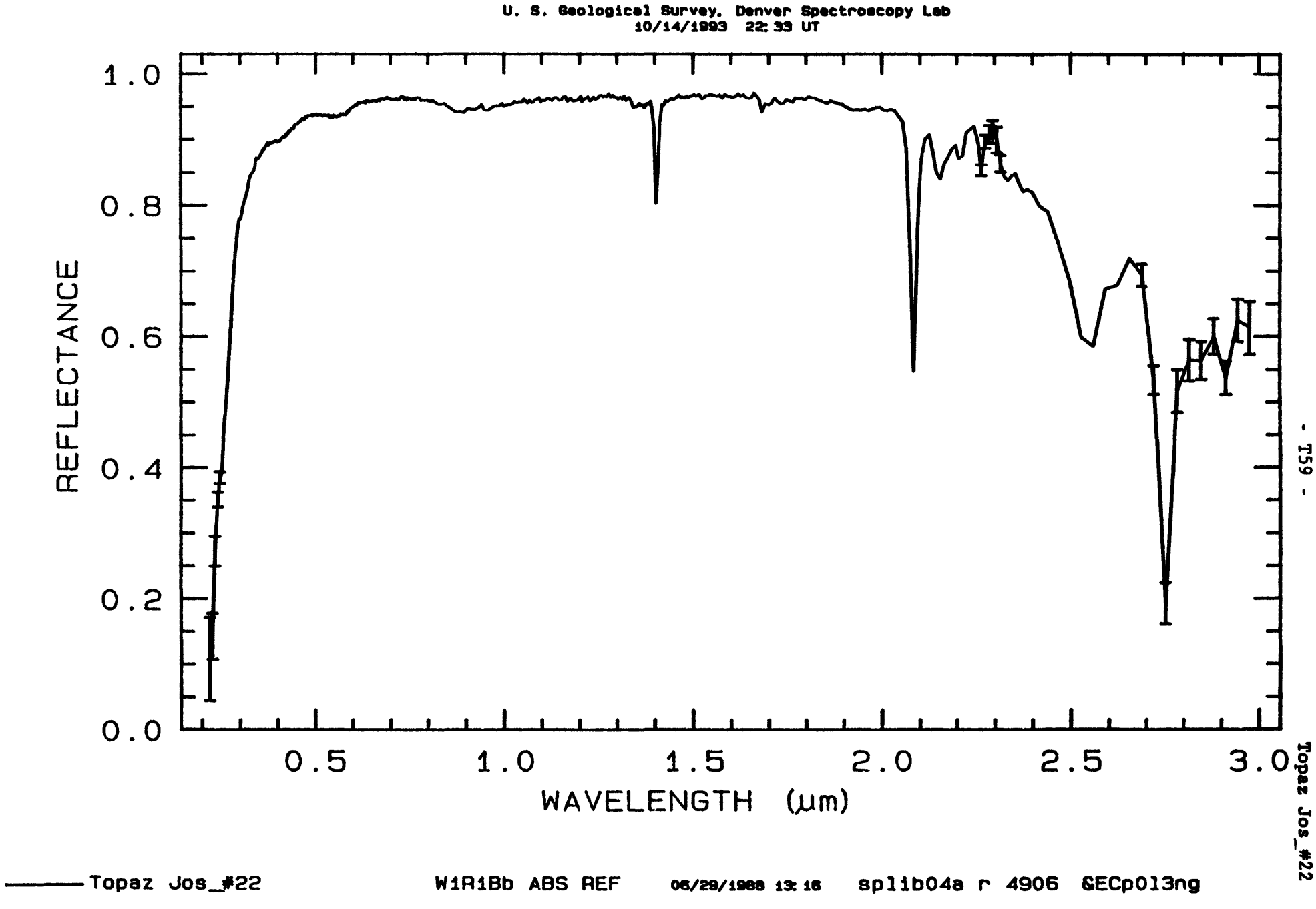
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4906	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T59 -
Topaz Jos_#22
Topaz Jos_#22 W1R1Bb ABS REF 06/29/1988 13:16 splib04a r 4906 &ECp013ng

TITLE: Topaz Harris_Park_#3 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Harris_Park_#3

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Devils's Head, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.02, H_2O^+= 0.24

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

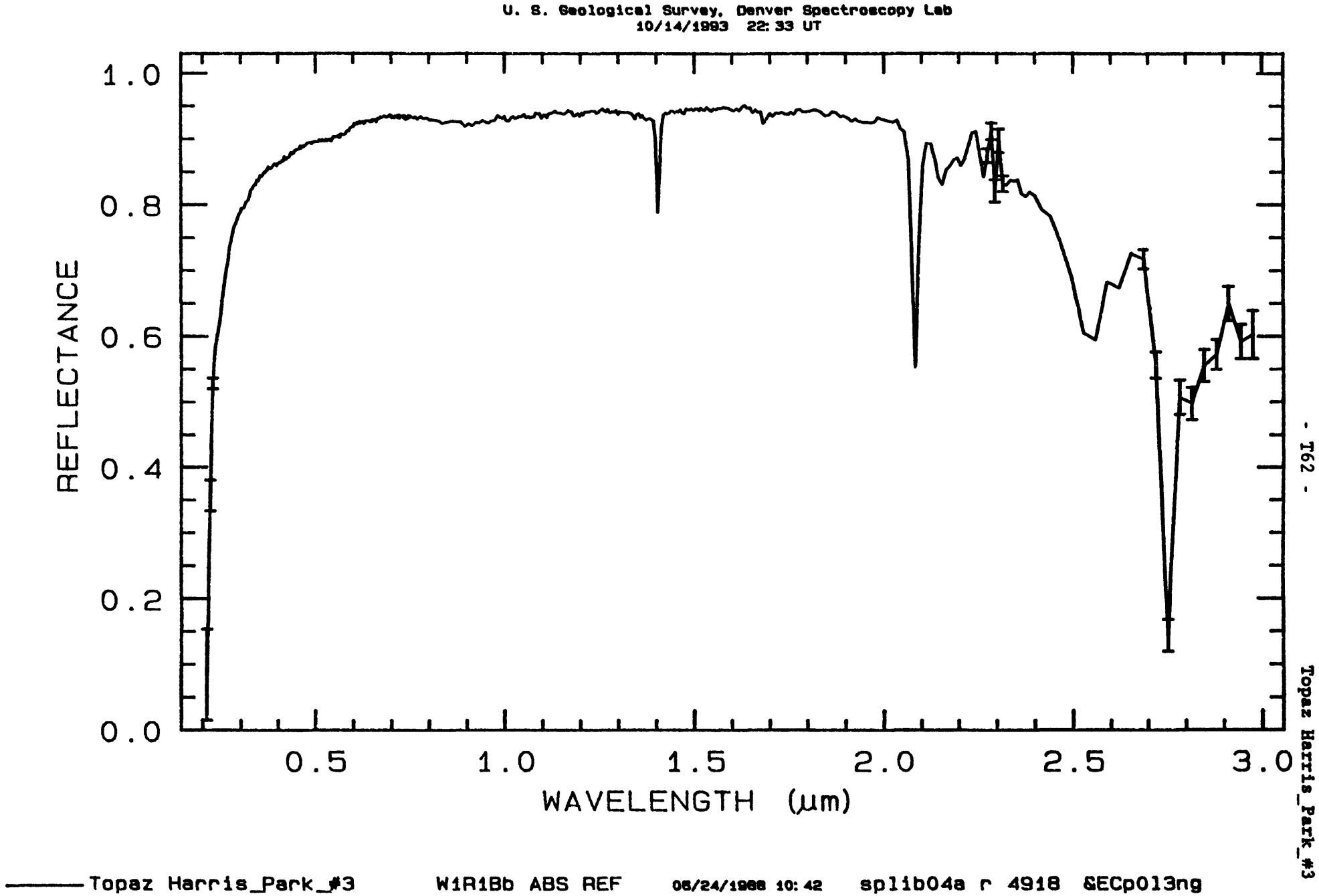
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4918	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Topaz Harris_Park_#3
W1R1Bb ABS REF
08/24/1988 10:42
splib04a r 4918 &ECp013ng

TITLE: Topaz Tarryalls_#4 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Tarryalls_#4

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Tarryalls, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.06, H_2O^+= 0.46

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

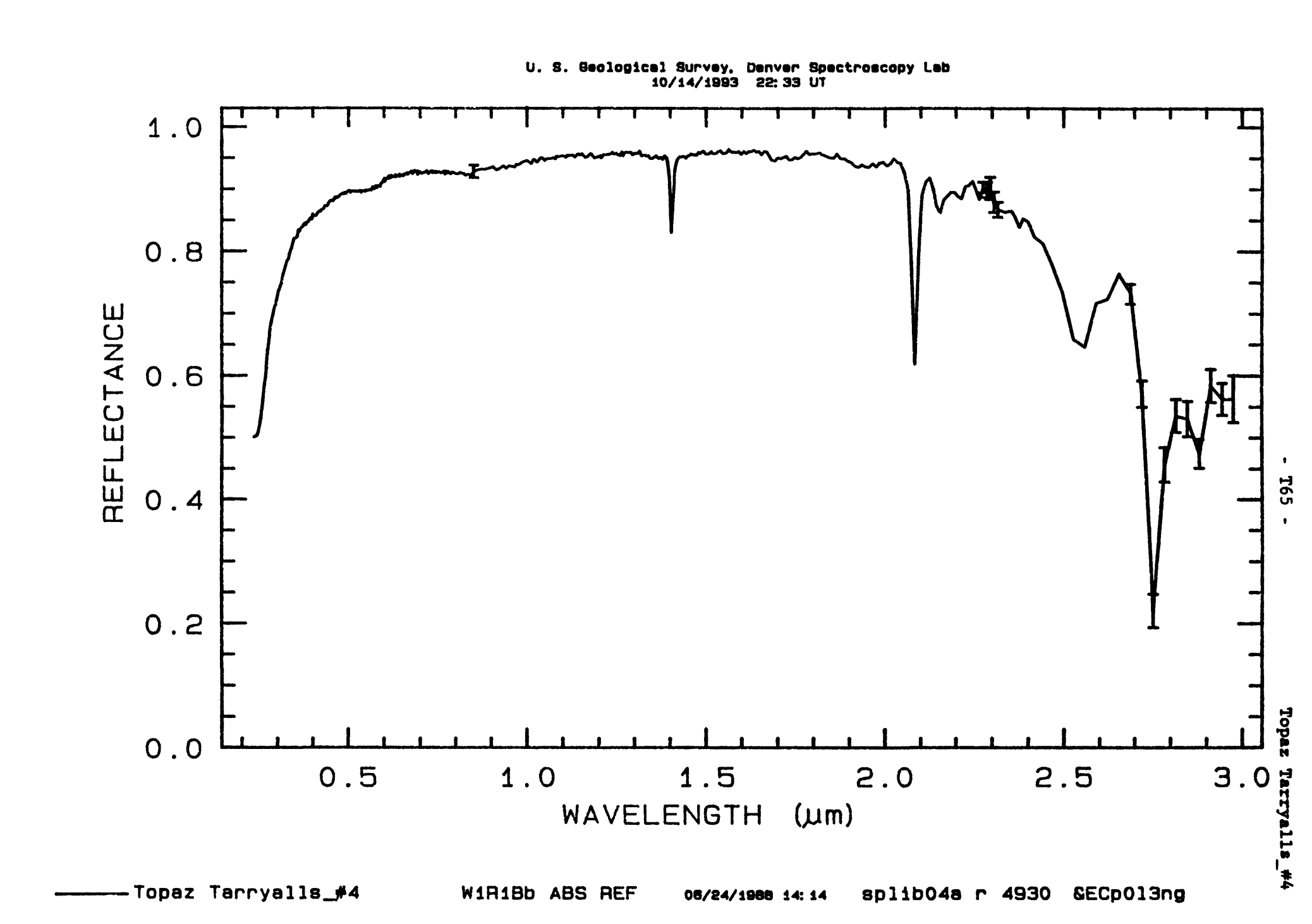
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4930	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T65 -
Topaz Tarryalls_#4
Topaz Tarryalls_#4 W1R1Bb ABS REF 06/24/1988 14:14 splib04a r 4930 &ECp013ng

TITLE: Topaz Little_3_Mine_#41 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Little_3_Mine_#41

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Little 3 Mine, San Diego Co., CA

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.01, H_2O^+= 0.55

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

TITLE: Andradite HS111 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS111

MINERAL_TYPE: Nesosilicate

MINERAL: Andradite (Garnet group)

FORMULA: Ca3(Fe+3)2(SiO4)3

FORMULA_NROFF: $Ca_3Fe^{+3}_2(SiO_4)_3$

COLLECTION_LOCALITY: Graham County, Arizona

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Grossular and with Schorlomite.

Under a hand lens the sample appears brown. Individual grains have varying shades of brown with an overall "salt and pepper" effect. The visible and near-IR spectrum shows spectrally pure andradite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Andradite + Quartz - by Norma Vero

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

85 vol% andradite
15 vol% Fe-stained mineral or andradite

av gr sz = 270μm

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

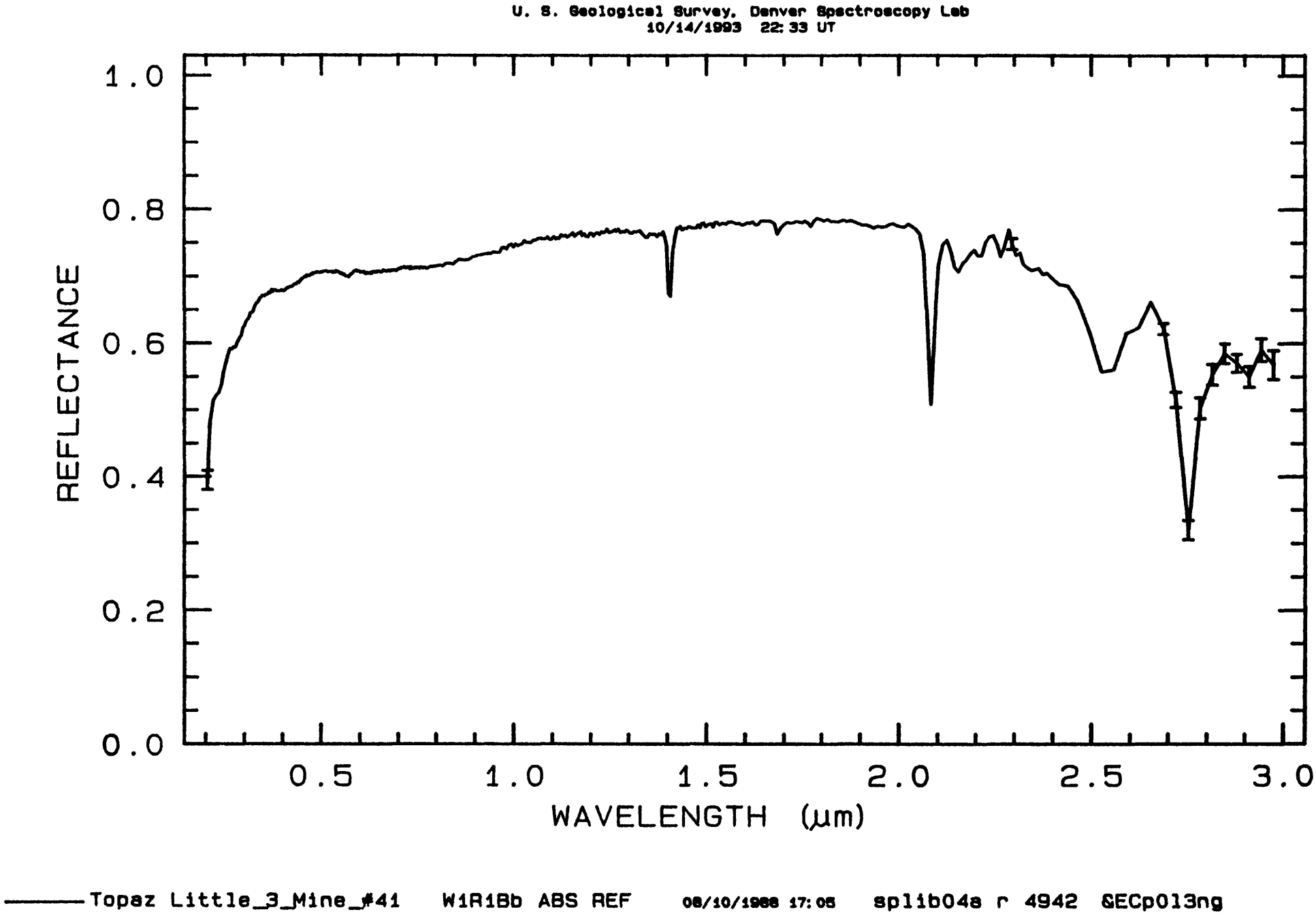
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4942	0.2-3.0μm	200	g.s.=



Topaz Little_3_Mine_#41

TITLE: Topaz Cameron_Cone_#42 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Cameron_Cone_#42

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Volyn, U.S.S.R.

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.08, H_2O^+= 0.30

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

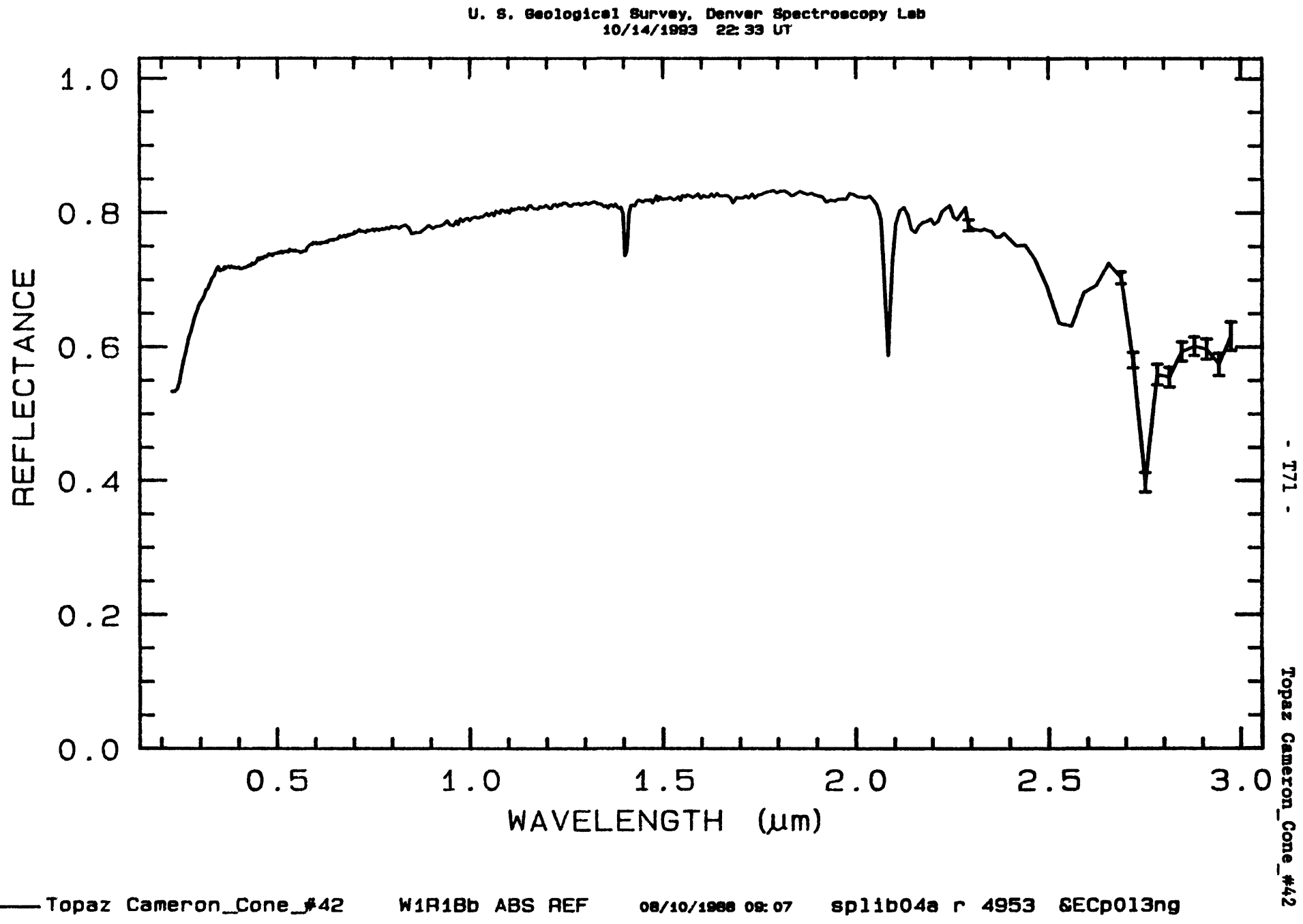
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4953	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 171 -
Topaz Cameron_Cone_#42
Topaz Cameron_Cone_#42 W1R1Bb ABS REF 08/10/1988 09:07 splib04a r 4953 &ECp013ng

TITLE: Topaz Mt._Antero_#5 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Mt._Antero_#5

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Mt. Antero, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.02, H_2O^+= 0.29

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

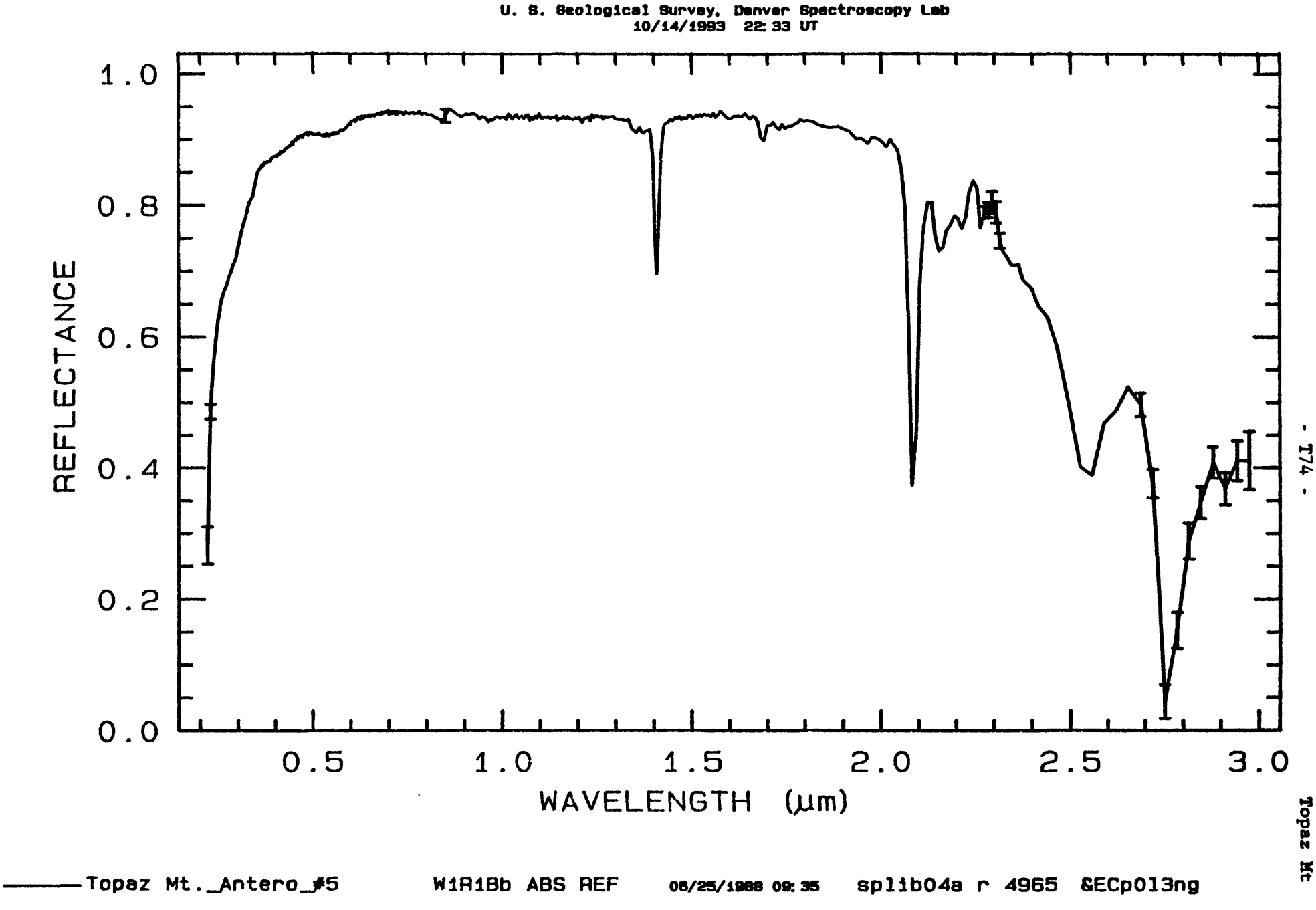
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4965	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 174 -
Topaz Mt
Topaz Mt._Antero_#5 W1R1Bb ABS REF 06/25/1988 09:35 splib04a r 4965 &ECp013ng

TITLE: Topaz Glen_Cove_#6 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Glen_Cove_#6

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Glen Cove, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.03, H_2O^+= 0.20

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

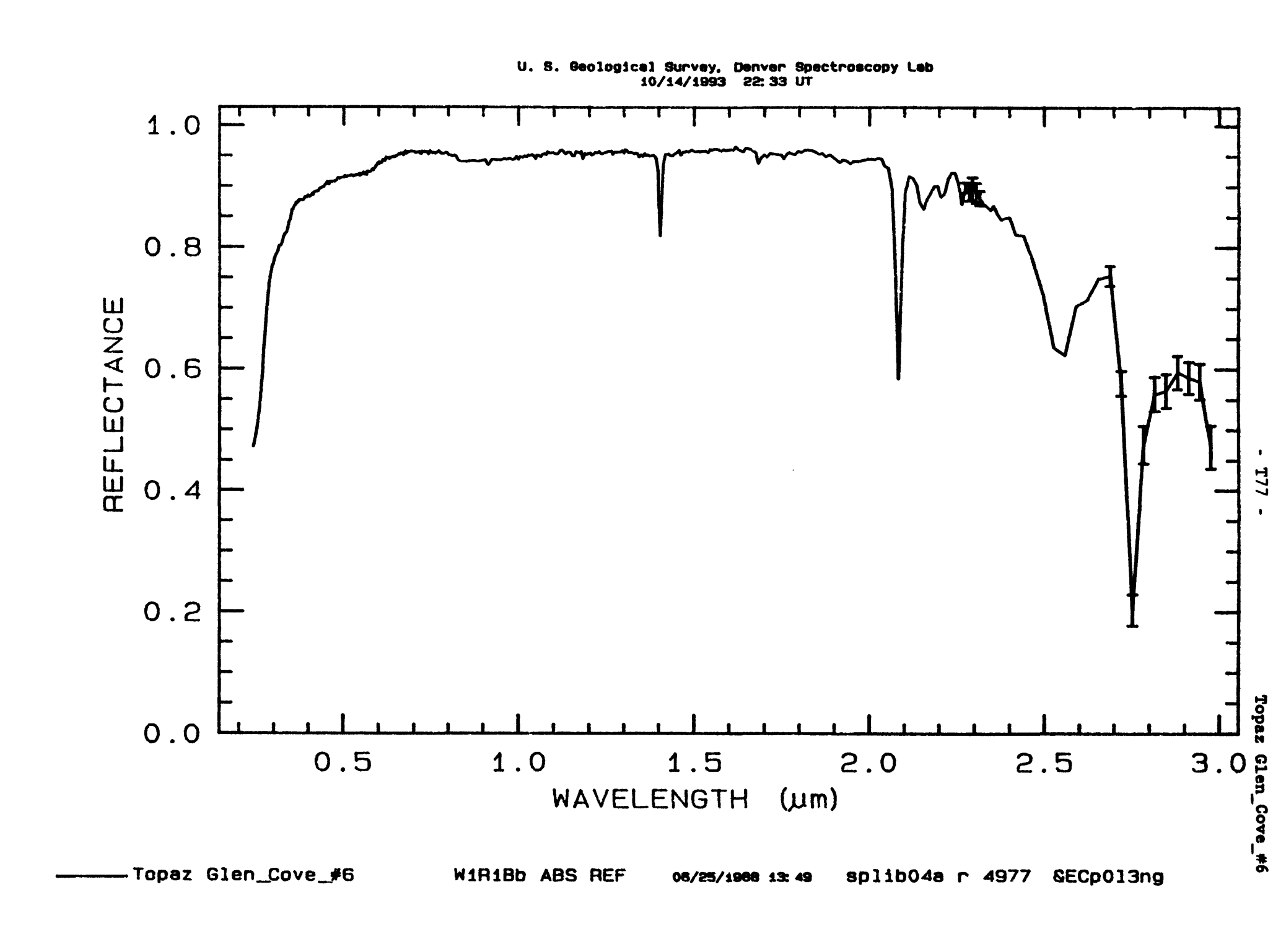
LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4977	0.2-3.0μm	200	g.s.=

Conchoidally fractured andradite grains some of which are partially Fe-stain coated. Entire grains Fe-stained may be different phase or andradite. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 378	0.2-3.0μm	200	g.s.= 270 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 177 -
Topaz Glen_Cove_#6
Topaz Glen_Cove_#6 W1R1Bb ABS REF 08/25/1988 13:49 splib04a r 4977 &ECp013ng

TITLE: Topaz Glen_Cove_#8 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Glen_Cove_#8

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Glen Cove, Colorado

ORIGINAL_DONOR: Gene Foord

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.04, H_2O^+= 0.26

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

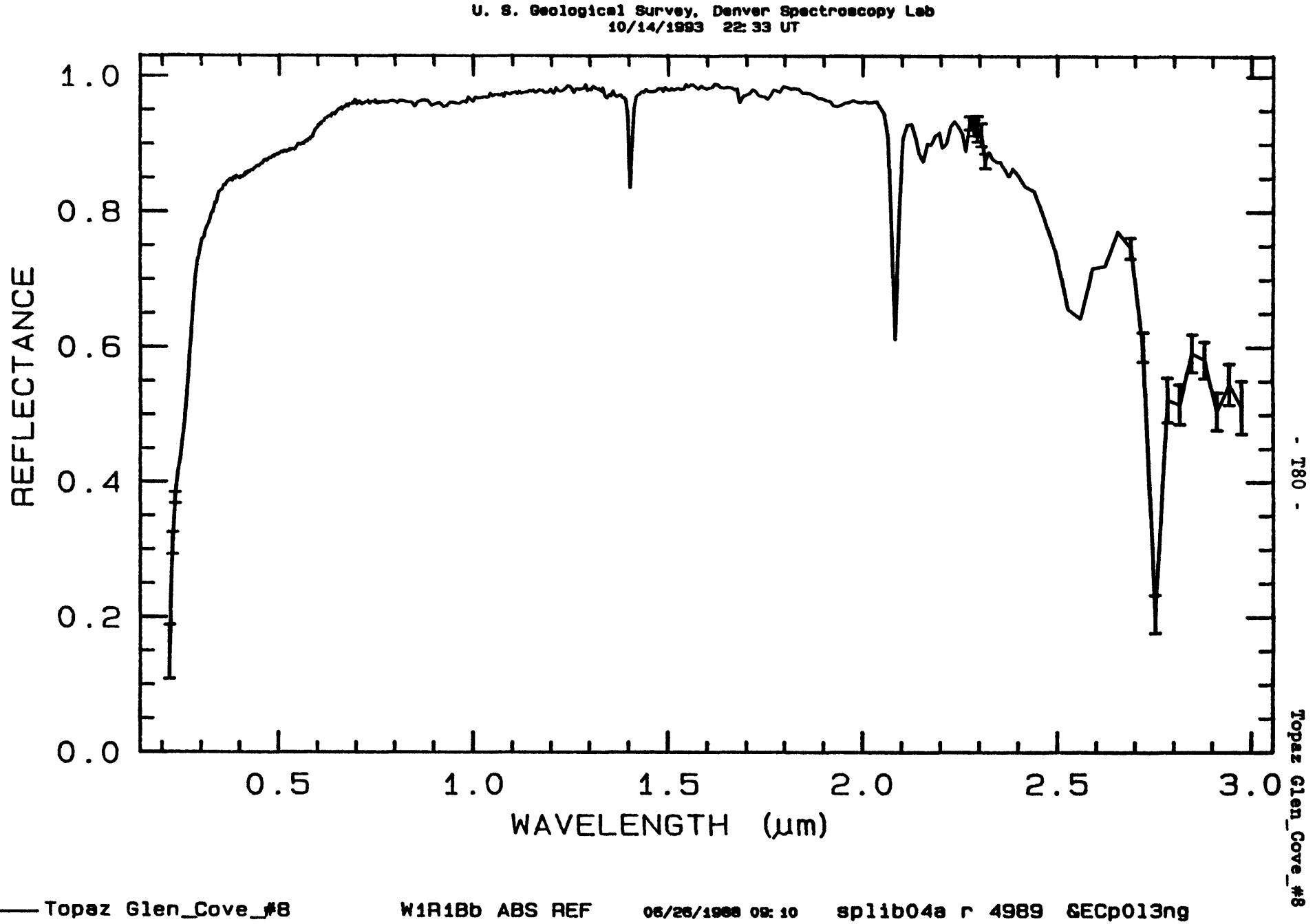
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4989	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T80 -
Topaz Glen_Cove_#8
Topaz Glen_Cove_#8 W1R1Bb ABS REF 06/26/1998 09:10 splib04a r 4989 GECp013ng

TITLE: Topaz Harris_Park_#9 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Harris_Park_#9

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Harris Park, Colorado

ORIGINAL_DONOR: W. Sabidine

CURRENT_SAMPLE_LOCATION: Gene Foord, USGS

ULTIMATE_SAMPLE_LOCATION: Gene Foord, USGS

SAMPLE_DESCRIPTION:

Most of the (OH^-) in topaz is generally replaced by F^-, the maximum fluorine content being 20.7%.

Hurlbut, C.S., and C. Klein, 1977, Manual of Mineralogy, 19th Ed. John Wiley and Sons, New York, New York, 353p.

Topaz is commonly found as a vapor phase or hydrothermal crystallization product in three principal geologic associations: rhyolites; pegmatities and greisens; and hydrothermal veins. The mineral also occurs as a liquidus phase in ongonites and some rhyolites.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

H_2O^- = 0.04, H_2O^+= 0.33

Compositions of the 65 topaz samples are grouped in terms of H_2O^+, F, and trace element content. H_2O^+ contents for (in wt. %) for rhyolitic topaz ranged from 0.06 to 0.11, pegmatitic topaz from 0.20 to 0.91, and hydrothermal topaz from 1.69 to 2.67; fluorine content is inversely

related to water content. This is a pegmatitic topaz.

Foord, E.L., L. Jackson, J. Taggart, J. Crock, and T.V.V. King, 1988, Environment of Crystallization of Topaz as Determined From Crystal Chemistry and Infrared Spectra. Program and Abstracts Annual GSA Meeting, October 31-November 3, 1988, Denver CO, A224,#4128.

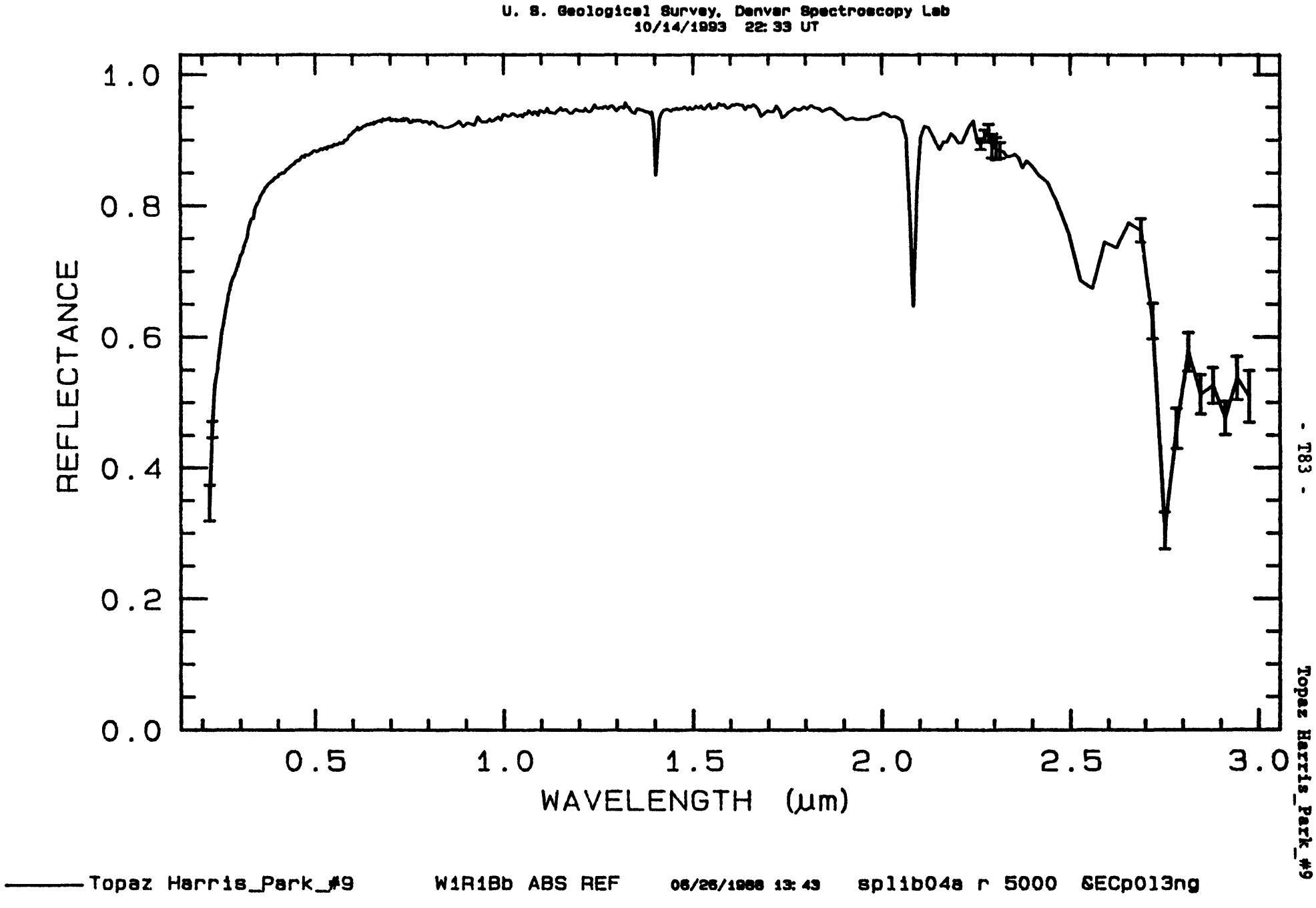
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5000	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- T83 -
Topaz Harris_Park_#9
Topaz Harris_Park_#9 W1R1Bb ABS REF 06/26/1998 13:43 splib04a r 5000 &ECp013ng

TITLE: Topaz HS184 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS184

MINERAL_TYPE: Nesosilicate

MINERAL: Topaz

FORMULA: Al2SiO4(F,OH)2

FORMULA_NROFF: $Al_2SiO_4(F,OH)_2$

COLLECTION_LOCALITY: Stoneham, Maine

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample is colorless and displays a featureless spectrum in the visible, but has an unusual hydroxyl feature in the near-infrared.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sample contains approximately 50% albite. No HCl fizz.

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

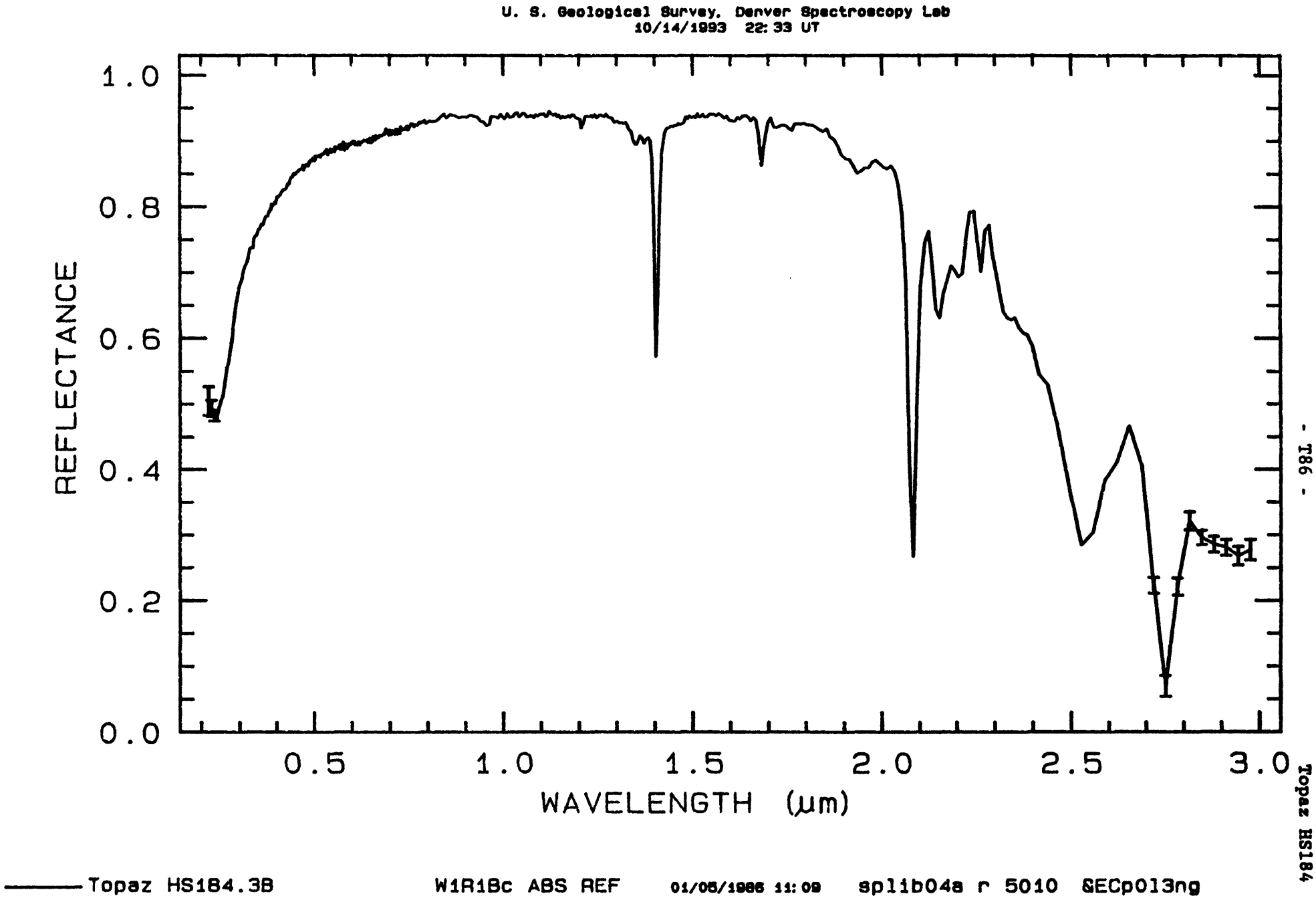
END_COMPOSITION_DISCUSSION.

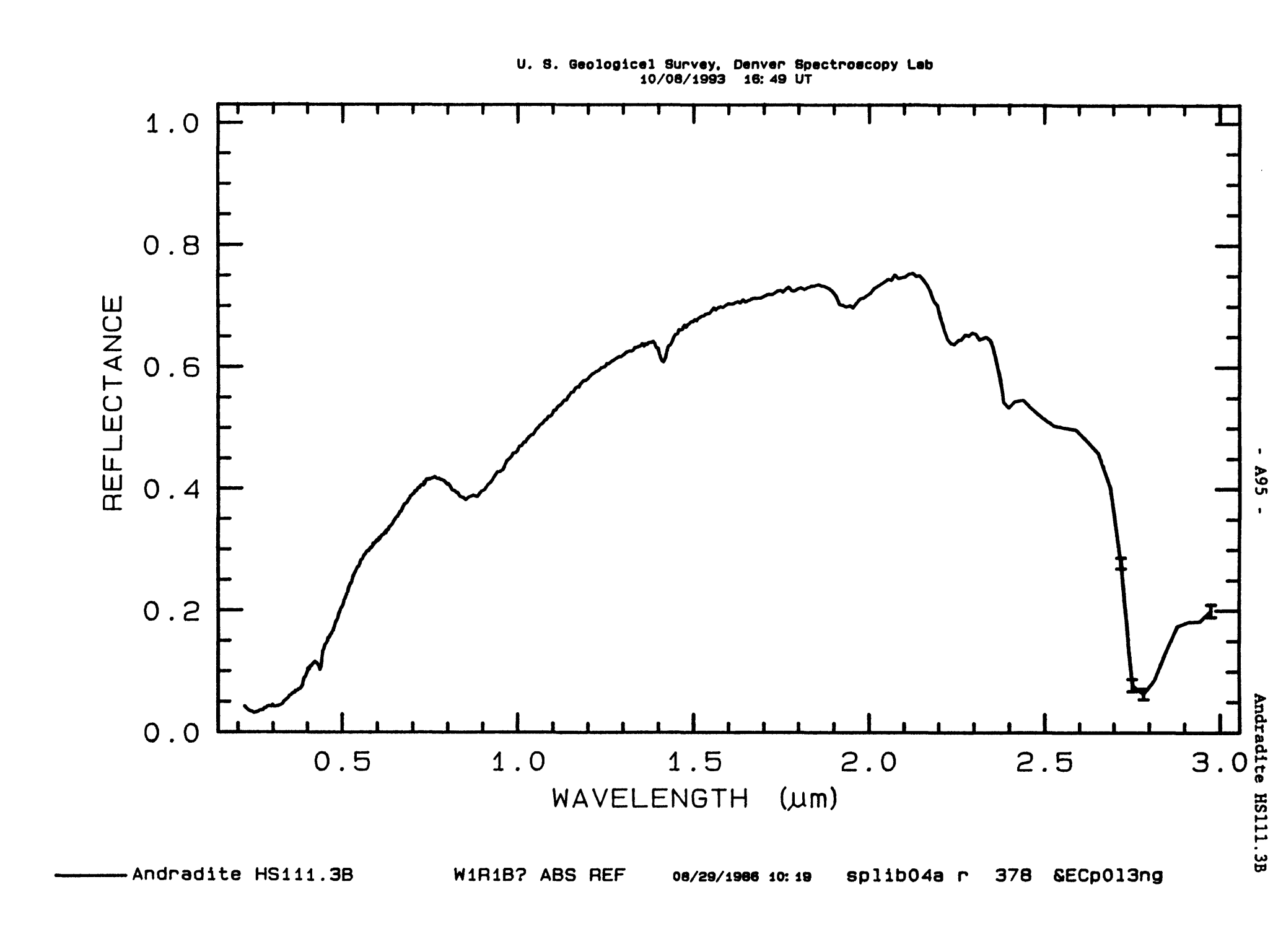
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5010	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 186 -
Topaz HS184
Topaz HS184.3B
W1R1Bc ABS REF
01/06/1986 11:09
splib04a r 5010 &ECp013ng


U. S. Geologicel Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A95 -
Andradite HS111.3B
Andradite HS111.3B W1R1B? ABS REF 08/29/1986 10:19 splib04a r 378 &ECp013ng

TITLE: Tourmaline HS282 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS282

MINERAL_TYPE: Cyclosilicate

MINERAL: Tourmaline (Tourmaline group)

FORMULA: (Na,Ca)(Li,Mg,Al)(Al,Fe,Mn)6(BO3)3(Si6O18)(OH)4

FORMULA_NROFF: $(Na,Ca)(Li,Mg,Al)(Al,Fe,Mn)_6(BO_3)_3(Si_6O_{18})(OH)_4$

COLLECTION_LOCALITY: Australia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample is brown. The spectrum shows intense features near 0.75 μ and 1.1 μ, due to transitions in ferric and ferrous iron, respectively, and features in the 1.4 and 2.2 to 2.4 μ region.

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Tourmaline + medium amount of mica + medium amount of other; M: ~10% feldspar, ~10% muscovite, no HCl fizz

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

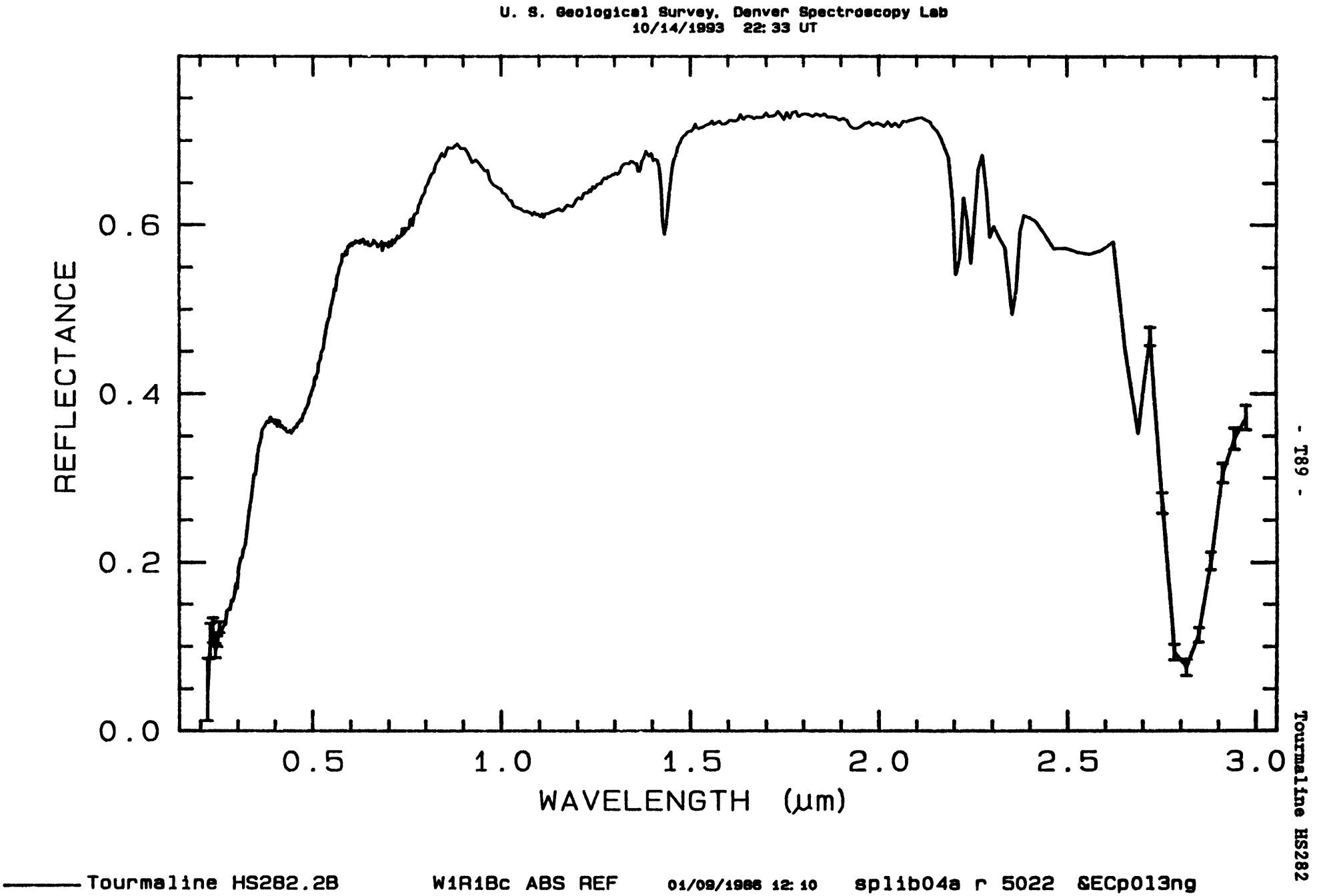
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5022	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 189 -
Tourmaline HS282
Tourmaline HS282.2B W1R1Bc ABS REF 01/09/1986 12:10 splib04a r 5022 &ECp013ng

TITLE: Tremolite HS18 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS18

MINERAL_TYPE: Inosilicate

MINERAL: Tremolite (Amphibole group)

FORMULA: Ca2Mg5Si8O22(OH)2

FORMULA_NROFF: $Ca_2Mg_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: St. Lawrence County, New York

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Actinolite and Ferroactinolite.

"S-1A. Amphibole, variety Tremolite. St. Lawrence Co., N.Y. (18B). This sample has a fairly prominent broad band near 1μ, indicating that it contains some ferrous ion. It displays a very sharp band at 1.4μ, and less sharp bands between 2.0 and 2.5 μ due to the overtone and combination tones of the OH stretch, respectively. In particular, the bands at 2.2 and 2.3 μ are due to combination tones of the OH strectch with lattice modes. The weak band at 1.9μ is probably due to a small amount of molecular H_2O in the sample."

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Tremolite + medium amount quartz + small amount of mica + large amount of others; M: ~1% magnetite, no other minerals visible (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	57.70	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.05	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	1.00	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	0.34	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.33	wt%	NROFF: MnO
COMPOSITION:	MgO:	24.45	wt%	NROFF: MgO
COMPOSITION:	CaO:	12.26	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.51	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.15	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	97.79	wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Average of 6 analyses. $X_{Fe}+2 = 0.0083$ $X_{Fe}+3 = 0.0083$ $X_{Mg}+2 = 0.9924$ $X_{Fe_{tot}} = 0.0151$

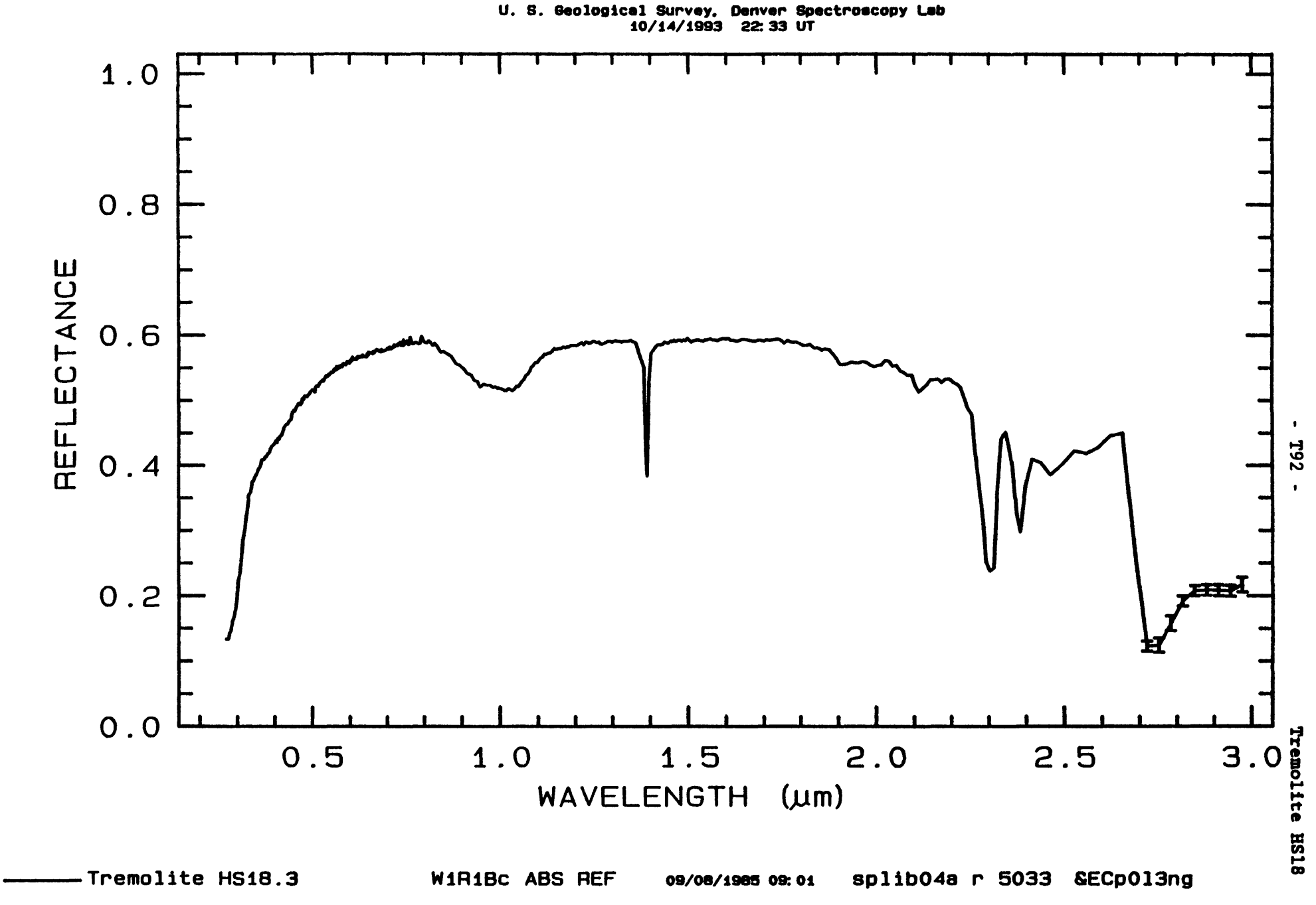
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5033	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T92 -
Tremolite HS18
Tremolite HS18.3
W1R1Bc ABS REF
09/08/1985 09:01
splib04a r 5033 &ECp013ng

TITLE: Tremolite NMNH117611 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH117611

MINERAL_TYPE: Inosilicate

MINERAL: Tremolite (Amphibole group)

FORMULA: Ca2Mg5Si8O22(OH)2

FORMULA_NROFF: $Ca_2Mg_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Canada

ORIGINAL_DONOR: Smithsonian Institution

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Actinolite and Ferroactinolite.

"Results of petrographic examination: One 21.41g piece, deep brown, and translucent. Part of a single crystal with euhedral faces. Very, very small amount of calcite contamination. Wash with HCl. Under microscope, appears to be virtually all pure, clean tremolite with a very small amount (<1%) of low refractive index impurity. Refractive index indicates very little iron."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Tremolite plus a trace of mica.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	54.60	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.41	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	1.88	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	2.25	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.19	wt%	NROFF: MnO
COMPOSITION:	MgO:	23.13	wt%	NROFF: MgO
COMPOSITION:	CaO:	8.82	wt%	NROFF: CaO
COMPOSITION:	Na2O:	5.54	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	1.42	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	98.23	wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

"Microprobe analysis shows sample to be homogeneous within and between grains. It has extremely high soda and potash. Thus chemically it is more towards richterite than tremolite. Average of 10 analyses."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

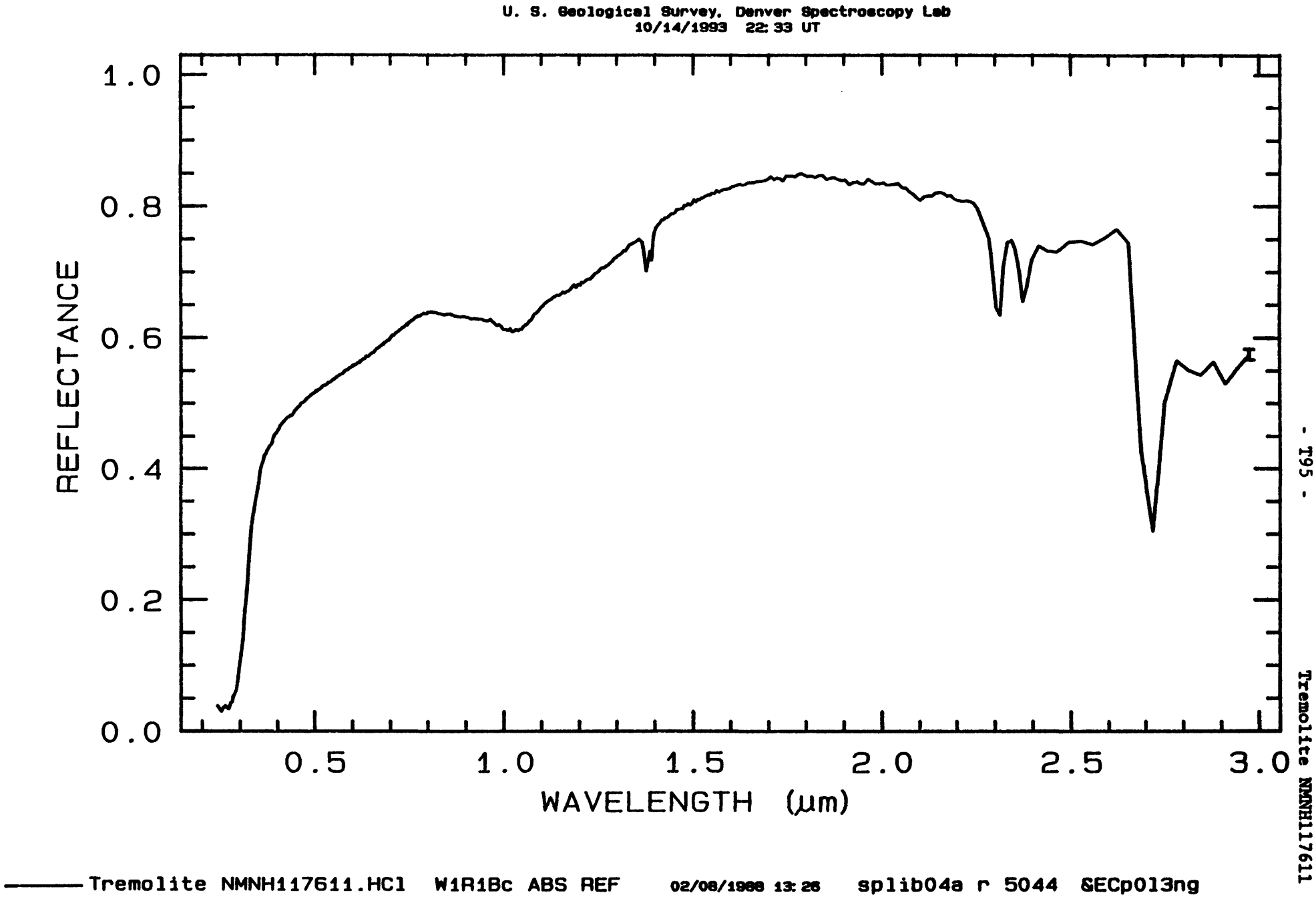
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5044	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- T95 -
Tremolite NMNH117611
Tremolite NMNH117611.HCl W1R1Bc ABS REF 02/08/1988 13:26 splib04a r 5044 &ECp013ng

TITLE: Trona GDS148 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS148

MINERAL_TYPE: Hydrous Carbonate

MINERAL: Trona

FORMULA: Na3(CO3)(HCO3)*2H2O

FORMULA_NROFF: $Na_3(CO_3)(HCO_3)\bullet 2H_2O$

COLLECTION_LOCALITY: Green River Formation, Wyoming

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure trona. (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rmccarty@speclab (Ryan McCarty)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5054	0.2-3.0μm	200	g.s.=

TITLE: Andradite NMNH113829 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH113829

MINERAL_TYPE: Nesosilicate

MINERAL: Andradite (Garnet group)

FORMULA: Ca3(Fe+3)2(SiO4)3

FORMULA_NROFF: $Ca_3Fe^{+3}_2(SiO_4)_3$

COLLECTION_LOCALITY: Rimpfischwange, Zermitt, Valais, Switzerland

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Forms series with Grossular and with Schorlomite.

The original sample description and mid-infrared spectrum was published in:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

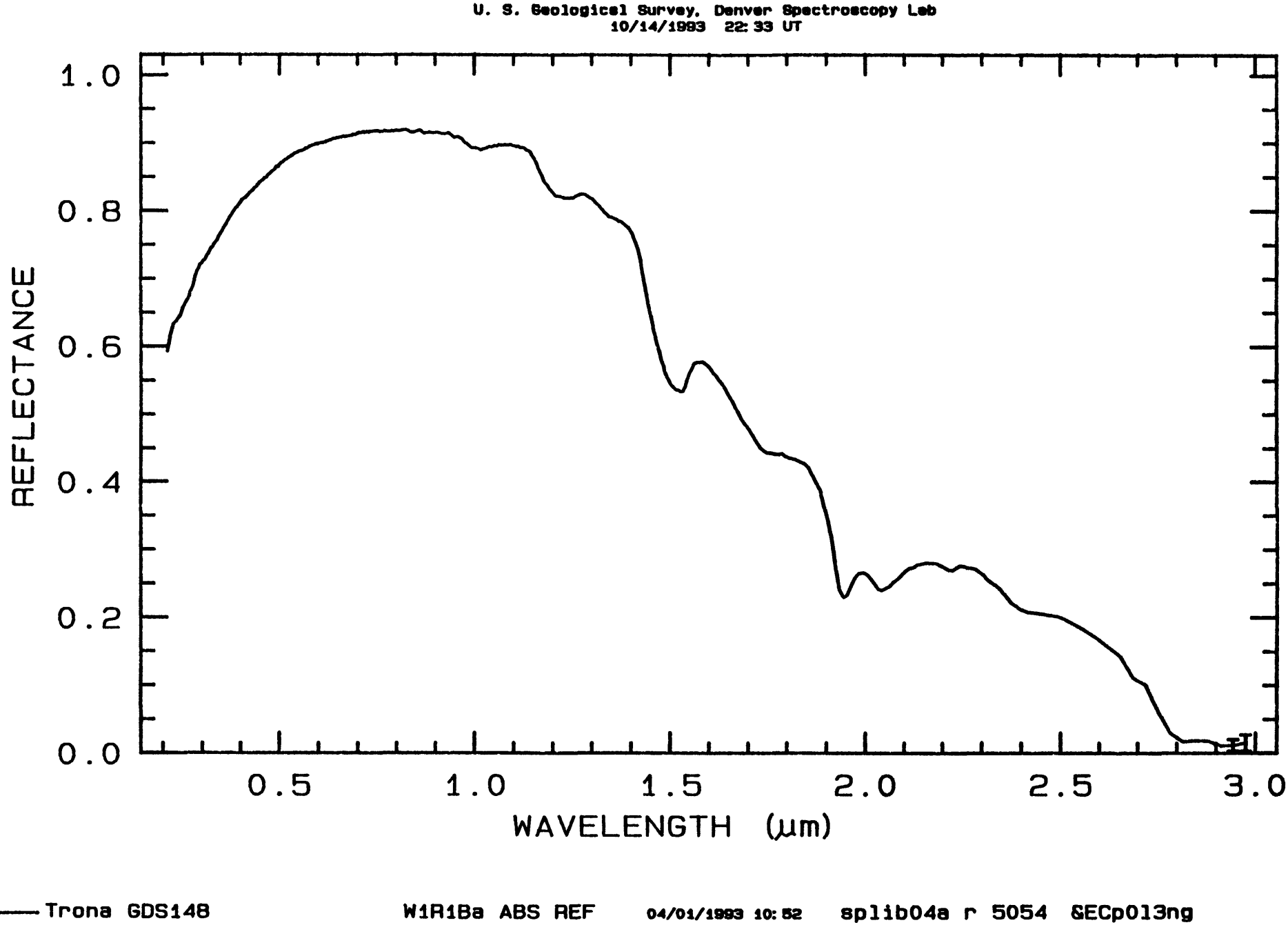
Hand-picked sample is pure andradite. From:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Specific XRD analysis says pure Andradite - by Norma Vergo

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 22:33 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Trona GDS148
W1R1Ba ABS REF
04/01/1993 10:52
splib04a r 5054 &ECp013ng

TITLE: Ulexite HS441 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS441

MINERAL_TYPE: Hydrous Borate

MINERAL: Ulexite

FORMULA: NaCaB5O9*8H2O

FORMULA_NROFF: $NaCaB_5O_9 \bullet 8H_2O$

COLLECTION_LOCALITY: California

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

40 kV - 30 mA, 6.5-9.5 keV [smear mount of ground sample is ulexite.out, bulk mount or random mount of unground sample is ulexite2.out]
References: JCPDS #12-419 (from Clark and Christ, 1959); Ghose et al. (1978)
Found: Ulexite
Comments: There are so many peaks that reflections of a second phase, if present could be obscured by overlap. Pattern ulexite2.out is extraordinary and was indexed successfully to about 35 degrees 2 theta using powder intensities calculated from the structure of Ghose et al. (1978). Reflections are very sharp, indicating a high degree of crystallinity and compositional heterogeneity.

J.S. Huebner and J. Pickrell, unpublished data, written communication, USGS, Reston, VA (1993)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

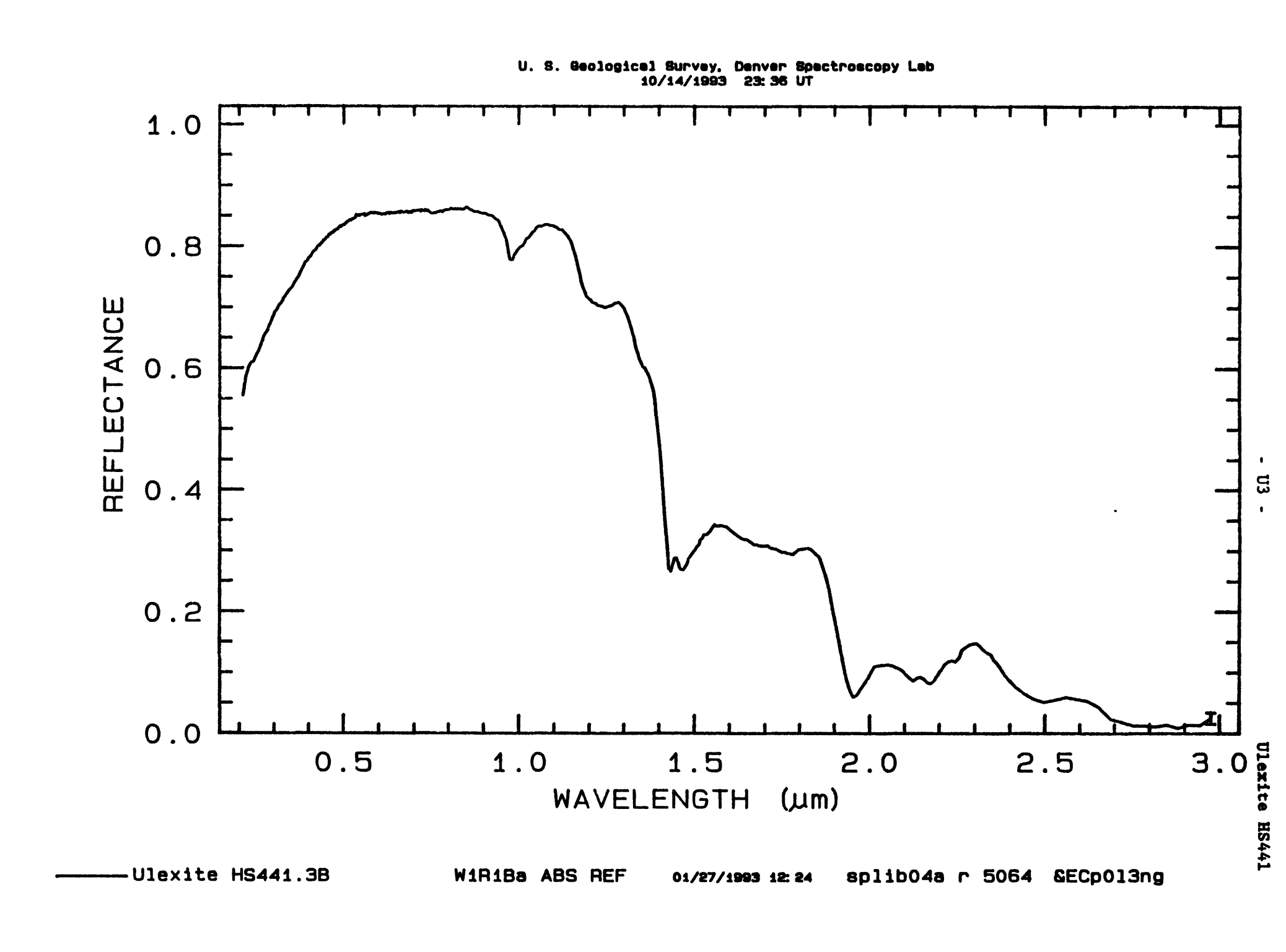
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5064	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- U3 -
Ulexite HS441
Ulexite HS441.3B
W1R1Ba ABS REF
01/27/1993 12:24
splib04a r 5064 &ECp013ng

TITLE: Ulexite GDS138 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS138

MINERAL_TYPE: Hydrous Borate

MINERAL: Ulexite

FORMULA: NaCaB5O9*8H2O

FORMULA_NROFF: $NaCaB_5O_9 \bullet 8H_2O$

COLLECTION_LOCALITY: Boron, California

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure ulexite. (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

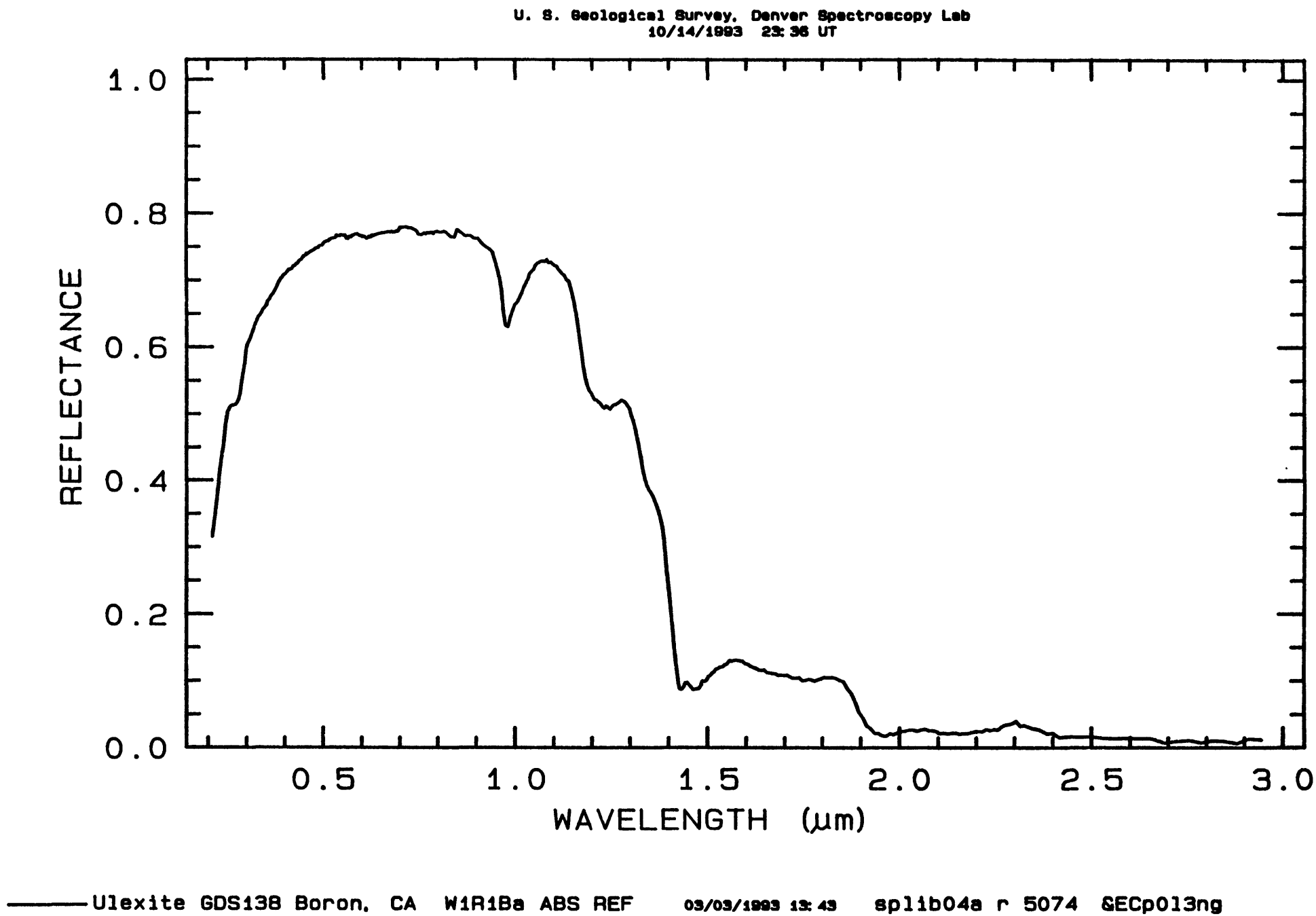
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5074	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 05 -
Ulexite GDS138
Ulexite GDS138 Boron, CA W1R1Ba ABS REF 03/03/1993 13:43 splib04a r 5074 &ECp013ng

TITLE: Uralite HS345 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS345

MINERAL_TYPE: Inosilicate

MINERAL: Uralite (Amphibole group)

FORMULA: Ca2(Mg,Fe2+)5(Si8O22)(OH,F)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{2+})_5(Si_8O_{22})(OH,F)_2$

COLLECTION_LOCALITY: Calumet, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"I-15 Uralite 345B--Calumet, Colo. $Ca_2(Mg,Fe^{2+})_5(Si_8O_{22})(OH,F)_2$: This is a hornblende formed by alteration of pyroxenes. It is generally actinolitic in composition, but often contains aluminum (Deer et al., 1963). Its spectrum shows a doubled iron feature near 0.75 and 1.0μ, the former due to Fe^{3+} substituting for Al, the latter due to Fe^{2+} substituting for Mg. The 1.4μ hydroxyl feature is considerably weaker than the 2.32μ and 2.38μ hdroxyl bands. The 1.9μ band indicates a slight amount of included water."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Amphibole - major (hornblende?) Clinopyroxene - major (augite?) Unidentifiable residual Note: Uralite is described as an amphibole psuedomorphous after pyroxene.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

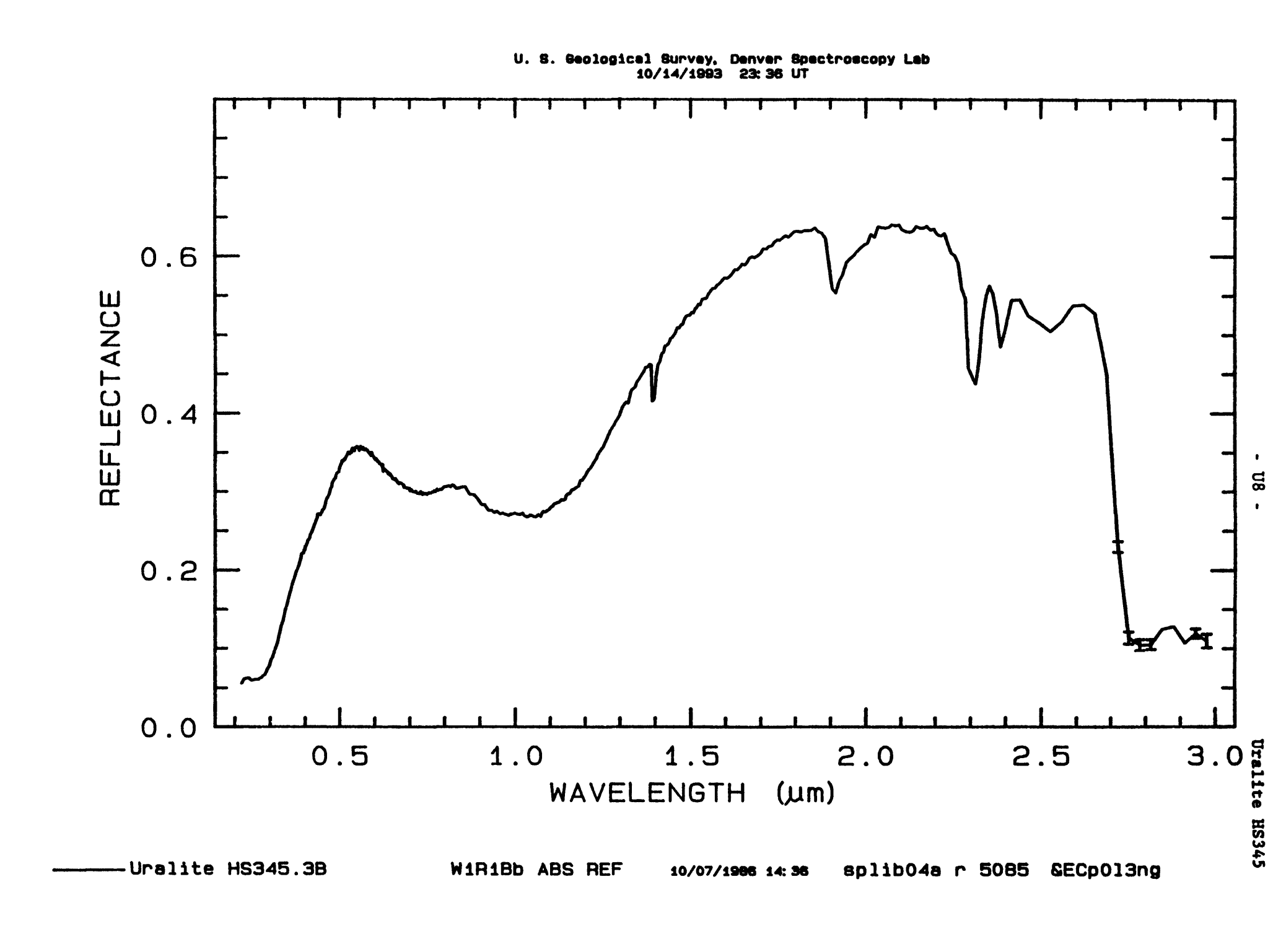
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5085	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 08 -
Uralite HS345
Uralite HS345.3B
W1R1Bb ABS REF
10/07/1986 14:36
splib04a r 5085 &ECp013ng

TITLE: Uvarovite NMNH106661 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH106661

MINERAL_TYPE: Nesosilicate

MINERAL: Uvarovite (Garnet group)

FORMULA: Ca3Cr(+3)2(SiO4)3

FORMULA_NROFF: $Ca_3Cr^{+3}{}_2(SiO_4)_3$

COLLECTION_LOCALITY: Unknown

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Grossular.

The garnet group includes a series of isostructural subspecies with space group Ia3d; the crystallize in the hexoctahedral class of the isometric system and are similar in crystal habit. Garnet compositions can be expressed by the general structural formula $A_3B_2(SiO_4)$ where the A site houses Ca, Mg, Fe^{+2} or Mn^{+2} and the B site incorporates Al, Fe^{+3}, and Cr_{+3}.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2: 35.9700 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2: 0.0744 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3: 5.7720 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3: 19.9300 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3: 0.2657 wt%	NROFF:	V_2O_3
COMPOSITION:	FeO: 1.0750 wt%	NROFF:	FeO
COMPOSITION:	NiO: 0.0099 wt%	NROFF:	NiO
COMPOSITION:	MnO: 0.7153 wt%	NROFF:	MnO
COMPOSITION:	MgO: 0.4420 wt%	NROFF:	MgO
COMPOSITION:	CaO: 32.5200 wt%	NROFF:	CaO
COMPOSITION:	----------		
COMPOSITION:	Total: 96.7743 wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

COMPOSITION:	SiO2:	35.50 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.07 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.29 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	28.17 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.11 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.14 wt%	NROFF:	MgO
COMPOSITION:	CaO:	33.11 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.02 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.01 wt%	NROFF:	K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	97.42 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	97.42 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

The above analysis was an average of 8 analyses and indicates nearly end-member composition. The analysis shows the sample is homogenous within and between grain boundaries.

From: Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

The following description is from: Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

"The sample is a cluster of subhedral crystals, green in color varying slightly with shade. Some grains are coated with a white contaminant that is soft. Dark impurities can be seen in the microscope. The white conmtaminant does not disapear with HCl treatment. The sample was crushed to free individual 3mm crystals and the clean bright green crystals hand picked. A few grains have a light brownish tinge on some edges. The microprobe grains appeared pure."

av gr sz = 200μm

Clear pure grains, conchoidal fracture, isotropic under cross-polarized light. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 390	0.2-3.0μm	200	g.s.= 200 μm

Microprobe by G. Swayze, avg of several points

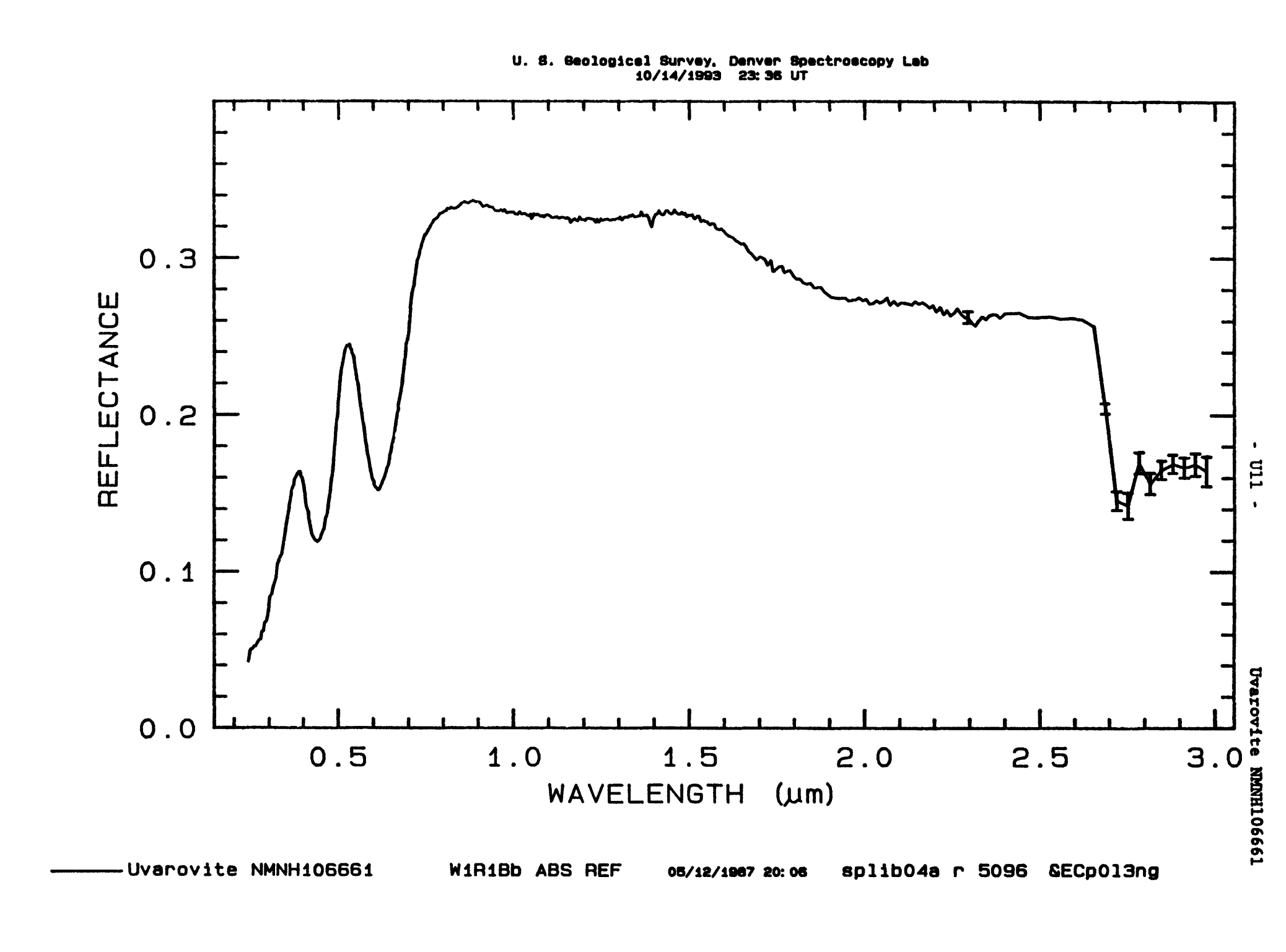
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5096	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- U11 -
Uvarovite NMNH106661
Uvarovite NMNH106661 W1R1Bb ABS REF 05/12/1997 20:06 splib04a r 5096 &ECp013ng

TITLE: Vermiculite GDS13 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS13

MINERAL_TYPE: Phyllosilicate

MINERAL: Vermiculite

FORMULA: (Mg,Fe+2,Al)3(Al,Si)4O10(OH)2*4H2O

FORMULA_NROFF: $(Mg,Fe^{+2},Al)_3(Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Llano, Texas

ORIGINAL_DONOR: Norma Vergo

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure vermiculite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

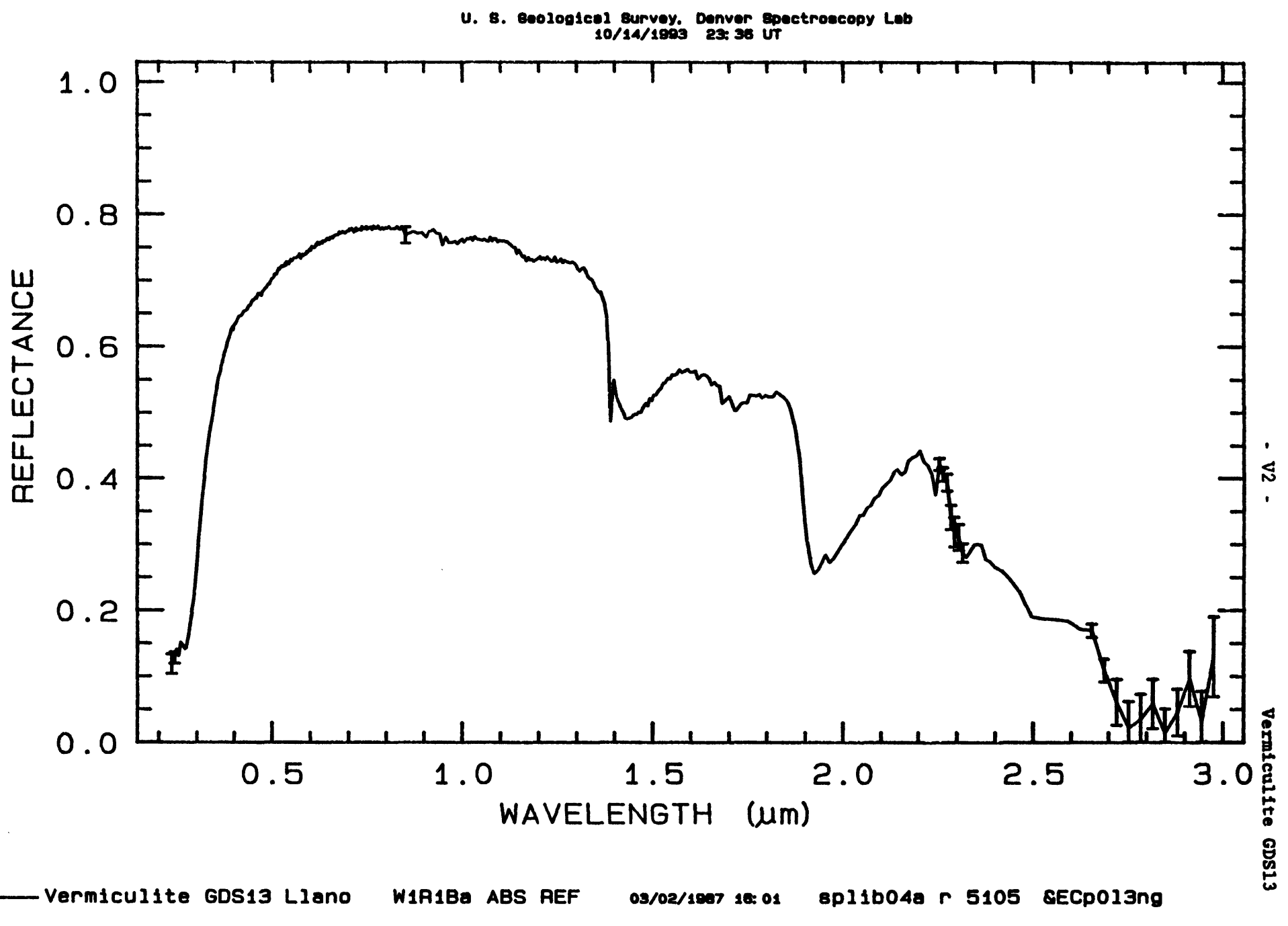
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5105	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- V2 -
Vermiculite GDS13
Vermiculite GDS13 Llano W1R1Ba ABS REF 03/02/1987 16:01 splib04a r 5105 &ECp013ng

TITLE: Vermiculite VTx-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: VTx-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Vermiculite

FORMULA: (Mg,Fe+2,Al)3(Al,Si)4O10(OH)2*4H2O

FORMULA_NROFF: $(Mg,Fe^{+2},Al)_3(Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Llano, Texas

ORIGINAL_DONOR: Clay Mineral Repository

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Not vermiculite - not pure (Norma Vergo). Spectrally pure, but not chemically pure. (Norma Vergo).

There is some confusion on whether this is a pure vermiculite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	19.5	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	<0.02	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	1.53	wt%	NROFF: Al_2O_3
COMPOSITION:	Fe2O3:	0.56	wt%	NROFF: Fe_2O_3
COMPOSITION:	MnO:	0.03	wt%	NROFF: MnO
COMPOSITION:	MgO:	27.7	wt%	NROFF: MgO
COMPOSITION:	CaO:	17.7	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.26	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.03	wt%	NROFF: K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF: P_2O_5
COMPOSITION:	LOI:	32.7	wt%	NROFF: LOI
COMPOSITION:	---	---	---	
COMPOSITION:	Total:		wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

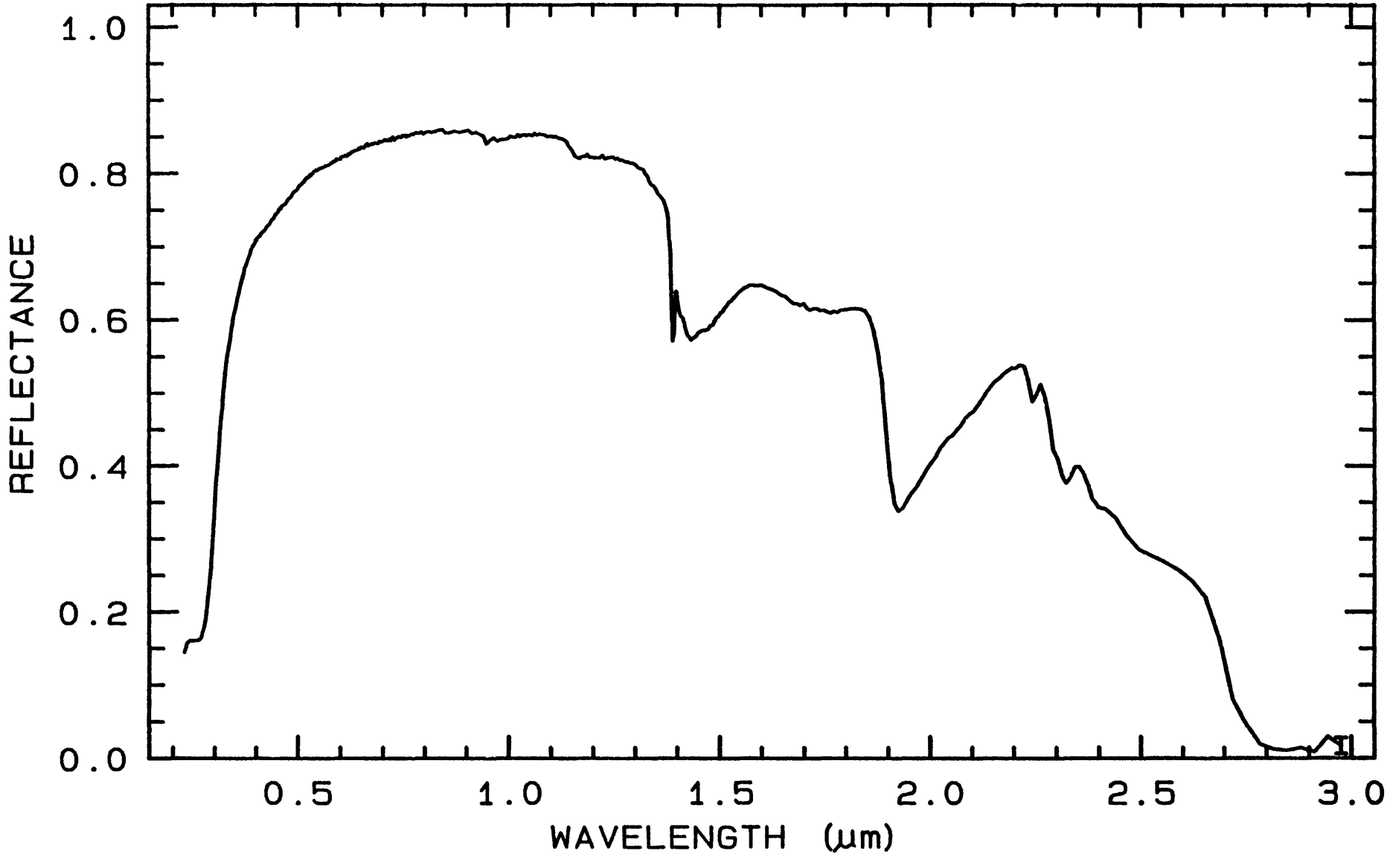
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5116	0.2-3.0μm	200	g.s.= <250μm
LIB_SPECTRA:	splib04a r 5127	0.2-3.0μm	200	g.s.=

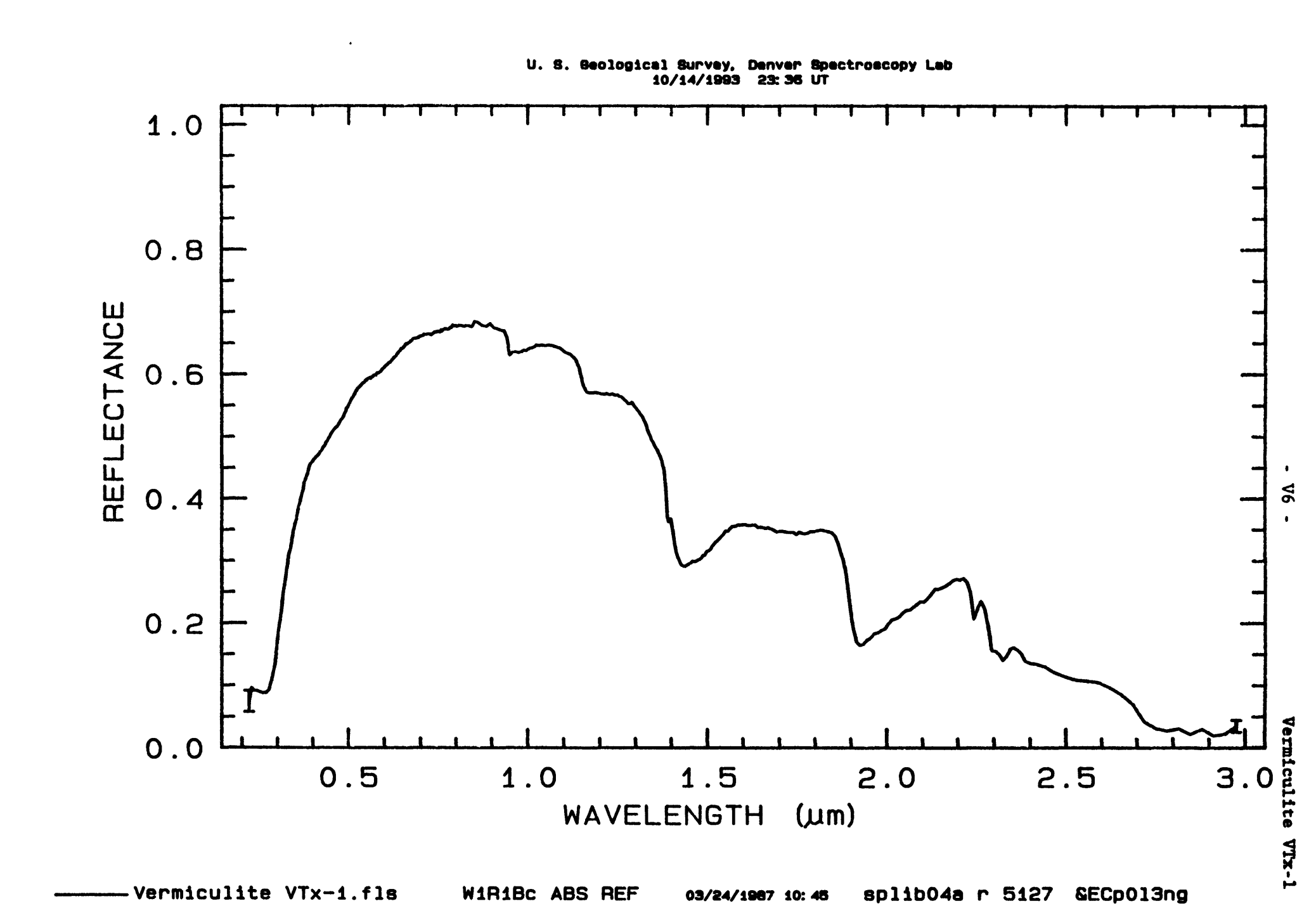
U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT



- V5 -

Vermiculite VTx-1

Vermiculite VTx-1.a <250 W1R1Bc ABS REF 03/31/1987 09:25 splib04a r 5116 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- V6 -
Vermiculite VTx-1
Vermiculite VTx-1.fls W1R1Bc ABS REF 03/24/1987 10:45 splib04a r 5127 &ECp013ng

TITLE: Vermiculite WS681 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS681

MINERAL_TYPE: Phyllosilicate

MINERAL: Vermiculite

FORMULA: (Mg,Fe+2,Al)3(Al,Si)4O10(OH)2*4H2O

FORMULA_NROFF: $(Mg,Fe^{+2},Al)_3(Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Kent, Connecticut

ORIGINAL_DONOR: Ward Natural Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Vermiculite and mica-rich mixed layer phase, probably dioctahedral (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

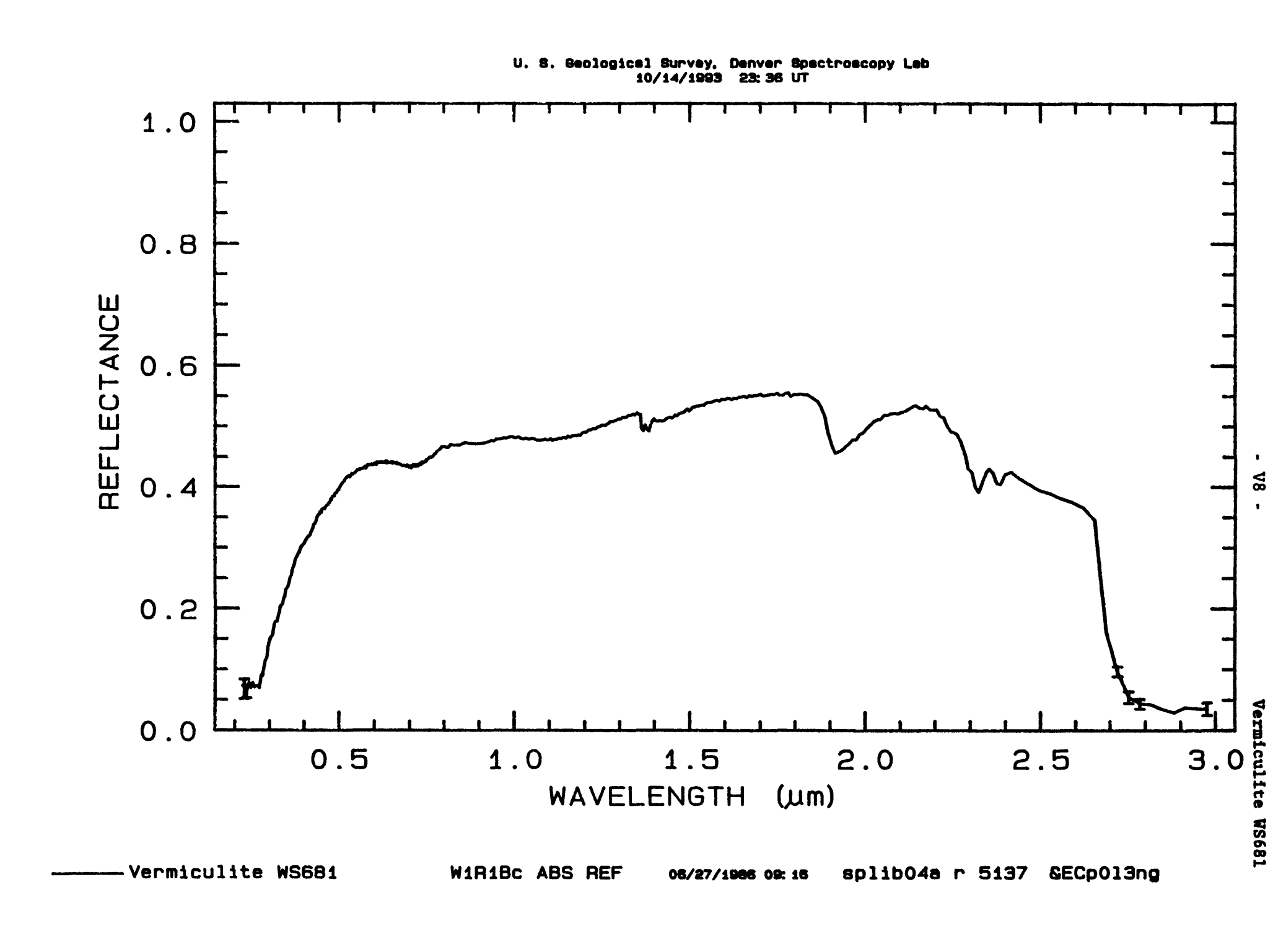
END_COMPOSITION_DISCUSSION.

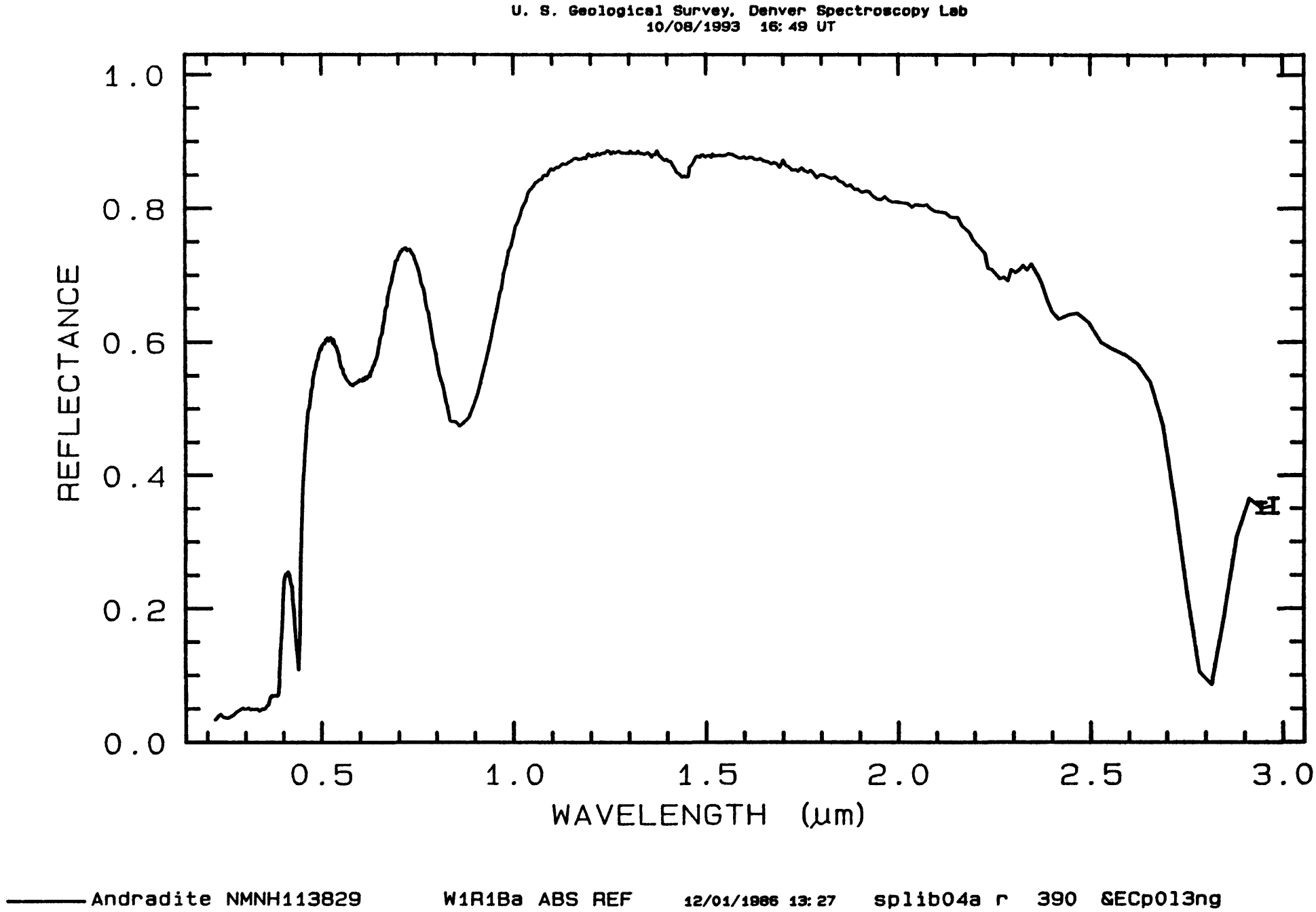
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5137	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- V8 -
Vermiculite WS681
Vermiculite WS681 W1R1Bc ABS REF 06/27/1966 02:16 splib04a r 5137 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A98 -
Andradite NMNH113829
Andradite NMNH113829 W1R1Ba ABS REF 12/01/1986 13:27 splib04a r 390 &ECp013ng

TITLE: Vesuvianite HS446 Idocrase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS446

MINERAL_TYPE: Cyclosilicate

MINERAL: Vesuvianite (Idocrase)

FORMULA: Ca10Mg2Al4(SiO4)5(Si2O7)2(OH)4

FORMULA_NROFF: $Ca_{10}Mg_2Al_4(SiO_4)_5(Si_2O_7)_2(OH)_4$

COLLECTION_LOCALITY: Maine

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"S-6 Idocrase 446B--Maine. $Ca_{10}(MgFe)_2Al_4$- $(SiO_4)_5(Si_2O_7)_2(OH)_4$: Idocrase is found in crystalline limestones as a result of contact metamorphism. The spectrum displays a weak but well resolved ferrous iron band at 9.95 μ, a weak ferric ion band near 0.75 μ, and the typical associated fall off in reflectivity to the blue. Very well resolved hydroxyl doubled features occur near 1.4 and 1.44 μ, and the weak 1.9 μ feature indicates some H_2O. Combination OH bands occur near 2.2 and 2.37 μ. Note that these hydroxyl and water bands are located at their usual positions, unlike those displayed by other members of the epidote group. It is interesting that some authors (eg. Deer et al., 1963) do not include idocrase as a member of the epidote group, and the anomalous positions of its hydroxyl and water bands support this view."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

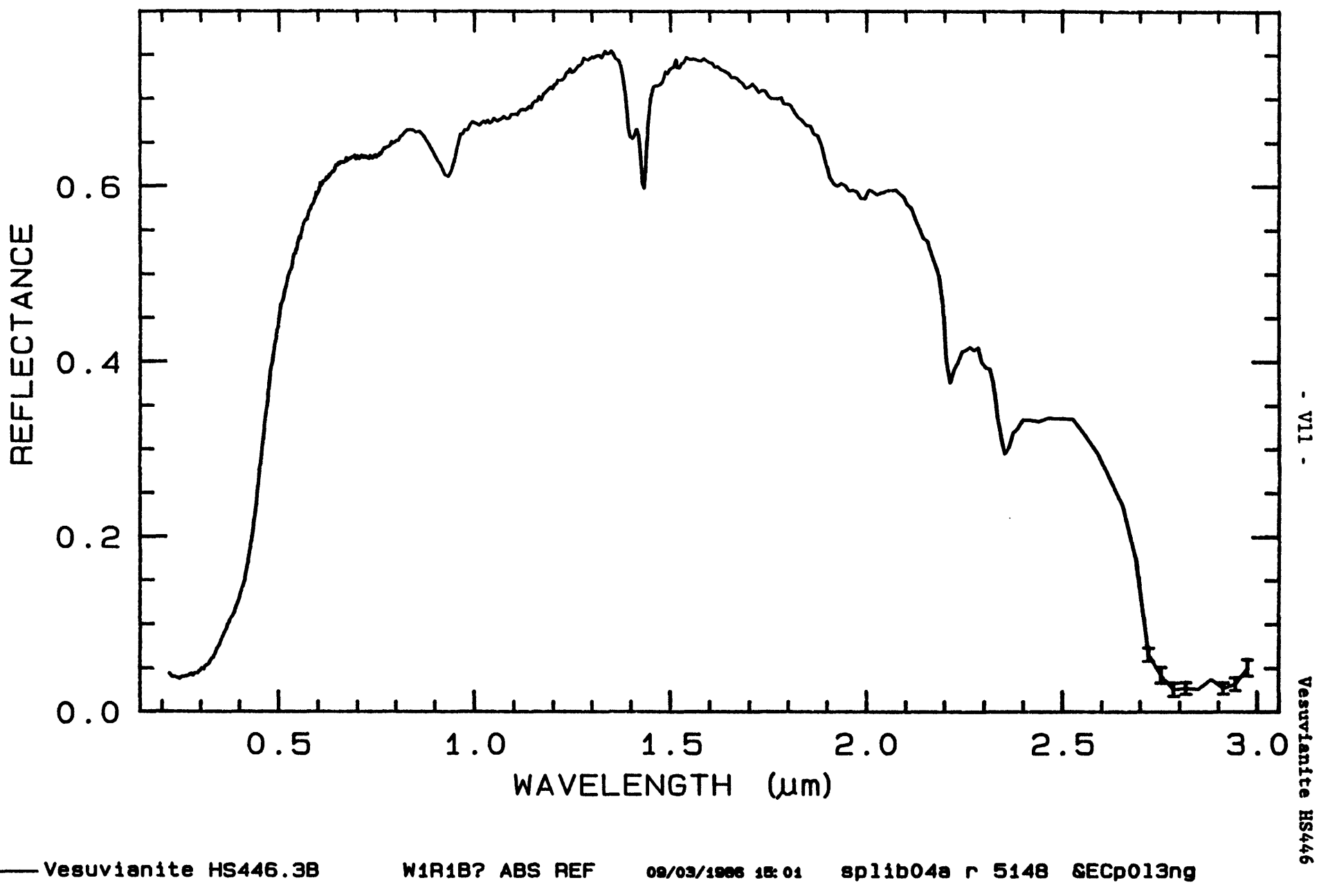
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5148	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:36 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Vesuvianite HS446
Vesuvianite HS446.3B W1R1B? ABS REF 09/03/1996 15:01 splib04a r 5148 &ECp013ng

TITLE: Witherite HS273 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS273

MINERAL_TYPE: Carbonate

MINERAL: Witherite (Aragonite group)

FORMULA: BaCO3

FORMULA_NROFF: $BaCO_3$

COLLECTION_LOCALITY: England

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"C-10 Witherite. England (64, hand-ground). Witherite, $BaCO_3$, is a comparatively rare mineral, usually found in hydrothermal veins associated with galena. Like strontianite, witherite is a member (and isostructure) of the aragonite group, and displays only carbonate bands. Witherite is normally fairly pure $BaCO_3$, and this sample is no exception."

Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure witherite

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

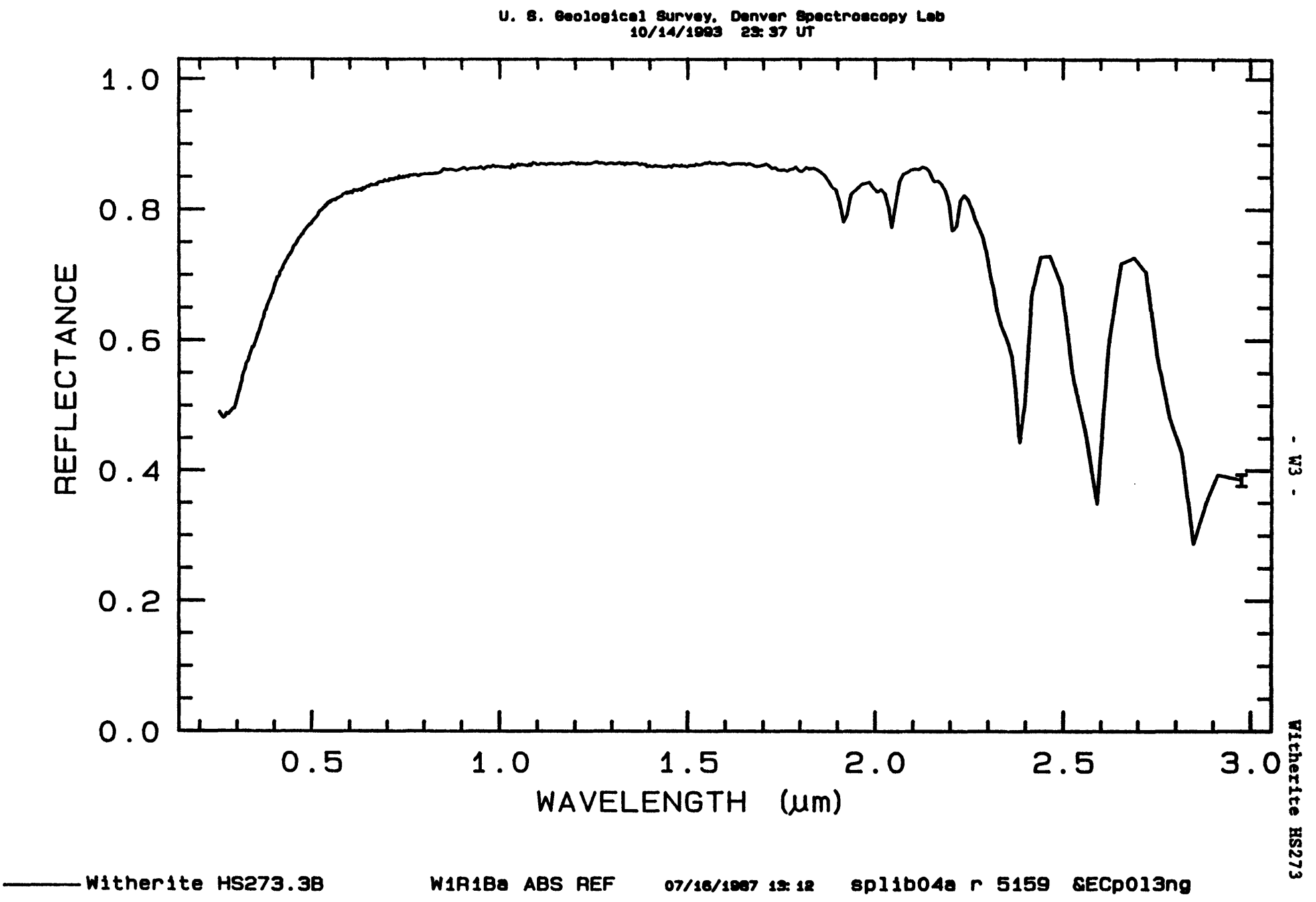
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5159	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:37 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 13 -
Witherite HS273
Witherite HS273.3B W1R1Ba ABS REF 07/16/1997 13:12 splib04a r 5159 &ECp013ng

TITLE: Wollastonite HS348 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS348

MINERAL_TYPE: Inosilicate

MINERAL: Wollastonite

FORMULA: CaSiO3

FORMULA_NROFF: $CaSiO_3$

COLLECTION_LOCALITY: Santa Fe Mine, Pichucalco, Chiapas, Mexico

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sieve interval 74-250μm.

"Results of petrographic examination: Single crystal 2 x 0.5 x 1 cm and one large piece 4 x 0.5 x 1. cm. One dirty surface and sulfide inclusions which were separated by crushing and hand picking. Under petrographic microscope, some grains show a little alteration and inclusions or voids along cleavage directions - possible exsolved pyroxene?"

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

X-ray analysis indicates sample is pure.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM (WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	50.84	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.01	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	0.05	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	0.18	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.75	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.08	wt%	NROFF: MgO
COMPOSITION:	CaO:	47.62	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.01	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.03	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.57	wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis shows that sample is homogeneous between and within grains. Average of 7 analyses.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

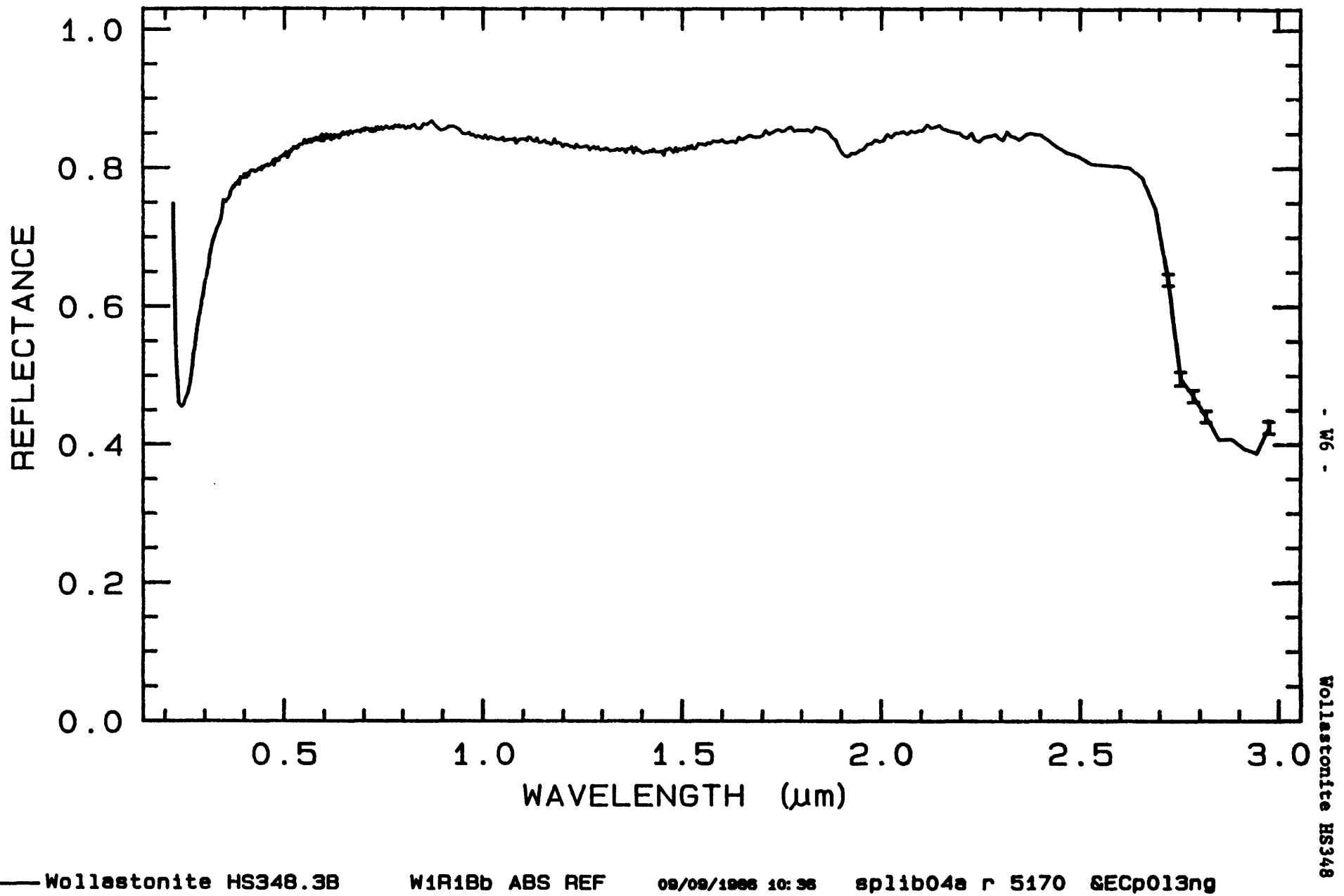
MICROSCOPIC_EXAMINATION:

Colorless transparent to white. Almost no contamination visually apparent. Insignificant number of crystals with small (1/50th the size of the wollastonite crystal) inbedded dark grains.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5170	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:37 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Wollastonite HS348.3B W1R1Bb ABS REF 09/09/1996 10:36 splib04a r 5170 &ECp013ng
Wollastonite HS348

TITLE: Zincite+Franklinite HS147 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS147

MINERAL_TYPE: Oxide

MINERAL: Zincite + Franklinite

FORMULA: ZnO + (Zn,Mn+2,Fe+2)(Fe+3,Mn+3)2O4

FORMULA_NROFF: ZnO + $(Zn,Mn^{+2},Fe^{+2})(Fe^{+3},Mn^{+3})_2O_4$

COLLECTION_LOCALITY: Franklin, New Jersey

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"0-16. Zincite (plus Franklinite). Franklin, N.J. (147B). Zincite, ZnO, is a very rare mineral found in large amounts exclusively at Franklin, N.J., intimately intergrown with franklinite. The chemical formula for franklinite is usually written $ZnFe_2O_4$, but shows variations in composition indicated by the more typical formual (Fe, Zn, Mn) (Fe, $Mn)_2O_4$. Both zincite and franklinite are highly colored, the zincite possibly by the manganese ion (Palache et al., 1944), the franklinite primarily by the ferric ion. Both the ferrous and ferric ions are primarily responsible for the fall- off in reflectivity towards the blue and for the crossover for different particle size samples. The band at 1.15μ is due to the Fe^{2+} ion, and at 0.8μ to Fe^{3+}, both of which locate easily in the host zinc oxide crystal and are most marked in the finer particle size. The fall-off in reflectivity is caused by a combination of the presence of ferrous and ferric ion, intrinsic absorption and a tailing off of the zinc oxide conduction band into the visible range."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Zincite - major
Franklinite - major
Possible unidentifiable residual

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

TITLE: Andradite WS487 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS487

MINERAL_TYPE: Nesosilicate

MINERAL: Andradite (Garnet group)

FORMULA: Ca3(Fe+3)2(SiO4)3

FORMULA_NROFF: $Ca_3Fe^{+3}_2(SiO_4)_3$

COLLECTION_LOCALITY: Stanley Butte, Arizona

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Grossular and with Schorlomite.

Dry sieve to < 250 μm

Weak spectral features at 2.2 μm and 1.4 μm indicate presence of OH bearing mineral. Bands in the visible appear representative of andradite. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

99.5 vol% andradite
0.5 vol% opaques

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

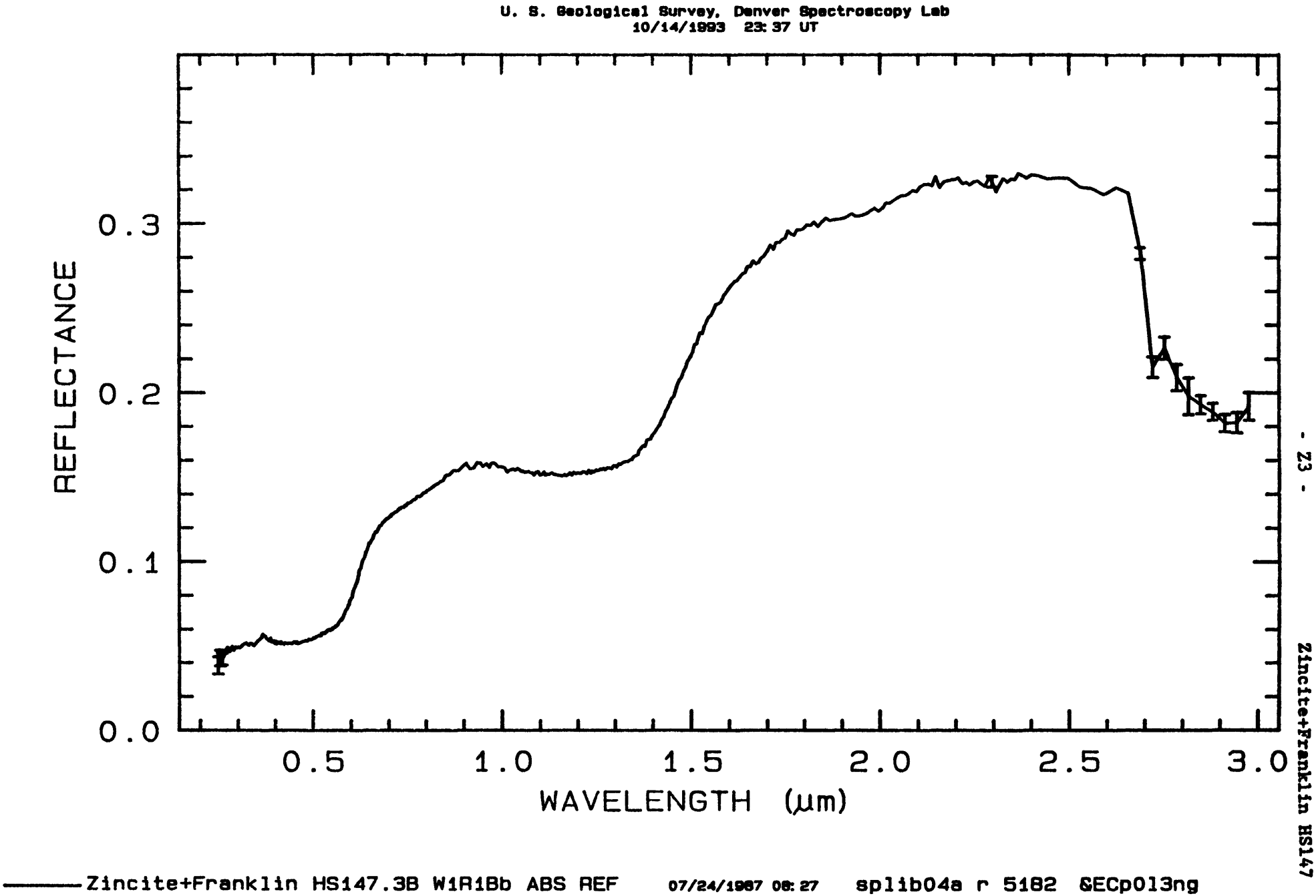
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5182	0.2-3.0μm	200	g.s.=



Zincite+Franklin HS147

TITLE: Zircon WS522 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS522

MINERAL_TYPE: Nesosilicate

MINERAL: Zircon

FORMULA: ZrSiO4

FORMULA_NROFF: $ZrSiO_4$

COLLECTION_LOCALITY: Gurpui, Goias, Brazil

ORIGINAL_DONOR: Ward Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

<250 μ grain size.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

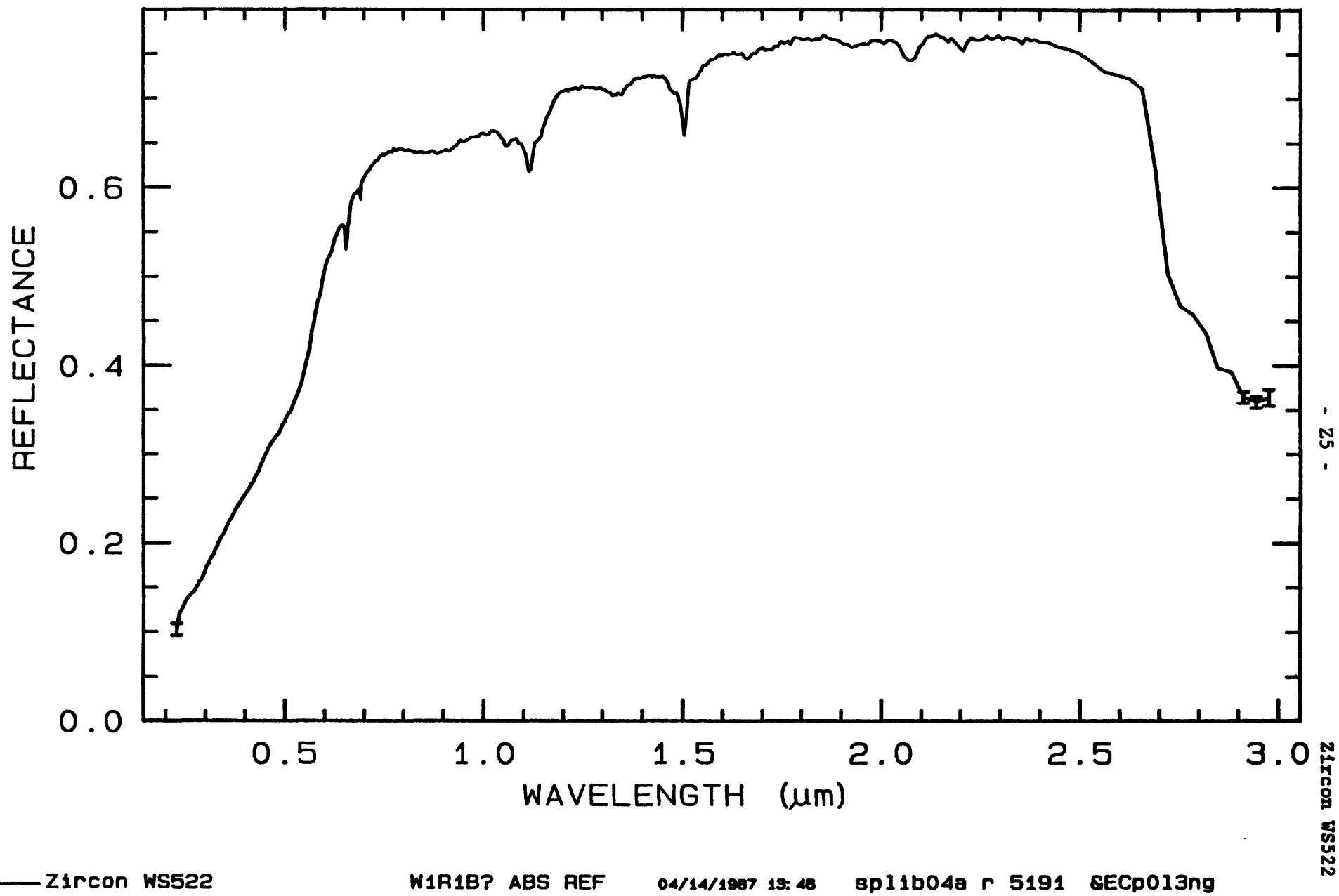
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5191	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 23:37 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Zircon WS522
Zircon WS522
W1R1B? ABS REF
04/14/1987 13:46
splib04a r 5191 GECp013ng

TITLE: Zoisite HS347 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS347

MINERAL_TYPE: Sorosilicate

MINERAL: Zoisite (Epidote group)

FORMULA: Ca2Al3(SiO4)3(OH)

FORMULA_NROFF: $Ca_2Al_3(SiO_4)_3(OH)$

COLLECTION_LOCALITY: Norway

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"S-2 Zoisite 347--Norway. $Ca_2(AlOH)Al_2\text{-}(SiO_4)_3$. Zoisite, also a metamorphic mineral found in schists and gneisses, is orthorhombic and is dimorphous with clinozoisite. This sample displays extremely intense bands at 0.43, 0.53 and 0.8 μ, indicative of ferric iron possibly with contributions from Mn^{+2}. The major OH feature is most unusual, occurring at 1.68 μ, as opposed to the normal 1.4 μ position. There is also the unusual weak band at 1.85 μ, and the water feature at 1.9 μ with doubled features at 2.3 μ and 2.35 μ, and another band at 2.48 μ. These features are caused by combinations of OH with lattice or bending modes of ALOH, but the exact nature of these bands is not known."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Zoisite + medium amount quartz + small amount other(s); M: ~40% quartz, feldspar may be present

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

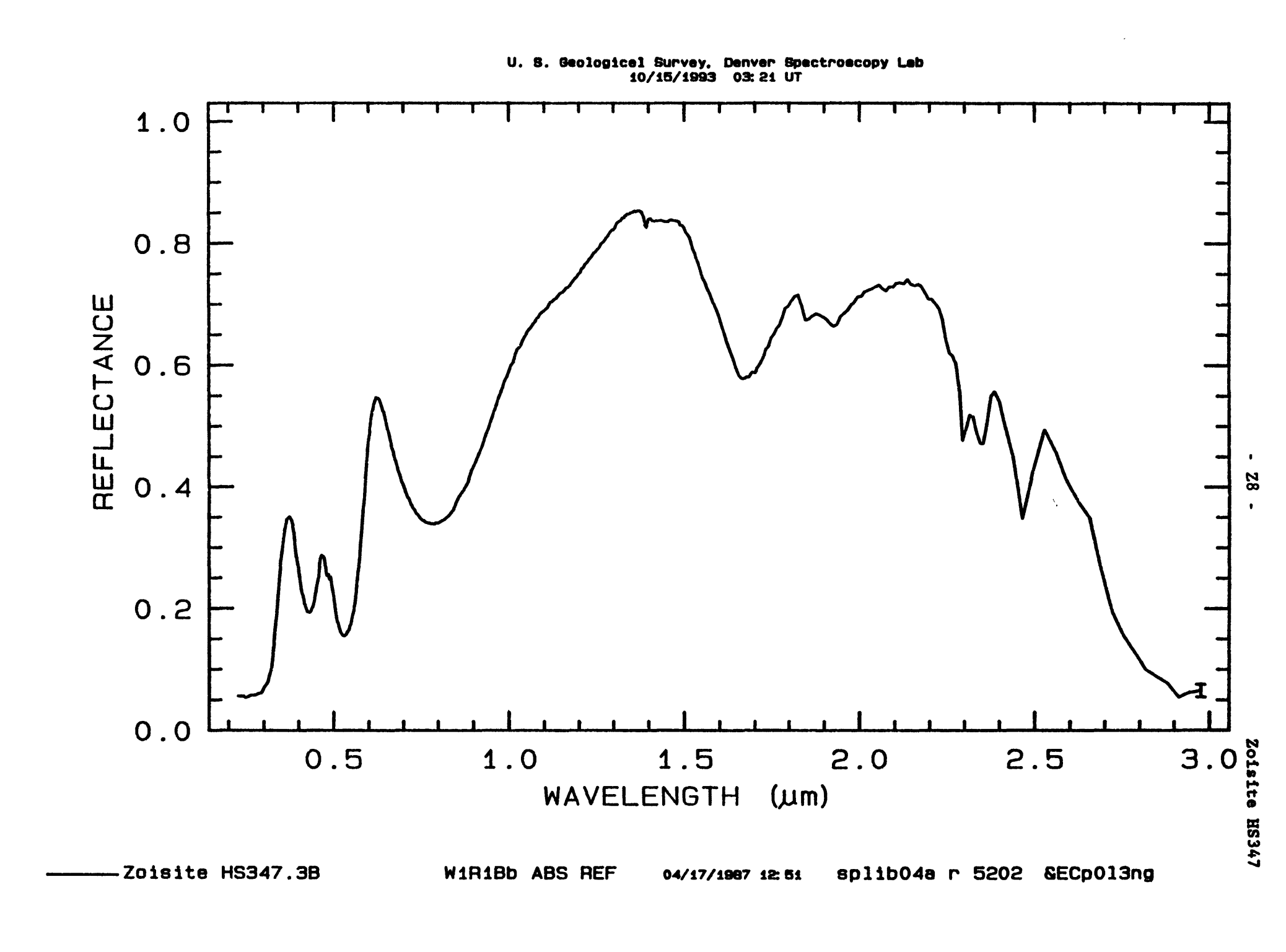
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 5202	0.2-3.0μm	200	g.s.=



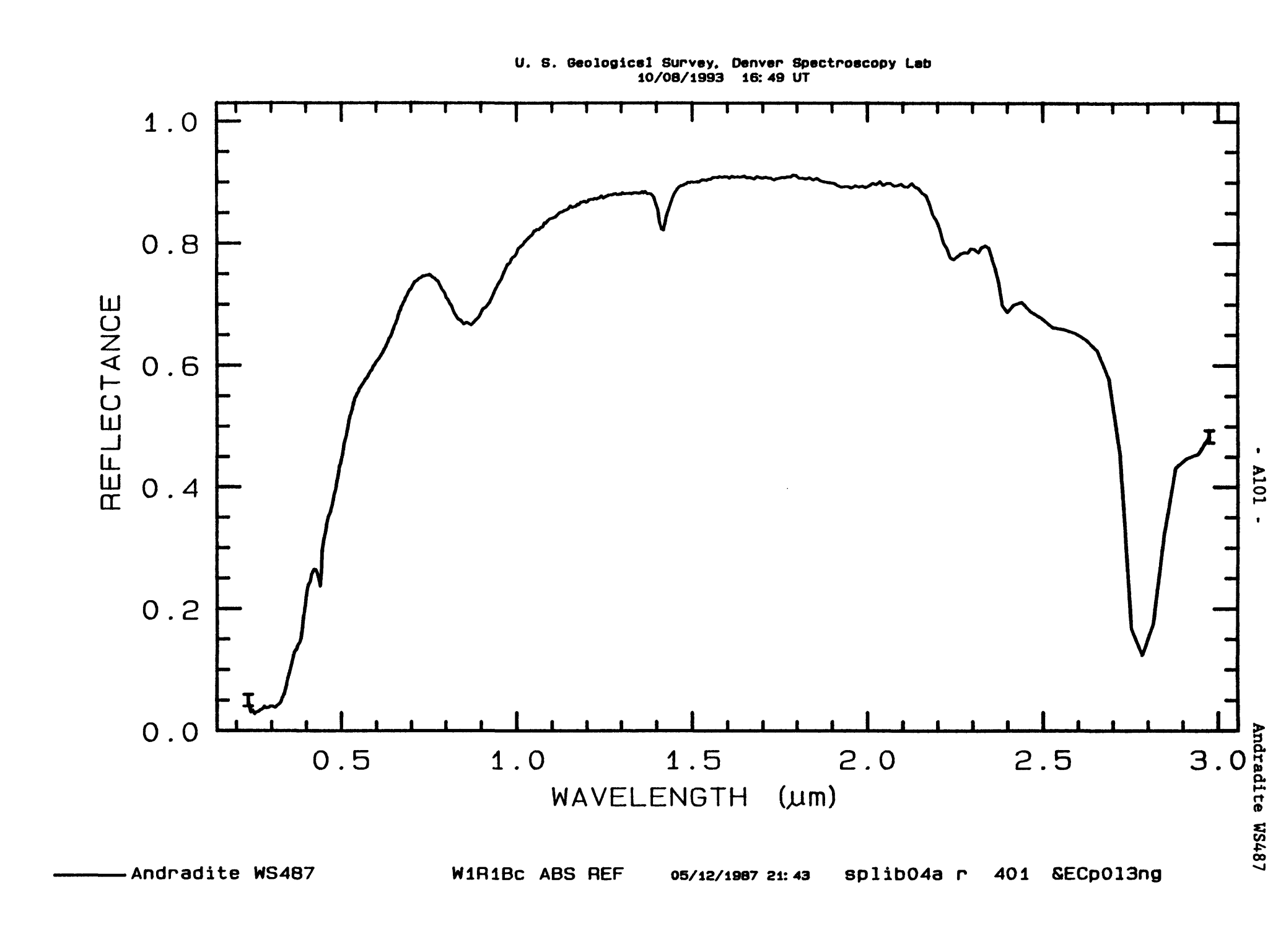
Zoisite HS347

Mostly pure highly fractured andradite grains with opaques inclusions and single opaque grains. Uniform grain size distribution with an avg. grain size of 175μm. G. Swayze Grains mostly of tabular shape.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	401	0.2-3.0μm	200	g.s.=175 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A101 -
Andradite WS487
Andradite WS487 W1R1Bc ABS REF 05/12/1987 21:43 splib04a r 401 &ECp013ng

TITLE: Andradite WS488 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS488

MINERAL_TYPE: Nesosilicate

MINERAL: Andradite (Garnet group)

FORMULA: Ca3(Fe+3)2(SiO4)3

FORMULA_NROFF: $Ca_3Fe^{+3}_2(SiO_4)_3$

COLLECTION_LOCALITY: Franklin, New Jersey

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Grossular and with Schorlomite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	34.71 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.09 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	4.76 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.00 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3:	0.01 wt%	NROFF:	V_2O_3
COMPOSITION:	FeO:	21.47 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.01 wt%	NROFF:	NiO
COMPOSITION:	MnO:	9.45 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.02 wt%	NROFF:	MgO
COMPOSITION:	CaO:	25.70 wt%	NROFF:	CaO
COMPOSITION:	---	---		
COMPOSITION:	Total:	96.23 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	96.23 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Analysis by Gregg Swayze using the USGS Denver microprobe, average of 6 samples.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

96 vol% andradite
4 vol% opaques (biotite?) not magnetite

Bimodal grain size distribution:

population 1 av gr sz = 150um vol%= 75
population 2 av gr sz = 10um vol%= 25%

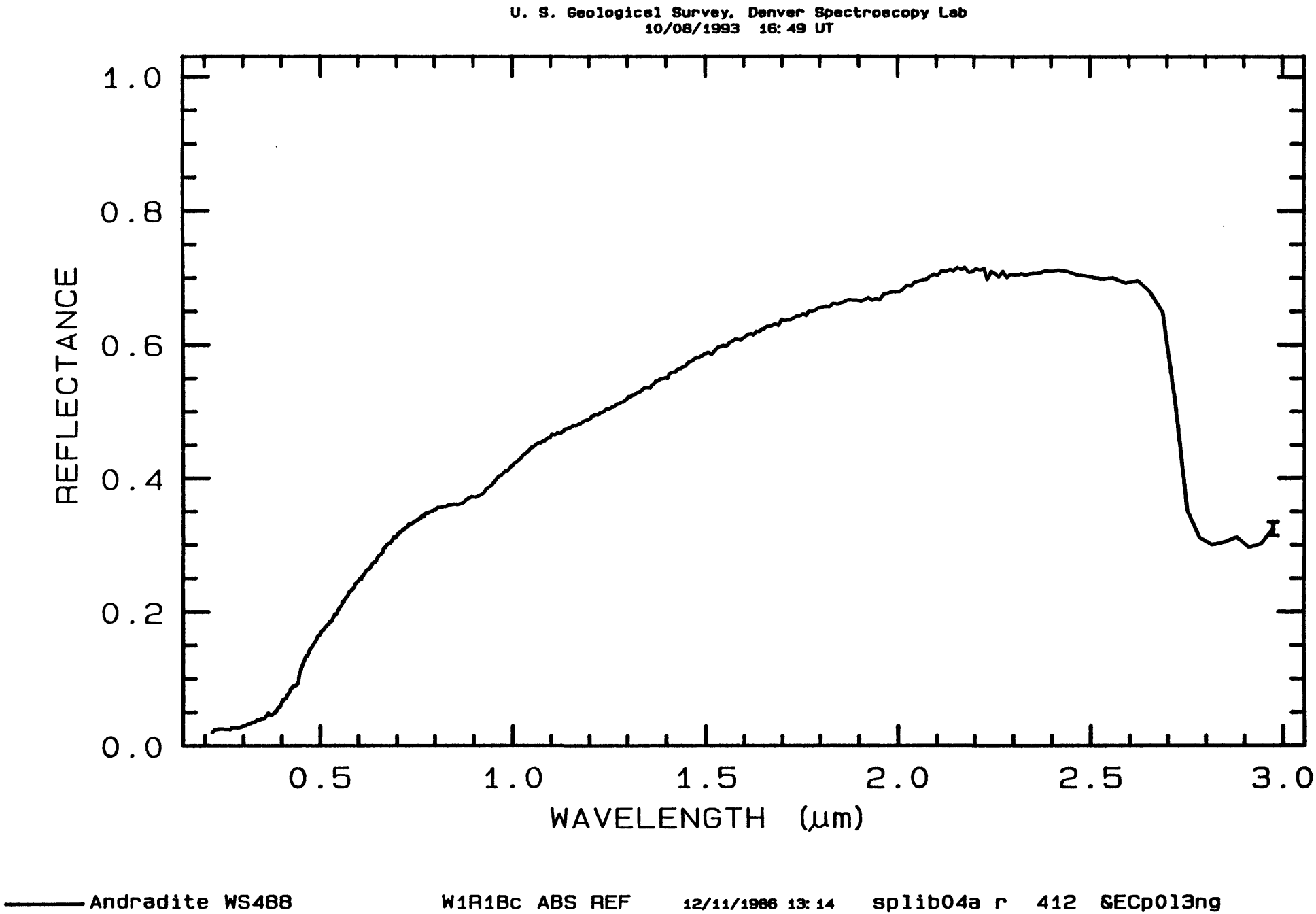
av gr sz of all populations = 130um

Conchoidally fractured andradite grains with opaque inclusions in the grains. 10um sized andradite grains coat 60% of the surfaces of the larger grains. Large grain surfaces either conchoidal fractures or flat parting surfaces. No fizz from HCl. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 412	0.2-3.0μm	200	g.s.=130 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A104 -
Andradite WS488
Andradite WS488
W1R1Bc ABS REF
12/11/1986 13:14
splib04a r 412 &ECp013ng

TITLE: Anhydrite GDS42 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS42

MINERAL_TYPE: Sulfate

MINERAL: Anhydrite

FORMULA: CaSO4

FORMULA_NROFF: $CaSO_4$

COLLECTION_LOCALITY: New Mexico

ORIGINAL_DONOR: Gem Show purchase

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample was purchased at a Gem show. The sample is probably from New Mexico, but that is not 100% certain. The sample appears white with no contamination. The reflectance spectrum indicates virtually no contamination. There are very weak bands in the visible, possibly indicating some iron, but it is not apparent visually under a hand lens.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV
Reference: JCPDS #6-226; Huebner's reference patterns
Found: Anhydrite
Sought but not found: gypsum
Comment: Extremely sharp reflections indicate good crystallinity.
Excellent matchup with the JCPDS card.

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:

population 1	170μm	82 vol%
population 2	10μm	18 vol%

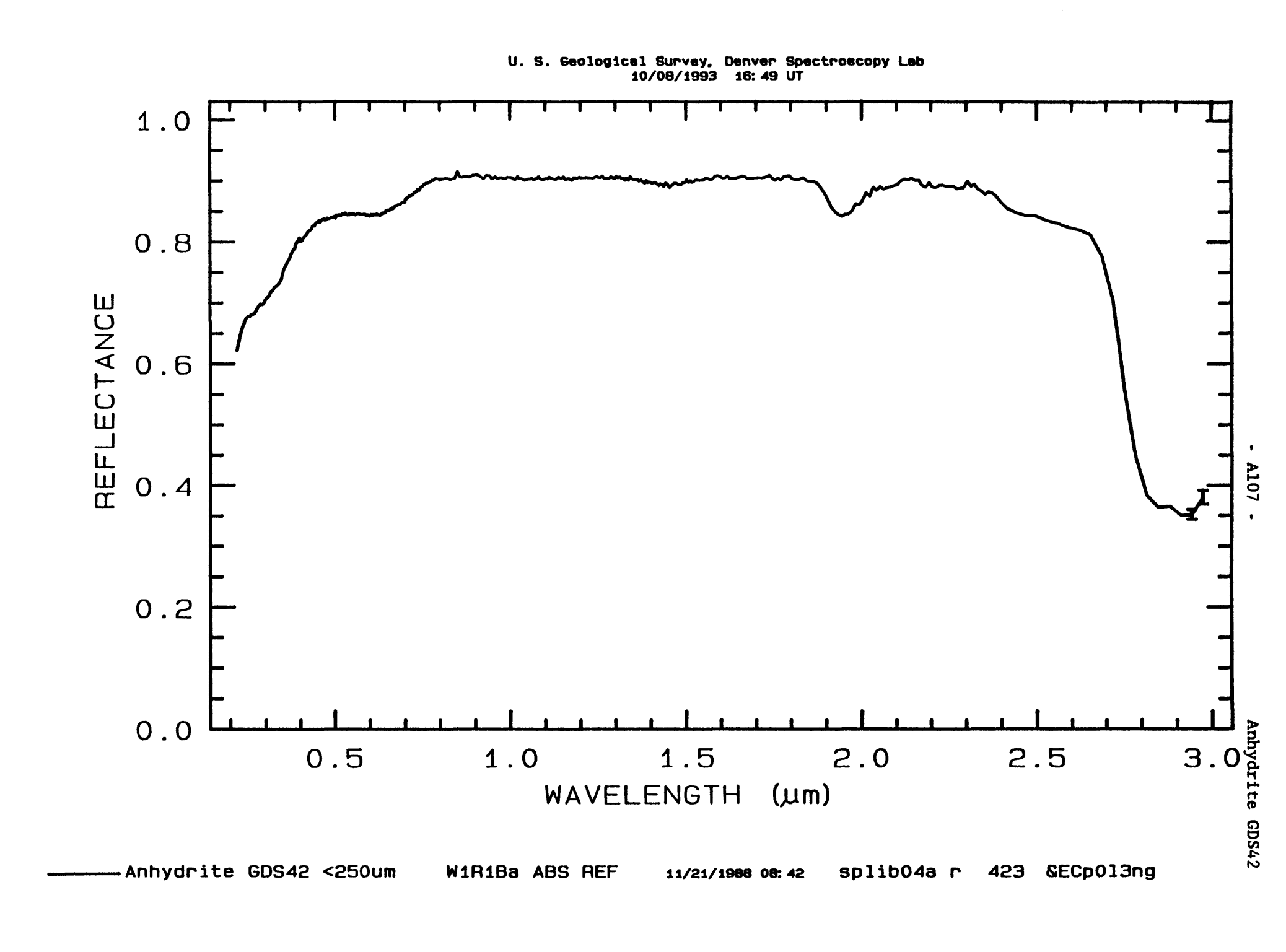
av gr sz of populations = 154μm

Prismatic grains, good cleavage, lg blue color in hand specimen. Trace of opaques. High birefringence and biaxial (+). All these are consistent with andydrite. Twinning parallel to long dimension. Smaller grains adhere extensively to larger grains. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 423	0.2-3.0μm	200	g.s.=154 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A107 -
Anhydrite GDS42
Anhydrite GDS42 <250um W1R1Ba ABS REF 11/21/1988 08:42 splib04a r 423 &ECp013ng

TITLE: Annite WS660 Biotite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS660

MINERAL_TYPE: Phyllosilicate

MINERAL: Annite (Mica group)

FORMULA: K(Fe+2)3AlSi3O10(OH,F)2

FORMULA_NROFF: $KFe^{+2}_3AlSi_3O_{10}(OH,F)_2$

COLLECTION_LOCALITY: Bancroft, Ontario, Canada

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample appears uniform dark green and the visible-NIR spectrum shows strong iron bands and a spectrum typical of pure annite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Triocathedral mica - major - probably a mixture of compositions. No other components.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	39.526 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	2.042 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	11.052 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	16.995 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.693 wt%	NROFF:	MnO
COMPOSITION:	MgO:	14.456 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.008 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.607 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	9.668 wt%	NROFF:	K_2O
COMPOSITION:	Cl:	0.052 wt%	NROFF:	Cl
COMPOSITION:	F:	3.181 wt%	NROFF:	F
COMPOSITION:	---	---		
COMPOSITION:	Total:	98.281 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:

population 1 av gr sz = 300μm 80 vol%
population 2 av gr sz = 10μm 20 vol%

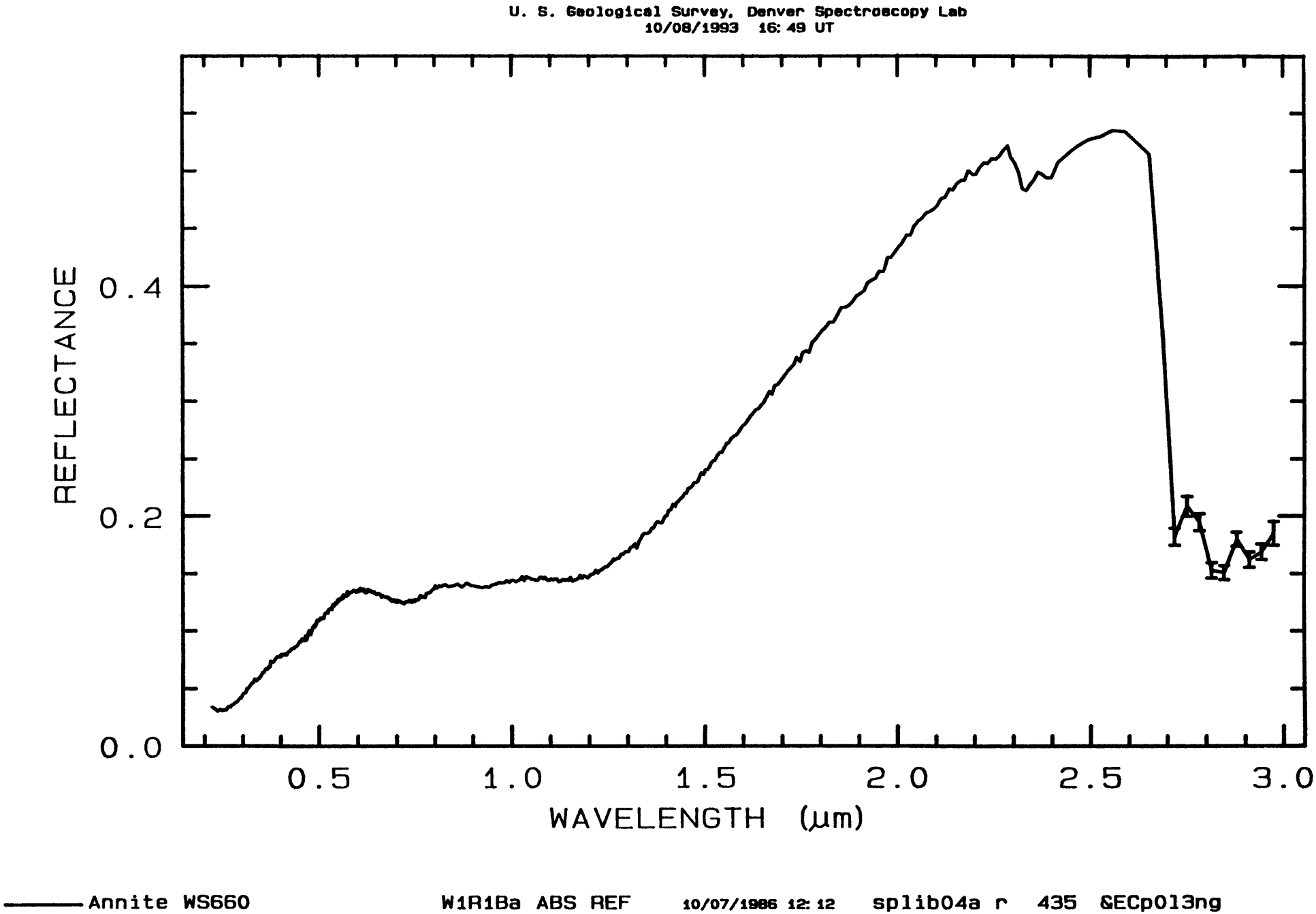
av gr sz of populations = 270μm

Pure annite with larger grains 80% coated by smaller grains. Micaceous flakes with avg. flake diameter = 20μm. Biaxial (-), larger 2V, slight pleochroism, single good basal cleavage. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	435	0.2-3.0μm	200	g.s.= 270 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A110 -
Annite WS660
Annite WS660
W1R1Ba ABS REF
10/07/1986 12:12
splib04a r 435 &ECp013ng

TITLE: Annite WS661 Biotite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS660

MINERAL_TYPE: Phyllosilicate

MINERAL: Annite (Mica group)

FORMULA: K(Fe+2)3AlSi3O10(OH,F)2

FORMULA_NROFF: $KFe^{+2}_3AlSi_3O_{10}(OH,F)_2$

COLLECTION_LOCALITY: Faraday, Ontario, Canada

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample appears uniform dark green and the visible-NIR spectrum shows strong iron bands and a spectrum typical of pure annite. The sample is darker than WS660 and the absorption features near 2.3-μm are weaker, possibly indicating a more iron rich end-member than WS660.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Trioctahedral mica - major - probably a mixture of compositions. No other components.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	33.489 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.542 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	14.513 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	33.840 wt%	NROFF:	FeO
COMPOSITION:	MnO:	1.775 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.006 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.011 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.360 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	8.876 wt%	NROFF:	K_2O
COMPOSITION:	Cl:	0.196 wt%	NROFF:	Cl
COMPOSITION:	F:	2.060 wt%	NROFF:	F
COMPOSITION:	---	---		
COMPOSITION:	Total:	95.667 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:

population 1	160μm	90 vol%
population 2	25μm	10 vol%

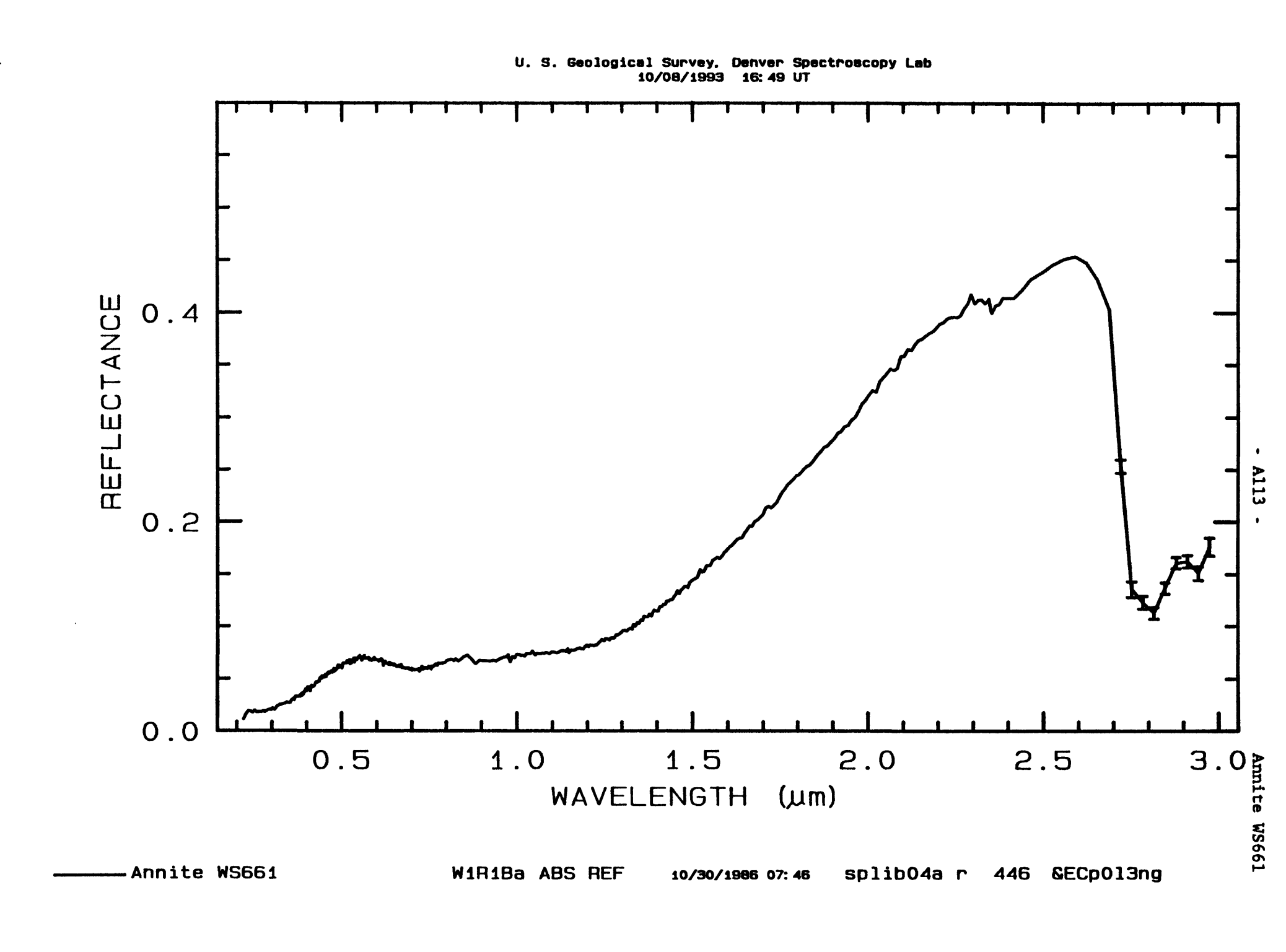
av gr sz of populations = 150μm

Pure sample, large grains 60% coated with smaller grains, slight pleochroism. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 446	0.2-3.0μm	200	g.s.= 150 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 16:49 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A113 -
Annite WS661
Annite WS661
W1R1Ba ABS REF
10/30/1986 07:46
splib04a r 446 &ECp013ng

TITLE: Anorthite GDS28 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS28

MINERAL_TYPE: Tectosilicate

MINERAL: Anorthite (Plagioclase, Ca end member)(Feldspar group)

FORMULA: CaAl2Si2O8

FORMULA_NROFF: $CaAl_2Si_2O_8$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Bruce Hemingway, USGS

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

The original sample and mid-IR spectrum was described in:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

From that study, the sample was described as pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure Anorthite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	43.53	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.01	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	37.36	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.02	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.03	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.03	wt%	NROFF:	MgO
COMPOSITION:	CaO:	19.26	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.03	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.04	wt%	NROFF:	K_2O
COMPOSITION:	----------				
COMPOSITION:	Total:	100.32	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.32	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analysis is the average of 10 analyses. See also: Robie, R.A., Hemingway, B.S., and Wilson, W.H., 1978, American Min., v.63, p. 109-123.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

The sample appears to be pure anorthite with very fine (cryptocrystalline) texture according to:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

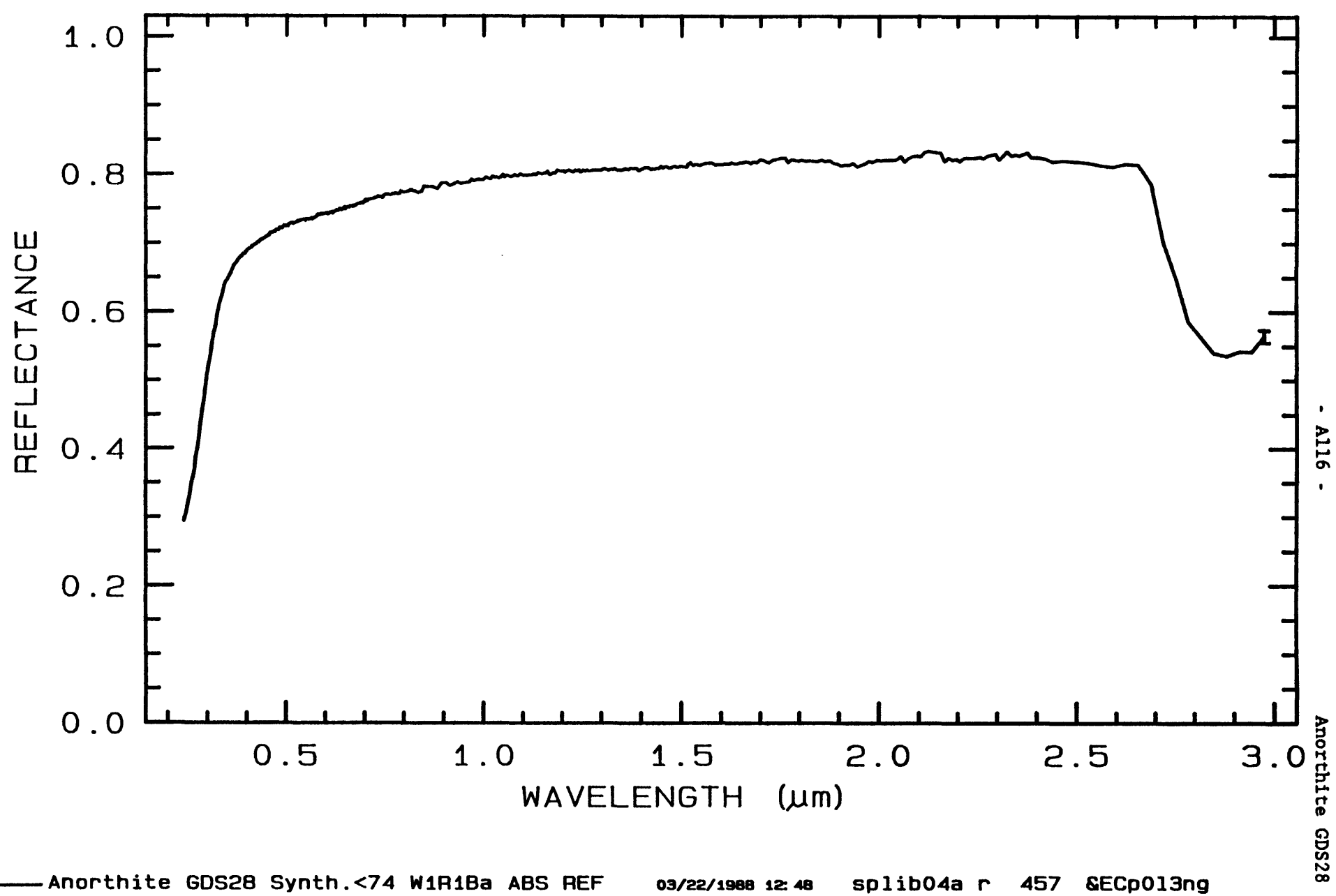
av gr sz = 200um

Abundant vapor bubbles or fluid inclusions, elongate grains somtimes sided by cleavage planes. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	457	0.2-3.0μm	200	g.s.=200μm



Anorthite GDS28

TITLE: Anorthite HS201 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS201

MINERAL_TYPE: Tectosilicate

MINERAL: Anorthite (Plagioclase, Ca end member)(Feldspar group)

FORMULA: CaAl2Si2O8

FORMULA_NROFF: $CaAl_2Si_2O_8$

COLLECTION_LOCALITY: Japan

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The original sample and vis-nir spectrum was described in:

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

Howver, the sample measured here was purified using a Franz separator and hand picked by Gregg Swayze. The resulting sample and spectrum appear pure (see microscopic examination).

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

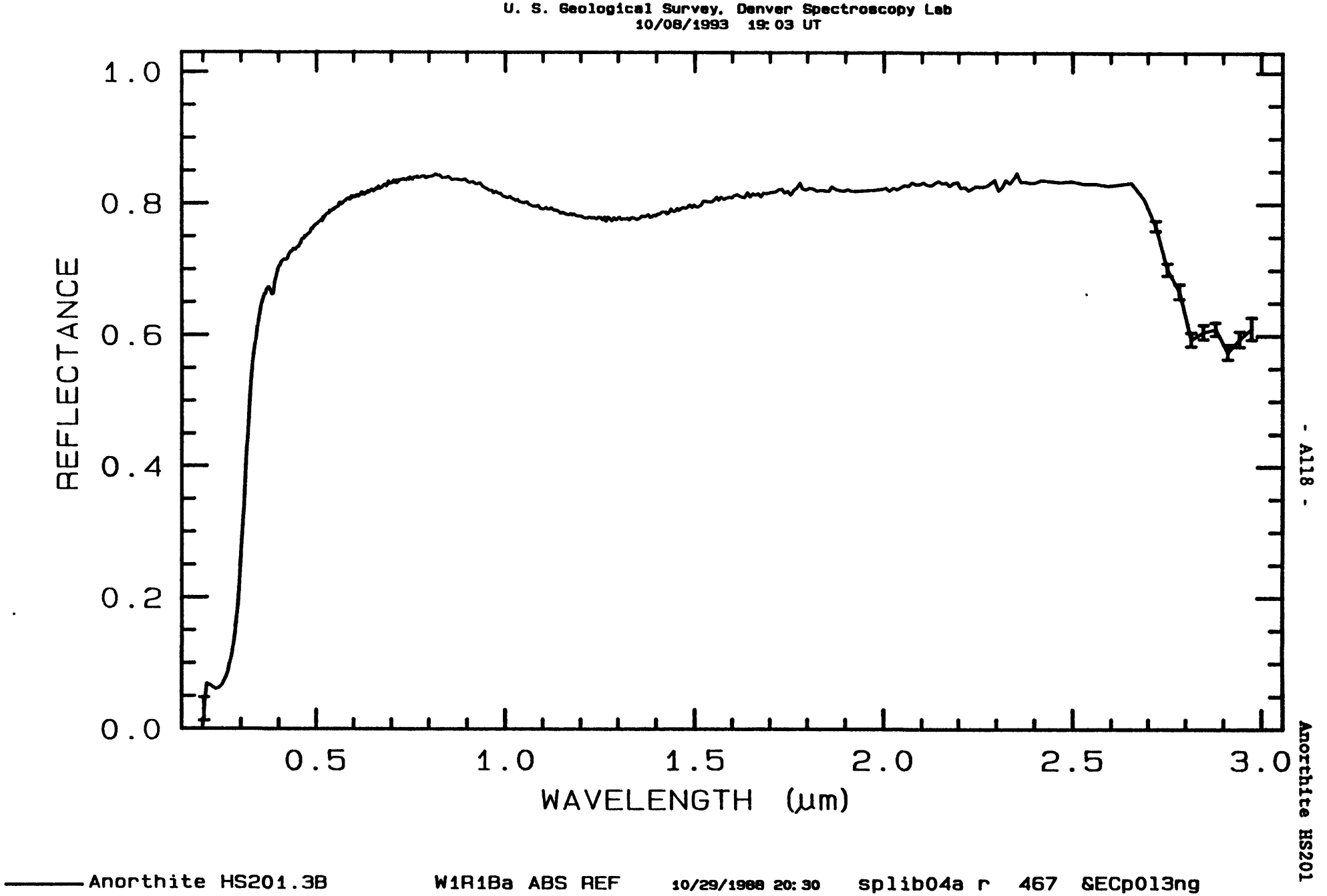
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a	r 467	0.2-3.0μm	200	g.s.= 76μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Anorthite HS201.3B W1R1Ba ABS REF 10/29/1988 20:30 splib04a r 467 &ECp013ng
Anorthite HS201

TITLE: Anorthite HS349 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS349

MINERAL_TYPE: Tectosilicate

MINERAL: Anorthite (Plagioclase, Ca end member)(Feldspar group)

FORMULA: CaAl2Si2O8

FORMULA_NROFF: $CaAl_2Si_2O_8$

COLLECTION_LOCALITY: Grass Valley, California

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The original sample and vis-nir spectrum was described in:

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

They said they removed most of the pyroxene from the original sample, and none is obvious in the visible-NIR spectrum. There are a few dark grains in the bulk sample, but << 1%. Hunt et al said the original sample contained some diopside and magnetic impurities, but the magnetic impurities were removed.

Some alteration is evident by the 2.3-μm region absorption bands in the spectrum. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Anorthite + (medium) Chlorite + (small) 9.4 angstrom peak
+ 2.778 angstrom (Microcline?) - by Norma Vergo

Notes: the microscopic analysis shows that the impurities can't be detected, so the sample should be spectrally pure in the visible. There is a 2.3-μm band and weak 1.4 band, so some impurities do show there.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Clean, clear to frosted rectangular grains. Very pure, no visible alteration, synthetic twining. G. Swayze

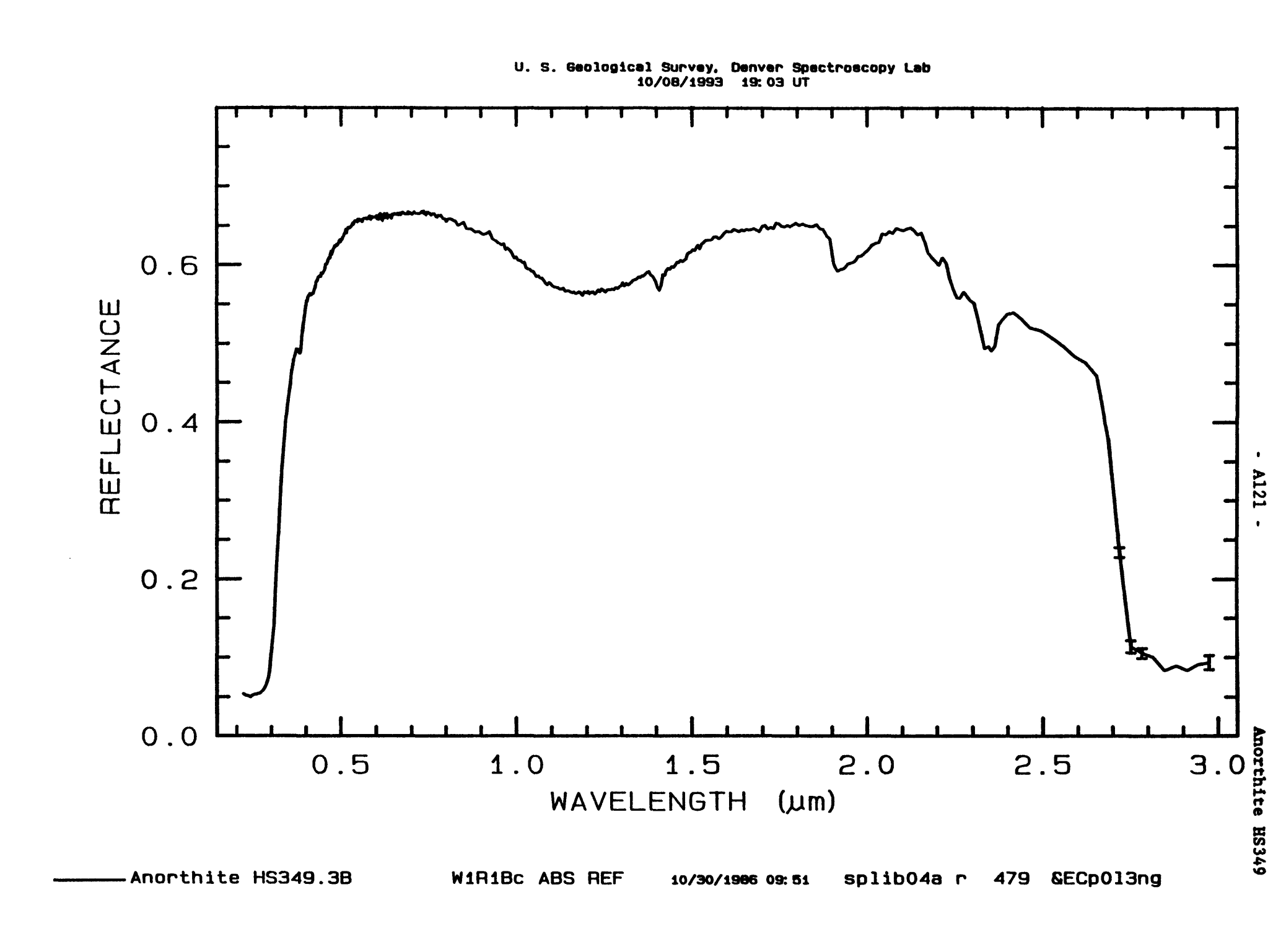
av gr sz = 280μm

Notes: XRD indicated chlorite and others present, but they can't be detected optically, so the vis spectrum should be spectrally pure. There is a 2.3-μm band and weak 1.4 band, so some impurities do show weakly in the nir.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	479	0.2-3.0μm	200	g.s.= 280 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A121 -
Anorthite HS349
Anorthite HS349.3B W1R1Bc ABS REF 10/30/1986 09:51 splib04a r 479 &ECp013ng

TITLE: Anthophyllite HS286 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS286

MINERAL_TYPE: Inosilicate

MINERAL: Anthophyllite (Amphibole group)

FORMULA: (Mg,Fe+2)7Si8O22(OH)2

FORMULA_NROFF: $(Mg,Fe^{+2})_7Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: North Carolina

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Magnesio-anthophyllite and Ferro-anthophyllite.

Spectra for this sample were originally published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

With the note: "The dominant feature in its spectrum is the very well defined band at 0.95μm due to Fe^{+2} in the octohedral site, and this is accompanied by bands at 0.375, 0.475 and 0.65μm. The very weak 0.65μm band indicates the presence of a very little ferric iron which enters the mineral when aluminum substitutes for silicon. Bands at 1.4, 2.32, and 2.4μm are all due to the OH vibrations, and there is a complete absence of evidence for molecular H_2O."

Sample measured for the library was the 74-250μm sieve interval, 3B.

Hunt et al. also noted some magnetite contamination, but with the high reflectance level at 1.6 μm it must be very low. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

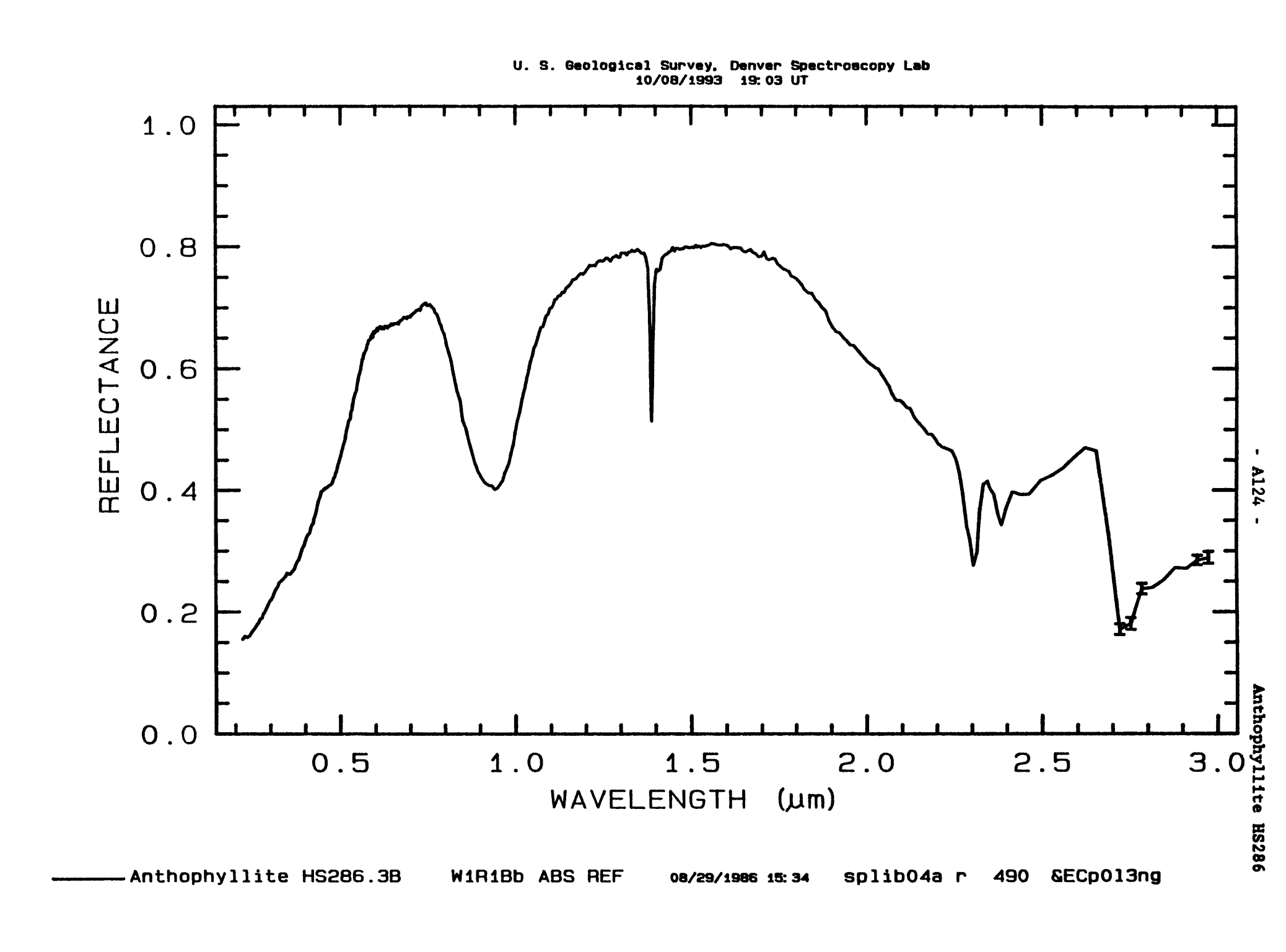
MICROSCOPIC_EXAMINATION:

Asbestiform crystal habit, pale color due to Fe-staining? Length slow, straight extinction. No twinning. These characteristics are consistent with anthophyllite. Grain size is that of clumps of fibres. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 490	0.2-3.0μm	200	g.s.= 150 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A124 -
Anthophyllite HS286
Anthophyllite HS286.3B W1R1Bb ABS REF 08/29/1986 15:34 splib04a r 490 &ECp013ng

TITLE: Antigorite NMNH96917 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH96917

MINERAL_TYPE: Phyllosilicate

MINERAL: Antigorite (Kaolinite-Serpentine group)

FORMULA: (Mg,Fe+2)3Si2O5(OH)4

FORMULA_NROFF: $(Mg,Fe^{+2})_3Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Rossa, Antigors Valley, Italy

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Clinochrysotile, Lizardite, and Orthochrysotile.

The sample was ground in an alumina mortar and pestle and was wet sieved using methanol into <30μm (f), 30-45μm (e), 60-104μm (d), 104-150μm (c), 150-250μm (b) and >250μm (a) size fractions. (Letter denotes spectrum designation)

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Gene Whitney, USGS Denver, indicate that the sample was representative of its structural class. Analysis by Norma Vergo indicate that the sample contains a medium amount of hornblend and other minerals. Hornblende is estimated to be 6-8 volume percent. Spectrally, the presence of hornblende is not believed to introduce specific absorption features to the antigorite, but may contribute to the general lowering of the reflectance at wavelengths less than 1.5μm.

King, T.V.V. and R.N. Clark, 1989, Spectral Characteriastics of Chlorites and Mg-Serpentines Using High-Resolution Spectroscopy. *J. Geophys. Res.*, **94**, 13,997-14,008.

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	41.30 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.15 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	1.59 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.61 wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	4.51 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.11 wt%	NROFF:	MnO
COMPOSITION:	MgO:	36.30 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.43 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.04 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.02 wt%	NROFF:	K_2O
COMPOSITION:	H2O:	11.19 wt%	NROFF:	H_2O
COMPOSITION:	----------			
COMPOSITION:	Total:	99.26 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

This is an isochemical end member Mg-rich serpentine. Spectrally the mineral separates do not show absorptions due to any mineral species other than antigorite. See XRD discussion.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

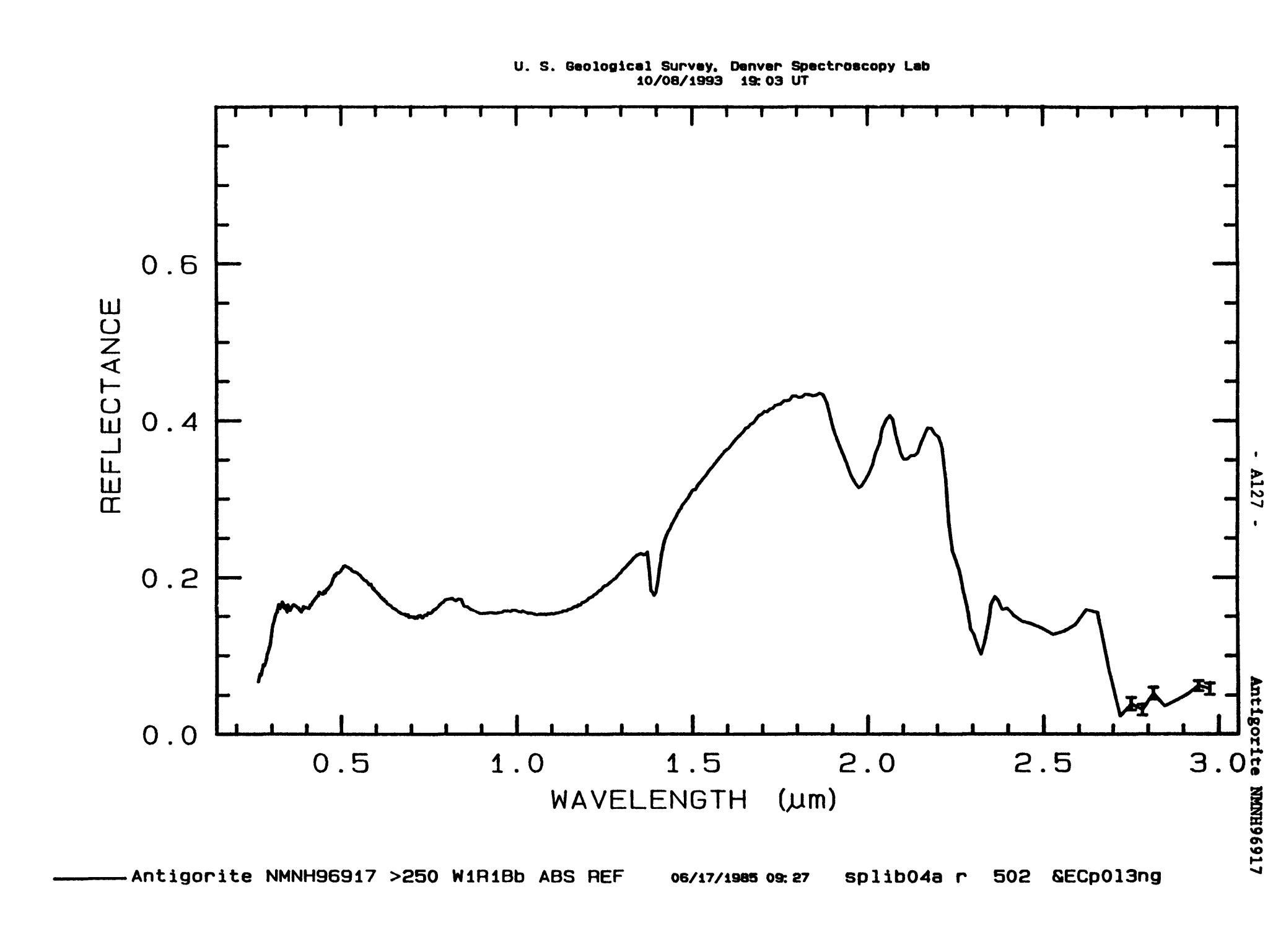
Platy habit, pale green color, 2 vol% white micaceous mineral that could be a varient of the green antigorite or a mineral contaminant, opaque inclusions altered to sesquioxides (total amount 3-5 vol% of grain volumes), first order gray interference color, moderate relief. All these properties are consistent with antigorite. G. Swayze

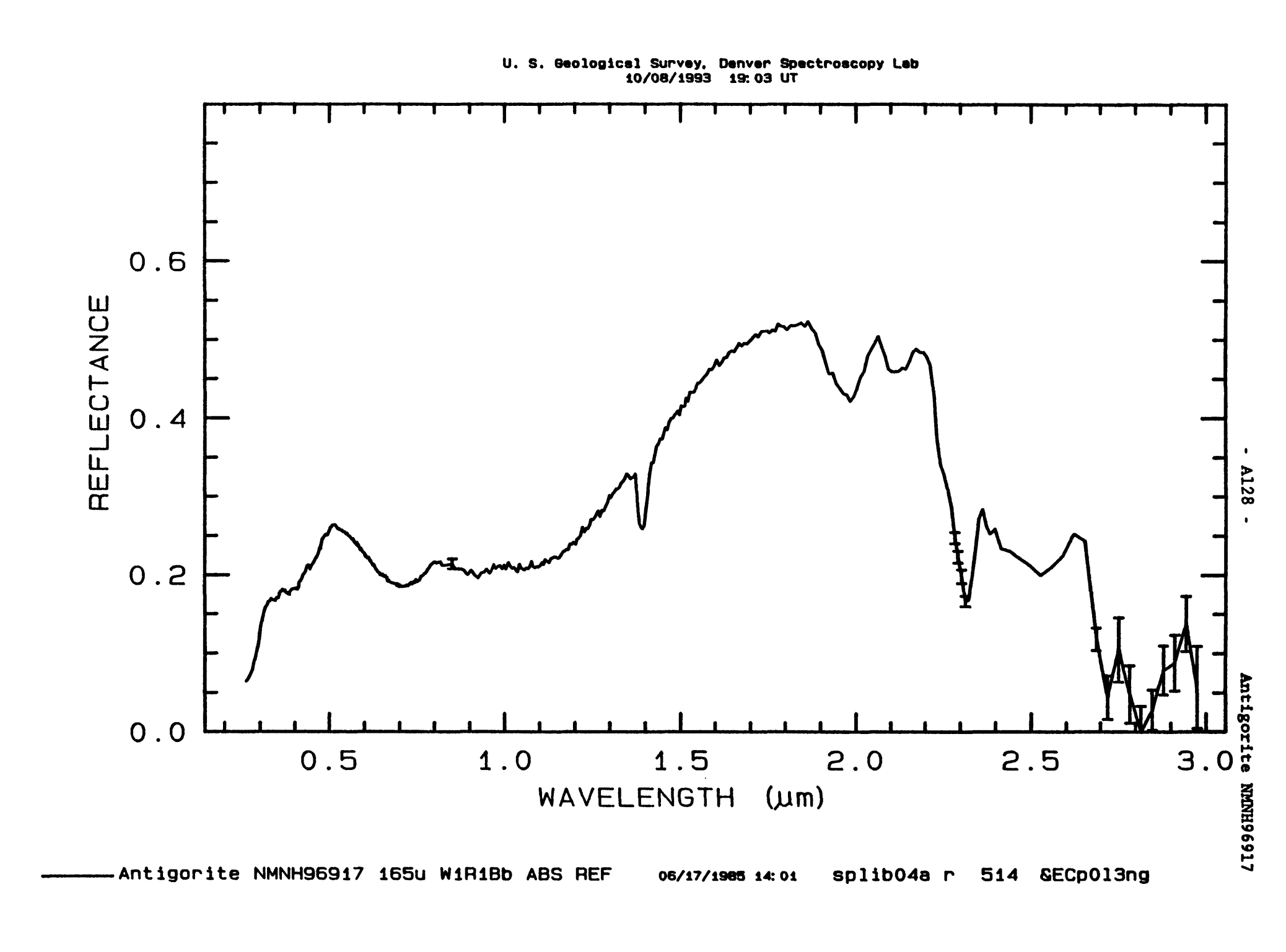
Grain size fraction 104-150 μm contained 8 vol% magnetite and 30 vol% clear feldspar?

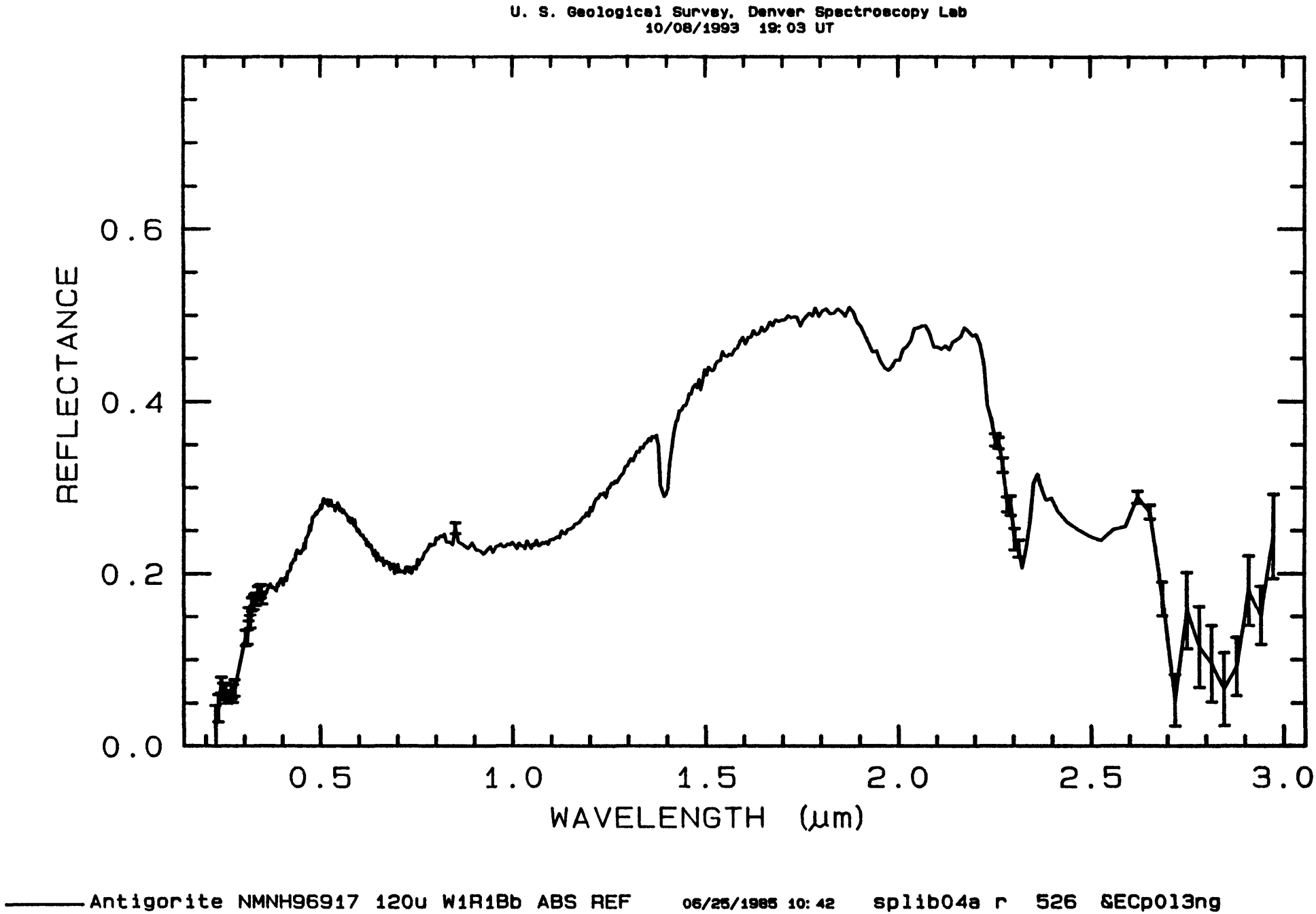
END_MICROSCOPIC_EXAMINATION.

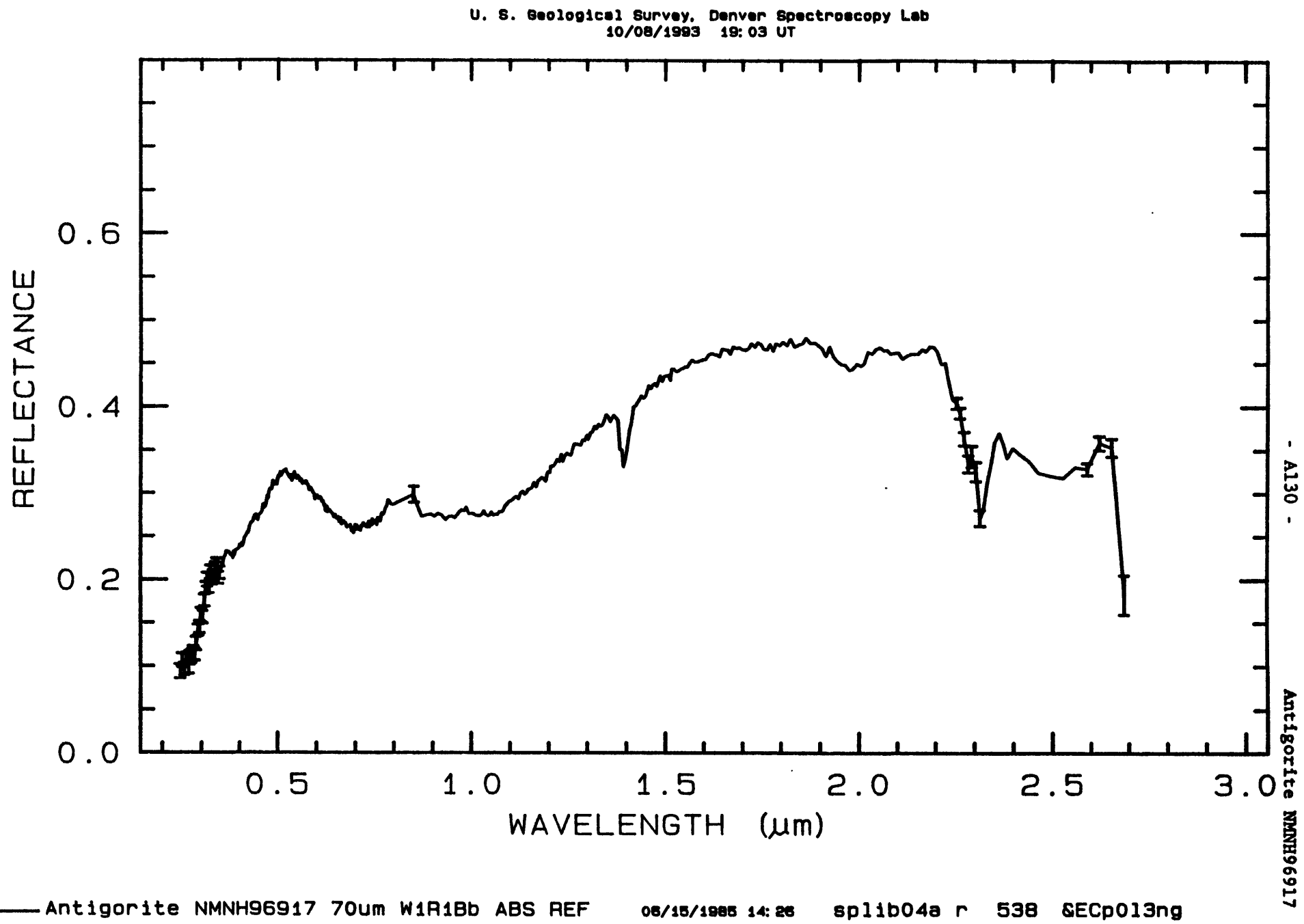
DOCUMENTED_BY: tking@speclab (Trude V.V. King)

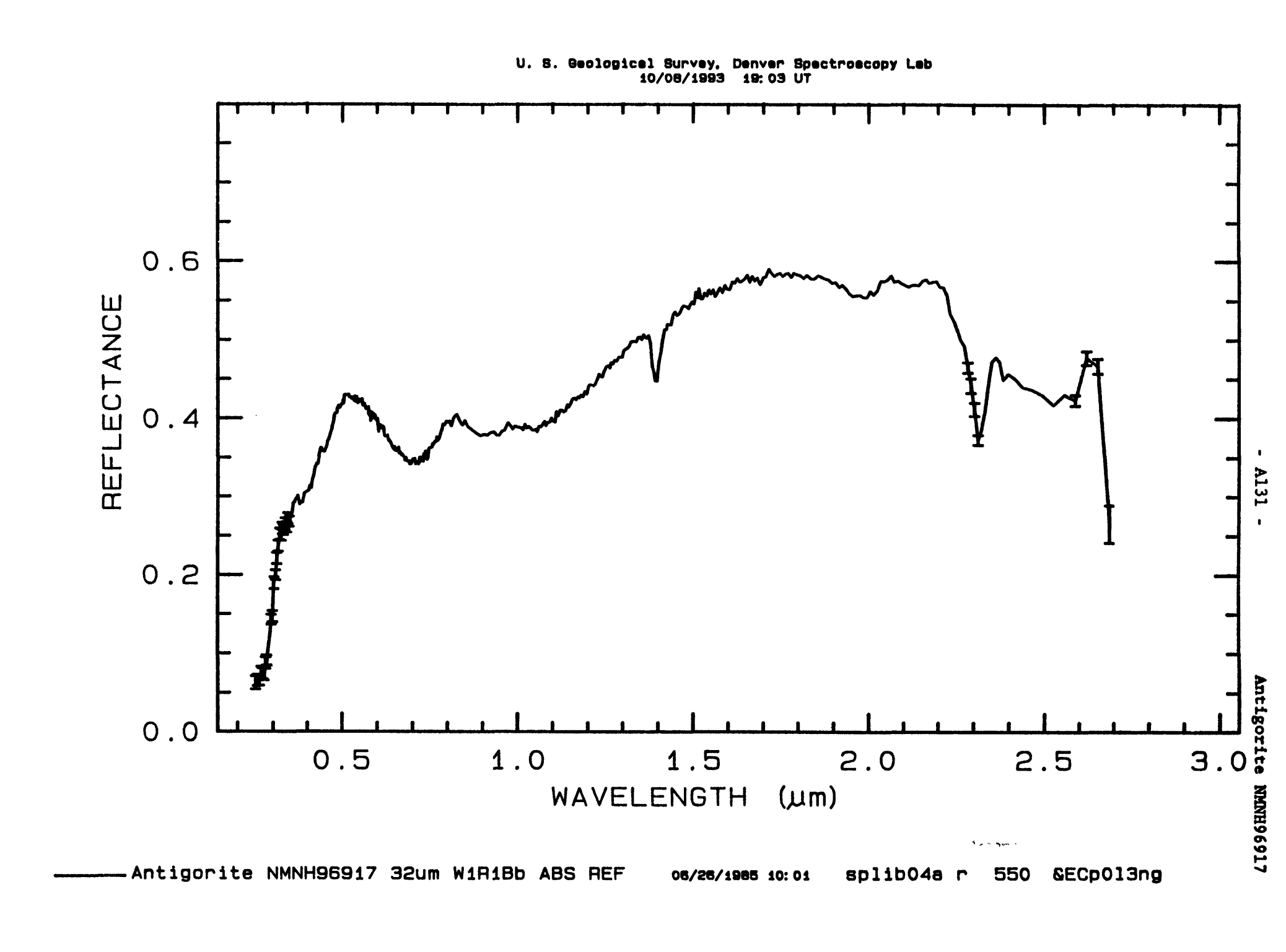
LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 502	0.2-2.7μm	200	a g.s.=1000μm
LIB_SPECTRA:	splib04a r 514	0.2-2.7μm	200	b g.s.=165μm
LIB_SPECTRA:	splib04a r 526	0.2-2.7μm	200	c g.s.=120μm
LIB_SPECTRA:	splib04a r 538	0.2-2.7μm	200	d g.s.=70μm
LIB_SPECTRA:	splib04a r 550	0.2-2.7μm	200	e g.s.=32μm
LIB_SPECTRA:	splib04a r 562	0.2-2.7μm	200	f g.s.=15μm

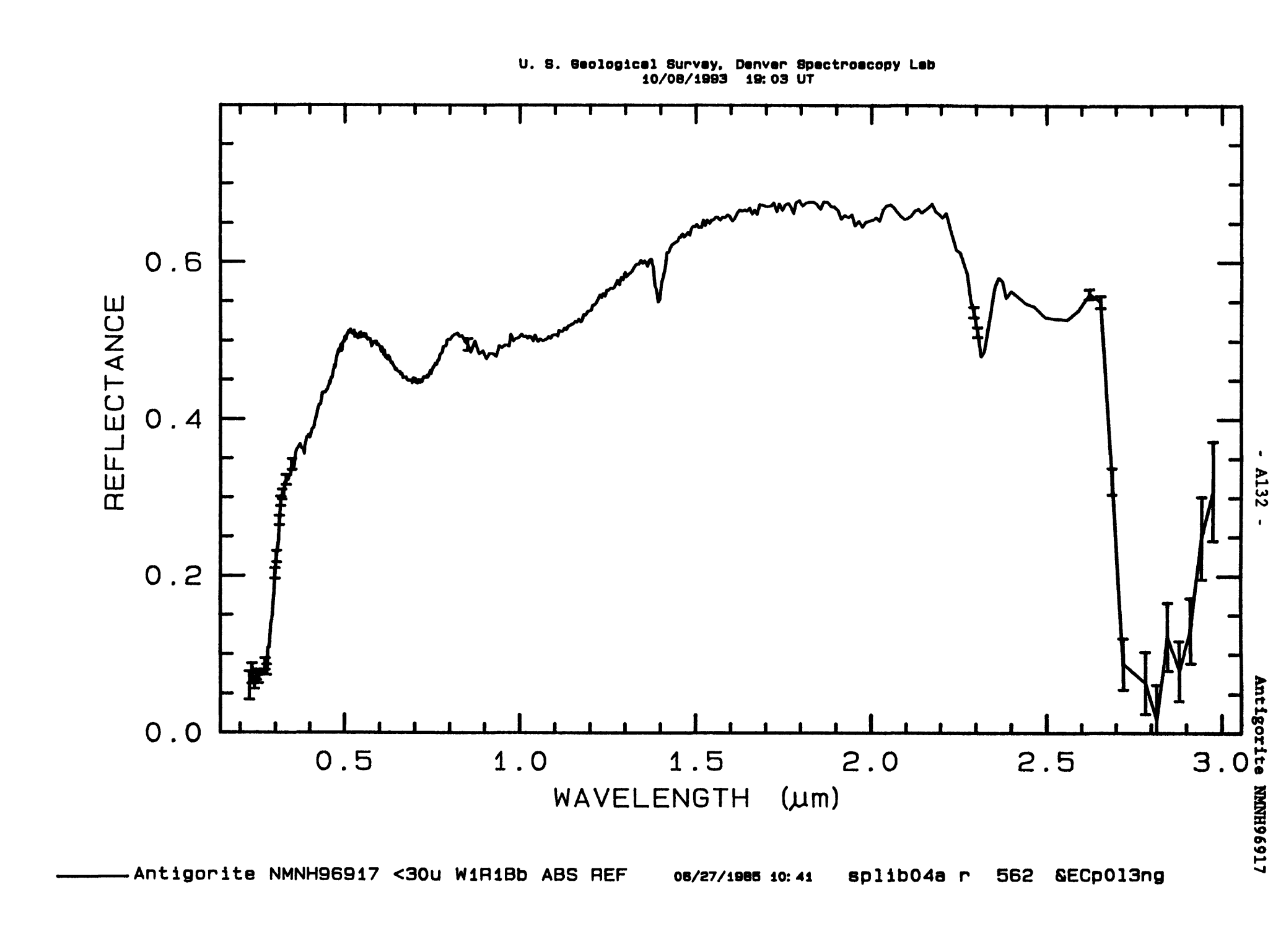

U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A127 -
Antigorite NMNH96917
Antigorite NMNH96917 >250 W1R1Bb ABS REF 06/17/1985 09:27 splib04a r 502 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A128 -
Antigorite NMNH96917
Antigorite NMNH96917 165u W1R1Bb ABS REF 06/17/1985 14:01 splib04a r 514 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A129 -
Antigorite NMNH96917
Antigorite NMNH96917 120u W1R1Bb ABS REF 06/26/1995 10:42 splib04a r 526 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A130 -
Antigorite NMNH96917
Antigorite NMNH96917 70um W1R1Bb ABS REF 08/15/1985 14:26 splib04a r 538 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A131 -
Antigorite NMNH96917
Antigorite NMNH96917 32um W1R1Bb ABS REF 06/26/1995 10:01 splib04a r 550 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A132 -
Antigorite NMNH96917
Antigorite NMNH96917 <30u W1R1Bb ABS REF 08/27/1985 10:41 splib04a r 562 &ECp013ng

TITLE: Antigorite NMNH17958 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH17958

MINERAL_TYPE: Phyllosilicate

MINERAL: Antigorite (Kaolinite-Serpentine group)

FORMULA: (Mg,Fe+2)3Si2O5(OH)4

FORMULA_NROFF: $(Mg,Fe^{+2})_3Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Kalsertal, Tyrol, Austria

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: Smithsonian

SAMPLE_DESCRIPTION:

Polymorphous with Clinochrysotile, Lizardite and Orthochyrsotile.

Large green single crystal.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Specrally this sample is similar to other antigorites.

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure magnesian antigorite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Pure magnesian serpentine.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Under the microscope, appears mostly pure antigorite, but some (<3%) alteration or impurity, possibly chrysotile.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Bimodal grain size distribution:

gr sz pop 1 : 300 μm at 40 vol%
gr sz pop 2 : 10 μm at 60 vol%

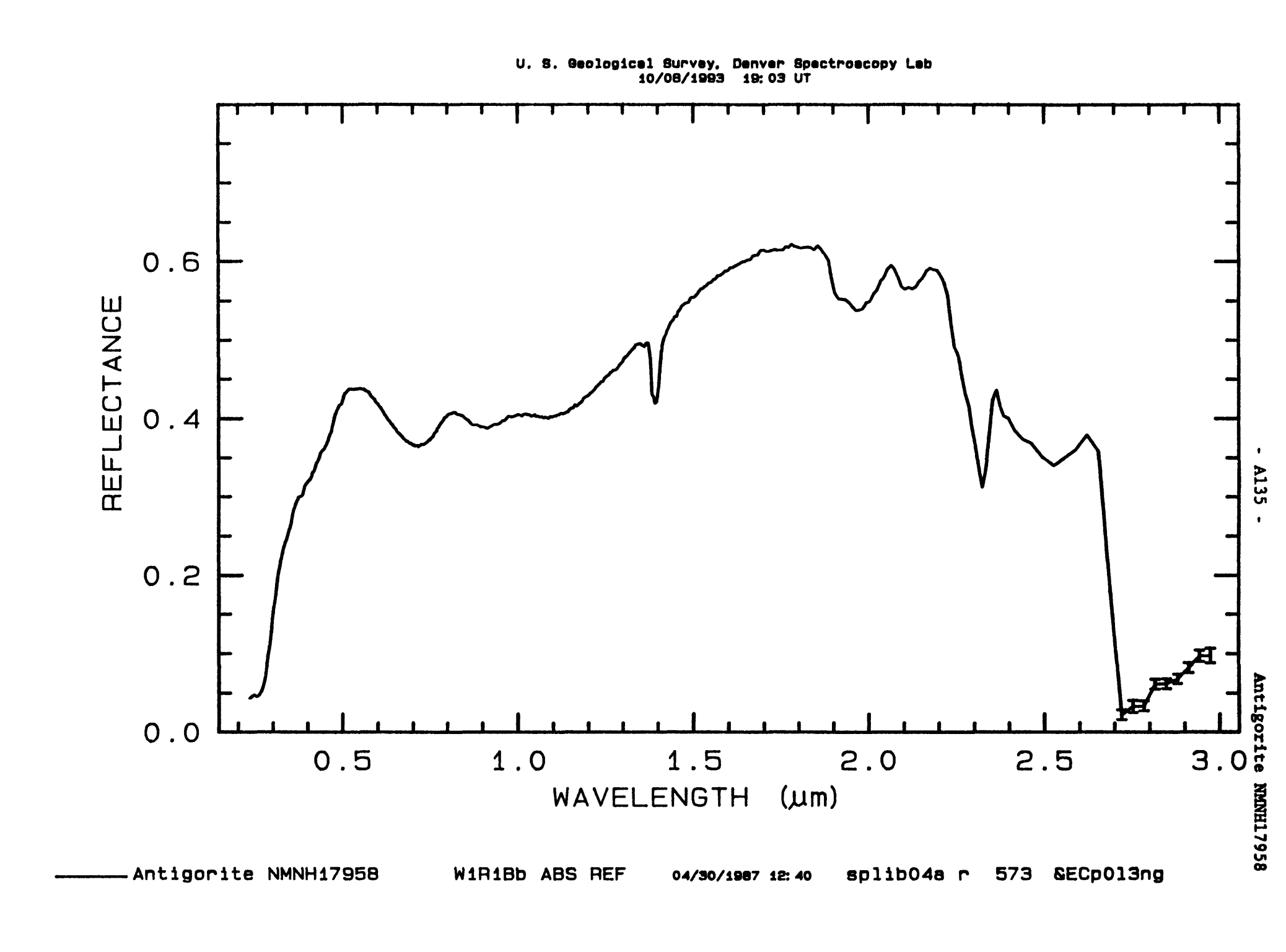
av gr sz = 110 μm

Pale green color, platy habit, 1st order grey, parallel extinction, prismatic habit in some grains (chrysotile?). G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	573	0.2-3.0μm	200	g.s.= 110 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A135 -
Antigorite NMNH17958
Antigorite NMNH17958 W1R1Bb ABS REF 04/30/1987 12:40 splib04a r 573 &ECp013ng

TITLE: Arsenopyrite HS262 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS262

MINERAL_TYPE: Sulfide

MINERAL: Arsenopyrite (Arsenopyrite group)

FORMULA: FeAsS

FORMULA_NROFF: FeAsS

COLLECTION_LOCALITY: Gold Hill, Utah

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spectra for this sample were originally published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: IV. Sulphides and sulphates. Modern Geology, v. 3, p. 1-14.

With the note: "This sample is contaminated with some quartz and a small amount of pyrite and elemental sulphur. Arsenopyrite is opaque and spectrally featureless. Its opacity is caused by the conduction band extending over the entire range, mainly due to the presence of arsenic. The contaminants in this sample are not abundant enough to alter this behaviour, and the fact that the largest paritcle size falls approximately in the middle of its reflectivity range has no real significance."

Sample measured for the library was the 74-250μm sieve interval.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

av gr sz = 265μm for arsenopyrite

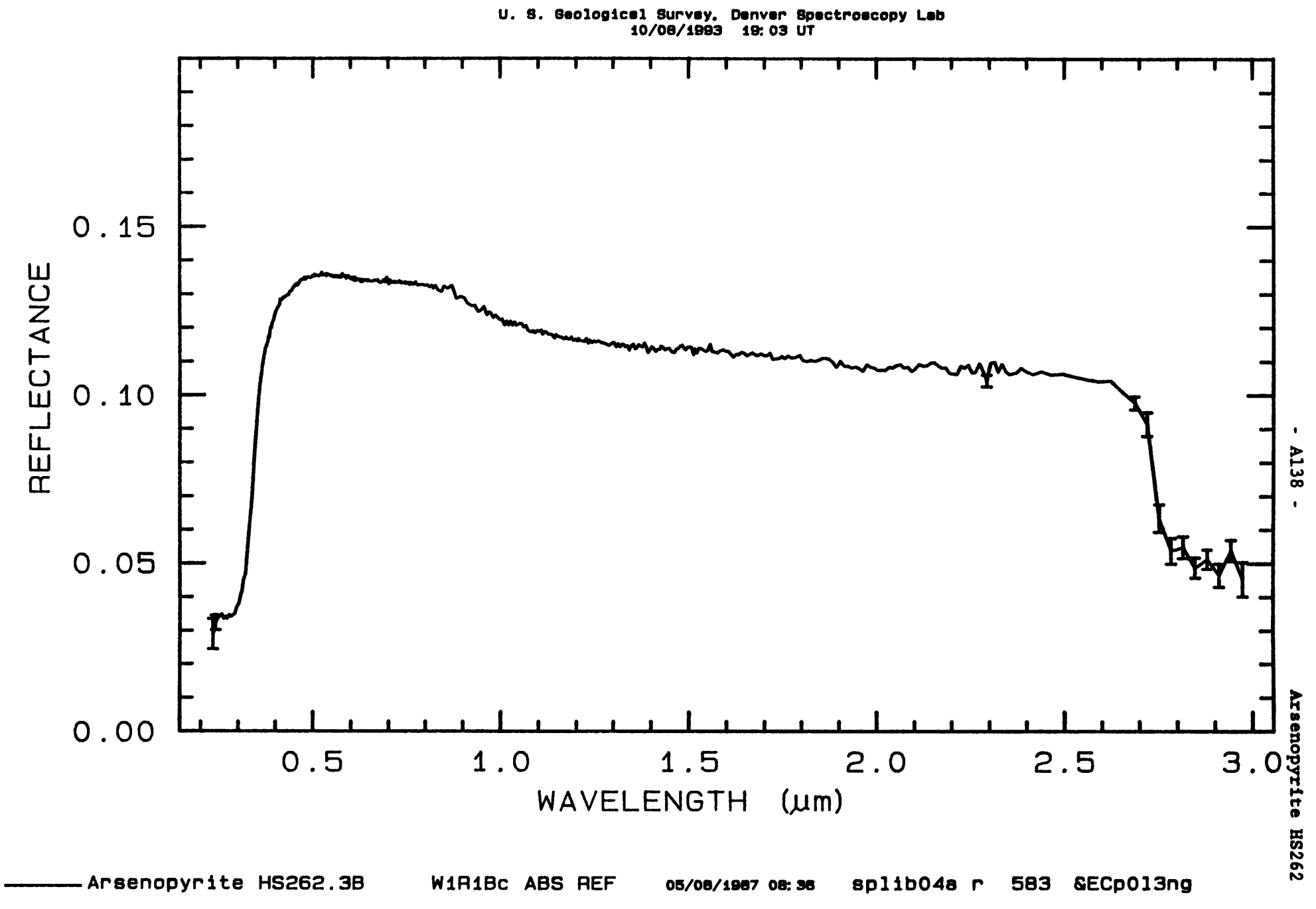
59 vol% quartz
40 vol% arsenopyrite
1 vol% elemental sulfur

Optically opaque, grayish yellow metallic luster. Suggest magnetic separation be done on this sample. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	583	0.2-3.0μm	200	g.s.= 265μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A138 -
Arsenopyrite HS262
Arsenopyrite HS262.3B W1R1Bc ABS REF 05/08/1987 08:38 splib04a r 583 &ECp013ng

TITLE: Augite NMNH120049 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH120049

MINERAL_TYPE: Inosilicate

MINERAL: Augite (Pyroxene group)

FORMULA: (Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)2O6

FORMULA_NROFF: $(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$

COLLECTION_LOCALITY: Rozier (nr.), Gorges du Tarn, Tarn, France

ORIGINAL_DONOR: National Museum of Natural History (Smithsonian)

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Diopside and hedenbergite form a complete solid solution series with physical and optical properties varying linearly with composition. Augite is a clinopyroxene in which some Na substitutes for Ca, some Al substitutes for both Mg (or Fe) and Si, and in which Fe and Mg contents are higher than in diopside or hedenbergite.

"Results of petrographic examination: One 22.31g. piece, black, probably part of one crystal; some veining with lighter mineral (serpentine?) difficult to remove. Microscopic examiniation of hand-picked sample indicates about 1-2% contamination by low-index, iron stained mineral. Cleavage is virtually nonexistent, however, index of refraction and 2V point to augite."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Augite + dolomite (m). (Norma Vergo)

Sample is augite plus a moderate amount of dolomite. Sample subsequently treated with warm HCl to remove dolomite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:      SiO2:  48.93  wt%    NROFF: SiO2
COMPOSITION:      TiO2:   1.38  wt%    NROFF: TiO2
COMPOSITION:     Al2O3:   8.44  wt%    NROFF: Al2O3
COMPOSITION:       FeO:   8.59  wt%    NROFF: FeO
COMPOSITION:       MnO:   0.21  wt%    NROFF: MnO
COMPOSITION:       MgO:  14.37  wt%    NROFF: MgO
COMPOSITION:       CaO:  16.87  wt%    NROFF: CaO
COMPOSITION:      Na2O:   1.57  wt%    NROFF: Na2O
COMPOSITION:       K2O:   0.02  wt%    NROFF: K2O
COMPOSITION: ---------------------
COMPOSITION:    Total: 100.38  wt%
COMPOSITION:  O=Cl,F,S:        wt%  #correction for Cl, F, S
COMPOSITION: New Total:        wt%
```

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Average of 10 samples.

"Microprobe analysis shows the sample to be homogenous within and between grains. Sample could be classified as "ferroan augite". It has relatively high aluminum, iron and soda, and low calcium. Analysis indicates WO34, EN45, FS21 composition."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

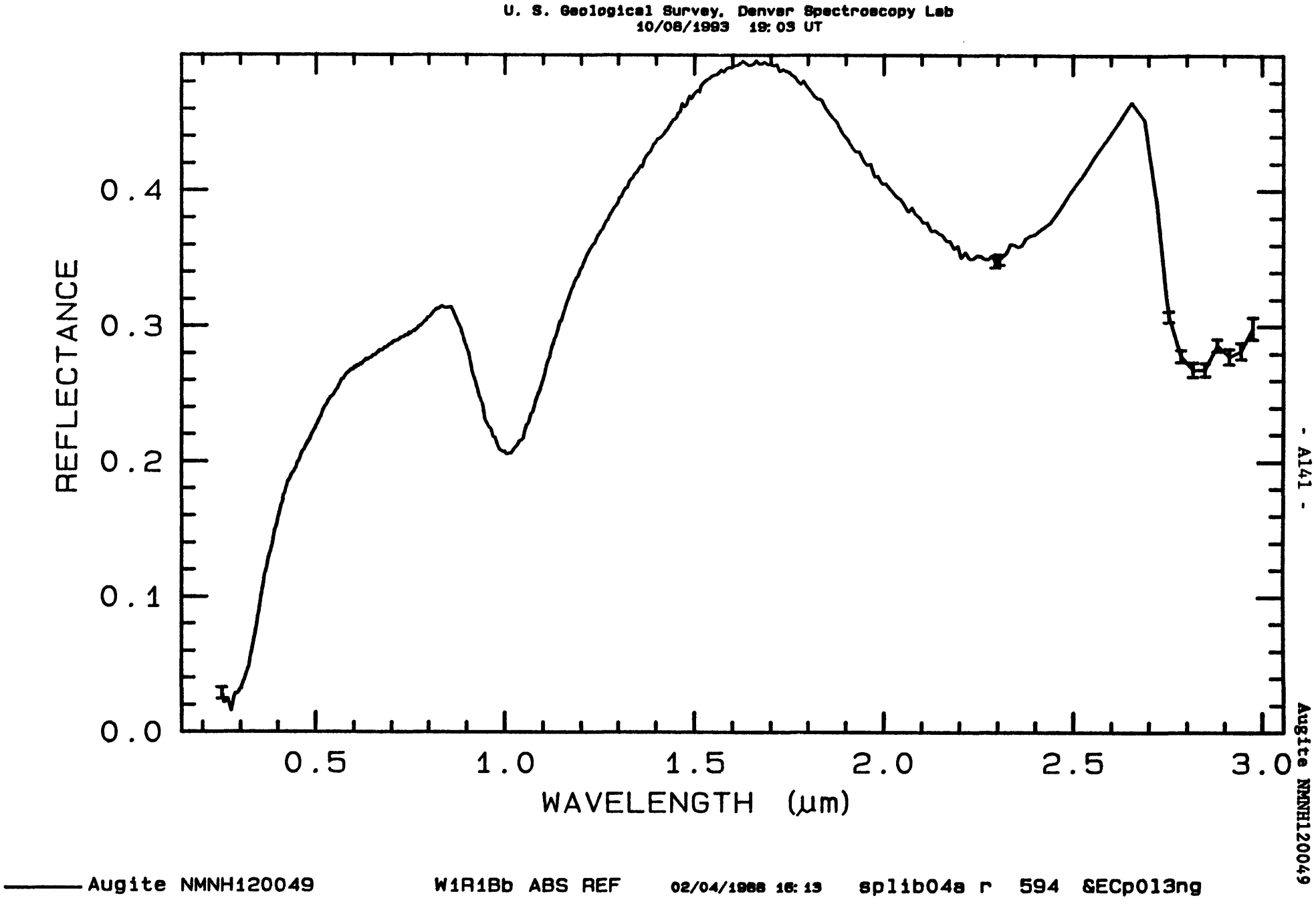
"Microscopic examiniation of hand-picked sample indicates about 1-2% contamination by low-index, iron stained mineral. Cleavage is virtually nonexistent, however, index of refraction and 2V point to augite."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	594	0.2-3.0μm	200	g.s.= 35μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A141 -
Augite NMNH120049
Augite NMNH120049 W1R1Bb ABS REF 02/04/1988 16:13 splib04a r 594 &ECp013ng

TITLE: Augite WS588 Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS558

MINERAL_TYPE: Inosilicate

MINERAL: Augite (Pyroxene Group)(was listed as Diopside)

FORMULA: (Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)2O6

FORMULA_NROFF: $(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$

COLLECTION_LOCALITY: Hull, Ontario, Canada

ORIGINAL_DONOR: Wards Mineral Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS: None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:
pop 1 gr sz = 450 μm at 80 vol%
pop 2 gr sz = 15 μm at 20 vol%

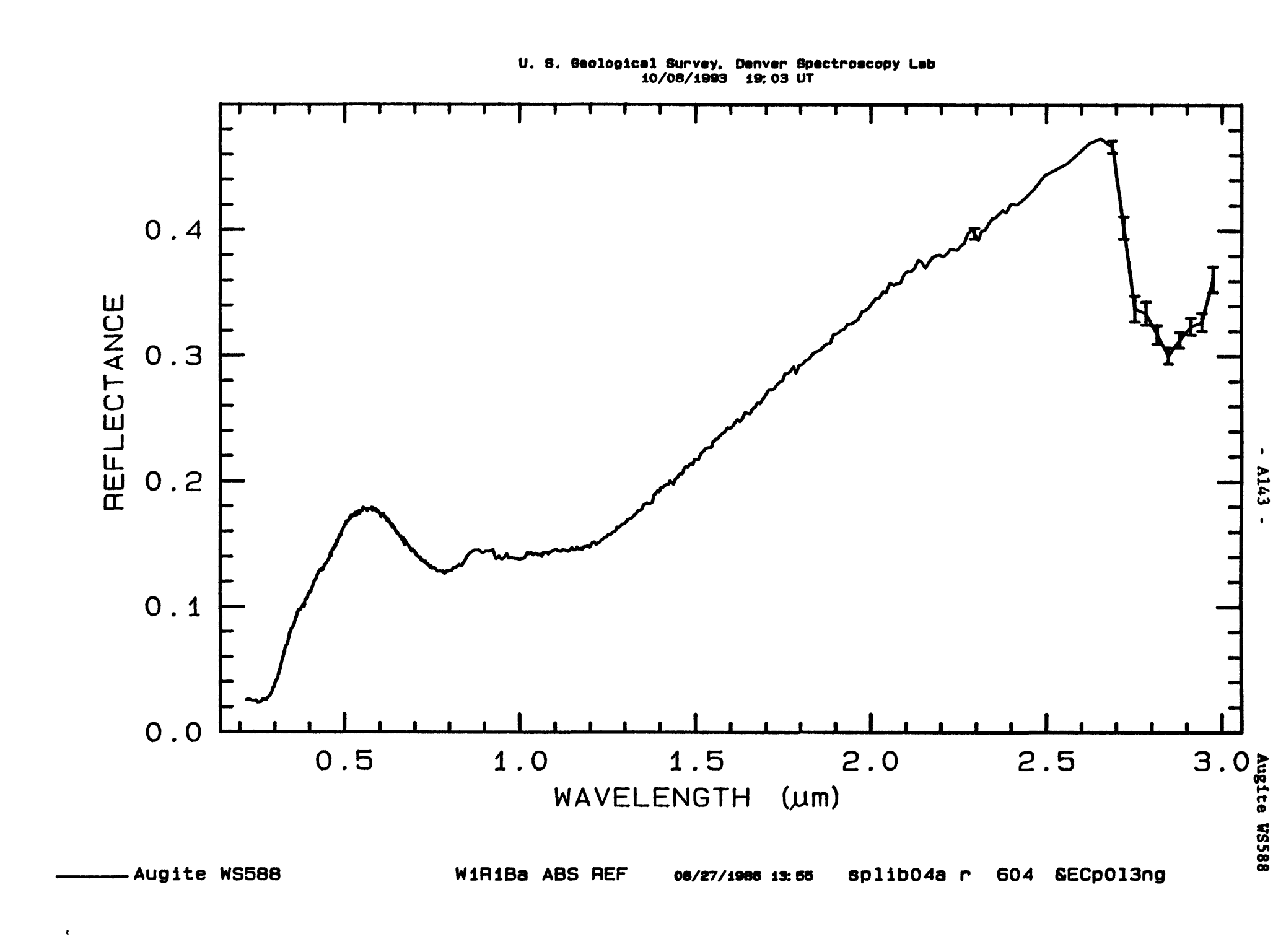
avg gr sz = 400 μm

Pure sample, inclined extinction, two cleavages at nearly right angles, pale green color, high order colors under cross-polarized light, biaxial (+), weak pleochroism, all consistent with aguite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 604	0.2-3.0μm	200	g.s.= 400 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Augite WS588
W1R1Ba ABS REF 08/27/1986 13:55 splib04a r 604 &ECp013ng
Augite WS588

TITLE: Augite WS592 Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS592

MINERAL_TYPE: Inosilicate

MINERAL: Augite (Pyroxene Group)(was listed as Diopside)

FORMULA: (Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)2O6

FORMULA_NROFF: $(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$

COLLECTION_LOCALITY: Klammath, OR

ORIGINAL_DONOR: Wards Mineral Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS: None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

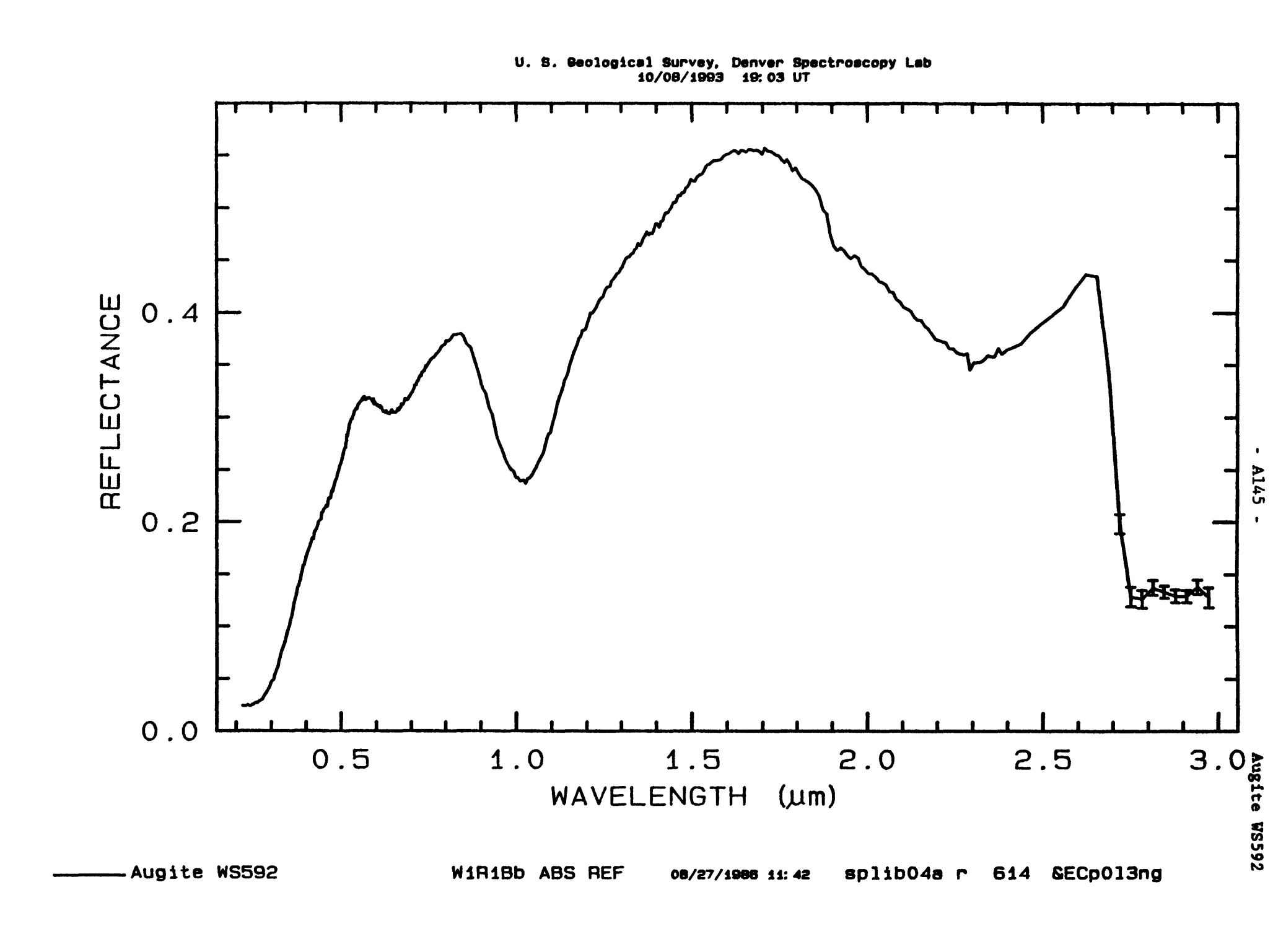
Bimodal grain size distribution:
pop 1 sz = 223 μm at 60 vol%
pop 2 sz = 40 μm at 40 vol%
avg gr sz = 174 μm

Trace magnetite. Two cleavages at nearly right angles, inclined extinction, slight pleochroism?, pale green color, high order color under cross-polarized light, biaxial (+). All consistent with augite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 614	0.2-3.0μm	200	g.s.= 174 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A145 -
Augite WS592
Augite WS592
W1R1Bb ABS REF 08/27/1986 11:42 splib04a r 614 &ECp013ng

TITLE: Axinite HS342 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS342

MINERAL_TYPE: Cyclosilicate

MINERAL: Axinite (Axinite group)

FORMULA: (Ca,Mn,Fe+2)3Al2BO3Si4O15(OH)

FORMULA_NROFF: $(Ca,Mn,Fe^{+2})_3Al_2BO_3Si_4O_{15}(OH)$

COLLECTION_LOCALITY: Mexico

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"$(Ca, Fe^{2+}, Mn)_3Al_2(BO_3)(Si_4O_{12})(OH)$: Axinite is found in contact-altered calcareous rocks and in hydrothermal veins. Its spectrum reveals iron bands in the visible and an extremely intense feature centered near 1.2μm, together with a broad feature to longer wavelengths."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, vol. 4, pp 85-106.

74-250μm sieve interval.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No compositional analyses available

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

99 vol% axinite
1 vol% wh. mica?

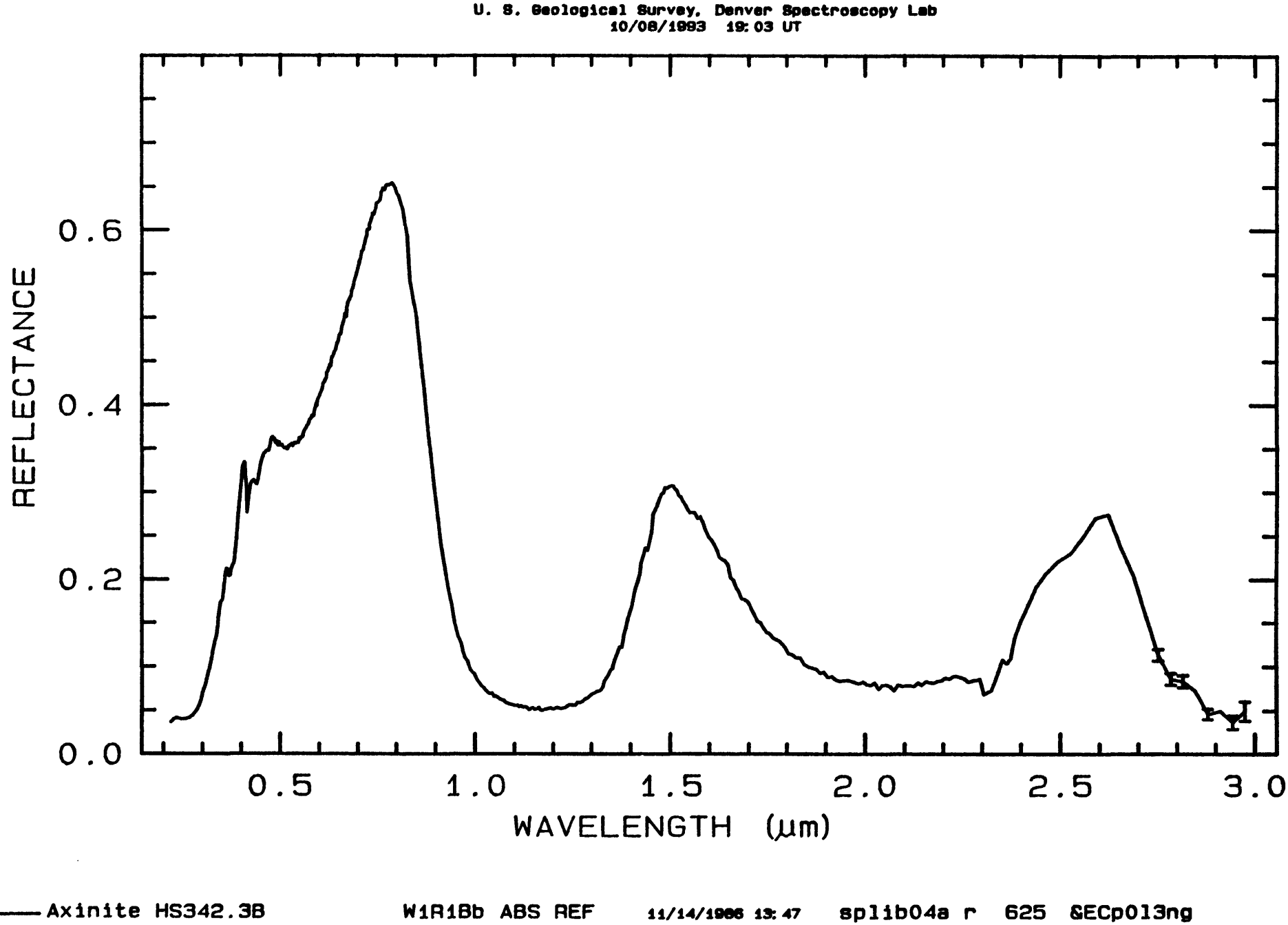
av gr sz = 330μm

Flaky fractured axinite grains with faint pink color. One distinct cleavage, high relief, inclined extinction, and (-) biaxial with 2V=40/(de. All these optical properties are consistent with axinite. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 625	0.2-3.0μm	200	g.s.= 330 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:03 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Axinite HS342
Axinite HS342.3B
W1R1Bb ABS REF
11/14/1986 13:47
splib04a r 625 &ECp013ng

TITLE: Azurite WS316 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS316

MINERAL_TYPE: Carbonate

MINERAL: Azurite

FORMULA: Cu3(CO3)2(OH)2

FORMULA_NROFF: $Cu_3(CO_3)_2(OH)_2$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Chunks of azurite on a black mineral.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

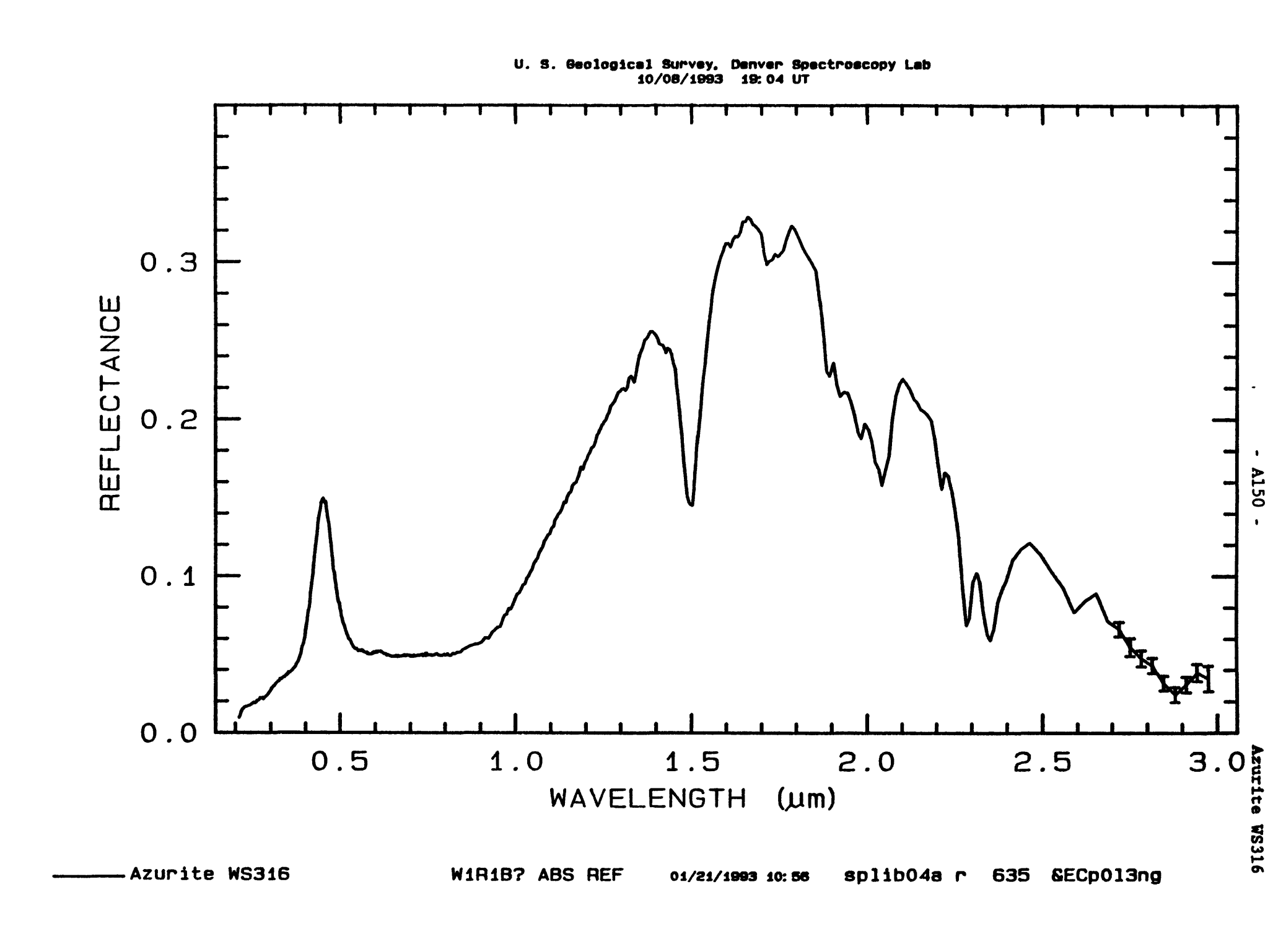
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	635	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:04 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- A150 -
Azurite WS316
Azurite WS316
W1R1B? ABS REF
01/21/1993 10:56
splib04a r 635 &ECp013ng

TITLE: Barite HS79 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS79

MINERAL_TYPE: Sulfate

MINERAL: Barite (Barite group)

FORMULA: BaSO4

FORMULA_NROFF: $BaSO_4$

COLLECTION_LOCALITY: Custer County, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Theoretical percentages of the oxides in the formula are BaO 65.7%, SO_3 34.3%. Sr substitutes for Ba and a complete solid soluution series extends to celestite, but most material is near one end or the other of the series. A small amount of Pb may also substitute for Ba.

Sieve interval 74-250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No compositional analyses.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

80 vol% barite
20 vol% pink Fe-stained barite

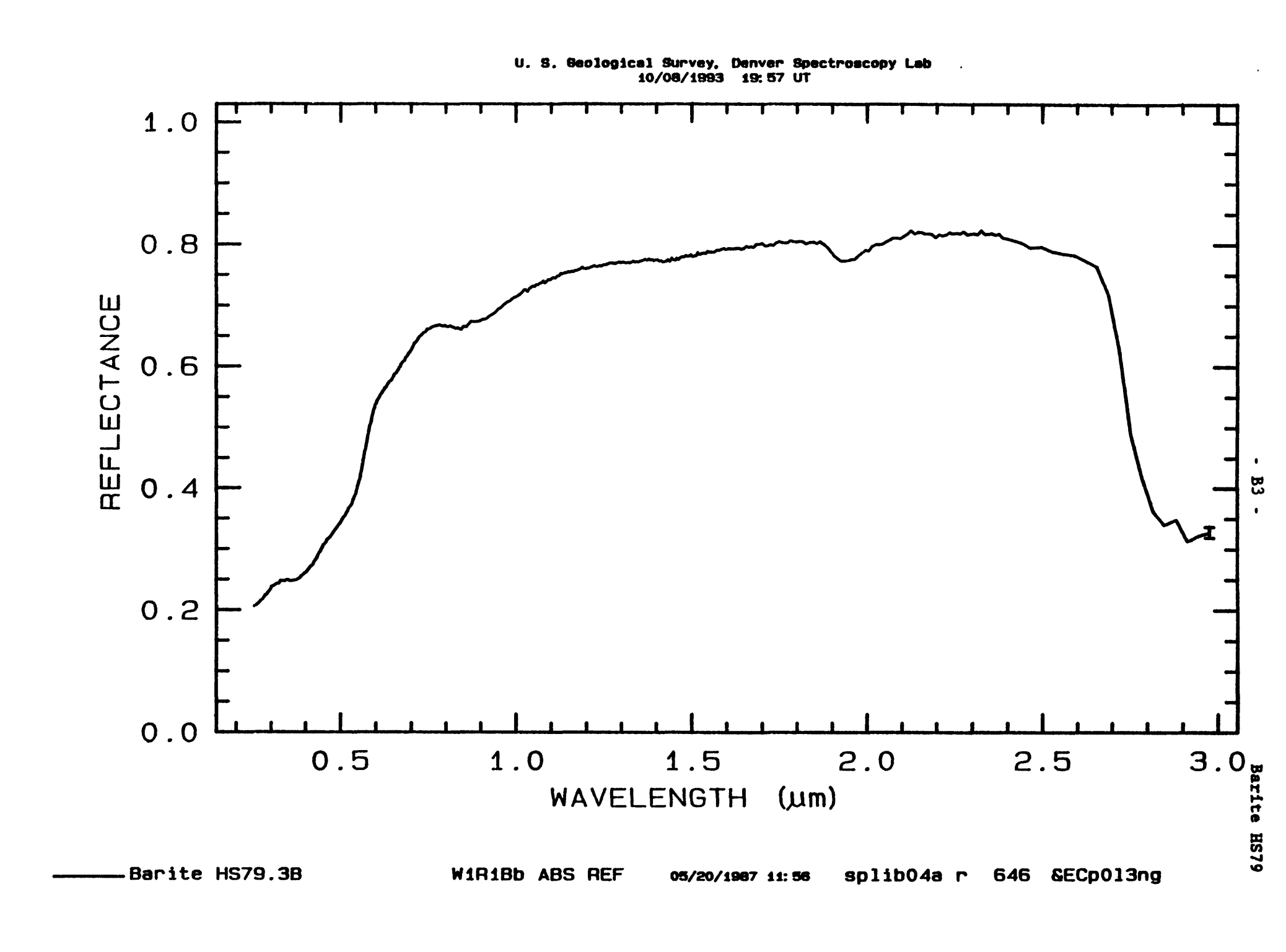
av gr sz = 200μm

Rectangular grains some with bundles of limonite? inbedded. Others stained by limonite. Heavy sample, biaxial (+), low 2v, all consistent with barite. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 646	0.2-3.0μm	200	g.s.= 200 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Barite HS79.3B
W1R1Bb ABS REF
05/20/1987 11:56
splib04a r 646 &ECp013ng
Barite HS79

TITLE: Bassanite GDS145 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS145

MINERAL_TYPE: Hydrous Sulfate

MINERAL: Bassanite

FORMULA: 2CaSO4*H2O

FORMULA_NROFF: $2CaSO_4 \bullet H_2O$

COLLECTION_LOCALITY: Heated Gypsum to Form

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

dehydration of gypsum at 60°C

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

dehydration of gypsum at 60°C

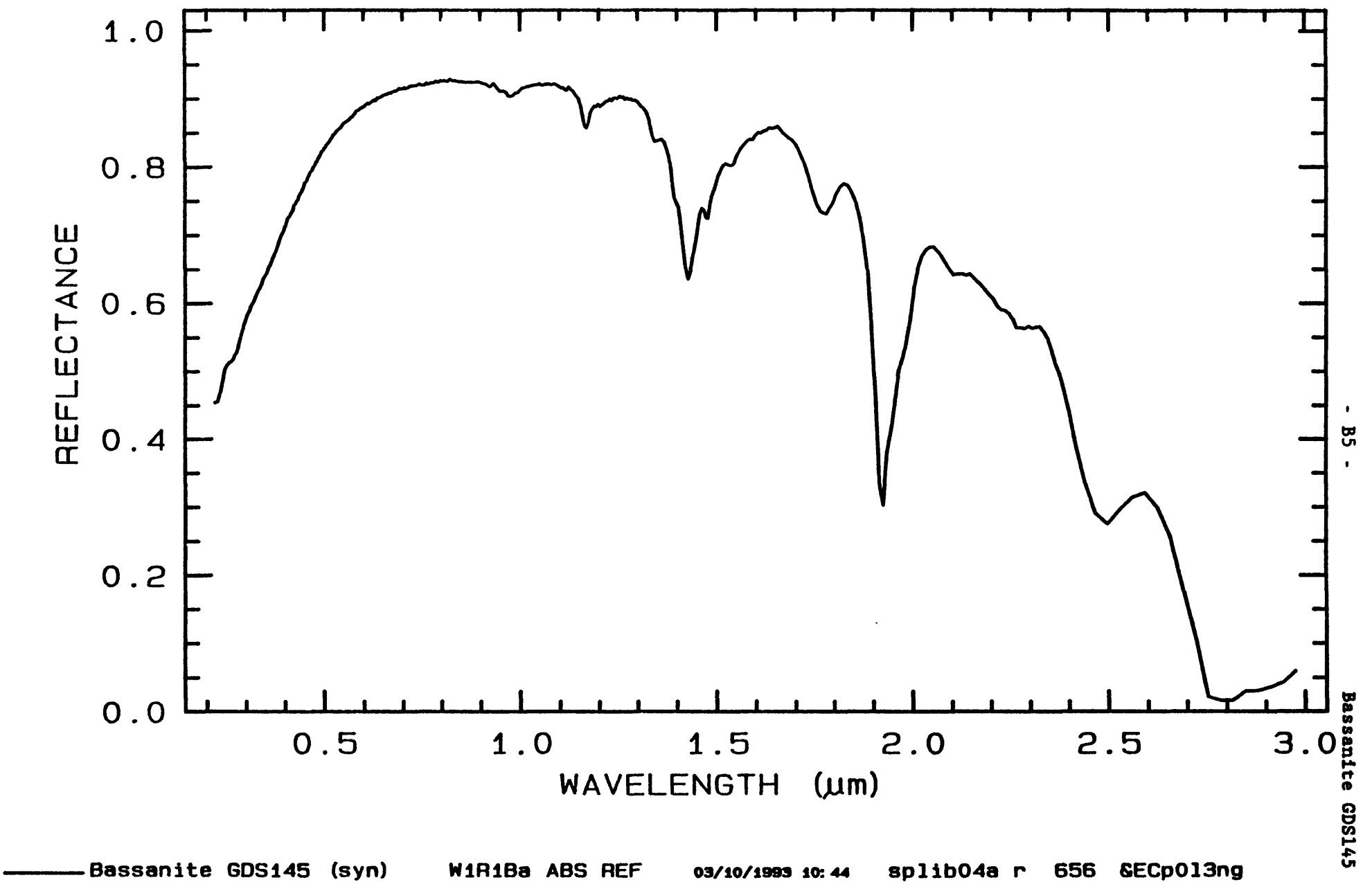
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 656	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Bassanite GDS145
Bassanite GDS145 (syn) W1R1Ba ABS REF 03/10/1993 10:44 splib04a r 656 &ECp013ng

TITLE: Beryl GDS9 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS9

MINERAL_TYPE: Cyclosilicate

MINERAL: Beryl

FORMULA: Be3Al2Si6O18

FORMULA_NROFF: $Be_3Al_2Si_6O_{18}$

COLLECTION_LOCALITY: Maine, USA

ORIGINAL_DONOR: Wards Natural Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

None

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Beryl + trace other (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grains size distribution:

population 1	140μm	97 vol%
population 2	15μm	3 vol%

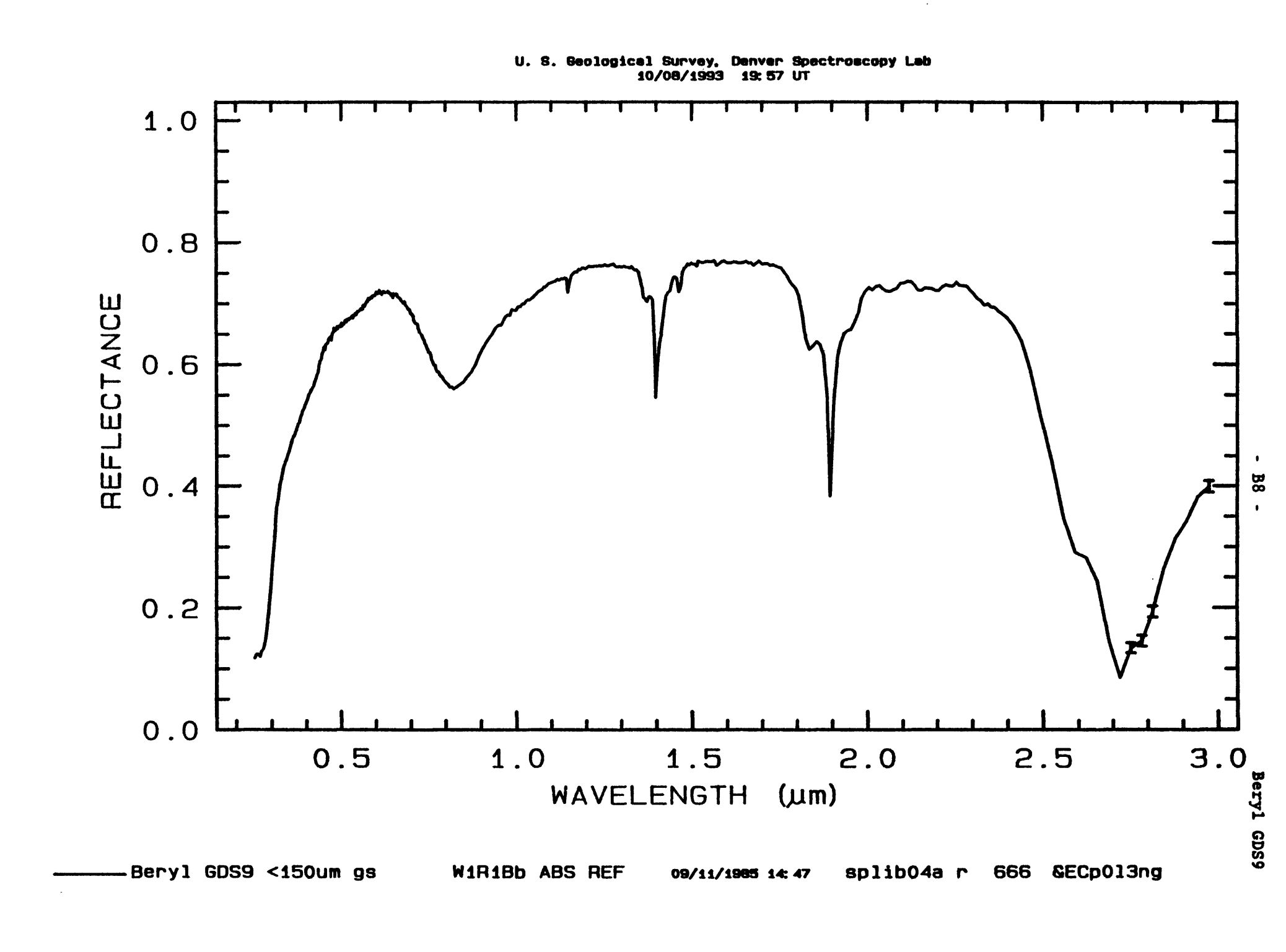
av gr sz of populations = 138μm

Conchoidally fractured grains, trace of opaques, length fast, uniaxial (-). Smaller grains slightly adhere to larger grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	666	0.2-3.0μm	200	g.s.= 138 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Beryl GDS9 <150um gs W1R1Bb ABS REF 09/11/1985 14:47 splib04a r 666 &ECp013ng
Beryl GDS9
- 88 -

TITLE: Beryl HS180 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS180

MINERAL_TYPE: Cyclosilicate

MINERAL: Beryl

FORMULA: Be3Al2Si6O18

FORMULA_NROFF: $Be_3Al_2Si_6O_{18}$

COLLECTION_LOCALITY: Maine

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Theoretical percentages of the oxides in the formula are BeO 14.0%, Al_2O_3 19.0%, SiO_2 67.0%. The presence of alkalis (Na and K) and Li may considerably reduce the percentage of BeO. Small and variable amounts of zeolithic H_2O are present.

Sieve interval 74-250μm.

"Results of petrographic examination: Hand sample is pale green and appears pure. Microscopic examination shows that there is a small amount (2% or less) of very fine, low birefringent material in the sample. The grains occasionally have rhombic or cubic shape. These grains are unidentifiable."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure (Norma Vergo).

Pure beryl.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	66.12	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.01	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	17.36	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.48	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.00	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.17	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.01	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.35	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.03	wt%	NROFF:	K_2O
COMPOSITION:	---	---	---		
COMPOSITION:	Total:	84.53	wt%		
COMPOSITION:	O=Cl,F,S:		wt%		
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

"Microprobe analysis shows that grains selected are homogeneous within and between grains. Average of 10 analyses lacking beryllium indicates silica and alumina content appropriate for beryl."

NOTE: EM composition total is the total without beryllium.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

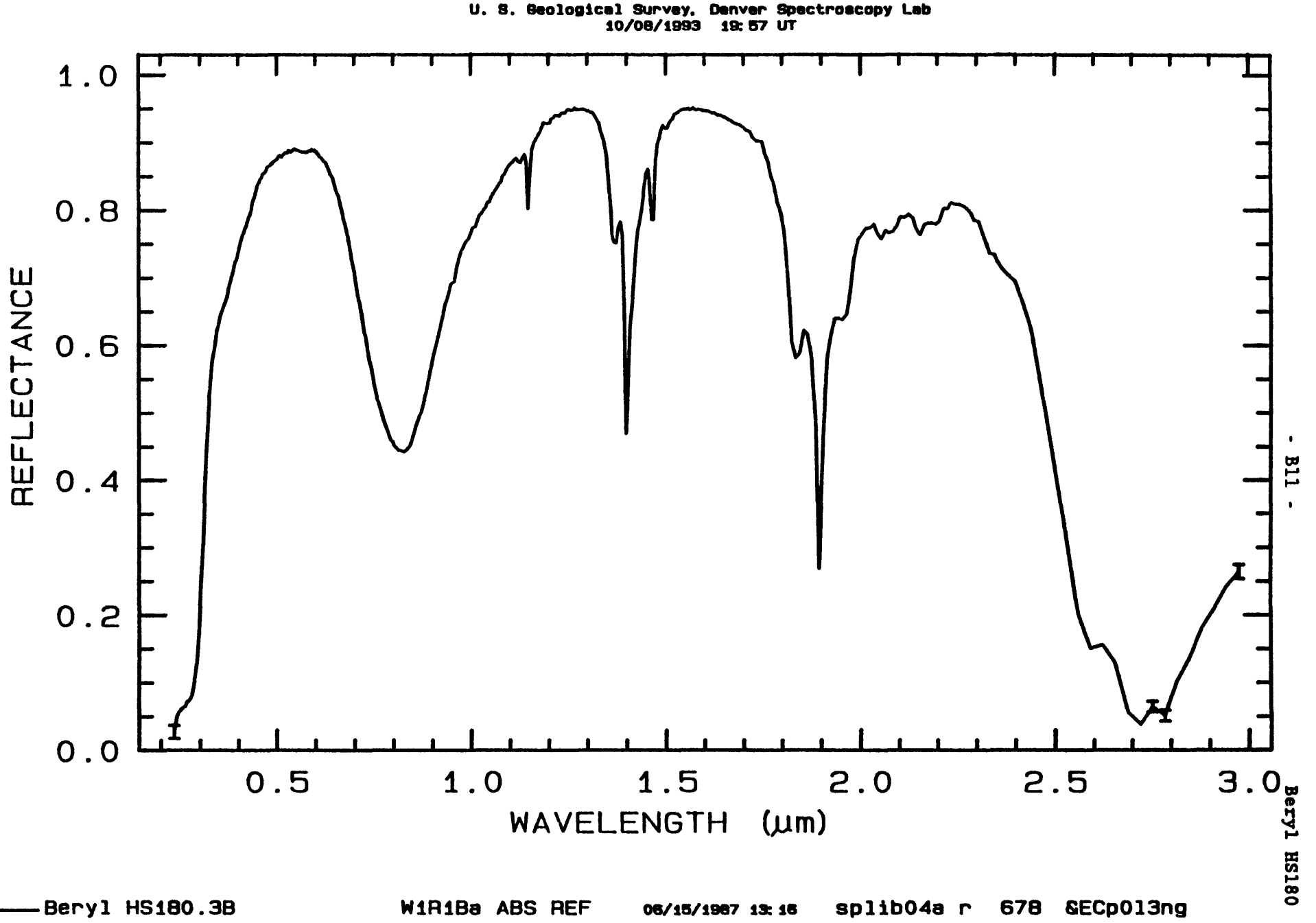
av gr sz = 285μm

Conchoidally fractured beryl grains (spares yellow staining). Very pure 100% beryl. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 678	0.2-3.0μm	200	g.s.= 285 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- B11 -
Beryl HS180
Beryl HS180.3B
W1R1Ba ABS REF
06/15/1987 13:16
splib04a r 678 &ECp013ng

TITLE: Biotite HS28 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS28

MINERAL_TYPE: Phyllosilicate

MINERAL: Biotite (Mica group)

FORMULA: K(Mg,Fe+2)3(Al,Fe+3)Si3O10(OH,F)2

FORMULA_NROFF: $K(Mg,Fe^{+2})_3(Al,Fe^{+3})Si_3O_{10}(OH,F)_2$

COLLECTION_LOCALITY: Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Phlogopite.

Usually in irregular foliated masses. Composition is similar to phlogopite but with considerable substitution of Fe^{+2} for Mg. There is also substitiution by Fe^{+3} and Al for Mg and by Al for Si. In addition a series exists between phlogopite and biotite. The trioctahedral biotite structure is the same as that of phlogopite.

"S-5. Biotite. Bancroft, Ontario (28). A potassium magnesium-iron-aluminum silicate, essentially $K(Mg,Fe)_3AlSi_3O_{10}(OH)_2$. Biotite is a widely distributed accessory mineral in igneous rocks and also occurs in some metamorphic rocks. Ferrous and ferric ions cause a very broad band in the 0.6 to 1.5μm region, and the drop-off in the blue. Hydroxyl bands are barely observable in the spectra. There are several possible reasons for the lack of observable OH overtones in this spectrum: The OH groups are commonly oriented (because the mica flakes lie on their cleavage faces) so that the observation angle may preclude their observation in the spectrum; the fundamental OH stretch is normally much broader in biotite than in other micas; and the OH concentration in this sample may be particulary low, because the OH in biotite may be readily replaced by F, Na, Fe^{+2} etc."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Biotite plus trace other

Clark, R.N., King, T.V.V., Klejwa, M., Swayze, G.A., and Vergo, N., 1990, High spectral resolution reflectance spectroscopy of minerals: Journal of Geophysical Research, v. 95, no. 8B, p 12,653-12,680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDA) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	38.00 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	1.96 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	11.42 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	17.44 wt%	NROFF:	FeO
COMPOSITION:	MnO:	.83 wt%	NROFF:	MnO
COMPOSITION:	MgO:	13.85 wt%	NROFF:	MgO
COMPOSITION:	CaO:	.01 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	.56 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	8.91 wt%	NROFF:	K_2O
COMPOSITION:	Cl:	.06 wt%	NROFF:	Cl
COMPOSITION:	F:	4.90 wt%	NROFF:	F
COMPOSITION:	---	---		
COMPOSITION:	Total:	97.12 wt%		
COMPOSITION:	O=Cl,F,S:	1.74 wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	95.38 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Average of 6 samples. (Done by Gregg Swayze)

END_COMPOSITION_DISCUSSION.

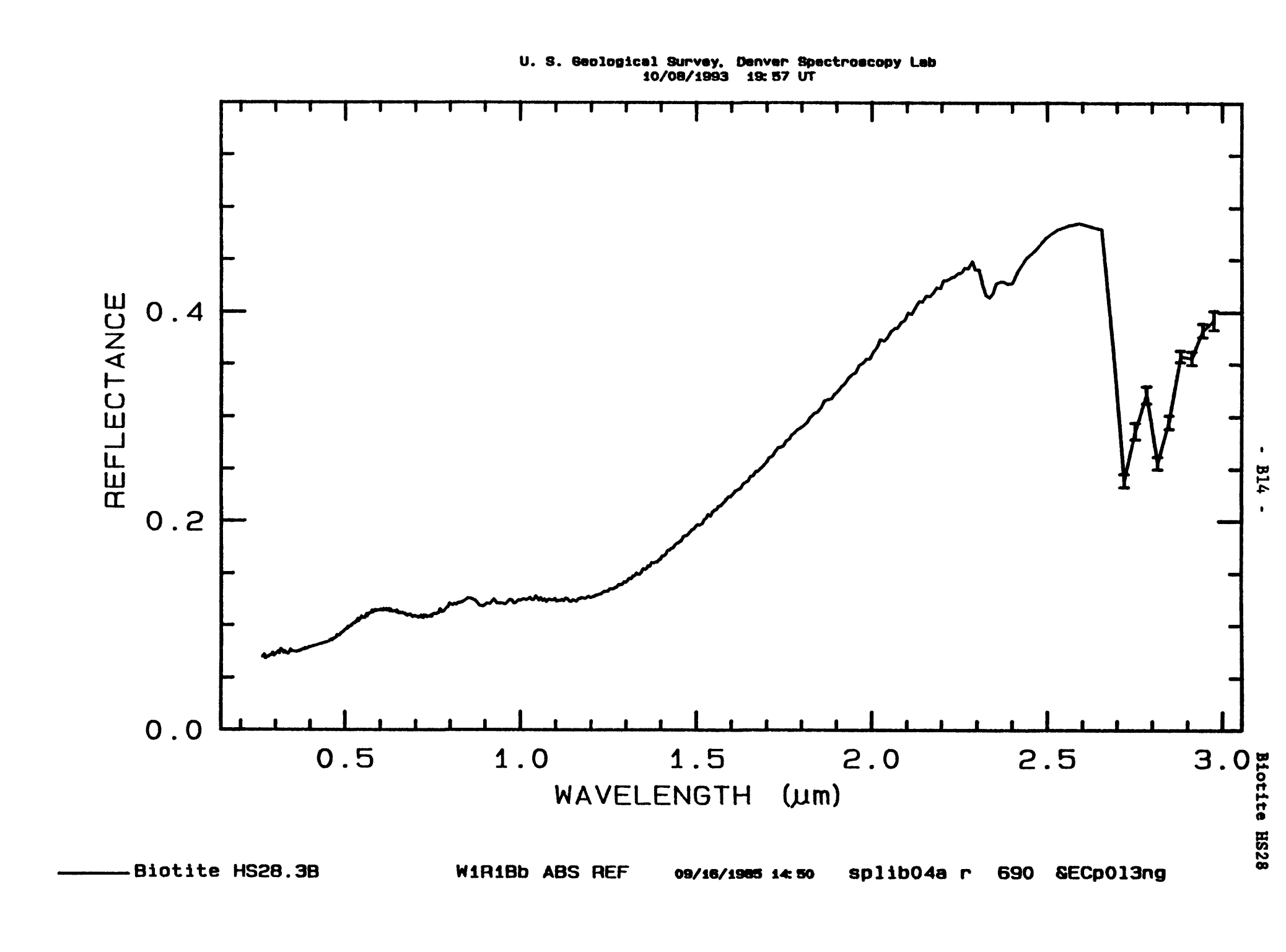
MICROSCOPIC_EXAMINATION:

Basal cleavage, slight pleochroism, pale green color, no mottled extinction, 1st order gray interference color, rod like inclusions (1-2 vol% sillimanite, length slow, straight extinction), biaxial (-), 2v about 30 degrees. Apart from lack of mottled extinction and low order interference color, all is consistent with this sample being biotite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 690	0.2-3.0μm	200	g.s.= 300 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- B14 -
Biotite HS28
Biotite HS28.3B
W1R1Bb ABS REF
09/16/1985 14:50
splib04a r 690 &ECp013ng

TITLE: Bloedite GDS147 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS147

MINERAL_TYPE: Hydrous Sulfate

MINERAL: Bloedite

FORMULA: Na2Mg(SO4)2*4H2O

FORMULA_NROFF: $Na_2Mg(SO_4)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Soda Lake, California

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure Bloedite. (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

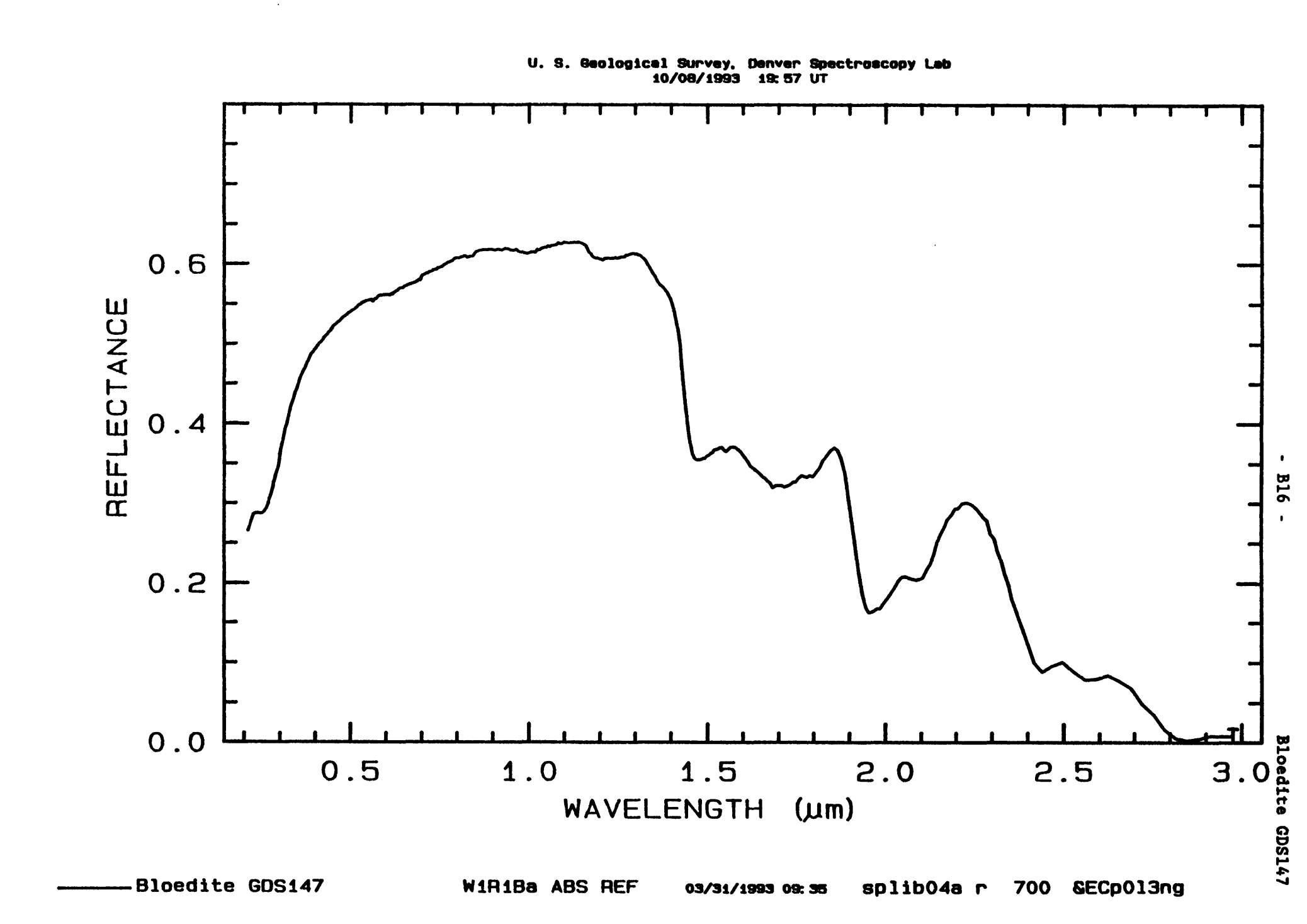
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a	r 700	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Bloedite GDS147
Bloedite GDS147 W1R1Ba ABS REF 03/31/1993 09:36 splib04a r 700 &ECp013ng

TITLE: Bronzite HS9 Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS9

MINERAL_TYPE: Inosilicate

MINERAL: Bronzite (ferroan Enstatite) (Pyroxene group)

FORMULA: (Mg,Fe+2)2Si2O6

FORMULA_NROFF: $(Mg,Fe^{+2})_2Si_2O_6$

COLLECTION_LOCALITY: Jackson Co., North Carolina

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spectrum displays double ferrous iron band typical of iron-rich orthopyroxenes.

Original spectrum published in:

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

"S-17E. Pyroxene, variety Bronzite. Jackson CO, N. Carolina (9B). This sample also displays the double ferrous ion band in the near-infrared typical of iron-rich orthopyroxenes. The slight band in the visible at 0.5μm is also a ferrous ion band."

Sieve interval 74 - 250μm.

Weak absorptions at 1.4 and 2.3 μm indicate trace alteration/contamination (probably tremolite). Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

85 vol% Bronzite
10 vol% quartz (uniaxial +)
5 vol% green grains (augite?) and Fe-stained pyroxene

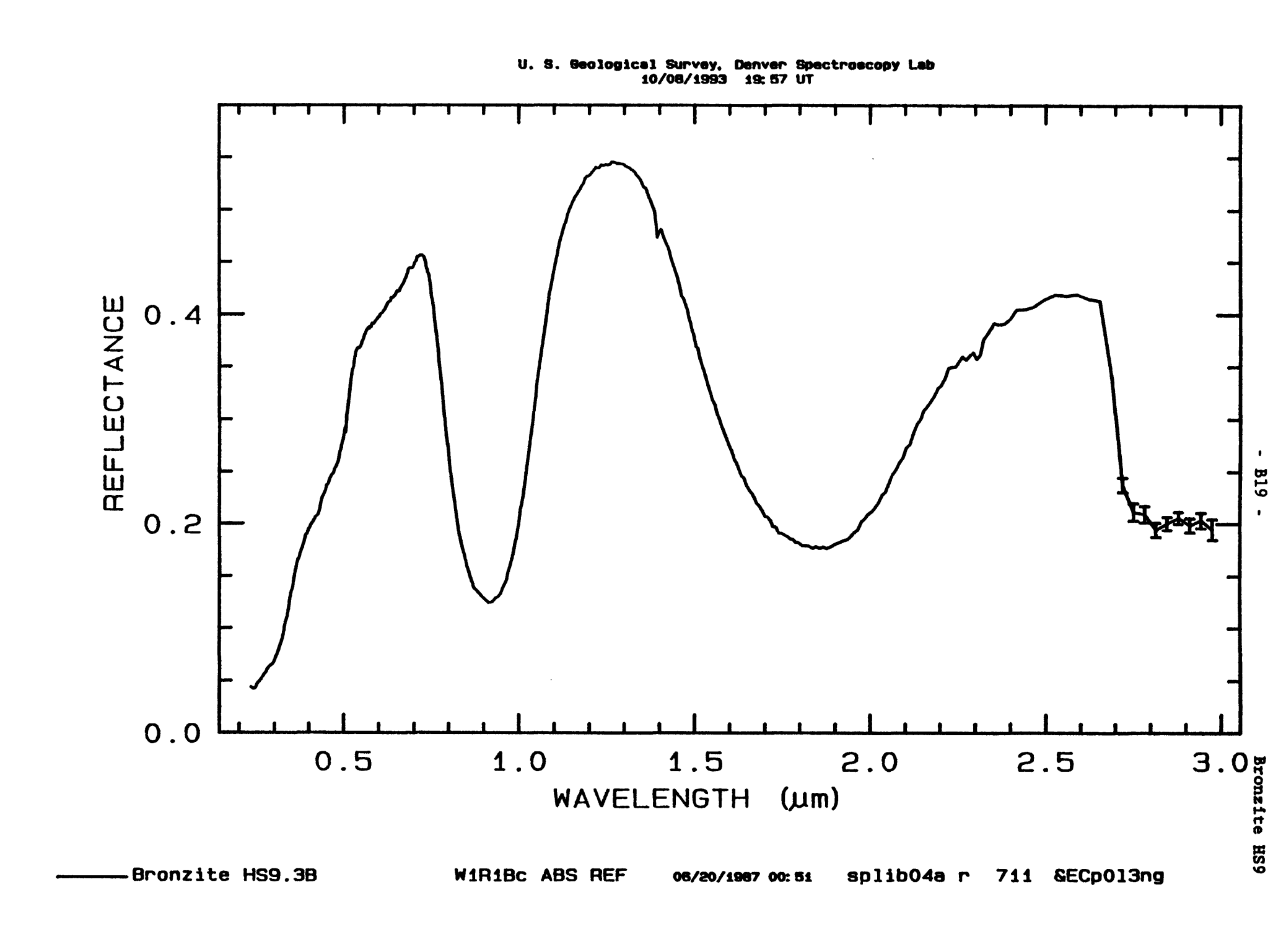
av gr sz = 260 μm

Prismatic grains, two cleavages at near 90 degree angle, straight extinction, length slow, high relief, all consistent with orthopyroxene. Opaque inclusions in bronzite (< 1vol%). G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 711	0.2-3.0μm	200	g.s.= 260 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 819 -
Bronzite HS9
Bronzite HS9.3B
W1R1Bc ABS REF
06/20/1987 00:51
splib04a r 711 &ECp013ng

TITLE: Brookite HS443 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS443

MINERAL_TYPE: Oxide

MINERAL: Brookite (Rutile group)

FORMULA: TiO2

FORMULA_NROFF: TiO_2

COLLECTION_LOCALITY: Arkansas

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Trimorphous with Anatase and Rutile.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

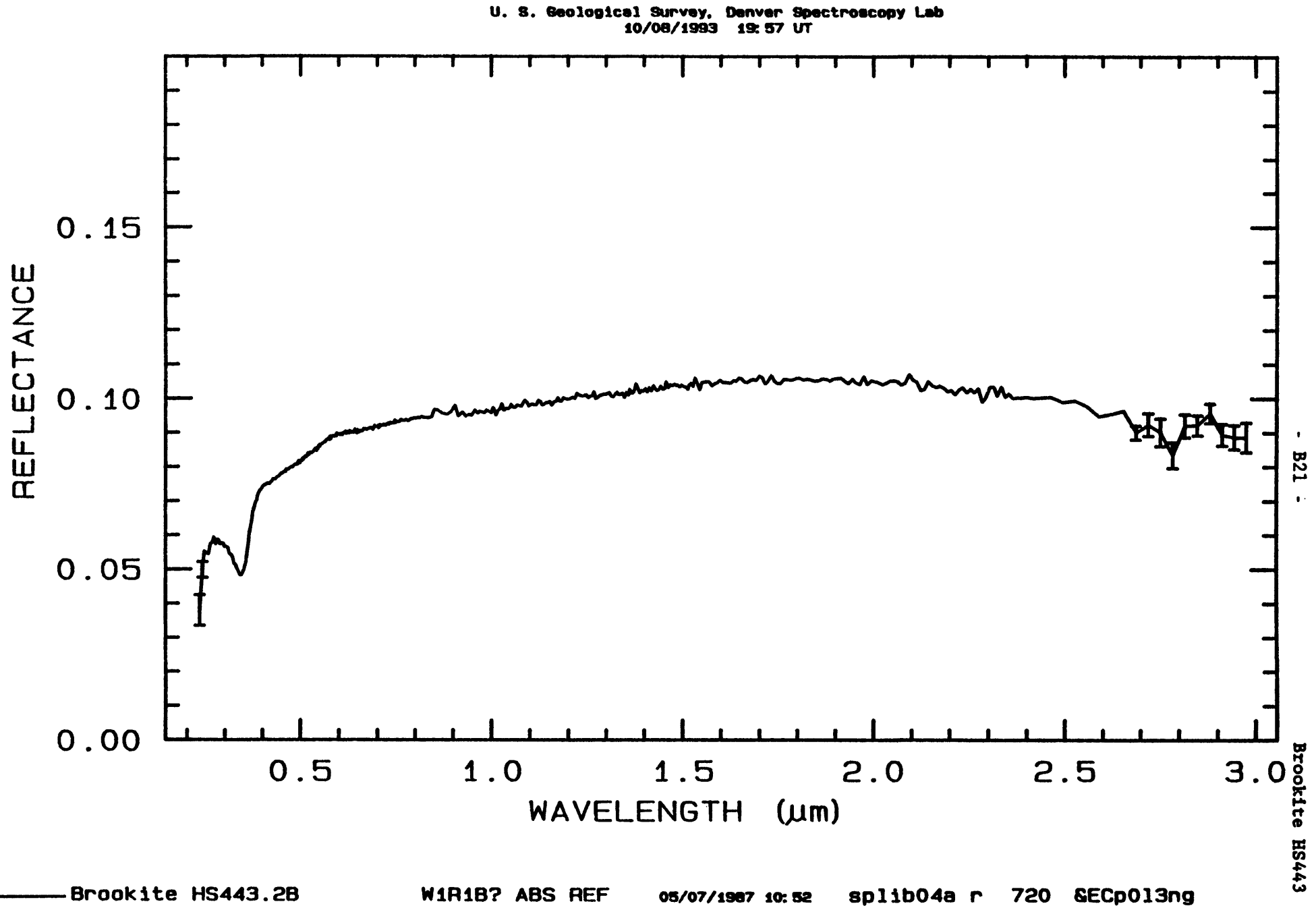
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 720	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- B21 -
Brookite HS443
Brookite HS443.2B W1R1B? ABS REF 05/07/1997 10:52 splib04a r 720 &ECp013ng

TITLE: Brucite HS247 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS247

MINERAL_TYPE: Hydroxide

MINERAL: Brucite

FORMULA: Mg(OH)2

FORMULA_NROFF: $Mg(OH)_2$

COLLECTION_LOCALITY: Lodi, Nevada

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Brucite, $Mg(OH)_2$, is a hydroxide typically found associated with serpentine, dolomite, magnesite and chromite as a decomposition product of magnesium silicates, especially serpentine. The brucite spectrum displays the best resolved vibrational bands in the present series, and interpretation of its spectrum has received considerable attention in the literature, The extremely sharp bands at 0.96μm and near 1.5μm are clearly due to vibrations of the hydroxyl group. The sharp band near 0.74μm likewise must be an overtone or combination tone of the OH group, and it occurs at the shortest wavelength of any vibrational band we have so far seen in this series. The multiplicity of bands in the brucite spectrum (as distinct from the single features in some of the micas, and evidenced by the sharp, well-resolved group of features near 1.4μm) have been variously interpreted as combinations of the fundamental stretching vibration with librational motions of the hydroxyl ions (Hexter, 1958); as combinations of the lattice vibrational modes with the OH stretching vibrations (Buchanan et al., 1962); and as caused by the close proximity of the hydroxyl ions in the brucite lattice, which causes the hydroxyl groups to have specific but different orientations and force constants (Boutin and Basset, 1963). The strong broad bands at longer wavelengths (2.32 and 2.49μm) have been studied using oriented crystals and polarized light (Mara and Sutherland, 1953). They also subjected the brucite to deuteration which resulted in appropriate wavelength shifts in the spectrum, indicating that these bands are indeed due to true OH vibrations."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, vol. 2, pp 195-205.

Sieve interval 74-250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Brucite plus medium amount dolomite plus small amount of other. (Norma Vergo)

HCL treatment shows ~8% carbonate. Spectral purity of narrow feature: spectrally pure according to analysis in:

Clark, R.N., King, T.V.V., Klejwa, M., Swayze, G.A., and Vergo, N., 1990, High spectral resolution reflectance spectroscopy of minerals: Journal of Geophysical Research, v. 95, no. 8B, p 12,653-12,680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No compositional analyses.

END_COMPOSITION_DISCUSSION.

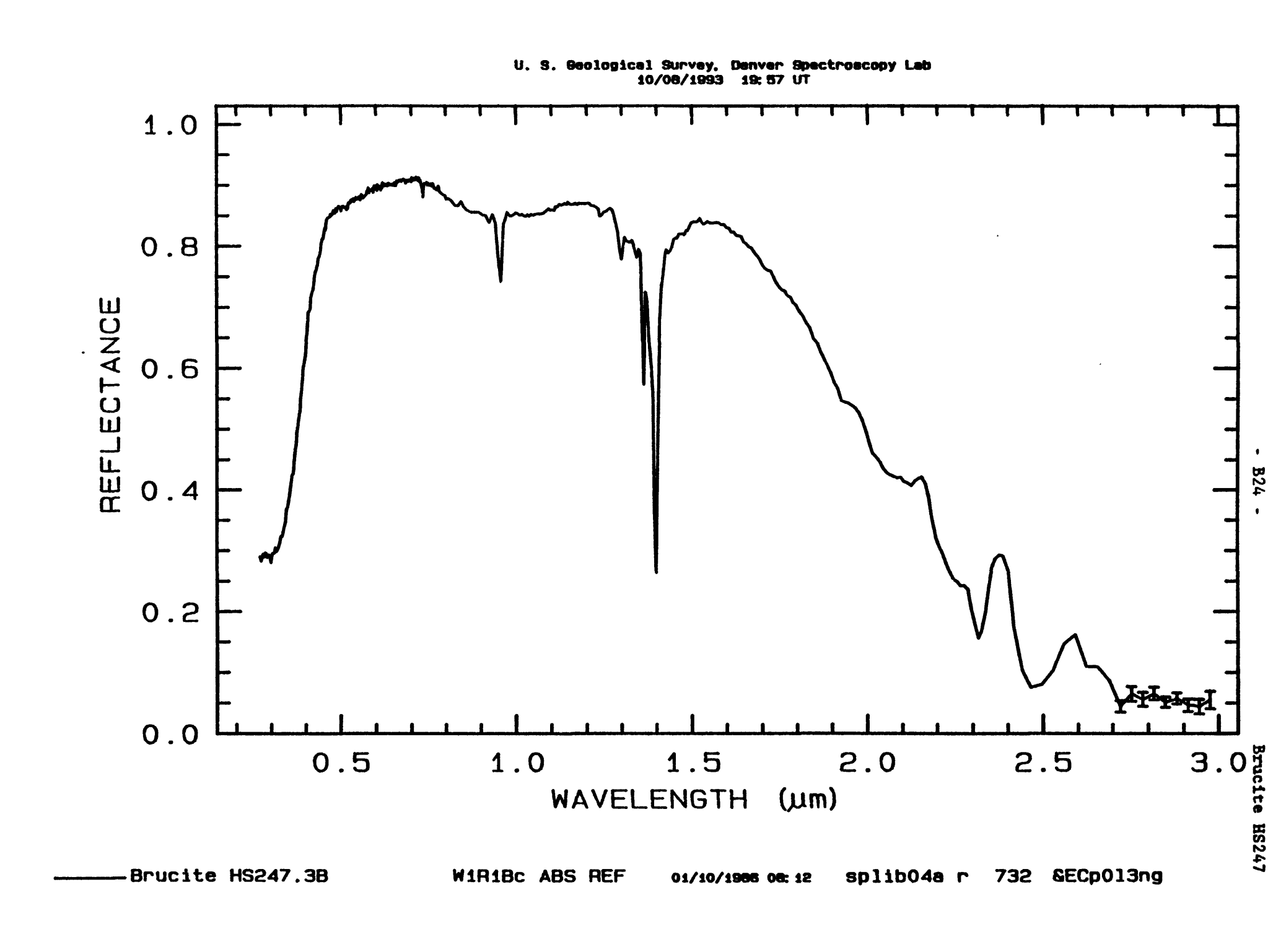
MICROSCOPIC_EXAMINATION:

Sample is contaminated with calcite (it fizzes with HCl). See above XRD discussion: sample has about 8% calcite. Calcite forms mostly powder coating on the brucite grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 732	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Brucite HS247.3B
W1R1Bc ABS REF
01/10/1986 08:12
splib04a r 732 &ECp013ng
Brucite HS247

TITLE: Buddingtonite GDS85 D-206 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS85 (D-206)

MINERAL_TYPE: Tectosilicate

MINERAL: Buddingtonite (Feldspar group)

FORMULA: (NH4)AlSi3O8*0.5H2O

FORMULA_NROFF: $(NH_4)AlSi_3O_8 \bullet \frac{1}{2}H_2O$

COLLECTION_LOCALITY: Sulphur Bank, California

ORIGINAL_DONOR: Dennis Krohn, USGS Reston

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Reston (M. Dennis Krohn)

SAMPLE_DESCRIPTION:

Comment: there are weak bands at 1.4 and 1.55 μm. The 1.55 might be due to alunite. If so, the buddingtonite feature is more than 10 times stronger, so the buddingtonite 2.1-μm feature is probably spectrally pure. Similar arguments for the 1.4 band. If these features are due to buddingtonite itself, then it is even more spectrally pure. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Quartz - major component
Buddingtonite - major component
No apparent alunite

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal Grain size distribution:
mode 1: 217 μm @ 5 vol%
mode 2: 12 μm @ 95 vol%

avg gr sz = 50 μm (includes quartz)

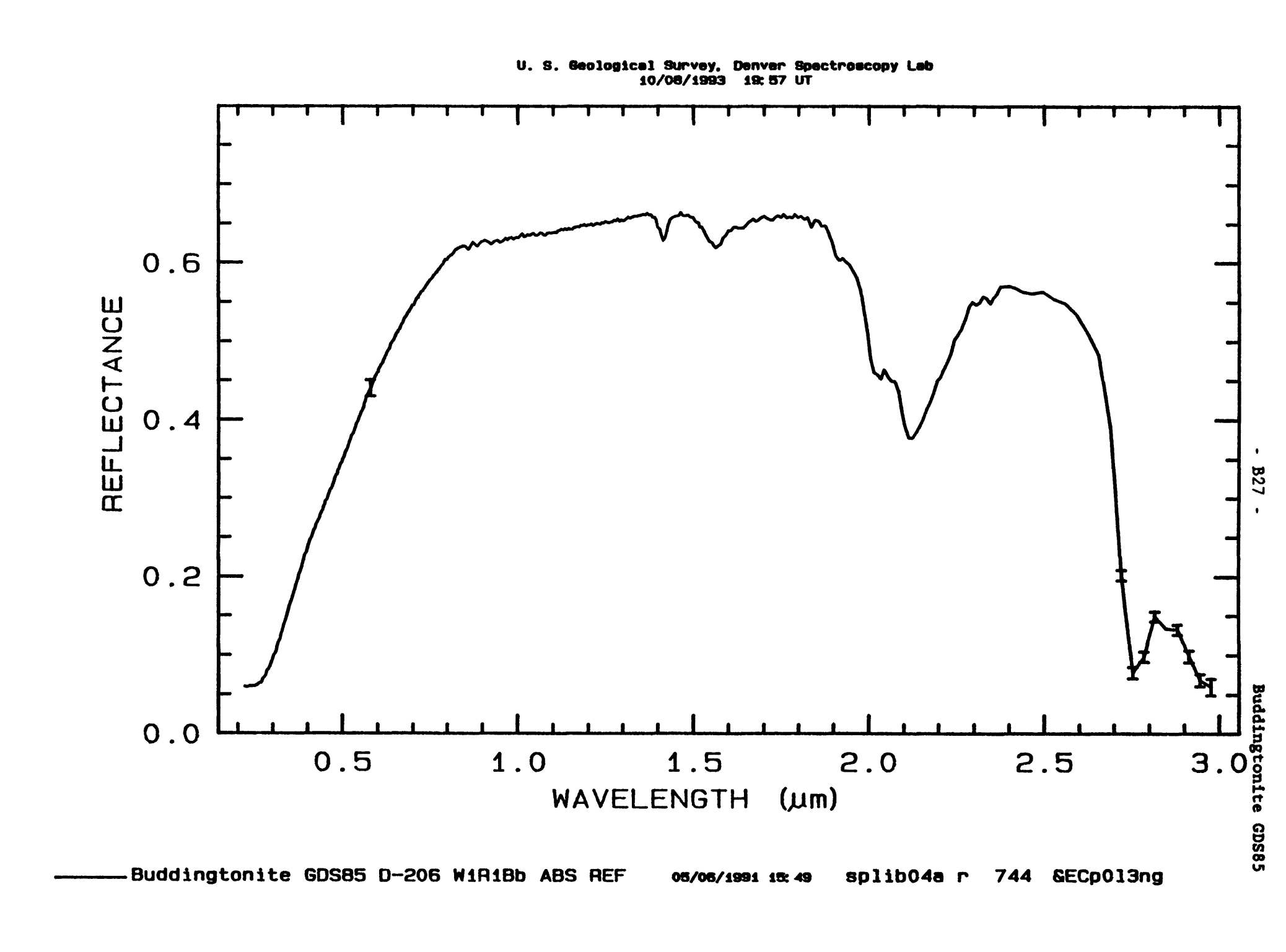
mode:
75 vol% Buddingtonite
20 vol% quartz
5 vol% Fe-oxides

Buddingtonite has mottled extinction and is highly altered. Quartz forms larger grains. Most buddingtonite is polygranular with effective grain size around 40 μm. No HCl fizz. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	744	0.2-3.0μm	200	g.s.= 50 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Buddingtonite GDS85 D-206 W1R1Bb ABS REF 05/06/1991 15:49 splib04a r 744 &ECp013ng
- B27 -
Buddingtonite GDS85

TITLE: Buddingtonite NHB2301 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NHB2301

MINERAL_TYPE: Tectosilicate

MINERAL: Buddingtonite (Feldspar group)

FORMULA: (NH4)AlSi3O8*0.5H2O

FORMULA_NROFF: $(NH_4)AlSi_3O_8 \bullet \frac{1}{2}H_2O$

COLLECTION_LOCALITY: Sharon Heights #2, San Mateo, CA

ORIGINAL_DONOR: Richard C. Erd, USGS Menlo Park, CA

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure (?)

Kruse, F.A. and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

From composition analyses: $(NH_4)_2O$ = 8.34 wt%
other = .59 wt%

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

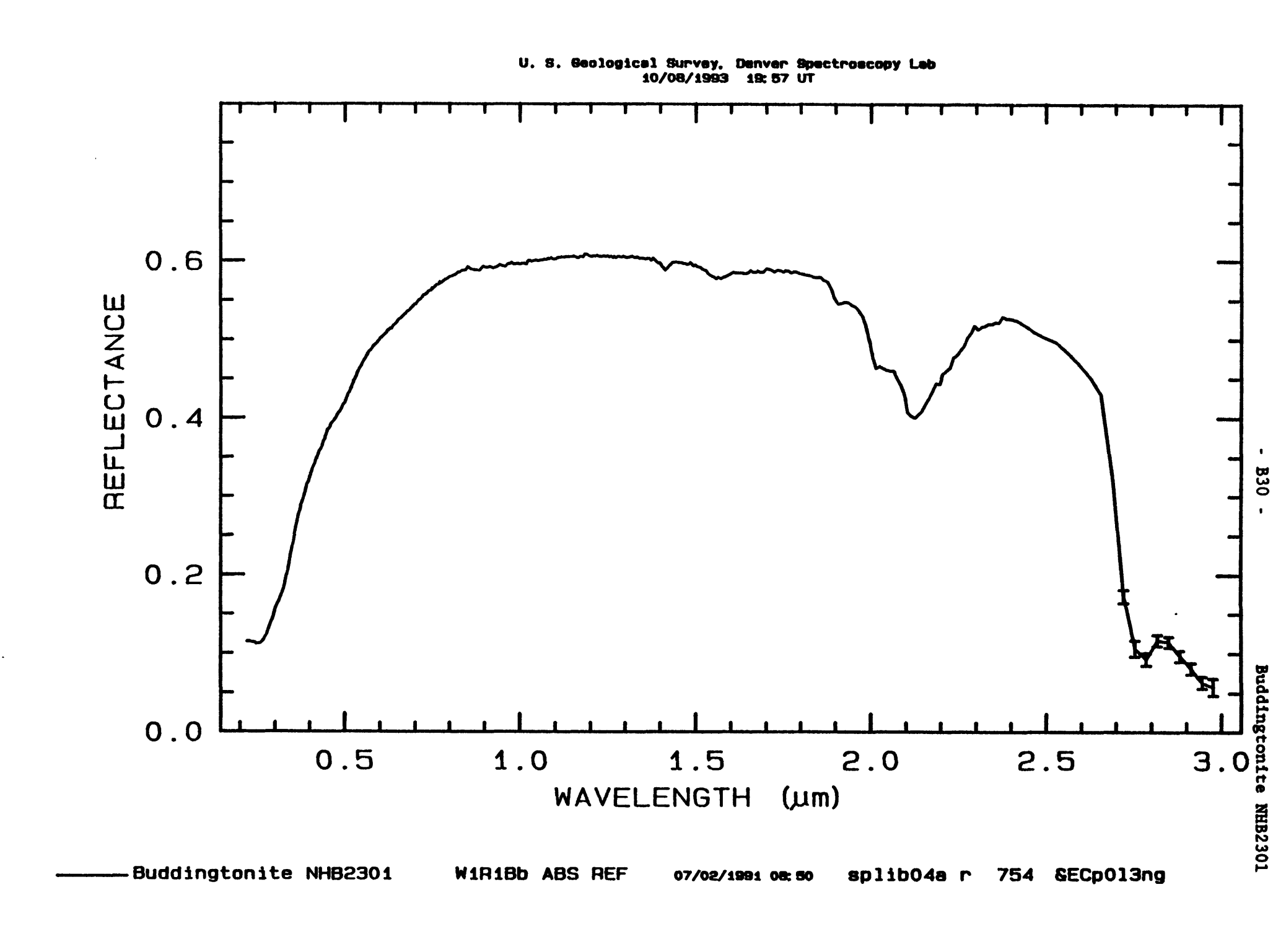
avg gr sz = 8 μm

Purity of sample difficult to evaluate because of fine grain size. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	754	0.2-3.0μm	200	g.s.= 8 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 830 -
Buddingtonite NHB2301
Buddingtonite NHB2301 W1R1Bb ABS REF 07/02/1991 08:50 splib04a r 754 &ECp013ng

TITLE: Butlerite GDS25 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS25

MINERAL_TYPE: Sulfate

MINERAL: Butlerite

FORMULA: Fe+3(SO4)(OH)*2H2O

FORMULA_NROFF: $Fe^{+3}(SO_4)(OH)\bullet 2H_2O$

COLLECTION_LOCALITY: MIT Collection

ORIGINAL_DONOR: Harvard Dana Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample was originally called Fibroferrite (Dave Sherman). Fibroferrite and butlerite have almost the same compostion, differing only in the H_2O content.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure butlerite.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

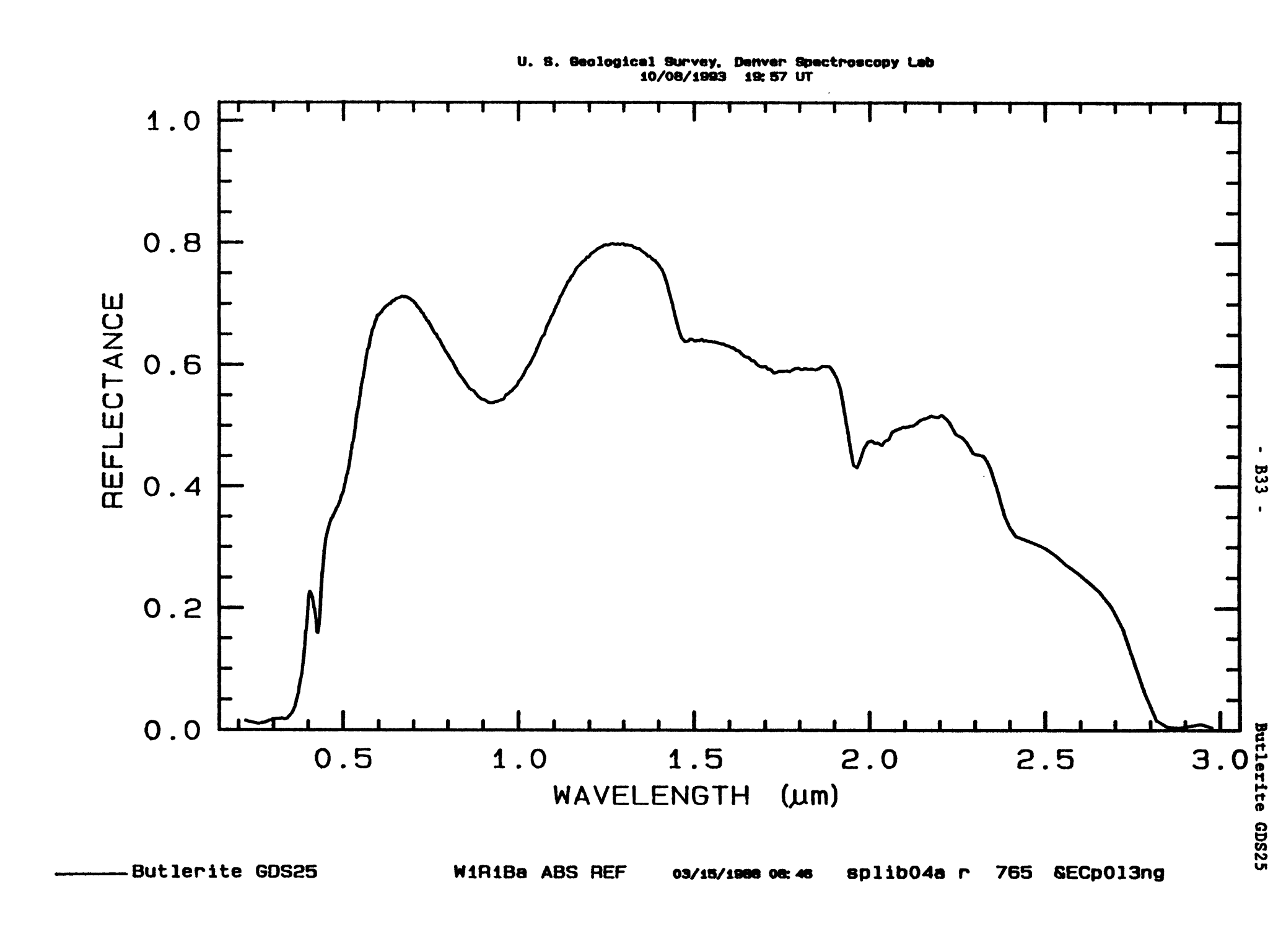
Avg gr sz = 10 μm

Very pure sample, all fibrous grains, length fast, nearly straight extinction. Fibrous nature prevents further determination of optical properties. Since I have no optical data on this mineral type to test its identity I cannot be optically sure this is Fibroferrite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	765	0.2-3.0μm	200	g.s.= 10 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 19:57 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- B33 -
Butlerite GDS25
Butlerite GDS25 W1R1Ba ABS REF 03/15/1988 08:46 splib04a r 765 &ECp013ng

TITLE: Bytownite HS106 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS106

MINERAL_TYPE: Tectosilicate

MINERAL: Bytownite (Plagioclase)(Feldspar group)

FORMULA: (Na,Ca)Al(Al,Si)Si2O8

FORMULA_NROFF: (Na,Ca)Al(Al,Si)Si_2O_8

COLLECTION_LOCALITY: Crystal Bay, Minnesota

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Bytownite is a plagioclase feldspar series mineral whose end members are albite (Na) and anorthite (Ca). Bytownite falls into the 70-90% anorthite category in this series.

Sieve interval 74-250μm.

This sample shows a nice plagioclase feldspar absorption feature near 1.2 μm, but the 2.0-μm band and bands longer than about 2.3 μm are due to water from a caotaminant. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No compositional analyses.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

96 vol% bytownite
4 vol% sphene or garnet

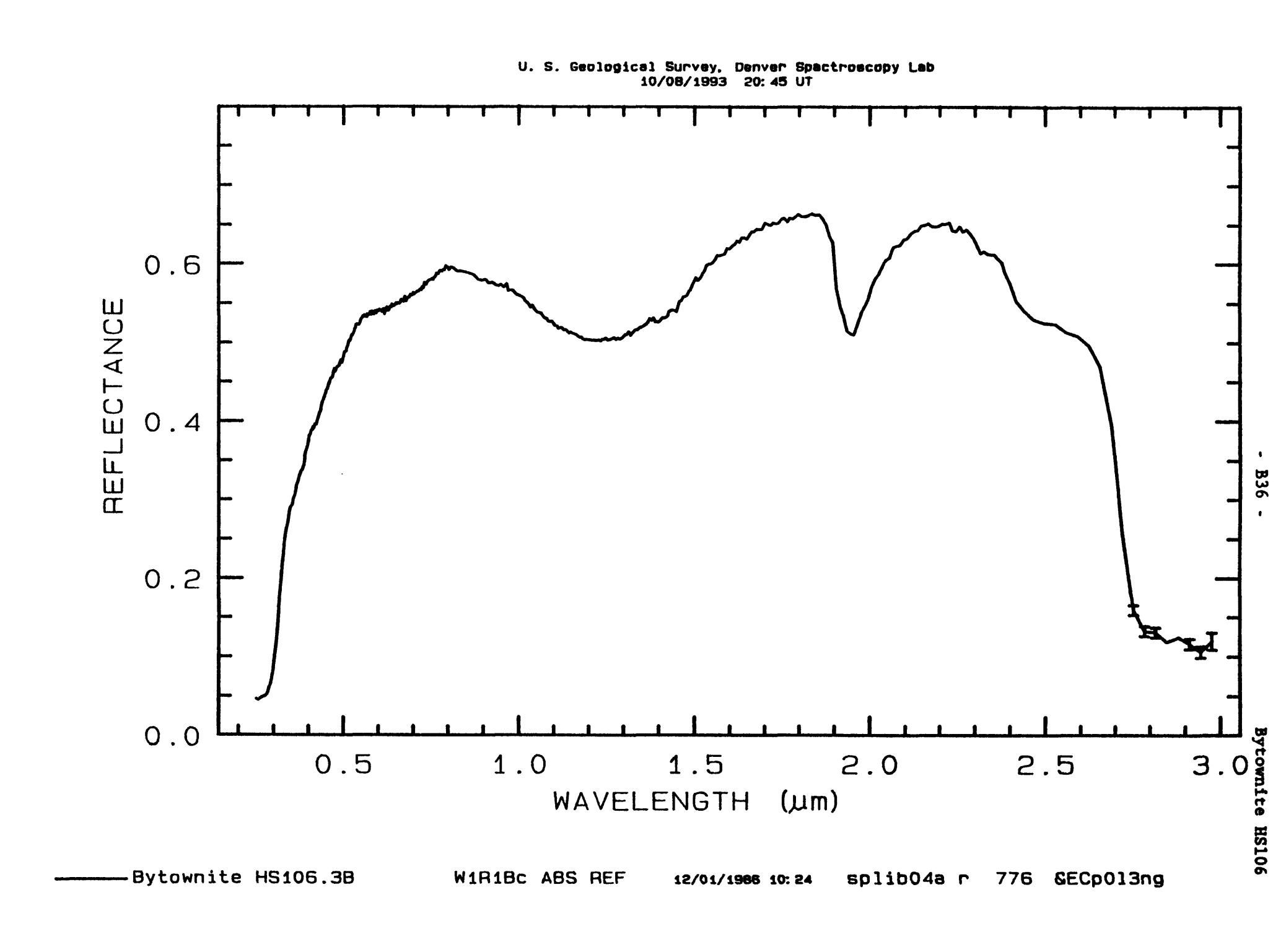
av gr sz = 290μm

Clear rectangular grains with two cleavages, and twins. Biaxial (+)
G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 776	0.2-3.0μm	200	g.s.= 290μm



Bytownite HS106

TITLE: Calcite WS272 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS272

MINERAL_TYPE: Carbonate

MINERAL: Calcite (Calcite group)

FORMULA: CaCO3

FORMULA_NROFF: $CaCO_3$

COLLECTION_LOCALITY: Tunguska, Siberia, USSR

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Rhodochrosite. Trimorphous with Aragonite and Vaterite.

This sample was ground from a beautiful single crystal of type Iceland Spar. The single crystal appeared pure, and the visible-NIR spectrum appears pure.

See Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Calcite + small amount of "other" -- by Norma Vergo However, there is no "other" apparent in the single crystals or the ground sample. -- Roger N. Clark

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:

population 1	450μm	85 vol%
population 2	15μm	15 vol%

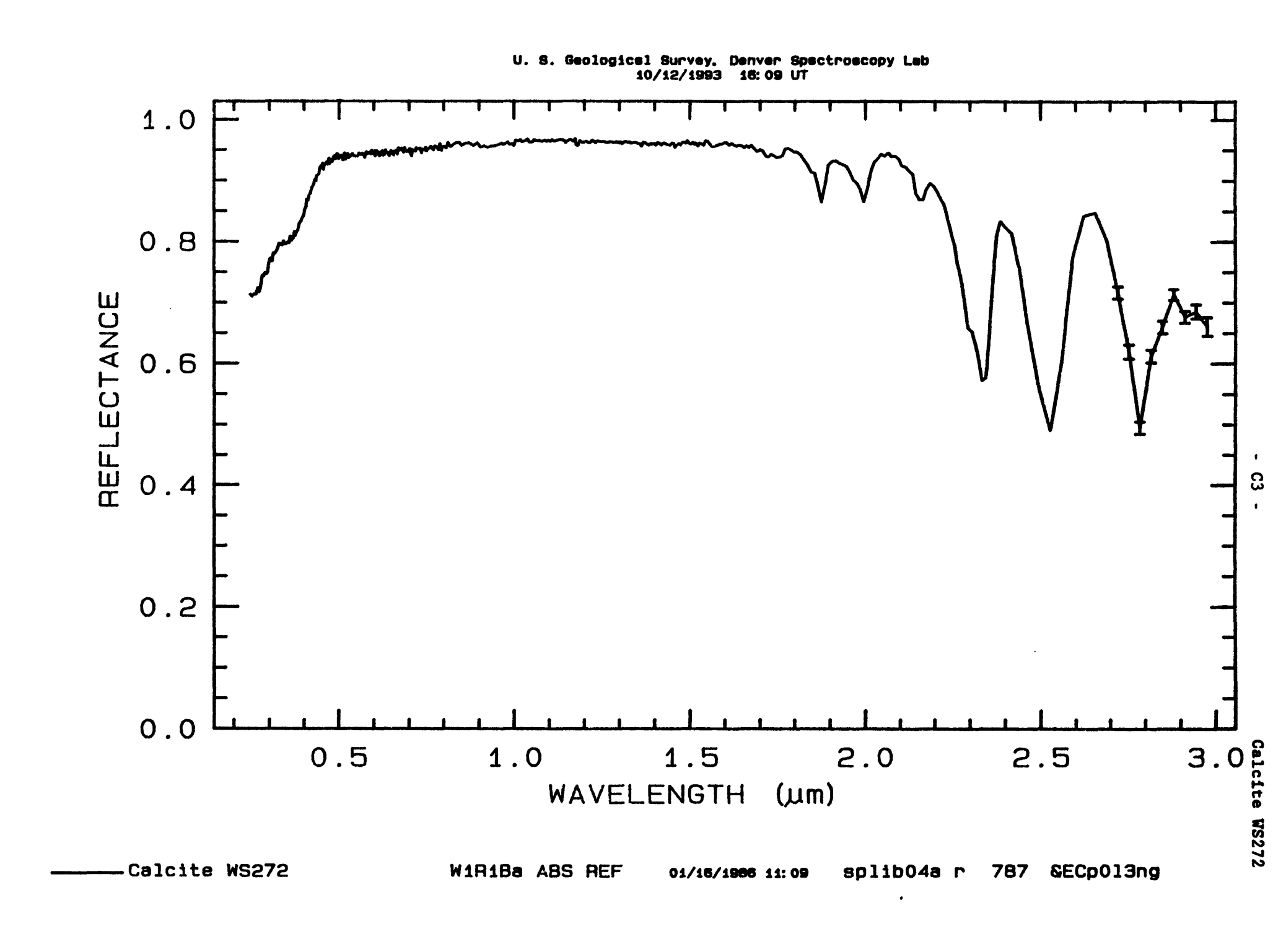
av gr sz of populations = 410μm

Pure sample from single crystal. Rhombic cleavage, twins, uniaxial, very high birefringence, fizzes readily in dilute HCl. Smaller grains adhere to larger grains covering 40-80% of larger grains cleavage surfaces.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	787	0.2-3.0μm	200	g.s.= 410 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:09 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C3 -
Calcite WS272
Calcite WS272
W1R1Ba ABS REF 01/16/1996 11:09 splib04a r 787 &ECp013ng

TITLE: Calcite HS48 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS48

MINERAL_TYPE: Carbonate

MINERAL: Calcite (Calcite group)

FORMULA: CaCO3

FORMULA_NROFF: $CaCO_3$

COLLECTION_LOCALITY: Cherokee County, Kansas

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Rhodochrosite. Trimorphous with Aragonite and Vaterite.

Original sample description and visible-NIR spectrum was published in:

Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

They said: "the sample appears colorless and mineralogically pure. Its spectrum clearly displays the strong carbonate bands from 1.8 to 2.6μ as in the sample above, which are common to most carbonates. It also displays a weak band near 1.1μ and a fall-off in reflectivity shortward of 0.4μ, which can be attributed to the presence of ferrous ion substituting in small amount for calcium. An analysis of this sample shows that 0.09% of iron by weight is present. This chemical and spectral behavior is quite typical of calcite. Again, pilling of the finest size fraction probably produces the crossover of the spectral curves in the visible."

The spectrum here indicates a pure calcite. The sample appears white with no contaminants under a hand lens.

See Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure Calcite -- by Norma Vergo

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

An analysis of this sample by:

Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

shows that 0.09% of iron by weight is present.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:

population 1	210μm	98 vol%
population 2	20μm	2 vol%

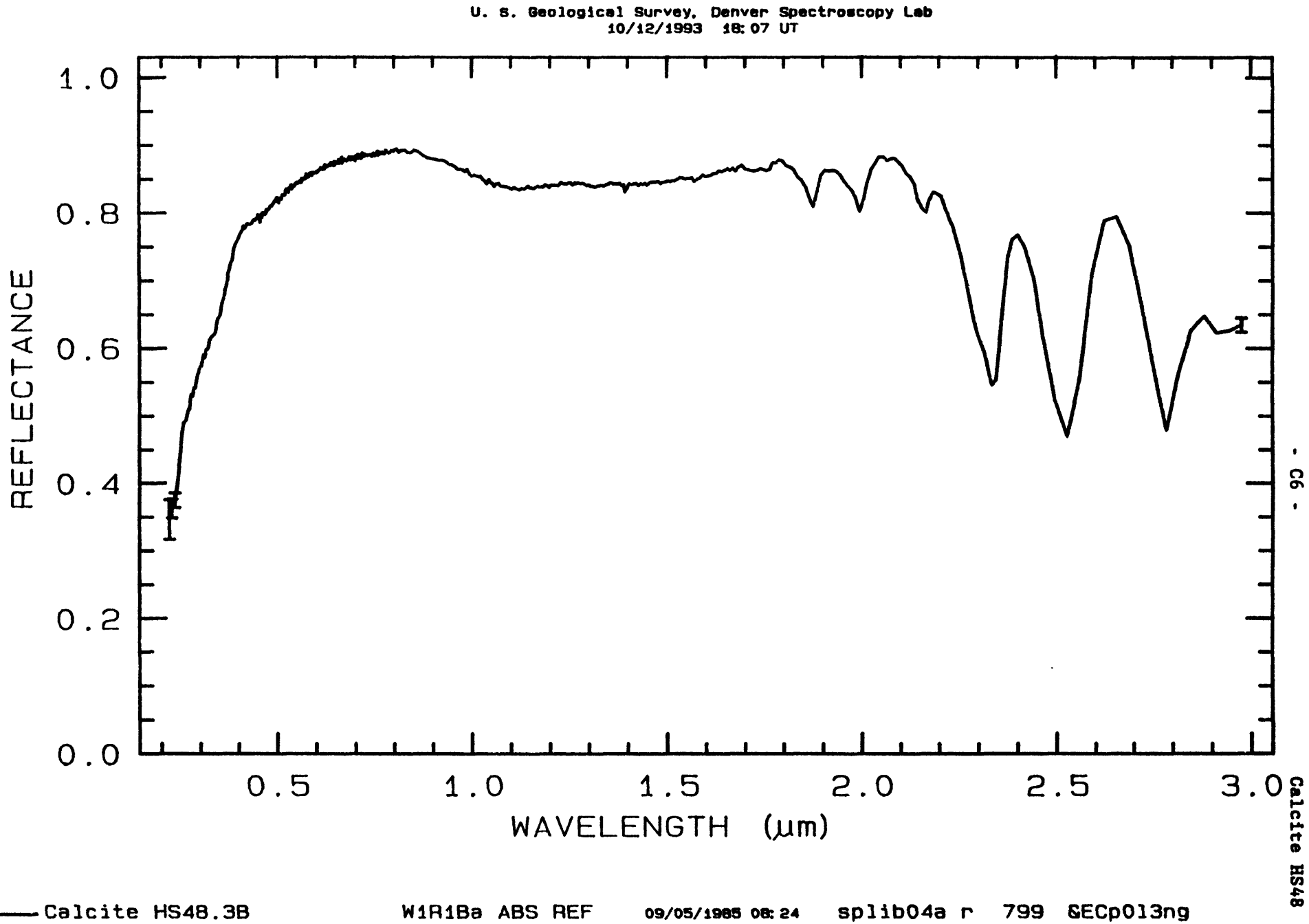
av gr sz of populations = 208μm

Pure sample. Clear rhombs. Large grains 40% coated with smaller grains. Readily fizzes in dilute HCl. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	799	0.2-3.0μm	200	g.s.= 208 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 18:07 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 66 -
Calcite HS48
Calcite HS48.3B W1R1Ba ABS REF 09/05/1985 08:24 splib04a r 799 &ECp013ng

TITLE: Calcite CO2004 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CO2004

MINERAL_TYPE: Carbonate

MINERAL: Calcite (Calcite group)

FORMULA: CaCO3

FORMULA_NROFF: $CaCO_3$

COLLECTION_LOCALITY: Alligator Ridge Mine, Nevada

ORIGINAL_DONOR: Phoebe Hauff

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Forms series with Rhodochrosite. Trimorphous with Aragonite and Vaterite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Calcite + minor quartz

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal Grain size distribution:
mode 1: 575 μm @ 70 vol%
mode 2: 25 μm @ 30 vol%

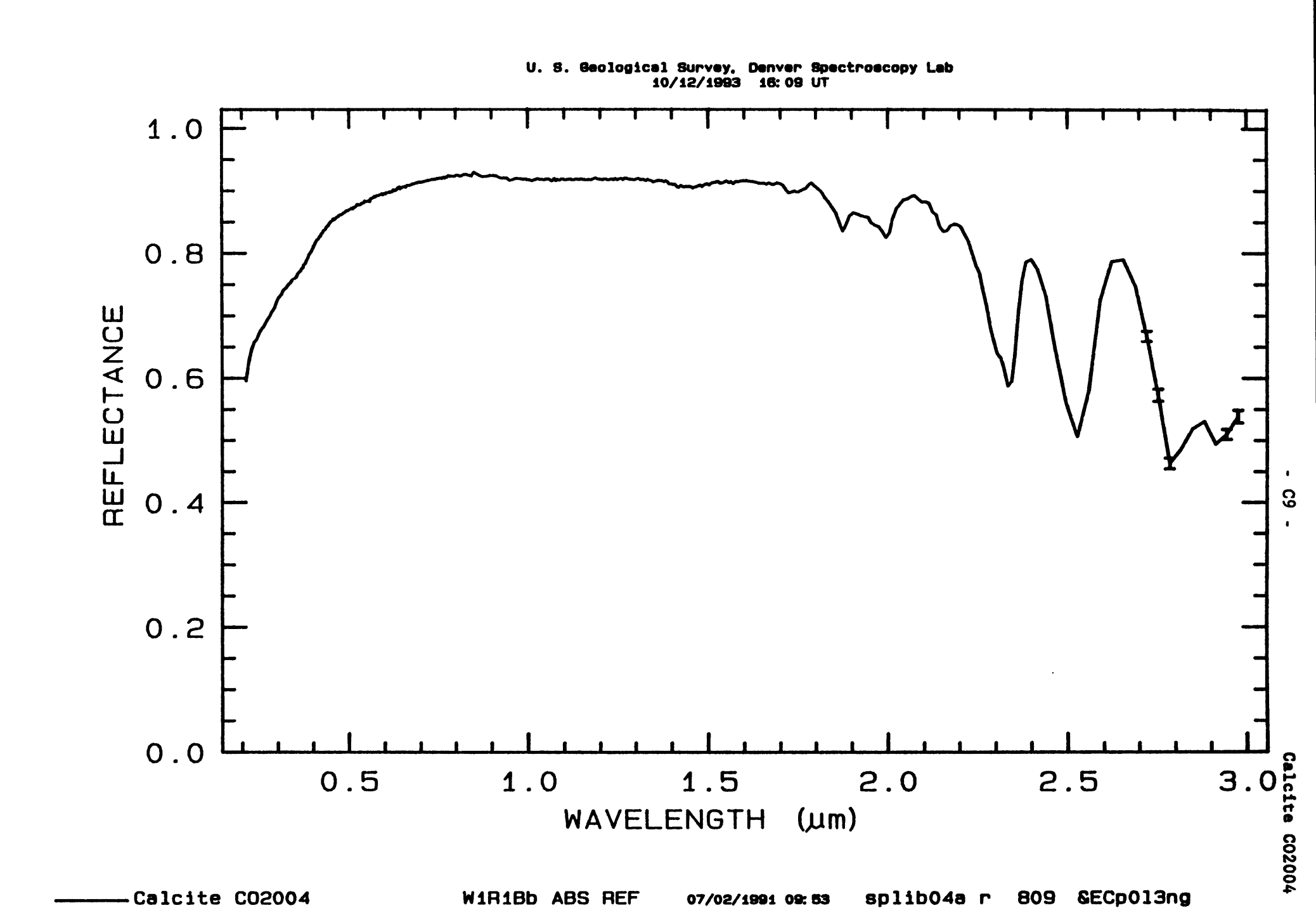
avg gr sz = 480 μm

Uniaxial (-), high birefringence, rhombic cleavage, clear color, vigorous fizz with HCl, all consistent with calcite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 809	0.2-3.0μm	200	g.s.= 480 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1983 16:09 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Calcite CO2004
Calcite CO2004 W1R1Bb ABS REF 07/02/1991 09:53 splib04a r 809 &ECp013ng

TITLE: Carbon_Black GDS68 DESCRIPT

DOCUMENTATION_FORMAT: ELEMENT

SAMPLE_ID: GDS68

MINERAL_TYPE: Element

MINERAL: Carbon

FORMULA: C

FORMULA_NROFF: C

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Sargent Welch

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample and the visible-NIR spectrum was originally published in:

Clark, R.N., 1983, Spectral Properties of Mixtures of Montmorillonite and Dark Carbon Grains: Implications for Remote Sensing Minerals Containing Chemically and Physically Adsorbed Water: J. Geophys. Res., v. 88, p. 10635-10644.

The sample was manufactured by Sargent Welch (in about 1980) and consists of 99.0 wt% pure carbon, 0.5 wt% ash, and 0.5 wt% acetone extractables. The sample was examined with scanning electron microscopy (SEM) and the grain size is quite uniform at 0.17 μm. Note that the Clark 1983 spectrum has too high a reflectance due to scattered light in the UH spectrometer.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: Other # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	C:	99.0	wt%	NROFF: C
COMPOSITION:	volatile:	0.5	wt%	NROFF: volatile
COMPOSITION:	unknown:	0.5	wt%	NROFF: unknown
COMPOSITION:	----------			
COMPOSITION:	Total:	100.0	wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

The sample analysis was by Sargent Welch and consists of 99.0 wt% pure carbon, 0.5 wt% ash, and 0.5 wt% acetone extractables.

END_COMPOSITION_DISCUSSION.

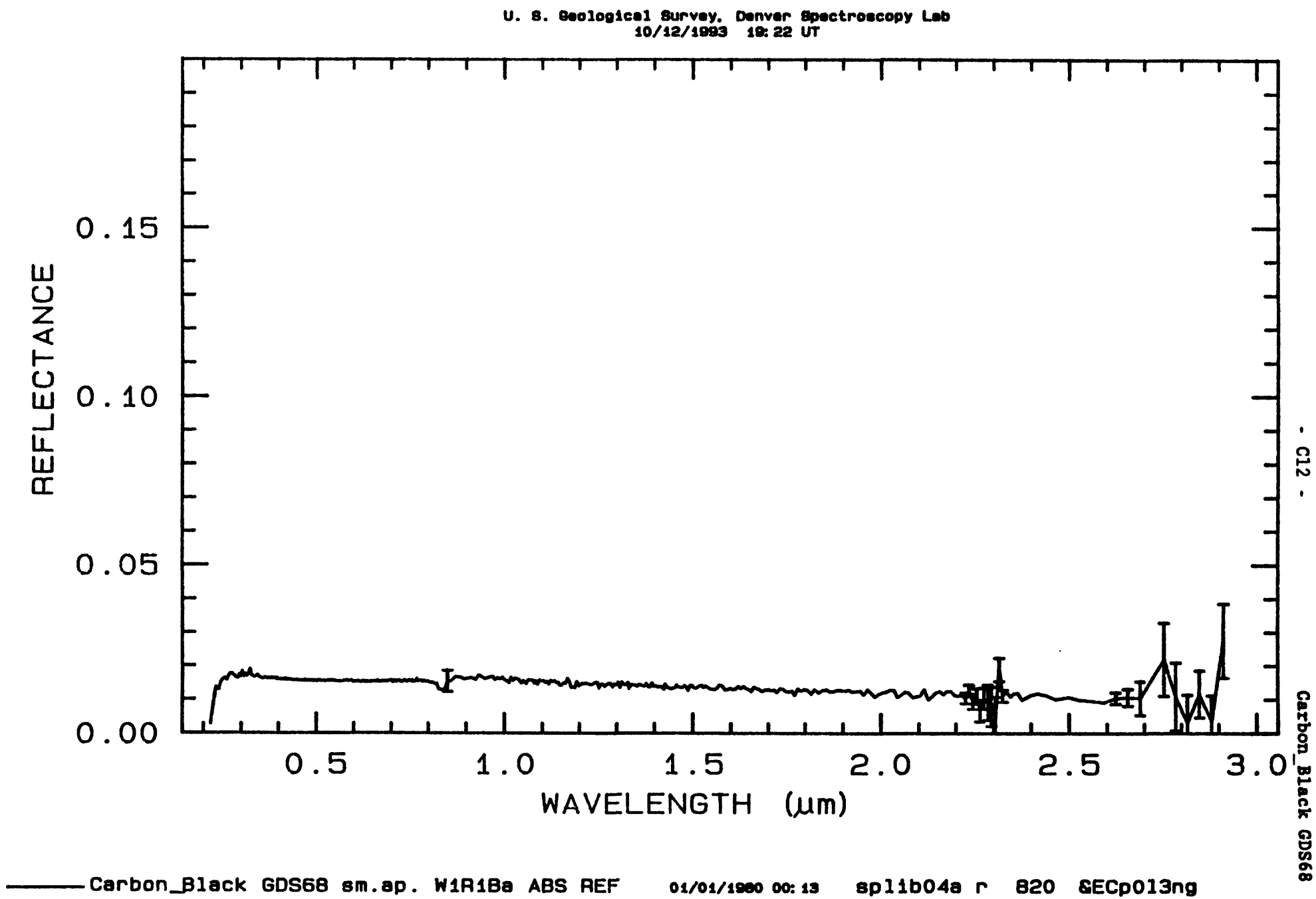
MICROSCOPIC_EXAMINATION:

SEM shows the grains to be spherical with a 0.17 μm diameter. No visible contamination under x-polarized light. Clumps range in size greater than 0.17μm.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	820	0.2-3.0μm	200	g.s.=0.17 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 19:22 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C12 -
Carbon_Black GDS68
Carbon_Black GDS68 sm.ap. W1R1Ba ABS REF 01/01/1980 00:13 splib04a r 820 &ECp013ng

TITLE: Carnallite NMNH98011 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH98011

MINERAL_TYPE: Halide (Hydrous Chloride)

MINERAL: Carnallite

FORMULA: KMgCl3*6H2O

FORMULA_NROFF: $KMgCl_3 \bullet 6H_2O$

COLLECTION_LOCALITY: Barcelona, Spain

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

Pure Carnellite. (Jim Crowley, 1991)

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

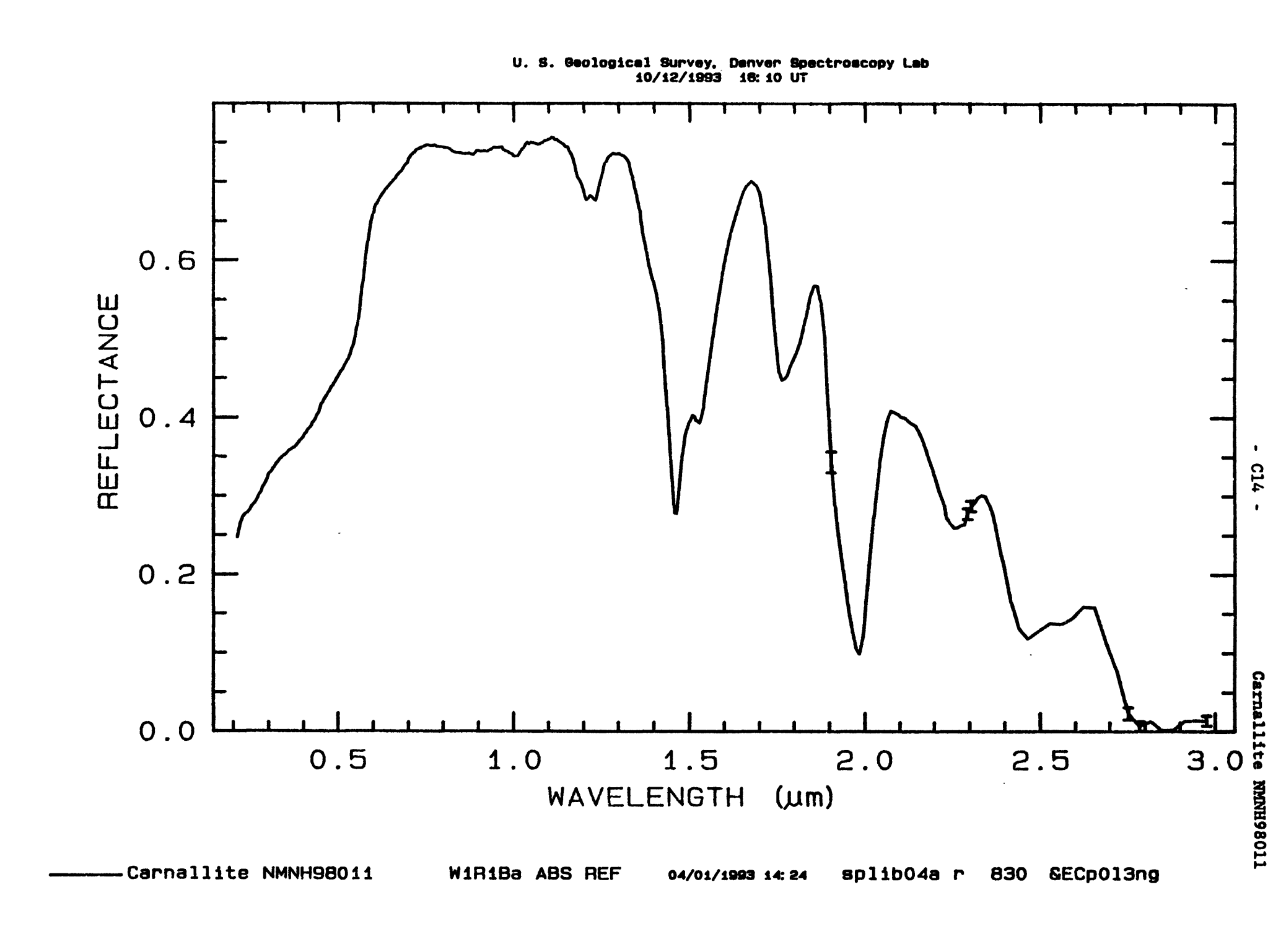
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rmccarty@speclab (Ryan McCarty)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	830	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C14 -
Carnallite NMNH98011
Carnallite NMNH98011 W1R1Ba ABS REF 04/01/1993 14:24 splib04a r 830 &ECp013ng

TITLE: Carnallite HS430 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS430

MINERAL_TYPE: Halide

MINERAL: Carnallite

FORMULA: KMgCl3*6H2O

FORMULA_NROFF: $KMgCl_3 \bullet 6H_2O$

COLLECTION_LOCALITY: Carlsbad, New Mexico

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample was originally described by Hunt and Salisbury as:

"H-5. Sylvite. Carlsbad, N.M. (430B). Sylvite, KCl, has the same origin, mode of occurrence and associations as halite, but is much rarer. Like halite, it is colorless when pure, but is more often some shade of red due to ferric oxide inclusions. It may also be yellow or blue, and it has been suggested that the blue coloration is due to F-centers in inclusions of rock salt. This sample is reddish orange, and the absorption shortwards of 0.55 μ is due to ferric oxide inclusions. The well-defined bands in the near-infrared at 1.0, 1.23, 1.46, 1.77, 1.99, and 2.27 μ are clearly due to water of hydration. Except for a small shift to longer wavelengths these bands are essentially identical with those found in gypsum (see spectra SS-11A, B, C, D, in Part IV). The sylvite obviously contains some hydrated impurity, although it does not appear to be gypsum in this case. Most probably it is magnesium chloride hydrate, but almost any hydrate produces a set of bands similar to those displayed here."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1972, Visible and near-infrared spectra of minerals and rocks: V. Halides, phosphates, arsenates, vanadates and borates. Modern Geology, v. 3, p. 121-132.

XRD has shown this sample to be primarily Carnallite. The visible and near infrared spectral features are from Carnallite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"45 kV - 35 mA, 6.5-9.5 keV
Reference: JCPDS #28-869
Found: Carnallite plus an unidentified reflection at 3.16-3.16 angstroms.
Comments: All strong relections on the JCPDS card were found. The

carnallite reflections are sharp, indicating good crystallinity. The unidentified reflection is broad and may be a doublet."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

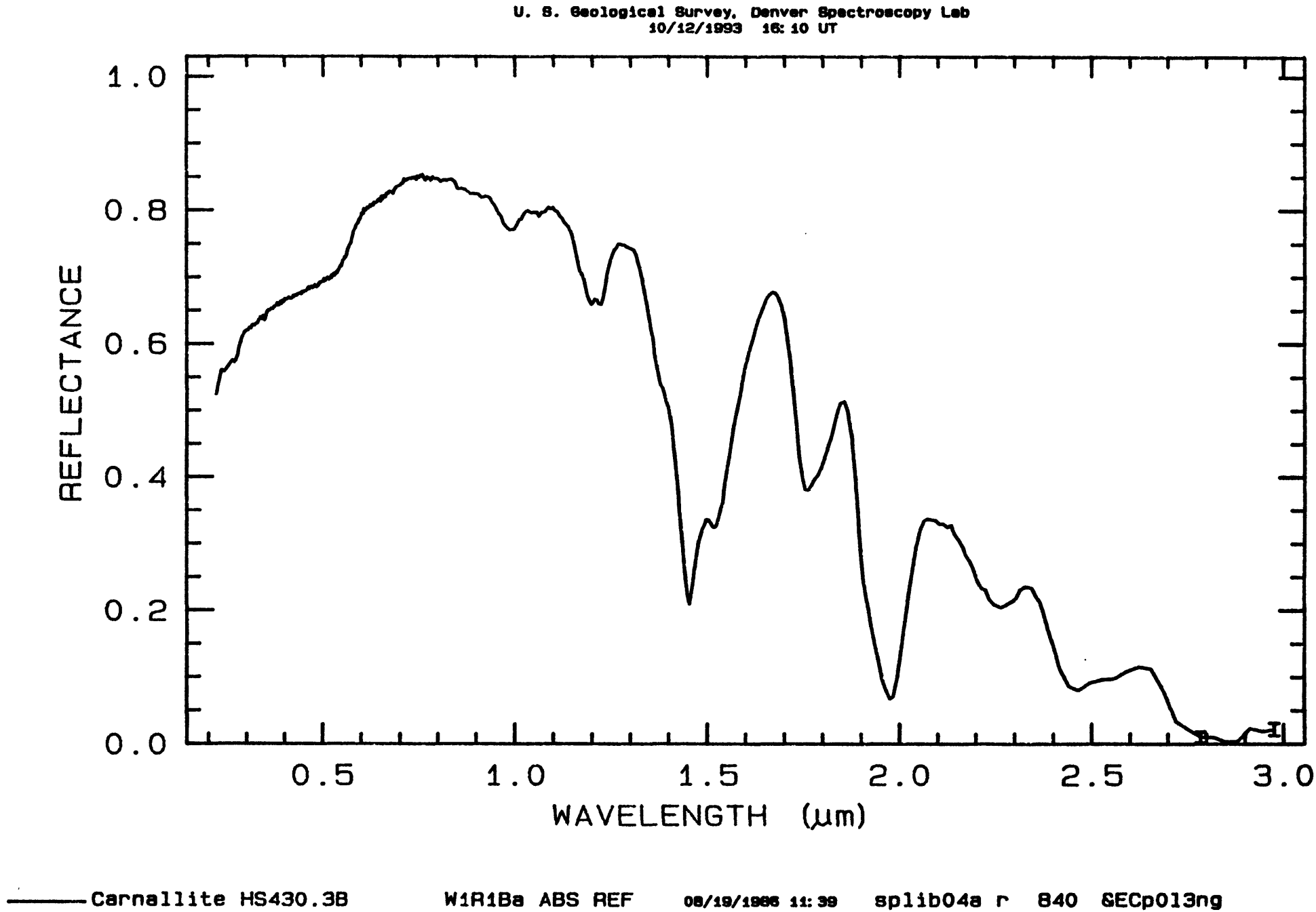
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 840	0.2-3.0μm	200	g.s.=



Carnallite HS430

TITLE: Cassiterite HS279 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS279

MINERAL_TYPE: Oxide

MINERAL: Cassiterite (Rutile group)

FORMULA: SnO2

FORMULA_NROFF: SnO_2

COLLECTION_LOCALITY: Nigeria

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Close to SnO_2 with Sn 78.6%, O 21.4%. Small amounts of Fe^{+3} may be present and lesser amounts of Nb and Ta substitute for Sn. The structure is that of rutile.

"O-2. Cassiterite. Nigeria (279B). Cassiterite, SnO_2, is the most important ore of tin. It is often found in hydrothermal veins or pegmatites, but also forms as a result of secondary processes in the oxidation zone of weathered tin deposits. Ferric iron is usually present as well as small amounts of tantalum and columbium. Because features due to the Sn^{2+} ion occur only in the ultraviolet, it is the presence of impurities which color the cassiterite so that it is commonly reddish brown to almost black. This particular sample is a dark reddish brown massive variety, with inclusions of limonite and quartz. The fall-off in reflectivity of this sample toward the blue we attribute to the presence of iron (0.2% by weight), which produces a tailing off of the absorption edge of the conduction band due to extrinsic absorption. Near-infrared iron bands, which are seen in other minerals in this series, are not displayed by cassiterite, because the iron is not in an octahedral site. In addition, the low reflectivity in the 1μ region would tend to quench any bands, such as should be displayed by a limonitic contaminant. The principal effect of this contaminant is seen in the largest particle size range, which has a slightly higher reflectivity than the 74- 250μ size range. Inspection of the 250-1200μ sample reveals that light colored limonite and quartz inclusions are present as individual grains in this size range, which probably explains its higher reflectivity. The reflectivity of all size ranges is reduced substantially in the infrared after acid leaching has removed most of the ferric oxide."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

Sieve interval 74 - 250μm.

The spectrum here goes to 0.2 μm, considerably shorter than the Hunt et al. spectrum in the above paper. From the new spectrum, we can see that the features are not those of limonite. However, the limonite impurity may brighten the spectrum slightly. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

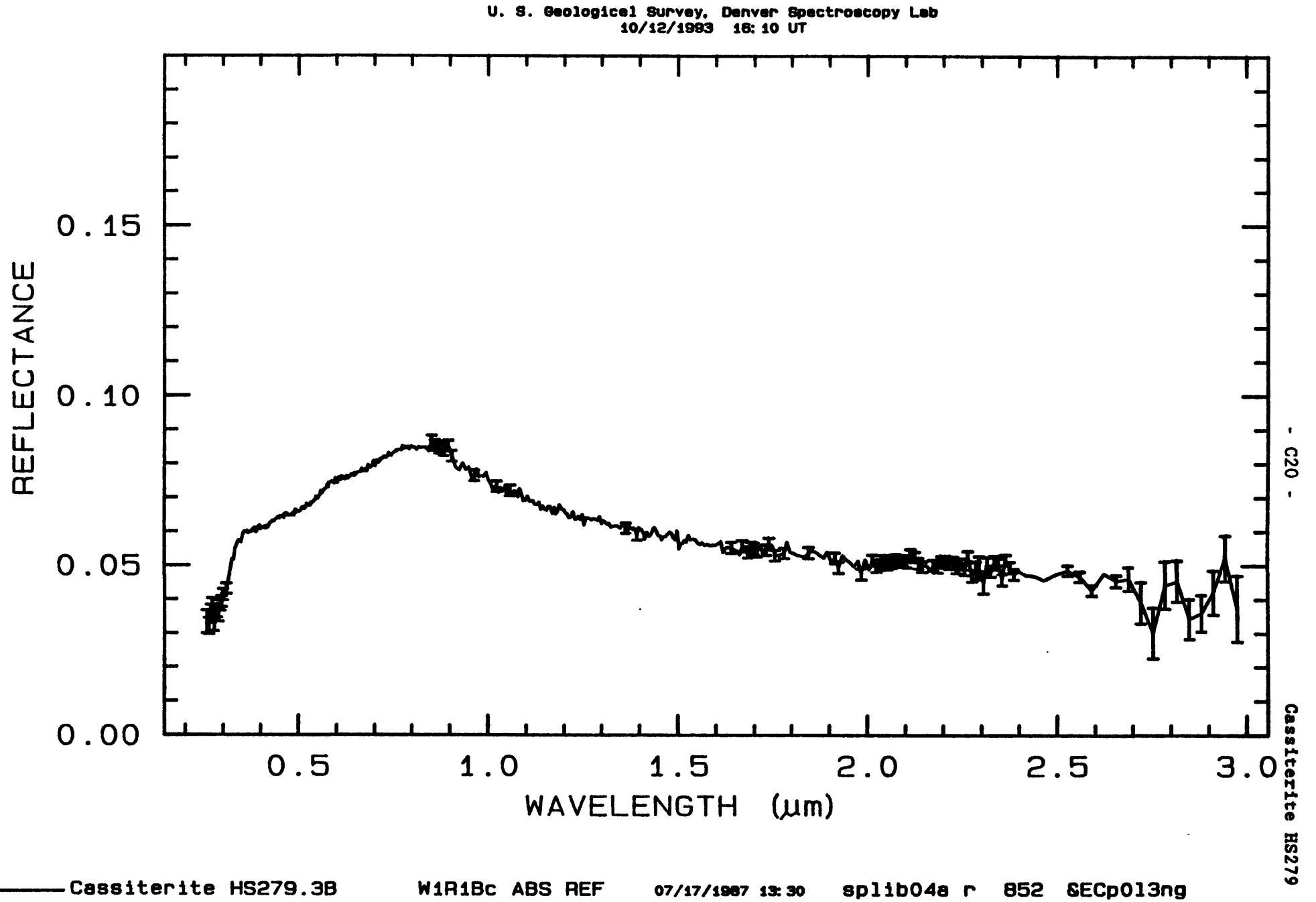
Mode:
77-82 vol% cassiterite
10-15 vol% limonite grains
8 vol% magnetite (may be intergrown with cassiterite)

Translucent red, high birefringence, weak pleochroism, all consistent with cassiderite. Acid wash and Franz-separator treatment may be able to remove impurities. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 852	0.2-3.0μm	200	g.s.= 240 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C20 -
Cassiterite HS279
Cassiterite HS279.3B W1R1Bc ABS REF 07/17/1987 13:30 splib04a r 852 &ECp013ng

TITLE: Celestite HS251 Barite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS251

MINERAL_TYPE: Sulfate

MINERAL: Celestite (Barite group)

FORMULA: SrSO4

FORMULA_NROFF: $SrSO_4$

COLLECTION_LOCALITY: Mexico

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample originally described in:

Hunt, G.R., Salisbury, J.W., and Lenhoff, C.J., 1971, Visible and Near-Infrared spectra of minerals and rocks: IV. Sulphides and Sulphates: Modern Geology, V. 3, p 1-14.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV
Reference: JCPDS #5-593; Huebner's reference pattern
Found: Celestite
Sought but not found: quartz - the strong (100) reflection is not present
Comment: Reflections match the JCPDS card well. However, the reflections are broad rather than sharp, somewhat like my reference pattern (synthetic $SrSO_4$)."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

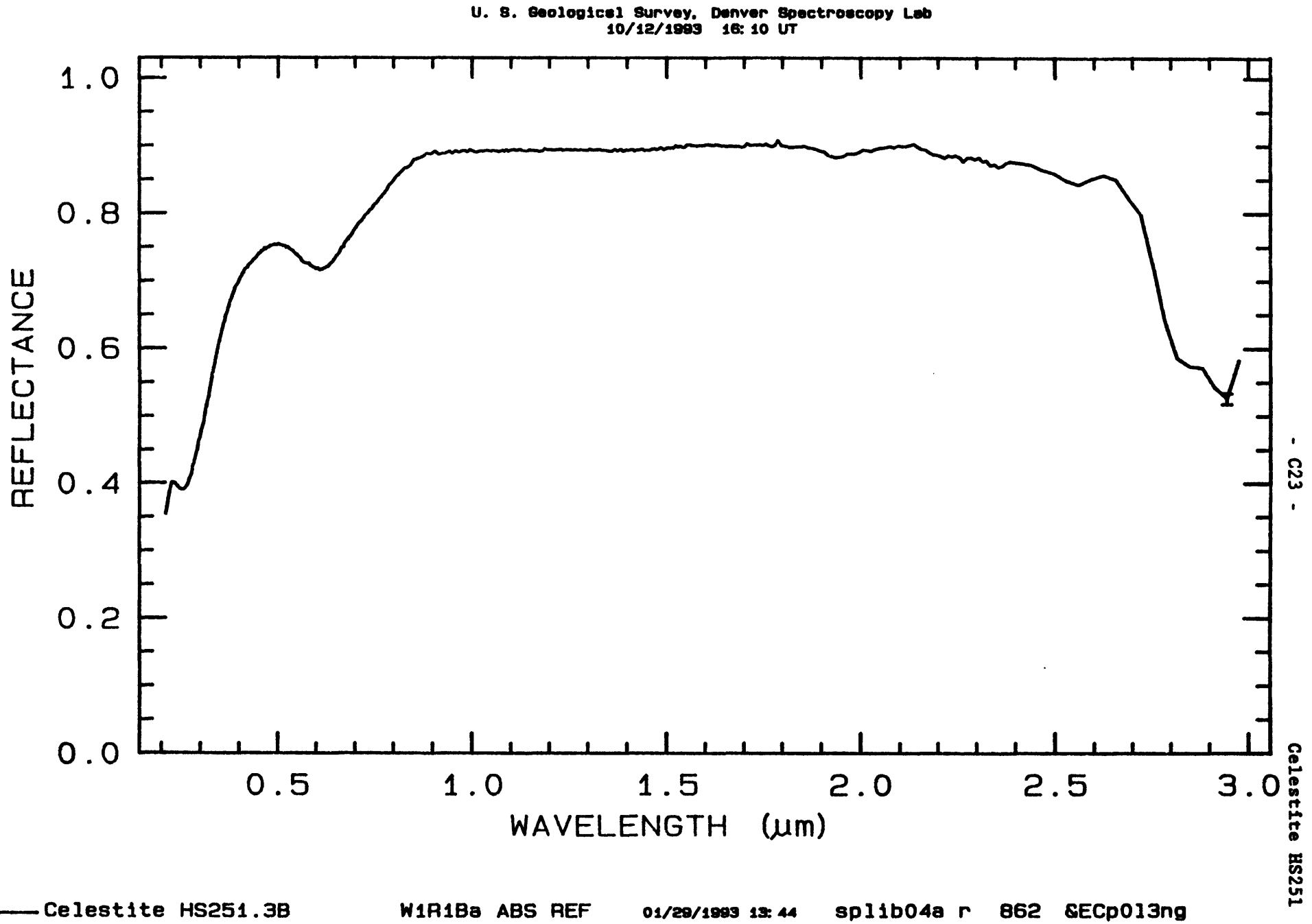
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	862	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C23 -
Celestite HS251
Celestite HS251.3B
W1R1Ba ABS REF
01/29/1993 13:44
splib04a r 862 &ECp013ng

TITLE: Celsian HS200 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS200

MINERAL_TYPE: Tectosilicate

MINERAL: Celsian (Feldspar group)

FORMULA: BaAl2Si2O8

FORMULA_NROFF: $BaAl_2Si_2O_8$

COLLECTION_LOCALITY: Australia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Orthoclase. Dimorphous with Paracelsian.

"This barium feldspar contains garnet and tourmaline as impurity. Its spectrum displays a very well defined and intense 1.9μ water feature with accompanying 1.4μ, 2.2μ, and 2.36μ features which are surprisingly weak."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

Sieve interval 74 - 250μm.

The impurities cause the large 2.0 band, and the weak features at 1.4 μm and in the 2.2-2.4 μm region. Celsian has no diagnostic spectral features in this spectral region. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Quartz - major component
Feldspar - major component (max microcline is best match)
Trioctahedral mica - more than a trace (phlogopite?)
Minor abmounts of other minerals possible

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

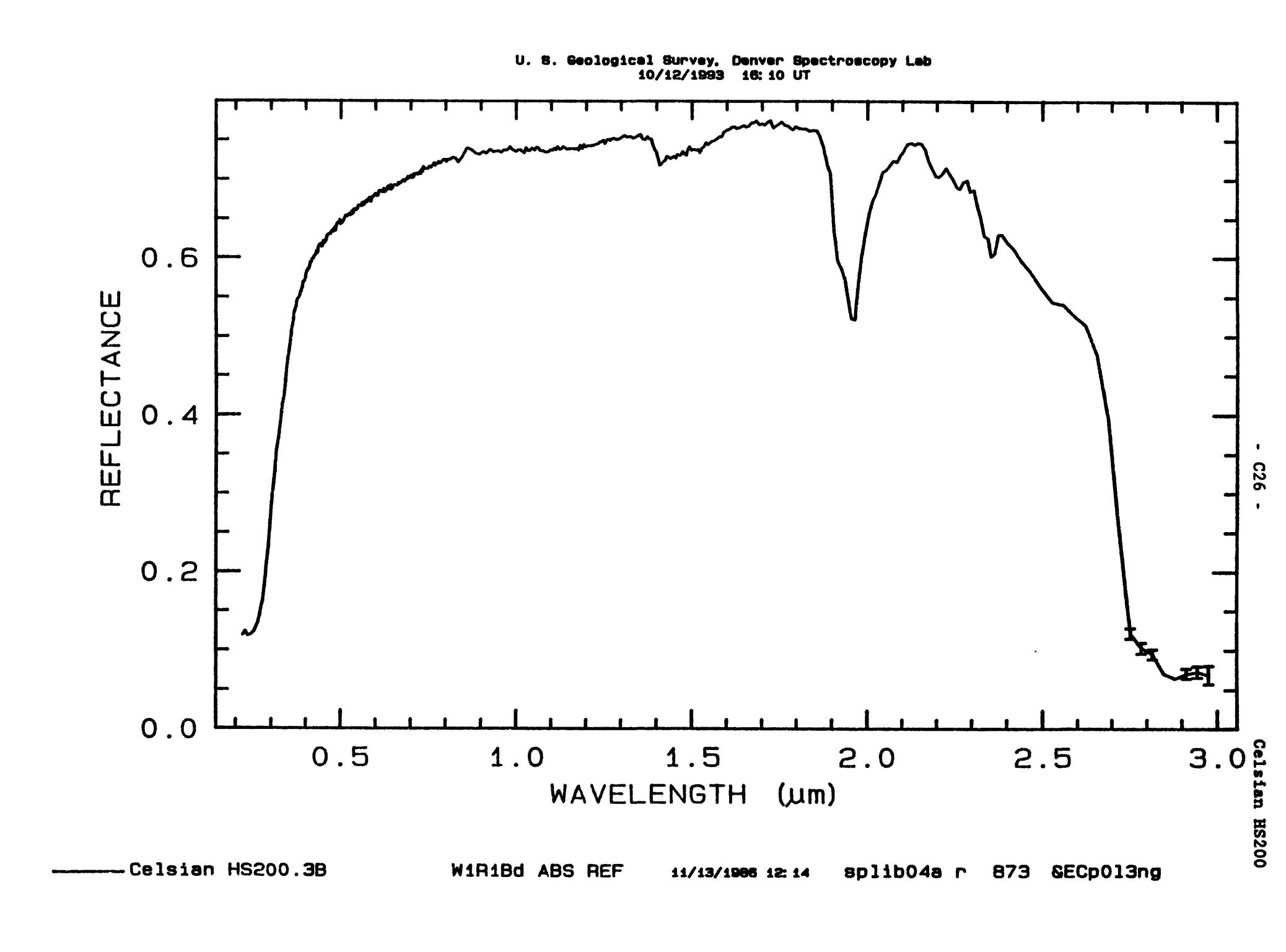
Mode:
98-99 vol% celsian feldspar
1-2 vol% tourmaline (pleochroic, conchoidal fracture)
tr other (garnet?, deep green)

Twins, two cleavages at 90 degrees, biaxial (-), low order interference color, 2-3 vol% fluid inclusions, some alteration (about 5 vol%). All consistent with celsian. Smaller (10-20 μm) grains coat larger grains up to 20-30% surface of larger grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	873	0.2-3.0μm	200	g.s.= 253 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Celsian HS200
Celsian HS200.3B
W1R1Bd ABS REF
11/13/1996 12:14
splib04a r 873 &ECp013ng

TITLE: Chabazite HS193 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS193

MINERAL_TYPE: Tectosilicate

MINERAL: Chabazite (Zeolite group)

FORMULA: CaAl2Si4012*6H2O

FORMULA_NROFF: $CaAl_2Si_4O_{12} \bullet 6H_2O$

COLLECTION_LOCALITY: Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Usually found in rhombohedral chrystals, with nearly cubic angles. The ideal composition listed in the FORMULA field often has considerable replacement of Ca by Na and K as well as (Na,K)Si for CaAl. The structure of chabazite consists of an Al-Si-O framework with large cagelike openings bounded by rings of tetrahedra. The cages are connected to each other by channels which allow diffusion of molecules of less than ~3.9 Angstroms.

The bands seen in its near-infrared spectrum are typical of large quantities of molecular water.

See: Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

96 vol% Chabazite
2 vol% other phases including magnetite
2 vol% Fe-stained grains

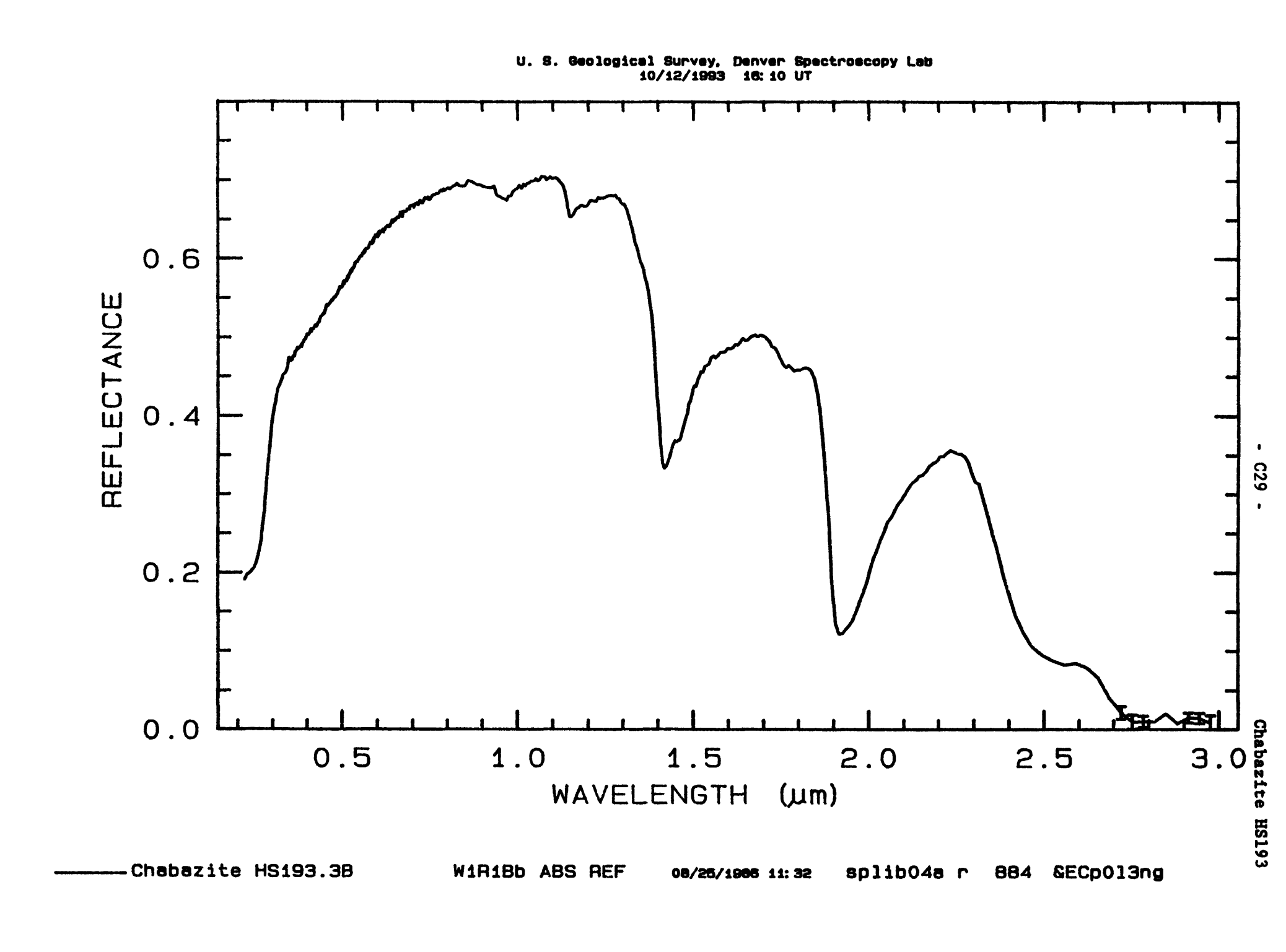
av gr sz = 275μm

Clear grains, fibrous prismatic cones, low birefringence, very small 2V which is charateristic of the Chabazite group. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 884	0.2-3.0μm	200	g.s.= 275μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Chabazite HS193.3B W1R1Bb ABS REF 08/26/1996 11:32 splib04a r 884 &ECp013ng
Chabazite HS193

TITLE: Chalcedony CU91-6A DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CU91-6A

MINERAL_TYPE: Tectosilicate

MINERAL: Chalcedony (var. of Quartz)

FORMULA: SiO2

FORMULA_NROFF: SiO_2

COLLECTION_LOCALITY: Cuprite, Nevada

ORIGINAL_DONOR: Greg Swayze

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

SEM analyses shows crystal morphology indicative of chalcedony. G. Swayze

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Quartz, from Steve Sutley, written communication, 1992

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

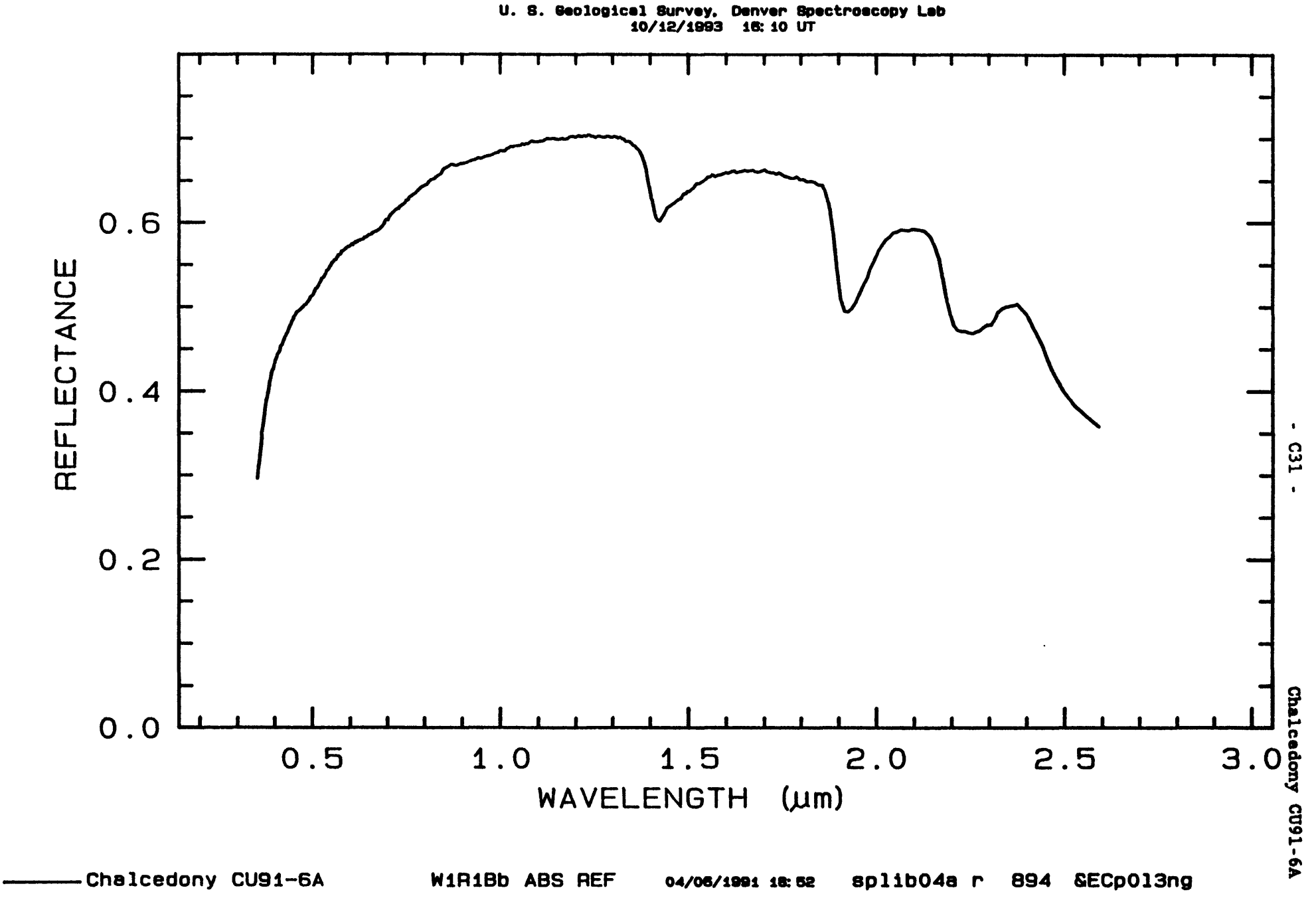
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a	r 894	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C31 -
Chalcedony CU91-6A
Chalcedony CU91-6A W1R1Bb ABS REF 04/06/1991 16:52 splib04a r 894 &ECp013ng

TITLE: Chalcopyrite HS431 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS431

MINERAL_TYPE: Sulfide

MINERAL: Chalcopyrite (Chalcopyrite group)

FORMULA: CuFeS2

FORMULA_NROFF: $CuFeS_2$

COLLECTION_LOCALITY: Quebec

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Eskebornite.

Spectra for this sample were originally published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: IV. Sulphides and sulphates. Modern Geology, v. 3, p. 1-14.

With the note: "It exhibits typical opaque behaviour, decreasing in reflectivity as its particle size is reduced. It is not, however, spectrally featureless. A fall-off in the reflectivity toward the blue, together with a weak band near 0.9μm, results in the characteristic brass-yellow color of this mineral. Both spectral features are due to iron, which is present in chalcopyrite in the trivalent state (Deer et al., 1962). The copper also makes a contribution to the feature near 0.9μm. This sample is contaminated with approximately 10% pyrrhotite, which has no appreciable effect on the spectrum."

Sample measured for the library was the 74-250μm sieve interval.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

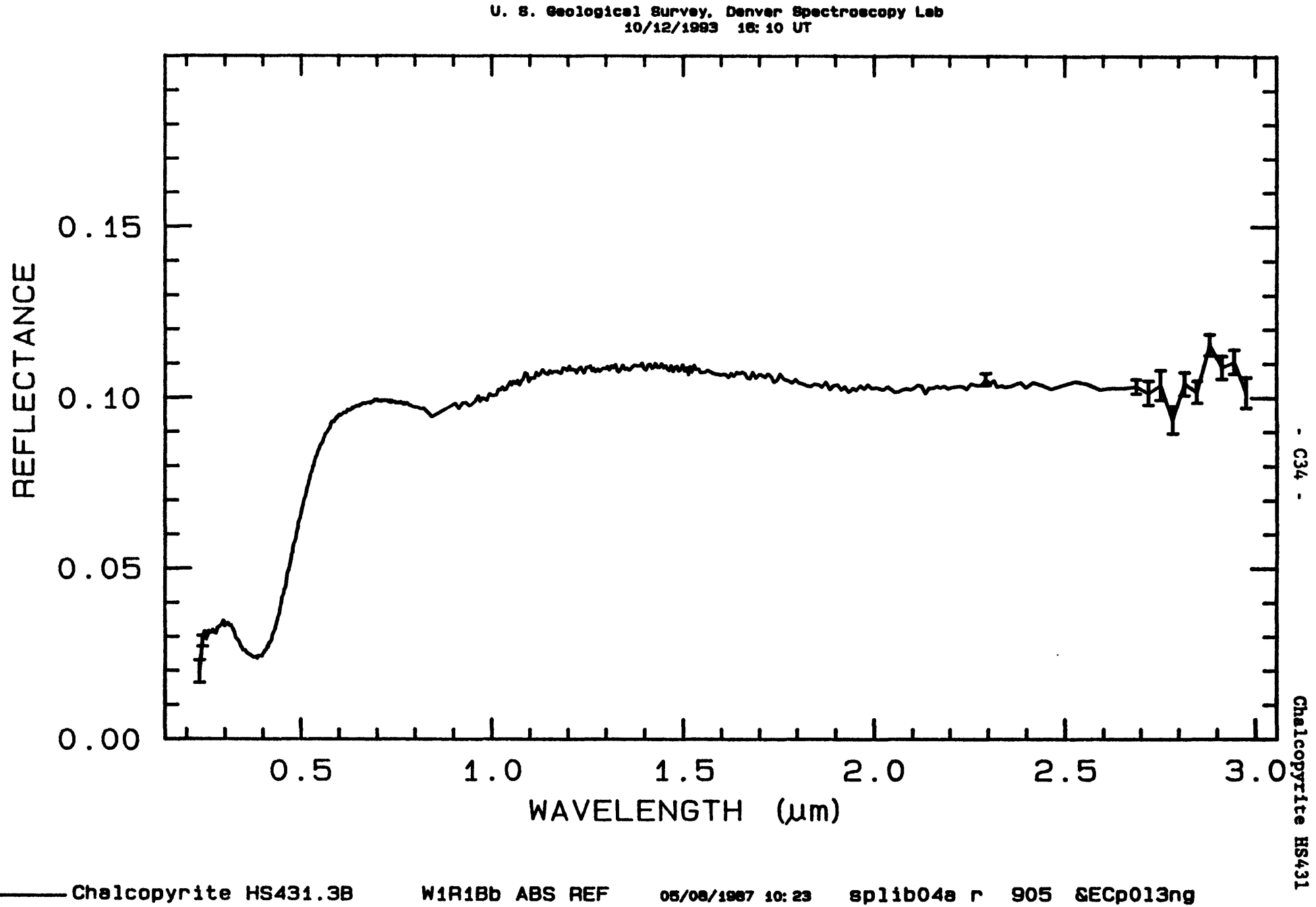
Mode:
95 vol% chalcopyrite (yellow-gold color)
5 vol% pyrrhotite (slightly magnetic)
tr quartz

Opaque, yellow-gold metallic luster, uneven fracture. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 905	0.2-3.0μm	200	g.s.= 246 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Chalcopyrite HS431.3B W1R1Bb ABS REF 05/08/1987 10:23 splib04a r 905 &ECp013ng
Chalcopyrite HS431

TITLE: Chalcopyrite S26-36 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S26-36

MINERAL_TYPE: Sulfide

MINERAL: Chalcopyrite (Chalcopyrite group)

FORMULA: CuFeS2

FORMULA_NROFF: $CuFeS_2$

COLLECTION_LOCALITY: Ellenville (Ulster) Mine, Ellenville, Ulster County, NY

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Forms series with Eskebornite.

Composition deviates very little from ideal $CuFeS_2$. Its structure can be regarded as a derivative of the sphalerite structure in which half the Zn is replaced by Cu and the other half by Fe. This leads to a doubling of the unit cell.

NOTE: For specific sample information refer to the following reference: Friedman, J. D., Mutschler, F. E., Zartman, R. E., Briggs, P. H., Swayze, G. A., Theisen, A. F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

NOTE: For specific sample information refer to the following reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open

File Report 89-193.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

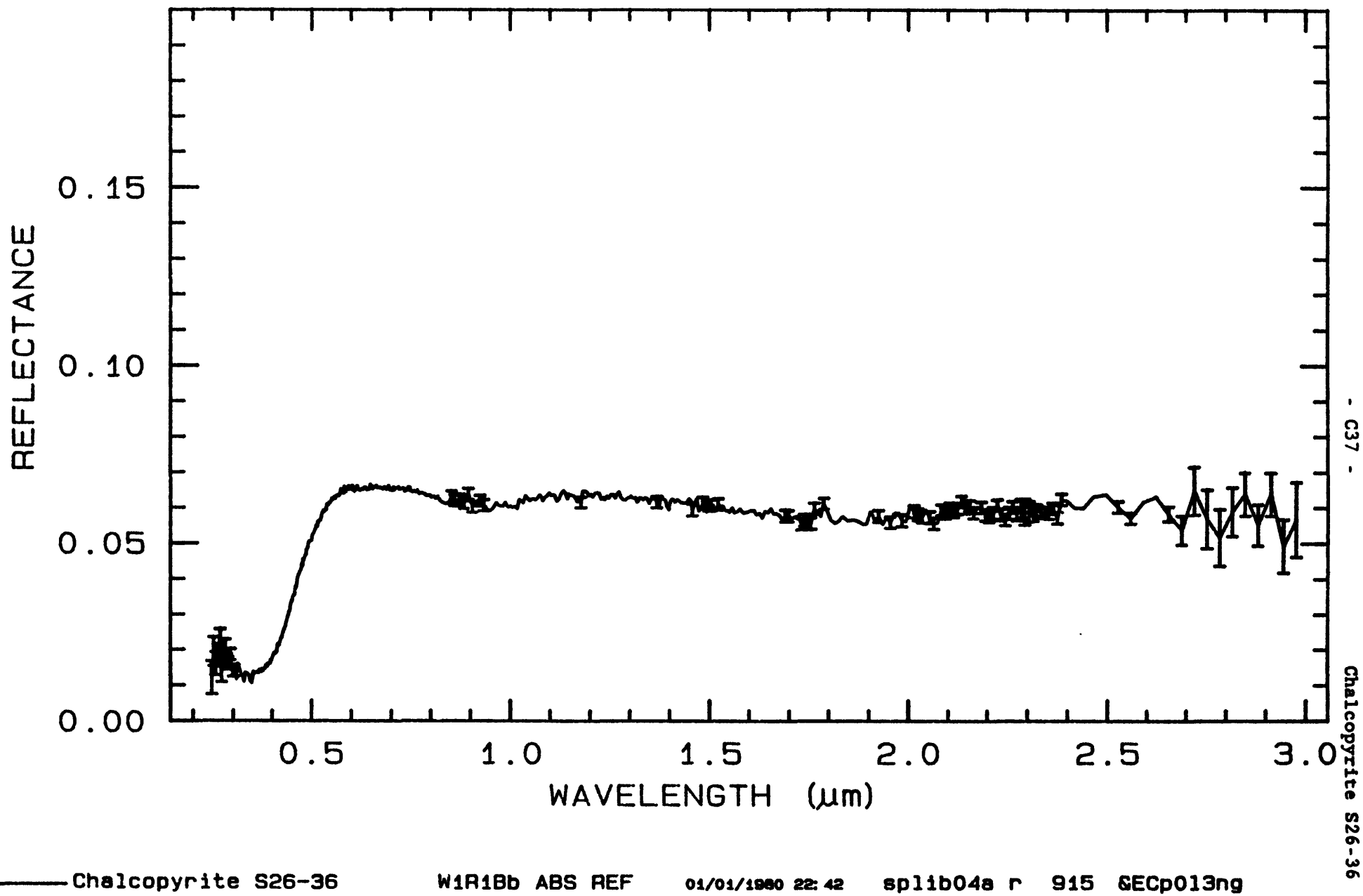
mode by wt%:
99 wt% chalcopyrite
1 wt% sphalerite

Whole rock sample

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 915	0.2-3.0μm	200	g.s.=



Chalcopyrite S26-36

TITLE: Chert ANP90-6D DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: ANP90-6D

MINERAL_TYPE: Tectosilicate

MINERAL: Chert (var. of Quartz)

FORMULA: SiO2

FORMULA_NROFF: SiO_2

COLLECTION_LOCALITY: Arches National Park, Utah

ORIGINAL_DONOR: Greg Swayze

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

White chert from the Moab Tongue of the Entrada Formation.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

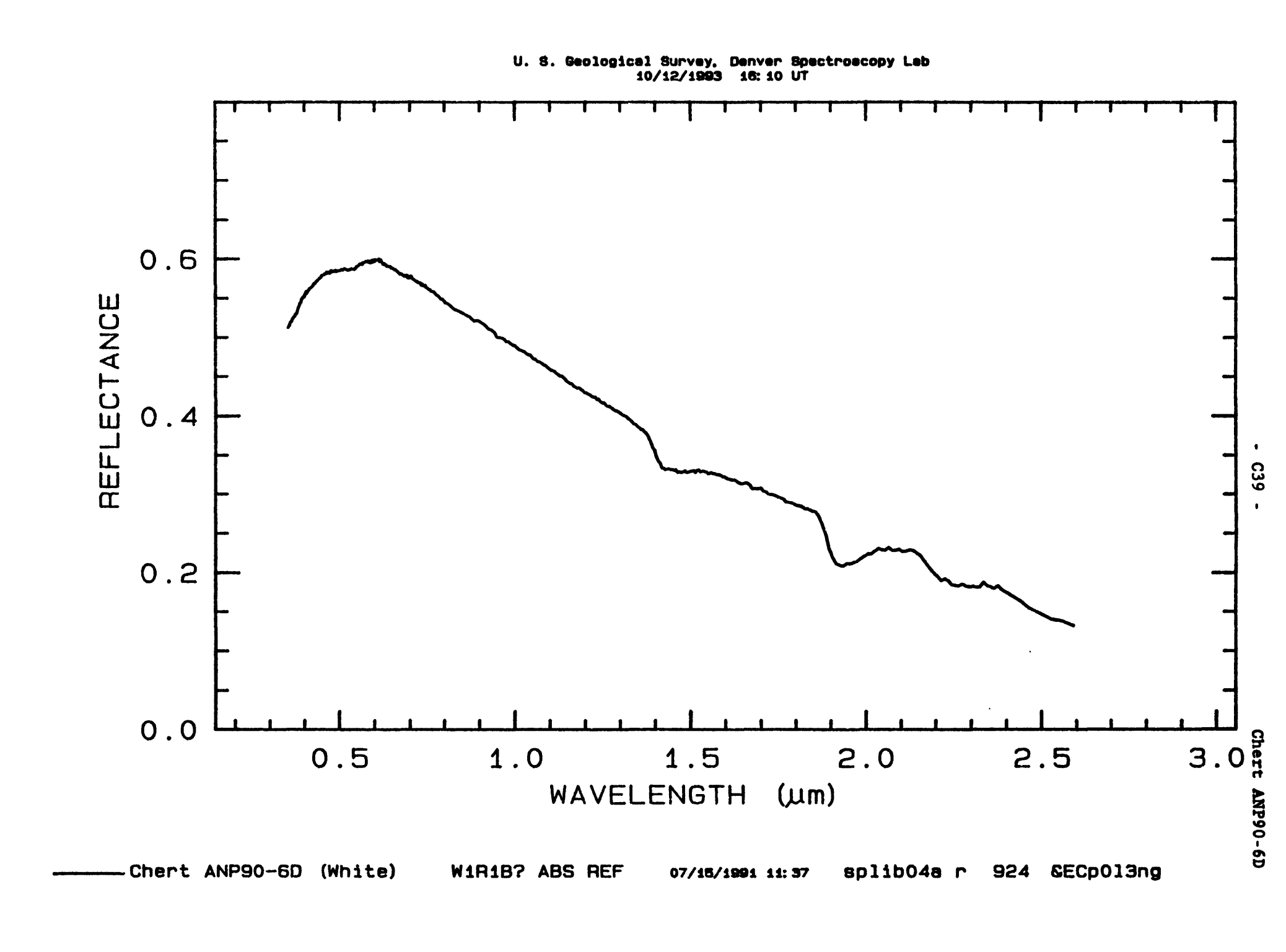
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	924	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Chert ANP90-6D (White) W1R1B? ABS REF 07/15/1991 11:37 splib04a r 924 &ECp013ng
- C39 -
Chert ANP90-6D

TITLE: Chlorapatite WS423 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS423

MINERAL_TYPE: Phosphate

MINERAL: Chlorapatite (Apatite group)

FORMULA: Ca5(PO4)3Cl

FORMULA_NROFF: $Ca_5(PO_4)_3Cl$

COLLECTION_LOCALITY: Snarum, Norway

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spectrum shows weak Nd^{+3} bands.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"Found: Apatite plus unindexed weak reflections at 26.61 [near position of the strongest quartz reflection, the (101)] and at 25.94, 31.71, 32.84, and 43.4

Cell dimensions: a=9.6078(8), c=6.7912(8)A, using BaF_2 internal standard

Comment: extrarordinarily clear pattern with many sharp peaks indicating high degree of crystallinity and compositional homogeneity. Synthetic chlorapatite reported to have a=9.641 and c=6.771 A. Either WS423 does not have end member composition or the JCDPS reference is in error. Minor amounts of at least one additional phase."

J.S. Huebner and J. Randow, unpublished data, written communication, USGS, Reston, VA (1993)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

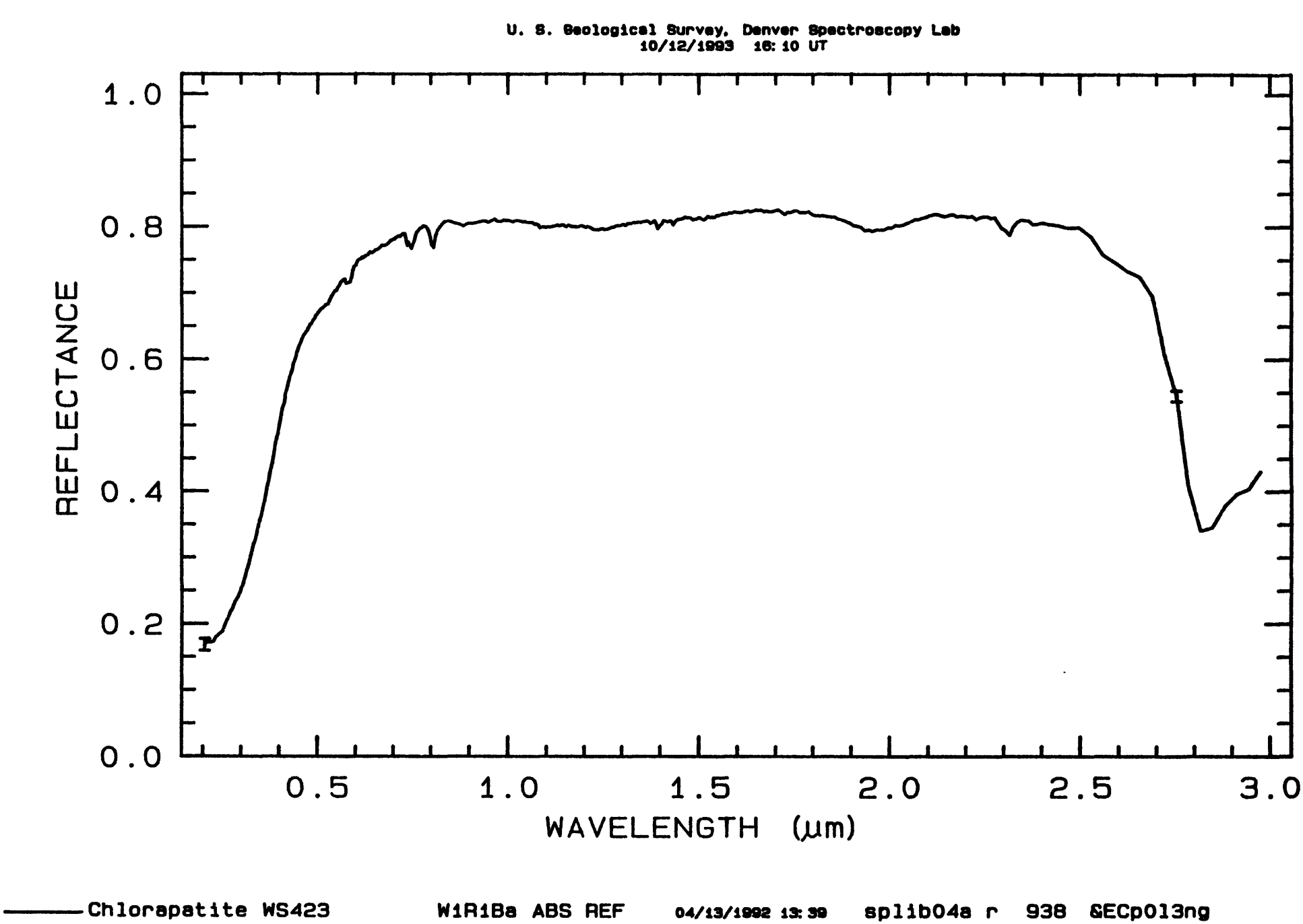
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r	938	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C42 -
Chlorapatite WS423
Chlorapatite WS423 W1R1Ba ABS REF 04/13/1992 13:39 splib04a r 938 &ECp013ng

TITLE: Chlorite HS179 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS179

MINERAL_TYPE: Phyllosilicate

MINERAL: Chlorite (Chlorite group)

FORMULA: (Mg,Fe)3(Si,Al)4O10(OH)2-(Mg,Fe)3(OH)6

FORMULA_NROFF: $(Mg,Fe)_3(Si,Al)_4O_{10}(OH)_2$-$(Mg,Fe)_3(OH)_6$

COLLECTION_LOCALITY: Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published in: Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

With the note: "This specimen appears to be quite pure. The spectrum displays three broad bands between 0.7 and 1.1μm. The bands at 0.7μm (barely discernible in this spectrum but very marked in the following sample (HS197) and at 0.9μm are due to Fe3+ in six fold coordination. The band near 1.1μm is due to the ferrous ion in six fold coordination. The sharp features at 1.4μm and between 2.0 and 2.6 μm are hydroxyl bands as in previous samples."

For additional information on spectral features of chlorites see: King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13,997-14,008.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

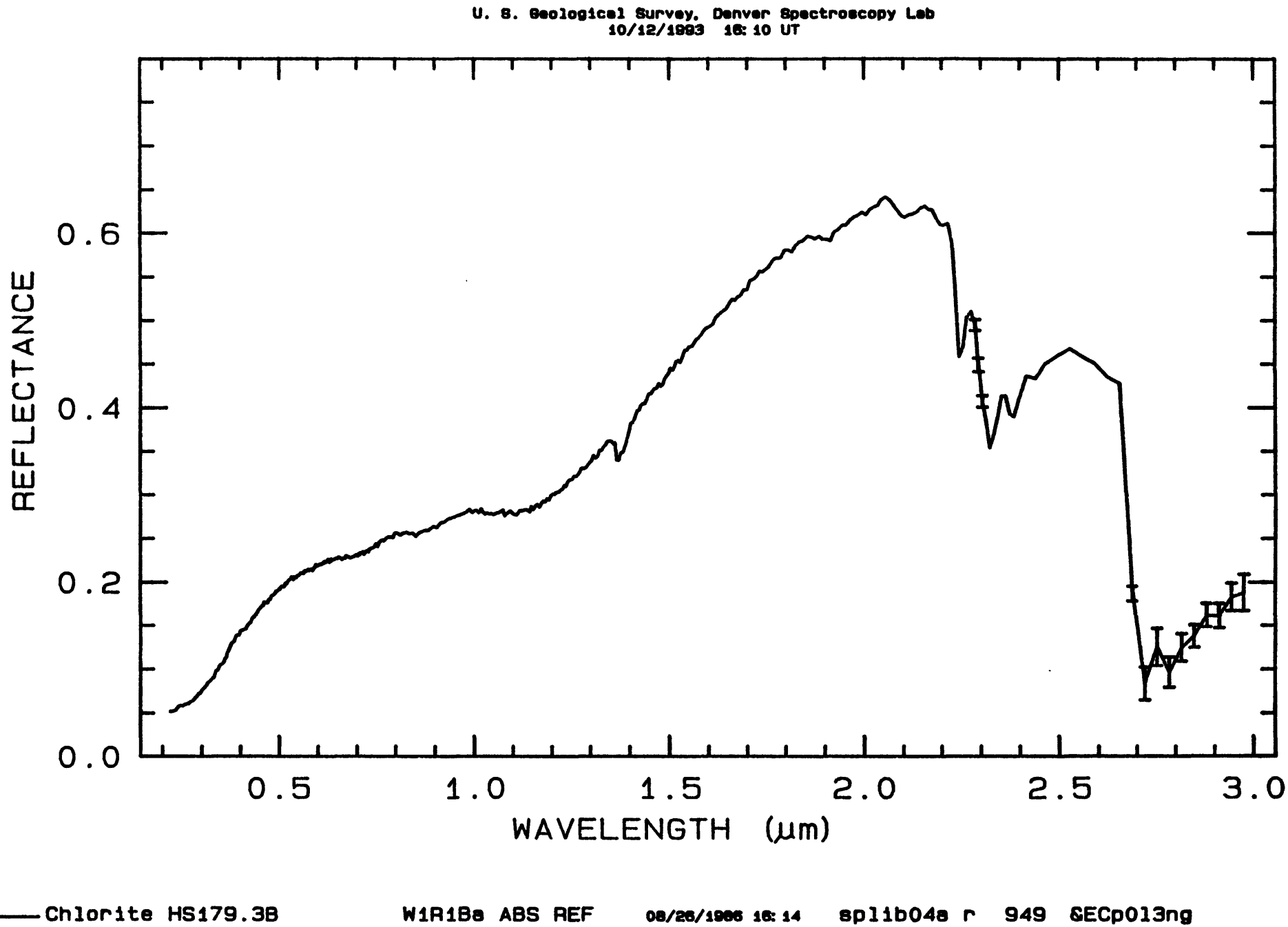
MICROSCOPIC_EXAMINATION:

Basal cleavage, low relief, slight pleochroism, 1st order gray, biaxial (-), 2V= 10 degrees, twins, all consistent with chlorite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 949	0.2-2.7μm	200	g.s.= μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 16:10 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Chlorite HS179
Chlorite HS179.3B W1R1Ba ABS REF 08/26/1996 16:14 splib04a r 949 &ECp013ng

TITLE: Chlorite SMR-13 Mg DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Chlorite SMR-13

MINERAL_TYPE: Phyllosilicate

MINERAL: Chlorite Mg-rich (Chlorite group)

FORMULA: (Mg,Fe)3(Si,Al)4O10(OH)2-(Mg,Fe)3(OH)6

FORMULA_NROFF: $(Mg,Fe)_3(Si,Al)_4O_{10}(OH)_2$-$(Mg,Fe)_3(OH)_6$

COLLECTION_LOCALITY: unknown

ORIGINAL_DONOR: Gene Whitney, USGS Denver

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION:

SAMPLE_DESCRIPTION:

Sample was ground in an alumina mortar and pestle and wet sieved with methanol into <30μm (e), 30-45μm (d), 45-60μm (c), 60-104μm (b), and 104-150μm (a) size fractions. (Letter denotes spectrum designation)

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008. .nf

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sample was analyzed and found to be a Mg-rich chlorite. (King and Clark, 1989)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	31.00 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.08 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3	17.30 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	8.34 wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	0.12 wt%	NROFF:	MnO
COMPOSITION:	MgO:	30.20 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.02 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.23 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	<0.02 wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05 wt%	NROFF:	P_2O_5
COMPOSITION:	LOI:	12.30 wt%	NROFF:	LOI
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.66 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Compositional data provided by Gene Whitney.

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_COMPOSITION_DISCUSSION.

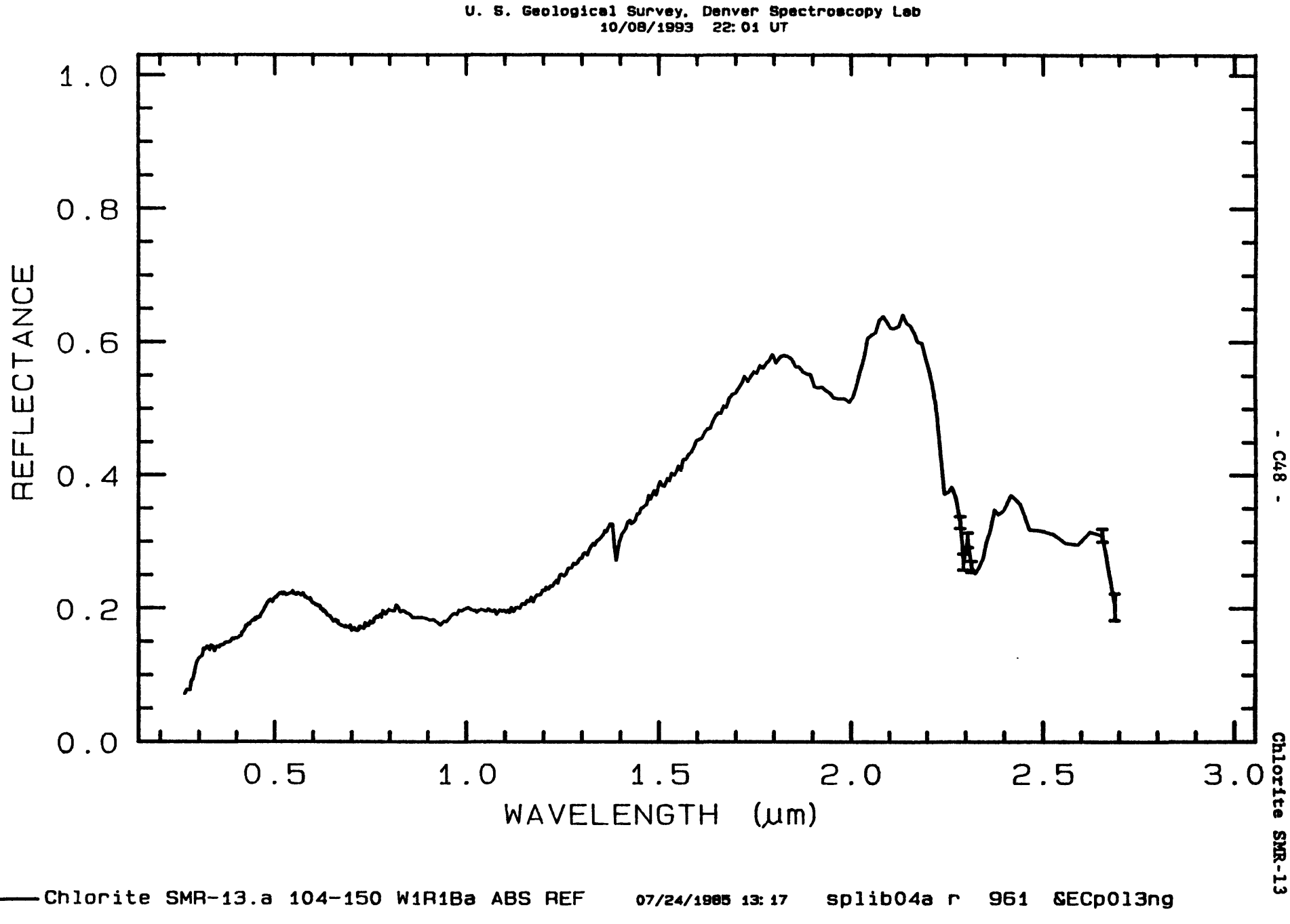
MICROSCOPIC_EXAMINATION:

Microscopically this appears to be a pure chlorite sample. All size fractions were examined visually and by energy dispersive methods to insure chemical homogenity as a function of grain size interval. Plates about 10 μm thick. G.Swayze.

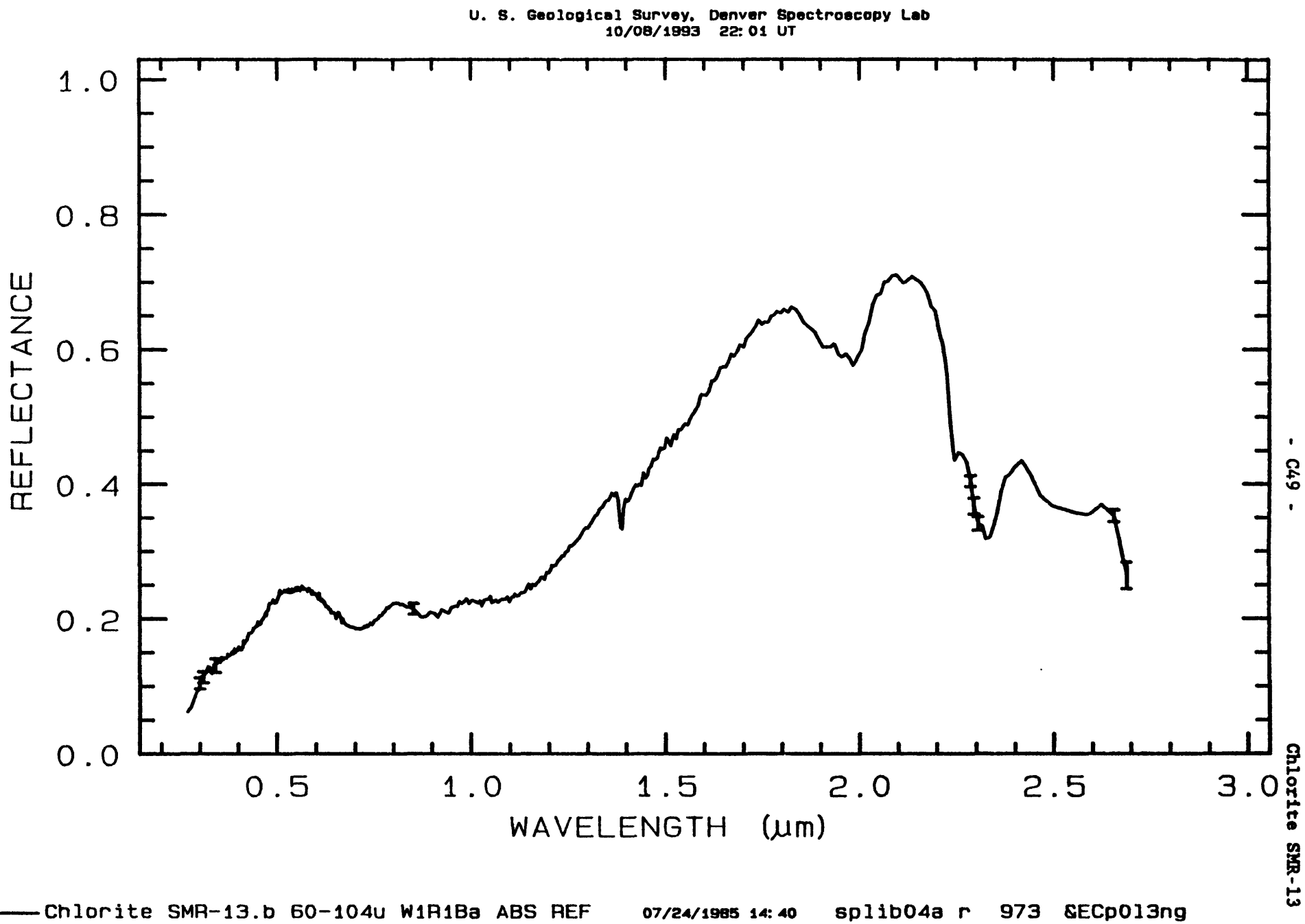
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

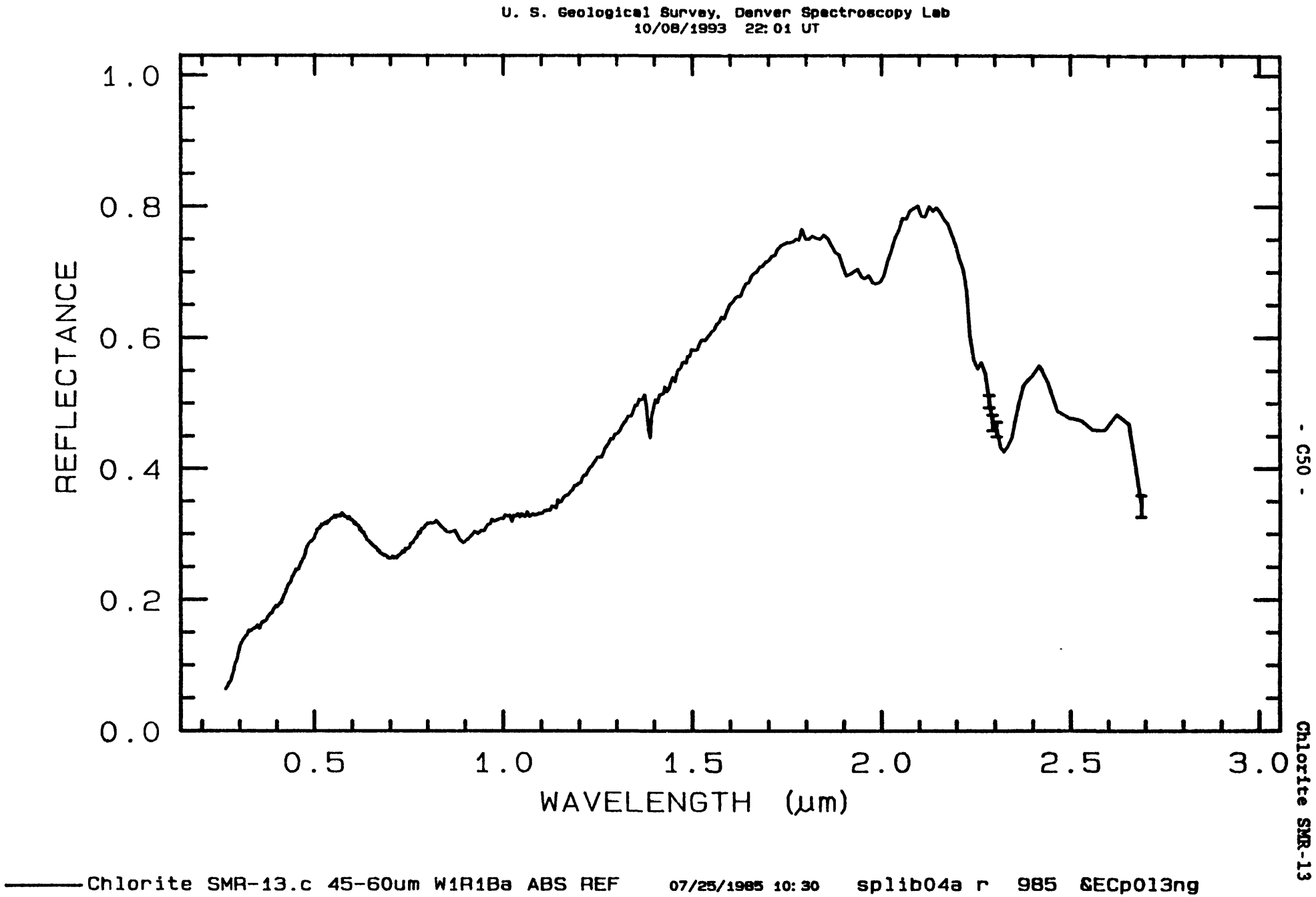
LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 961	0.2-2.7μm	200	g.s.=115μm
LIB_SPECTRA:	splib04a r 973	0.2-2.7μm	200	g.s.=70μm
LIB_SPECTRA:	splib04a r 985	0.2-2.7μm	200	g.s.=49μm
LIB_SPECTRA:	splib04a r 997	0.2-2.7μm	200	g.s.=33μm
LIB_SPECTRA:	splib04a r 1007	0.2-2.7μm	200	g.s.=15μm

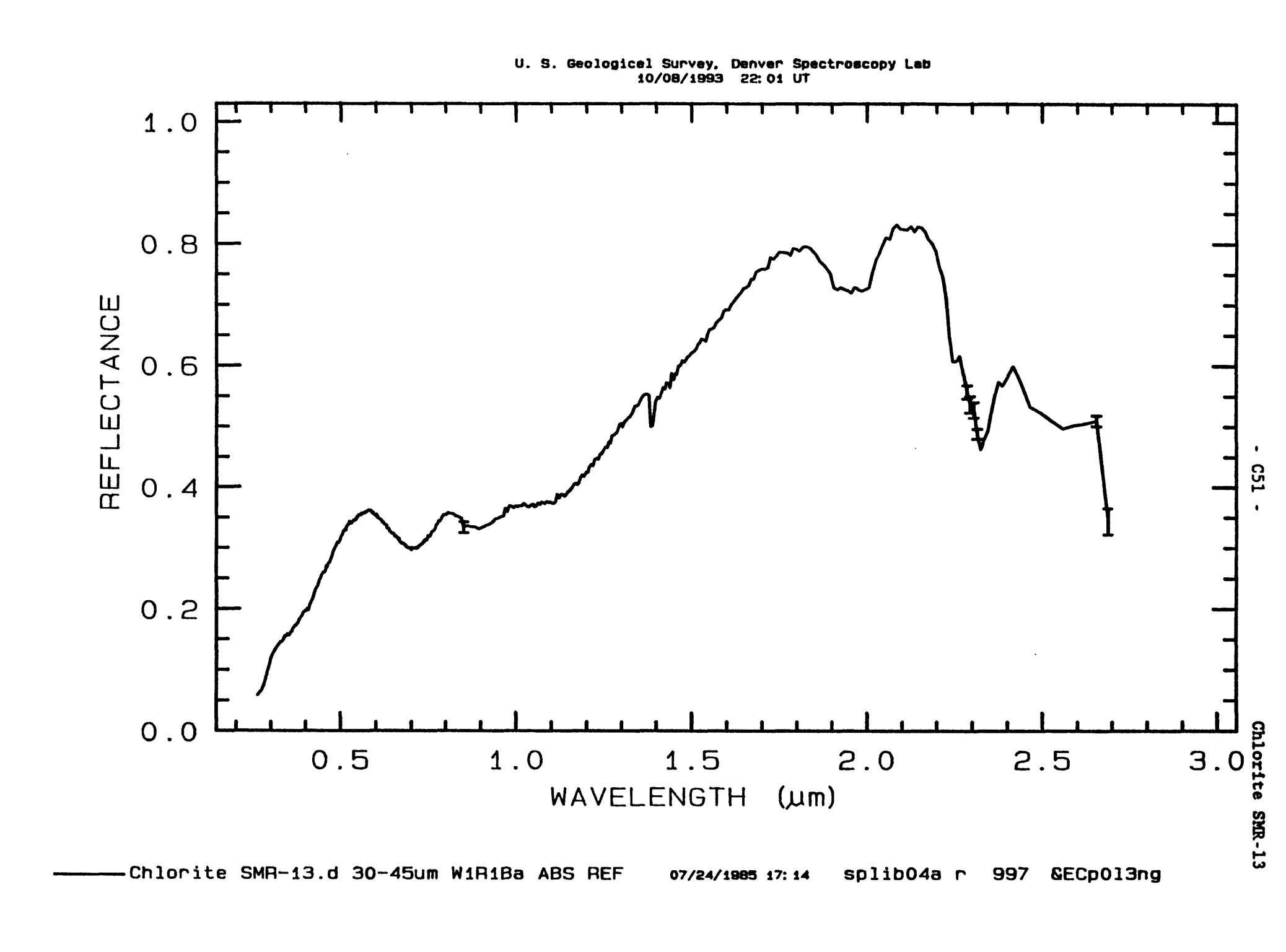


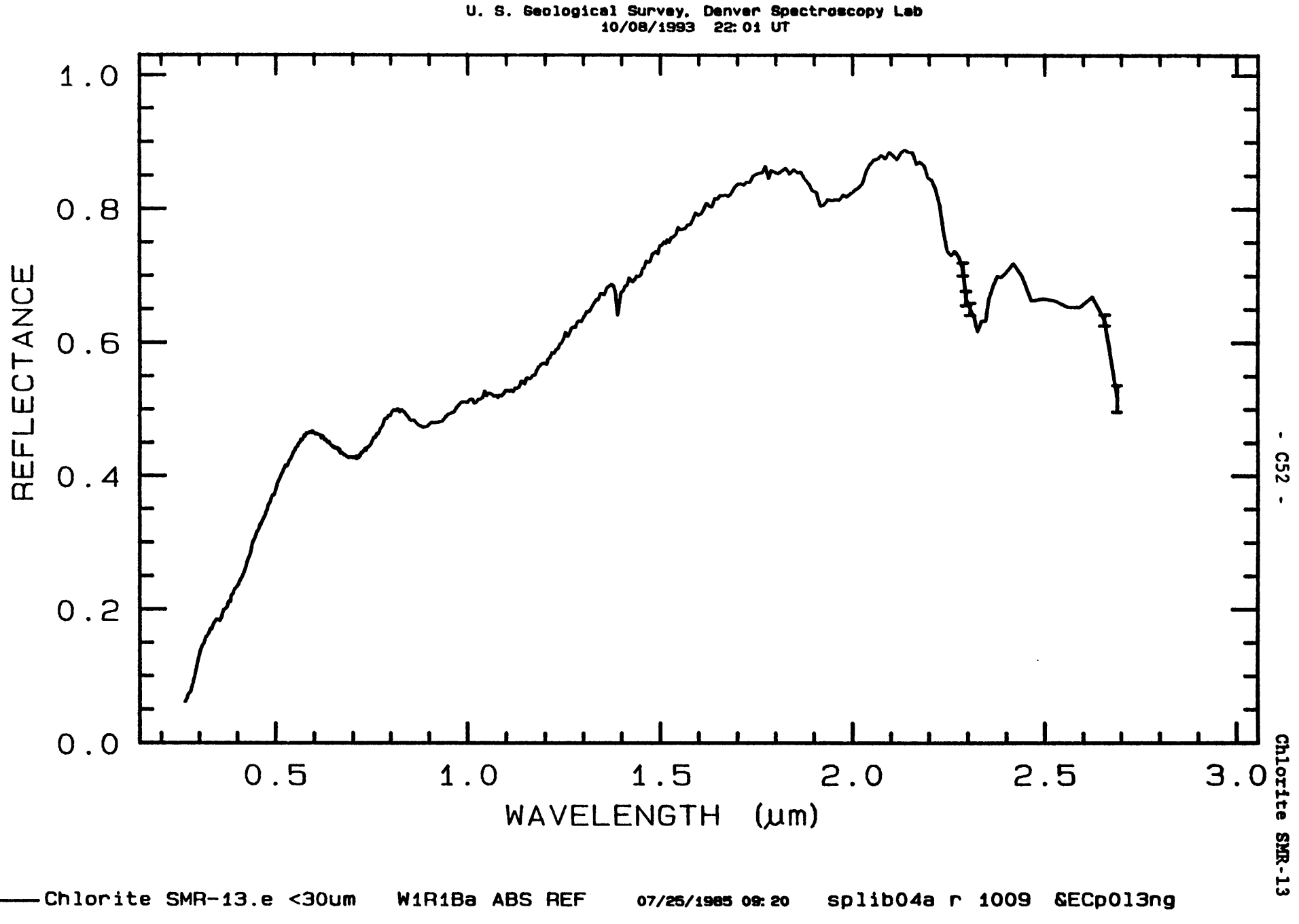
Chlorite SMR-13



Chlorite SMR-13


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 22:01 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C50 -
Chlorite SMR-13
Chlorite SMR-13.c 45-60um W1R1Ba ABS REF 07/25/1985 10:30 splib04a r 985 &ECp013ng


U. S. Geologicel Survey, Denver Spectroscopy Lab
10/08/1993 22:01 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C51 -
Chlorite SMR-13
Chlorite SMR-13.d 30-45um W1R1Ba ABS REF 07/24/1985 17:14 splib04a r 997 &ECp013ng



Chlorite SMR-13

TITLE: Chromite HS281 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS281

MINERAL_TYPE: Oxide

MINERAL: Chromite (Spinel group)

FORMULA: Fe+2Cr2O4

FORMULA_NROFF: $Fe^{+2}Cr_2O_4$

COLLECTION_LOCALITY: Sierra Leone

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Magnesiochromite and with Hercynite. Dimorphous with Donathite.

Some Mg is always present substituting for Fe^{+2} and some Al and Fe^{+3} may substitute for chromium. There is extensive solid solution between chromite and magnesiochromite, $MgCr_2O_4$. Occurs chiefly in ultramafic igneous rocks and is a common constituent of peridotites and other ultrabasic rocks and of serpentines derived from them.

Sieve interval 74 - 250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

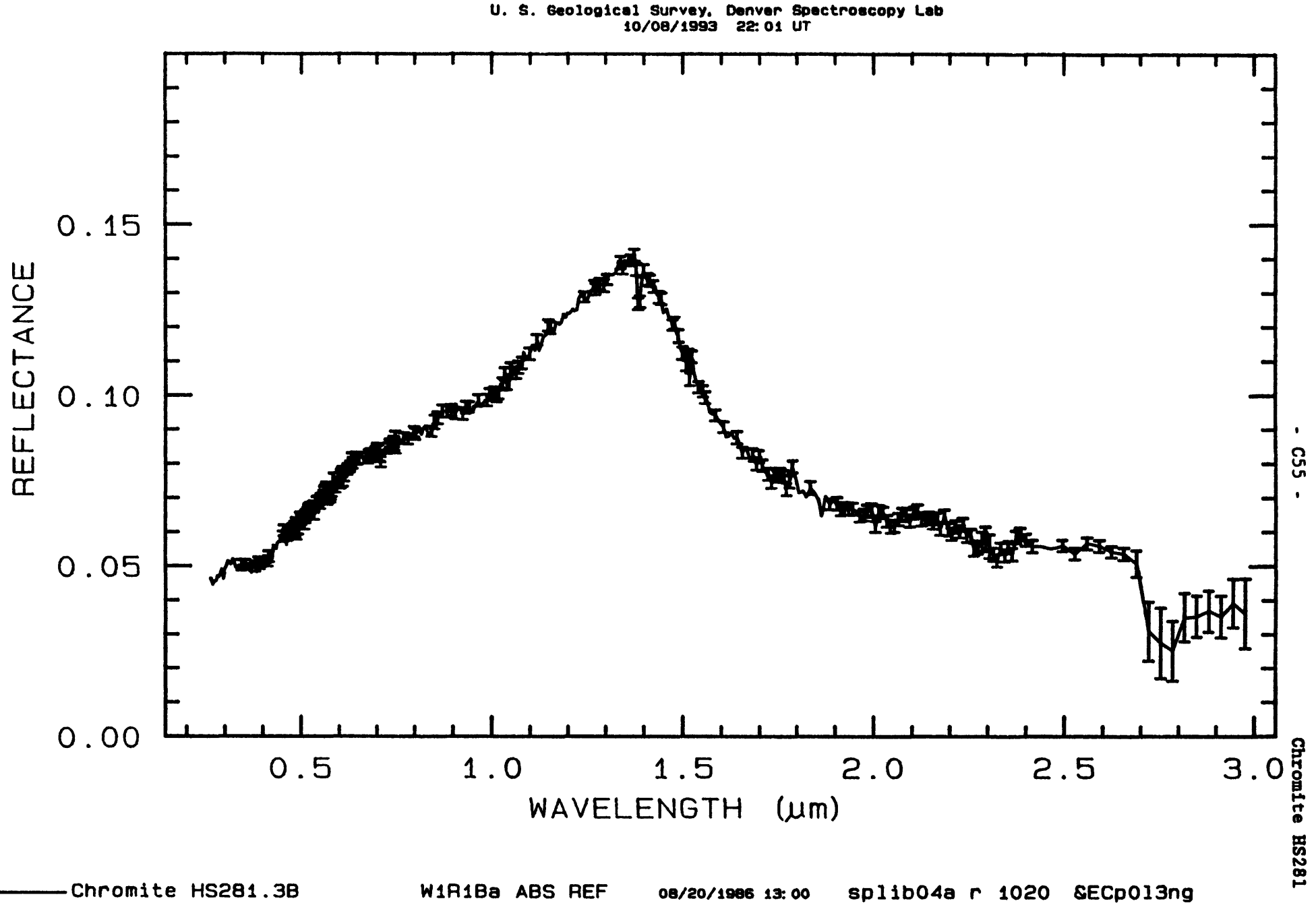
Mode:
50 vol% chromite
30 vol% Fe-stained feldspar
20 vol% white mica

Chromite has transparent edges, otherwise opaque. Spectrum albedo so low that any features due to impurities are obscured. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1020	0.2-3.0μm	200	g.s.= 225 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 22:01 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C55 -
Chromite HS281
Chromite HS281.3B
W1R1Ba ABS REF
08/20/1986 13:00
splib04a r 1020 &ECp013ng

TITLE: Chrysocolla HS297 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS297

MINERAL_TYPE: Phyllosilicate

MINERAL: Chrysocolla

FORMULA: (Cu,Al)2H2Si2O5(OH)4*nH2O

FORMULA_NROFF: $(Cu,Al)_2H_2Si_2O_5(OH)_4 \bullet nH_2O$

COLLECTION_LOCALITY: Miami, AZ

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Chrysocalla is a hydrogel or gelatinous precipitate.

"C-5 Chrysocolla 297B--Miami, Ariz. $CuSiO_3nH_2O$: Chrysocolla is a secondary mineral occurring in the oxidized zone of copper veins. The spectrum is dominated by the intense Cu^{2+} absorption near 0.75 μ, which together with the fall off in reflectivity to the blue, produces a reflectivity maximum near 0.5 μ and the blue green color of the mineral. Constitutional water produces the very intense 1.42 μ and 1.92 μ bands as well as the 2.23 μ feature."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

Sieve interval 74 - 250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Quartz - significant component Chrysocolla - possible component Note: Except for quartz this sample is amorphous. Chrysocolla is amorphous, therefore XRD is not a definitive test for chrysocolla.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

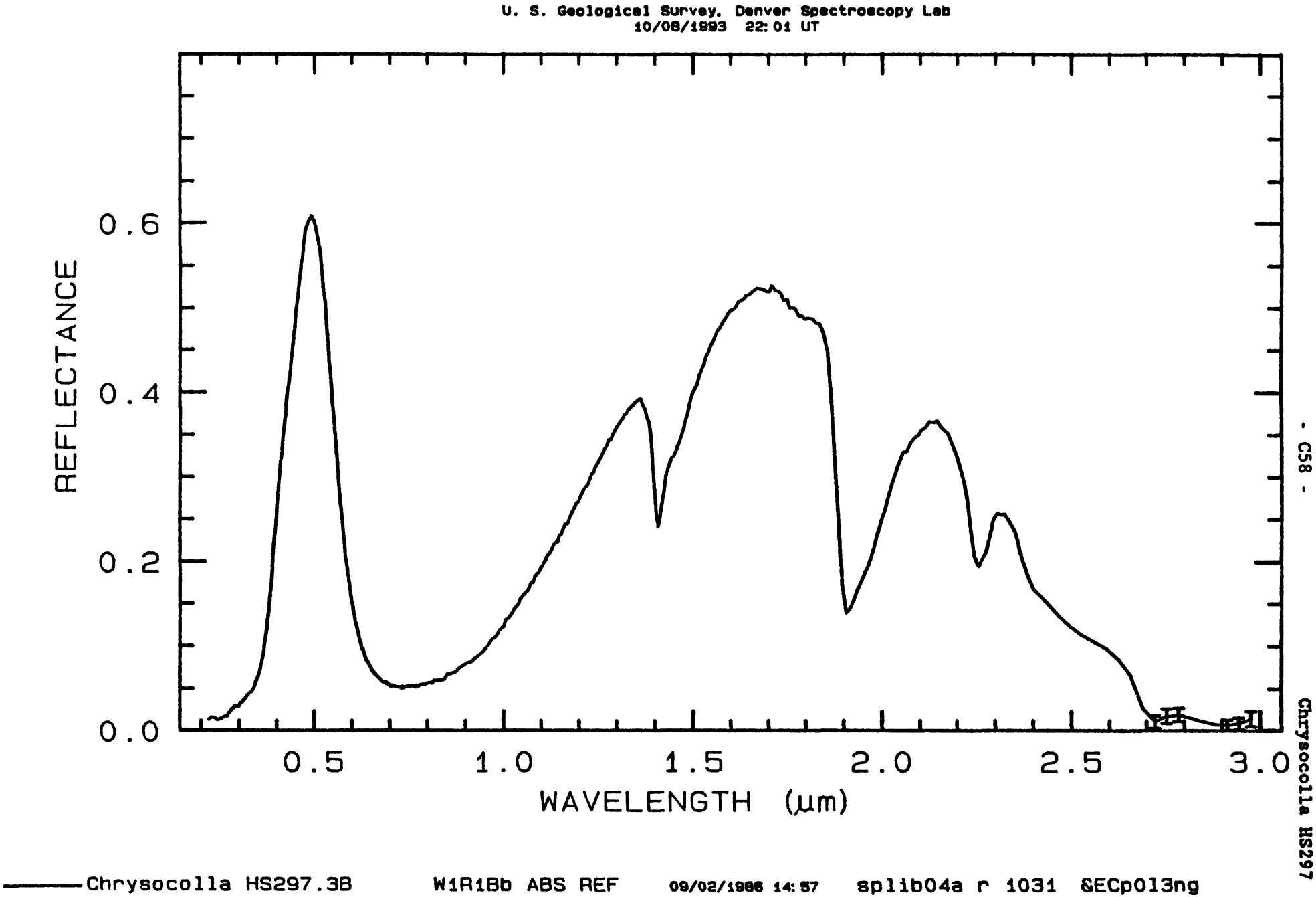
mode:
90 vol% chrysocolla
10 vol% cryptocrystalline quartz

Light blue color, chonchoidal fracture, fine fibrous crystal habit so optic sign cannot be determined (actually chrysocolla is amorphous so it would not have an optic sign). Soft. All consistent with chrysocolla. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1031	0.2-3.0μm	200	g.s.= 217 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 22:01 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- C58 -
Chrysocolla HS297
Chrysocolla HS297.3B W1R1Bb ABS REF 09/02/1986 14:57 splib04a r 1031 &ECp013ng

TITLE: Chrysotile HS323 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS323

MINERAL_TYPE: Phyllosilicate

MINERAL: Chrysotile (Kaolinite-Serpentine Group)

FORMULA: Mg3Si2O5(OH)4

FORMULA_NROFF: $Mg_3Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Arizona

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION:

SAMPLE_DESCRIPTION:

Chrysotile was not available in grain sizes greater than 200μm and was not sieved to grain sizes less than 200μm because of it carcinogenic character.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

This is a pure chrysotile. Sample analysis by Norma Vergo.

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Several attempts were made to chemically analyze this sample by XRF. However, sufficent quantities were not available to perform a reliable analysis.

END_COMPOSITION_DISCUSSION.

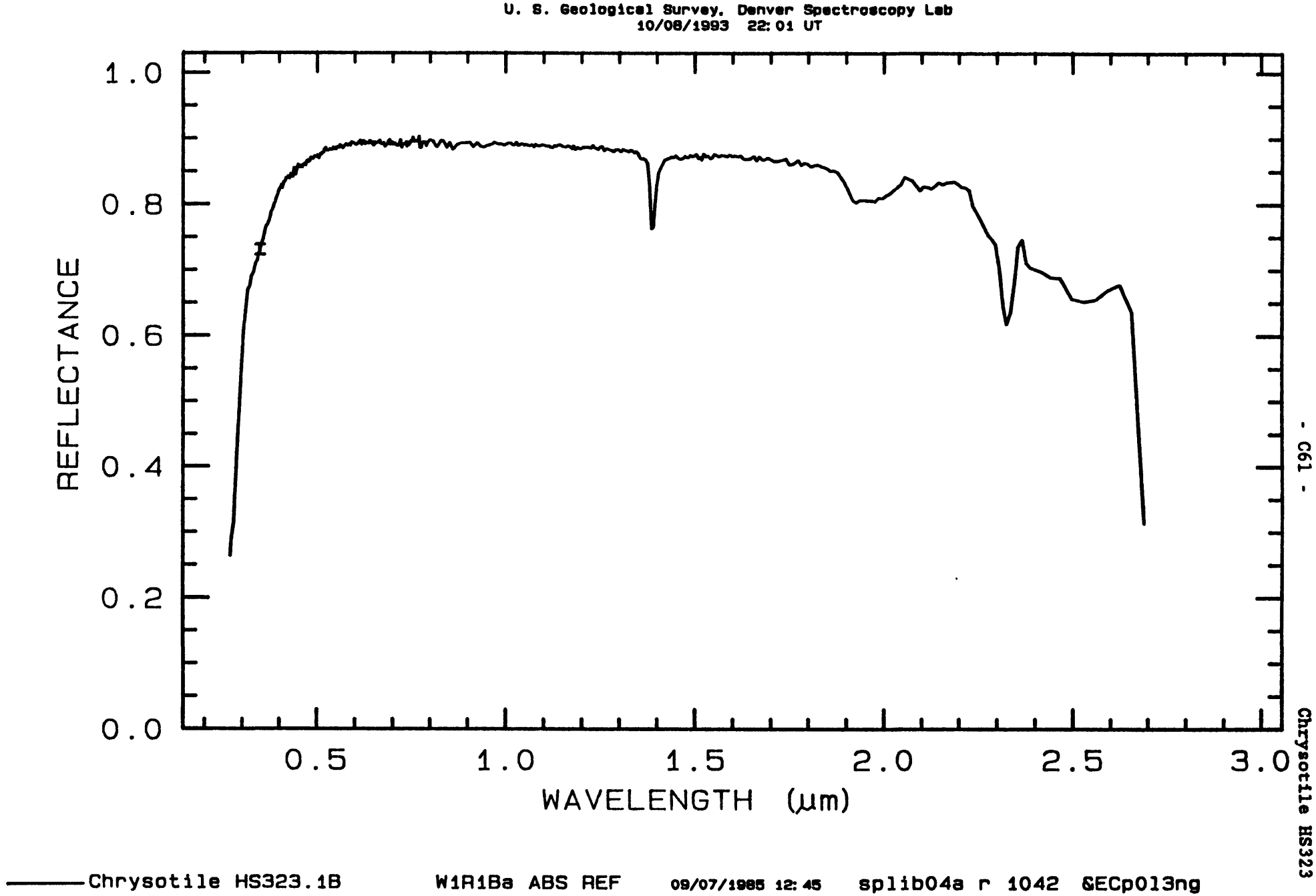
MICROSCOPIC_EXAMINATION:

Microscopically this is a pure chrysotile. Fibres avg. diameter is about 8 μm from optical observations. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r____	0.2-2.7μm	200	g.s.= 8 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 22:01 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Chrysotile HS323.1B W1R1Ba ABS REF 09/07/1985 12:45 splib04a r 1042 &ECp013ng
Chrysotile HS323

TITLE: Cinnabar HS133 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS133

MINERAL_TYPE: Sulfide

MINERAL: Cinnabar

FORMULA: HgS

FORMULA_NROFF: HgS

COLLECTION_LOCALITY: Manhattan, Nevada

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Trimorphous with Metacinnabar and Hypercinnabar.

This sample is impure, and contains 0.6% iron by weight. This is enough iron to be present as the oxide, however, and to provide the characteristic absorptions near 0.85μm. The sample also contains bound hydrated water (1.4, 1.9, and 2.2-2.4μm absorptions) attached to the ferric oxide.

Hunt, G.R., J.W. Salisbury, C.J. Lenhoff, 1971, Visible and Near-Infrared spectra of Minerals and Rocks: IV. Sulphides and Sulphates. Mod. Geol. 3, pp 1-14.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Cinnabar - major component No other identifiable components No sign of iron oxide

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:

60 vol% cinnabar
40 vol% cinnabar coated quartz and feldspar

bimodal grain size distribution:

60 vol% 199 μm cinnabar
5 vol% 10 μm cinnabar coating other grains

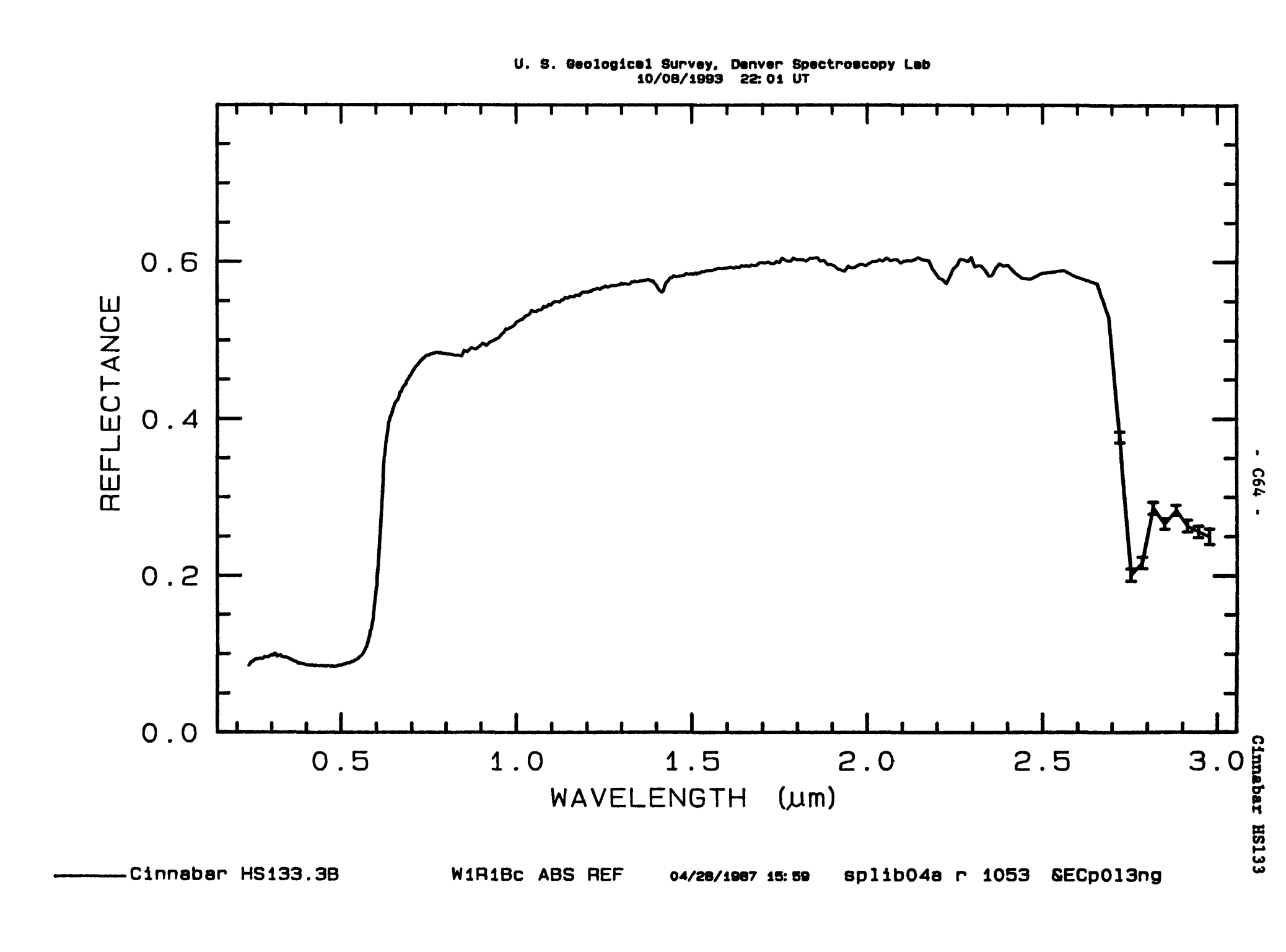
normalized av gr sz of cinnabar = 183 μm
grain size feld/qtz = 199 μm

Coatings of cinnabar on feld/qtz grains avg. about 20-30% of felds/qtz surface. Blood red color, red translucent, multiple good cleavages. All consistent with cinnabar. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1053	0.2-3.0μm	200	g.s.= 184 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 22:01 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C64 -
Cinnabar HS133
Cinnabar HS133.3B
W1R1Bc ABS REF
04/28/1987 15:59
splib04a r 1053 &ECp013ng

TITLE: Clinochlore NMNH83369 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH83369

MINERAL_TYPE: Phyllosilicate

MINERAL: Mg-Clinochlore (Chlorite group)

FORMULA: (Mg,Fe+2)5Al(Si3Al)O10(OH)8

FORMULA_NROFF: $(Mg,Fe^{+2})_5Al(Si_3Al)O_{10}(OH)_8$

COLLECTION_LOCALITY: Tilly Foster mine, Brewster, New York

ORIGINAL_DONOR: National Museum of Natural History (Jim Crowley)

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Chamosite, Chlorite group.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure magnesium clinochlore (Jim Crowley).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	32.0	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	<0.02	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	16.0	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.76	wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	33.9	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.09	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.07	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	---	---	---		
COMPOSITION:	Total:		wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

XRF analysis by Joe Taggart and A. Bartel of the USGS

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

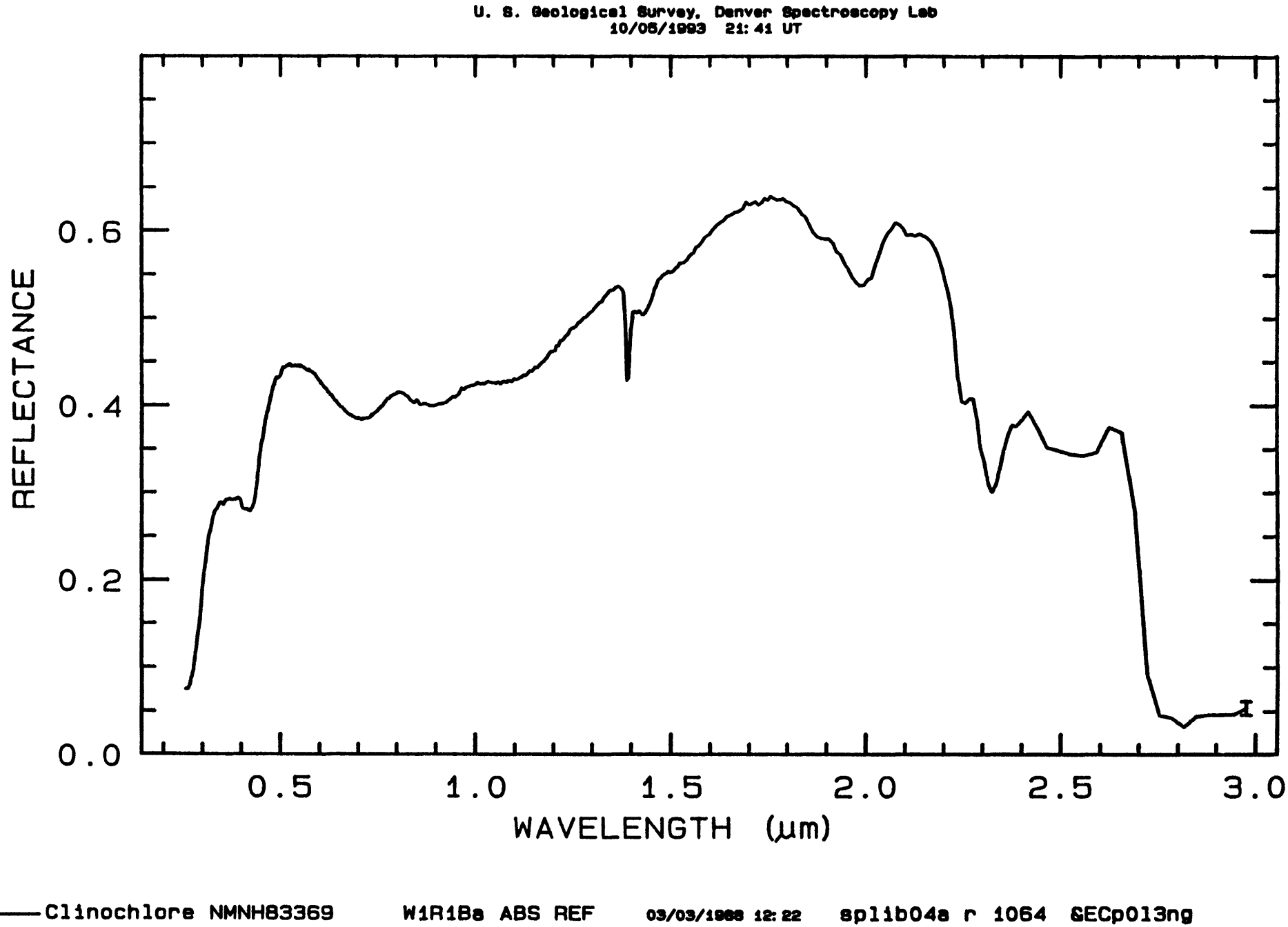
Basal cleavage, pale green color, scaly aggregates, first order gray interference color, low relief, all consistent with chlorite. Trace magnetite and epidote(?). G. Swayze.

plates 35 μm thick and 500 μm in diameter.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1064	0.2-3.0μm	200	g.s.= 500 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 21:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Clinochlore NMNH83369
Clinochlore NMNH83369 W1R1Ba ABS REF 03/03/1988 12:22 splib04a r 1064 &ECp013ng

TITLE: Clinochlore_Fe GDS157 Chlorite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS157

MINERAL_TYPE: Phyllosilicate

MINERAL: Ferroan Clinochlore (Ripidolite) (Chlorite group)

FORMULA: (Fe+2,Mg)5Al(Si3Al)O10(OH)8

FORMULA_NROFF: $(Fe^{+2},Mg)_5Al(Si_3Al)O_{10}(OH)_8$

COLLECTION_LOCALITY: Flagstaff Hill, California

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample is described in:

Post, J.L. and C.C. Plummer, 1972, The chlorite series of Flagstaff Hill area, California: A preliminary investigation. Clays and Clay Minerals, v.20, pp271-283.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV, smear mount (ripidolt.out); 45 kV - 35 mA, 7.3- 9.5 keV, random mount (ripidlt2.out)
References: Bailey (1988), Huebner's reference patterns
Found: Chlorite, type IIb, one weak but distinct reflection at 9.7 angstroms (mica?), and one very weak reflection at 7.7 angstroms.
Sought but not found: quartz
Comments: Many sharp relections indicate very good crystallinity. Ripidlt2 is one of the best chlorite patterns I have ever seen. The chemical analysis places this chlorite in the composition range once called ripidolite. Note that the unidentified reflection at 7.7 angstroms is also present in sheridanite GDS158."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF

COMPOSITION:	SiO2:	25.2	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.90	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	19.6	wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.057	wt%	NROFF:	Cr_2O_3
COMPOSITION:	Fe2O3:	25.3	wt%	NROFF:	Fe_2O_3
COMPOSITION:	NiO:	0.051	wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.11	wt%	NROFF:	MnO
COMPOSITION:	MgO:	16.6	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.11	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.27	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.03	wt%	NROFF:	K_2O
COMPOSITION:	LOI:	10.0	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	98.228	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

Jim Post, 1993, written communication.

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

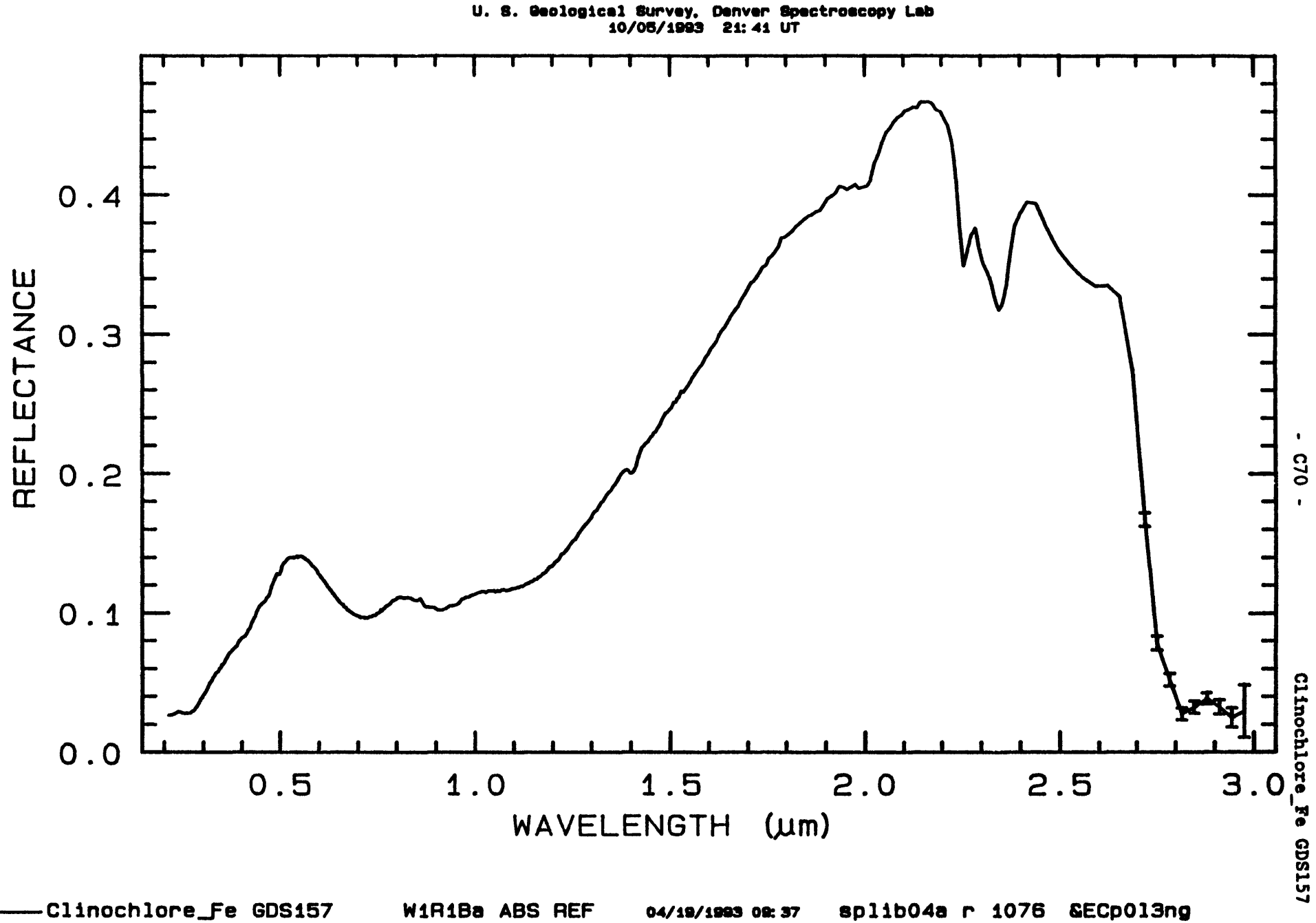
MICROSCOPIC_EXAMINATION:

Low order grey interference color, green pleochroic color, basal cleavage, all consistent with chlorite. No other mica obvious, some brown Fe staining present in some grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1076	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:41 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- C70 -
Clinochlore_Fe GDS157
Clinochlore_Fe GDS157 W1R1Ba ABS REF 04/19/1993 08:37 splib04a r 1076 &ECp013ng

TITLE: Clinochlore GDS158 Chlorite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS158

MINERAL_TYPE: Phyllosilicate

MINERAL: Clinochlore (Sheridanite) (Chlorite group)

FORMULA: (Mg,Fe+2)5Al(Si3Al)O10(OH)8

FORMULA_NROFF: $(Mg,Fe^{+2})_5Al(Si_3Al)O_{10}(OH)_8$

COLLECTION_LOCALITY: Flagstaff Hill, California

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample described in:

Post, J.L. and C.C. Plummer, 1972, The chlorite series of Flagstaff Hill area, California: A preliminary investigation. Clays and Clay Minerals, v.20, pp271-283.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"45 kV - 35 mA, 6.5-9.5 keV, smear mount (sherd8.out); 40 kV - 30 mA, random mount (sherd8-2.out)
References: Bailey (1988, MSA Reviews 19; 1988 in Clays and Clay Minerals); Huebner's reference patterns
Found: Chlorite type IIbb. A broad, very weak reflection at 9.6 is probably due to a trace of mica. A weak reflection at 3.23 angstroms may be due to a trace of feldspar. A weak unidentified reflection at 2.357 angstroms. And a weak, unidentified reflection at 7.8 angstroms that also appeared in GDS157 (the "ripidolite").
Sought but not found: quartz
Comments: With chemical analysis, the chlorite is a clinochlore IIbb. Severe preferred orientation in smear mounts; fortunately, there was enough sample for a random mount. Sharp chlorite reflections indicate excellent crystallinity. With GDS157 ("ripidolite"), the best chlorite patterns I have ever seen."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:      SiO2:  27.5   wt%    NROFF: SiO2
COMPOSITION:      TiO2:   1.04  wt%    NROFF: TiO2
COMPOSITION:     Al2O3:  19.8   wt%    NROFF: Al2O3
COMPOSITION:     Cr2O3:   0.057 wt%    NROFF: Cr2O3
COMPOSITION:     Fe2O3:  14.1   wt%    NROFF: Fe2O3
COMPOSITION:       NiO:   0.074 wt%    NROFF: NiO
COMPOSITION:       MnO:   0.13  wt%    NROFF: MnO
COMPOSITION:       MgO:  24.7   wt%    NROFF: MgO
COMPOSITION:       CaO:   0.10  wt%    NROFF: CaO
COMPOSITION:      Na2O:   0.22  wt%    NROFF: Na2O
COMPOSITION:       K2O:   0.03  wt%    NROFF: K2O
COMPOSITION:      P2O5:   0.11  wt%    NROFF: P2O5
COMPOSITION:       LOI:  11.5   wt%    NROFF: LOI
COMPOSITION: ----------------------
COMPOSITION:     Total:  99.361 wt%
COMPOSITION:  O=Cl,F,S:         wt%  #correction for Cl, F, S
COMPOSITION: New Total:         wt%
```

Jim Post, 1993, written communication.

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

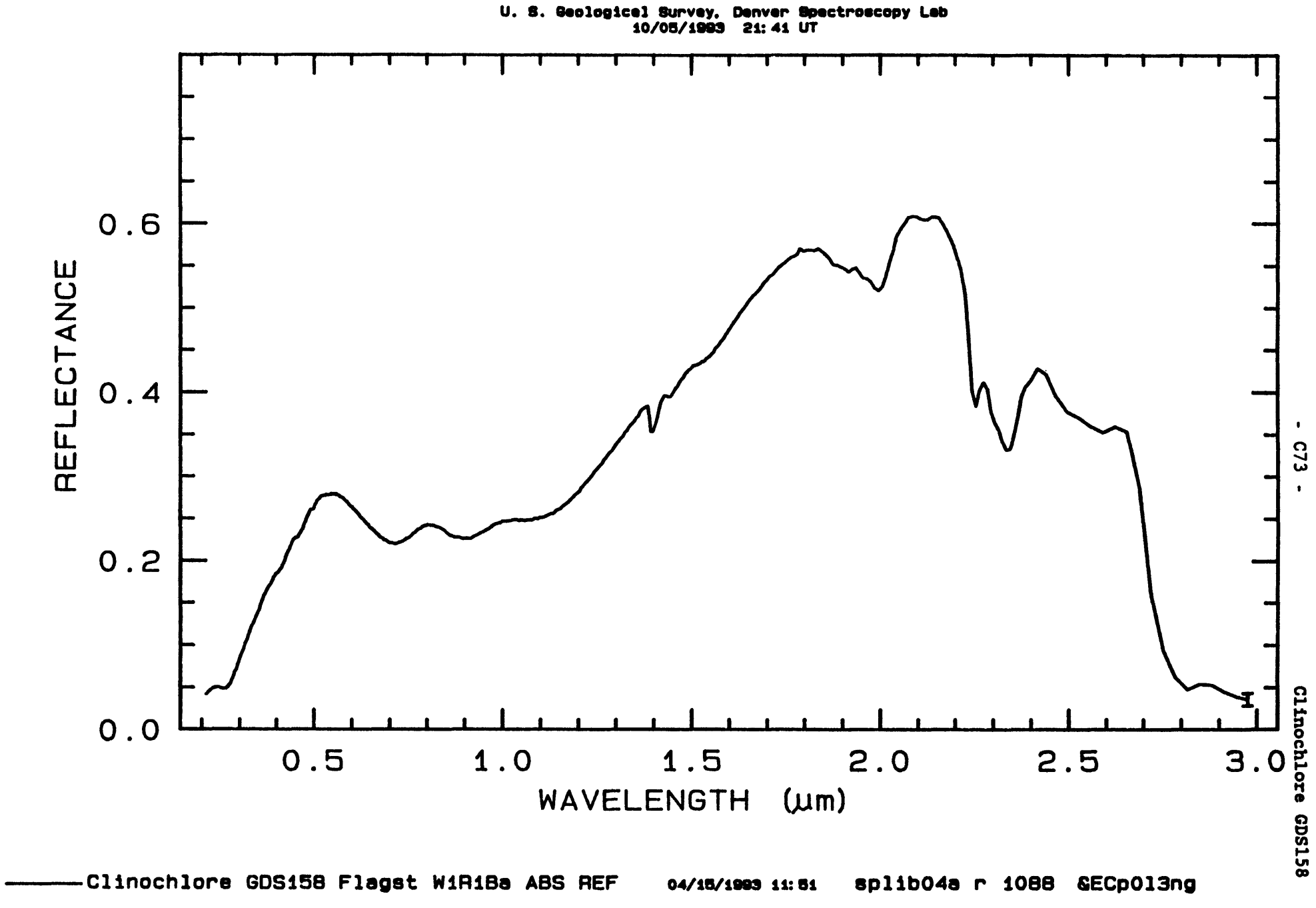
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 1088 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C73 -
Clinochlore GDS158
Clinochlore GDS158 Flagst W1R1Ba ABS REF 04/15/1993 11:51 splib04a r 1088 GECp013ng

TITLE: Clinochlore GDS159 Chlorite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS159

MINERAL_TYPE: Phyllosilicate

MINERAL: Clinochlore (Sheridanite) (Chlorite group)

FORMULA: (Mg,Fe+2)5Al(Si3Al)O10(OH)8

FORMULA_NROFF: $(Mg,Fe^{+2})_5Al(Si_3Al)O_{10}(OH)_8$

COLLECTION_LOCALITY: Frisco Mine, California?

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV (sheridan.out=sherd9.out)
Reference: JCPDS #12-242
Found: Chlorite type IIb; weak but sharp reflection at
9.3°2θ (mica?); weak reflection at 3.13 angstroms (albite?)
Sought but not found: quartz
Comments: An excellent chlorite pattern; sharp reflections indicate
good crystallinity. The chemical analysis is that of a
clinochlore.

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:      SiO2:  31.3   wt%    NROFF: SiO2
COMPOSITION:      TiO2:   0.20  wt%    NROFF: TiO2
COMPOSITION:     Al2O3:  19.4   wt%    NROFF: Al2O3
COMPOSITION:     Cr2O3:   0.004 wt%    NROFF: Cr2O3
COMPOSITION:     Fe2O3:   1.16  wt%    NROFF: Fe2O3
COMPOSITION:       MnO:   0.02  wt%    NROFF: MnO
COMPOSITION:       MgO:  34.7   wt%    NROFF: MgO
COMPOSITION:       CaO:   0.04  wt%    NROFF: CaO
COMPOSITION:      Na2O:   0.20  wt%    NROFF: Na2O
COMPOSITION:       K2O:   0.01  wt%    NROFF: K2O
COMPOSITION:      P2O5:   0.01  wt%    NROFF: P2O5
COMPOSITION:       LOI:  13.3   wt%    NROFF: LOI
COMPOSITION: ----------------------
COMPOSITION:     Total: 100.344 wt%
COMPOSITION:  O=Cl,F,S:         wt%  #correction for Cl, F, S
COMPOSITION: New Total:         wt%
```

Jim Post, 1993, written communication.

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

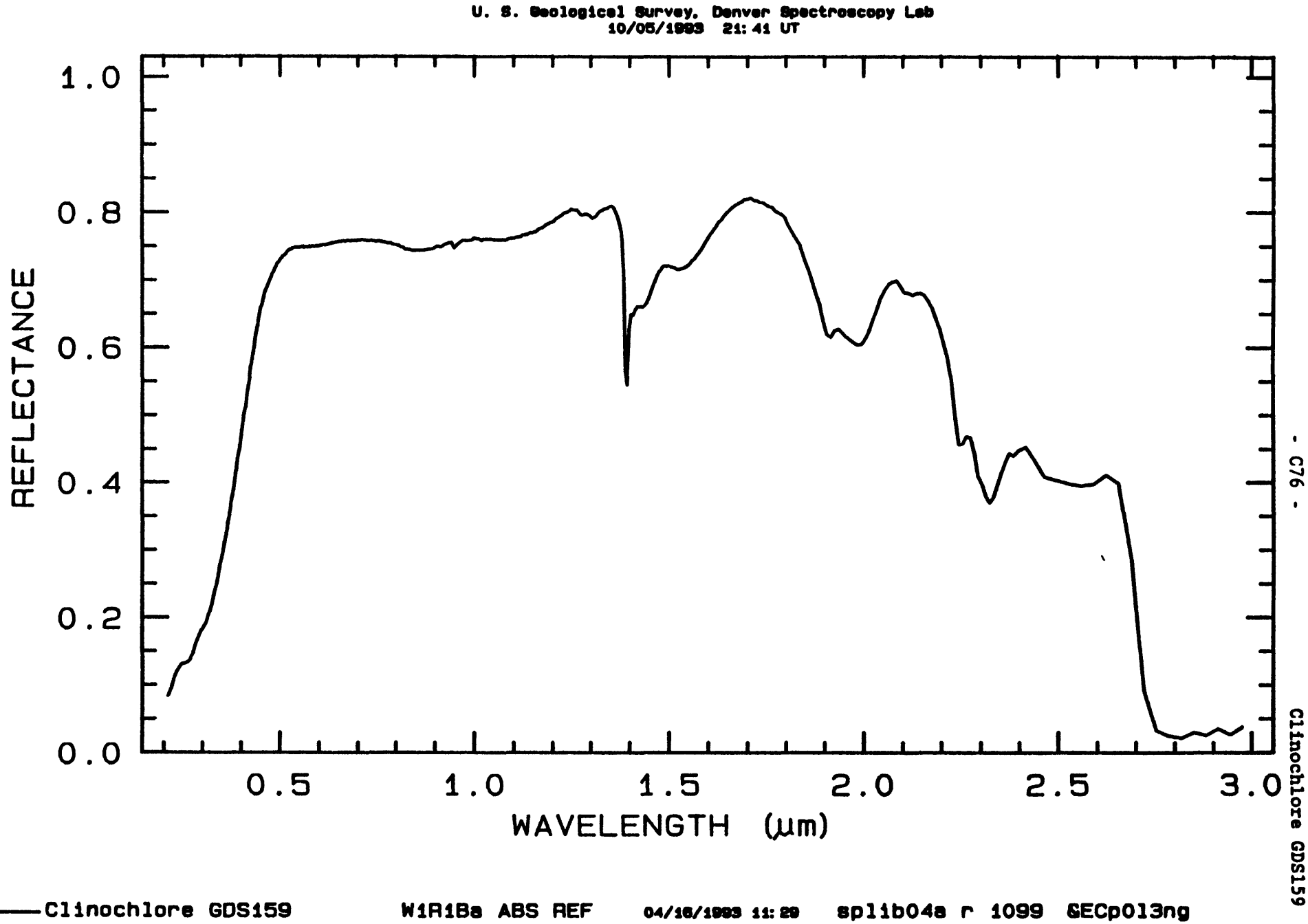
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1099	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Clinochlore GDS159
W1R1Ba ABS REF
04/16/1993 11:29
splib04a r 1099
GECp013ng

TITLE: Clinochlore_Fe SC-CCa-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CCa-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Ferroan Clinochlore (Ripidolite) (Chlorite Group)

FORMULA: (Fe+2,Mg)5Al(Si3Al)O10(OH)8

FORMULA_NROFF: $(Fe^{+2},Mg)_5Al(Si_3Al)O_{10}(OH)_8$

COLLECTION_LOCALITY: El Dorado Co., CA

ORIGINAL_DONOR: Clay Mineral Society, Clay Mineral Repository

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample was ground in an alumina mortar and pestle and wet sieved with methanol into <30μm (c), 45-104μm (b), and 104-150μm (a) size fractions.

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

This sample is representative of it structural classification.
(King and Clark, 1989).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	33.20	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.85	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3	25.80	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	20.70	wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	0.09	wt%	NROFF:	MnO
COMPOSITION:	MgO:	26.10	wt%	NROFF:	MgO
COMPOSITION:	CaO:	<0.02	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.22	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	<0.02	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	LOI:	9.23	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.78	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Compositional data provided by Gene Whitney, USGS, Denver, CO

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_COMPOSITION_DISCUSSION.

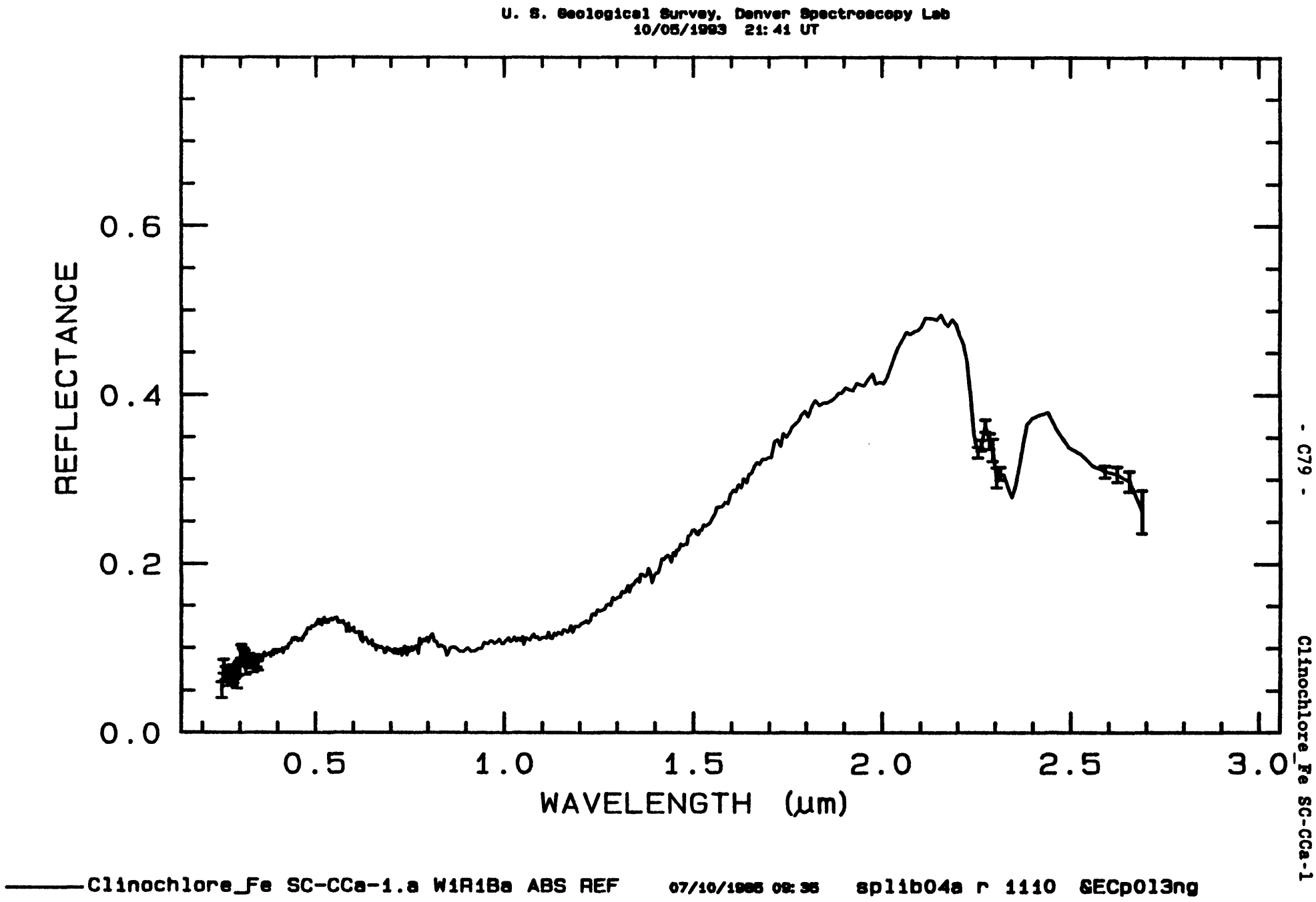
MICROSCOPIC_EXAMINATION:

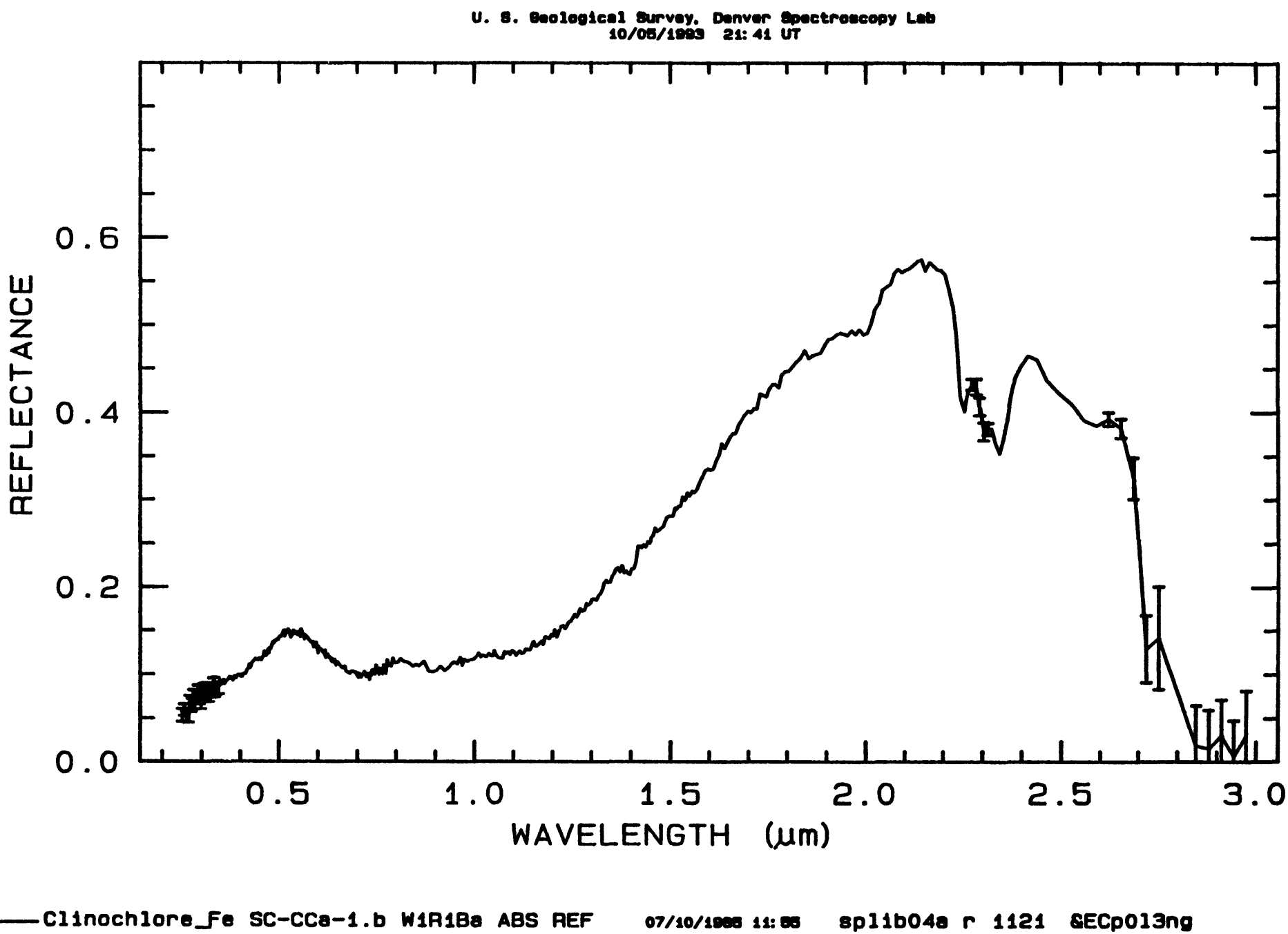
Microscopically this appears to be pure ripidolite. All size fractions were examined visually and by energy dispersive methods to ensure chemical homogenity as a function of grain size interval.

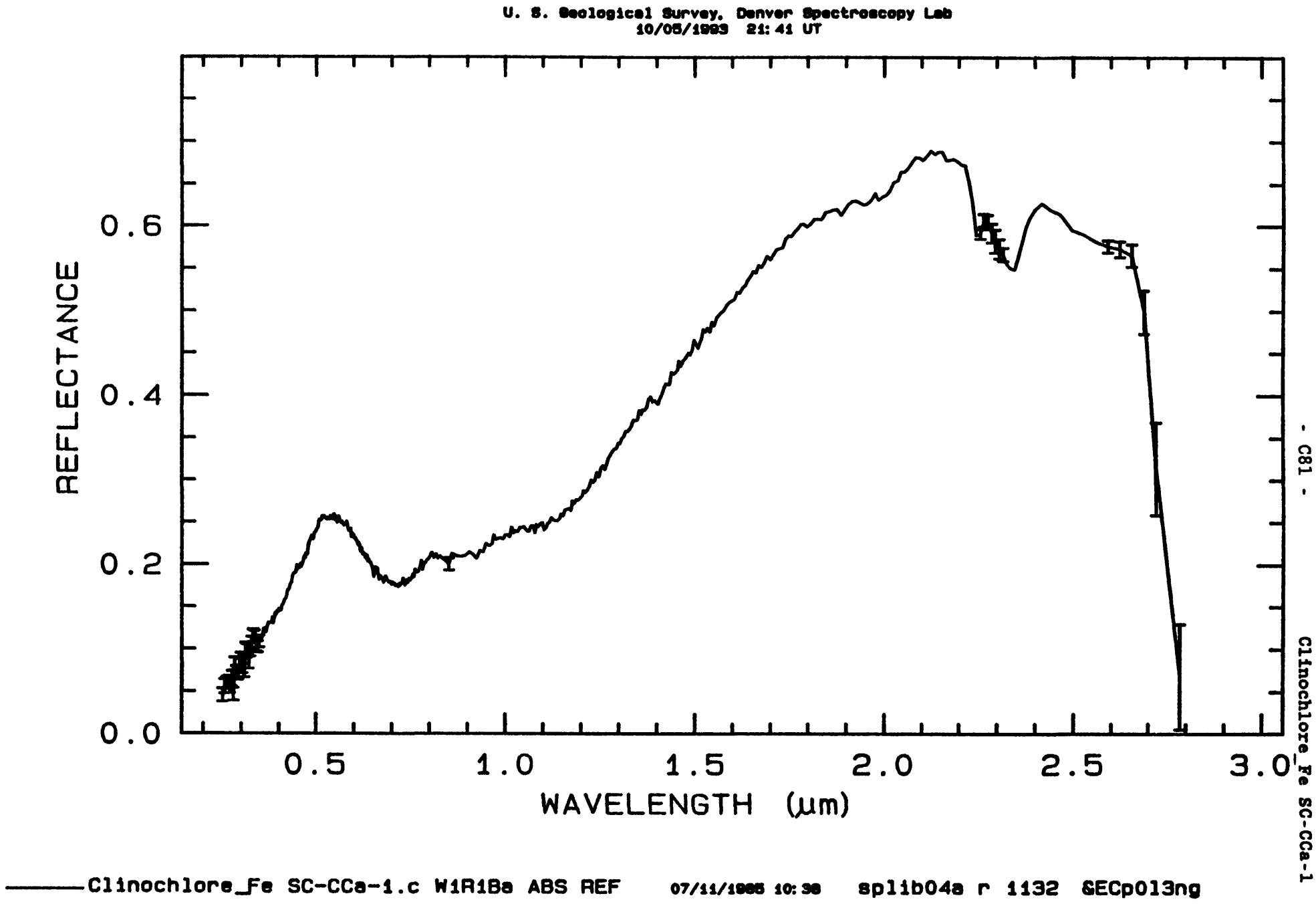
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1110	0.2-2.7μm	200	g.s.=115μm
LIB_SPECTRA:	splib04a r 1121	0.2-2.7μm	200	g.s.=53μm
LIB_SPECTRA:	splib04a r 1132	0.2-2.7μm	200	g.s.=15μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- C79 -
Clinochlore_Fe SC-CCa-1
Clinochlore_Fe SC-CCa-1.a W1R1Ba ABS REF 07/10/1995 09:36 splib04a r 1110 GECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
C80 - Clinochlore_Fe SC-CCa-1
Clinochlore_Fe SC-CCa-1.b W1R1Ba ABS REF 07/10/1988 11:55 splib04a r 1121 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C81 -
Clinochlore_Fe SC-CCa-1
Clinochlore_Fe SC-CCa-1.c W1R1Ba ABS REF 07/11/1995 10:38 splib04a r 1132 &ECp013ng

TITLE: Clinoptilolite GDS2 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS2

MINERAL_TYPE: Tectosilicate

MINERAL: Clinoptilolite (Zeolite group)

FORMULA: (Na,K,Ca)2-3Al3(Al,Si)2Si13O36*12H2O

FORMULA_NROFF: $(Na,K,Ca)_{2-3}Al_3(Al,Si)_2Si_{13}O_{36}\bullet 12H_2O$

COLLECTION_LOCALITY: Sheaville, Oregon

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The original sample description and vis-NIR spectrum was published in:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

The sample appears to be spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Clinoptilolite + medium amount of other - by Norma Vero

See:
Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

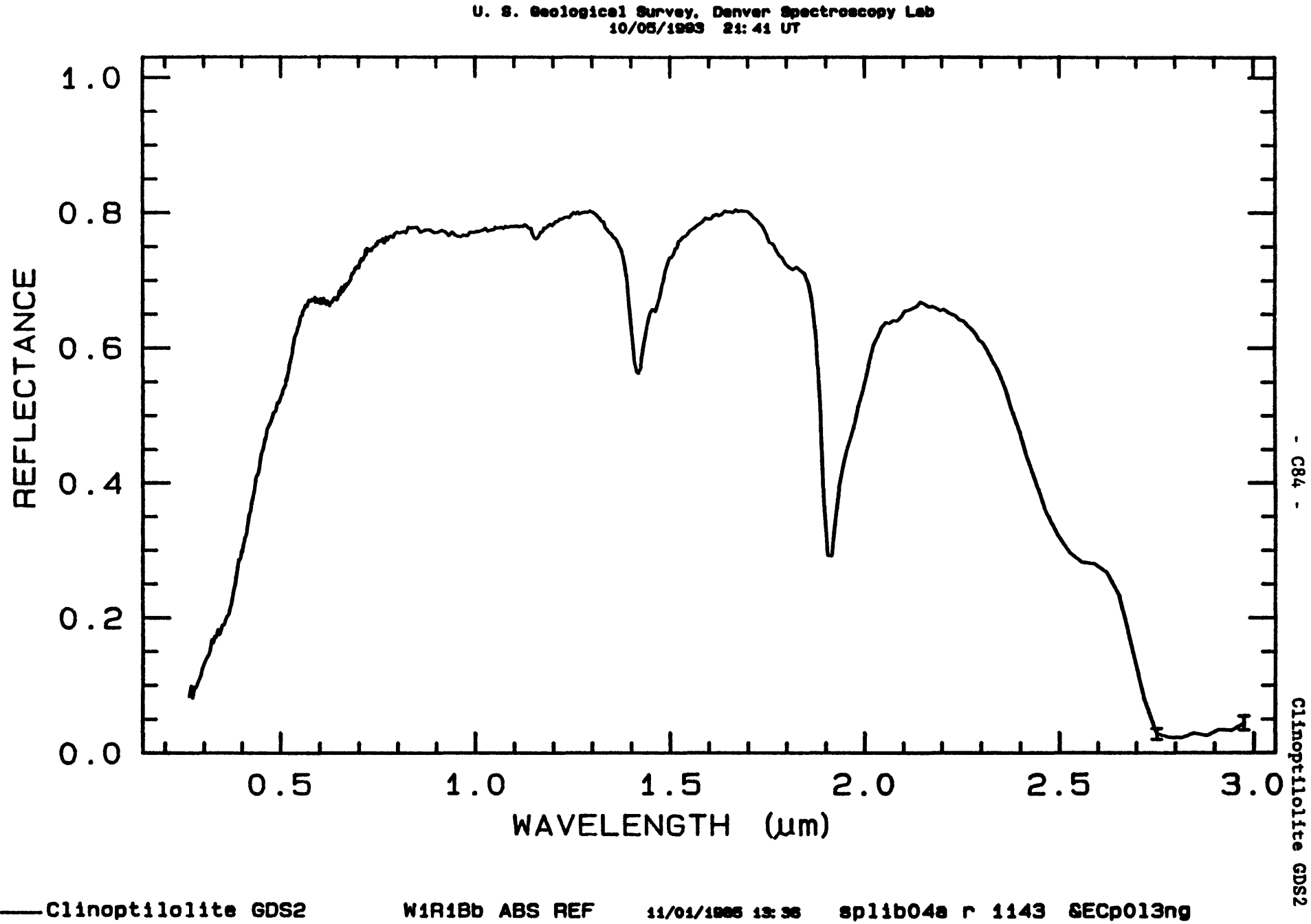
mode:
97-98 vol% clinoptilolite
2- 3 vol% quartz or feldspar
tr opaques

Grains have low first order gray interference color, good cleavage, Up to 15 vol% airbubbles or fluid inclusions in clinoptilolite hinder determination of optical properties. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1143	0.2-3.0μm	200	g.s.= 60 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C84 -
Clinoptilolite GDS2
Clinoptilolite GDS2 W1R1Bb ABS REF 11/01/1986 13:36 splib04a r 1143 GECp013ng

TITLE: Clinoptilolite GDS152 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS152

MINERAL_TYPE: Tectosilicate

MINERAL: Clinoptilolite (Zeolite group)

FORMULA: (Na,K,Ca)2-3Al3(Al,Si)2Si13O36*12H2O

FORMULA_NROFF: $(Na,K,Ca)_{2-3}Al_3(Al,Si)_2Si_{13}O_{36}\bullet 12H_2O$

COLLECTION_LOCALITY: Castle Creek, Idaho

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

We assume this sample is pure or nearly so as it is presented in:

Ehman, W.J. and Norma Vergo, 1986, Spectral discrimination of zeolites and dioctahedral clays in the near-infrared. Remote Sensing for Exploration Geology, 5th Thematic Conference, Reno, Nevada, September 29-October 2, 1986, Proceedings, pp 417-425.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

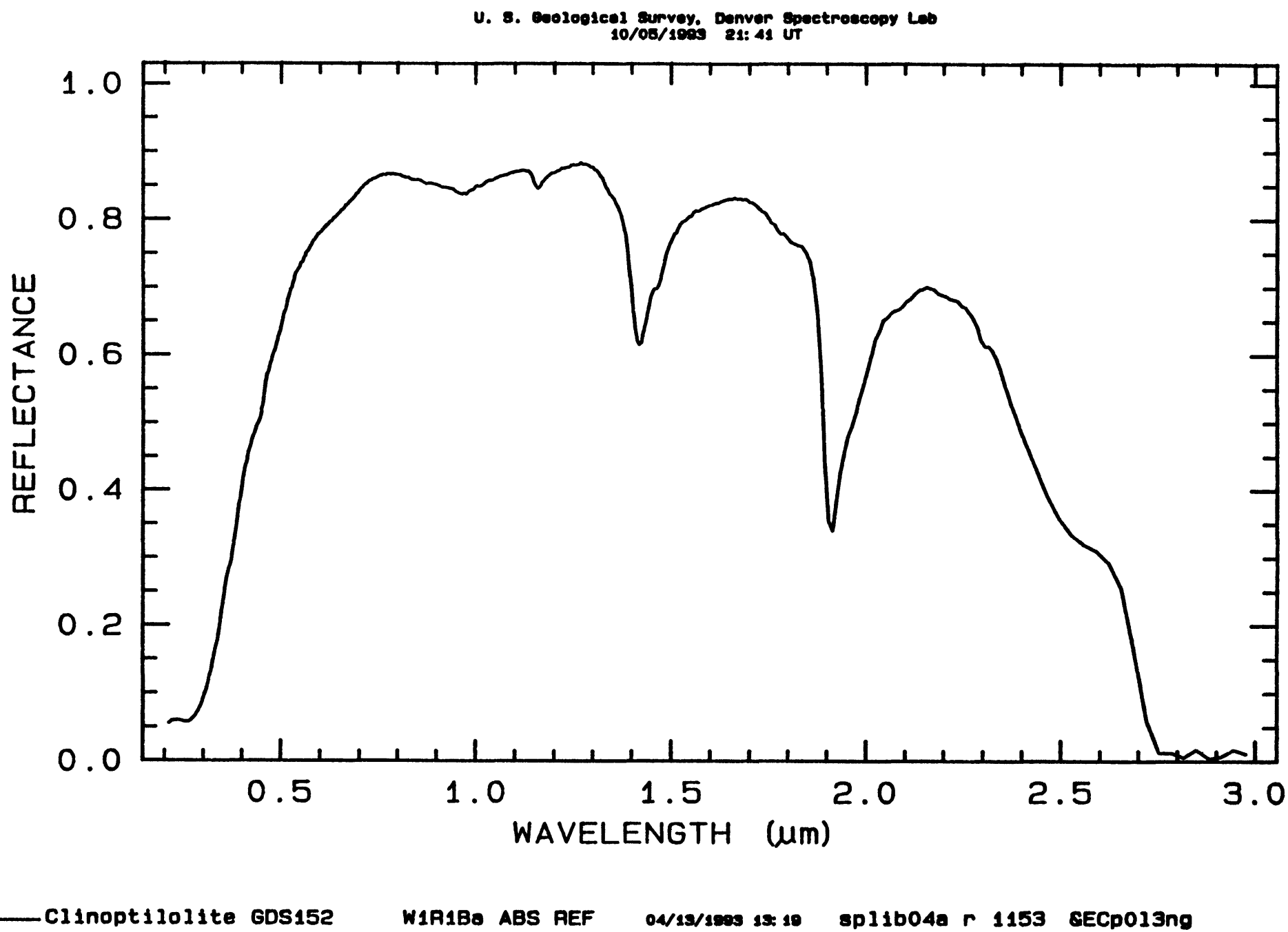
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1153	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1989 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Clinoptilolite GDS152
W1R1Ba ABS REF
04/13/1989 13:19
splib04a r 1153 GECp013ng

TITLE: Clinozoisite HS299 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS299

MINERAL_TYPE: Sorosilicate

MINERAL: Clinozoisite (Epidote group)

FORMULA: Ca2Al3(SiO4)3(OH)

FORMULA_NROFF: $Ca_2Al_3(SiO_4)_3(OH)$

COLLECTION_LOCALITY: Mexico

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Zoisite.

"This sample forms a continuous series with epidote. The sample contains some epidote and quartz impurities. The sample probably contains some Mn^{3+} and Fe^{3+} substituting for its aluminium, which would explain its reddish-brown color. The presensce of these ions would also explain absorption features at 0.41, 0.46, 0.55, and 0.8 μm. Absorption features attributed to the hydroxyl and water appear at longer wavelengths than normal."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and Near-Infrared Spectra of Minerals and Rocks: VI. Additional Silicates. Mod. Geol. 4, pp 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
85-90 vol% clinozoisite
10-15 vol% epidote
tr? qtz

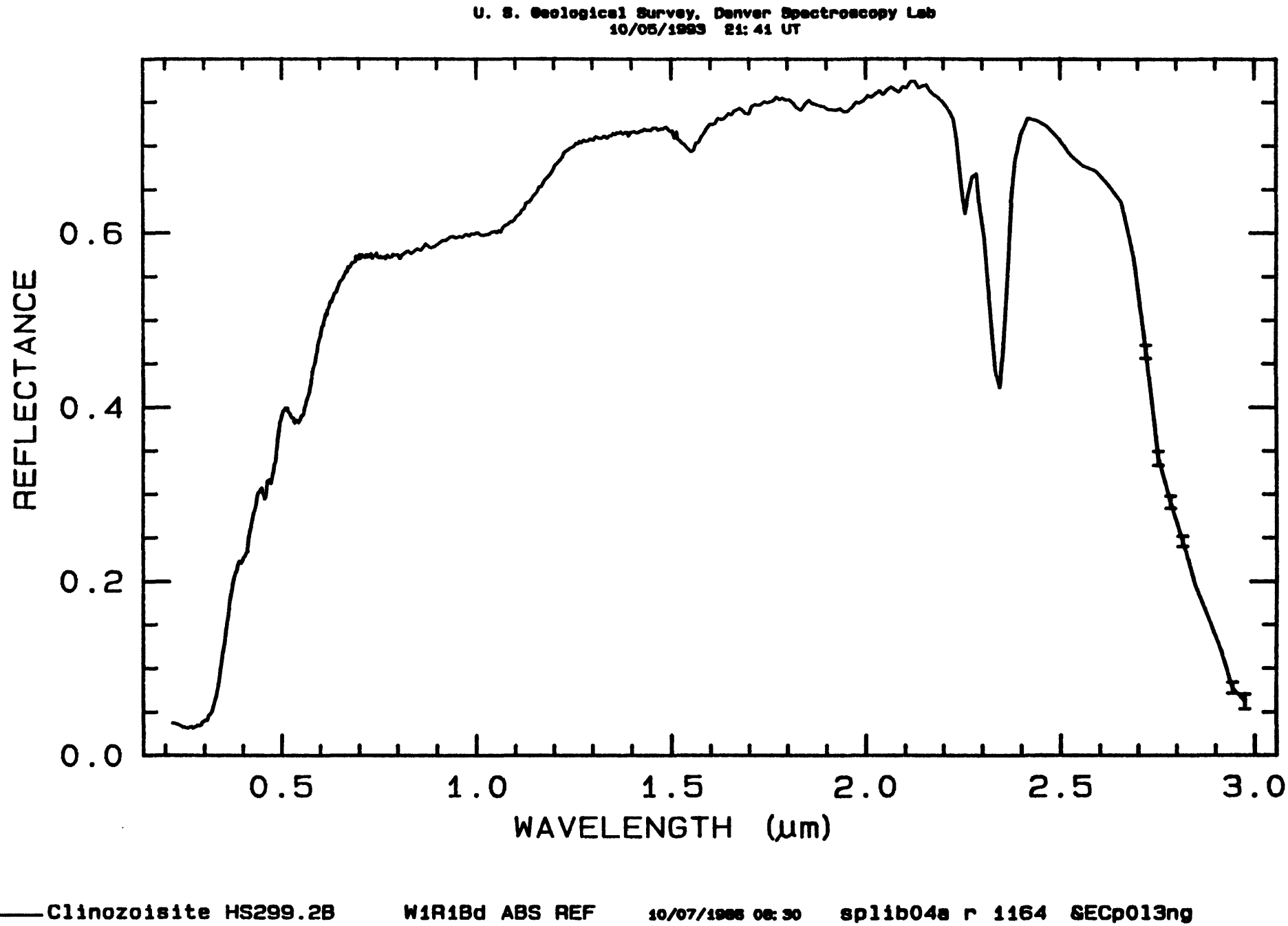
tr opaques

Clinozoisite, 2V=60 degrees, anomalous blue color, pink in transmitted light, many grains lie on cleavages giving close to optic axis figures, grains too small for sign determination, unclear whether this is epidote or clinozoisite, although green grains are probably epidote and pink grains clinozoisite. I suggest this sample not be used in the database due to significant epidote contamination. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1164	0.2-3.0μm	200	g.s. = 40 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:41 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C89 -
Clinozoisite HS299
Clinozoisite HS299.2B W1R1Bd ABS REF 10/07/1986 08:30 splib04a r 1164 GECp013ng

TITLE: Clintonite NMNH126553 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH126553

MINERAL_TYPE: Phyllosilicate

MINERAL: Clintonite (Mica group)

FORMULA: Ca(Mg,Al)3(Al3Si)O10(OH)2

FORMULA_NROFF: $Ca(Mg,Al)_3(Al_3Si)O_{10}(OH)_2$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: National Musuem of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA (clntnit.out); 45 kV - 35 mA, sample ground with glass (clntnit2.out); 40 kV - 30 mA, random mount (clntnt3.out), all with single channel analyzer set at 6.5-9.5 keV.
References: calculated xanthophyllite pattern of Borg and Smith (1969); JCPDS #20-321; 1M and 2M1 patterns calculated by H.T. Evans, Jr., using Akhundov et al. (1961) and Takeuchi (1965)
Found: Clintonite 1M, a subordinate unidentified phase, and minor chlorite.
Comments: Persistent preferred orientation makes indexing, and thus complete interpretation, of these patterns uncertain. I refined the cell to a = 5.202(2), b = 9.808(6), c = 9.815(3), and β = 100.17(3)°, but uncertainties in indexing increase the uncertainty in the cell dimensions over the uncertainties shown. The observed pattern matches the calculated 1M pattern much more closely than the 2M1 pattern; nevertheless, some intensity variations are bizarre. Residual reflections consist of weak, broad chlorite (001) and (002) reflections and 11 moderate to very weak, but very sharp, reflections of an unidentified phase, perhaps a layer silicate. (This unidentified phase may have additional strong reflections that overlap with the clintonite). The pattern is most unusual in that the three phases can be distinguished by the sharpness of their peaks; for this reason I doubt that there are two unidentified phases."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

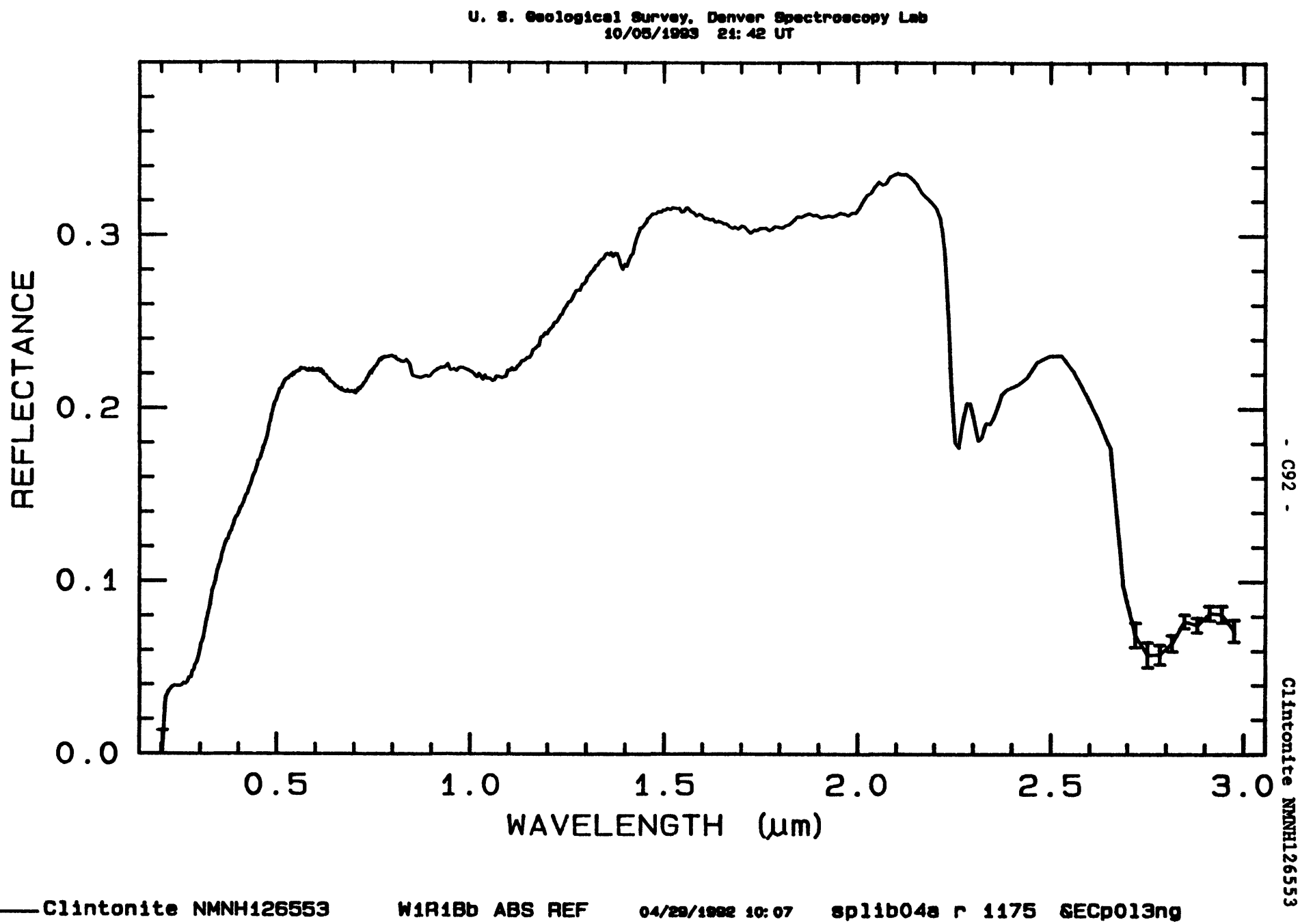
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1175	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- C92 -
Clintonite NMNH126553
Clintonite NMNH126553 W1R1Bb ABS REF 04/29/1992 10:07 splib04a r 1175 &ECp013ng

TITLE: Cobaltite HS264 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS264

MINERAL_TYPE: Sulfide

MINERAL: Cobaltite (Cobaltite group)

FORMULA: CoAsS

FORMULA_NROFF: CoAsS

COLLECTION_LOCALITY: Elliot Lake, Ontario, Canada

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"This sample is impure, containing a small amount of calcite. Despite this contaminant, the sample is spectrally featureless throughout the range. The calcite probably only serves to slightly raise its overall reflectivity."

Hunt, G.R., J.W. Salisbury, C.J. Lenhoff, 1971, Visible and Near-Infrared spectra of Minerals and Rocks: IV. Sulphides and Sulphates. Mod. Geol. 3, pp 1-14.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

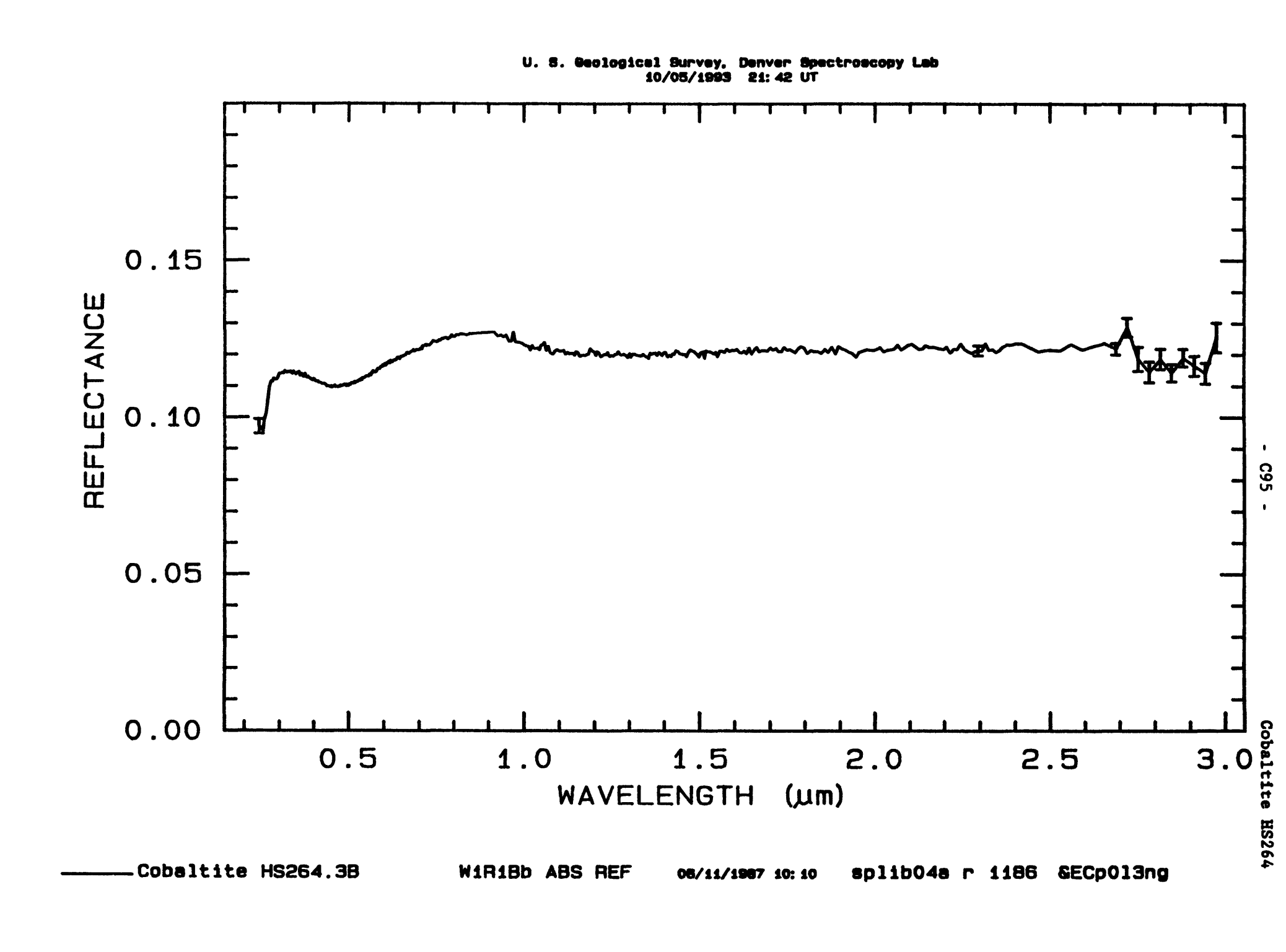
mode:
60 vol% calcite (with cobaltite inclusions)
40 vol% cobaltite

Silver-white metallic luster. This is consistent with cobaltite. Suggest wash this sample with HCl to remove calcite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1186	0.2-3.0μm	200	g.s. = 226 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C95 -
Cobaltite HS264
Cobaltite HS264.3B W1R1Bb ABS REF 06/11/1987 10:10 splib04a r 1186 &ECp013ng

TITLE: Colemanite GDS143 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS143

MINERAL_TYPE: Hydrous Borate

MINERAL: Colemanite

FORMULA: Ca2B6O11*5H2O

FORMULA_NROFF: $Ca_2B_6O_{11} \bullet 5H_2O$

COLLECTION_LOCALITY: Boron, California

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

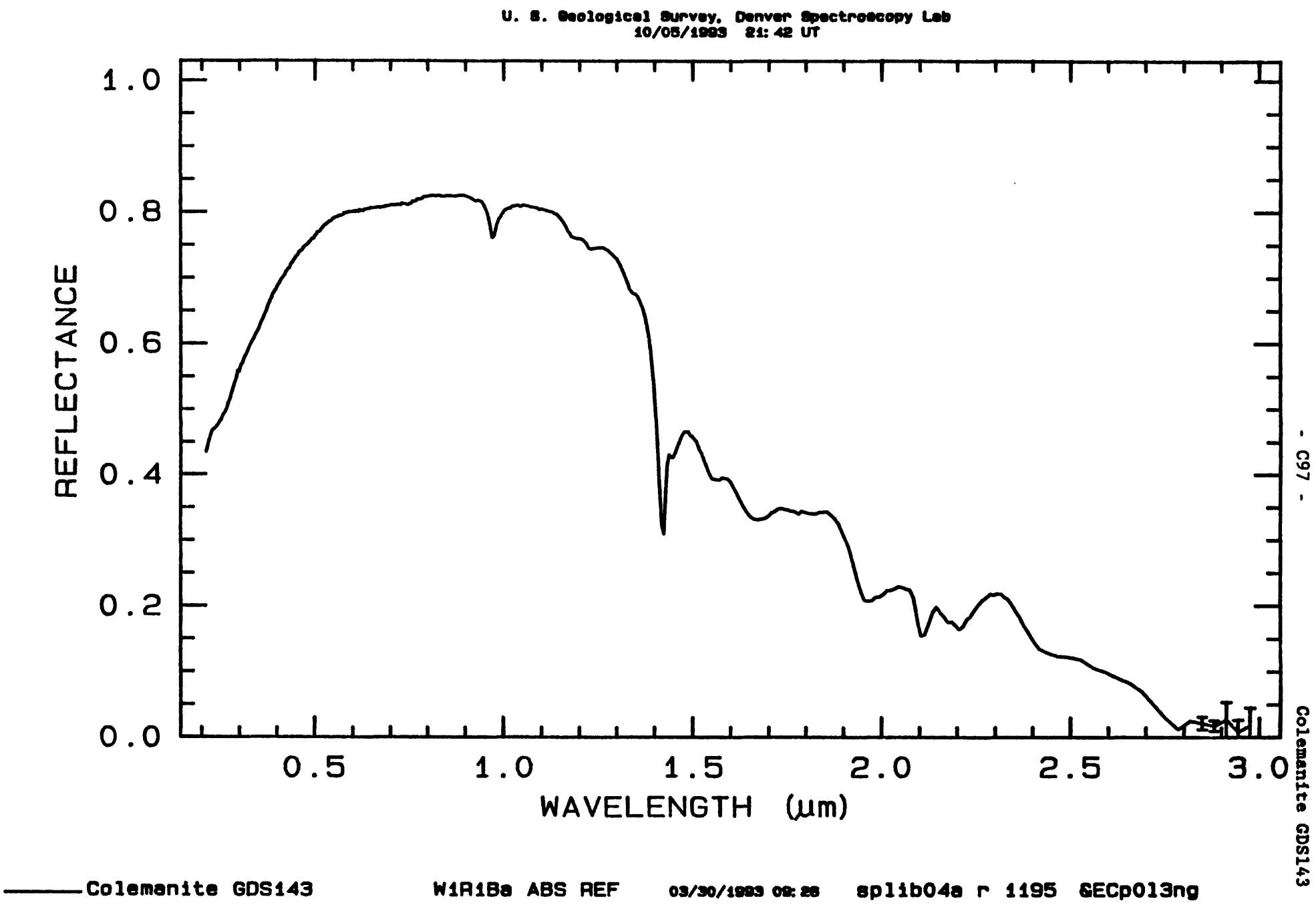
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1195	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Colemanite GDS143
Colemanite GDS143 W1R1Ba ABS REF 03/30/1993 09:28 splib04a r 1195 &ECp013ng

TITLE: Cookeite CAr-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SC-CAr-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Cookeite (Chlorite group)

FORMULA: LiAl4(Si3Al)O10(OH)8

FORMULA_NROFF: $LiAl_4(Si_3Al)O_{10}(OH)_8$

COLLECTION_LOCALITY: N. Little Rock, ARK

ORIGINAL_DONOR: Clay Mineral Society, Source Clay Repository

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample was ground in an alumina mortar and pestle and wet sieved with methanol into <30μm (c), 30-45μm, 60-104μm (b), and 104-150μm (a) size fractions. (Letter denotes spectrum designation.)

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sample is cookeite plus medium amount of calcite. The sample is spectrally pure. XRD analysis by Norma Vergo.

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

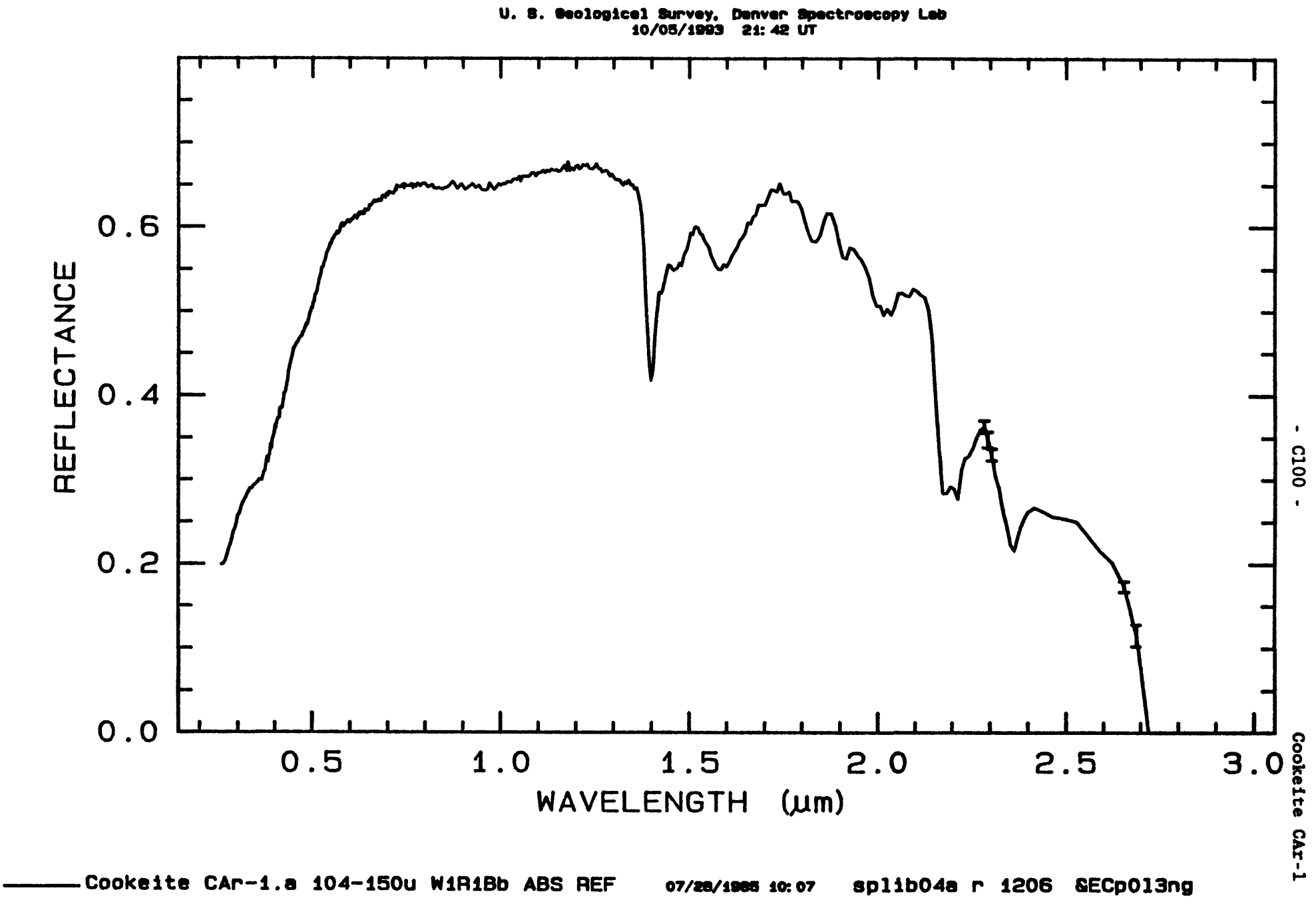
Up to 2 vol% quartz impurity, cookeite has low relief, first order gray color, biaxial (+), no calcite observed in x-polarized light. No fizz with HCl, so calcite identification by XRD appears to be in error. Suggest new XRD analysis.

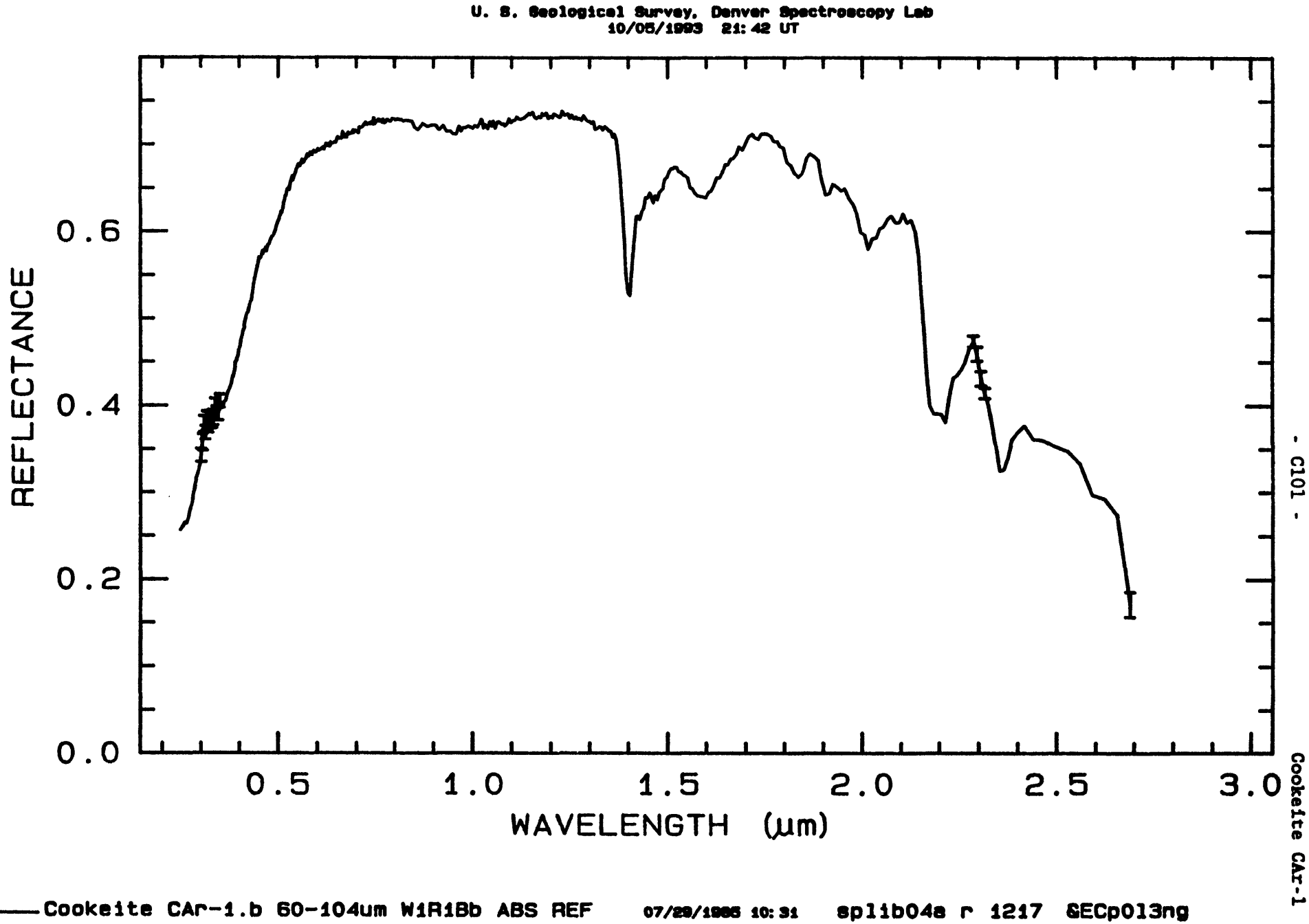
All properties are consistent with chlorite. G. Swayze.

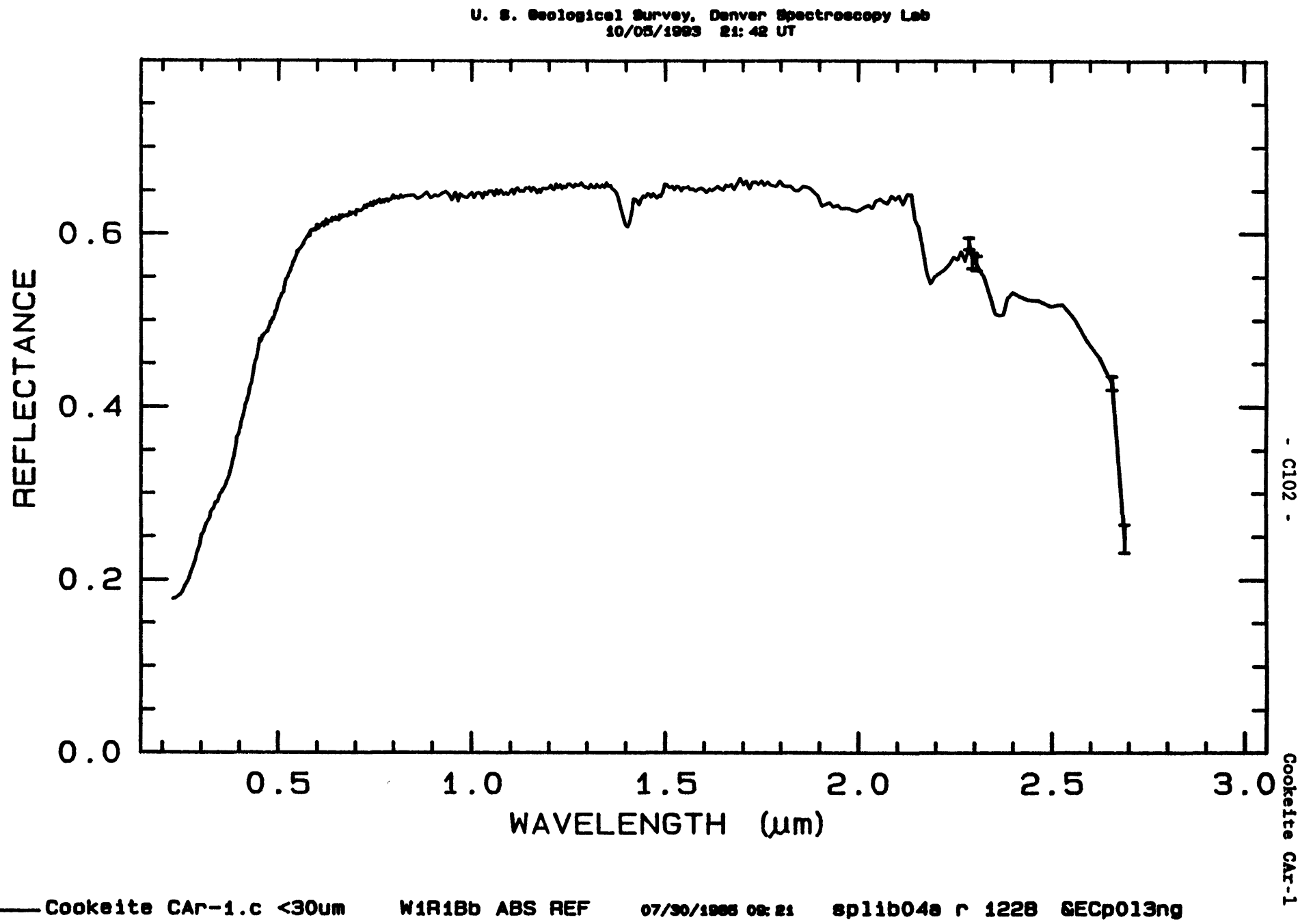
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1206	0.2-2.7μm	200	g.s.=115μm
LIB_SPECTRA:	splib04a r 1217	0.2-2.7μm	200	g.s.=70μm
LIB_SPECTRA:	splib04a r 1228	0.2-2.7μm	200	g.s.=15μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C100 -
Cookeite CAr-1
Cookeite CAr-1.a 104-150u W1R1Bb ABS REF 07/28/1995 10:07 splib04a r 1206 GECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C101 -
Cookeite CAr-1
Cookeite CAr-1.b 60-104um W1R1Bb ABS REF 07/29/1986 10:31 splib04a r 1217 SECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C102 -
Cookeite CAr-1
Cookeite CAr-1.c <30um W1R1Bb ABS REF 07/30/1986 08:21 splib04a r 1228 GECp013ng

TITLE: Copiapite GDS21 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS21

MINERAL_TYPE: Sulfate

MINERAL: Copiapite (Copiapite group)

FORMULA: Fe+2(Fe+3)4(SO4)6(OH)2*20H2O

FORMULA_NROFF: $Fe^{+2}Fe^{+3}_4(SO_4)_6(OH)_2 \bullet 20H_2O$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: MIT Mineral Collection, Dave Sherman

CURRENT_SAMPLE_LOCATION: Dave Sherman

ULTIMATE_SAMPLE_LOCATION: Dave Sherman

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV (smear mount on quartz, copiapit.out);
40 kV - 30 mA, 7.3-9.5 keV (slurry onto quartz plate, copiapt2.out)
References: JCPDS #35-583, 29-714, 20-659, 19-394, 33-1472, 42-599, 27-77
Found: two members of the copiapite group; perhaps at least one additional phase
Comment: The original pattern (copiapit.out) was barren above 30°; a second pattern showed little above 38° but the strip chart revealed that some reflections at low 2θ are doublets, indicating the presence of two phases having related structures. The intensity ratio is about 5:2. There are seven mineral species in the copiapite group. I have not succeeded in completely indexing the pattern, using the JCPDS data, so I don't know which copiapite species (or solid solutions) are present. EDA analysis (on the SEM) shows a aluminum and silicon in addition Fe, S, and O. This results could indicate that one of the copiapites is Al-rich. Also that a trace of quartz is present (there are what I call insignificant peaks at the positions of the strong quartz (100) and (101) reflections - insignificant because they could just as likely be background noise. A hand-specimen with crystals suitable for single-crystal X-ray diffraction would help us sort out the copiapite species present."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

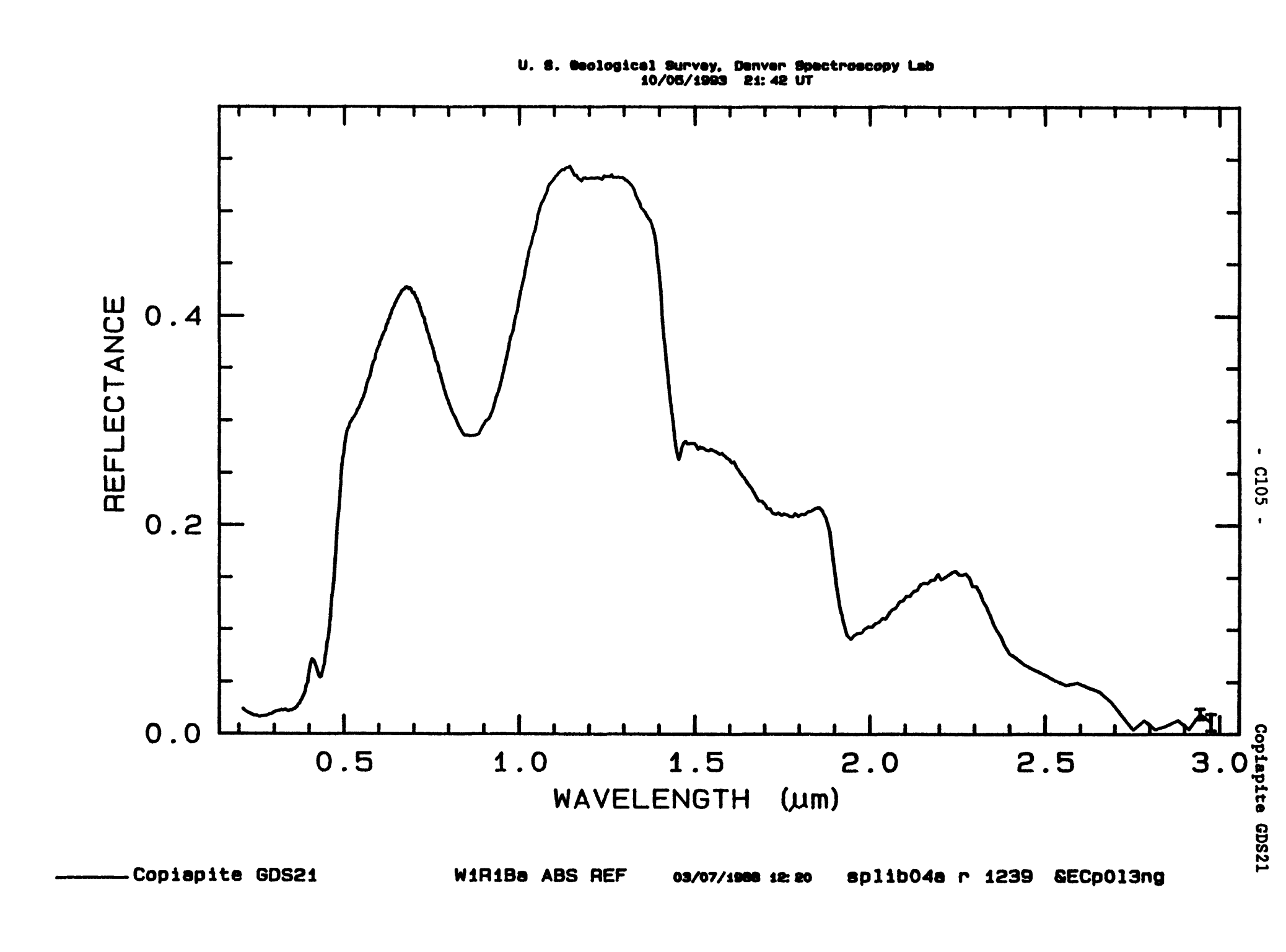
MICROSCOPIC_EXAMINATION:

Yellow color, good rhombic(?) cleavage, inclined extinction, length fast, unable to get good interference figure because of preferred cleavage orientations. Trace pink transparent mineral. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1239	0.2-3.0μm	200	g.s. = 225 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C105 -
Copiapite GDS21
Copiapite GDS21 W1R1Ba ABS REF 03/07/1988 12:20 splib04a r 1239 GECp013ng

TITLE: Coquimbite GDS22 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS22

MINERAL_TYPE: Sulfate

MINERAL: Coquimbite

FORMULA: (Fe+3)2(SO4)3*9H2O

FORMULA_NROFF: $Fe_2^{+3}(SO_4)_3 \bullet 9H_2O$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: MIT Mineral Collection, Dave Sherman

CURRENT_SAMPLE_LOCATION: Dave Sherman

ULTIMATE_SAMPLE_LOCATION: Dave Sherman

SAMPLE_DESCRIPTION:

Dimorphous with Paracoquimbite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS: None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

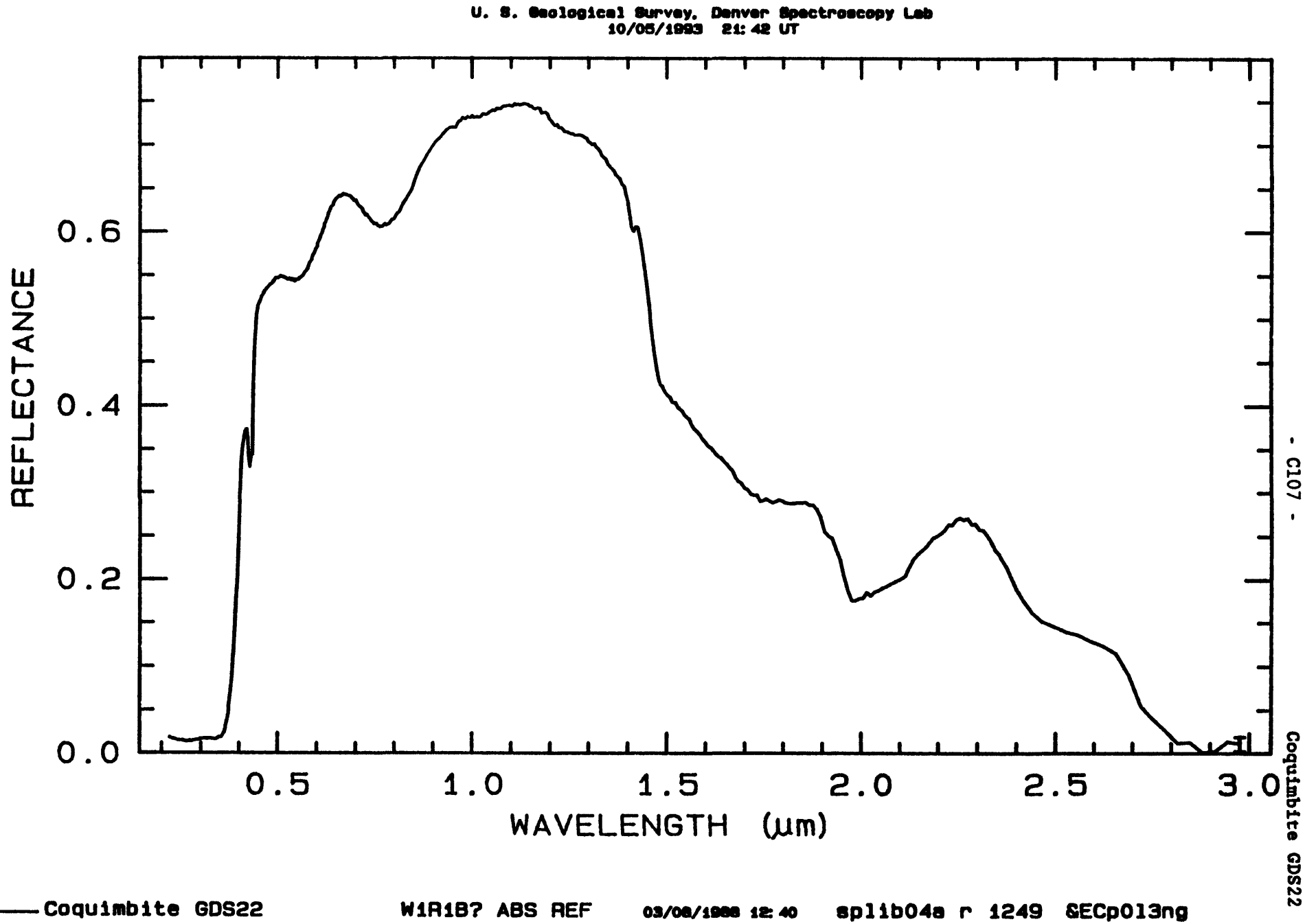
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1249	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C107 -
Coquimbite GDS22
Coquimbite GDS22
W1R1B? ABS REF
03/08/1988 12:40
splib04a r 1249 &ECp013ng

TITLE: Cordierite HS346 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS346

MINERAL_TYPE: Cyclosilicate

MINERAL: Cordierite

FORMULA: Mg2Al4Si5O18

FORMULA_NROFF: $Mg_2Al_4Si_5O_{18}$

COLLECTION_LOCALITY: Guffy, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Sekaninaite. Dimorphous with Indialite.

"C-2 Cordierite 346B--Guffy, Colo. $Al_3(Mg, Fe^{2+})_2 (Si_5AlO_{18})$: Cordierite is a mineral of metamorphic origin usually found in gneisses and crystalline schists, or in contact metamorphic zones. Its spectrum shows a weak Fe^{2+} feature at 0.95 μ, which is in accord with typical cordierite composition, and weak broad hydroxyl and water features at 1.4, 1.9, and 2.2 μ which are not. These latter bands are due to alteration proucts, principally muscovite. Reflectivities I through IV are 50%, 43%, 31%, and 12% at 1.0 μ."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

ULTIMATE_SAMPLE_LOCATION: USGS

XRD_ANALYSIS:

Cordierite + quartz + muscovite + talc (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

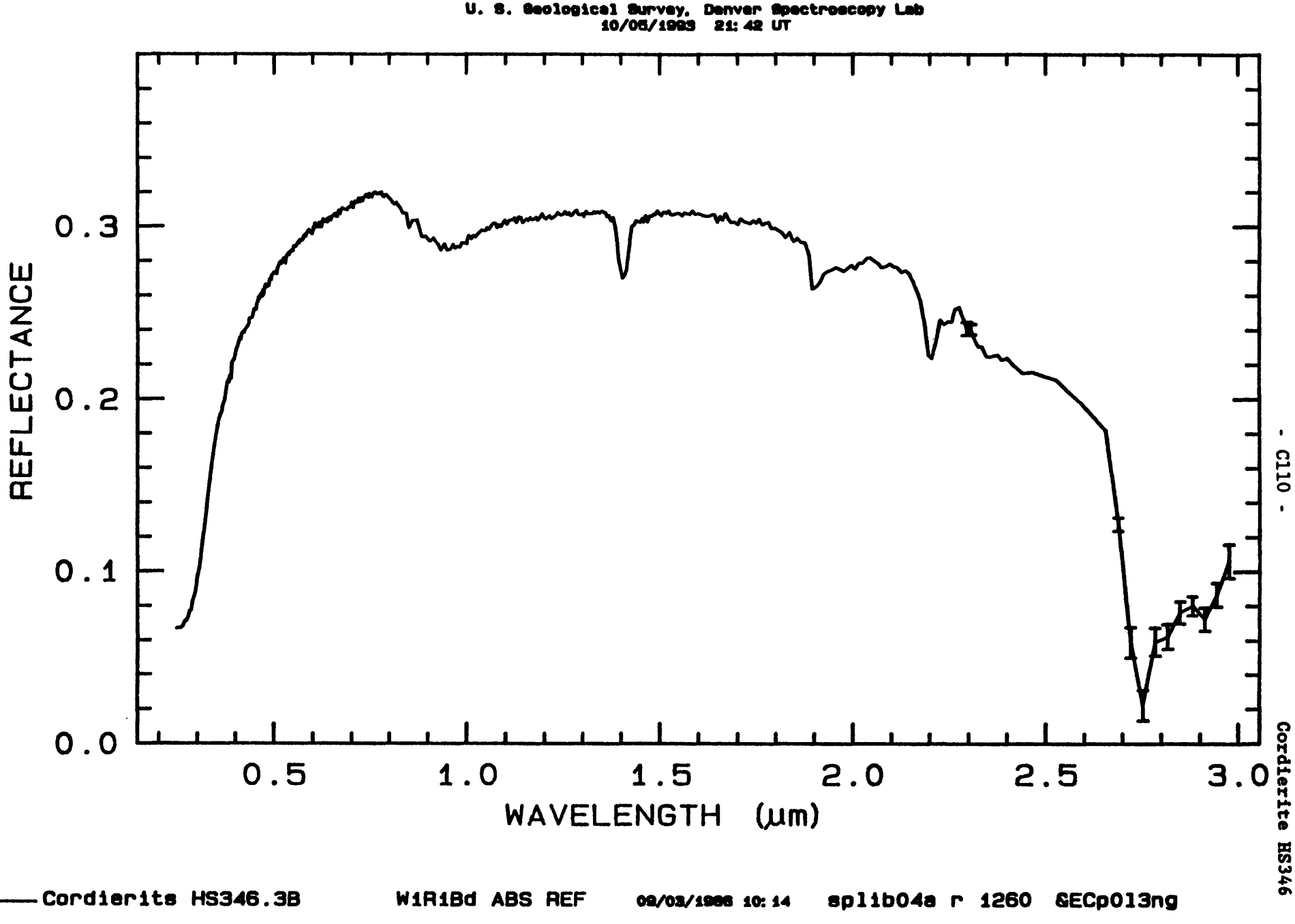
mode:
52-62 vol% cordierite
30-40 vol% mica (clear)
8 vol% opaques as inclusions in cordierite

Because of significant mica contamination, I suggest this sample be deleted from database. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1260	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1989 21:42 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C110 -
Cordierite HS346
Cordierite HS346.3B
W1R1Bd ABS REF
09/03/1986 10:14
splib04a r 1260 &ECp013ng

TITLE: Corrensite CorWa-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: Cor-Wa-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Corrensite (Chlorite + Vermiculite) (Chlorite group)

FORMULA: 1:1 interstrat. trioct. chlorite & vermiculite (Mg,Fe)6(Si,Al)4O10(OH)8 + (Mg,Fe+2,Al)3(Al,Si)4O10(OH)2*4H2O

FORMULA_NROFF: 1:1 interstrat. trioct. chlorite & vermiculite $(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$ + $(Mg,Fe^{+2},Al)_3(Al,Si)_4O_{10}(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Packwood, Washington

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Interstratified trioctahedral phyllosilicate. Regularly interstratified chlorite and vermiculite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Corrensite + albite + quartz, albite ~8 vol. %, quartz ~4%, corrensite coats albite and quartz grains.

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Corrensite is a regular 1:1 interstratification of trioctahedral chlorite and trioctahedral smectite or vermiculite.

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

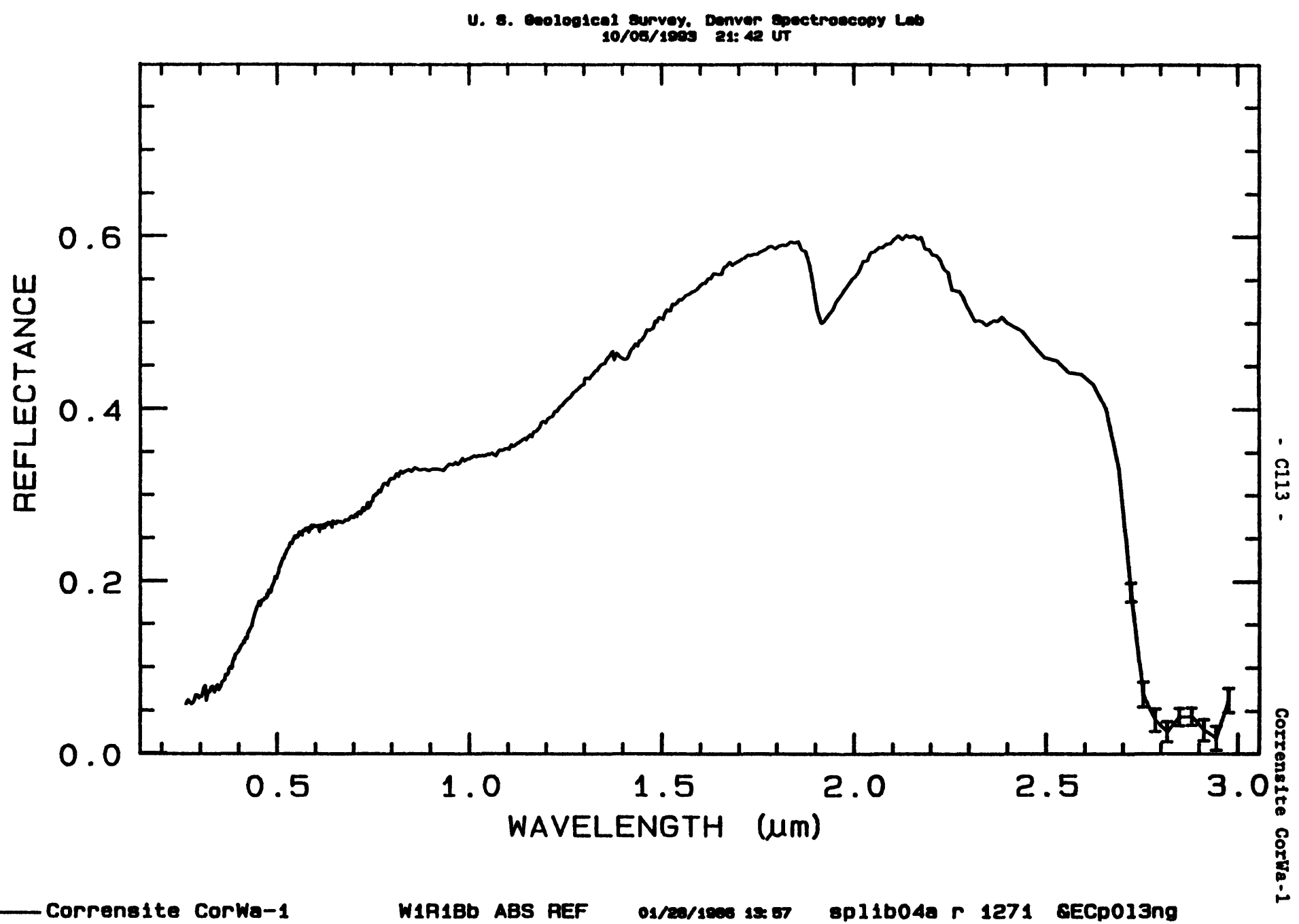
mode:
88 vol% corrensite
8 vol% albite
4 vol% quartz

Corrensite coats albite and quartz grains and occurs as discrete grains.
G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av Reslv.	Power	Comment
LIB_SPECTRA:	splib04a r 1271	0.2-3.0um	200	g.s. = 37 μm	


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C113 -
Corrensite CorWa-1
Corrensite CorWa-1 W1R1Bb ABS REF 01/28/1986 13:57 splib04a r 1271 GECp013ng

TITLE: Corundum HS283 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS283

MINERAL_TYPE: Oxide

MINERAL: Corundum (Hematite group)

FORMULA: Al2O3

FORMULA_NROFF: Al_2O_3

COLLECTION_LOCALITY: Transvaal

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample was prepared from crystals that were brownish near the surface and blueish-green near in the interior.

Hunt, G.R., J.W. Salisbury, C.J. Lenhoff, 1971, Visible and Near-Infrared spectra of Minerals and Rocks: III. Oxides and Hydroxides. Mod. Geol. 2, pp 195-205.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Analysis showed the sample to contain 0.01% Cr; 0.5% Fe; and 0.2% Si, with traces of Ti, V, Mn, Mg, Ca, and Cu. The iron appears to be present on both the ferrous (0.55, 0.45, and 1.1μm absorption features) and ferric (0.7, 0.45, and near 0.4 μm) forms. The Cr^{3+} ion contributes to the 0.4, 0.55 and 0.7 μm (emission) features.

Hunt, G.R., J.W. Salisbury, C.J. Lenhoff, 1971, Visible and Near-Infrared spectra of Minerals and Rocks: III. Oxides and Hydroxides. Mod. Geol. 2, pp 195-205.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

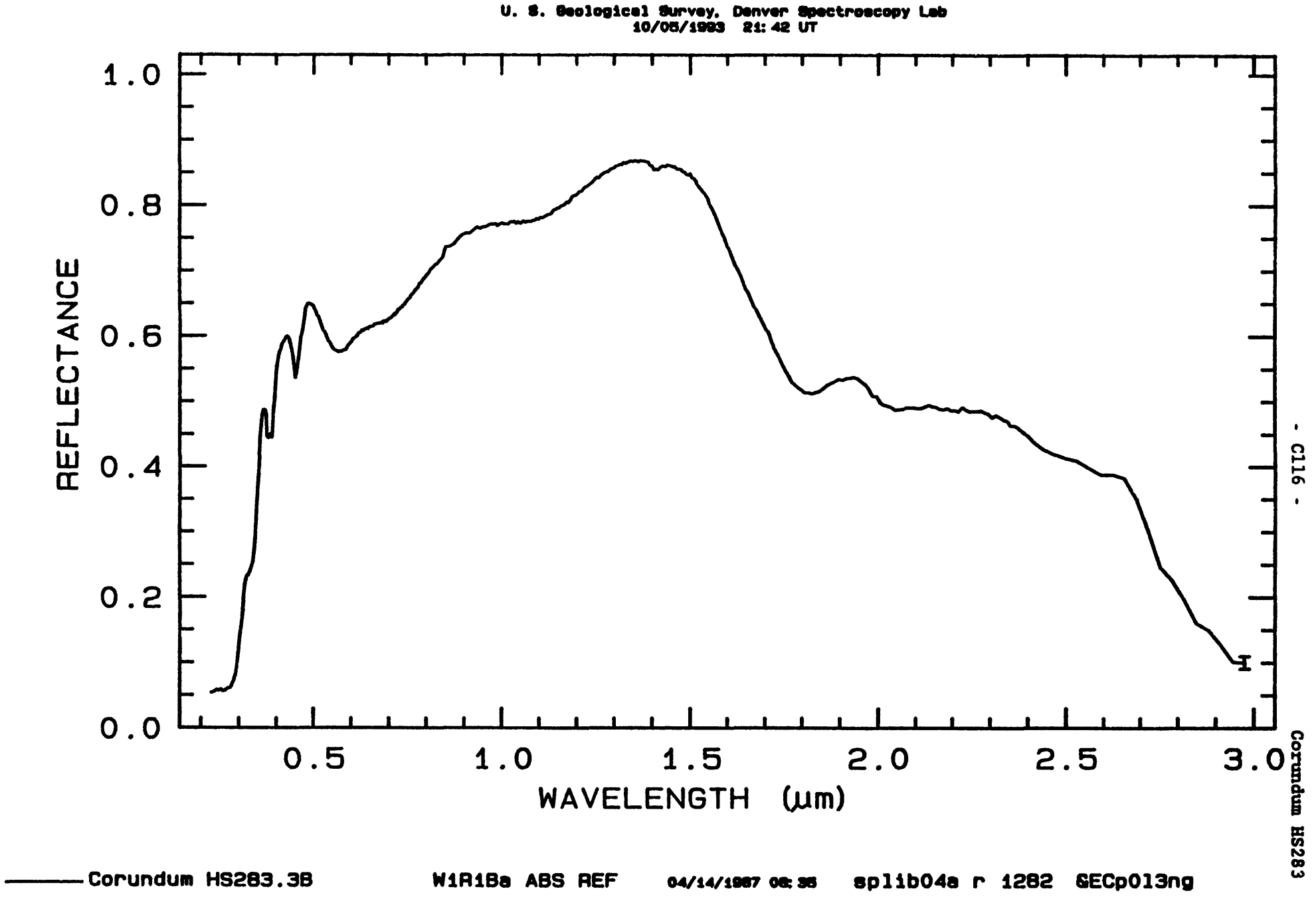
No cleavage, good parting, uniaxial (-), high relief. All consistent with

corrundum. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1282	0.2-3.0μm	200	g.s. = 245 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C116 -
Corundum HS283
Corundum HS283.3B
W1R1Ba ABS REF
04/14/1987 08:36
splib04a r 1282 GECp013ng

TITLE: Covellite HS477 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS477

MINERAL_TYPE: Sulfide

MINERAL: Covellite

FORMULA: CuS

FORMULA_NROFF: CuS

COLLECTION_LOCALITY: Montana

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

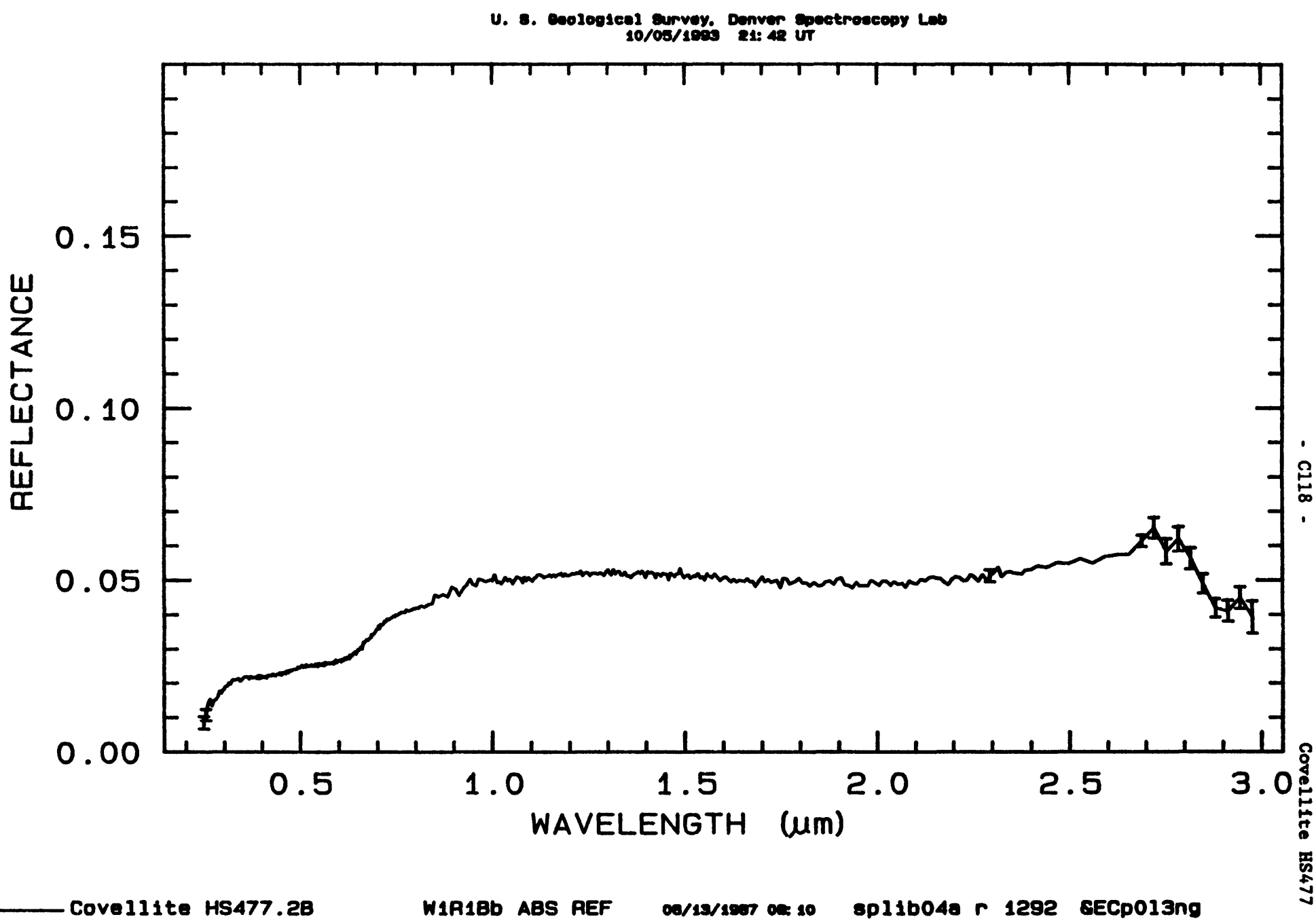
MICROSCOPIC_EXAMINATION:

Lead gray metallic luster, trace white impurities. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1292	0.2-3.0μm	200	g.s. = 17 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C118 -
Covellite HS477
Covellite HS477.2B W1R1Bb ABS REF 06/13/1997 08:10 splib04a r 1292 GECp013ng

TITLE: Cronstedtite M3542 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: M3542

MINERAL_TYPE: Phyllosilicate

MINERAL: Cronstedtite (Kaolinite-Serpentine group)

FORMULA: Fe+22Fe+3(Si,Fe+3)O5(OH)4

FORMULA_NROFF: $Fe_2^{+2}Fe^{+3}(Si,Fe^{+3})O_5(OH)_4$

COLLECTION_LOCALITY: Cornwall, England

ORIGINAL_DONOR: Ed Olsen, Field Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Agrees with cronstedtite pattern PDF 17-470 (Ed Olsen, personal communication).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

The cronstedtite occurs with quartz and may contain as much as 5% quartz (E. Olsen, personal communication). Spectrally there is no evidence of the presence of quartz.

END_COMPOSITION_DISCUSSION.

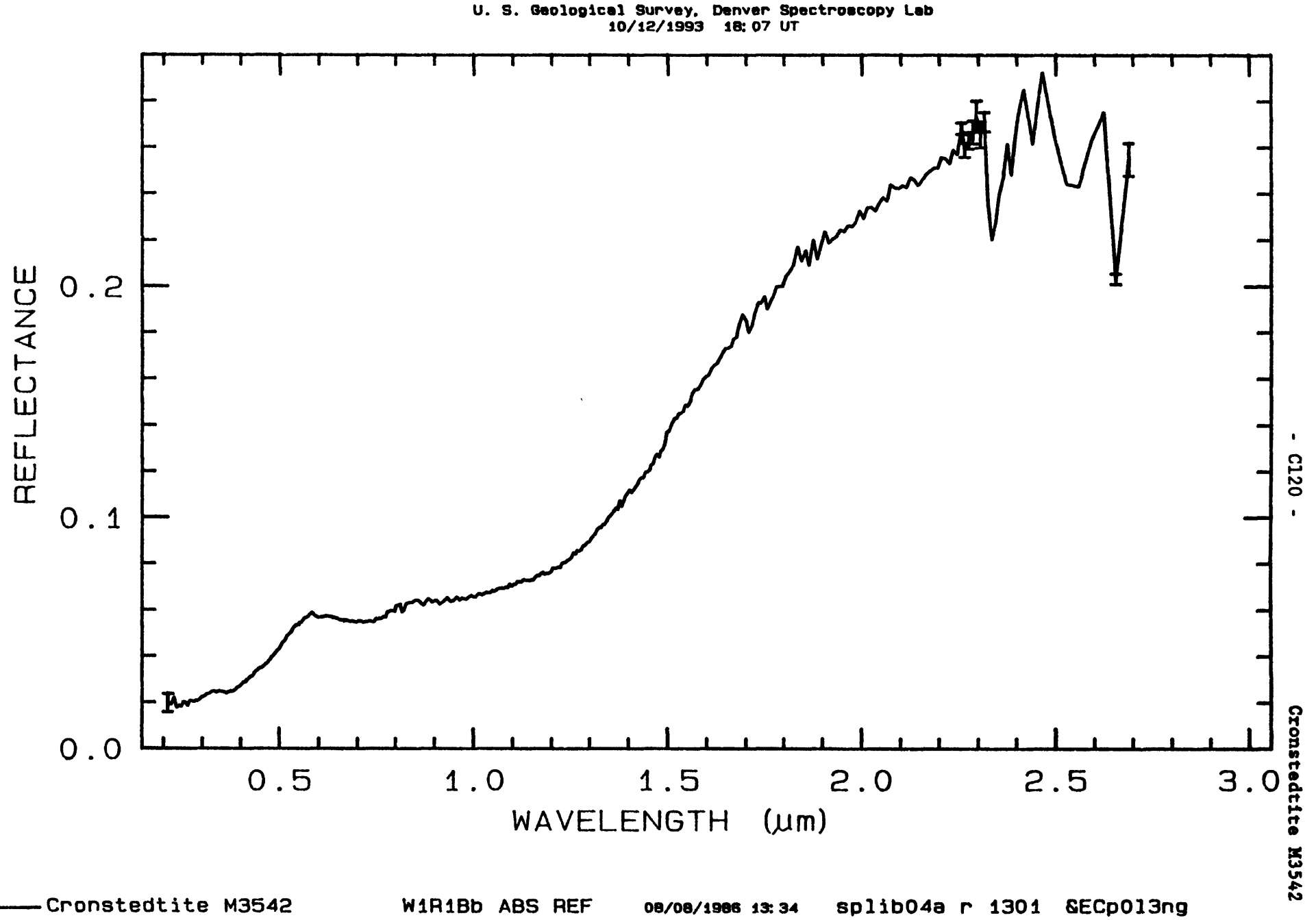
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 1301 0.2-3.0μm 200


U. S. Geological Survey, Denver Spectroscopy Lab
10/12/1993 18:07 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C120 -
Cronstedtite M3542
Cronstedtite M3542 W1R1Bb ABS REF 08/08/1986 13:34 splib04a r 1301 &ECp013ng

TITLE: Cummingtonite HS294 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS294

MINERAL_TYPE: Inosilicate

MINERAL: Cummingtonite (Amphibole group)

FORMULA: (Mg,Fe+2)7Si8O22(OH)2

FORMULA_NROFF: $(Mg,Fe^{+2})_7Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Lead, SD

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Magnesiocummingtonite and Grunerite.

"I-13 Cummingtonite 294B--Lead, S. Dakota. $(Mg, Fe^{2+})_5(Si_8O_{22})(OH)_2$: This amphibole has the same composition as anthophyllite, but is monoclinic rather than orthorhombic in crystal form. Its spectrum is a relatively smooth curve in which there is no evidence of hydroxyl bands, but in which the main feature is a broad ferrous iron band near 1.0μ. The lack of hydroxyl bands in what appears to be a rather pure amphibole in hand specimen is something that we cannot explain. Reflectivities I through IV are 40%, 24%, 12%, and 8% at 0.75μ, and 32%, 15%, 6%, and 4% at 1.0μ. The sample is a dar greenish gray. The low reflectivities are a function of this sample darkness, not of contamination with opaques."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Cummingtonite + quartz + biotite + chlorite + others (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

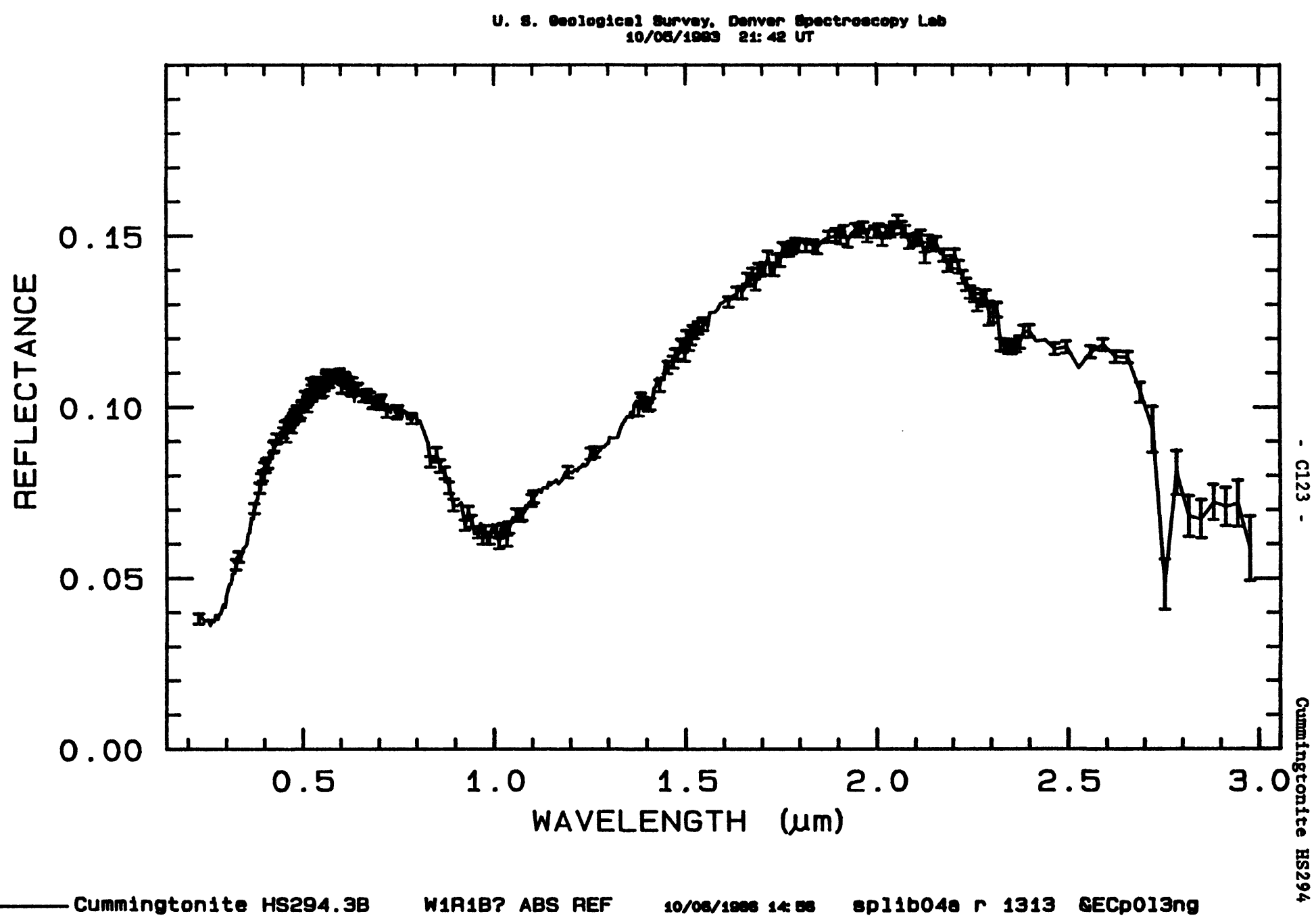
MICROSCOPIC_EXAMINATION:

Sample has two different amphiboles, one green and the other clear in about equal proportions. Sample also contains significant quartz and trace garnet? G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1313	0.2-3.0μm	200	


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 21:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C123 -
Cummingtonite HS294
Cummingtonite HS294.3B W1R1B? ABS REF 10/06/1996 14:58 splib04a r 1313 GECp013ng

TITLE: Cuprite HS127 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS127

MINERAL_TYPE: Oxide

MINERAL: Cuprite

FORMULA: Cu2O

FORMULA_NROFF: Cu_2O

COLLECTION_LOCALITY: Butte, Montana

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This is a relatively pure cuprite sample (analysis indicate 0.008% by weight Fe). Transition of the cupric ion in the cuprite crystal field results in absorption feature at 0.85μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Mod. Geol., 2, pp. 195-205.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

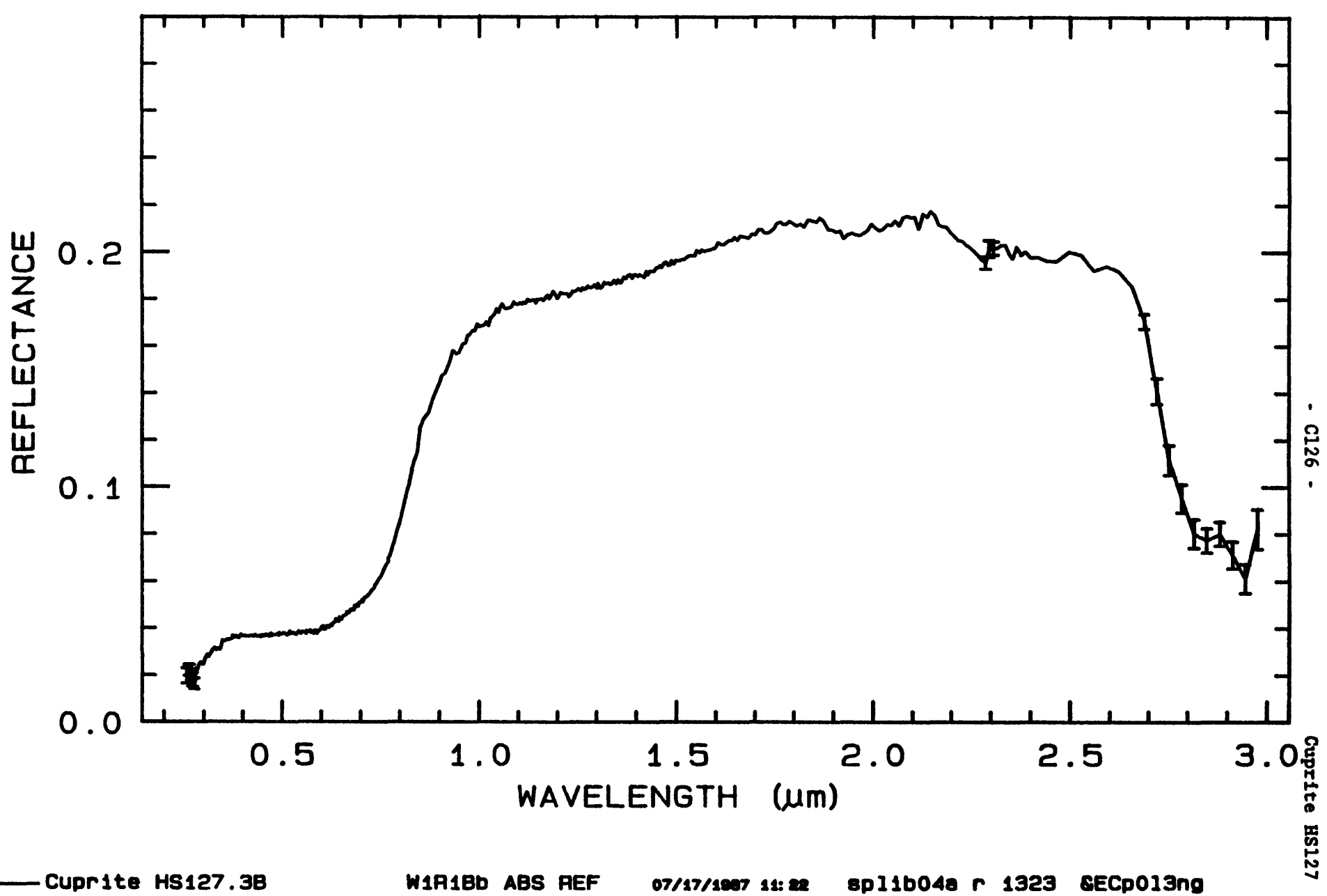
mode:
77 vol% cuprite
10 vol% quartz
10 vol% azurite-malachite
3 vol% white soft mineral

Red metallic luster is diagnostic of cuprite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1323	0.2-3.0μm	200	g.s. = 269 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 21:42 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C126 -
Cuprite HS127
Cuprite HS127.3B
W1R1Bb ABS REF
07/17/1987 11:22
splib04a r 1323 &ECp013ng

The U. S. Geological Survey, Digital Spectral Library: Version 1: 0.2 to 3.0 μm

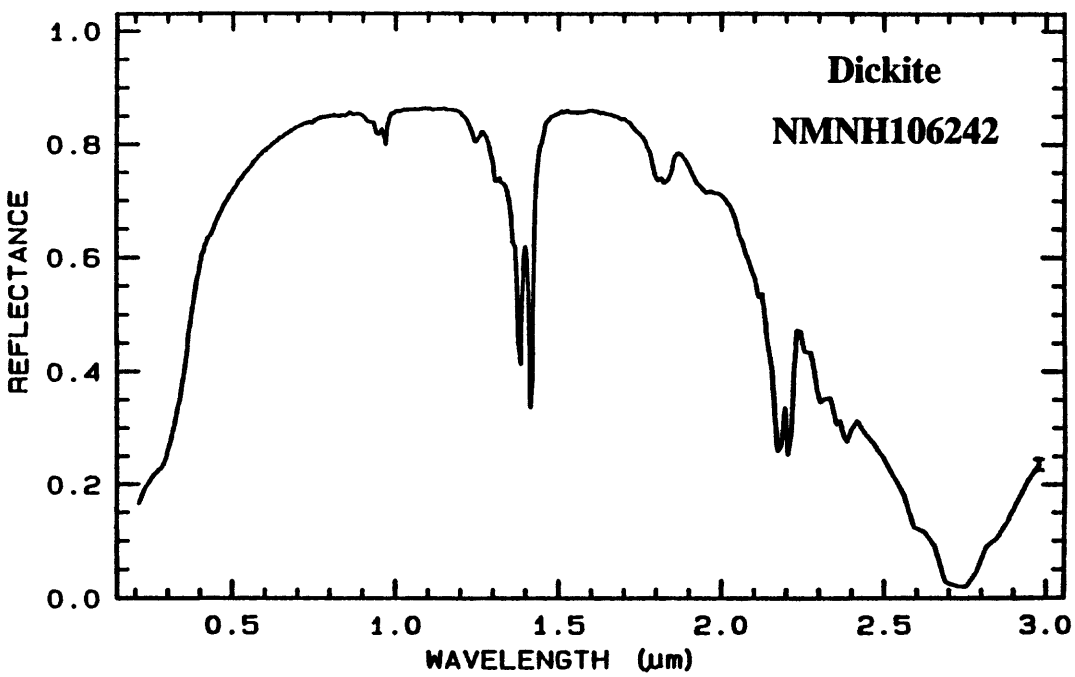
Roger N. Clark, Gregg A. Swayze, Andrea J. Gallagher,

Trude V.V. King, and Wendy M. Calvin

U.S. Geological Survey

Open File Report 93-592

1993



Volume 2: D - K

TITLE: Datolite HS442 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS442

MINERAL_TYPE: Nesosilicate

MINERAL: Datolite

FORMULA: CaBSiO4(OH)

FORMULA_NROFF: $CaBSiO_4(OH)$

COLLECTION_LOCALITY: Connecticut

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"N-15 Datolite 442B--Conn. $CaB(SiO_4)(OH)$: Datolite is typical of a mineral of secondary origin found in cavities in basaltic lavas and similar rocks. Its spectrum is completely dominated by well-resolved features near 1.02 μ , 1.26 μ, 1.48 μ, 1.74 μ, and 1.80 μ as well as multiple bands between 2.1 and 2.5 μ. The overall appearance of this spectrum from 0.6 to 1.85 μ is essentially identical with that of gypsum (see Part IV, p. 7-8, spectra SS 11-A through D) including the unusual 1.7 μ feature, although all the features in datolite are shifted slightly to longer wavelengths from the corresponding positions in gypsum. However, in datolite the intense 1.9 μ feature, indicative of the presence of molecular water is completely absent, and yet the spectrum of gypsum is explained entirely in terms of its molecular water of crystallization, with the 1.7 μ feature involving librational modes of water. It would seem therefore, in the absence of water that the bands short of 1.85 μ in datolite must be due to combination modes of at least two different types of OH stretching vibrations. The bands between 2.1 and 2.5 μ can be explained in terms of combination of these OH stretching modes with lattice modes with additional contributions from carbonate vibrations (due to calcite, which is present as an impurity) and possibly from combinations involving the boron-oxygen stretching modes (see Part V, p. 130-131, spectra B-1 through B-4)."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure datolite (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

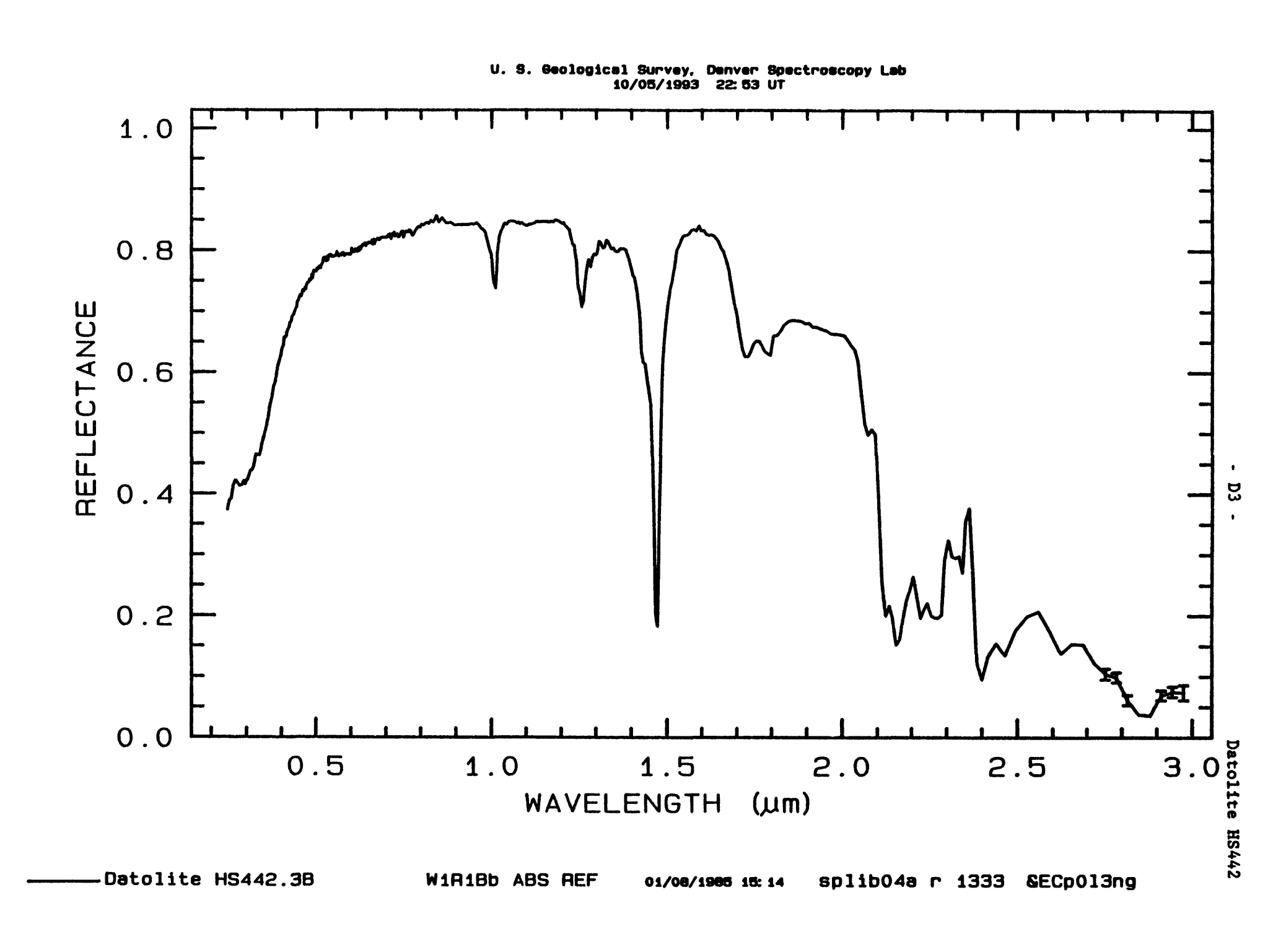
Mode:
98 - 99 vol% Datolite
1 - 2 vol% Calcite
tr opaques

Biaxial (-), lacks cleavage, conchoidal fracture. All consistent with datolite. Sample should be washed with HCl to remove carbonate. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1333	0.2-3.0μm	200	g.s.= 266 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- D3 -
Datolite HS442
Datolite HS442.3B
W1R1Bb ABS REF
01/08/1986 15:14
splib04a r 1333 &ECp013ng

TITLE: Datolite SU51399 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SU51399

MINERAL_TYPE: Nesosilicate

MINERAL: Datolite

FORMULA: CaBSiO4(OH)

FORMULA_NROFF: $CaBSiO_4(OH)$

COLLECTION_LOCALITY: None

ORIGINAL_DONOR: None

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

None

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:
95 vol% Datolite
5 vol% Calcite

Bimodal Grain size distribution:
pop1 sz = 237 μm at 80 vol%
pop2 sz = 15 μm at 20 vol%

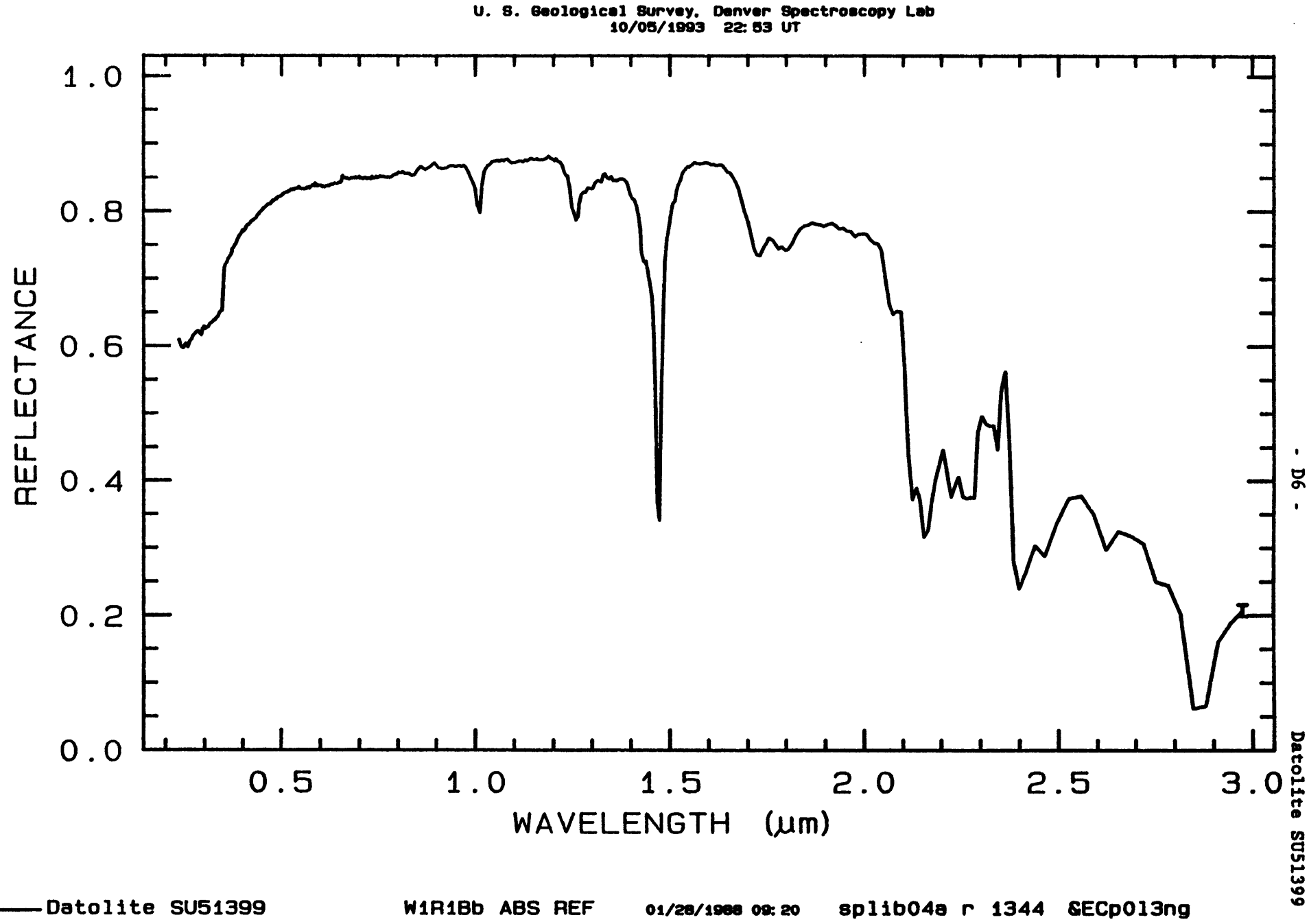
avg gr sz = 210 μm

Biaxial (-), no cleavage, conchoidal fracture, consistent with Datolite. Difficult to optically differentiate Datolite from calcite under microscope. Vol% calcite estimated from number of grains that fizzed with HCl. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1344	0.2-3.0μm	200	g.s.= 210 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Datolite SU51399
W1R1Bb ABS REF
01/28/1988 09:20
splib04a r 1344 &ECp013ng

TITLE: Desert_Varnish GDS141 (Entrada) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS141

MINERAL_TYPE: Mineral mixture (Birnessite + hematite and clays)

MINERAL: Desert_Varnish on Entrada Sandstone

FORMULA: Na4Mn14O27*9H2O + alpha-Fe2O3

FORMULA_NROFF: $Na_4Mn_{14}O_{27}\bullet 9H_2O + \alpha\text{-}Fe_2O_3$

COLLECTION_LOCALITY: Arches National Park, Utah

ORIGINAL_DONOR:

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Desert varnish invariably consists of birnessite in intimate mixture with hematite and large amounts of clay minerals. The clays are generally of the illite-montmorillonite type with minor kaolinite, but in several samples this concentration ratio is reversed."

Potter, R.M. and G.R. Rossman, 1979, Mineralogy of manganese dendrites and coatings. American Mineralogist, v.64, pp 1219-1226.

This sample is a coating on the Entrada Sandstone.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

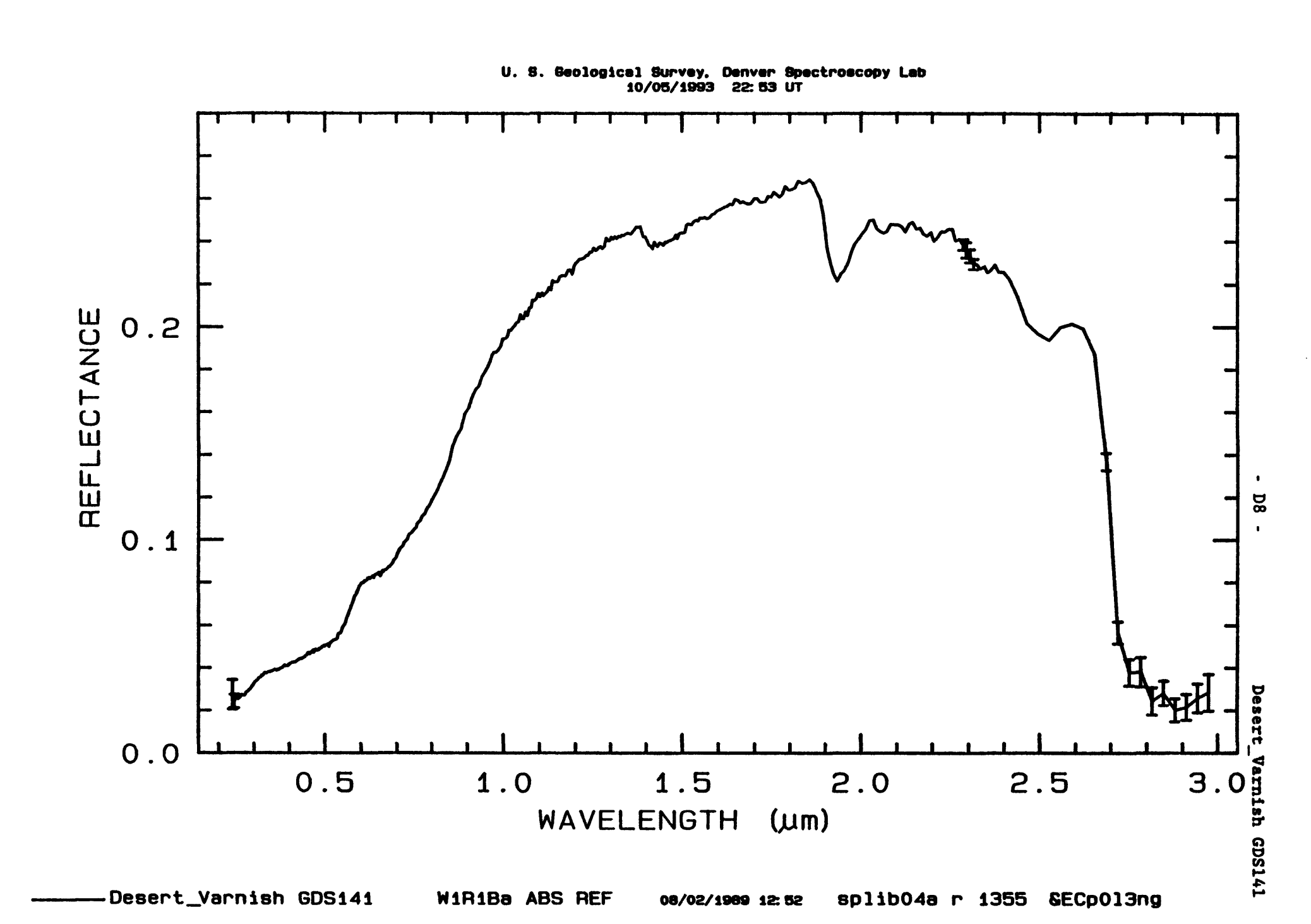
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1355	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Desert_Varnish GDS141
Desert_Varnish GDS141 W1R1Ba ABS REF 08/02/1989 12:52 splib04a r 1355 &ECp013ng

TITLE: Desert_Varnish GDS78A DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS78A

MINERAL_TYPE: Mineral mixture (Birnessite + hematite and clays)

MINERAL: Desert_Varnish

FORMULA: Na4Mn14O27*9H2O + alpha-Fe2O3 + clays

FORMULA_NROFF: $Na_4Mn_{14}O_{27}\bullet 9H_2$ + α-Fe_2O_3

COLLECTION_LOCALITY: Stoddard Wells, CA

ORIGINAL_DONOR: George Rossman, California Inst. of Techology

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Desert varnish invariably consists of birnessite in intimate mixture with hematite and large amounts of clay minerals. The clays are generally of the illite-montmorillonite type with minor kaolinite, but in several samples this concentration ratio is reversed."

This sample is a coating on desert pavement rhyolite and quartz cobbles.

Potter, R.M. and G.R. Rossman, 1979, Mineralogy of manganese dendrites and coatings. American Mineralogist, v.64, pp 1219-1226.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	34.35 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.78 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	20.01 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	10.96 wt%	NROFF:	FeO
COMPOSITION:	MnO:	22.63 wt%	NROFF:	MnO
COMPOSITION:	MgO:	2.43 wt%	NROFF:	MgO
COMPOSITION:	BaO:	1.22 wt%	NROFF:	BaO
COMPOSITION:	CaO:	1.28 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.23 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	1.89 wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	1.10 wt%	NROFF:	P_2O_5
COMPOSITION:	----------			
COMPOSITION:	Total:	96.88 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

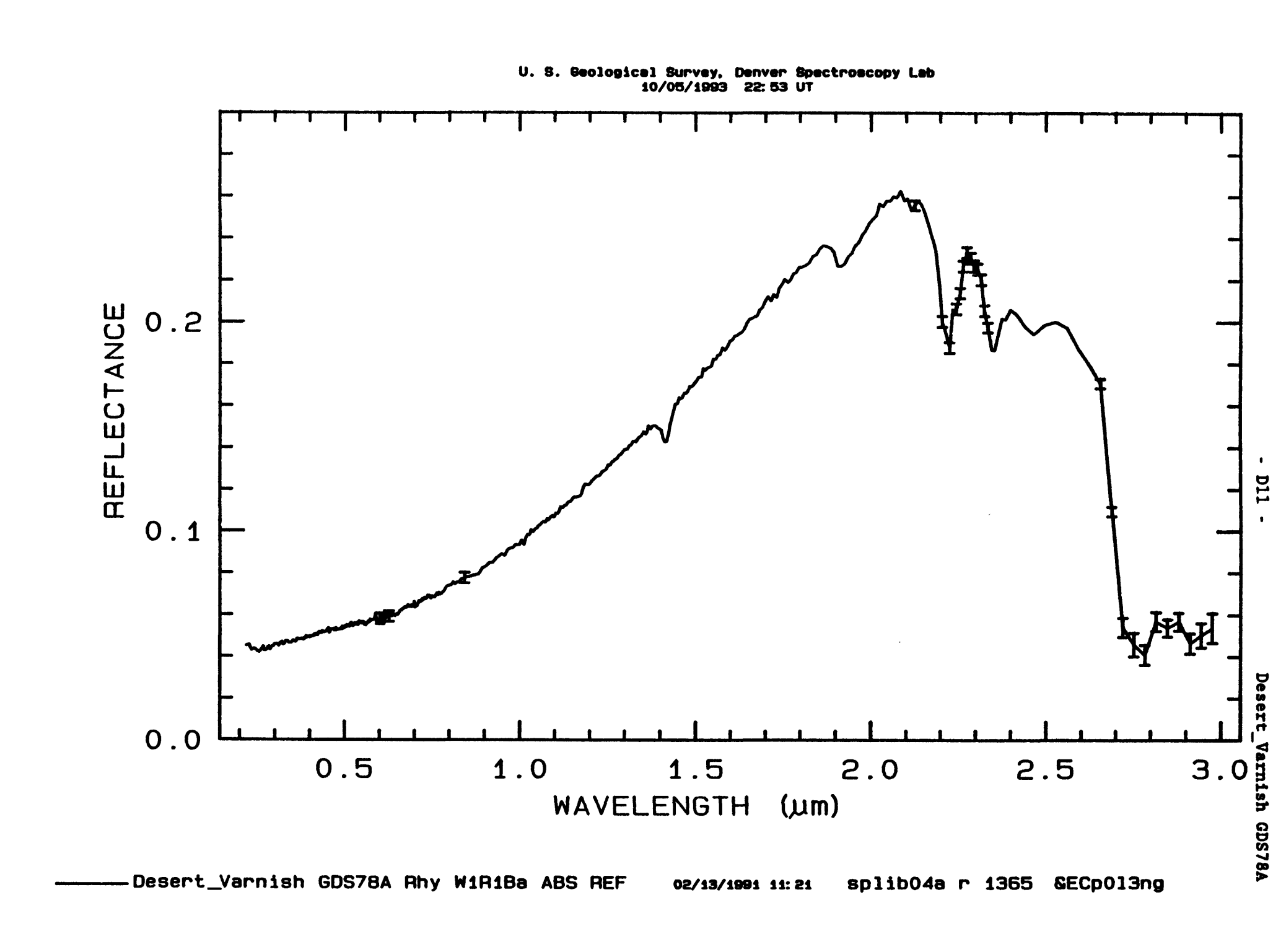
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1365	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- D11 -
Desert_Varnish GDS78A
Desert_Varnish GDS78A Rhy W1R1Ba ABS REF 02/13/1991 11:21 splib04a r 1365 &ECp013ng

TITLE: Desert_Varnish ANP90-14 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: AN090-14

MINERAL_TYPE: Mineral mixture (Birnessite + hematite and clays)

MINERAL: Desert_Varnish

FORMULA: Na4Mn14O27*9H2O + alpha-Fe2O3 + clays

FORMULA_NROFF: $Na_4Mn_{14}O_{27} \cdot 9H_2O + \alpha\text{-}Fe_2O_3$

COLLECTION_LOCALITY: Arches National Park

ORIGINAL_DONOR: Greg Swayze

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Desert varnish invariably consists of birnessite in intimate mixture with hematite and large amounts of clay minerals. The clays are generally of the illite-montmorillonite type with minor kaolinite, but in several reversed."

Potter, R.M. and G.R. Rossman, 1979, Mineralogy of manganese dendrites and coatings. American Mineralogist, v.64, pp 1219-1226.

This sample is a coating on sandstone.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

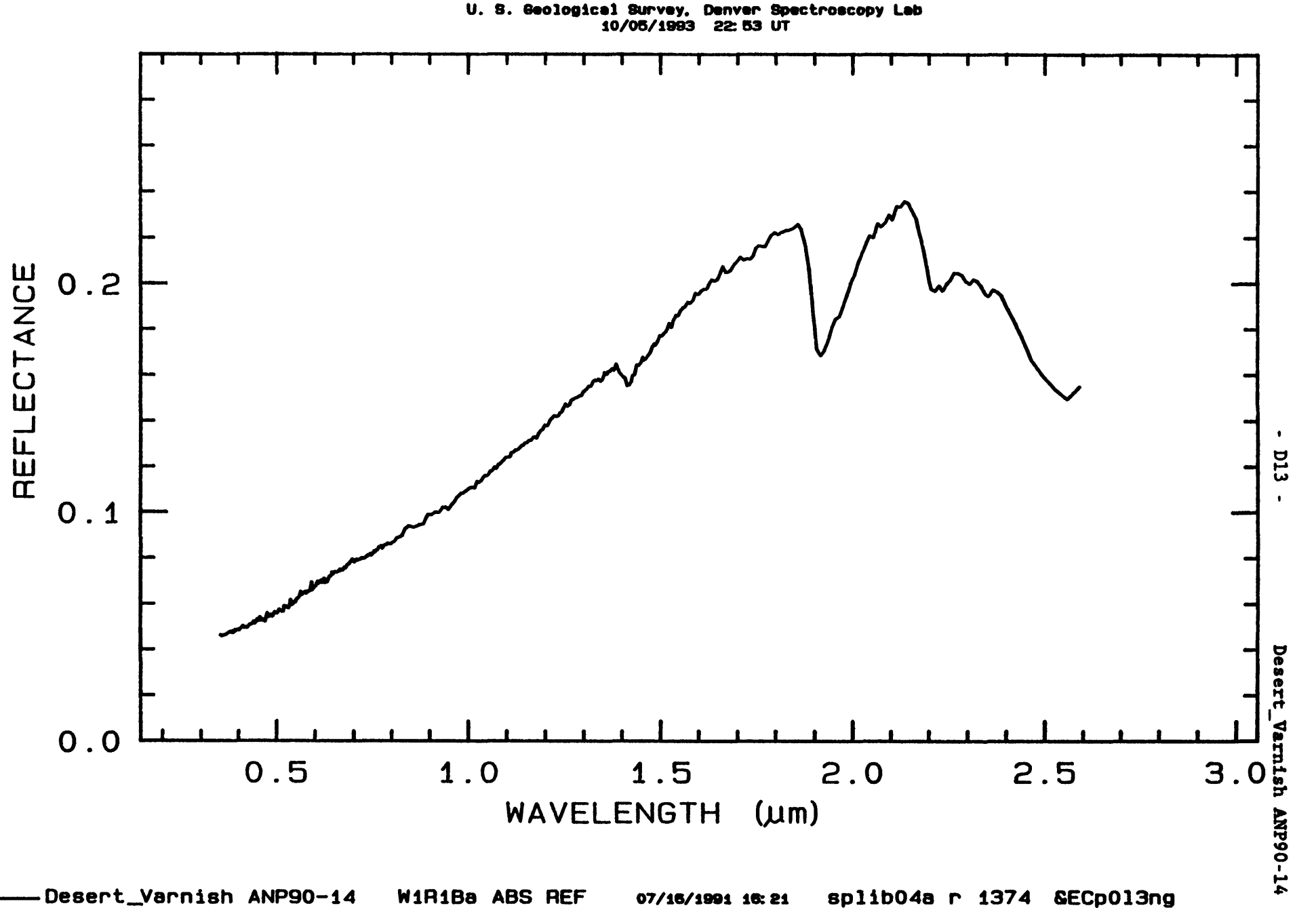
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1374	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- D13 -
Desert_Varnish ANP90-14
Desert_Varnish ANP90-14 W1R1Ba ABS REF 07/16/1991 16:21 splib04a r 1374 &ECp013ng

TITLE: Diaspore HS416 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS416

MINERAL_TYPE: Hydroxide

MINERAL: Diaspore

FORMULA: AlO(OH)

FORMULA_NROFF: AlO(OH)

COLLECTION_LOCALITY: Rosebud, MO

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Dimorph. with Boehmite. This sample is impure and is a mixture of bauxite minerals including gibbsite, kaolinite and a very small amount of a ferruginous material. Longward of 1.3μm the reflectance of the sample decreases. The sample has a 1.4 μm absorption (overtone of the hydroxyl) and a 1.8 μm absorption which is believed to be a displaced 1.9μm resulting from the presence of a free H_2O molecule."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure diaspore.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:
pop 1 = 268 μm at 92 vol%
pop 2 = 10 μm at 8 vol%

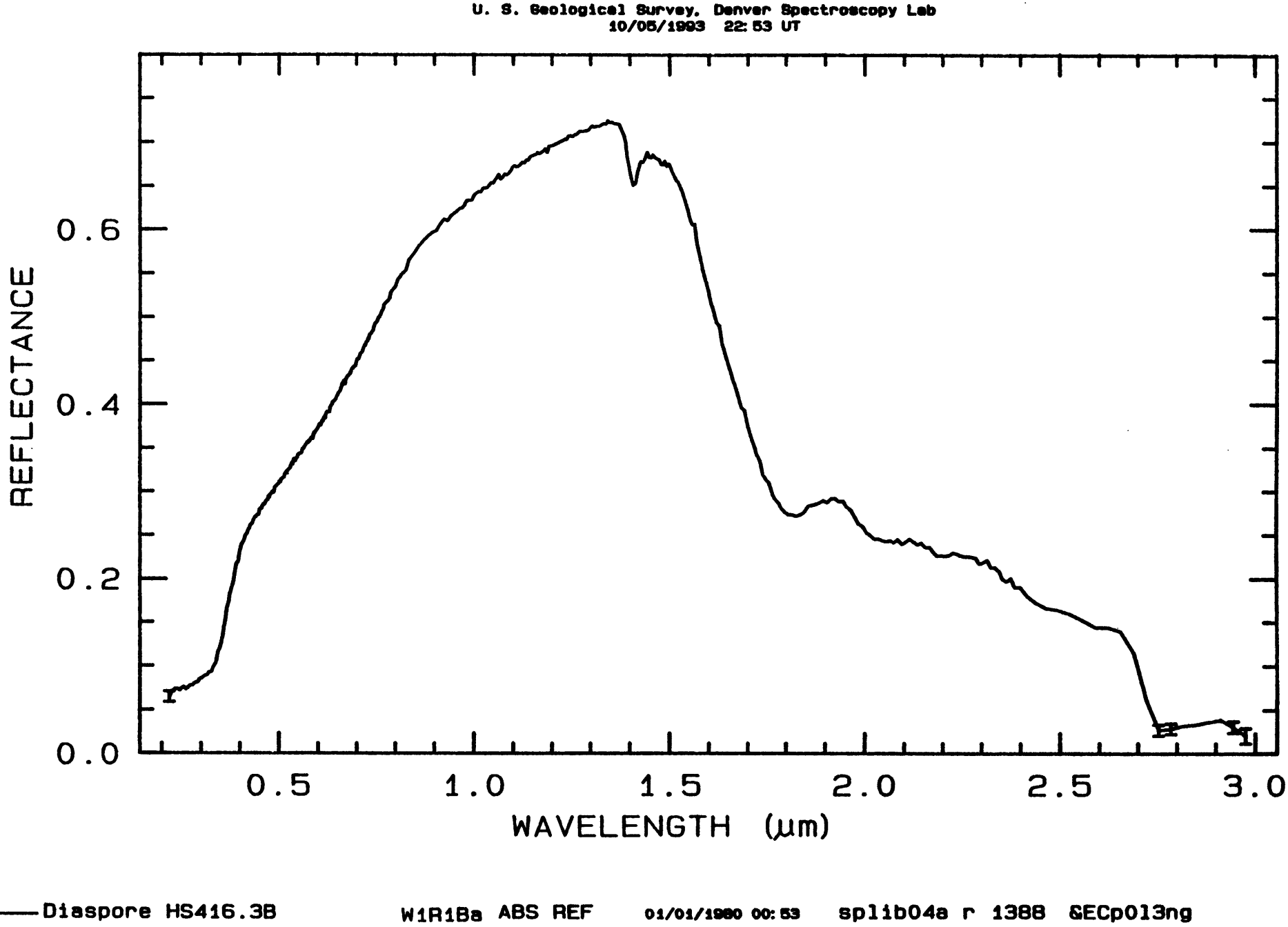
avg grain size = 257 μm

Small grains coat larger grains. Large grains are translucent and this makes it difficult to obtain optical properties. I recommend that this sample be x-rayed for proper identification. No fizz with HCl. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1388	0.2-3.0μm	200	g.s. = 257 μm



Diaspore HS416

TITLE: Dickite NMNH106242 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH106242

MINERAL_TYPE: Phyllosilicate

MINERAL: Dickite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Red Mountain, Colorado

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Halloysite, Kaolinite and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure, N. Vergo.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

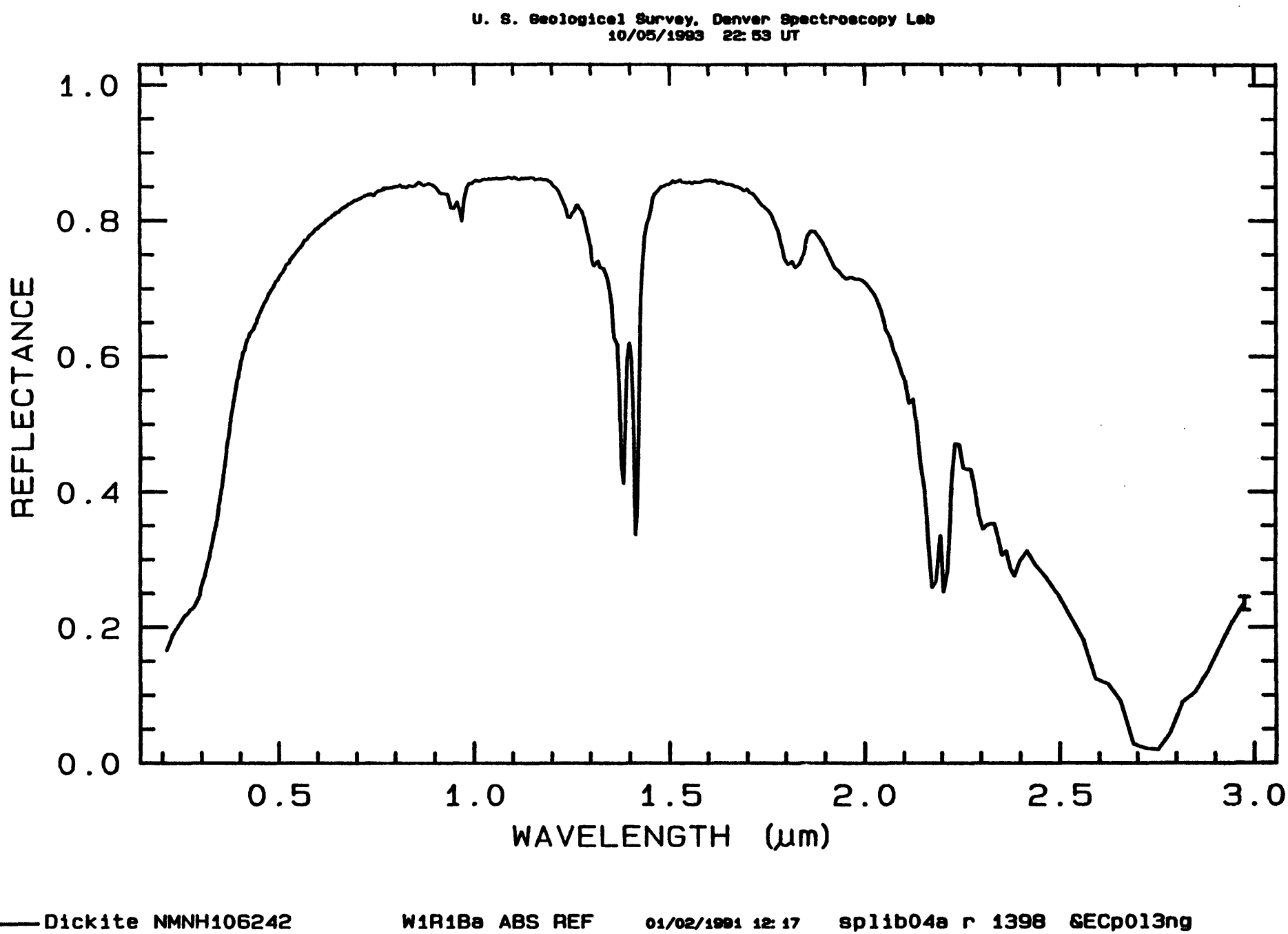
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1398	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Dickite NMNH106242
W1R1Ba ABS REF
01/02/1991 12:17
spl1b04a r 1398 &ECp013ng

TITLE: Dickite NMNH46967 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH46967

MINERAL_TYPE: Phyllosilicate

MINERAL: Dickite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Zuni Mine, Colorado

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Halloysite, Kaolinite, and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure, N. Vergo.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

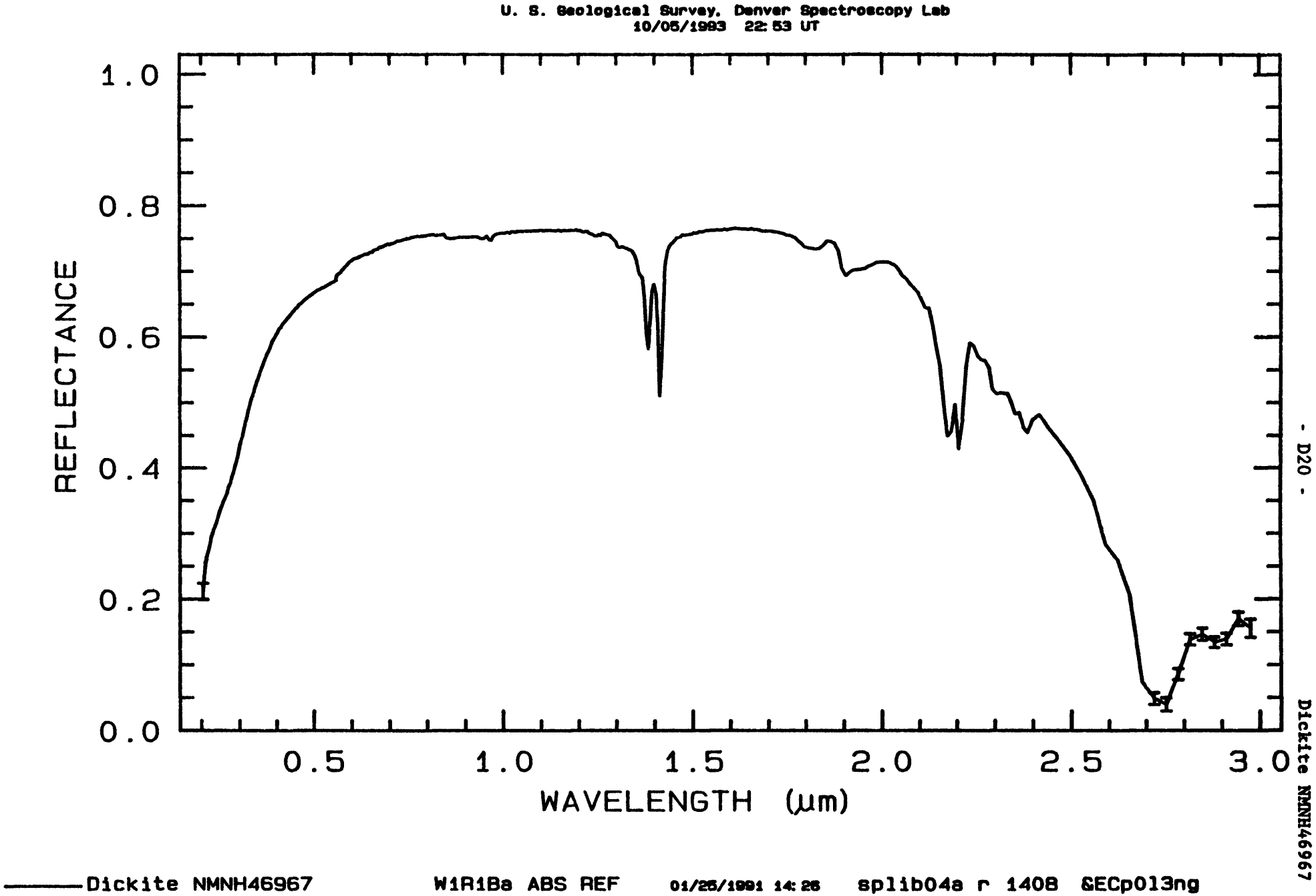
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1408	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- D20 -
Dickite NMNH46967
Dickite NMNH46967 W1R1Ba ABS REF 01/25/1991 14:28 splib04a r 1408 &ECp013ng

TITLE: Diopside HS317 (Cr) Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS317

MINERAL_TYPE: Inosilicate

MINERAL: Diopside (Pyroxene group)

FORMULA: CaMgSi2O6

FORMULA_NROFF: $CaMgSi_2O_6$

COLLECTION_LOCALITY: Finland

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Hedenbergite and with Johannsenite.

"This sample contains both ferrous and ferric iron which produce the absorptions at 0.45, 0.65 and 1.07μm. Ferrous iron substitutes for Mg in diopside. Cr also substitutes for Mg in this sample."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Primarily pyroxene; best matches are augite and diopside, but this is not definitive. Small amounts of other phases - pectolite, polyhalite, lazulite are possible contributors to residual.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
94 vol% Diopside

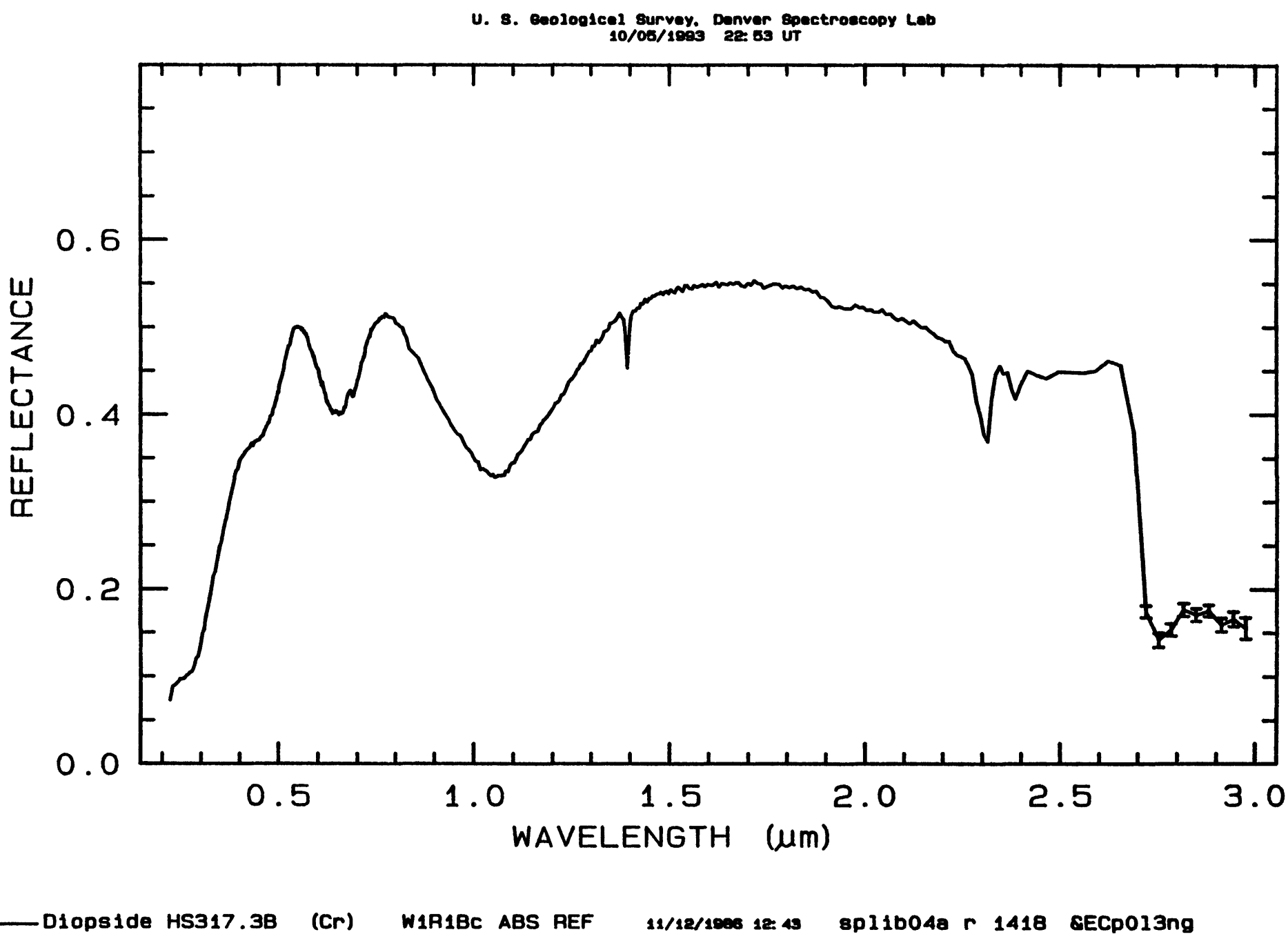
5 vol% Calcite (estimated by fizz in HCl)
1 vol% magnetite (as inclusions in diopside grains)

Very pale green color, some diopside grains white, two cleavages at nearly right angles, inclined extinction, biaxial (+), consistent with diopside. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1418	0.2-3.0μm	200	g.s.= 290 μm



Diopside HS317

TITLE: Diopside HS15 Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS15

MINERAL_TYPE: Inosilicate

MINERAL: Diopside (Pyroxene group)

FORMULA: CaMgSi2O6

FORMULA_NROFF: $CaMgSi_2O_6$

COLLECTION_LOCALITY: Edwards, NY

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Hedenbergite and with Johannsenite.

"This is not a pure magnesian diopside. An absorption bands at 1.05 indicates the presence of ferrous iron in the crystal structure. A small amout of water in fluid inclusions is indicated by the weak H_2O absorptions."

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS: None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

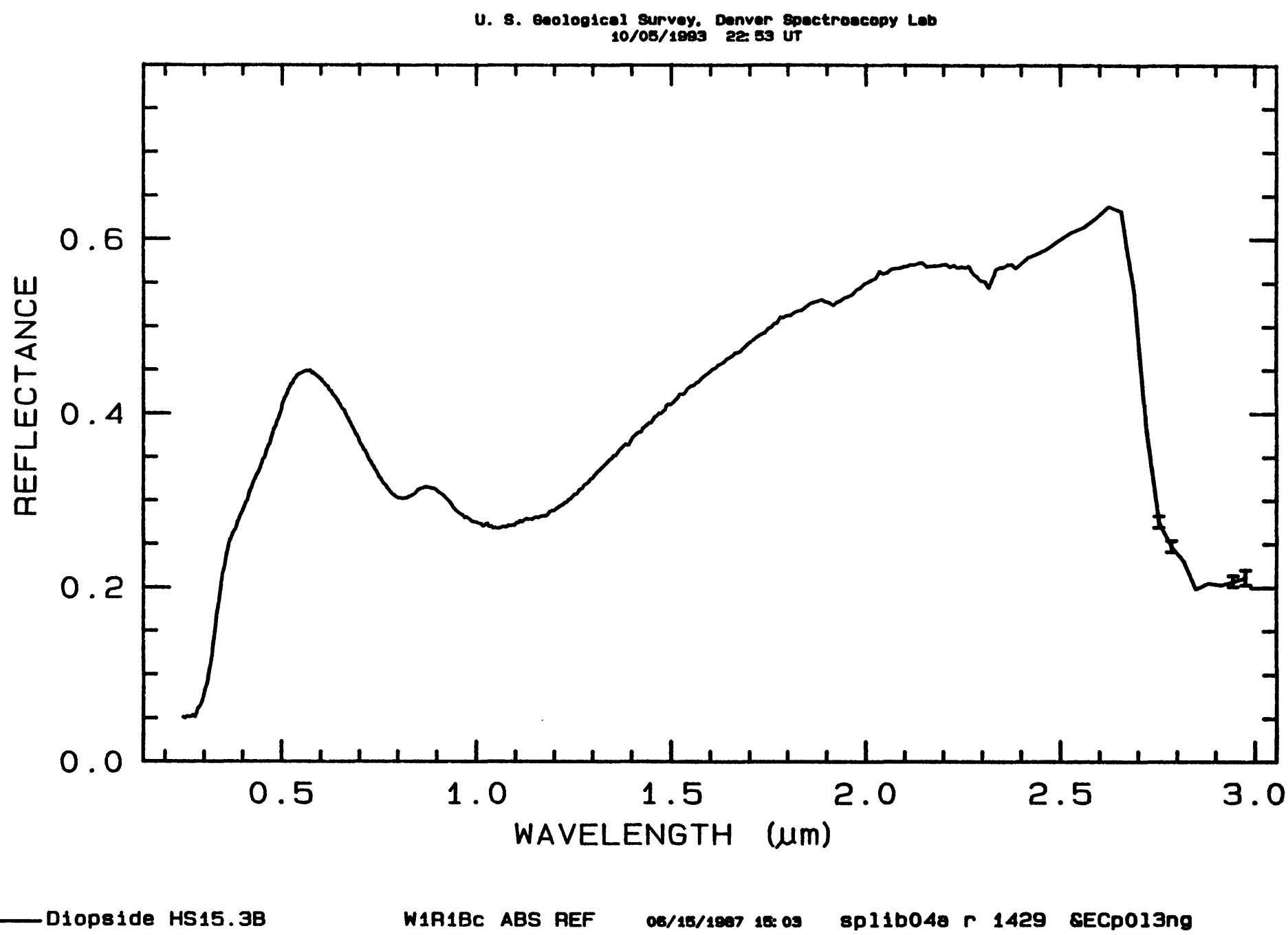
av gr sz = 295 μm

Pure sample. Large grains 10% surface coated with 10μm diopside grains. Large diopside grains have 8-10 vol% fluid inclusions, inclined extinction, high relief, biaxial (+), two cleavages at nearly right angles, all consistent with diopside. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1429	0.2-3.0μm	200	g.s.= 295 μm



Diopside HS15

TITLE: Diopside NMNHR18685 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNHR18685

MINERAL_TYPE: Inosilicate

MINERAL: Diopside (Pyroxene group)

FORMULA: CaMgSi2O6

FORMULA_NROFF: $CaMgSi_2O_6$

COLLECTION_LOCALITY: DeKalb, New York

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Hedenbergite and with Johannsenite.

"Results of petrographic examination: Most of the sample, which is green and about 13mm x 10mm x 6mm is clean, fresh. There is one area which is eroded and weathered and probably impure. Crushed sample was hand-picked to avoid impurities. There is a moderate amount of weathering and alteration. Alteration is brown in color (limonite?)."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Diopside plus a trace of quartz. Spectra show no quartz bands, but do show a trace of carbonate in reflectance of 74-250μ and 0-74μ size ranges.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Diopside + tr. quartz (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	54.77	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.05	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	0.49	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	0.87	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.06	wt%	NROFF: MnO
COMPOSITION:	MgO:	18.26	wt%	NROFF: MgO
COMPOSITION:	CaO:	25.60	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.39	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.01	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	100.49	wt%	
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S
COMPOSITION:	New Total:		wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analysis showed sample to be homogeneous within and between grains examined. Average of 12 analyses indicates that this sample is close to end member composition.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:

95 vol% diopside
5 vol% quartz

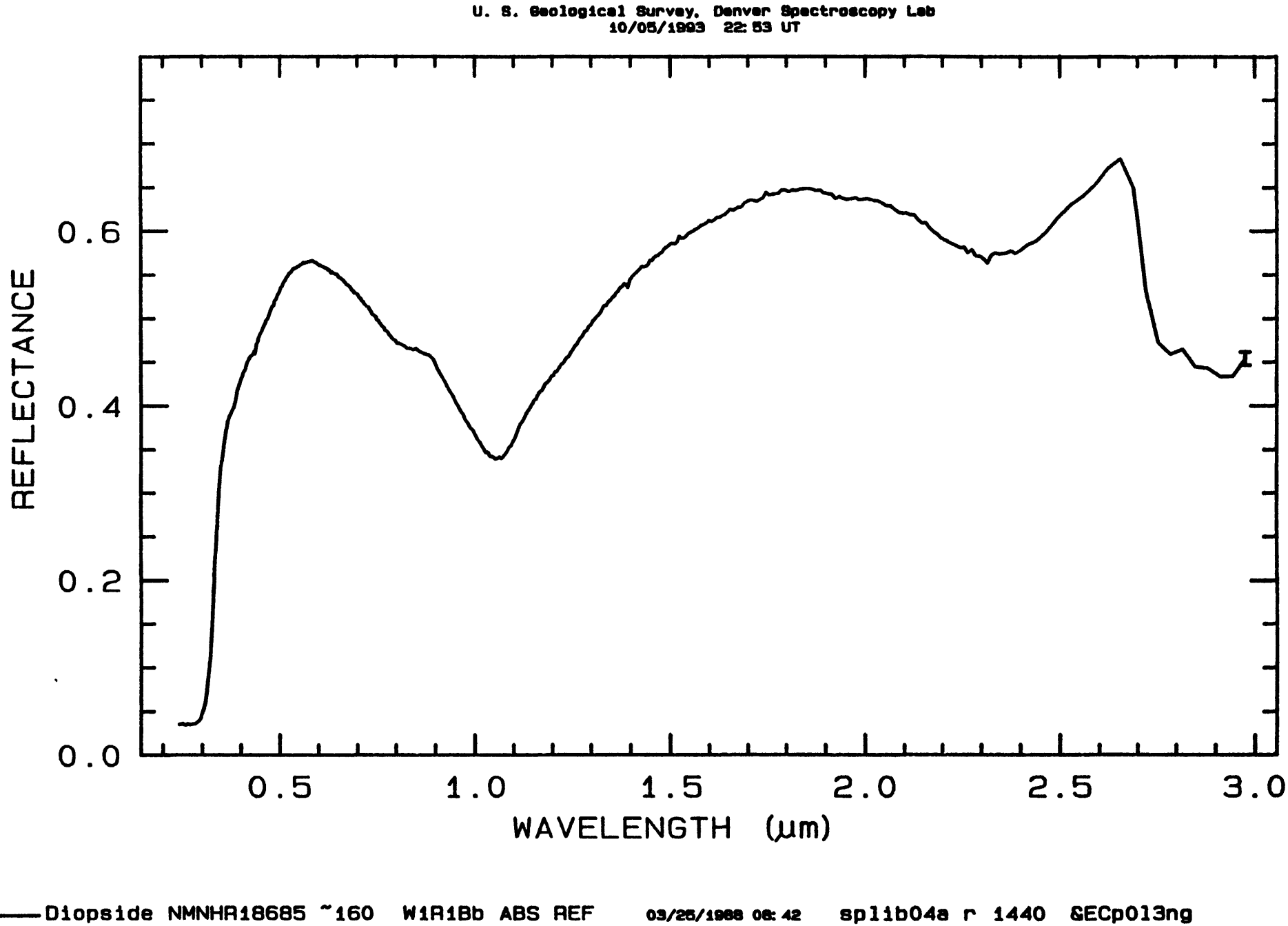
grain sz fraction 74-250 μm: avg gr sz = 263 μm
grain sz fraction <74 μm: avg gr sz = 32 μm

Two cleavages at nearly right angles, inclined extinction. No optical evidence of calcite and no HCl acid fizz in either grain size fraction. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1440	0.2-3.0μm	200	g.s.= 263 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Diopside NMNHR18685
Diopside NMNHR18685 ~160 W1R1Bb ABS REF 03/26/1998 08:42 splib04a r 1440 &ECp013ng

TITLE: Dipyre BM1959,505 Scapolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: BM1959,505

MINERAL_TYPE: Tectosilicate

MINERAL: Dipyre (Scapolite group)

FORMULA: 3NaAlSi3O8*NaCl

FORMULA_NROFF: $3NaAlSi_3O_8 \bullet NaCl$

COLLECTION_LOCALITY: Unknown

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Scapolites are metamorphic minerals with compositions suggestive of the feldspars. Dipyre is an intermediate composition of the solid solution series marialite-wernerite-meionite.

Two spectra are in the library, one of the original sample, and one after HL separation.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

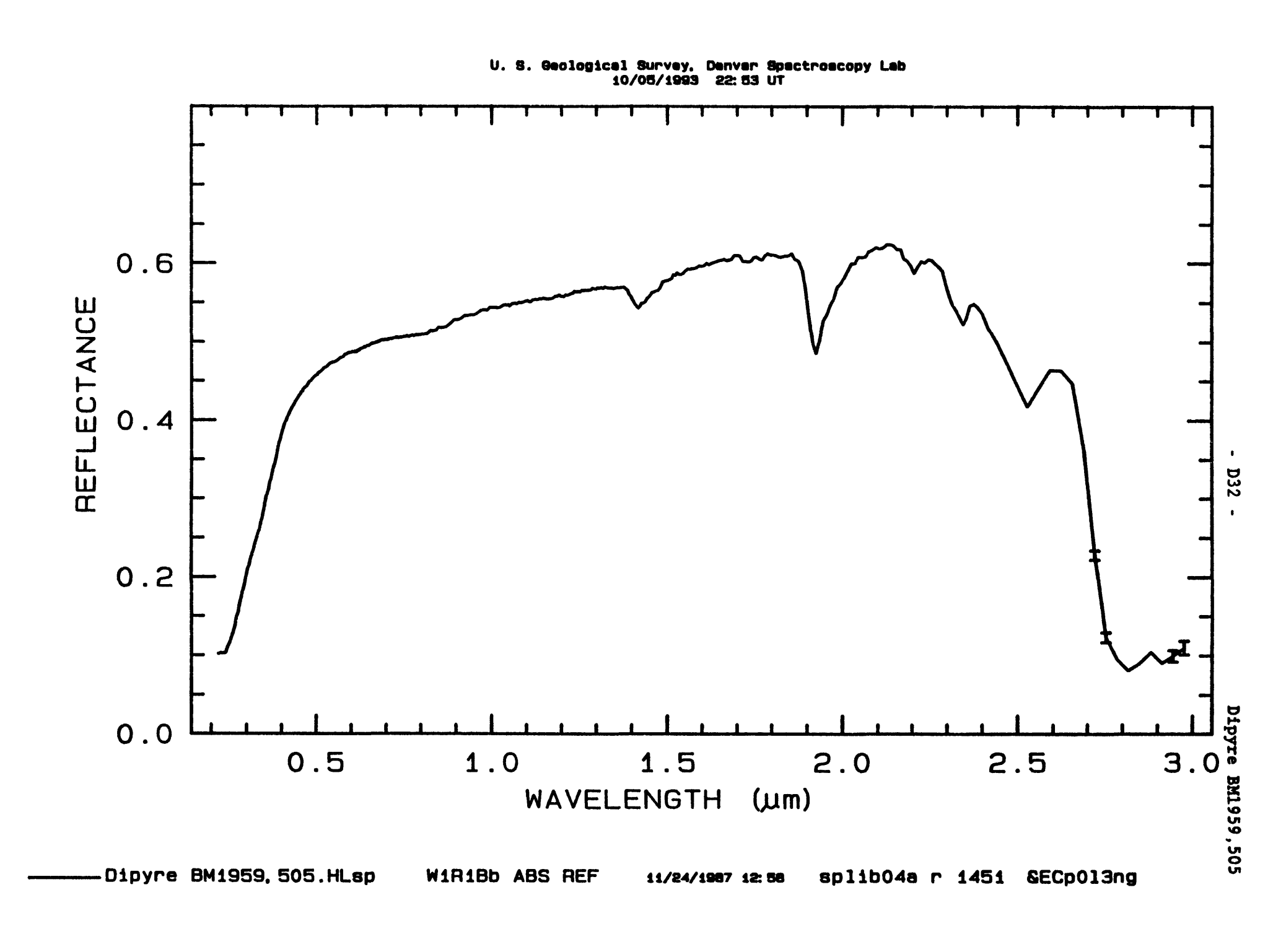
Scapolite + muscovite + 3.66, 3.36, 2.87, 2.838 Angstroms

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace),WChem

```
COMPOSITION:      SiO2: 56.8600 wt%    NROFF: SiO2
COMPOSITION:      TiO2:  0.00   wt%    NROFF: TiO2
COMPOSITION:     Al2O3: 22.8100 wt%    NROFF: Al2O3
COMPOSITION:       FeO:  0.0660 wt%    NROFF: FeO
COMPOSITION:       MnO:  0.0100 wt%    NROFF: MnO
COMPOSITION:       MgO:  0.0100 wt%    NROFF: MgO
COMPOSITION:       CaO:  6.5780 wt%    NROFF: CaO
COMPOSITION:      Na2O:  9.7040 wt%    NROFF: Na2O
COMPOSITION:       K2O:  1.4000 wt%    NROFF: K2O
COMPOSITION:        Cl:  3.8920 wt%    NROFF: Cl
COMPOSITION:         F:  0.0220 wt%    NROFF: F
COMPOSITION:       SO3:  0.0100 wt%    NROFF: SO3
COMPOSITION:       CO2:  0.1000 wt%    NROFF: CO2
COMPOSITION: ----------------------
COMPOSITION:     Total: 101.4620 wt%
COMPOSITION:  O=Cl,F,S:    .8875 wt%  #correction for Cl, F, S
COMPOSITION: New Total: 101.5745 wt%

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

1. Mol % SiO2 includes    .0196 mol % SiF4.
   Mol % SiO2 includes   1.8555 mol % SiCl2.
2. Fe oxide in analysis is total Fe+2 + Fe+3.
3. Number of tetrahedral sites per formula set at 12.
4. Number of anions per formula unit = 25.03625.
5. Cation site assignments: Standard clay-mineral default with
changes.
        Must occupy tetrahedral sites: Si Al
        To big cation sites: Fe+2 Mn Mg

X_Me = 25.70 % Me

X_Me = Ca/(Ca+Na) = 27.2 % Me

Sample: Dipyre

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:  where          Wave Range  Av_Rs_Pwr  Comment

LIB_SPECTRA:  splib04a r 1451    0.2-3.0μm      200     g.s.=
```


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- D32 -
Dipyre BM1959,505
Dipyre BM1959,505.HLsp W1R1Bb ABS REF 11/24/1987 12:58 splib04a r 1451 &ECp013ng

TITLE: Dolomite HS102 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS102

MINERAL_TYPE: Carbonate

MINERAL: Dolomite (Dolomite group)

FORMULA: CaMg(CO3)2

FORMULA_NROFF: $CaMg(CO_3)_2$

COLLECTION_LOCALITY: Lee, MA

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Ankerite and with Kutnohorite.

"This is a recrystallized dolomitic marble, which displays the carbonate absorption features at longer wavelengths than typical for calcites. Weak absoprtion band at 1.0μm is due to ferrous iron, which is shown to be present at 0.03 wt.% in the sample."

Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Dolomite plus trace of calcite XRD done by Norma Vergo

Clark, R.N., King, T.V.V., Klejwa, M., Swayze, G.A., and Vergo, N., 1990, High spectral resolution reflectance spectroscopy of minerals: Journal of Geophysical Research, v. 95, no. 8B, p 12,653-12,680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:

pop 1 avg gr sz = 288μm 98 vol%
pop 2 avg gr sz = 15μm 2 vol%

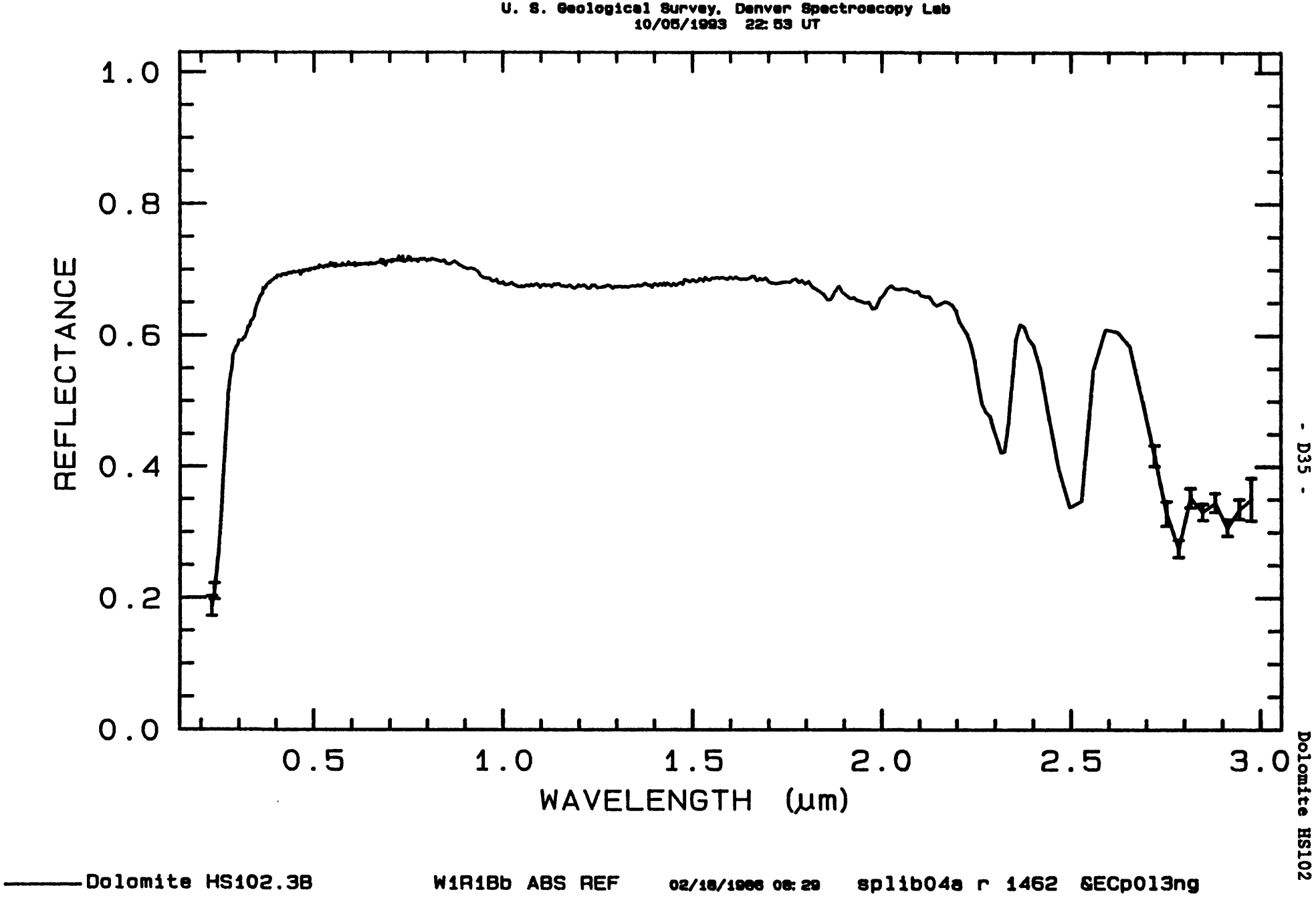
avg grain size of all populations: 285μm

Pure sample, sluggish fizz with dilute HCl. Lack of a vigorous fizz suggests very little if any calcite (this HCl mixture reacts vigorously with pure calcite samples). Uniaxial negative, high relief, higher order white, all consistent with dolomite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1462	0.2-3.0μm	200	g.s. = 285μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- D35 -
Dolomite HS102
Dolomite HS102.3B
W1R1Bb ABS REF
02/10/1996 08:29
splib04a r 1462 &ECp013ng

TITLE: Dolomite COD2005 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: COD2005

MINERAL_TYPE: Carbonate

MINERAL: Dolomite (Dolomite group)

FORMULA: CaMg(CO3)2

FORMULA_NROFF: $CaMg(CO_3)_2$

COLLECTION_LOCALITY: Grapevine Mountains, Nevada

ORIGINAL_DONOR: Fred Kruse

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Forms series with Ankerite and with Kutnohorite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Dolomite + trace calcite.

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal Grain Size distribution:
mode 1: 87 μm @ 75 vol%
mode 2: 8 μm @ 25 vol%

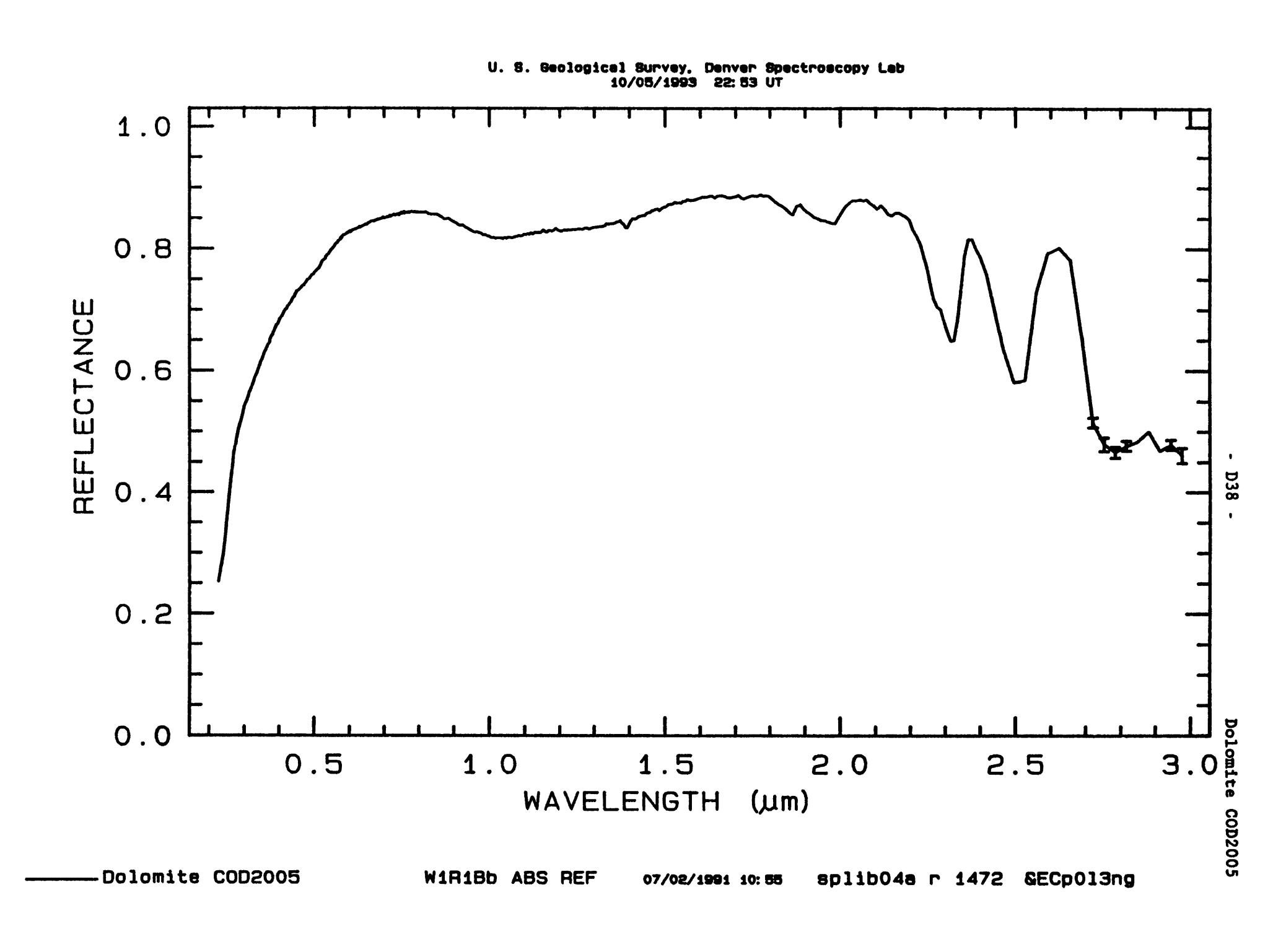
avg gr sz = 75 μm

High order white interference color, uniaxial (-). Sample looks pure. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1472	0.2-3.0μm	200	g.s.= 75 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/05/1993 22:53 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- D38 -
Dolomite COD2005
Dolomite COD2005
W1R1Bb ABS REF
07/02/1991 10:55
splib04a r 1472 &ECp013ng

TITLE: Dumortierite HS190 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS190

MINERAL_TYPE: Nesosilicate

MINERAL: Dumortierite

FORMULA: Al7(BO3)(SiO4)3O3

FORMULA_NROFF: $Al_7(BO_3)(SiO_4)_3O_3$

COLLECTION_LOCALITY: Pershing, County, NV

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"Strong absorption feature near 0.5μm is due to π-π transition in the boron-oxygen triangle. OH bands occur at 1.4, 2.2 and 2.6 μm."

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:

47 vol% Feldspar or quartz (white, poor cleavage, hard, no twins)
35 vol% Dumortierite
10 vol% quartz
 8 vol% muscovite

Bimodal grain size distribution:

pop1 avg gr sz = 349 μm 99 vol%
pop2 avg gr sz = 10 μm 1 vol%

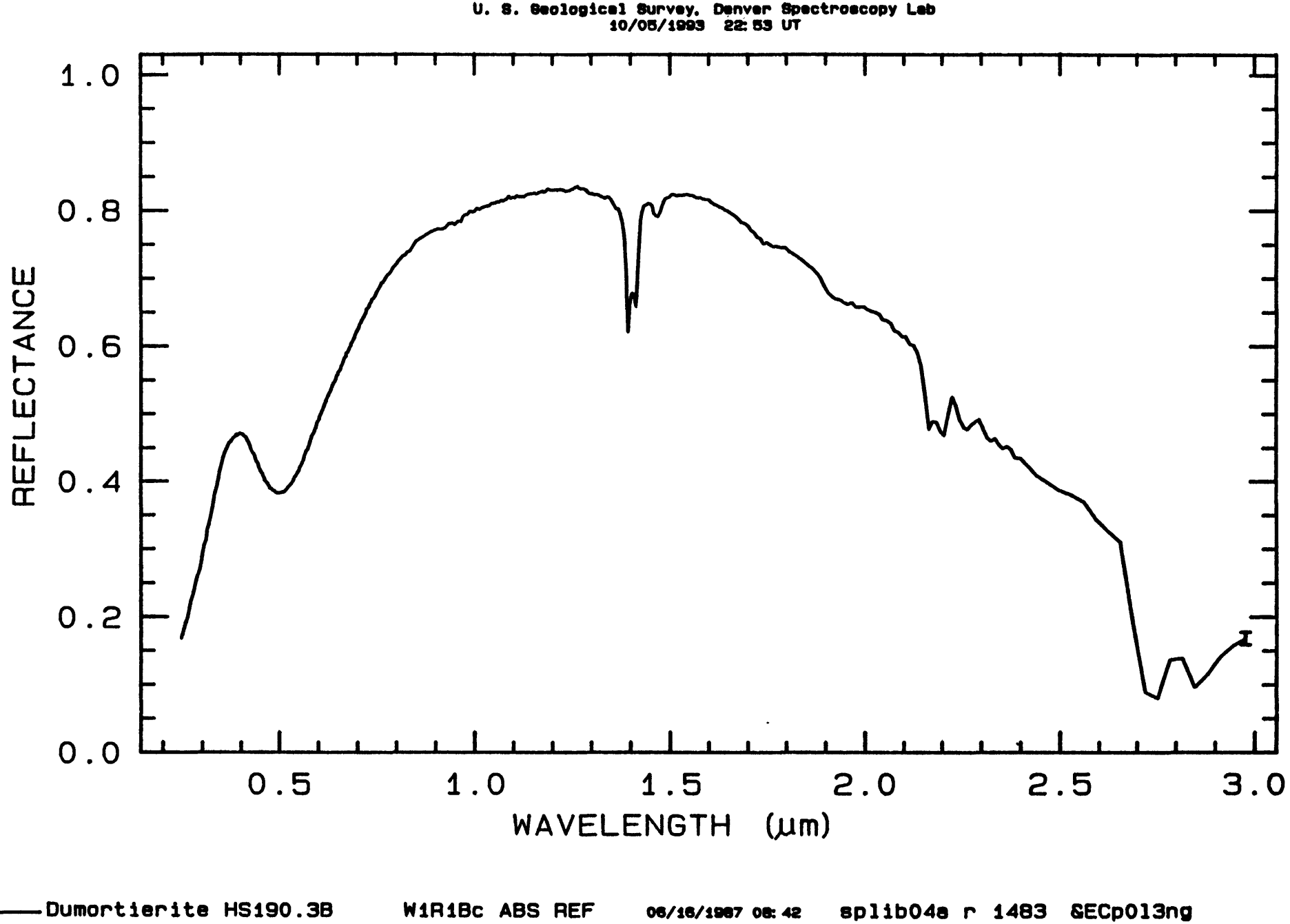
avg grain sizes for entire population = 347 μm *Intergrowths prevent giving grain sizes for individual minerals.

This sample is significantly contaminated with other minerals, however, except for the muscovite all other contaminants may not contribute spectral absorptions. Fine scale intergrowth of quartz and dumortierite make positive identification of quartz or feldspar very difficult. Strong violet-pink pleochroism in 35% of the grains, straight extinction and length fast (consistent with these grains being dumortierite but cannot get interference figures because pink grains are too fibrous).

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1483	0.2-3.0μm	200	g.s. = 347 μm



Dumortierite HS190

TITLE: Elbaite NMNH94217-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH94217

MINERAL_TYPE: Cyclosilicate

MINERAL: Elbaite (Tourmaline group)

FORMULA: Na(Li,Al)3Al6(BO3)3Si6O18(OH)4

FORMULA_NROFF: $Na(Li,Al)3Al_6(BO_3)_3Si_6O_{18}(OH)_4$

COLLECTION_LOCALITY: Sao Jose De Brejuada, Minas Gerais, Brazil

ORIGINAL_DONOR: National Museum of Natural History (Smithsonian)

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Dravite.

"Results of petrographic examination: A purple sudhedral crystal, transparent with some green coloration to one end. Sample is ~5mm x 2cm x 2cm. Under petrographic microscope, sample appears pure, clear."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Sample is in the following seive intervals: (a) 250μm, (b) 150μm, (c) <74μm

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Elbaite plus many peaks (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	36.83	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.04	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	40.56	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.12	wt%	NROFF:	FeO
COMPOSITION:	MnO:	4.40	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.03	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.13	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	2.37	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.01	wt%	NROFF:	K_2O
COMPOSITION:	---	---			
COMPOSITION:	Total:	84.49	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analysis showed the sample to be homogeneous within and between grains. Average of seven analyses does not include lithium, boron or water, but demonstrates the presence of sufficient manganese to indicate that this is not end member elbaite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Grain Size distributions:
250 μm fraction: bimodal gr sz dist.
pop 1 av gr sz = 662 μm 99 vol%
pop 2 av gr sz = 10 μm 1 vol%
av gr sz entire population = 659 μm

74<x<250 μm fraction: av gr sz = 196 μm

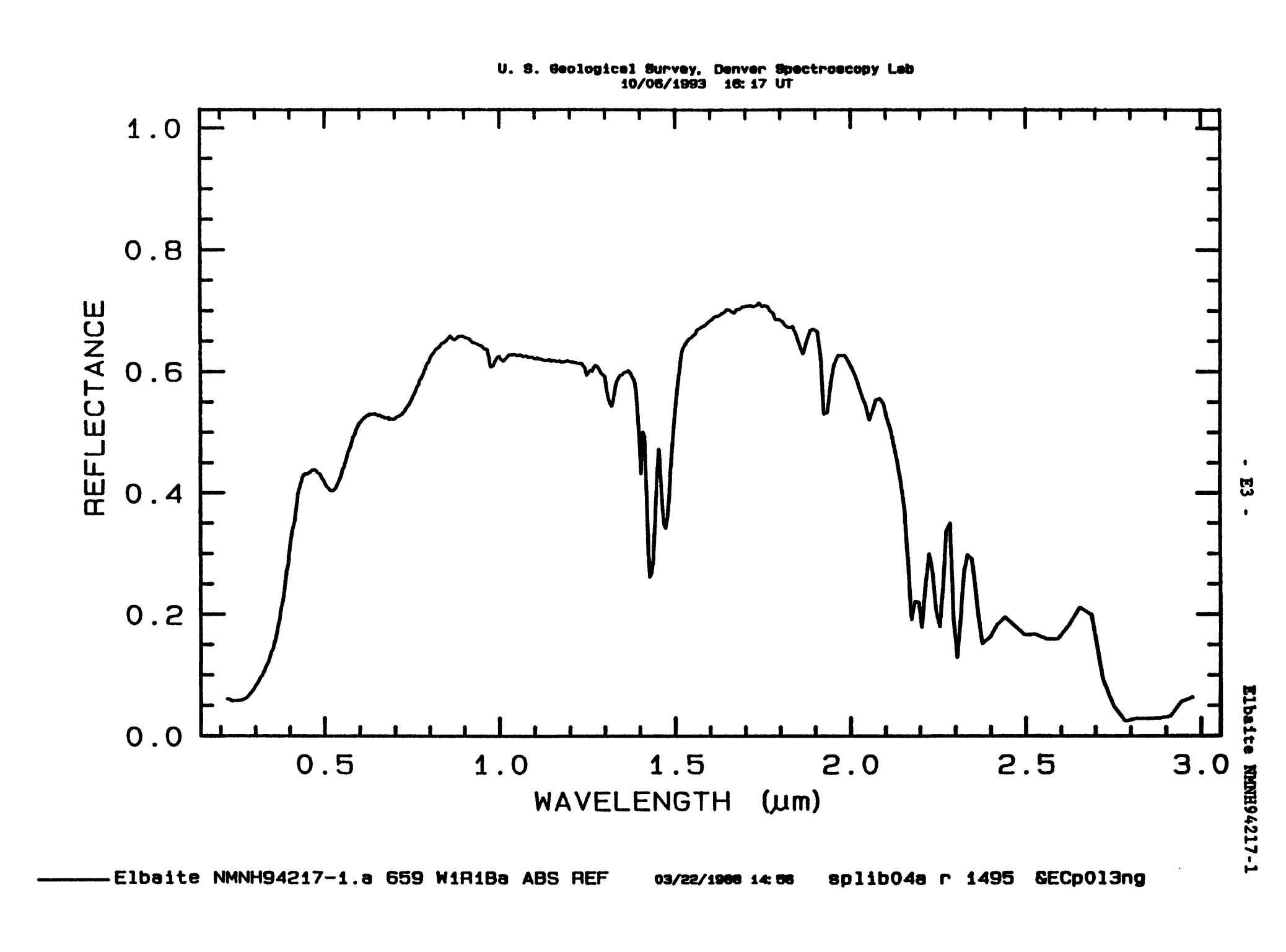
< 74 μm fraction: bimodal gr sz dist.
pop 1 av gr sz = 68 μm 75 vol%
pop 2 av gr sz = 15 μm 25 vol%
av gr sz entire population = 59 μm

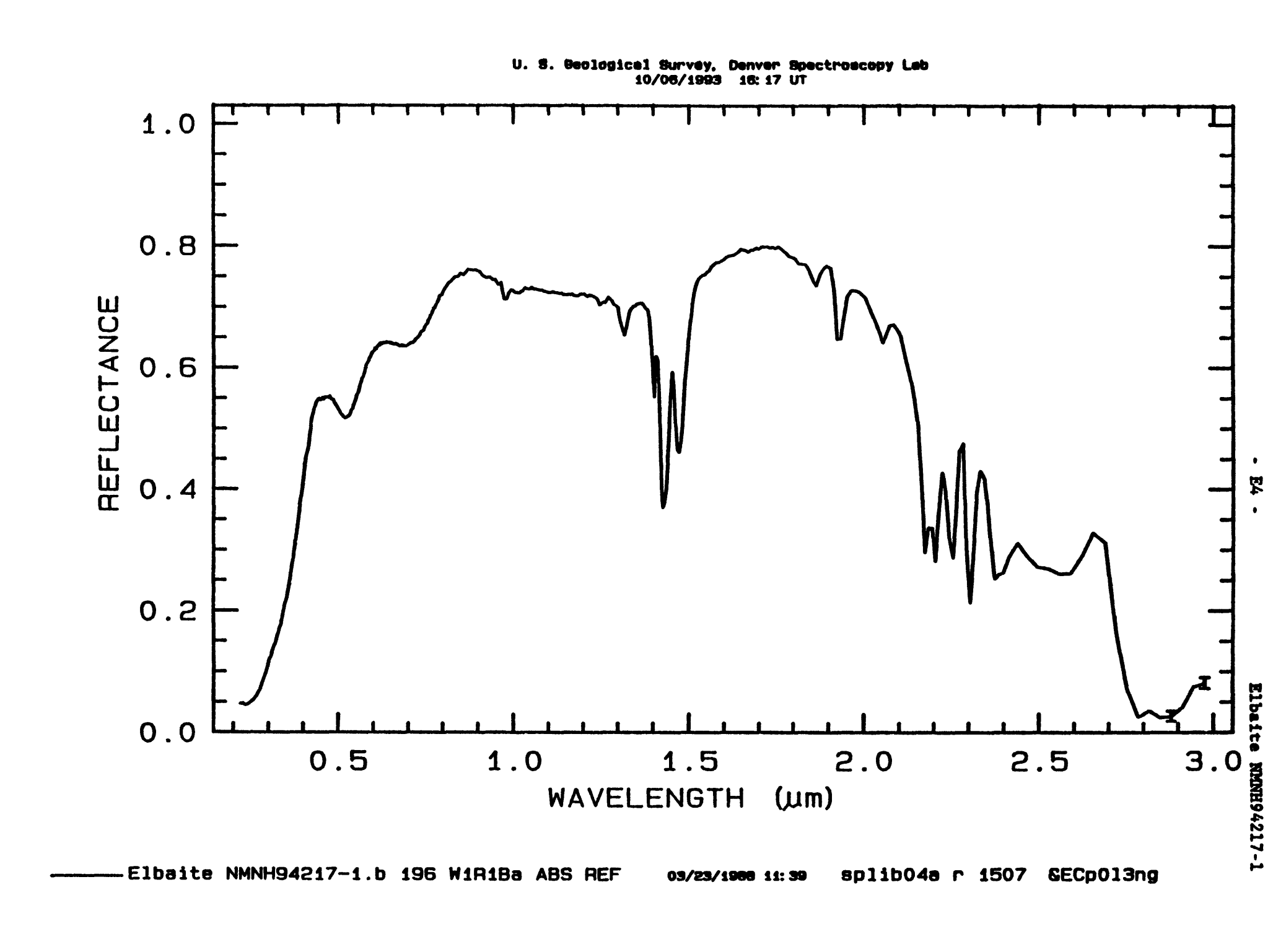
Samples are very pure. No cleavage, uniaxial (+), slight pink color. All consistent with tourmaline. M. Cowoski and G. Swayze.

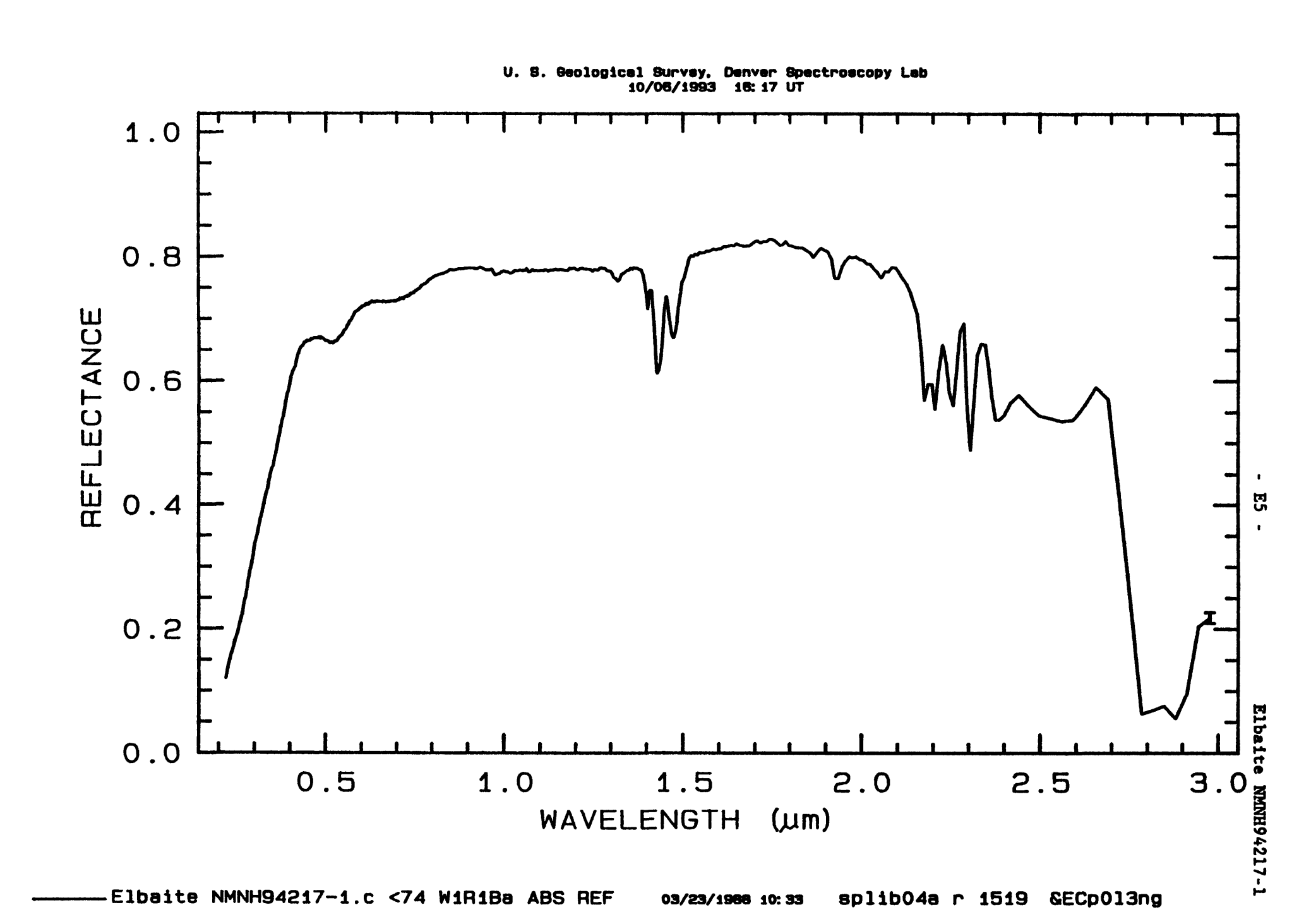
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1495	0.2-3.0μm	200	g.s.= 659 μm
LIB_SPECTRA:	splib04a r 1507	0.2-3.0μm	200	g.s.= 196 μm
LIB_SPECTRA:	splib04a r 1519	0.2-3.0μm	200	g.s.= 59 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- E3 -
Elbaite NMNH94217-1
Elbaite NMNH94217-1.a 659 W1R1Ba ABS REF 03/22/1988 14:56 splib04a r 1495 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Elbaite NMNH94217-1.b 196 W1R1Ba ABS REF 03/23/1998 11:39 splib04a r 1507 &ECp013ng
- E4 -
Elbaite NMNH94217-1



Elbaite NMNH94217-1

TITLE: Endellite GDS16 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS16

MINERAL_TYPE: Phyllosilicate

MINERAL: Endellite (Hydrohalloysite) (Kaolinite-Serpentine Group)

FORMULA: Al2Si2O5(OH)4*2H2O

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4 \bullet 2H_2O$

COLLECTION_LOCALITY: Joshin Mine, Tsumagoi-mura Azuma-gun, Gunma

ORIGINAL_DONOR: Grim Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

None

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

7A halloysite - no expansion with glycol. Pure. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:
97 vol% clay
2 vol% green material (too small to identify optically)
1 vol% opaques

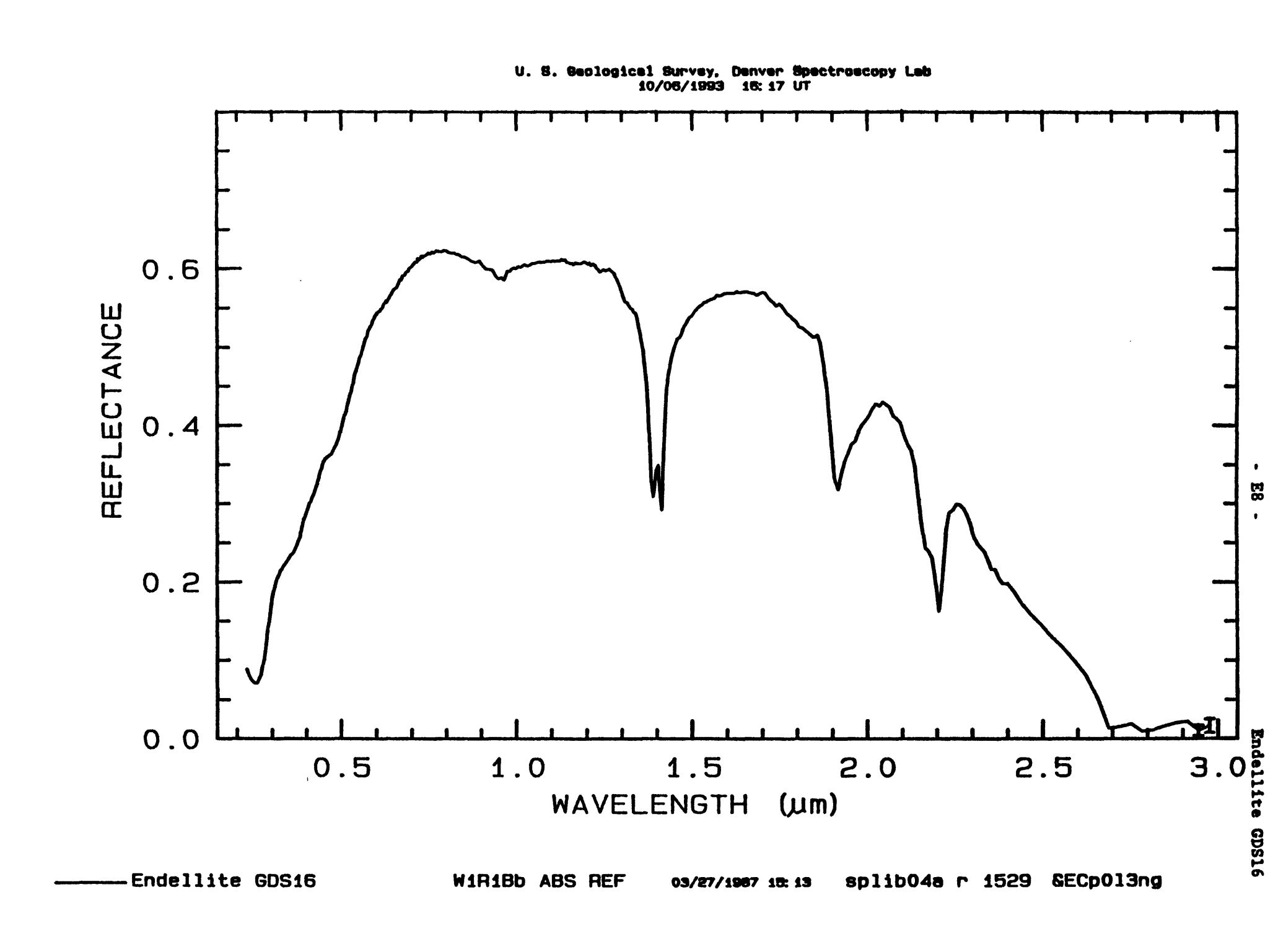
avg gr sz = < 10 μm

Grain size too small to determine optical properties. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1529	0.2-3.0μm	200	g.s.= < 10 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 15:17 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Endellite GDS16
W1R1Bb ABS REF 03/27/1987 15:13 splib04a r 1529 &ECp013ng
- 88 -
Endellite GDS16

TITLE: Enstatite NMNH128288 Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH128288

MINERAL_TYPE: Inosilicate

MINERAL: Enstatite (Pyroxene group)

FORMULA: Mg2Si2O6

FORMULA_NROFF: $Mg_2Si_2O_6$

COLLECTION_LOCALITY: Frank Smith Mine, Barkly West (near), S. Africa

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Orthoferrosilite and Hypersthene. Dimorphous with Clinoenstatite.

Under the microscope this hand-picked sample appears to be moderately altered. Higher index of refraction than expected indicates probable higher iron content than pure enstatite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Results of XRD: Enstatite plus a small amount of kaolinite and mica.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	56.70	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.01	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	1.69	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	4.97	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.15	wt%	NROFF: MnO
COMPOSITION:	MgO:	35.25	wt%	NROFF: MgO
COMPOSITION:	CaO:	0.85	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.02	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.02	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.66	wt%	
COMPOSITION:	O=Cl,F,S:		wt%	
COMPOSITION:	New Total:		wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

"Microprobe analysis showed some heterogenity. Six of the seven analyses were of enstatite bearing approximately 13% ferrosilite molecule. One analysis had slightly over 2% CaO, with a concomitant decrease in MgO, where the other analysis have 0.5% CaO. An average of the seven analysis is reported."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:
85 vol% enstatite
15 vol% mica

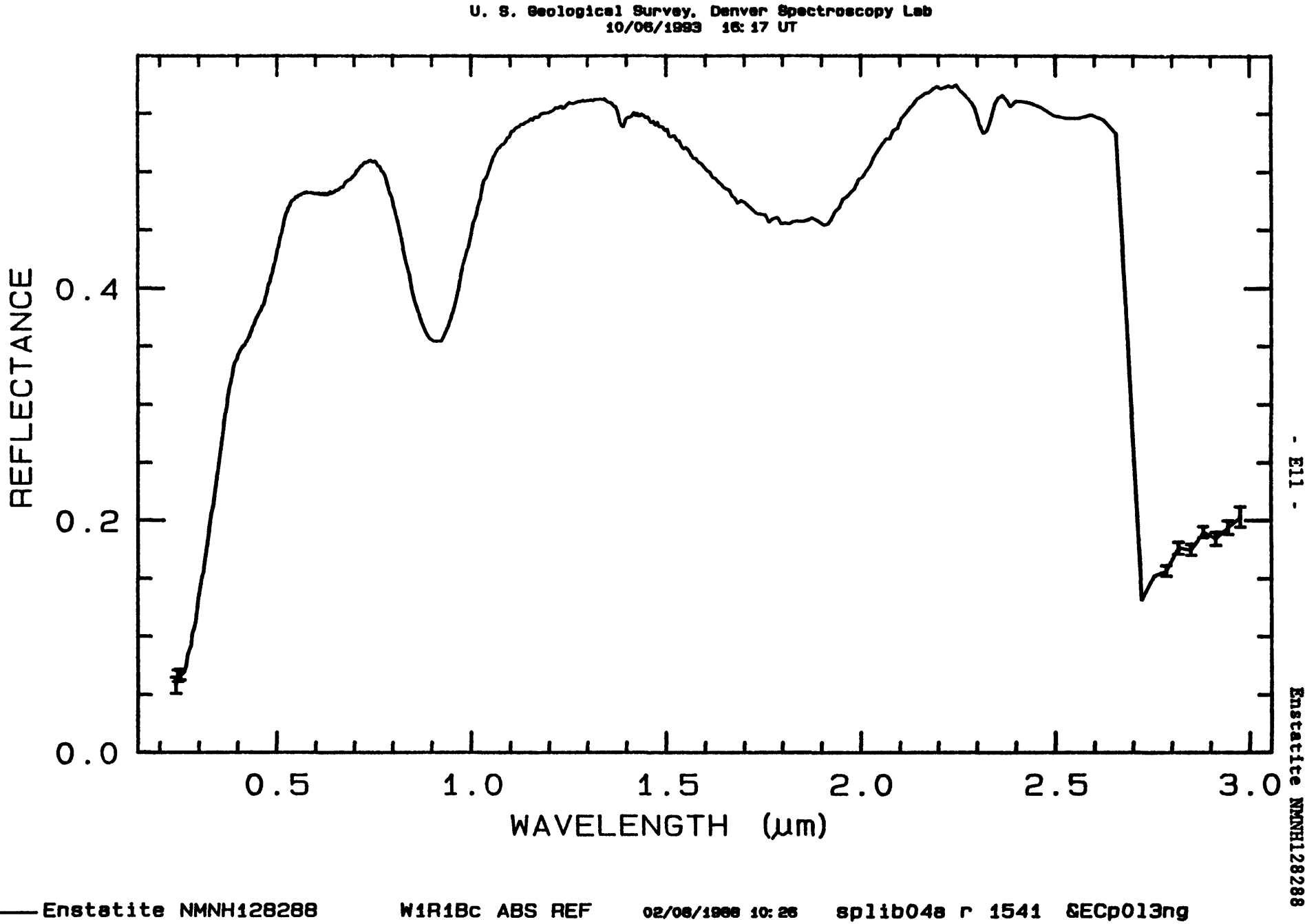
av gr sz = 25 μm (other estimate gave 47μm M. Cowoski)

Straight extinction, exsolution lamellae, low order gray, biaxial, prismatic cleavage, all consistent with orthopyroxene. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1541	0.2-3.0μm	200	g.s. = 25 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:17 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- E11 -
Enstatite NMNH128288
Enstatite NMNH128288 W1R1Bc ABS REF 02/08/1988 10:26 splib04a r 1541 &ECp013ng

TITLE: Epidote GDS26 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS26

MINERAL_TYPE: Sorosilicate

MINERAL: Epidote (Epidote group)

FORMULA: Ca2(Al,Fe+3)3(SiO4)3(OH)

FORMULA_NROFF: $Ca_2(Al,Fe^{+3})_3(SiO_4)_3(OH)$

COLLECTION_LOCALITY: Prince of Wales Island, Alaska

ORIGINAL_DONOR: Bruce Hemingway

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Clinozoisite.

"Results of petrographic examination: Deep green colored epidote crystals 2 cm x 1 cm in size. Looks pure. Microscopic examination indicates pure clean epidote with no alteration."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Sample is in two sieve intervals: (a) 75-200μm and (b) <75μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Spectrally pure. Epidote plus a large amount of quartz plus a small amount other; M: ~2% magnetite on epidote, ~15% quartz, ~3% plagioclase, no carbonate. (Norma Vergo)

"Epidote plus a trace of quartz. No quartz bands are apparent in the spectrum, however spectral features due to trace of a carbonate were seen and the sample was given acid treatment to remove this contaminent."

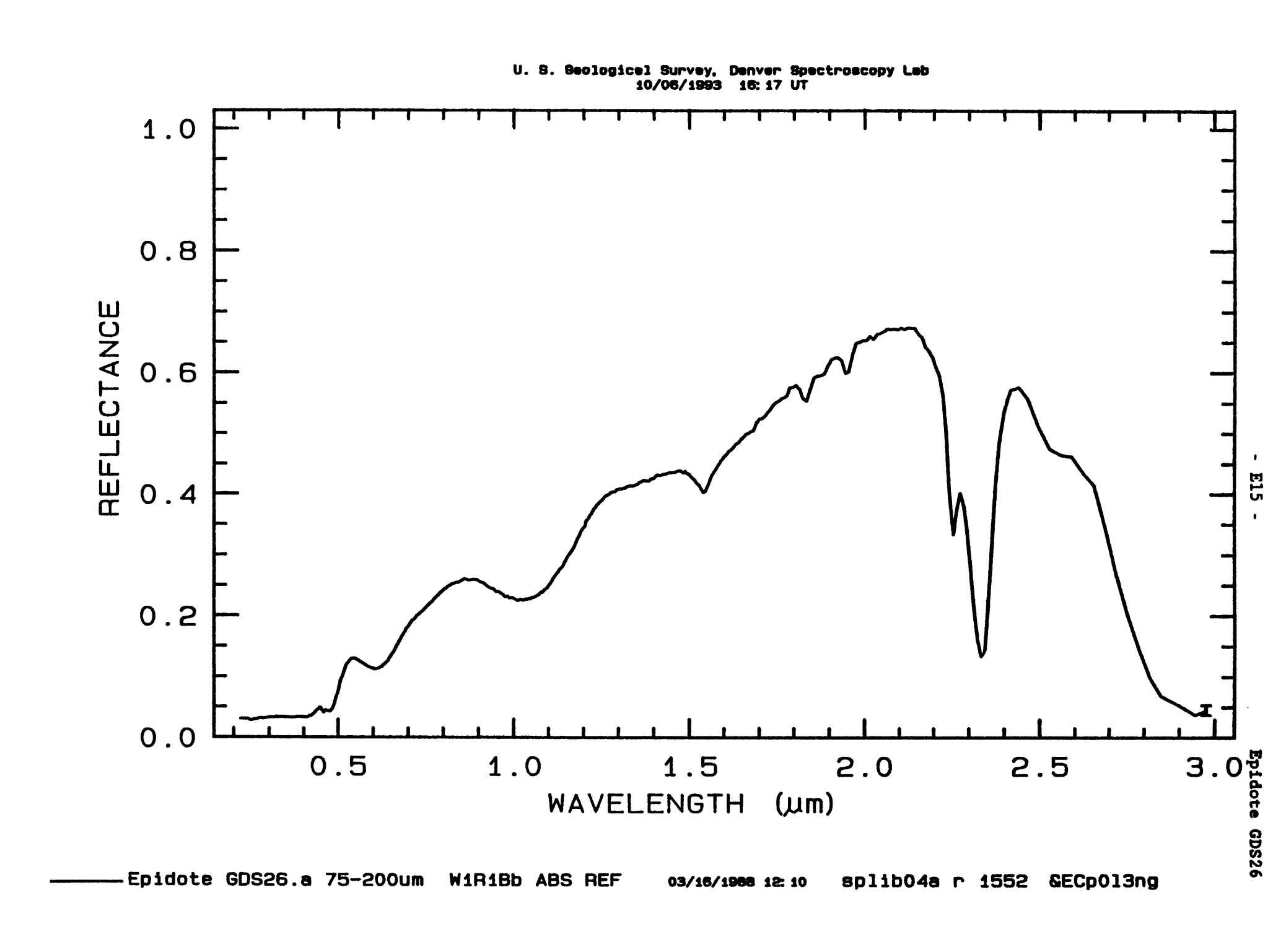
Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

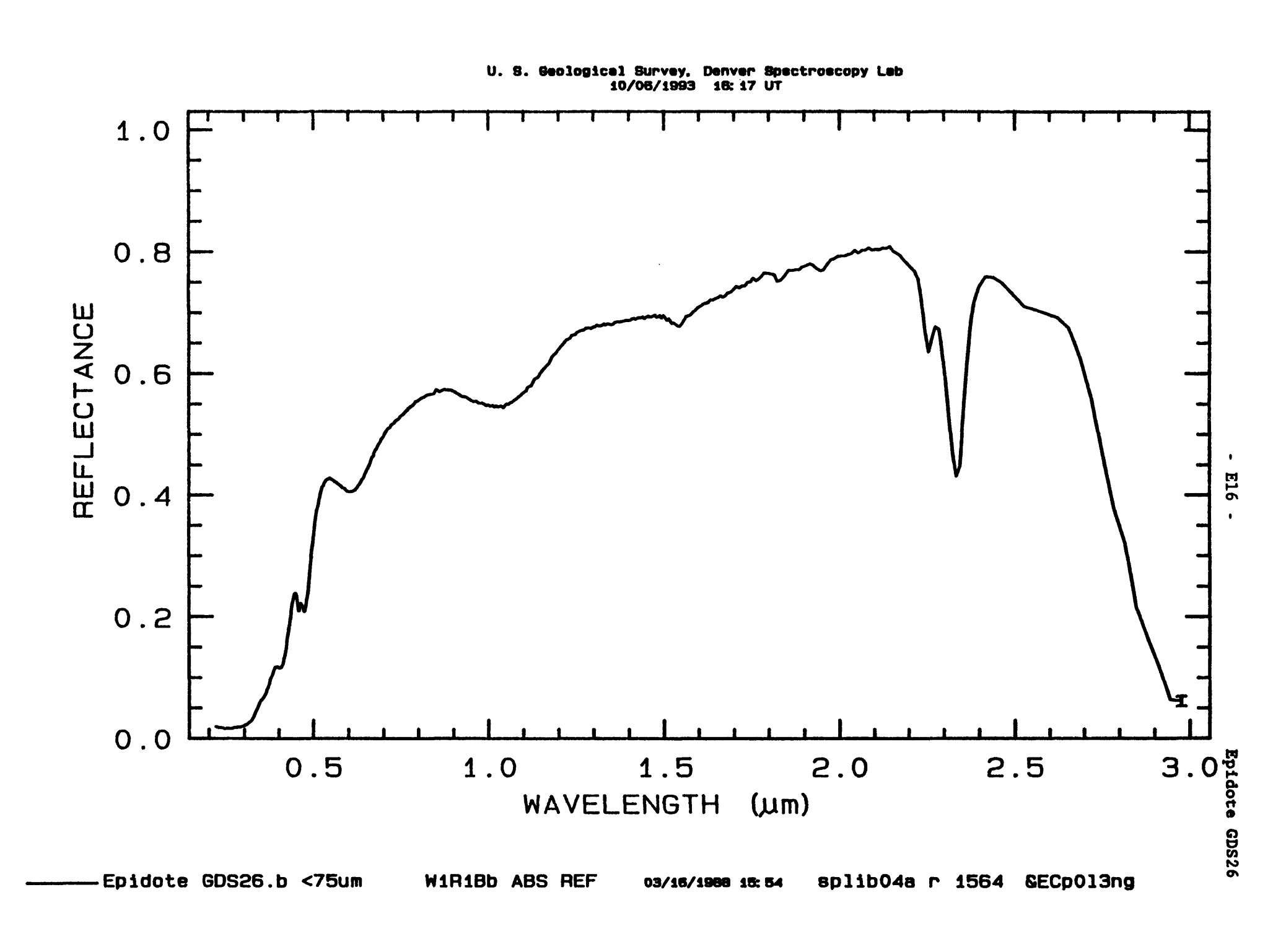
END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:      SiO2:  37.14  wt%    NROFF: SiO2
COMPOSITION:      TiO2:   0.16  wt%    NROFF: TiO2
COMPOSITION:     Al2O3:  23.05  wt%    NROFF: Al2O3
COMPOSITION:       FeO:  14.5   wt%    NROFF: FeO
COMPOSITION:       MnO:   0.18  wt%    NROFF: MnO
COMPOSITION:       MgO:   0.06  wt%    NROFF: MgO
COMPOSITION:       CaO:  22.85  wt%    NROFF: CaO
COMPOSITION:      Na2O:   0.01  wt%    NROFF: Na2O
COMPOSITION:       K2O:   0.02  wt%    NROFF: K2O
COMPOSITION: ---------------------
COMPOSITION:     Total:  97.97  wt%
COMPOSITION:  O=Cl,F,S:         wt%  #correction for Cl, F, S
COMPOSITION: New Total:         wt%

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analysis indicates that the sample is homogeneous within and
between grains, and has typical epidote composition.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared
(2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey
Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

75 < x < 200 μm fraction:
    mode:
   94 vol% epidote
    5 vol% quartz
    1 vol% plagioclase

avg gr sz = 171 μm

Green pleochroism, pistachio green color, perfect cleavage, biaxial (-),
high relief, all consistent with epidote.

< 75 μm fraction:
   mode:
 50 vol% epidote
 50 vol% quartz  (uniaxial (+), low order grey)

    Bimodal gr sz distribution:
      pop 1  50 μm  40 vol%
      pop 2   7 μm  60 vol%

avg gr sz for entire population = 32 μm

Note: < 75 μm fraction significantly contaminated with quartz. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:  where          Wave Range  Av_Rs_Pwr  Comment
```

LIB_SPECTRA: splib04a r 1552 0.2-3.0μm 200 g.s.= 171 μm
LIB_SPECTRA: splib04a r 1564 0.2-3.0μm 200 g.s.= 32 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- E15 -
Epidote GDS26
Epidote GDS26.a 75-200um W1R1Bb ABS REF 03/16/1988 12:10 splib04a r 1552 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- E16 -
Epidote GDS26
Epidote GDS26.b <75um W1R1Bb ABS REF 03/16/1988 15:54 splib04a r 1564 GECp013ng

TITLE: Epidote HS328 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS328

MINERAL_TYPE: Sorosilicate

MINERAL: Epidote (Epidote group)

FORMULA: Ca2(Al,Fe+3)3(SiO4)3(OH)

FORMULA_NROFF: $Ca_2(Al,Fe^{+3})_3(SiO_4)_3(OH)$

COLLECTION_LOCALITY: Arizona

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Clinozoisite.

"S-3 Epidote 328B--Arizona. $Ca_2(Al,Fe)Al_2O\bullet\ OH(Si_2O_7)(SiO_4)$: This metamorphic mineral is the iron-rich end member of the clinozoisite-epidote series. The features are those due to both ferrous and ferric iron at 0.41, 0.47, near 0.6 μ and 1.0 μ. Again, the hydroxyl features are unusual. The feature at 1.55 μ appears, and it is accompanied by a very weak feature at 1.4 μ (not discernible in reproduced spectrum). The two features near 1.85 μ and 1.9 μ, like those in zoisite, are apparent, as is a very intense feature at 2.35 μ with well defined side features."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Spectrally pure. Epidote plus a large amount of quartz plus a small amount other; M: ~2% magnetite on epidote, ~15% quartz, ~3% plagioclase, no carbonate. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
80 vol% epidote
15 vol% quartz
3 vol% plagioclase ?
2 vol% magnetite

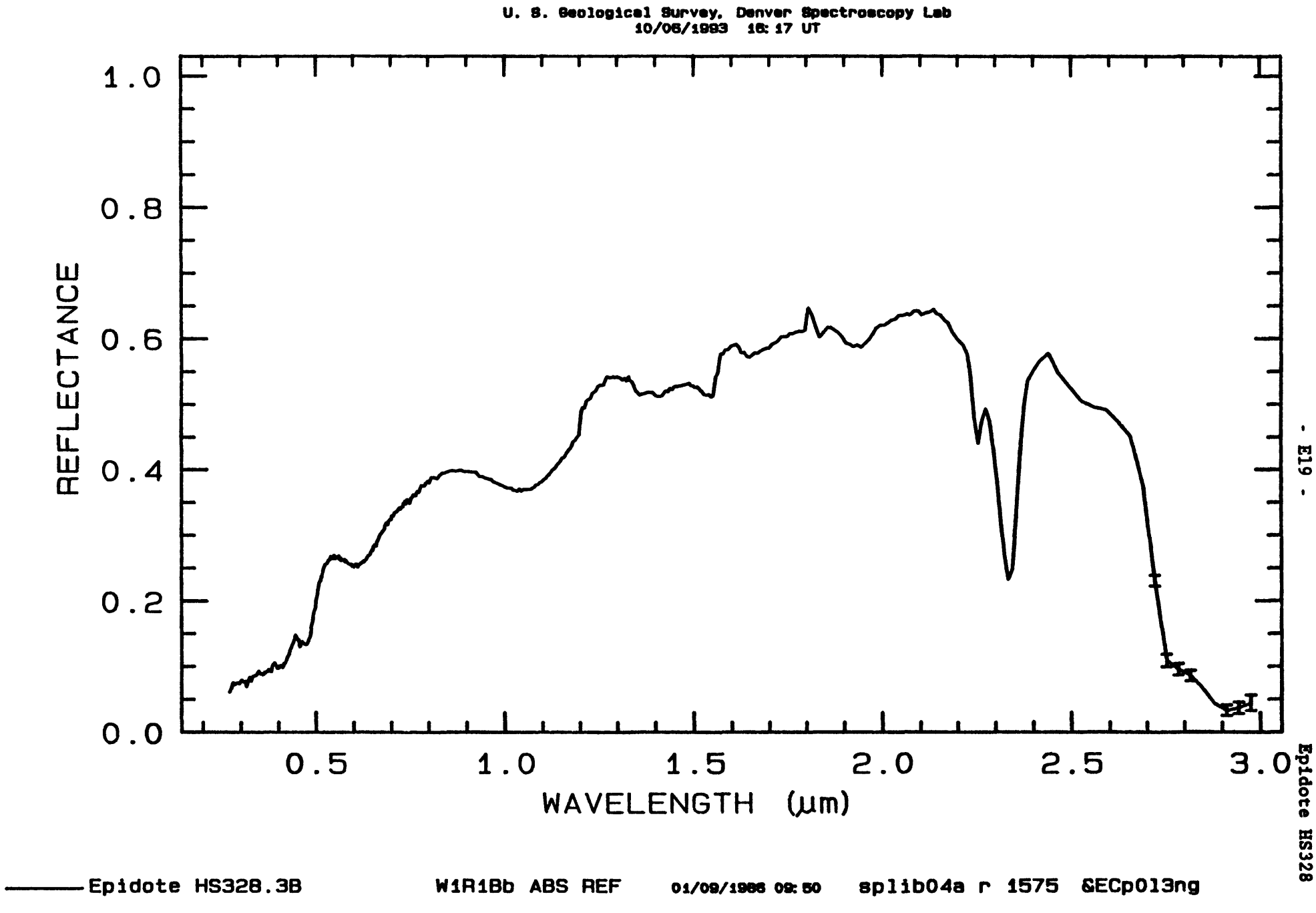
avg gr sz = 250 μm

Epidote grains are highly fractured or polygranular, with quartz intergrowths on about 10% of epidote grains. Individual crystal grain size is about 50 μm or less because of polygranular and fractured nature. Determination of optical properties is difficult because of fractures and polygranular nature.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1575	0.2-3.0μm	200	g.s.= 250 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 18:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Epidote HS328
Epidote HS328.3B
W1R1Bb ABS REF
01/09/1986 09:50
splib04a r 1575 &ECp013ng

TITLE: Epsomite GDS149 (Hexahydrite) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS149

MINERAL_TYPE: Hydrous Sulfate

MINERAL: Epsomite

FORMULA: MgSO4*7H2O

FORMULA_NROFF: $MgSO_4 \bullet 7H_2O$

COLLECTION_LOCALITY: A commercial product

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

"Epsom salts" commercial product

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

"Epsom salts" commercial product

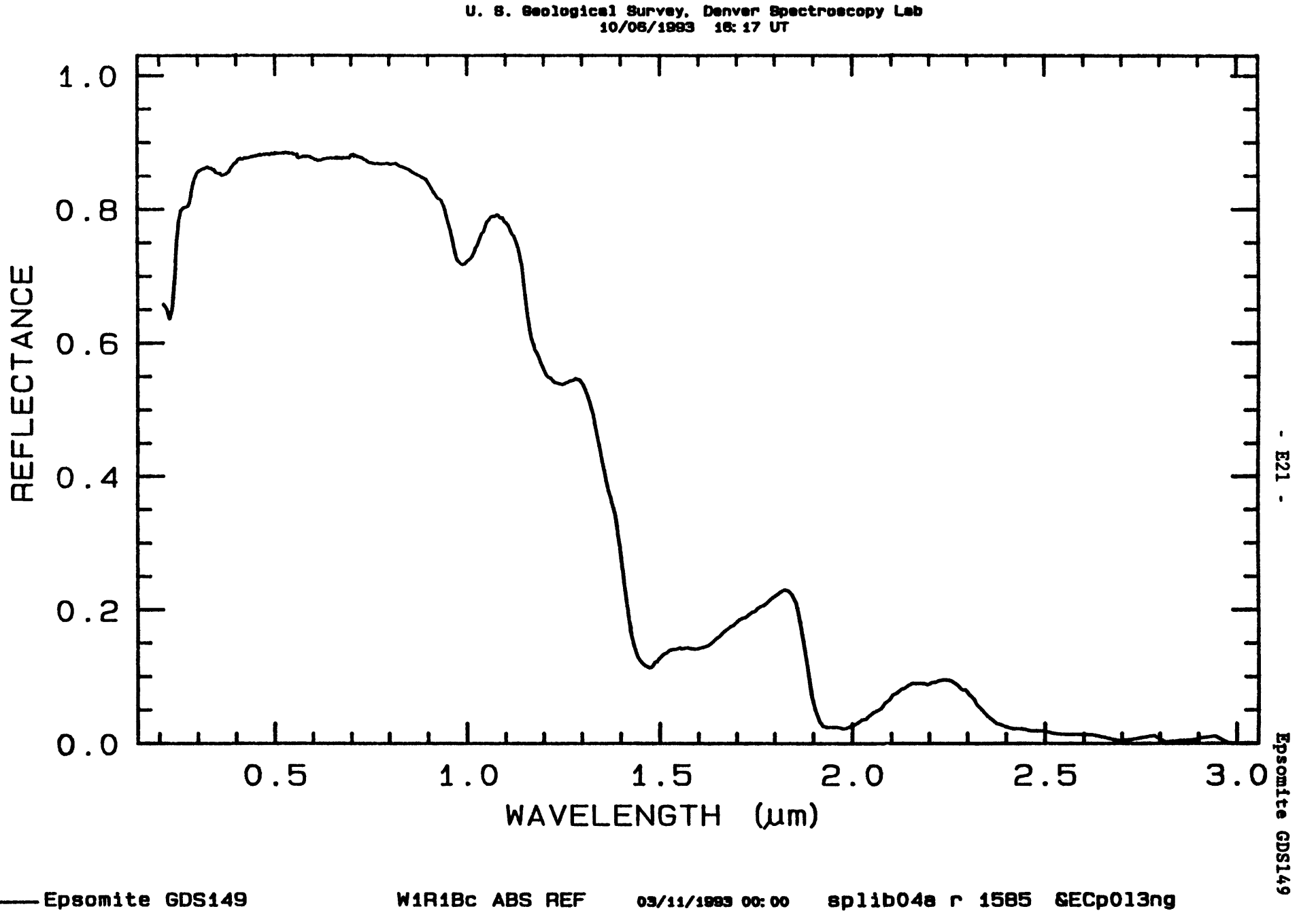
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1585	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- E21 -
Epsomite GDS149
Epsomite GDS149 W1R1Bc ABS REF 03/11/1993 00:00 splib04a r 1585 &ECp013ng

TITLE: Erionite+Offretite GDS72 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS72

MINERAL_TYPE: Tectosilicate

MINERAL: Erionite + Offretite (Zeolite group)

FORMULA: (K2,Ca,Na2)2Al4Si14O36*15H2O + (K2,Ca)5Al10Si26O72*30H2O

FORMULA_NROFF: $(K_2,Ca,Na_2)_2Al_4Si_{14}O_{36}\bullet 15H_2O$ + $(K_2,Ca)_5Al_{10}Si_{26}O_{72}\bullet 30H_2O$

COLLECTION_LOCALITY: Durkee, Oregon

ORIGINAL_DONOR: Unknown

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Offretite - major component
Erionite - major component
No other identifiable components

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
95 vol% zeolite
5 vol% contaminant (high birefringence, uniaxial mineral not included in grain size estimate)

av gr sz = < 5 μm

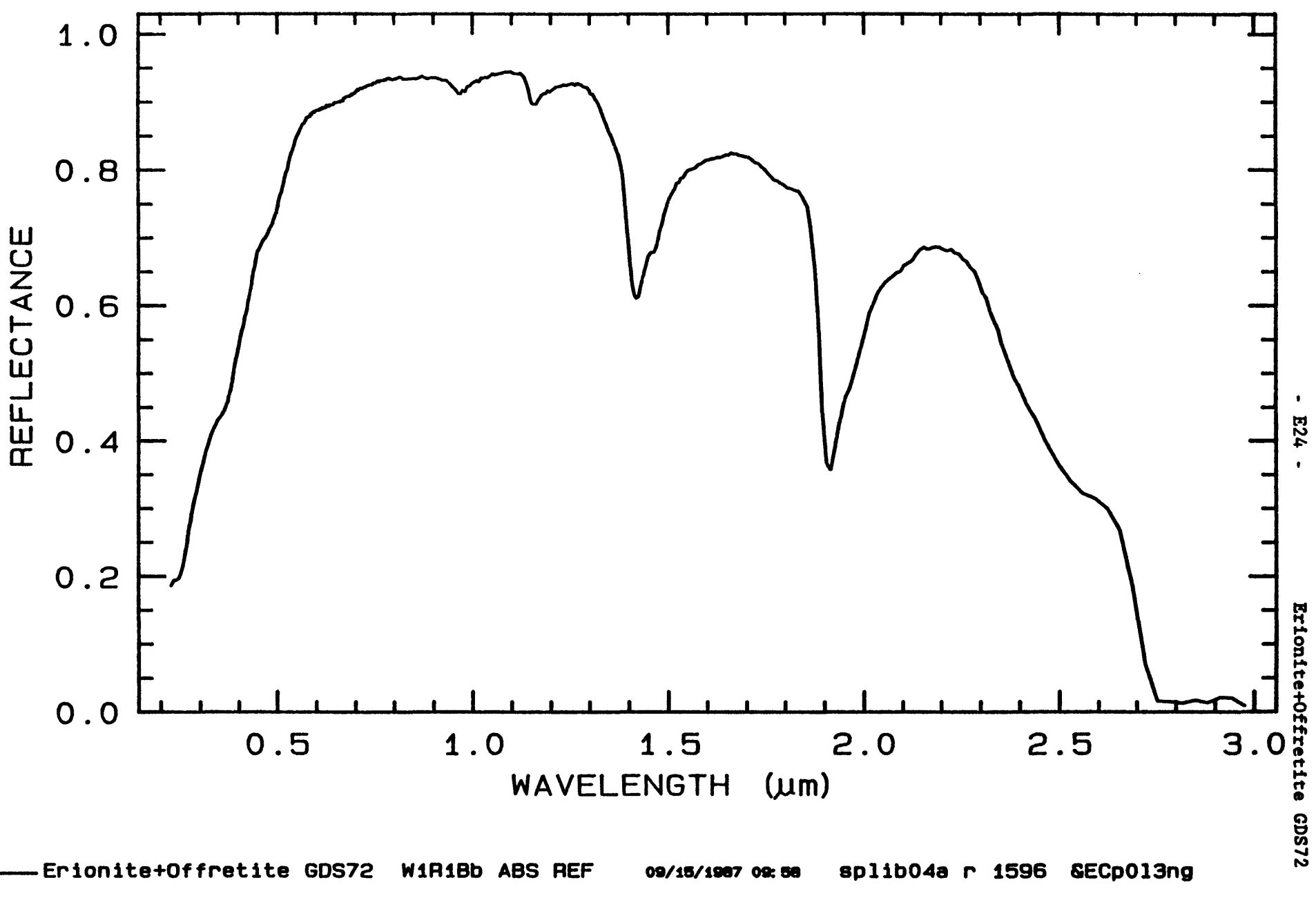
Elongate prismatic grains (similar to prisms with pyramid terminations) have a very low refractive index. Fine grain size limits other optical

determinations, but crystal habit and refractive index are consistent with this sample being a zeolite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1596	0.2-3.0μm	200	g.s.= < 5 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- E24 -
Erionite+Offretite GDS72
Erionite+Offretite GDS72 W1R1Bb ABS REF 09/15/1997 09:58 splib04a r 1596 &ECp013ng

TITLE: Erionite+Merlinoite GDS144 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS144

MINERAL_TYPE: Tectosilicate

MINERAL: Erionite (Zeolite group)

FORMULA: (K2,Ca,Na2)2Al4Si14O36*15H2O

FORMULA_NROFF: $(K_2,Ca,Na_2)_2Al_4Si_{14}O_{36}\bullet 15H_2O$

COLLECTION_LOCALITY: Eureka Co., California

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Erionite with Merlinoite as a major contaminant.
Jim Crowley, 1993, personal communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

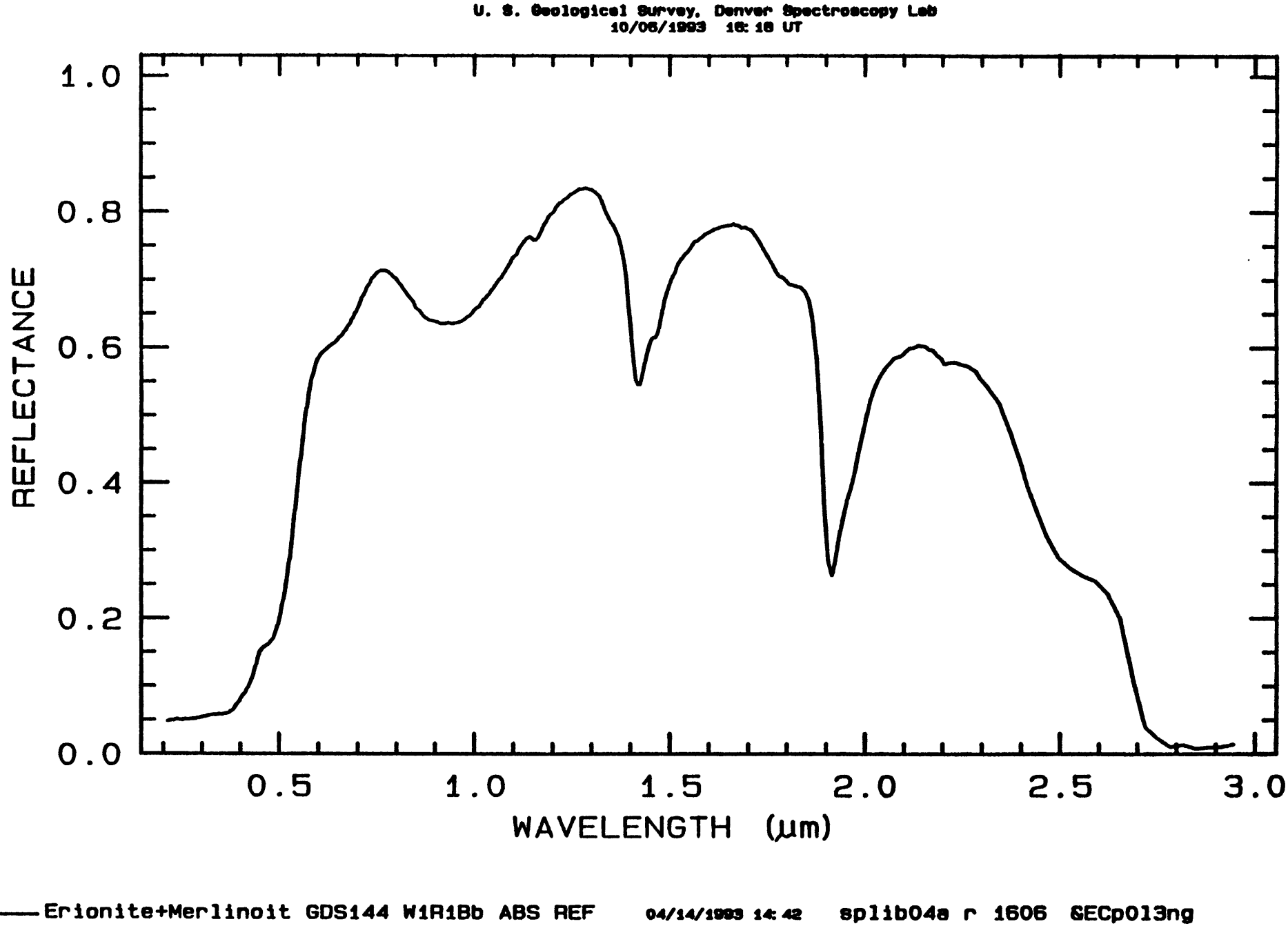
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1606	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:18 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- E26 -
Erionite+Merlinoit GDS144
Erionite+Merlinoit GDS144 W1R1Bb ABS REF 04/14/1993 14:42 splib04a r 1606 GECp013ng

TITLE: Eugsterite GDS140 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS140

MINERAL_TYPE: Hydrous Sulfate

MINERAL: Eugsterite

FORMULA: Na4Ca(SO4)3*2H2O

FORMULA_NROFF: $Na_4Ca(SO_4)_3 \bullet 2H_2O$

COLLECTION_LOCALITY: X-rayed (Synthetic)

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

evaporation of Na_2SO_4 + $CaSO_4$ solution at 70°C
Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sample is eugsterite but contains a small amount of gypsum (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

evaporation of Na_2SO_4 + $CaSO_4$ solution at 70°C

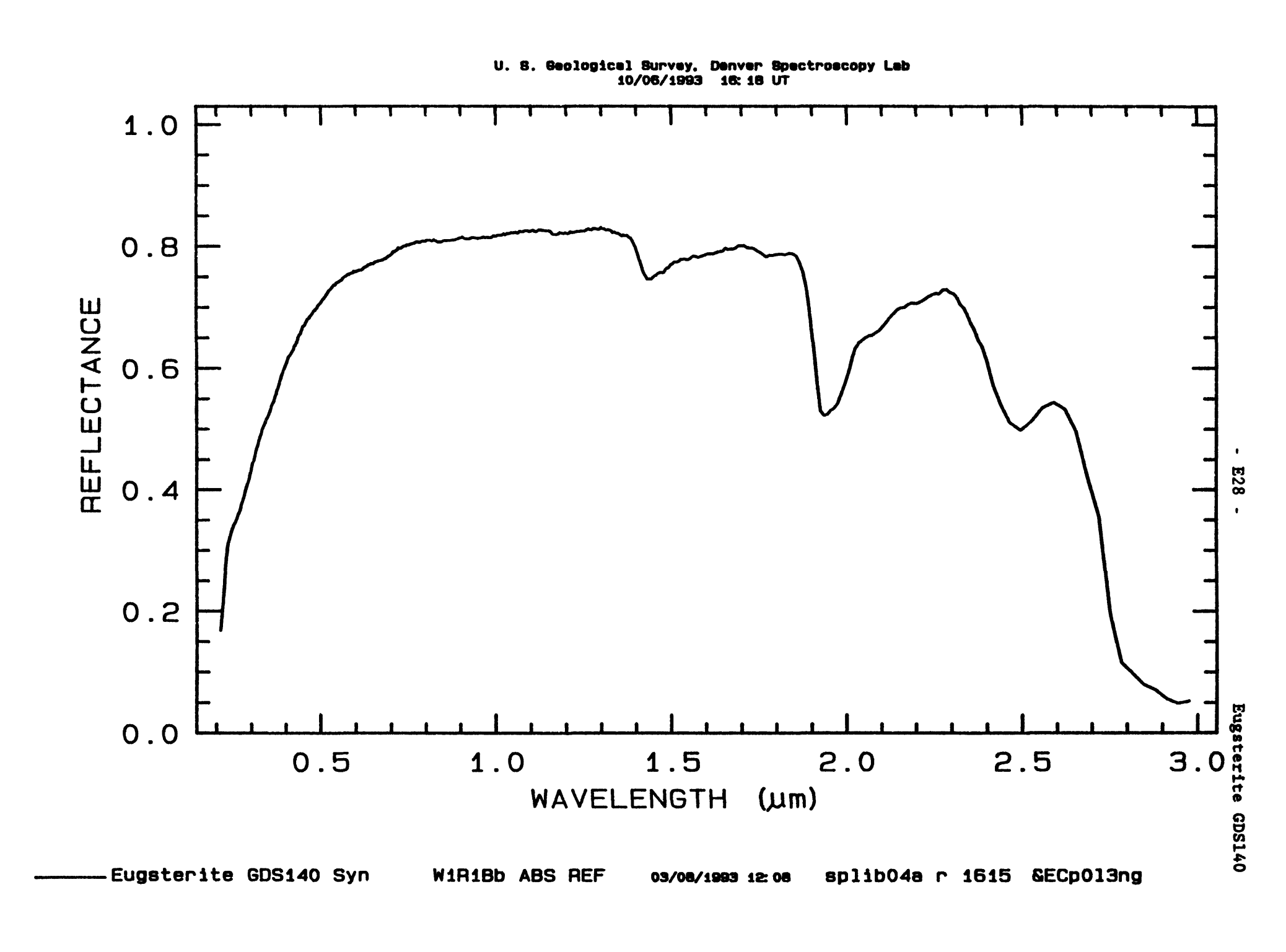
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1615	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 16:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- E28 -
Eugsterite GDS140
Eugsterite GDS140 Syn W1R1Bb ABS REF 09/08/1993 12:08 splib04a r 1615 &ECp013ng

TITLE: Europium_Oxide GDS33 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS33

MINERAL_TYPE: Oxide

MINERAL: Europium_Oxide

FORMULA: EuO

FORMULA_NROFF: EuO

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Spex Standard Reagent Grade, Lot #03811

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Reagent grade Eu-oxide, 83.6 % Eu, Lot #03811

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

83.6% Eu, Spex Standard, Reagent grade

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

No observed impurities. G. Swayze.

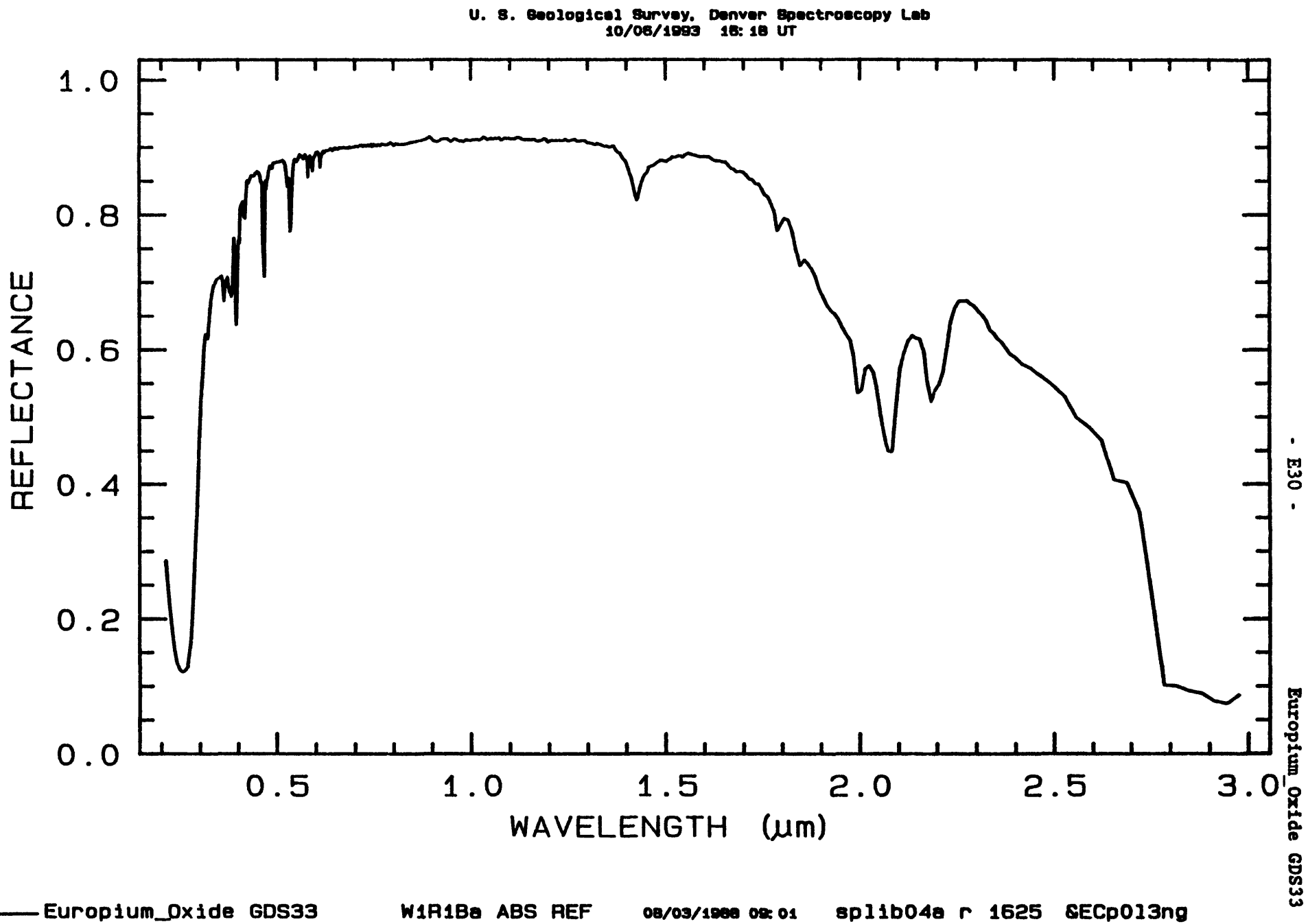
avg gr sz = 4 μm

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 1625 0.2-3μm 200 g.s.= 4 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 15:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- E30 -
Europium_Oxide GDS33
Europium_Oxide GDS33 W1R1Ba ABS REF 08/03/1988 09:01 splib04a r 1625 GECp013ng

TITLE: Fassaite HS118 Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS118

MINERAL_TYPE: Inosilicate

MINERAL: Fassaite (Pyroxene group)

FORMULA: Ca(Mg,Fe+3,Al)(Si,Al)2O6

FORMULA_NROFF: $Ca(Mg,Fe^{+3},Al)(Si,Al)_2O_6$

COLLECTION_LOCALITY: Helena, MT

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Primarily pyroxene; best matches are diopside and augite, but this is not definitive. Some amphibole present Some chlorite present Trace of an unidentifiable residual

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Fassaite commonly contains Fe^{+3} which results in an absorption feature at 0.85μm and ferrous iron which results in a weak band near 1.05μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
90 vol% clinopyroxene (light green)

5 vol% clinopyroxene (dark green)
5 vol% magnetite
tr Fe-oxide staining

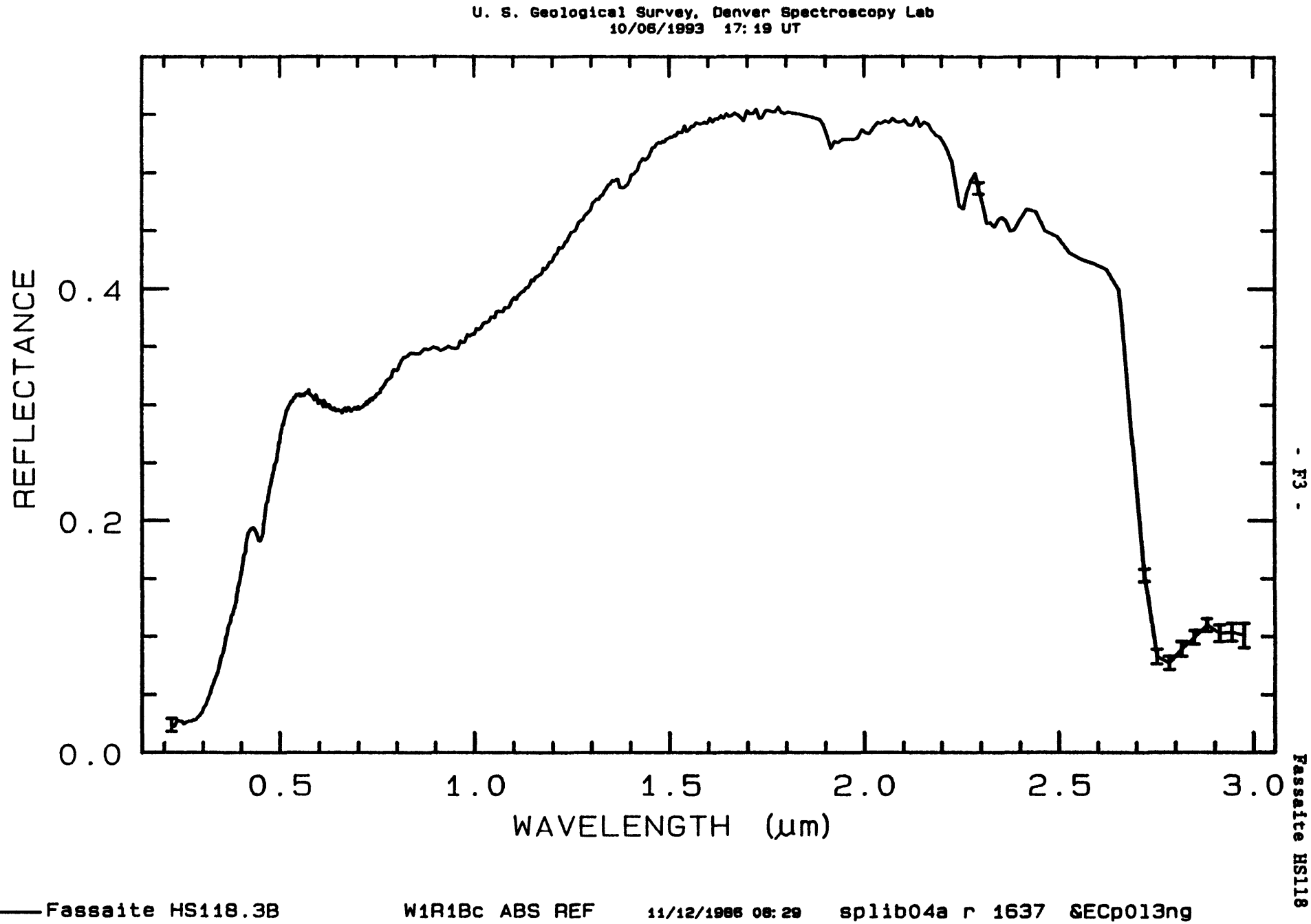
av gr sz = 292 μm

Smaller grains about 8 μm in diameter coat larger grains up to 15% of their surfaces. Magnetite occurs as inclusions in pyroxene grains. Two cleavages at nearly 90 degrees, biaxial (+), 2V ~ 60 degrees, inclined extinction, pleochroism most intense in darker green grains and I believe all one pyroxene. All these properties are consistent with clinopyroxene, and the 2V is about right for Fassaite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1637	0.2-3.0μm	200	g.s. = 292 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 17:19 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- F3 -
Fassaite HS118
Fassaite HS118.3B W1R1Bc ABS REF 11/12/1986 08:29 splib04a r 1637 &ECp013ng

TITLE: Ferrihydrite GDS75 Sy DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS75 (F6)

MINERAL_TYPE: Oxide

MINERAL: Ferrihydrite (Synthetic)

FORMULA: 5(Fe+3)2O3*9H2O

FORMULA_NROFF: $5Fe^{+3}_2O_3 \bullet 9H_2O$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Dave Sherman

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample is one of a series of ferrihydrite samples made by Dave Sherman for the following paper:

Sherman, D.M., R.G. Burns, and V.M. Burns, 1982, Spectral characteristics of the iron oxides with application to the Martian bright region mineralogy. Journal of Geophysical Research, v. 87, n. B12, pp. 10169-10180. (F6 is Dave Sherman's number)

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

the sample is x-ray amorphous - G. Swayze and Ken Esposito.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

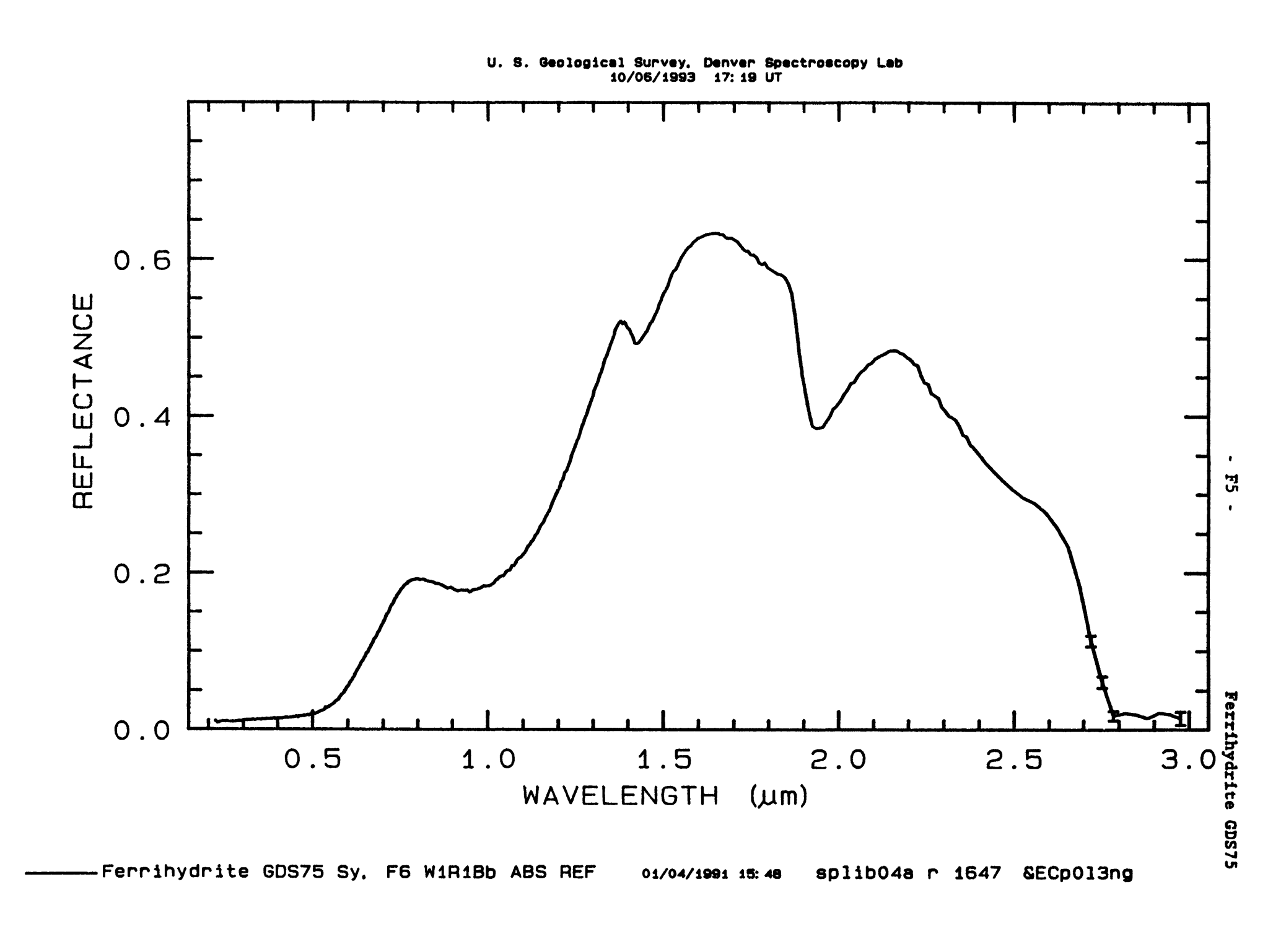
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1647	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 17:19 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- F5 -
Ferrihydrite GDS75
Ferrihydrite GDS75 Sy. F6 W1R1Bb ABS REF 01/04/1991 15:48 splib04a r 1647 &ECp013ng

TITLE: Fluorapatite WS416 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS416

MINERAL_TYPE: Phosphate

MINERAL: Fluorapatite (Apatite group)

FORMULA: Ca5(PO4)3F

FORMULA_NROFF: $Ca_5(PO_4)_3F$

COLLECTION_LOCALITY: Cerro de Mercado, Durango, Mexico

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spectrum shows weak Nd^{+3} bands.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"Found: Apatite (only)
Sought but not found: Quartz

Cell dimension: a=9.3922(4), c=6.8825(6) A, suing Si internal standard.

Comment: extraordinarlyily clear pattern with many sharp peaks indicating high degree of crystallinity and compositional homogeneity. Synthetic fluorapatite reported to have a=9.3684 and c=6.8841 A. Either WS416 does not have endmember composition or the JCDPS reference is in error."

J.S. Huebner and J. Randow, unpublished data, written communication, USGS, Reston, VA (1993)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

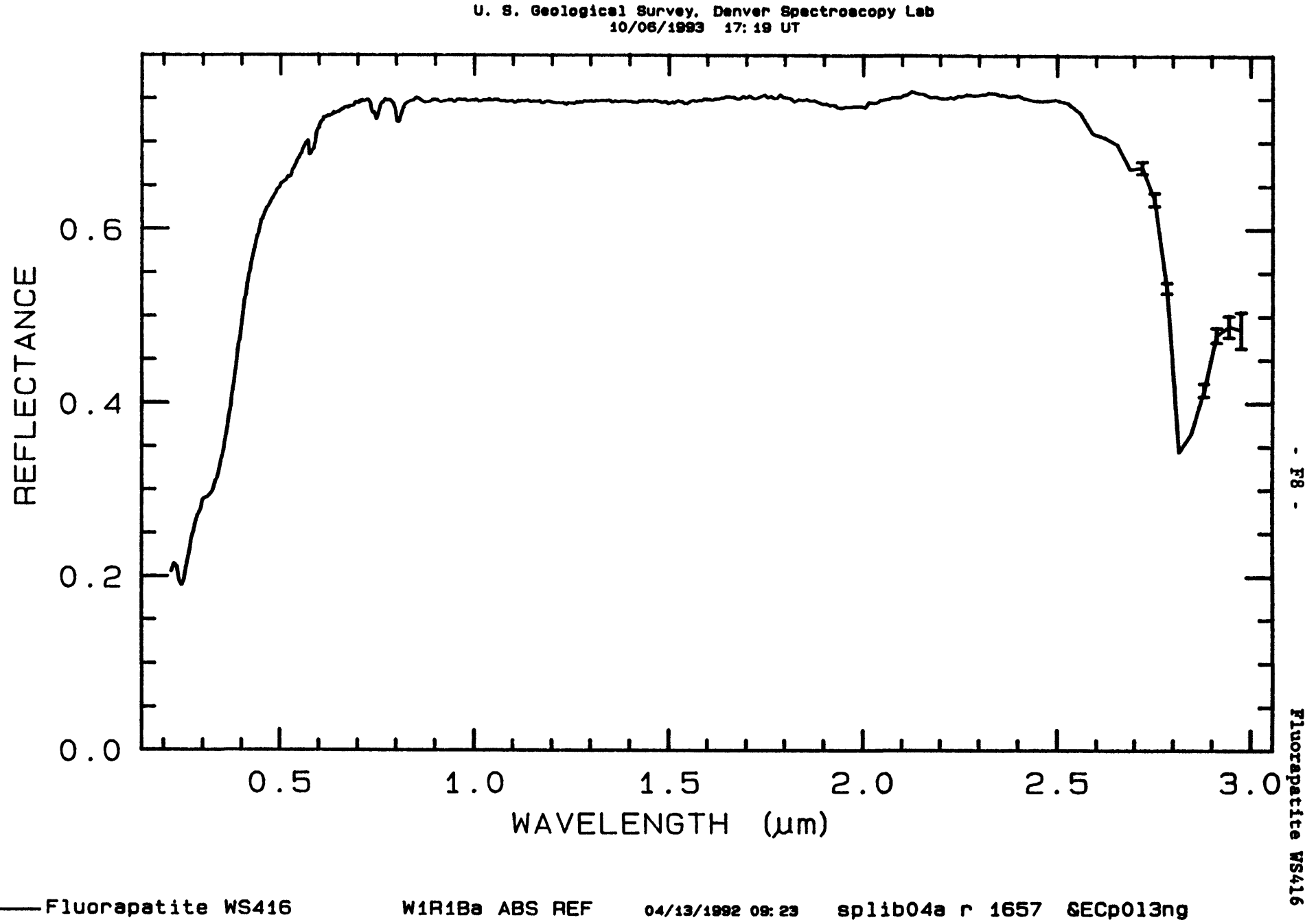
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1657	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 17:19 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Fluorapatite WS416
W1R1Ba ABS REF 04/13/1992 09:23 splib04a r 1657 &ECp013ng

TITLE: Galena HS37 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS37

MINERAL_TYPE: Sulfide

MINERAL: Galena

FORMULA: PbS

FORMULA_NROFF: PbS

COLLECTION_LOCALITY: Galena, Kansas

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Clausthalite.

Galena is usually pure, in the sense that substitution of other metal ions for lead is not very extensive. This sample appears quite pure, containing only a very minor amount of sphalerite. The largest size particles are opaque throughout the spectral region because of intense absorption in the conduction band which extends into the infrared.

Hunt, G.R., J.W. Salisbury, C.J. Lenhoff, 1971, Visible and Near-Infrared spectra of Minerals and Rocks: IV. Sulphides and Sulphates. Mod. Geol. 3, pp 1-14.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure galena.

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
98 vol% galena
2 vol% sphalerite

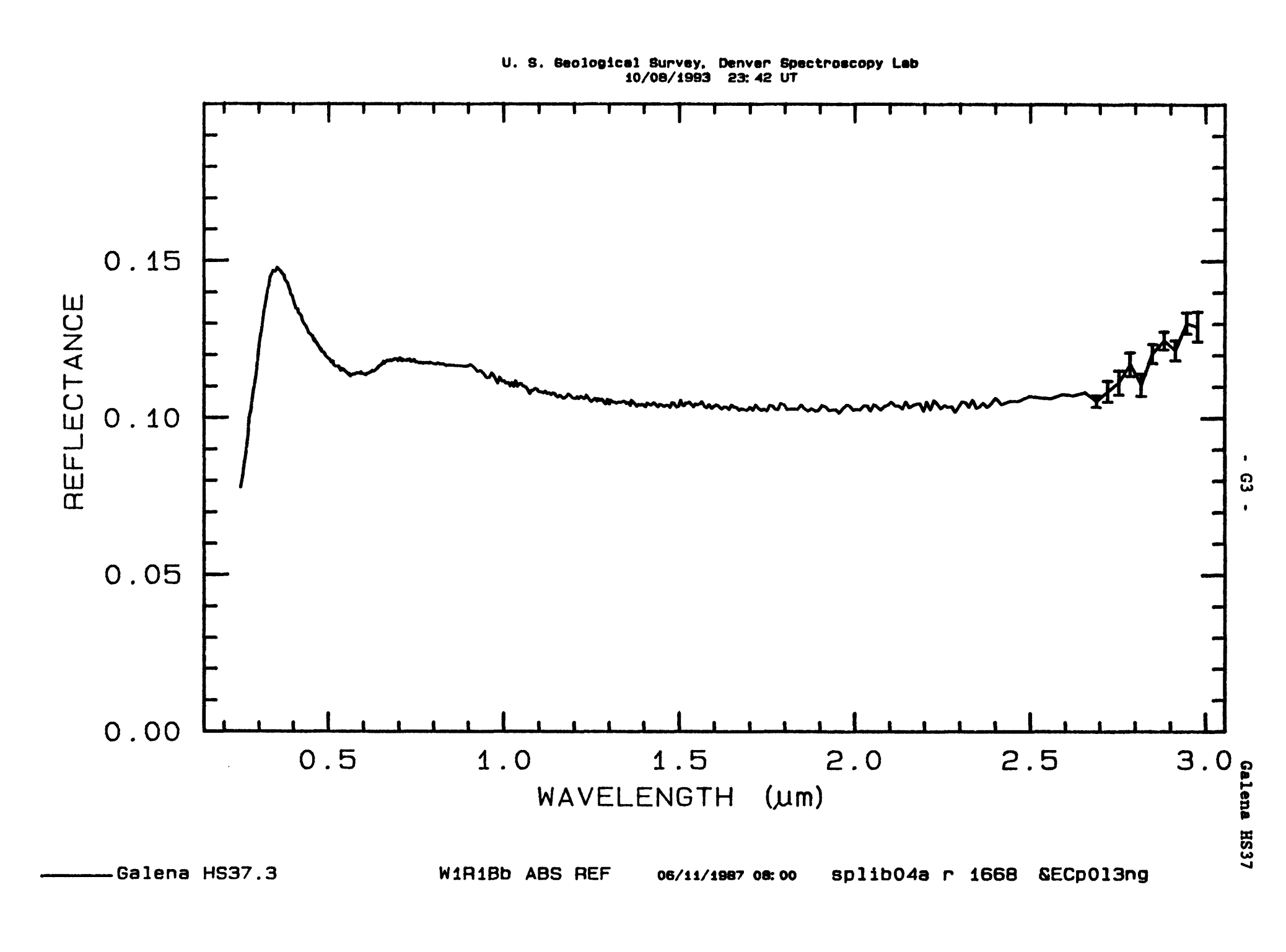
av gr sz = 290 μm

Cubic cleavage, grey metallic luster consistent with galena. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1668	0.2-3.0μm	200	g.s. = 290 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G3 -
Galena HS37
Galena HS37.3
W1R1Bb ABS REF
06/11/1987 08:00
splib04a r 1668 &ECp013ng

TITLE: Galena S102-17 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S102-17

MINERAL_TYPE: Sulfide

MINERAL: Galena

FORMULA: PbS

FORMULA_NROFF: PbS

COLLECTION_LOCALITY: Guymard Mine, Guymard, NY

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: Jules Freidman, USGS

ULTIMATE_SAMPLE_LOCATION: Jules Friedman, USGS

SAMPLE_DESCRIPTION:

Forms series with Clausthalite.

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	162.8	ppm
COMPOSITION_TRACE:	As	<25	ppm
COMPOSITION_TRACE:	Au	.010	ppm
COMPOSITION_TRACE:	Cd	35	ppm
COMPOSITION_TRACE:	Cr	50	ppm
COMPOSITION_TRACE:	Cu	450	ppm
COMPOSITION_TRACE:	Hg	6.00	ppm
COMPOSITION_TRACE:	Mn	<5	ppm
COMPOSITION_TRACE:	Ni	5	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	200	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.05	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	20	ppm
COMPOSITION_TRACE:	Zn		

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	92.0
Sph	6.6
Cpy	
Py	
Qtz	1.4

Assay	wt%
Cu	0.04
Fe	0.36
Pb	79.68
Zn	4.05
S	13.7

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:	
90 vol%	galena
10 vol%	sphalerite
tr	quartz

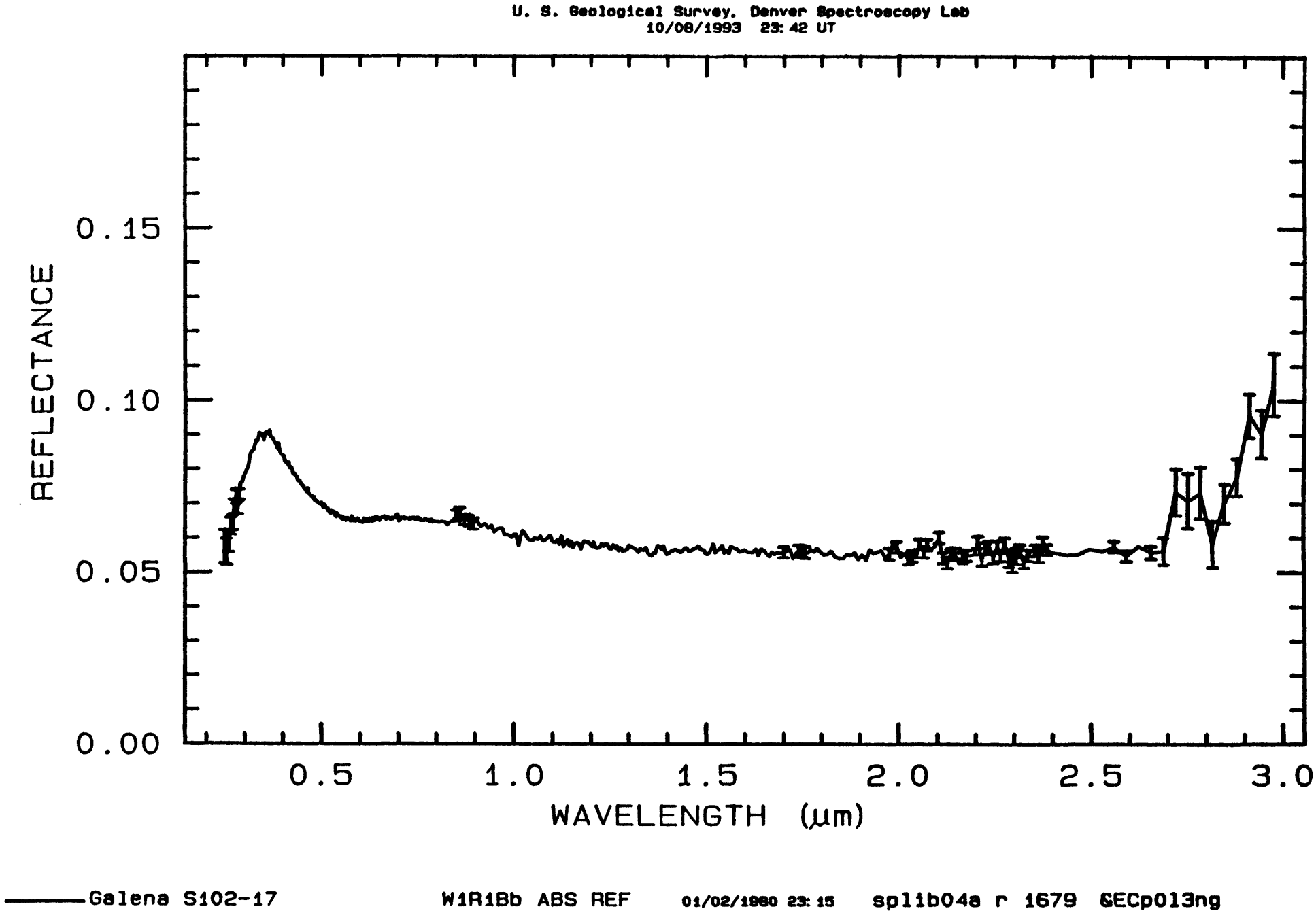
av gr sz = 50 μm

This sample has 10 vol% sphalerite and a trace of quartz. Galena has shiny blue metallic luster and is isotropic. This is consistent with this sample being galena. Sphalerite grains are nearly coated with smaller galena grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1679	0.2-3.0μm	200	g.s. = 50 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Galena S102-17
Galena S102-17 W1R1Bb ABS REF 01/02/1980 23:15 spl1b04a r 1679 &ECp013ng

TITLE: Galena S102-1B DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S102-1B

MINERAL_TYPE: Sulfide

MINERAL: Galena

FORMULA: PbS

FORMULA_NROFF: PbS

COLLECTION_LOCALITY: Guymard Mine, Guymard, NY

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: Jules Friedman, USGS

ULTIMATE_SAMPLE_LOCATION: Jules Freidman, USGS

SAMPLE_DESCRIPTION:

Forms series with Clausthalite.

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	151.5	ppm
COMPOSITION_TRACE:	As	<25	ppm
COMPOSITION_TRACE:	Au	<.005	ppm
COMPOSITION_TRACE:	Cd	10	ppm
COMPOSITION_TRACE:	Cr	45	ppm
COMPOSITION_TRACE:	Cu	400	ppm
COMPOSITION_TRACE:	Hg	1.65	ppm
COMPOSITION_TRACE:	Mn	<5	ppm
COMPOSITION_TRACE:	Ni	10	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	100	ppm
COMPOSITION_TRACE:	Se	45	ppm
COMPOSITION_TRACE:	Te	0.26	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	10	ppm
COMPOSITION_TRACE:	Zn	6000	ppm

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	95.0
Sph	1.0
Cpy	
Py	
Qtz	4.0

Assay	wt%
Cu	0.04
Fe	0.17
Pb	82.37
Zn	0.66
S	13.0

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
94 vol% galena
5 vol% quartz
1 vol% sphalerite

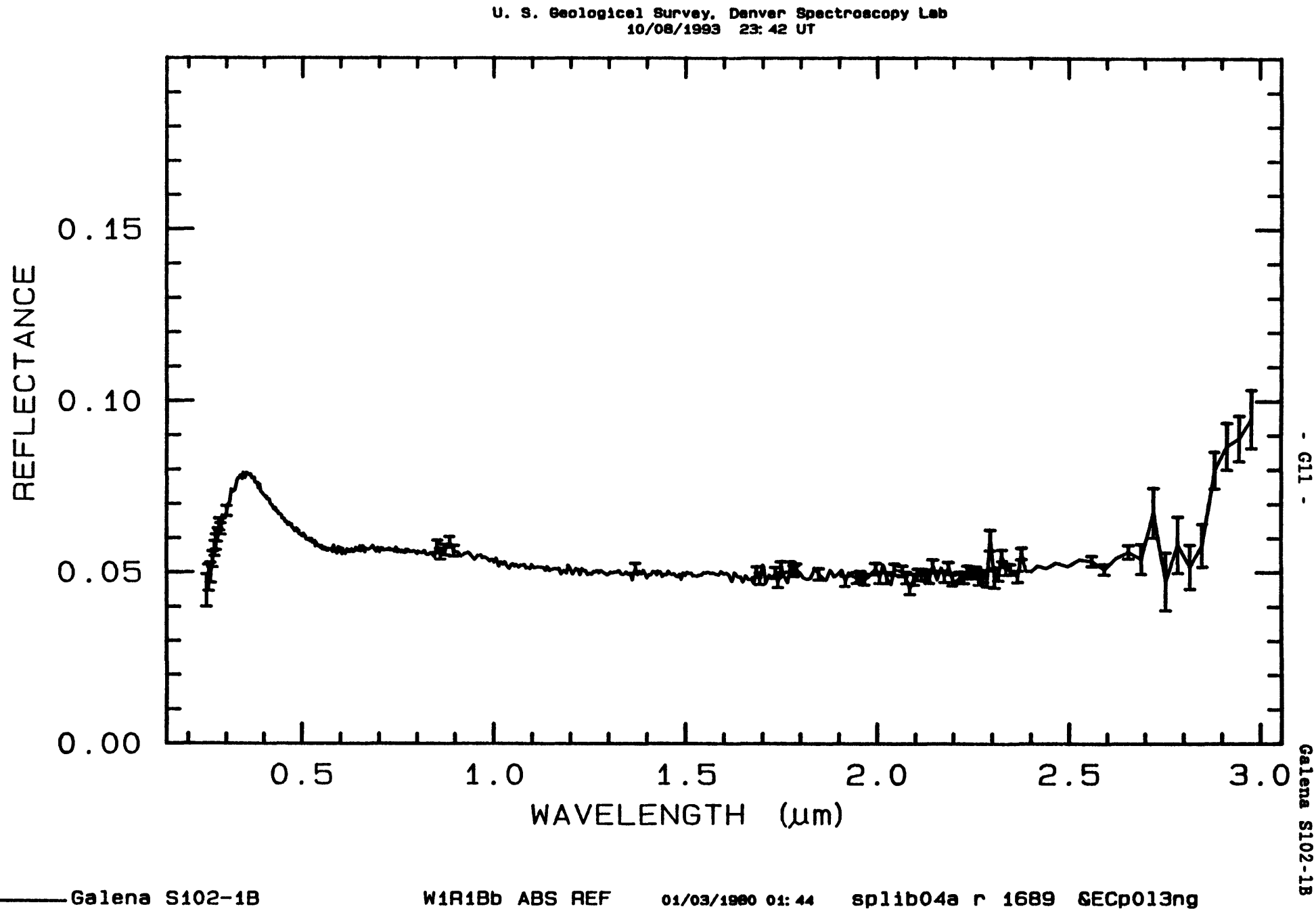
avg gr sz = 30 μm

Grains have shiny blue metallic luster and cubic cleavage. This is consistent with this sample being mostly galena. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1689	0.2-3.0μm	200	g.s. = 30 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G11 -
Galena S102-1B
Galena S102-1B
W1R1Bb ABS REF
01/03/1980 01:44
splib04a r 1689 &ECp013ng

TITLE: Galena S105-2 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S105-2

MINERAL_TYPE: Sulfide

MINERAL: Galena

FORMULA: PbS

FORMULA_NROFF: PbS

COLLECTION_LOCALITY: Washington Mine, Otisville, NY

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: Jules Friedman, USGS

ULTIMATE_SAMPLE_LOCATION: Jules Friedman, USGS

SAMPLE_DESCRIPTION:

Forms series with Clausthalite.

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	180.7	ppm
COMPOSITION_TRACE:	As	<25	ppm
COMPOSITION_TRACE:	Au	.005	ppm
COMPOSITION_TRACE:	Cd	<10	ppm
COMPOSITION_TRACE:	Cr	25	ppm
COMPOSITION_TRACE:	Cu	450	ppm
COMPOSITION_TRACE:	Hg	1.0	ppm
COMPOSITION_TRACE:	Mn	<5	ppm
COMPOSITION_TRACE:	Ni	<5	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	100	ppm
COMPOSITION_TRACE:	Se	25	ppm
COMPOSITION_TRACE:	Te	0.17	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	<5	
COMPOSITION_TRACE:	Zn	7000	

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	98.0
Sph	1.0
Cpy	
Py	
Qtz	1.0

Assay	wt%
Cu	0.04
Fe	0.10
Pb	84.56
Zn	0.69
S	12.5

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

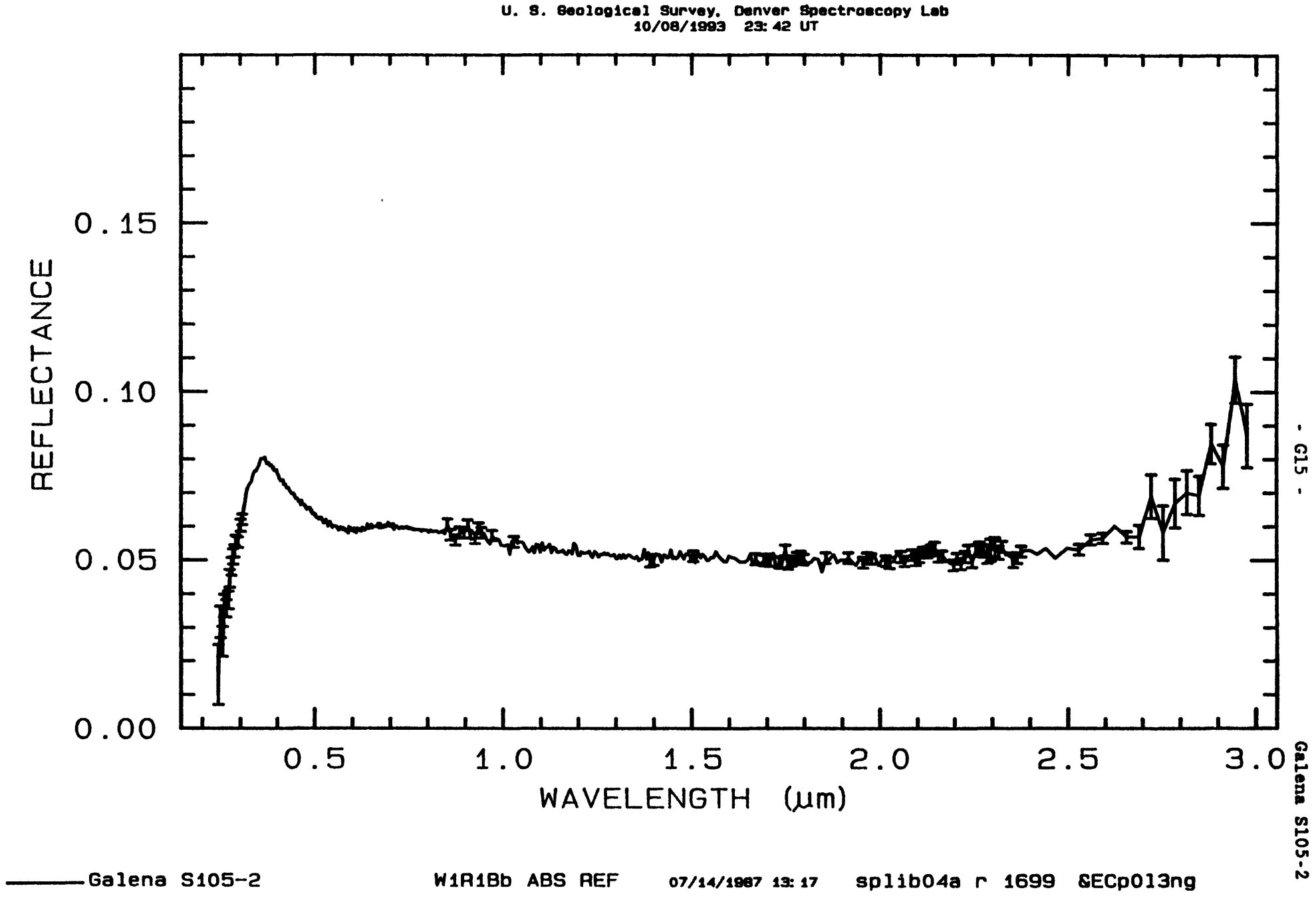
mode:
98 vol% galena
1 vol% sphalerite (I cannot see, but open file indicates present)
1 vol% quartz

Sample has shiny blue metallic luster and cubic cleavage, al consistent with a relatively pure galena sample. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 1699	0.2-3.0μm	200	g.s. = 58 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G15 -
Galena S105-2
Galena S105-2
W1R1Bb ABS REF 07/14/1987 13:17 splib04a r 1699 &ECp013ng

TITLE: Galena S26-39 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S26-39

MINERAL_TYPE: Sulfide

MINERAL: Galena

FORMULA: PbS

FORMULA_NROFF: PbS

COLLECTION_LOCALITY: Ellenville Mine, Ellenville, NY

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: Jules Friedman, USGS

ULTIMATE_SAMPLE_LOCATION: Jules Friedman, USGS

SAMPLE_DESCRIPTION:

Forms series with Clausthalite.

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	120.3	ppm
COMPOSITION_TRACE:	As	<25	ppm
COMPOSITION_TRACE:	Au	.005	ppm
COMPOSITION_TRACE:	Cd	<10	ppm
COMPOSITION_TRACE:	Cr	10	ppm
COMPOSITION_TRACE:	Cu	4500	ppm
COMPOSITION_TRACE:	Hg	0.38	ppm
COMPOSITION_TRACE:	Mn	<5	ppm
COMPOSITION_TRACE:	Ni	<5	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	100	ppm
COMPOSITION_TRACE:	Se	50	ppm
COMPOSITION_TRACE:	Te	0.39	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	<5	ppm
COMPOSITION_TRACE:	Zn	500	ppm

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	98.0
Sph	
Cpy	~ 1.0
Py	
Qtz	1.0

Assay	wt%
Cu	0.45
Fe	0.49
Pb	84.61
Zn	0.05
S	12.8

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

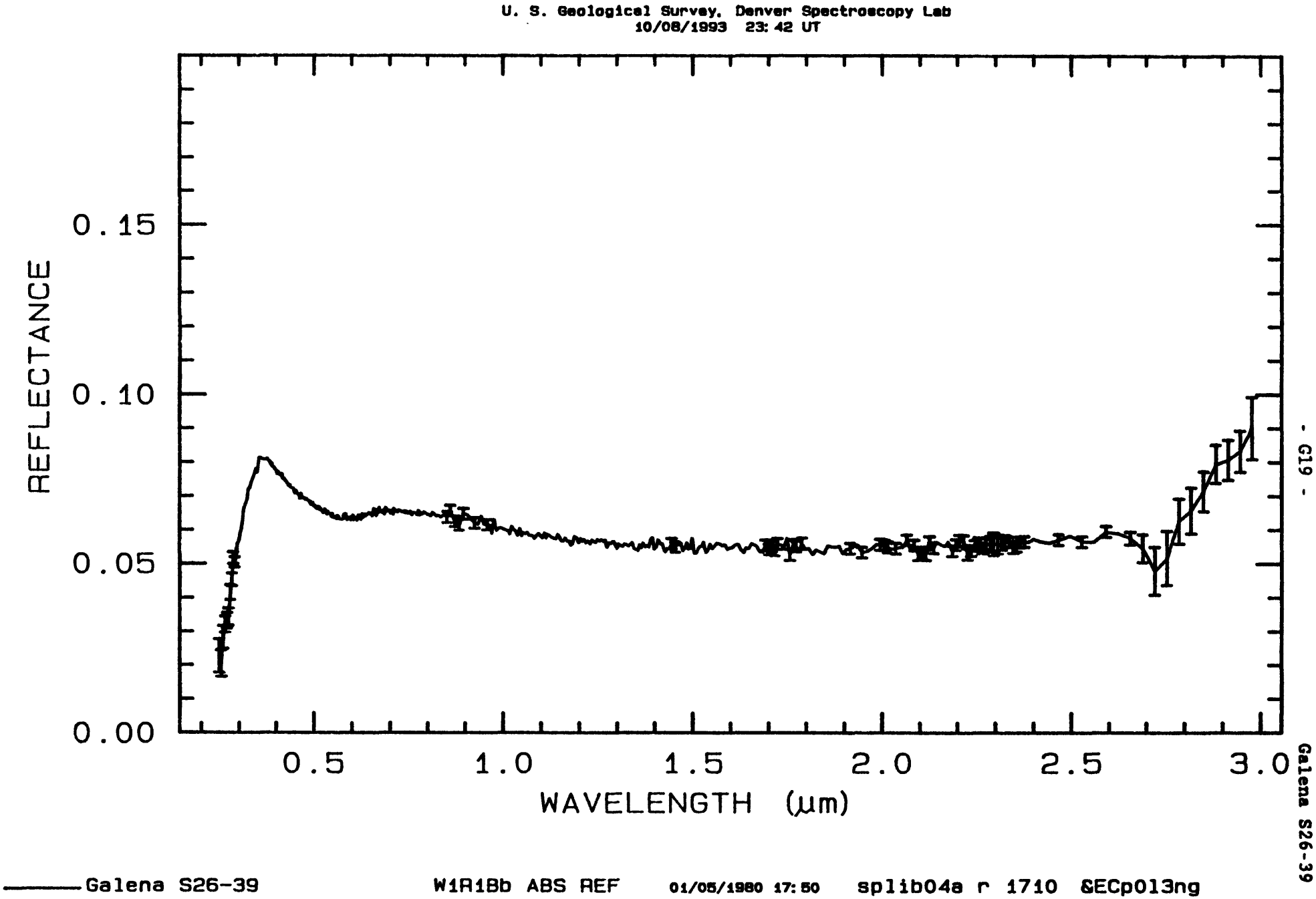
mode:	
100 vol%	galena
tr	quartz

No chalcopyrite is visible, although luster of some grains may be streaked with brass yellow. Galena has blue metallic luster and cubic cleavage indicating this is a nearly pure sample of galena. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1710	0.2-3.0μm	200	g.s.= 50 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G19 -
Galena S26-39
Galena S26-39
W1R1Bb ABS REF
01/05/1980 17:50
splib04a r 1710 &ECp013ng

TITLE: Galena S26-40 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S26-40

MINERAL_TYPE: Sulfide

MINERAL: Galena

FORMULA: PbS

FORMULA_NROFF: PbS

COLLECTION_LOCALITY: Ellenville Mine, Ellenville, NY

ORIGINAL_DONOR: Jules Friedman

CURRENT_SAMPLE_LOCATION: Jules Friedman, USGS

ULTIMATE_SAMPLE_LOCATION: Jules Friedman, USGS

SAMPLE_DESCRIPTION:

Forms series with Clausthalite.

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	444	ppm
COMPOSITION_TRACE:	As	<25	ppm
COMPOSITION_TRACE:	Au	0.005	ppm
COMPOSITION_TRACE:	Cd	<10	ppm
COMPOSITION_TRACE:	Cr	20	ppm
COMPOSITION_TRACE:	Cu	4300	ppm
COMPOSITION_TRACE:	Hg	0.12	ppm
COMPOSITION_TRACE:	Mn	<5	ppm
COMPOSITION_TRACE:	Ni	30	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	400	ppm
COMPOSITION_TRACE:	Se	45	ppm
COMPOSITION_TRACE:	Te	0.87	ppm
COMPOSITION_TRACE:	Tl	0.2	ppm
COMPOSITION_TRACE:	V	<5	ppm
COMPOSITION_TRACE:	Zn	110	ppm

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	98.0
Sph	
Cpy	~ 1.0
Py	
Qtz	1.0

Assay	wt%
Cu	0.49
Fe	0.49
Pb	84.66
Zn	0.02
S	13.0

Wilbur, J.S, F.E. Mutschler, J.D. Friedman, and R.E. Zartman, 1990, New chemical, isotopic, and fluid inclusion data from zinc-lead-copper veins, Shawangunk Mountains, New York. Economic Geology, v.85 no.1, pp. 182-196.

Friedman, J.D., F.E. Mutschler, R.E. Zartman, P.H. Briggs, G.A. Swayze, and A.F. Theisen, 1989, Shawangunk ore district, New York: Geochemical and spectral data. USGS Open-File Report 89-193, p. 92.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:	
100 vol%	galena
tr	chalcopyrite
tr	quartz

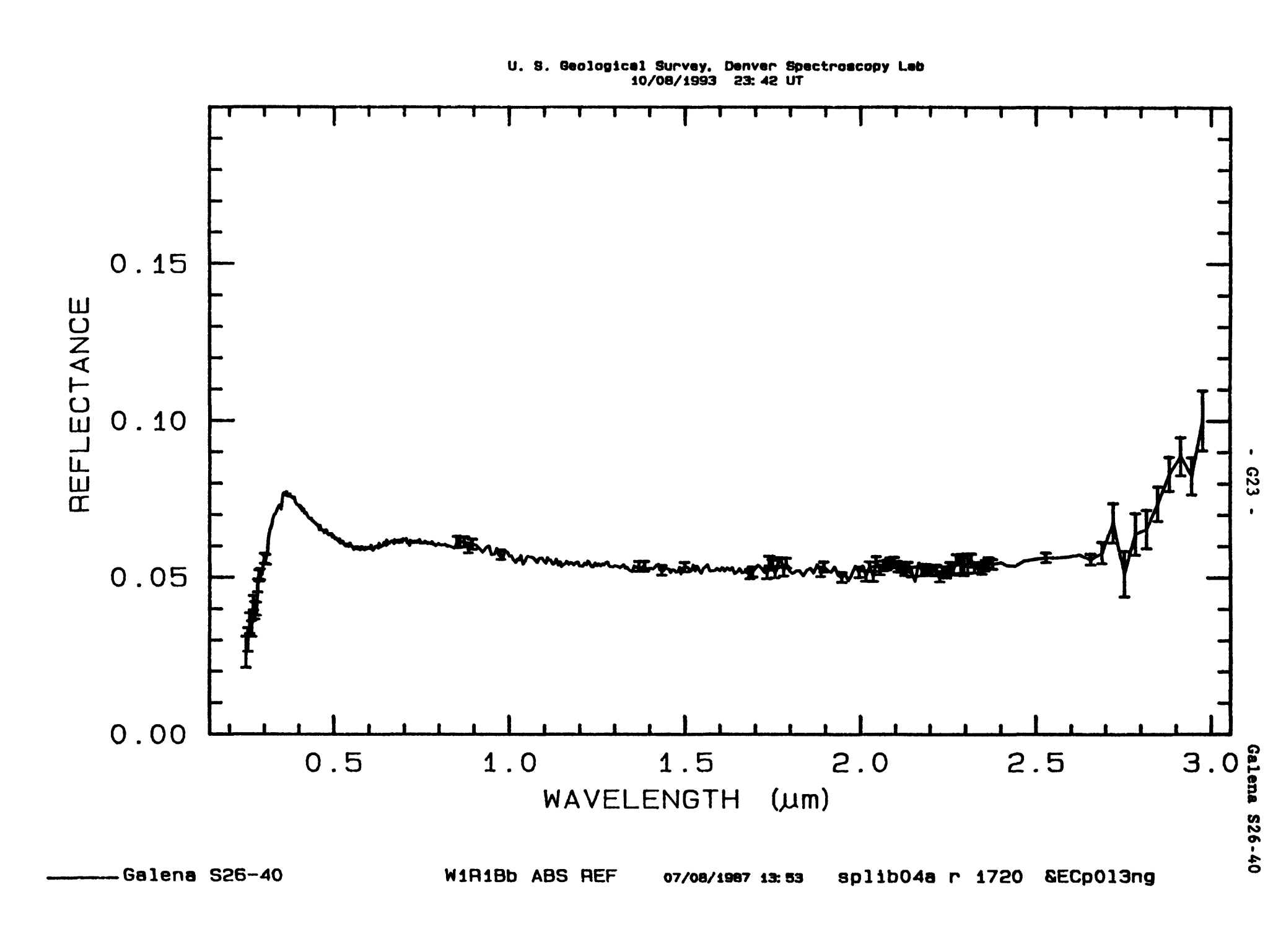
avg gr sz = 75 μm

Grains have shiny blue metallic luster and cubic cleavage. This is consistent with a slightly contaminated galena sample. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1720	0.2-3.0μm	200	g.s.= 75 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G23 -
Galena S26-40
Galena S26-40
W1R1Bb ABS REF
07/08/1987 13:53
splib04a r 1720 &ECp013ng

TITLE: Gaylussite NMNH102876-2 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH102876-2

MINERAL_TYPE: Hydrous Carbonate

MINERAL: Gaylussite

FORMULA: Na2Ca(CO3)2*5H2O

FORMULA_NROFF: $Na_2Ca(CO_3)_2 \bullet 5H_2O$

COLLECTION_LOCALITY: Searles Lake, California

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure gaylussite (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

This spectrum appears to have subdued features at wavelengths past 1.5 μm compared to the spectrum published in Crowley (1991) which may be due to the incomplete drying of the sample after crushing or the presence of fluid inclusions. G. Swayze

END_COMPOSITION_DISCUSSION.

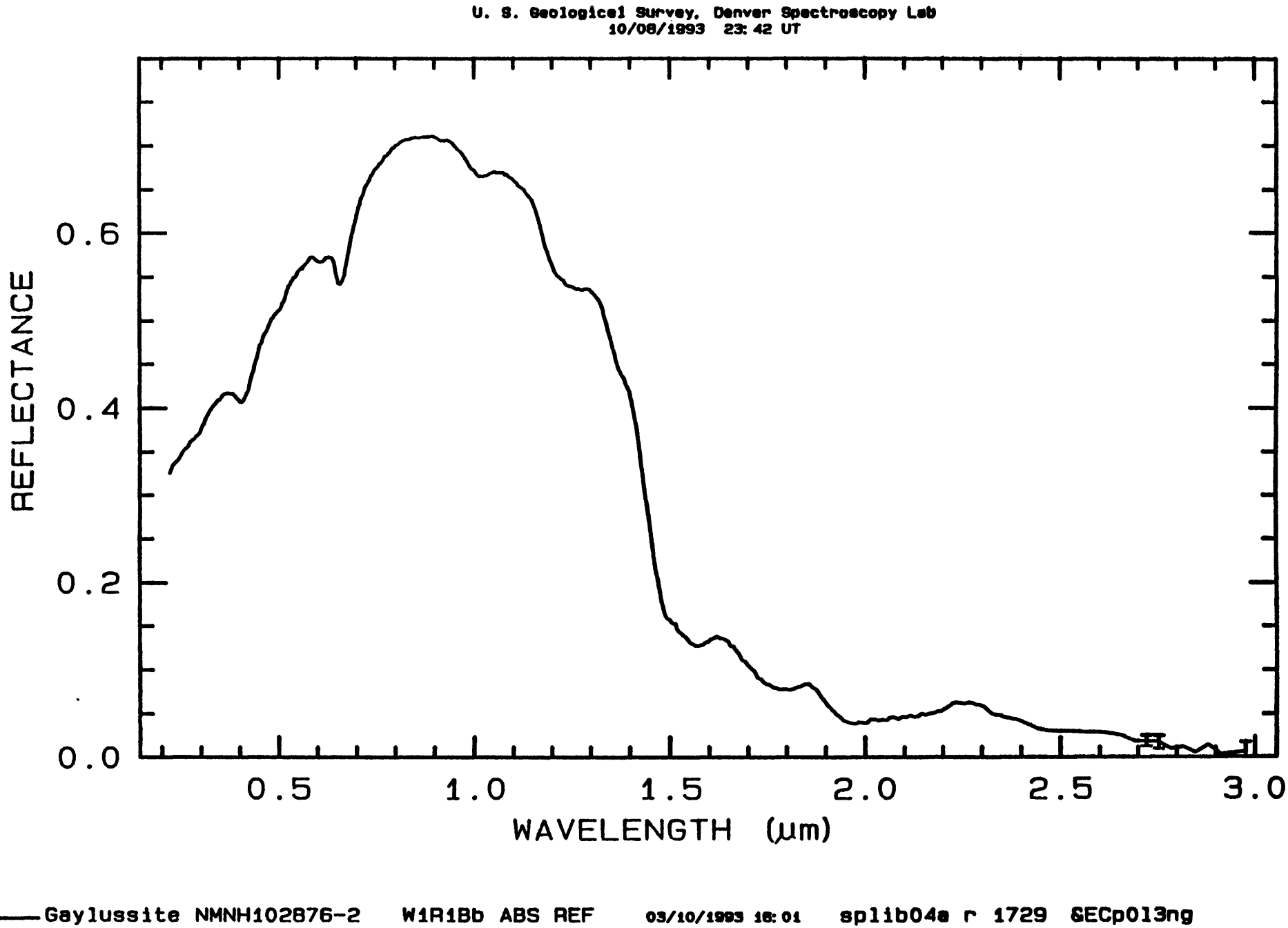
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 1729 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/06/1993 23:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
Gaylussite NMNH102876-2
- G26 -
Gaylussite NMNH102876-2 W1R1Bb ABS REF 03/10/1993 16:01 splib04a r 1729 &ECp013ng

TITLE: Gibbsite HS423 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS423

MINERAL_TYPE: Hydroxide

MINERAL: Gibbsite

FORMULA: Al(OH)3

FORMULA_NROFF: $Al(OH)_3$

COLLECTION_LOCALITY: Brazil

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Trimorphous with Bayerite and Nordstrandite.

Original spectrum published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

With the comment:"This particular sample is a cryptocrystalline stalactitic aggregate, composed of concentric layers of gibbsite of variable purity. Some layers are slightly contaminated with iron, which produces the gentle fall-off in reflectivity of the powdered samples toward the blue region of the visible. In the near-infrared, all the spectral features are due to the vibrations of the hydroxyl ion. In the mid-infrared, well defined fundamental Al-O-H bending modes occur at 10.34 and 9.8μm, and a series of fundamental stretching modes occur at 2.975, 2.917, 2.842, and 2.765μm. The second overtone and combinations of the stretching modes produce the weak but relatively sharp features which appear near 1.0μm in our spectra, the first overtone and combinations of the stretching mode produce the numerous relatively sharp features centered at 1.45μm, and the combinations of the stretching and bending modes produce the features near 2.3μm. Some free water is indicated by the bands near 1.9μm."

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure gibbsite

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
94 vol% gibbsite
6 vol% Fe-stained gibbsite grains

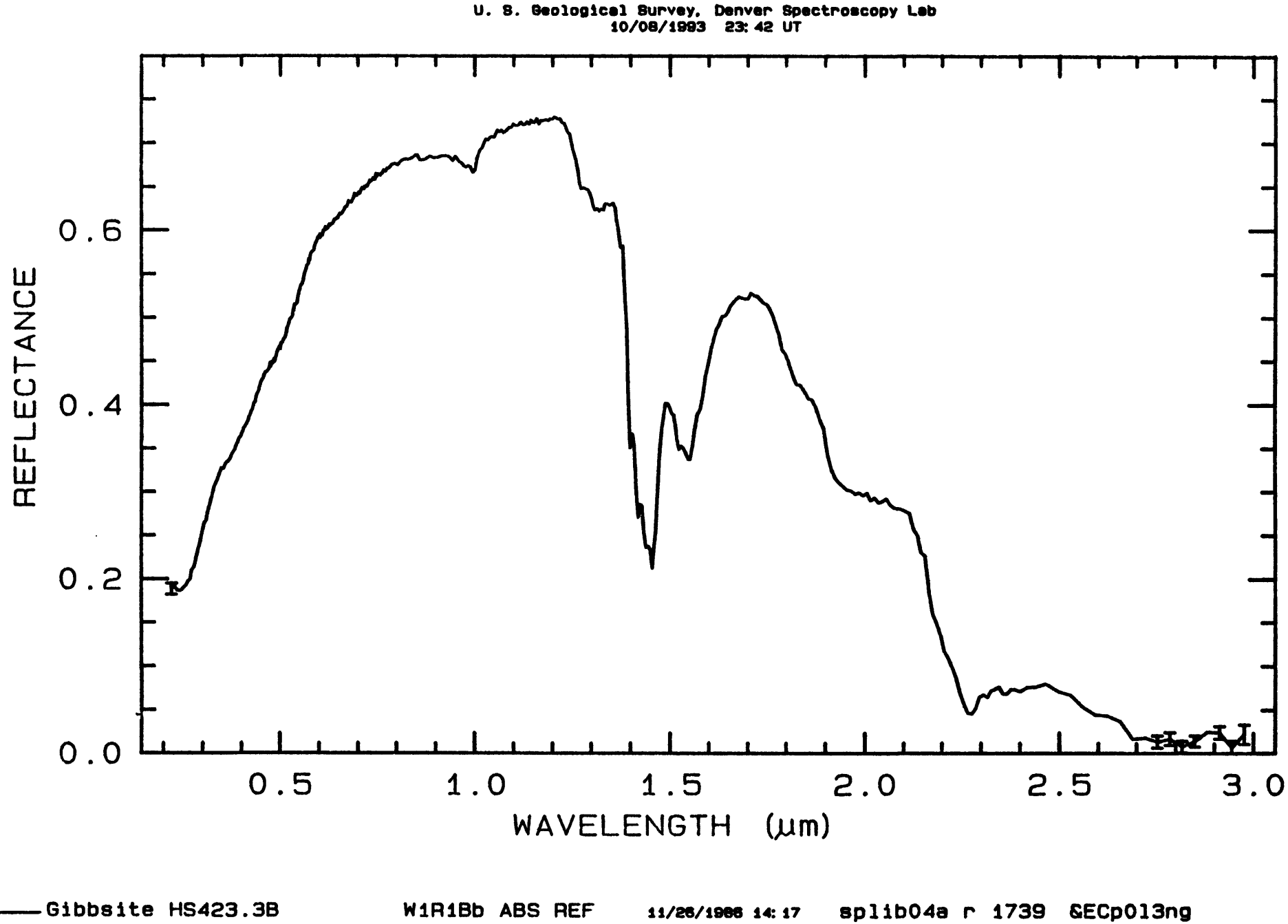
avg gr sz = 60 μm

Concentric dark lines of inclusions across crystal bundles indicates growth as stalatitic forms. Inclined extinction, small 2V (<20 degrees), biaxial (+), all consistent with gibbsite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1739	0.2-3.0μm	200	g.s.= 60 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Gibbsite HS423
Gibbsite HS423.3B W1R1Bb ABS REF 11/26/1986 14:17 splib04a r 1739 &ECp013ng

TITLE: Gibbsite WS214 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS214

MINERAL_TYPE: Hydroxide

MINERAL: Gibbsite

FORMULA: Al(OH)3

FORMULA_NROFF: $Al(OH)_3$

COLLECTION_LOCALITY: Minas Gerais, Brazil

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Trimorphous with Bayerite and Nordstrandite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Gibbsite - major component
Trace of unidentified residual

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

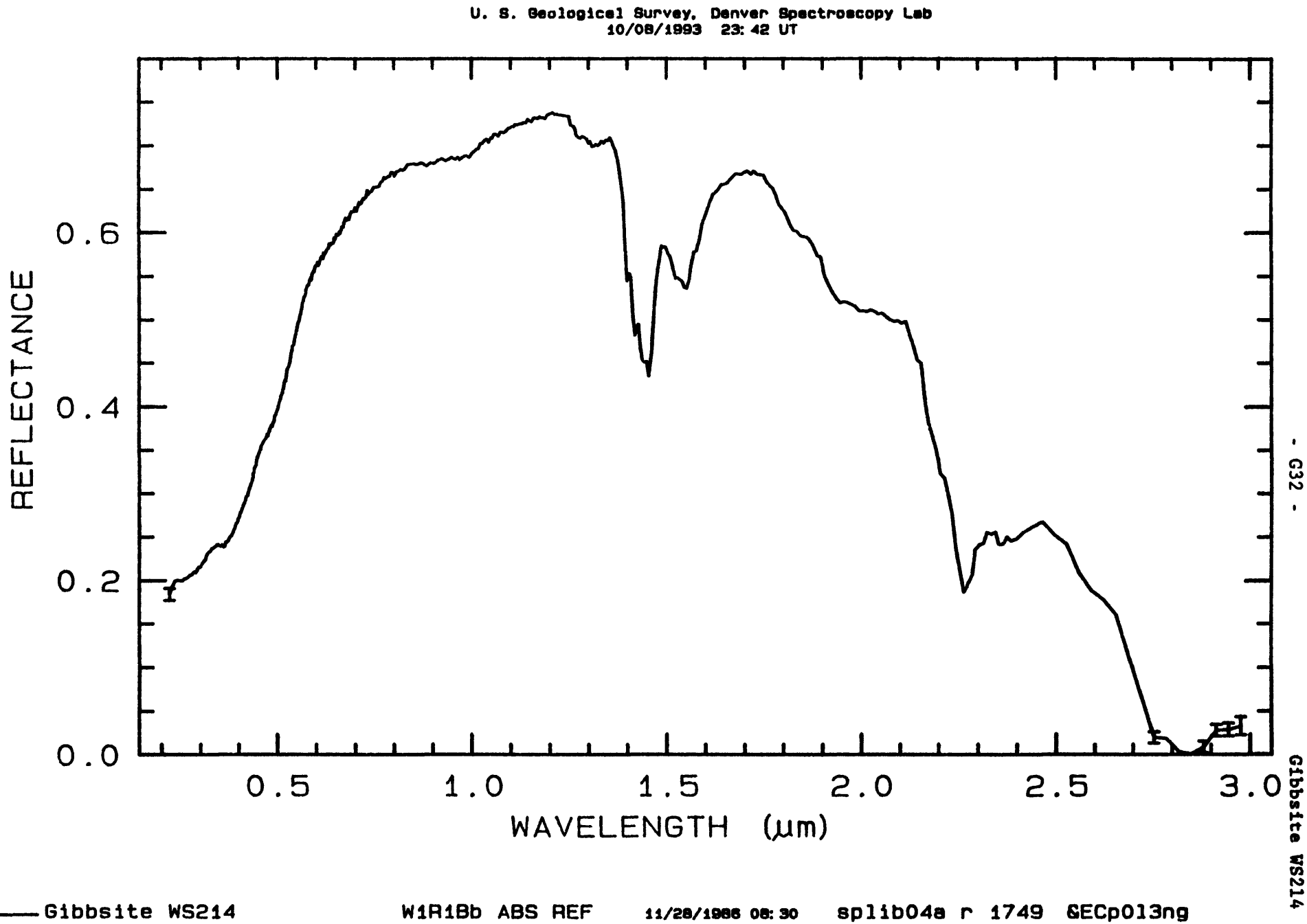
avg gr sz = 30 μm

Ubiquitous light colored Fe-oxide ? staining. Sample looks pure otherwise; good cleavage, prismatic crystal habit, twinning, crystals too small for determine otical sign. Other optical properties are consistent with gibbsite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1749	0.2-3.0μm	200	g.s.= 30 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G32 -
Gibbsite WS214
Gibbsite WS214
W1R1Bb ABS REF
11/28/1986 08:30
splib04a r 1749 GECp013ng

TITLE: Glauconite HS313 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS313

MINERAL_TYPE: Phyllosilicate

MINERAL: Glauconite (Mica group)

FORMULA: (K,Na)(Fe+3,Al,Mg)2(Si,Al)4O10(OH)2

FORMULA_NROFF: $(K,Na)(Fe^{+3},Al,Mg)_2(Si,Al)_4O_{10}(OH)_2$

COLLECTION_LOCALITY: South Dakota

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample measured was HS313.3B which was dry sieved to the grain size interval 74-250 μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Quartz - major component
1M mica (phlogopite, glauconite) - major component

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No analysis.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Optical examination gives the following mineral mode:

70 vol%	glauconite		
	pop 1	av gr sz = 230μm	65 vol%
	pop 2	av gr sz = 8μm	5 vol%
30 vol%	quartz and feldspar grains		
	pop 3	av gr sz = 260μm	30 vol%

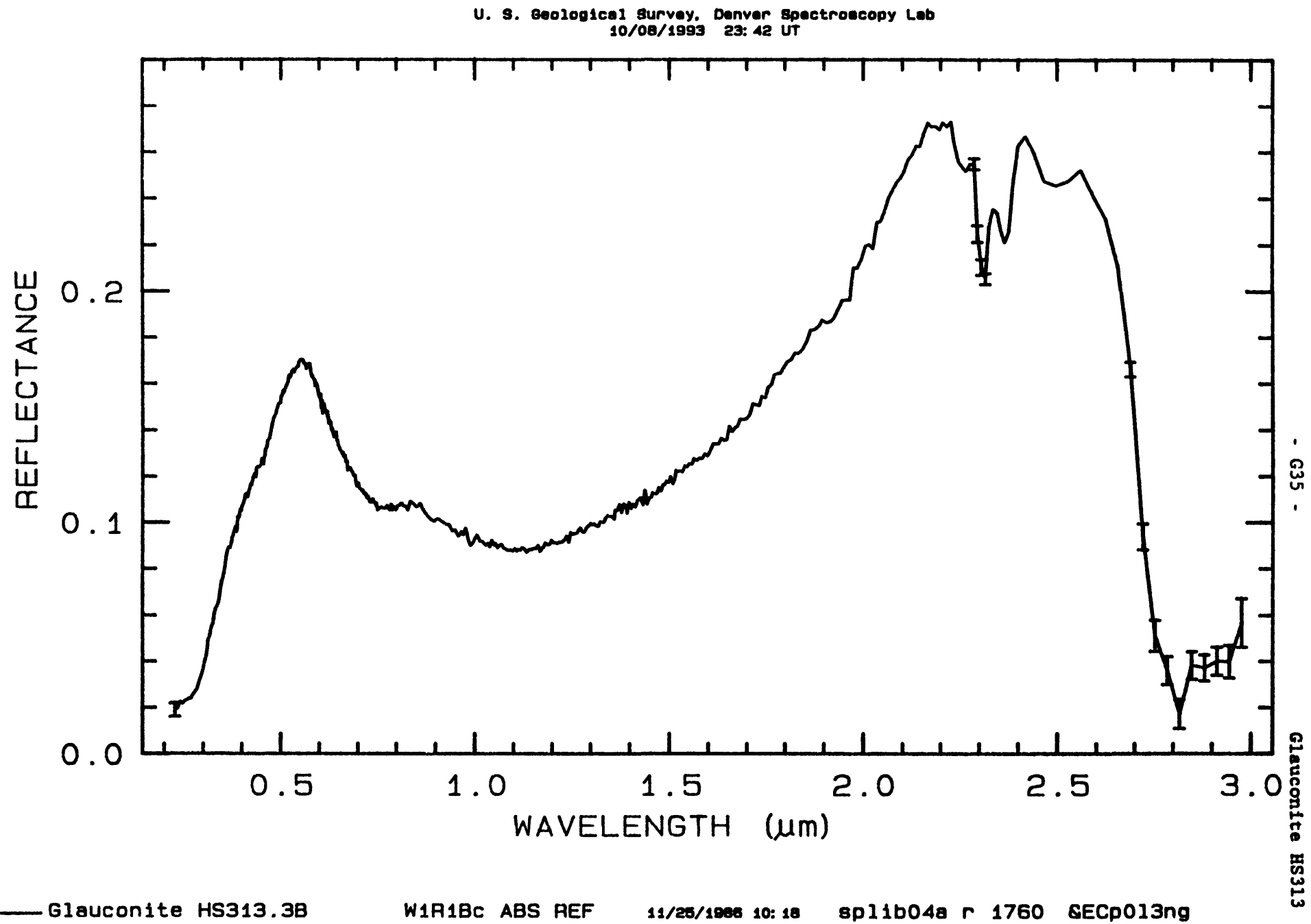
av gr sz populations = 234μm

Large rounded glauconite grains whose surfaces are 60% covered with smaller glauconite. Some of the quartz and feldspar grains are Fe-stained and partially glauconite coated. Glauconite grains have slight yellow-green pleochroism. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1760	0.2-3.0μm	200	g.s.= 234 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G35 -
Glauconite HS313
Glauconite HS313.3B W1R1Bc ABS REF 11/25/1986 10:18 splib04a r 1760 &ECp013ng

TITLE: Glaucophane HS426 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS426

MINERAL_TYPE: Inosilicate

MINERAL: Glaucophane (Amphibole group)

FORMULA: Na2(Mg,Fe+2)3Al2Si8O22(OH)2

FORMULA_NROFF: $Na_2(Mg,Fe^{+2})_3Al_2Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: California

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Ferroglaucophane.

Original spectrum published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

With the comment:"The iron-free end member is very rare, and in most glaucophane there is some replacement of Mg by Fe^{2+} and of Al by Fe^{3+}. Such substitution results in the broad absorption from 0.6 to 1.0μm. The 1.4μm hydroxyl band is quite evident, and the 2.32μm feature is the best resolved band in the spectrum. The 1.9μm band indicates that a little included water is present."

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates glaucophane + chlorite + others.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

TITLE: Goethite WS222 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS222

MINERAL_TYPE: Hydroxide

MINERAL: Goethite

FORMULA: alpha-FeO(OH)

FORMULA_NROFF: α-FeO(OH)

COLLECTION_LOCALITY: Superior Mine, Marquette, Michigan

ORIGINAL_DONOR: Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Akaganeite, Feroxyhyte, and Lepidocrocite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Goethite
Perhaps sonme quartz

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:
mode 1: av gr sz = 227 μm @ 30 vol%
mode 2: av gr sz = 5 μm @ 70 vol%

av gr sz = 125 μm

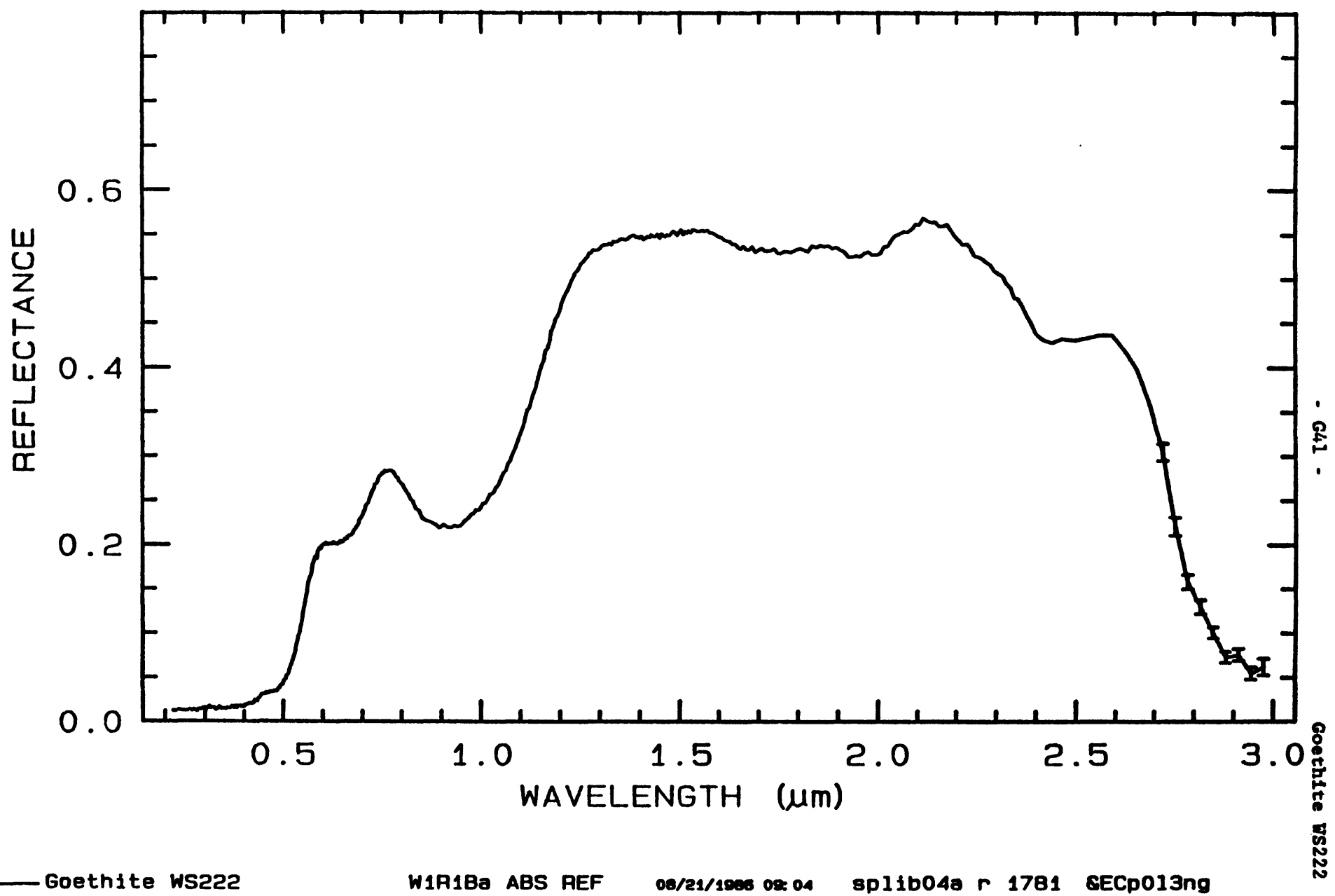
No visible impurties; large fibrous grains are 90% coated with finer grains. High relief, moderate red pleochroism, prismatic cleavage. All

this is consistent with pure goethite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1781	0.2-3.0μm	200	g.s.= 125 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:42 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Goethite WS222
Goethite WS222 W1R1Ba ABS REF 08/21/1986 09:04 splib04a r 1781 GECp013ng

TITLE: Goethite HS36 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS36

MINERAL_TYPE: Hydroxide

MINERAL: Goethite

FORMULA: alpha-FeO(OH)

FORMULA_NROFF: α-FeO(OH)

COLLECTION_LOCALITY: Biwabik, Minn

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Akaganeite, Feroxyhyte, and Lepidocrocite.

Original spectrum published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

With the note:"Like cuprite, goethite displays trans-opaque behavior, but does so at a slightly shorter wavelength (near 0.55μm). The ferric ion itself produces the feature near 0.9, and the fall-off short of 0.55μm is explained as being due to the presence of a conduction band with a quite well-resolved absorption edge, which is typical of the trans-opaque iron oxides. It should be noted in particular that goethite displays no hydorxyl bands in the near-infrared, despite its traditional formula, FeO-OH. Like diaspore (see above), the pure mineral should contain no free hydroxyl groups (Ewing, 1935)."

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:	
90 vol%	fibrous goethite
10 vol%	quartz or other clear mineral
tr	paper fibre
tr	metal shavings from grinder

Bimodal grain size distribution:
mode 1: av gr sz = 300 μm @ 98 vol%
mode 2: av gr sz = 10 μm @ 2 vol%

av gr sz = 297 μm

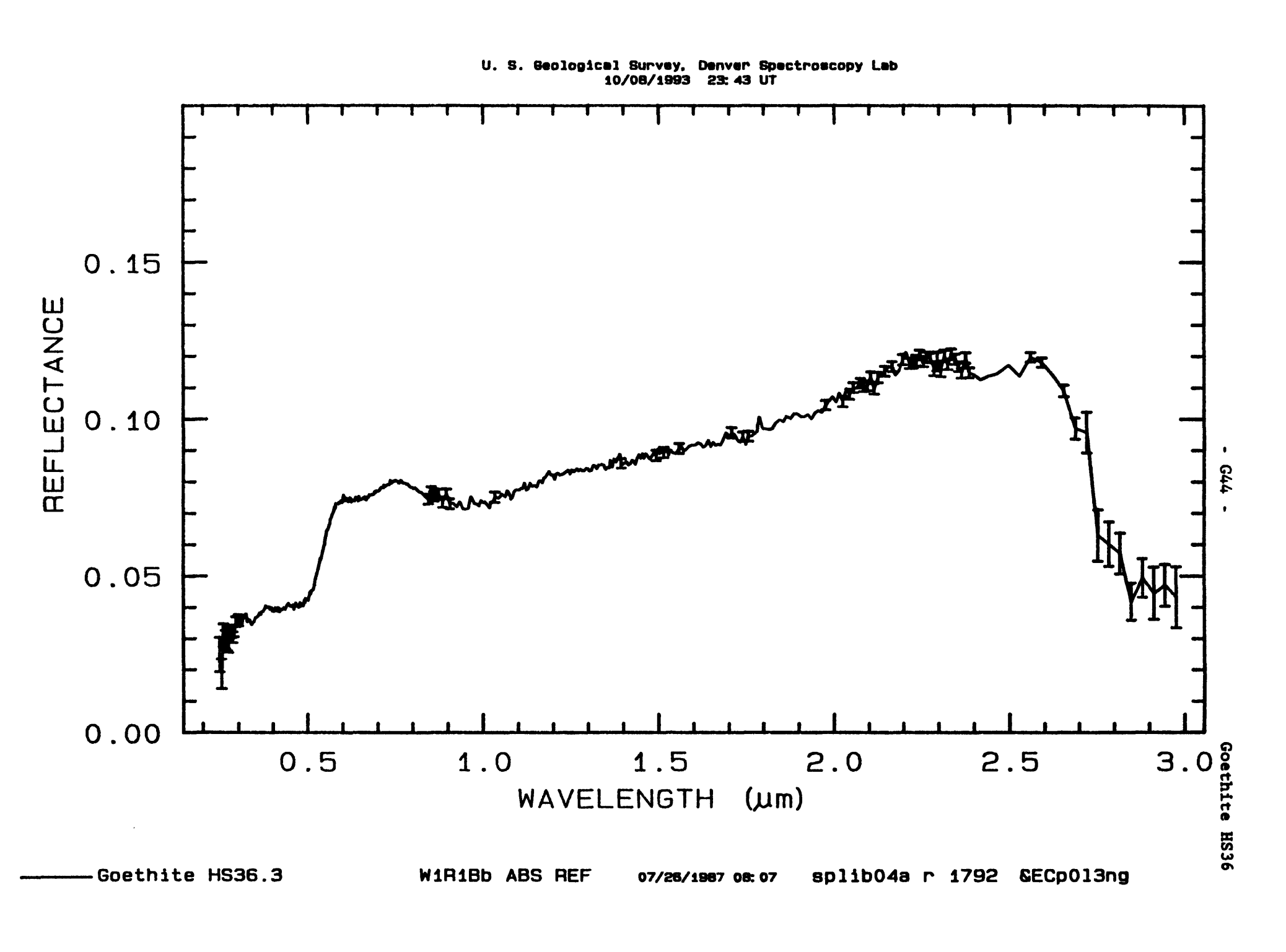
*above gr sz for goethite only; av gr sz quartz = 150 μm

Fibrous brown grains (prismatic?), length slow, biaxial, high relief. Translucent red in plain polarized light. Grains are slightly pleochroic. These properties are consistent with goethite. Sample should be cleaned of iron shavings with a magnet. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1792	0.2-3.0μm	200	g.s.= 300 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C44 -
Goethite HS36
Goethite HS36.3
W1R1Bb ABS REF
07/26/1987 08:07
splib04a r 1792 &ECp013ng

TITLE: Goethite WS219 (Limonite) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS219

MINERAL_TYPE: Hydroxide

MINERAL: Goethite

FORMULA: alpha-FeO(OH)

FORMULA_NROFF: α-FeO(OH)

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Akaganeite, Feroxyhyte, and Lepidocrocite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
50 vol% limonite coated quartz grains
35 vol% limonite small grains & limonite coated quartz
15 vol% limonite large grains

bimodal grain size distribution:
mode 1: av gr sz limonite coating = 8 μm 30 vol%
mode 2: av gr sz limonite grains = 60 μm 15 vol%

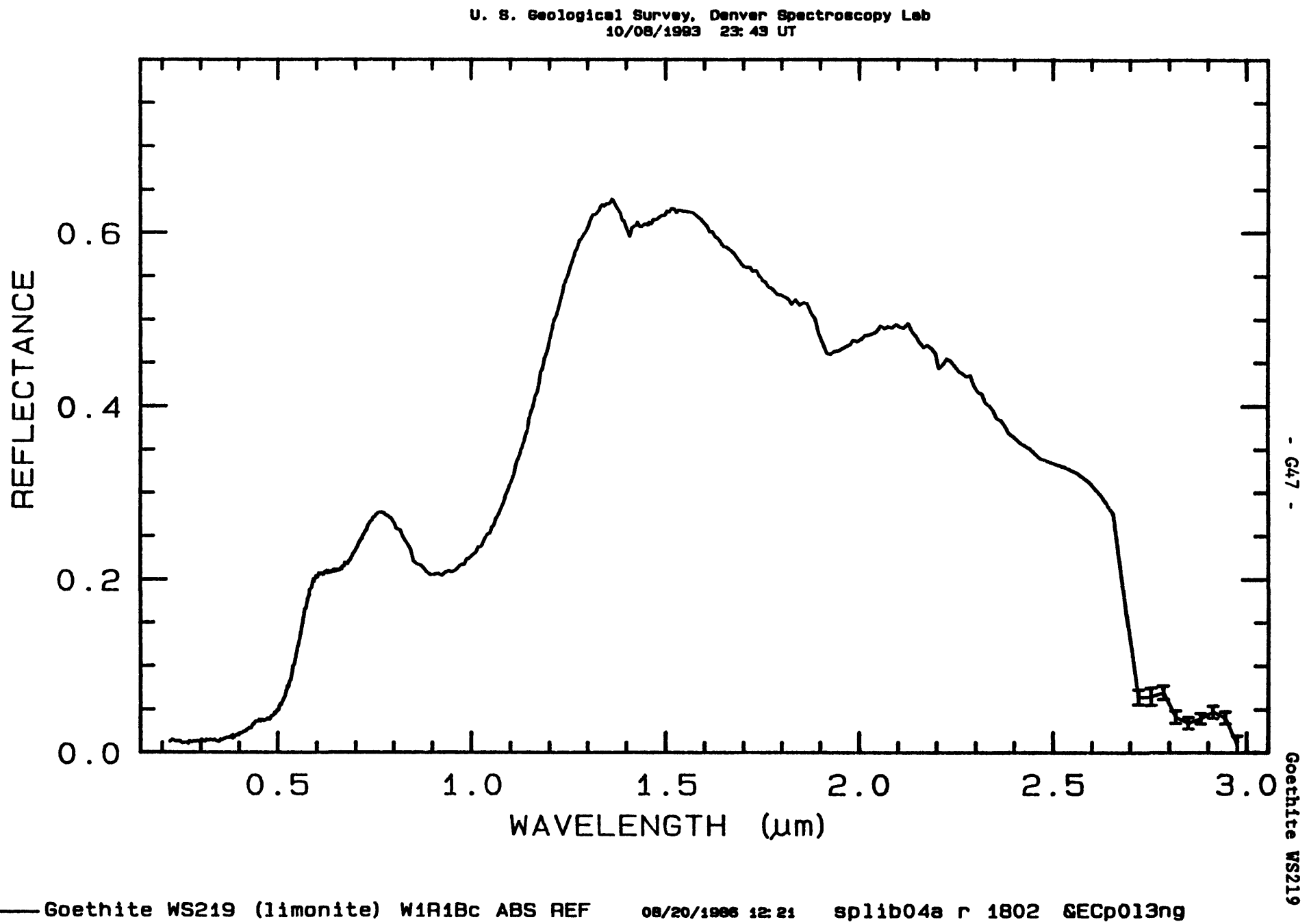
av gr sz = 35 μm of limonite

Smaller limonite grains 80% coat larger limonite and quartz grains. Grains size too small or grains isotropic so I cannot determine optical properties. In plain light grains resemble plates and not fibres suggesting the possible dominance of lepidochrosite? Yellow-brown color and high relief. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1802	0.2-3.0μm	200	g.s.= 35 μm



Goethite WS219

TITLE: Goethite WS220 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS220

MINERAL_TYPE: Hydroxide

MINERAL: Goethite

FORMULA: alpha-FeO(OH)

FORMULA_NROFF: α-FeO(OH)

COLLECTION_LOCALITY: Kent, Connecticut

ORIGINAL_DONOR: Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Akaganeite, Feroxyhyte, and Lepidocrocite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:
mode:
60 vol% quartz
20 vol% large goethite grains
20 vol% small goethite grains

Bimodal goethite grain size distribution:
mode 1: av gr sz = 50 μm @ 50 vol%
mode 2: av gr sz = 10 μm @ 50 vol%

av gr sz = 36 μm

quartz av gr sz = 75 μm

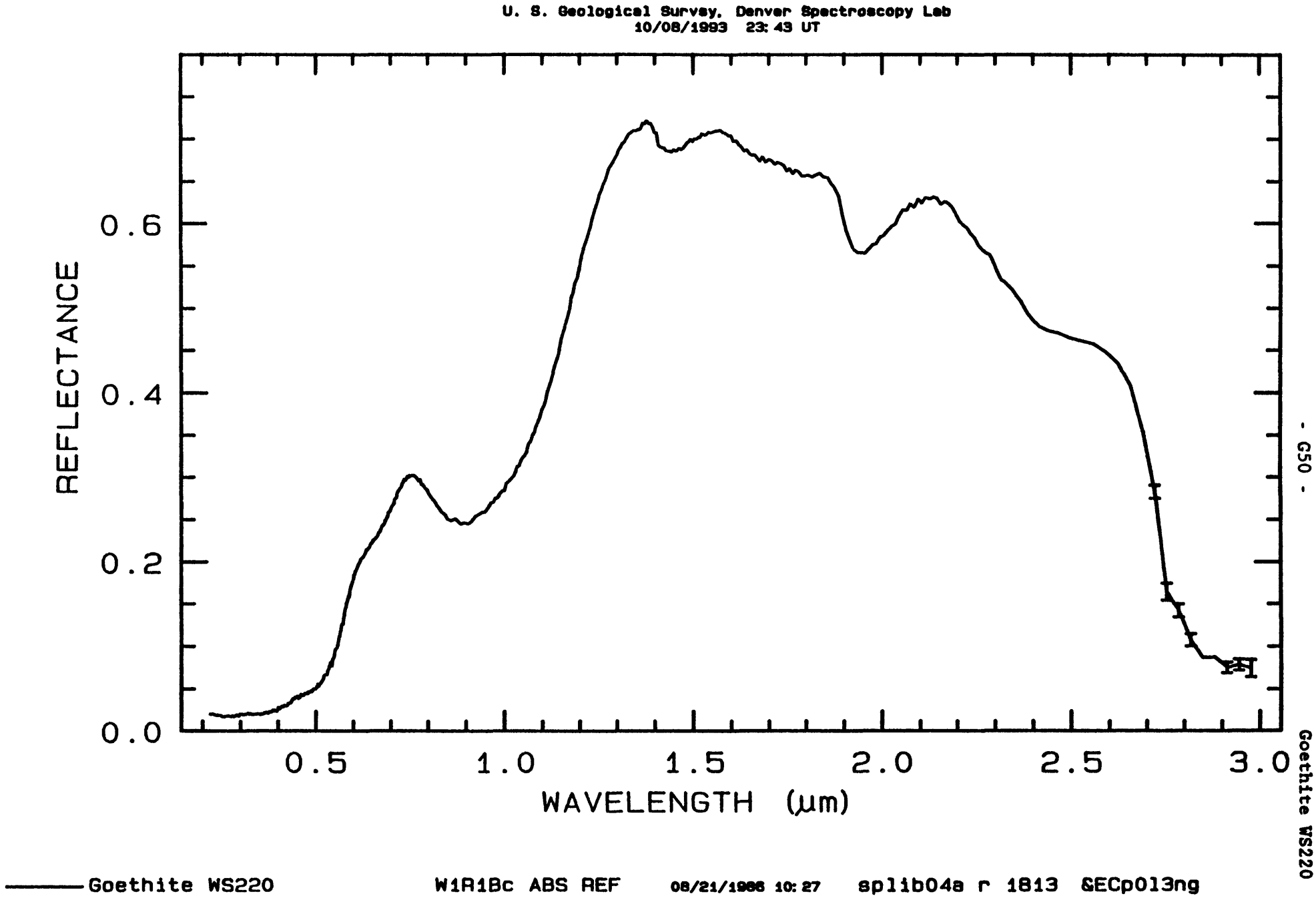
Significant quartz contamination, quartz is 50% coated by goethite. Large goethite grians are 50% coated with smaller goethite grains. High relief, non-fibrous, platey (lepidochrosite?). Slight red pleochroism. G. Swayze.

The high quartz content reduces the strength of the saturated UV-Vis absorption bands, otherwise spectrally pure. R. Clark

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1813	0.2-3.0μm	200	g.s.= 36 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G50 -
Goethite WS220
Goethite WS220
W1R1Bc ABS REF
08/21/1986 10:27
splib04a r 1813 &ECp013ng

TITLE: Grossular HS113 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS113

MINERAL_TYPE: Nesosilicate

MINERAL: Grossular (Grossularite) (Garnet group)

FORMULA: Ca3Al2(SiO4)3

FORMULA_NROFF: $Ca_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Transvaal, S. Africa

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Andradite, with Hydrogrossular, with Uvarovite.

In this sample some ferrous ion has substituted for calcium, producing the 1.0 μm absorption and some ferric ion has substituted for aluminum, producing the band near 0.8 μm. Such substitution is common for this mineral. The presence of Fe accounts for the absorption features near 0.6 and 0.43 μm and the series of bands between 1.4 and 1.51 μm are due to OH substituiton for SiO_4. Carbonate impurities cause absorption features near 2.25, 2.35, and 2.5 μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

See additional spectra of grossular garnets in library for comparison. This sample has been washed in HCl acid to remove carbonate contaminants.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Grossular + feldspar + others (Norma Vergo, USGS)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

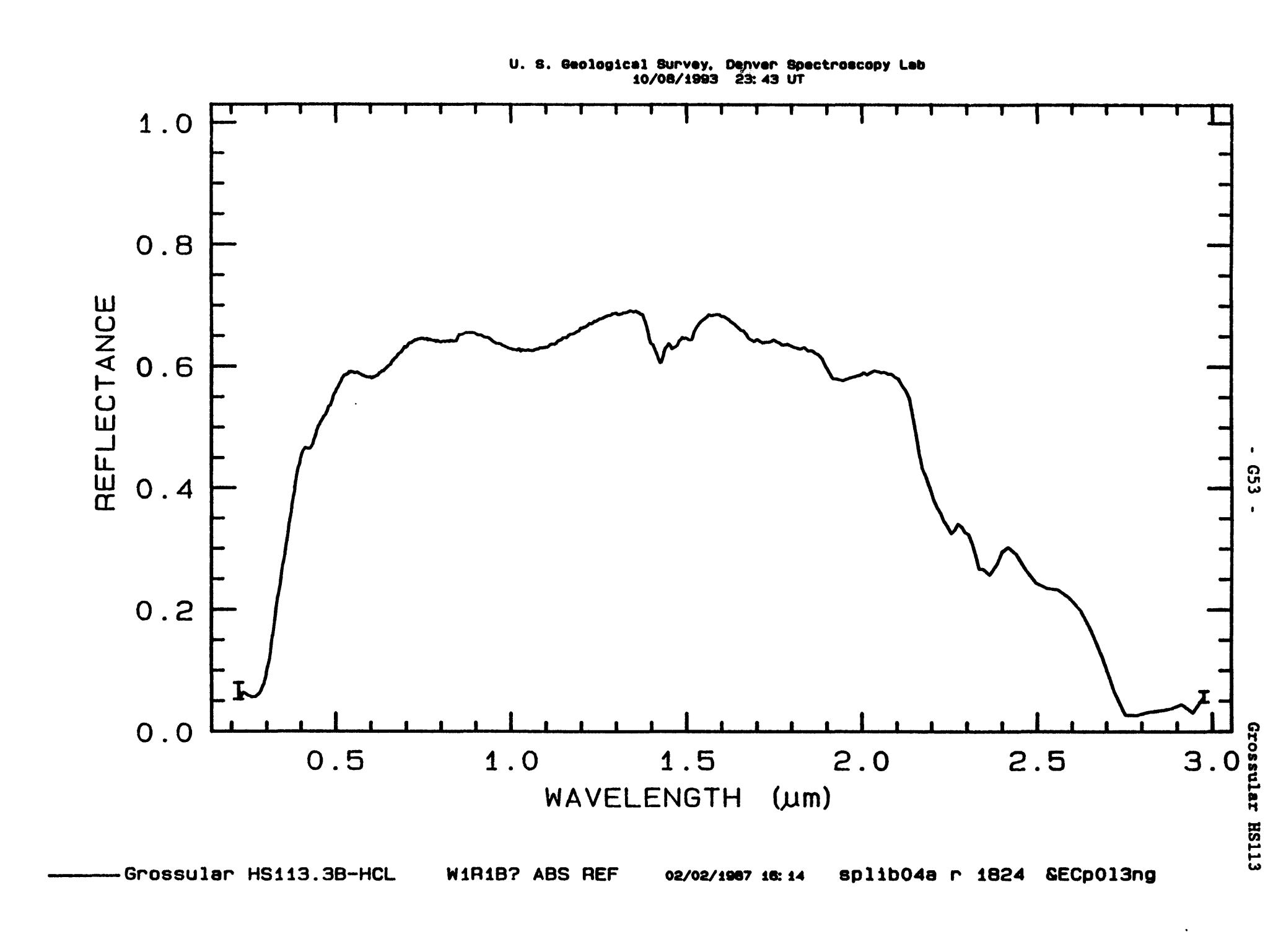
avg. grain size = 300 μm

Sample contains a trace of magnetite which can be cleaned with a magnet or Franz separator. Large garnet grains 15% coated by 8 μm garnet grains. Some of the thinner grains are isotropic, but the thicker grains have mottled extinction suggesting intense internal fracturing. Grains have high relief, high refrative index, rough fracture and no cleavage. Apart from the mottled extinction this sample resembles garnet. Sample tested with HCl acid and gave no fizz. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1824	0.2-3.0μm	200	g.s.= 300 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 653 -
Grossular HS113
Grossular HS113.3B-HCL W1R1B? ABS REF 02/02/1987 16:14 splib04a r 1824 &ECp013ng

TITLE: Grossular NMNH155371 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH155371

MINERAL_TYPE: Nesosilicate

MINERAL: Grossular (Grossularite) (Garnet group)

FORMULA: Ca3Al2(SiO4)3

FORMULA_NROFF: $Ca_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Pear Gillis Farm, Beach Glen, Buncombe Co, N.C

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Andradite, with Hydrogrossular, with Uvarovite.

Sample was hand-picked for analysis. See other grossular garnet in library for comparison. Original sample had a fair amount of diopside contamination.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Sample is grossular plus a small peak at 1.879A due to a trace of an unknown contaminant.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	38.84 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.70 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	17.95 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	7.08 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.51 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.15 wt%	NROFF:	MgO
COMPOSITION:	CaO:	35.81 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.05 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.03 wt%	NROFF:	K_2O
COMPOSITION:	----------			
COMPOSITION:	Total:	101.11 wt%		
COMPOSITION:	O=Cl,F,S:	wt%		
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analysis of the hand-picked sample indicate the grains are relatively homogeneous, with approximately 1 wt% variation in FeO and CaO. Average of 11 analyses indicte this sample is a solid-solution grossulerite with andrite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
97 vol% garnet
3 vol% diopside

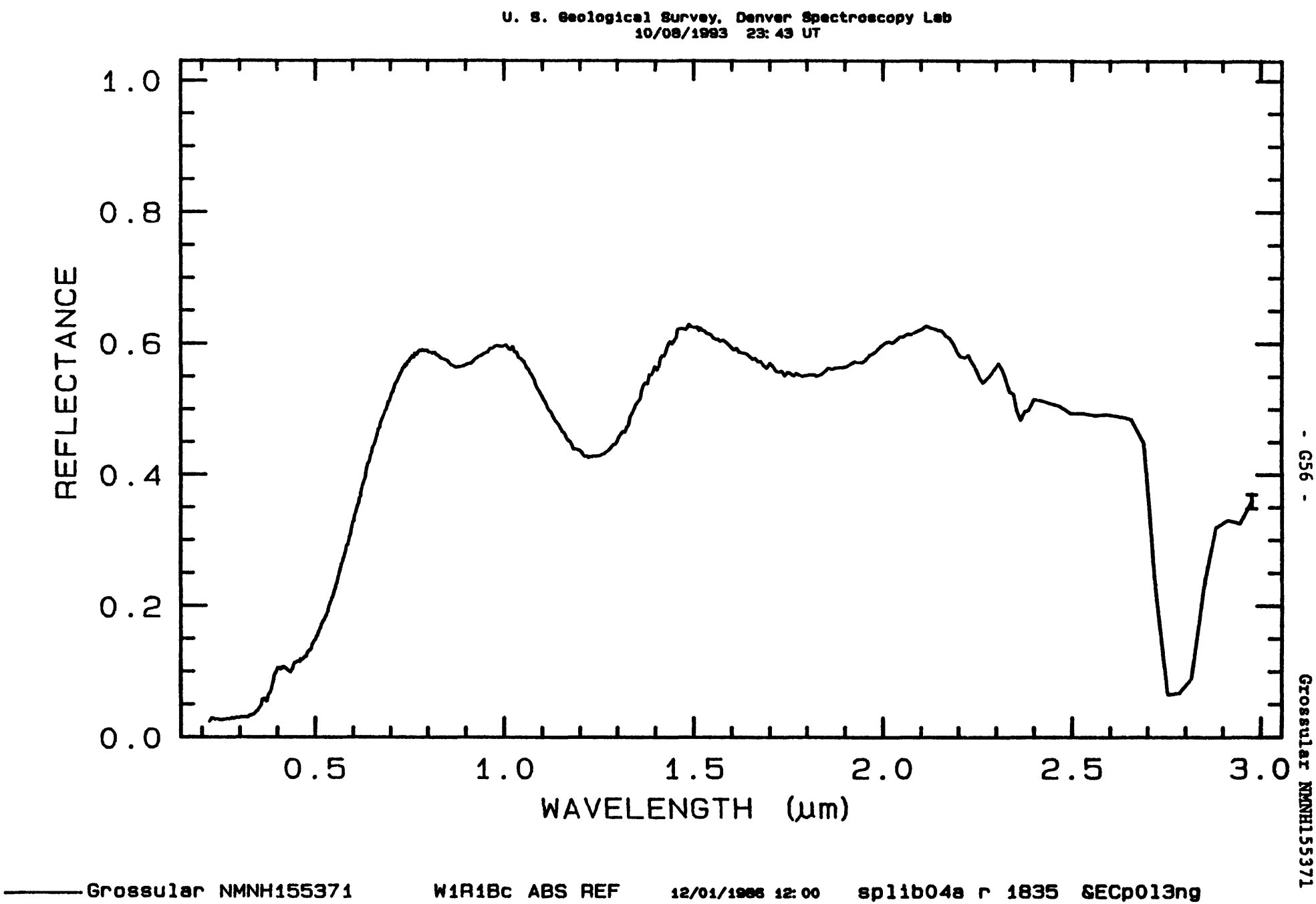
avg gr sz = 45 μm

Some biaxial, moderate relief grains present- probably diopside contaminant mentioned in sample description open file report. Sample composed of isotropic grains with refractive index > glycerin. Platey habit indicates parting. All observations consistent with this sample being nearly prue grossularite. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1835	0.2-3.0μm	200	g.s. = 45 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G56 -
Grossular NMNH155371
Grossular NMNH155371 W1R1Bc ABS REF 12/01/1986 12:00 splib04a r 1835 &ECp013ng

TITLE: Grossular WS485 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS485

MINERAL_TYPE: Nesosilicate

MINERAL: Grossular (Grossularite) (Garnet group)

FORMULA: Ca3Al2(SiO4)3

FORMULA_NROFF: $Ca_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Asbestos, Quebec, Canada

ORIGINAL_DONOR: Ward's Minerals

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Andradite, with Hydrogrossular, with Uvarovite.

See additional spectra of grossular garnets in library for comparison. This sample has been washed in HCl acid to remove carbonate contaminants.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:
model: 240 μm @ 50 vol%
mode2: 30 μm @ 50 vol%

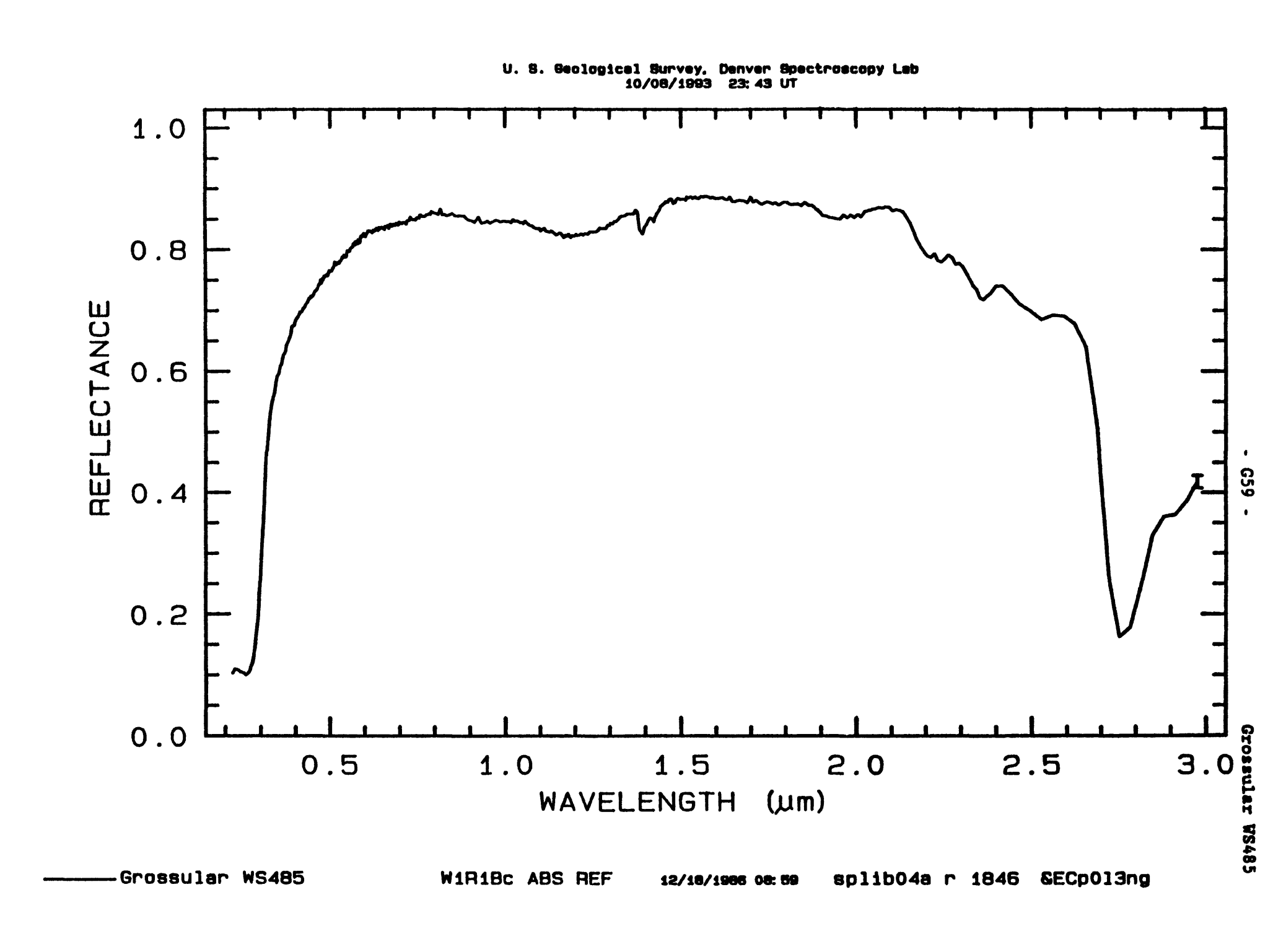
av gr sz = 171 μm

Sample looks clean with larger garnet grains 70% coated with finer grained garnet. Most grains are isotropic with parting surfaces. Trace contaminant could be feldspar because of low interference color and possible twinning. Optical properties are consistent with this sample being nearly pure garnet. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1846	0.2-3.0μm	200	g.s.= 171 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 659 -
Grossular WS485
Grossular WS485
W1R1Bc ABS REF
12/18/1986 08:59
splib04a r 1846 &ECp013ng

TITLE: Grossular WS483 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS483

MINERAL_TYPE: Nesosilicate

MINERAL: Grossular (Grossularite) (Garnet group)

FORMULA: Ca3Al2(SiO4)3

FORMULA_NROFF: $Ca_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Laguna de Jaco, Chihuahua, Mexico

ORIGINAL_DONOR: Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Andradite, with Hydrogrossular, with Uvarovite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
98 vol% garnet
2 vol% diopside?

Bimodal grains size distribution:
mode 1: 180 μm @ 70 vol%
mode 2: 10 μm @ 30 vol%

av gr sz = 150 μm

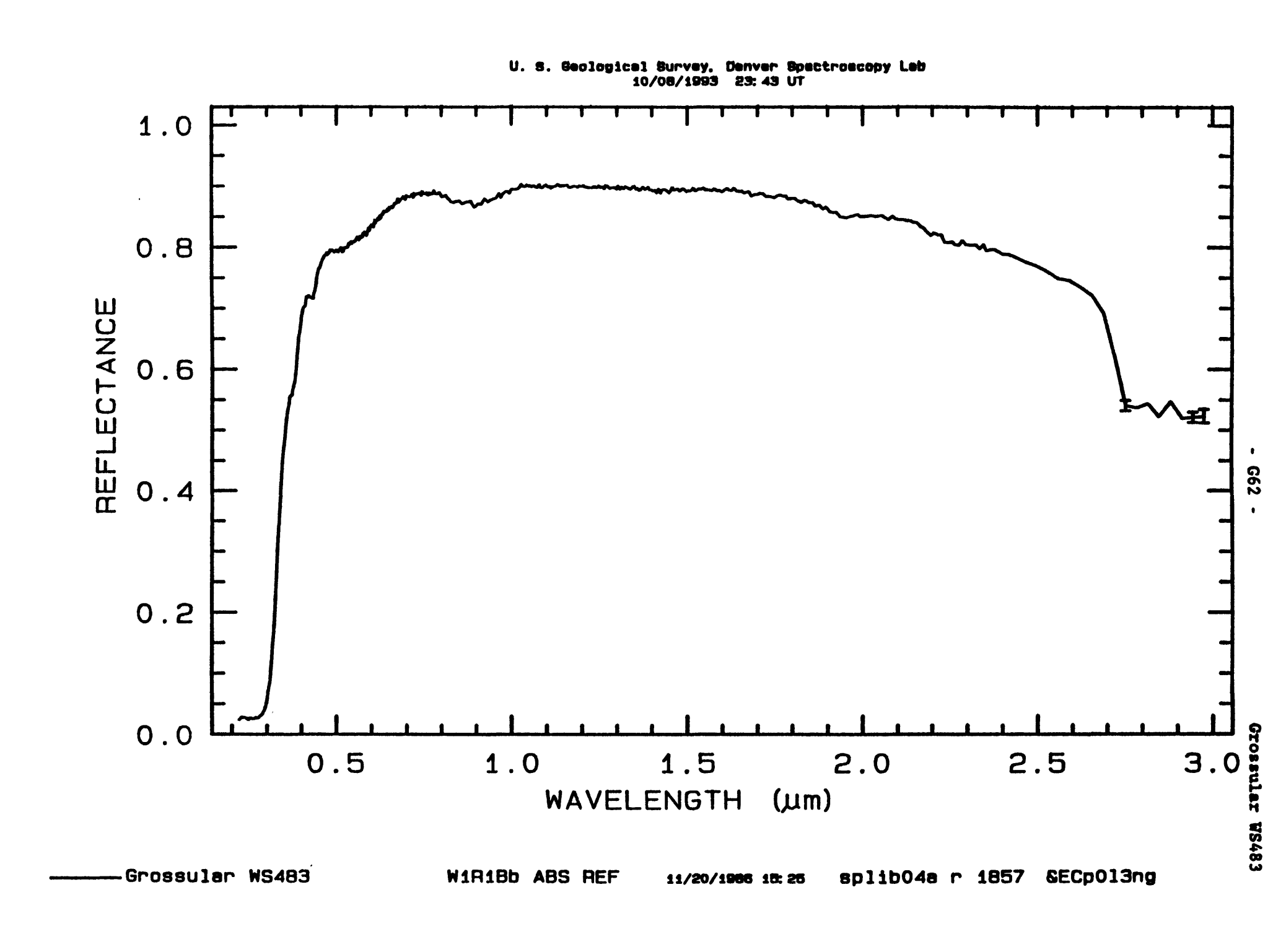
About 2 vol% grains have high interference colors and cleavage (diopside?)

but these are limited to the smaller grains size population. Other grains are isotropic, with conchoidal fratures, and have refractive index > glycerin. All this is consistent with a slightly contaminated garnet sample. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1857	0.2-3.0μm	200	g.s.= 150 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 262 -
Grossular WS483
Grossular WS483
W1R1Bb ABS REF 11/20/1986 15:26 splib04a r 1857 GECp013ng

TITLE: Grossular WS484 Garnet DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS484

MINERAL_TYPE: Nesosilicate

MINERAL: Grossular (Grossularite)(Garnet group)

FORMULA: Ca3Al2(SiO4)3

FORMULA_NROFF: $Ca_3Al_2(SiO_4)_3$

COLLECTION_LOCALITY: Asbestos, Quebec

ORIGINAL_DONOR: Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Labortory

SAMPLE_DESCRIPTION:

Forms series with Andradite, with Hydrogrossular, with Uvarovite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	39.710 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	.253 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	22.580 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	.006 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3:	.016 wt%	NROFF:	V_2O_3
COMPOSITION:	FeO:	1.769 wt%	NROFF:	FeO
COMPOSITION:	NiO:	.017 wt%	NROFF:	NiO
COMPOSITION:	MnO:	.690 wt%	NROFF:	MnO
COMPOSITION:	MgO:	.019 wt%	NROFF:	MgO
COMPOSITION:	CaO:	36.170 wt%	NROFF:	CaO
COMPOSITION:	---	---		
COMPOSITION:	Total:	101.230 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:
mode 1: 240 μm @ 75 vol%
mode 2: 15 μm @ 25 vol%

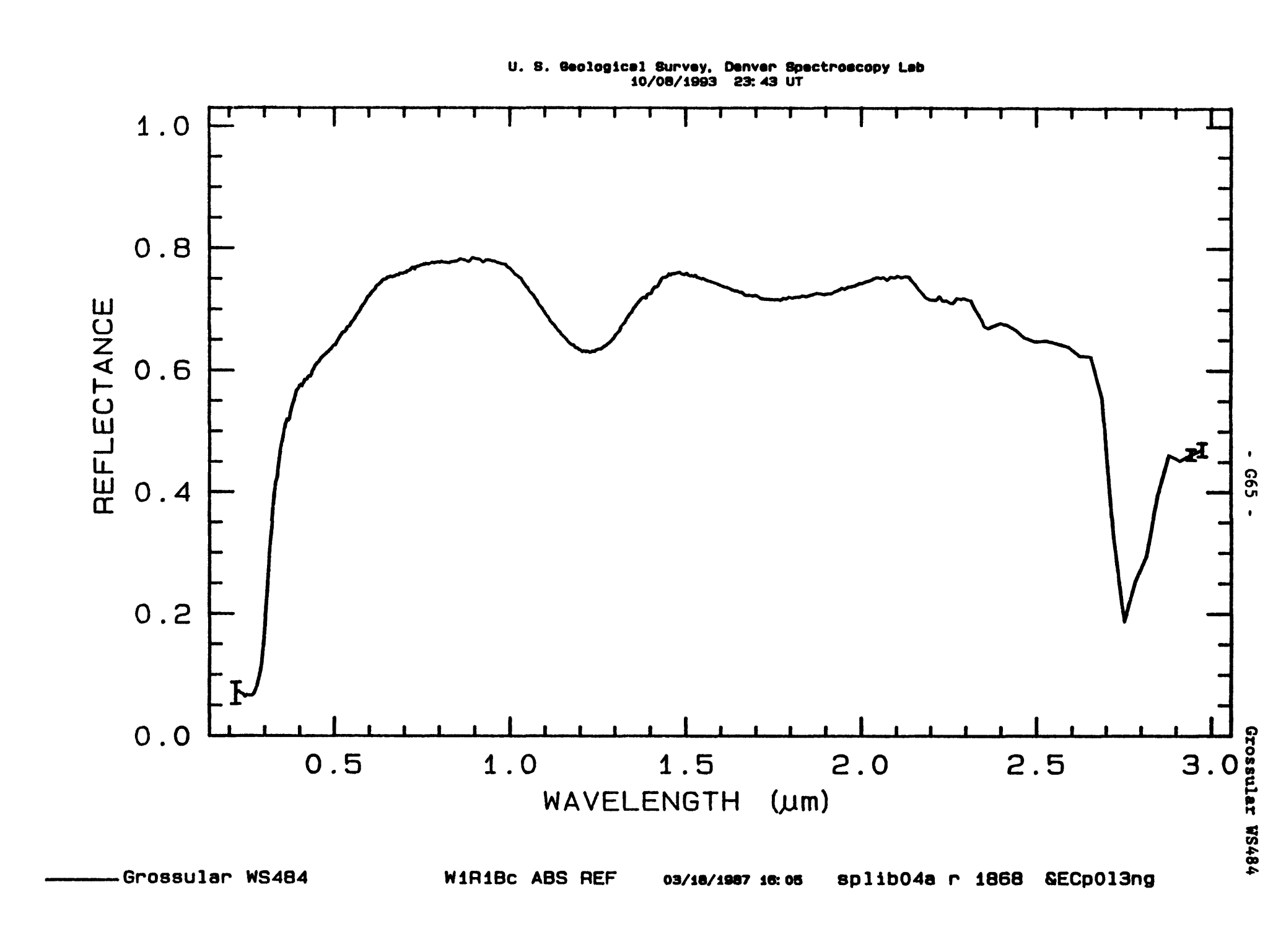
av gr sz = 210 μm

Trace iron staining. Grains isotropic, with parting, refractive index > glycerin. All consistent with this sample being pure garnet. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1868	0.2-3.0μm	200	g.s.= 210 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- G65 -
Grossular WS484
Grossular WS484
W1R1Bc ABS REF
03/18/1987 16:05
splib04a r 1868
&ECp013ng

TITLE: Gypsum HS333 (Selenite) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS333

MINERAL_TYPE: Sulfosalt

MINERAL: Gypsum (Selenite)

FORMULA: CaSO4*2H2O

FORMULA_NROFF: $CaSO_4 \bullet 2H_2O$

COLLECTION_LOCALITY: Washington County, Utah

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"This sample is colorless in hand specimen (colorless gypsum is called "selenite"), and is white when ground to fine particle size. It also appears to be quite pure, as its spectrum shows. As in the case of the previous sample, the near-infrared spectrum displays very prominent water bands beginning at 1μm and continuing out to 2.5μm."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: IV. Sulphides and sulphates. Modern Geology, v. 3, p. 1-14.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure gypsum

Clark, R.N., King, T.V.V., Klejwa, M., Swayze, G.A., and Vergo, N., 1990, High spectral resolution reflectance spectroscopy of minerals: Journal of Geophysical Research, v. 95, no. 8B, p 12,653-12,680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

No compositional analyses.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal grain size distribution:
mode 1: 245 μm @ 98 vol%
mode 2: 30 μm @ 2 vol%

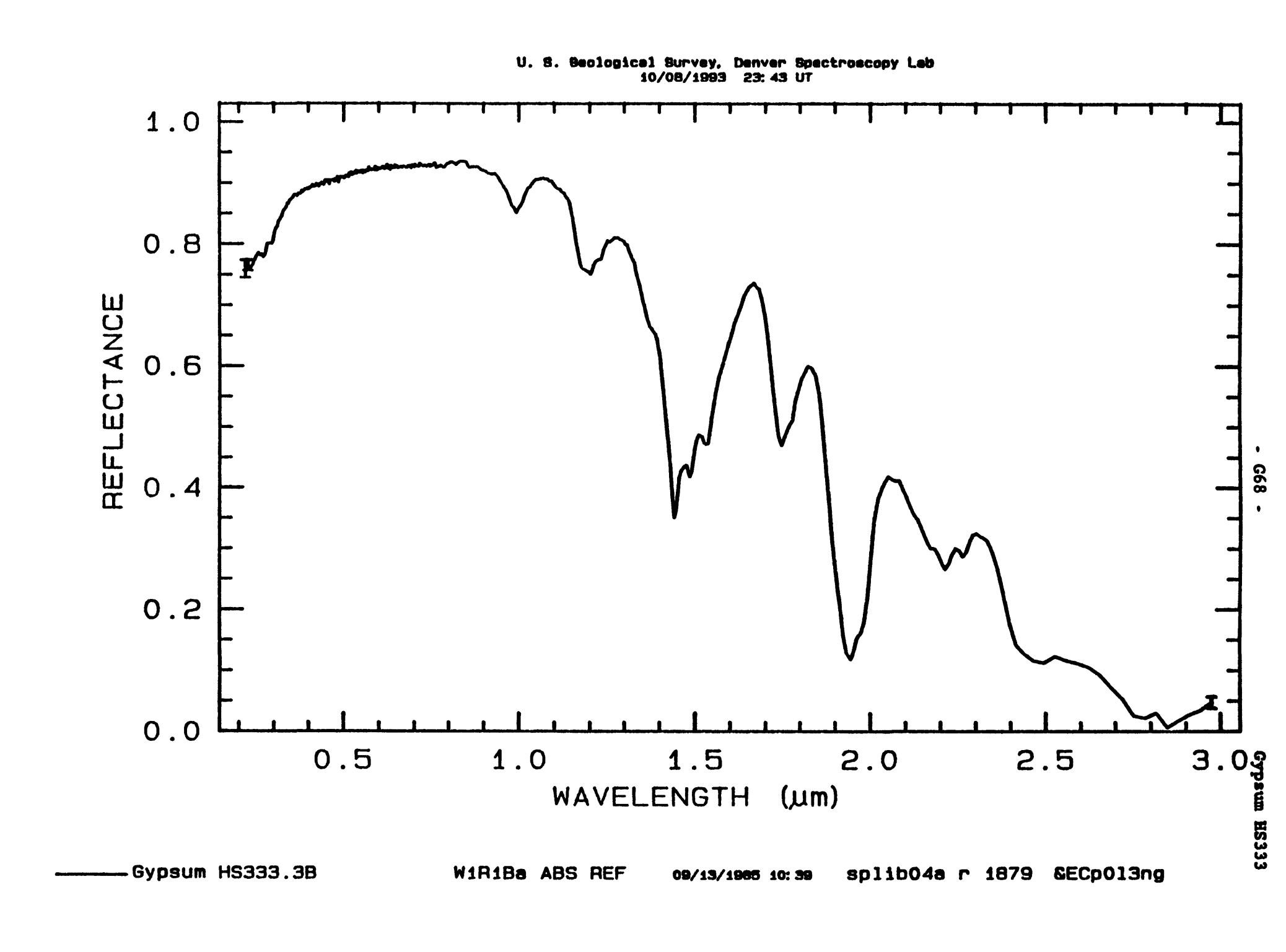
avg gr sz = 242 μm

Sample appears to be pure. Biaxial with good cleavages and low relief. Larger grains are 15% coated with smaller grains. All this is consistent wiht pure gypsum. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1879	0.2-3.0μm	200	g.s.= 242 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- C98 -
Gypsum HS333
Gypsum HS333.3B
W1R1Ba ABS REF
09/13/1995 10:39
splib04a r 1879 &ECp013ng

TITLE: Gypsum SU2202 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SU2202

MINERAL_TYPE: Sulfosalt

MINERAL: Gypsum

FORMULA: CaSO4*2H2O

FORMULA_NROFF: $CaSO_4 \bullet 2H_2O$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Ward Natural Science Collection

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure (?).

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal gr sz distribution:
mode 1 225 μm @ 35 vol%
mode 2 13 μm @ 65 vol%

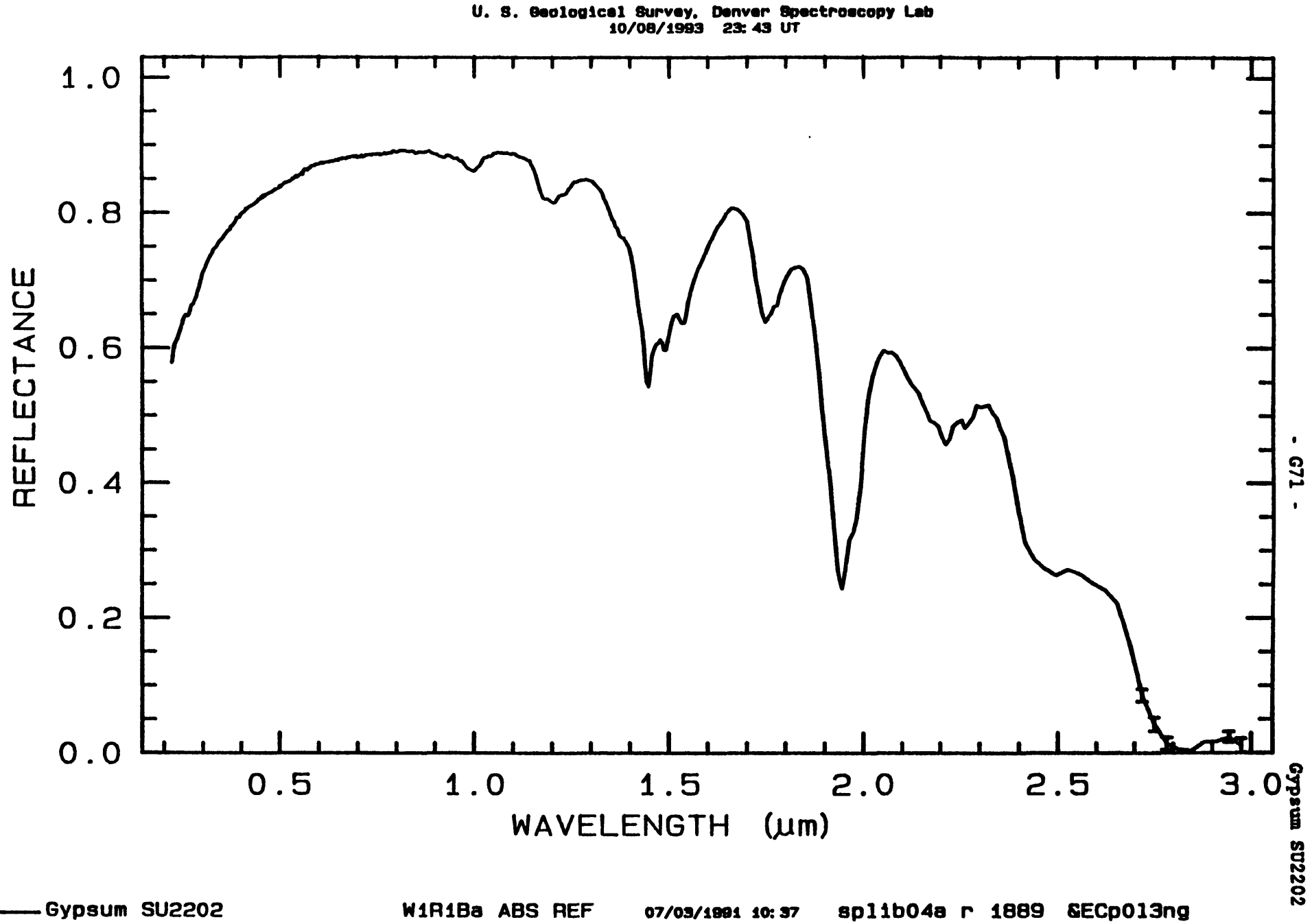
avg gr sz = 133 μm

Smaller grains coat 90% of larger grain surfaces. Very soft, well developed cleavage, biaxial, no contaminants. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1889	0.2-3.0μm	200	g.s.= 133 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/08/1993 23:43 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 671 -
Gypsum SU2202
Gypsum SU2202
W1R1Ba ABS REF
07/03/1991 10:37
sp11b04a r 1889 &ECp013ng

TITLE: H2O-Ice GDS136 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS136

MINERAL_TYPE: Oxide

MINERAL: Water_Ice (Frost)

FORMULA: H2O

FORMULA_NROFF: H_2O

COLLECTION_LOCALITY:

ORIGINAL_DONOR: made from triply distilled H2O, USGS

CURRENT_SAMPLE_LOCATION: none (evaporated)

ULTIMATE_SAMPLE_LOCATION: none (evaporated)

SAMPLE_DESCRIPTION:

The sample was created by growing ice on a 77K cold finger from water vapor from triply distilled H2O from Gary Olhoeft's lab, USGS, Denver. The sample should have very little contaminants; being essentially pure H2O.

Measured at 77K.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: Other # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:       H2O: 100.0   wt%    NROFF: H2O
COMPOSITION:       LOI: 100.0   wt%    NROFF: LOI
COMPOSITION: ----------------------
COMPOSITION:     Total: 100.0   wt%
COMPOSITION:  O=Cl,F,S:   0.0   wt%  #correction for Cl, F, S
COMPOSITION: New Total: 100.0   wt%
```

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

See sample_discussion above. The ice is very pure, certainly at a level that no contaminants could be detected with spectroscopy.

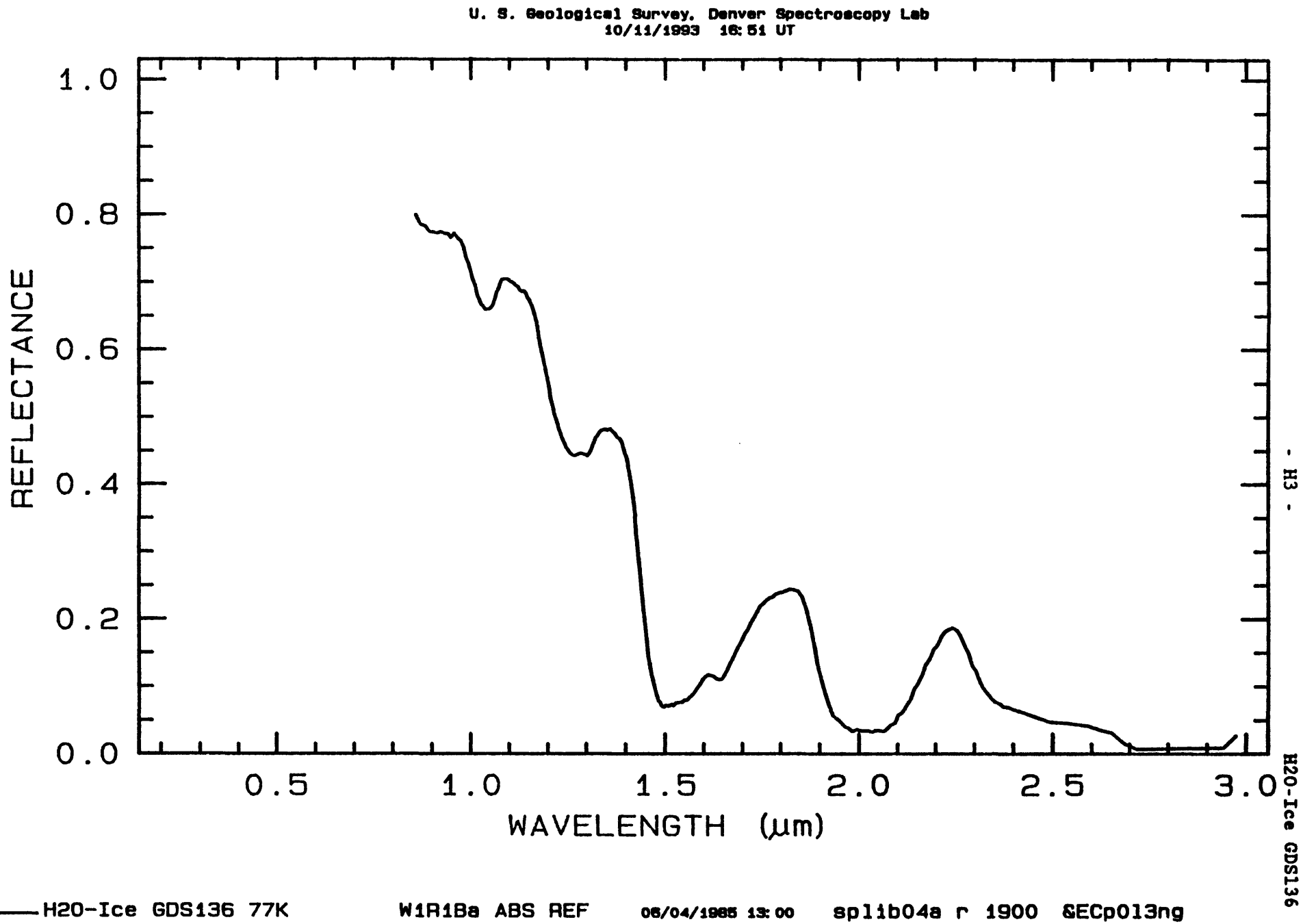
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1900	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H3 -
H2O-Ice GDS136
H2O-Ice GDS136 77K
W1R1Ba ABS REF
06/04/1985 13:00
splib04a r 1900 &ECp013ng

TITLE: Halite HS433 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS433

MINERAL_TYPE: Halide

MINERAL: Halite

FORMULA: NaCl

FORMULA_NROFF: NaCl

COLLECTION_LOCALITY: Kansas

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"H-4. Halite. Kansas (433B). Halite, NaCl, occurs primarily as extensive beds formed by evaporation of trapped bodies of salt water. It may also form as an effluorescence on the surface in arid areas, or as a sublimation product in volcanic regions. It is colorless when pure, but more typically orange or red, and may be grey, yellow or blue.

The common orange or red color is due to inclusions of ferric oxide material, while the grey is due to inclusions of clay. Like many of the halides, halite is subject to color center formation, which is responsible for the blue and purple tints. This sample is colorless and appears to be quite pure. It displays some very weak water bands from water in fluid inclusions near 1.95 and 2.25 μ, but is otherwise spectrally featureless, except for the 0-5 μ particle size range. The distinct brownish tone of this size range is caused by polyurethane contamination from the fluid energy mill."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1972, Visible and near-infrared spectra of minerals and rocks: V. Halides, phosphates, arsenates, vanadates and borates. Modern Geology, v. 3, p. 121-132.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

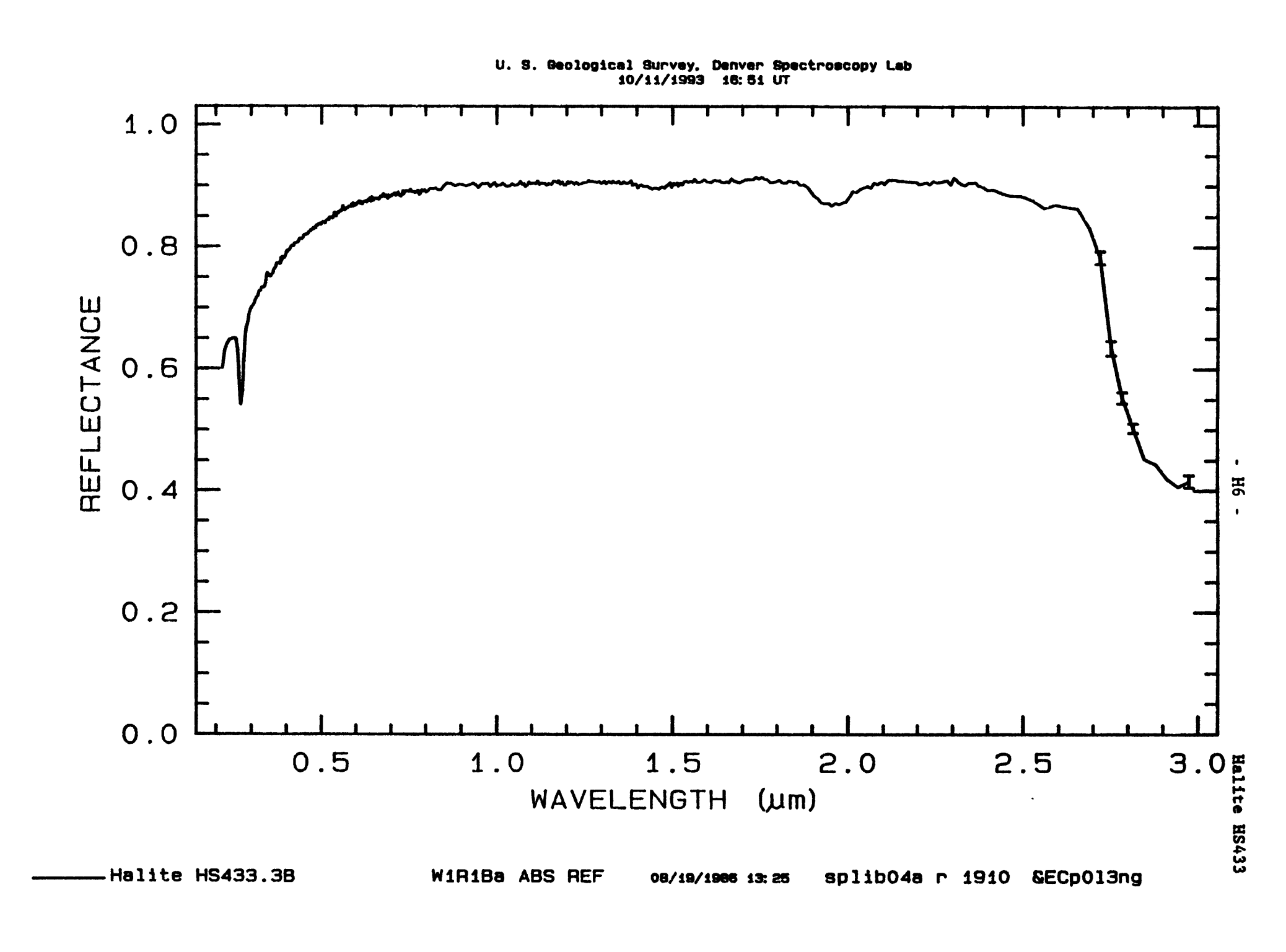
avg gr sz = 230 μm

Grains isotropic with cubic cleavage. Grains also have abundant (8 vol%) fluid or gas inclusions, and the grains are soluable in water. All this is consistent with this sample being pure salt.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1910	0.2-3.0μm	200	g.s.= 230 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H6 -
Halite HS433
Halite HS433.3B
W1R1Ba ABS REF
08/19/1986 13:25
splib04a r 1910 &ECp013ng

TITLE: Halloysite NMNH106236 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH106236

MINERAL_TYPE: Phyllosilicate

MINERAL: Halloysite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Utah (probably Eureka)

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Kaolinite, and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

7A halloysite - does not expand with glycol. Pure. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

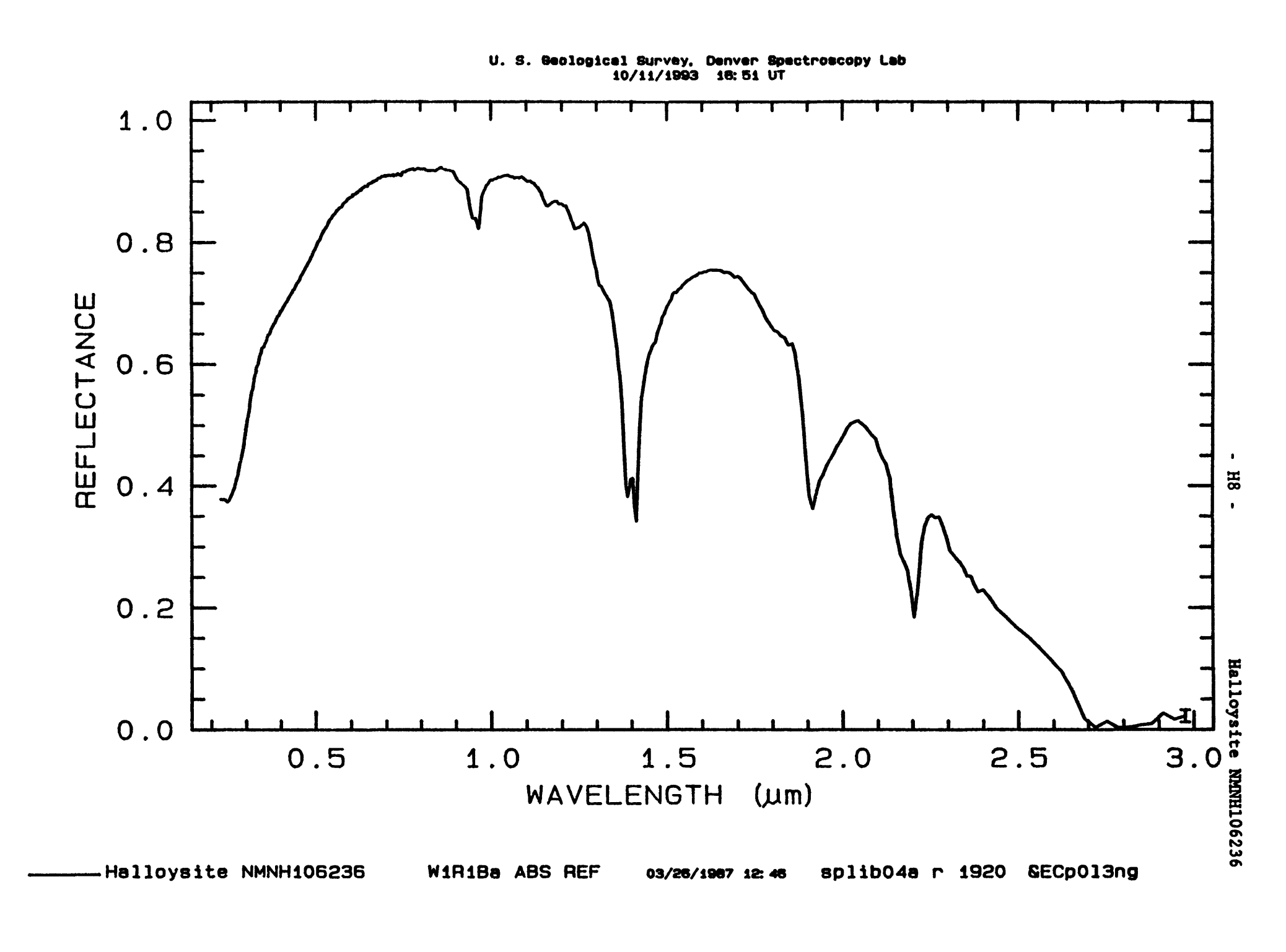
Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 1920 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H8 -
Halloysite NMNH106236
Halloysite NMNH106236 W1R1Ba ABS REF 03/26/1997 12:46 splib04a r 1920 GECp013ng

TITLE: Halloysite NMNH106237 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH106237

MINERAL_TYPE: Phyllosilicate

MINERAL: Halloysite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Indiana

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Kaolinite, and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

7A halloysite - does not expand with glycol. Pure. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

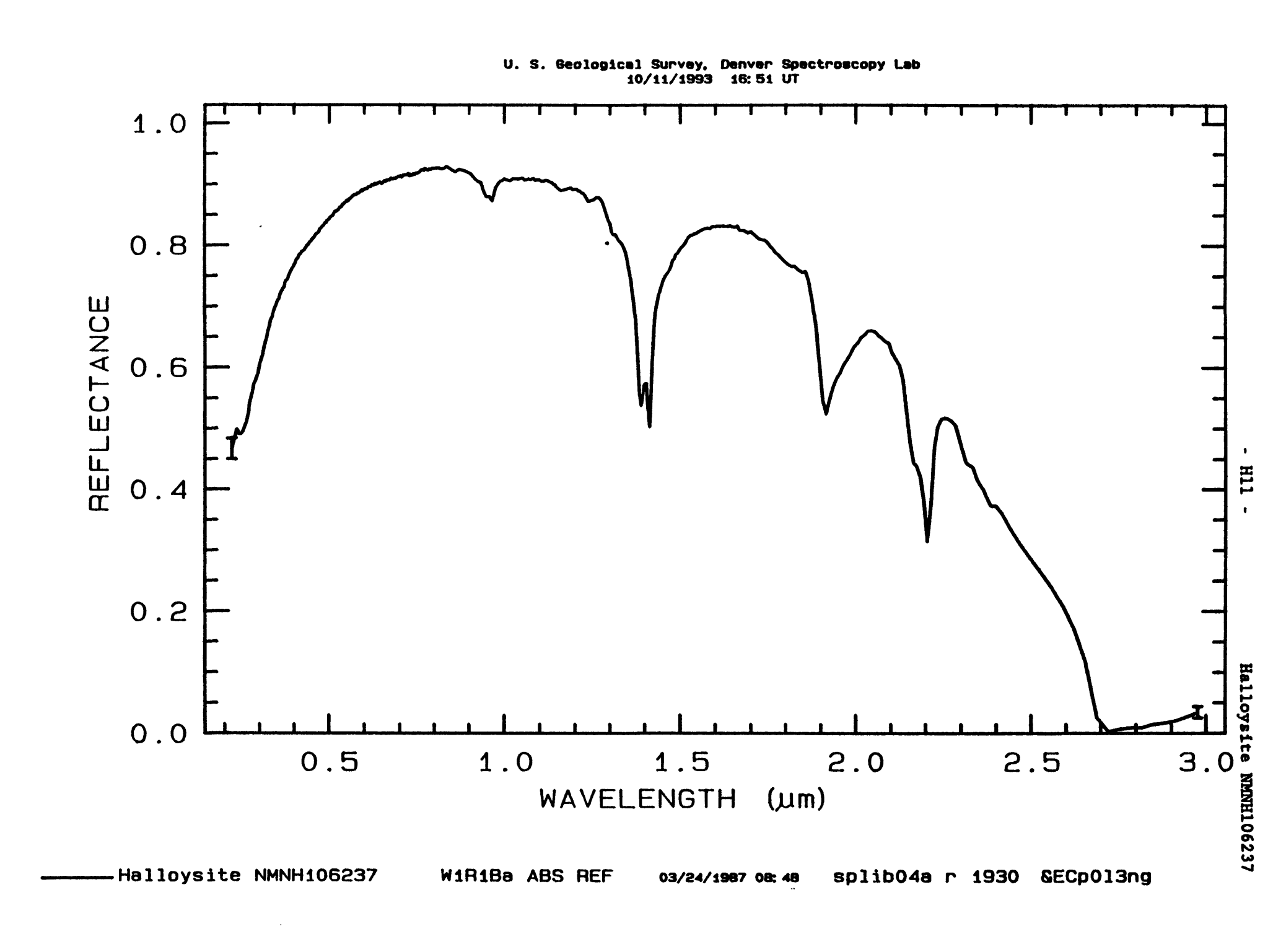
av gr sz = 300 μm

Grains about 90 vol% isotropic under cross-polarized light, and have variations in transparency suggesting inclusion of opaque materials up to 10 vol%. All this is consistent with halloysite slightly contaminated by other clays & opaques. Large grains 10% coated with smaller grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1930	0.2-3.0μm	200	g.s.= 300 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H11 -
Halloysite NMNH106237
Halloysite NMNH106237 W1R1Ba ABS REF 03/24/1987 08:48 splib04a r 1930 &ECp013ng

TITLE: Halloysite CM13 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM13

MINERAL_TYPE: Phyllosilicate

MINERAL: Halloysite (Kaolinite-Serpentine group)

FORMULA: A12Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Dragon Iron Mine, Eureka, Utah

ORIGINAL_DONOR: Clay Mineral Standard, Ward Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Kaolinite, and Nacrite.

A spectrum for this sample was published by:

Clark, R.N., King, T.V.V., Klejwa, M., Swayze, G.A., and Vergo, N., 1990, High spectral resolution reflectance spectroscopy of minerals: Journal of Geophysical Research, v. 95, no. 8B, p 12,653-12,680.

Who noted that the sample was spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Halloysite + quartz
<2μ 7A halloysite + smectite + trace 10A halloysite.
Spectrally pure. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	46.3	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.11	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	35.2	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.72	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.02	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.31	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.31	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	<0.02	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.26	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	14.4	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	1.80	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	16.2	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	15.8	wt%	NROFF:	LOI
COMPOSITION:	---	---	---		
COMPOSITION:	Total:		wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

Analysis by J. Taggart, Ardith J. Bartel, K. Stewart
Analysis by E. Brandt, J. H. Christie

Induced Coupled Plasma trace analysis exists but is not yet included.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal Grain Size Distribution:
mode 1: 670 μm @ 95 vol%
mode 2: 35 μm @ 5 vol%

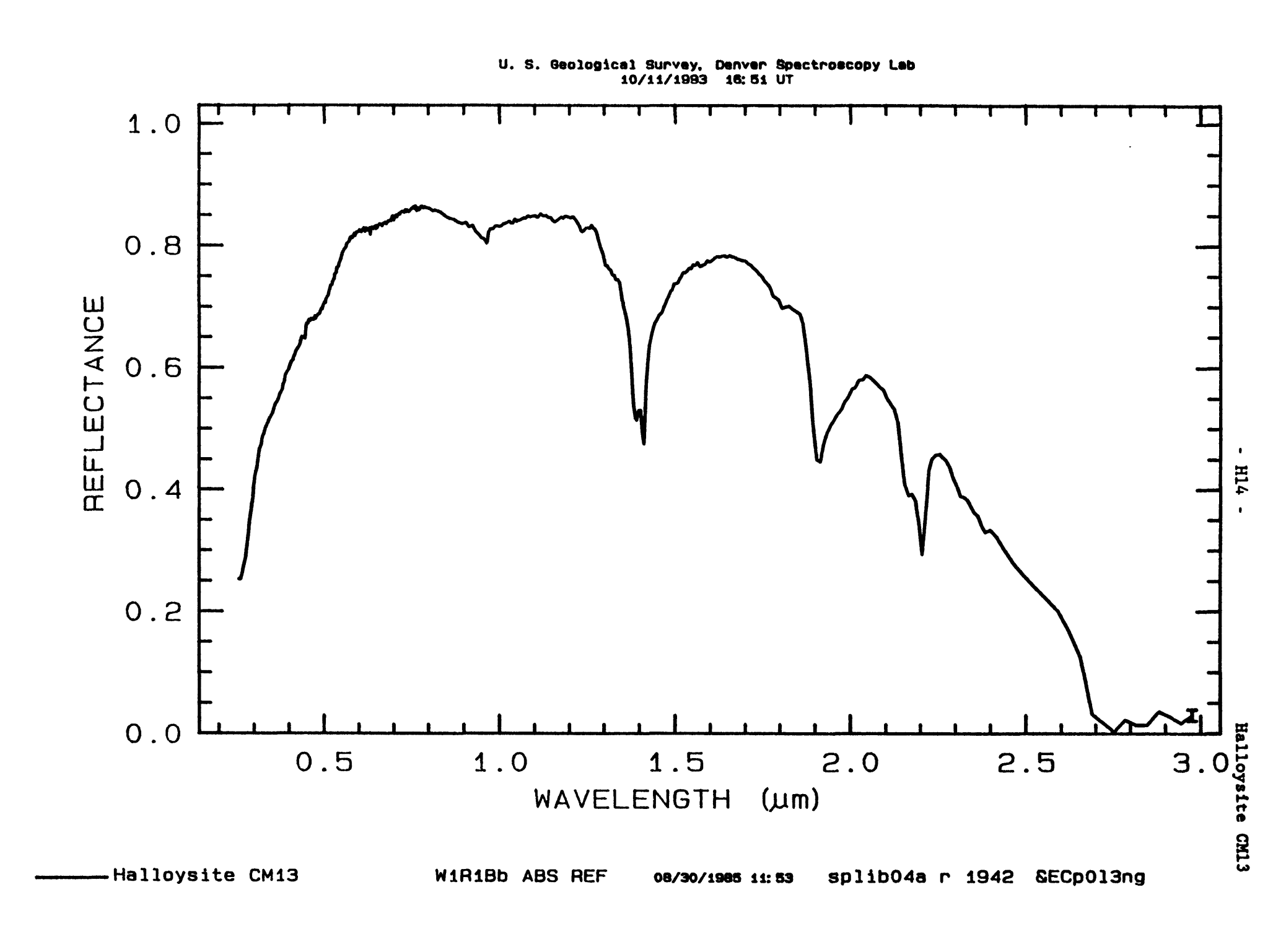
av gr sz = 650 μm

Sample is not isotropic under cross-polarized light. About 1 vol% of sample has iron-oxide staining. Larger grains are 50% coated with smaller grains. Because sample is not isotropic I think sample has other clay contaminants probably up to 50 vol%. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1942	0.2-3.0μm	200	g.s.= 650 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H14 -
Halloysite CM13
Halloysite CM13
W1R1Bb ABS REF
08/30/1985 11:53
splib04a r 1942 &ECp013ng

TITLE: Halloysite KLH503 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KLH503

MINERAL_TYPE: Phyllosilicate

MINERAL: Halloysite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Tintic, UT

ORIGINAL_DONOR: Phoebe Hauff/USGS Sedimentary Mineralogy Laboratory

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Kaolinite, and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Halloysite + Quartz.

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

avg gr sz = < 10 μm grain clumps are 450 μm in diameter

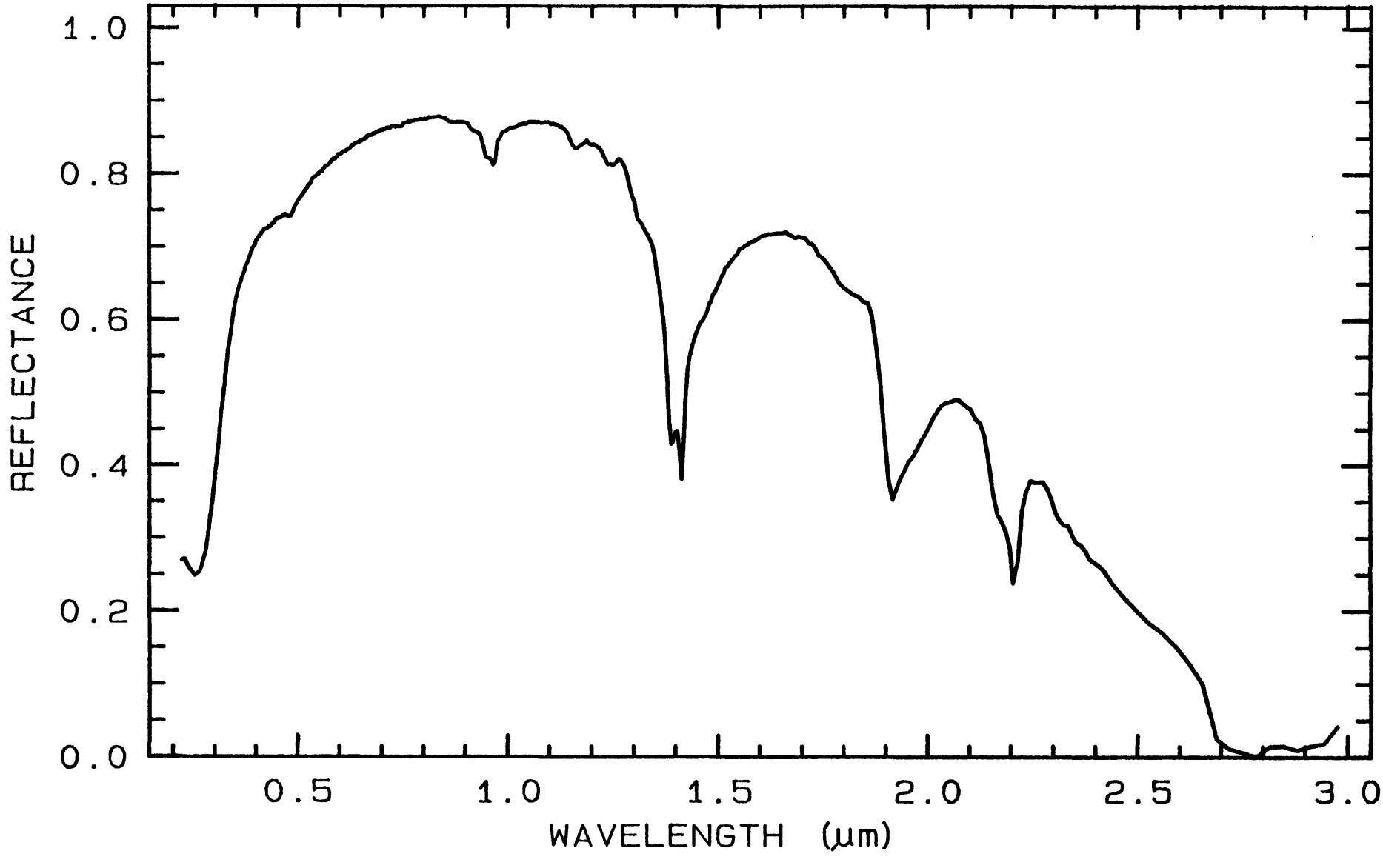
Sample contains 10 vol% quartz. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 1952	0.2-3.0μm	200	g.s.= 10 μm

U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT



- HL7 -

Halloysite KLH503

Halloysite KLH503 W1R1Bb ABS REF 07/09/1991 10:07 splib04a r 1952 &ECp013ng

TITLE: Halloysite+Kaolinite CM29 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM29

MINERAL_TYPE: Phyllosilicate

MINERAL: Halloysite + Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Wagon Wheel Gap, Colorado

ORIGINAL_DONOR: Clay Mineral Standard, Ward Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Kaolinite, and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Disordered kaolinite - a mixture of kaolinite and halloysite (from NIR data)] (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	43.8	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	<0.02	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	37.8	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.71	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.03	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.11	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.22	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	<0.06	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.21	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	14.8	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	0.80	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	15.6	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	15.4	wt%	NROFF:	LOI
COMPOSITION:	---	---	---		
COMPOSITION:	Total:		wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

Analysis by J. Taggart, Ardith J. Bartel, K. Stewart
Analysis by E. Brandt, J. H. Christie

Induced Coupled Plasma trace analysis exists but is not yet included.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

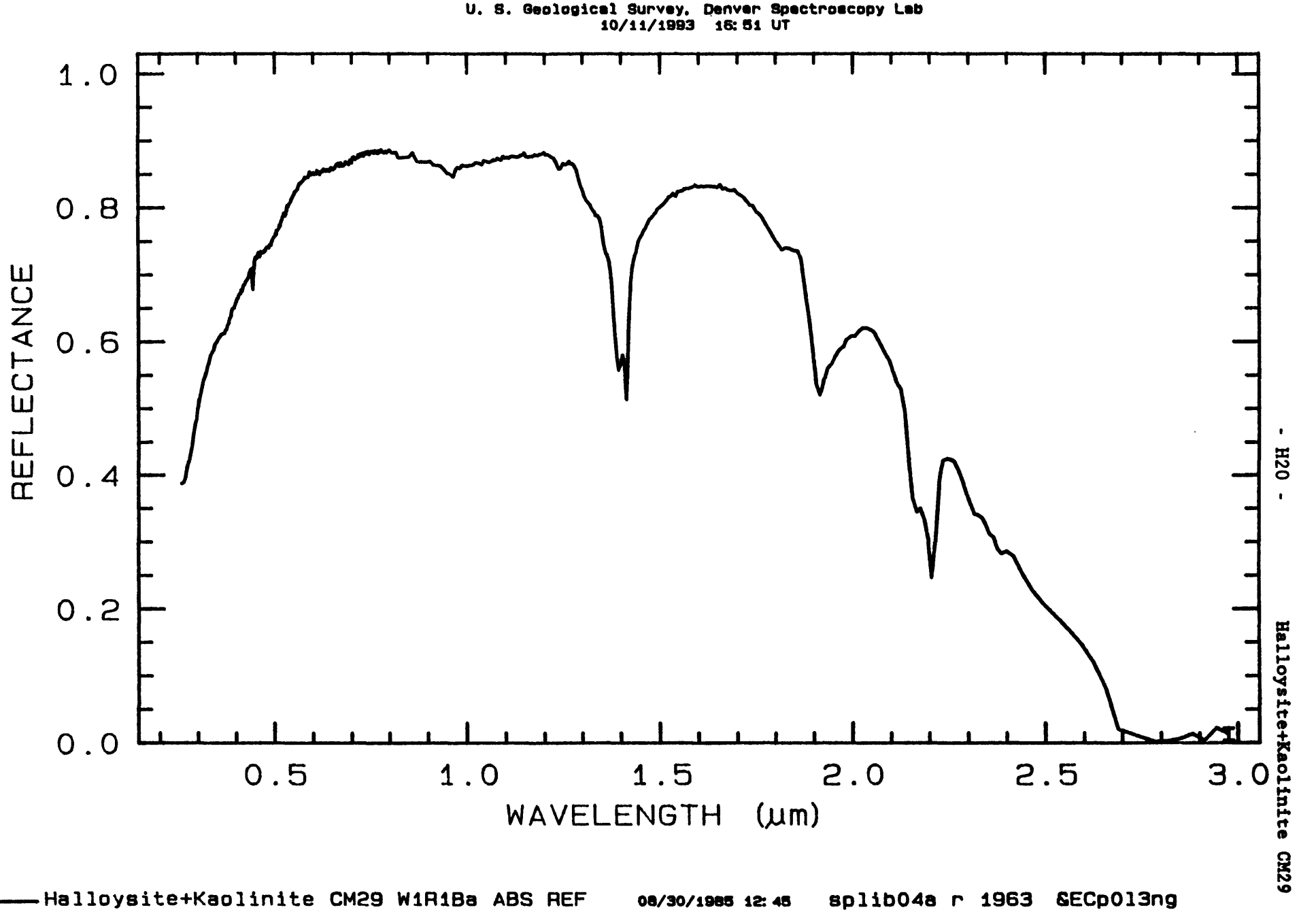
avg grain sz = 300 μm

Sample is isotropic in cross-polarized light. Clumps of plates? visible under microscope. Plates suggest kaolinite, but SEM work I have done on this sample shows at least some grains are hollow tubes which indicates sample is partially halloysite. This sample is then probably a mix of kaolinite and halloysite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1963	0.2-3.0μm	200	g.s.= 300 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H2O -
Halloysite+Kaolinite CM29
Halloysite+Kaolinite CM29 W1R1Ba ABS REF 08/30/1985 12:45 splib04a r 1963 &ECp013ng

TITLE: Hectorite SHCa-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SHCa-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Hectorite (Montmorillonite group)

FORMULA: Na0.33(Mg,Li)3Si4O10(F,OH)2

FORMULA_NROFF: $Na_{0.33}(Mg,Li)_3Si_4O_{10}(F,OH)_2$

COLLECTION_LOCALITY: San Bernadino, California

ORIGINAL_DONOR: Grim Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Trioctahedral lithium montmorillonite (stored in H_2O).

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Hectorite + quartz (m) + calcite (L) + dolomite (s)? (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	34.7	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.038	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.69	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.02	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.25	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.008	wt%	NROFF:	MnO
COMPOSITION:	MgO:	15.3	wt%	NROFF:	MgO
COMPOSITION:	CaO:	23.4	wt%	NROFF:	CaO
COMPOSITION:	Li2O:	2.18	wt%	NROFF:	Li_2O
COMPOSITION:	Na2O:	1.26	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.13	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.014	wt%	NROFF:	P_2O_5
COMPOSITION:	F:	(2.60)	wt%	NROFF:	F
COMPOSITION:	F:	(2.75)	wt%	NROFF:	F
COMPOSITION:	S:	0.01	wt%	NROFF:	S
COMPOSITION:	LOI:	21.80	wt%	NROFF:	LOI
COMPOSITION:	----------				
COMPOSITION:	Total:	99.80	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:
99 vol% hectorite
1 vol% quartz
tr opaques (metallic luster)

Bimodal Grain Size Distribution:
mode 1: 204 μm @ 80 vol%
mode 2: 25 μm @ 20 vol%

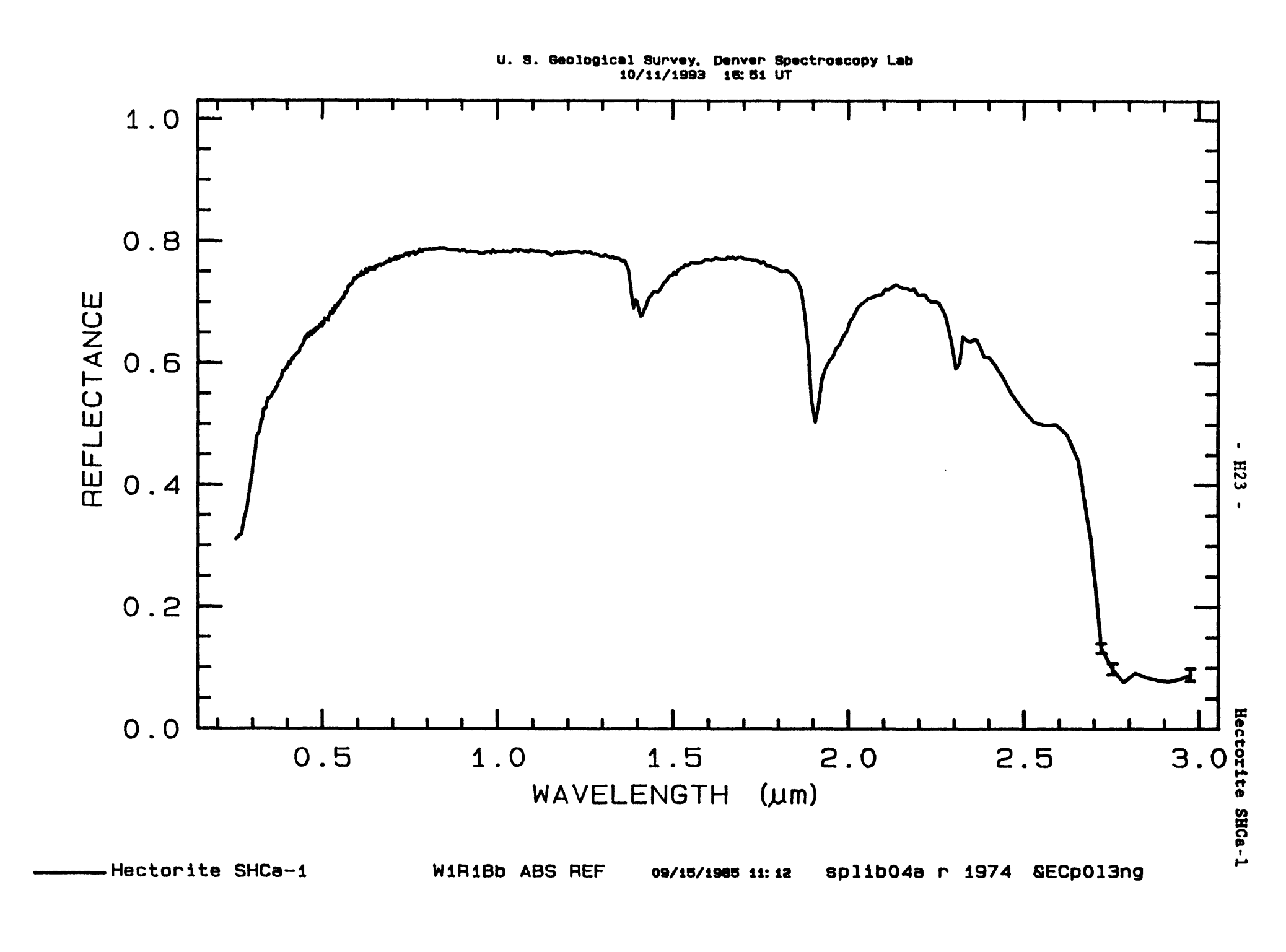
avg gr sz = 183 μm

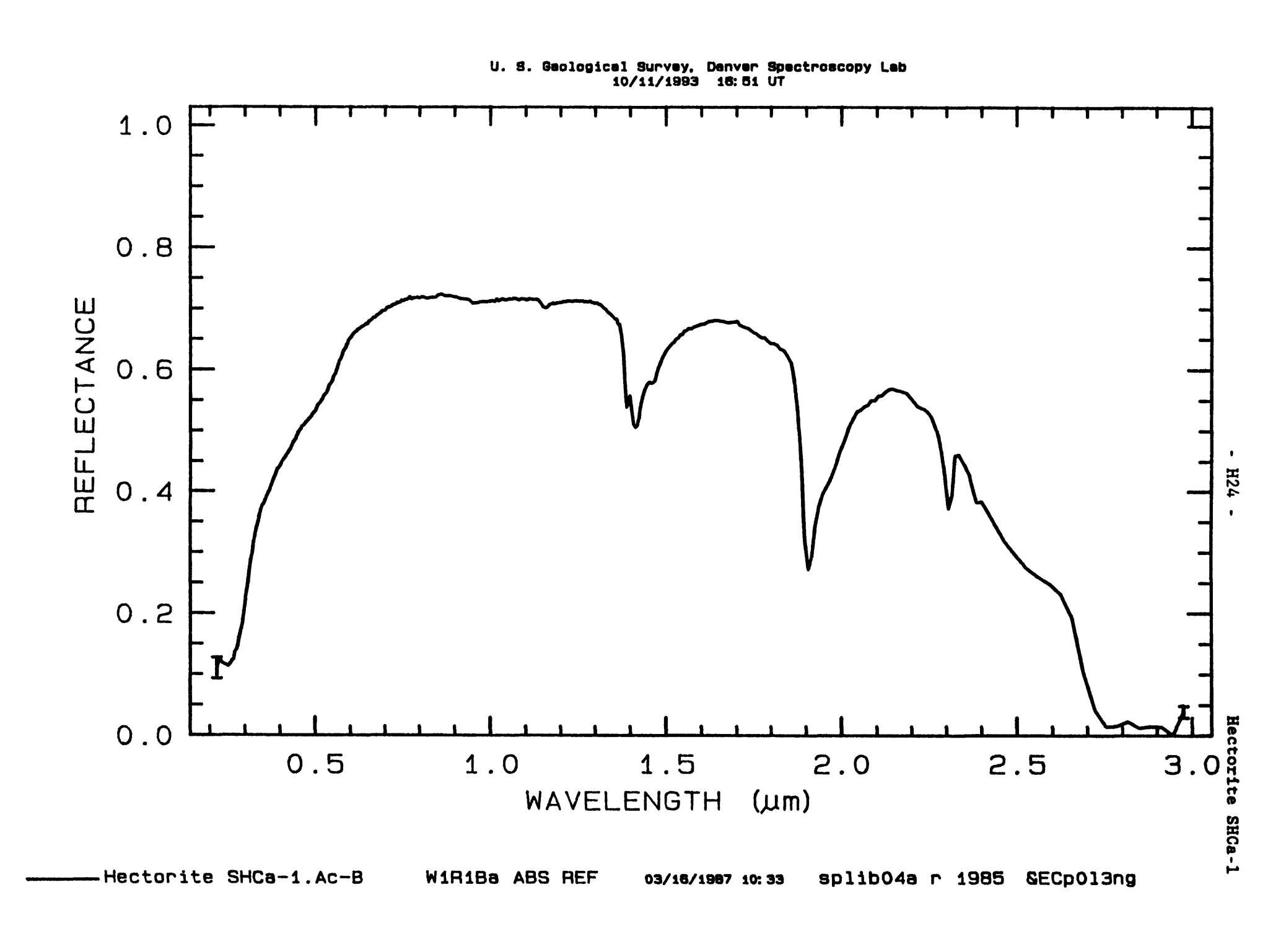
This sample was treated with acetate to dissolve carbonates. There is no fizz with HCl. Clay grains have sweeping extinction, quartz present but no evidence of calcite or dolomite. All consistent with a fairly pure sample of hectorite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1974	0.2-3.0μm	200	g.s.= 183 μm
LIB_SPECTRA:	splib04a r 1985	0.2-3.0μm	200	g.s.= 183 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H23 -
Hectorite SHCa-1
Hectorite SHCa-1
W1R1Bb ABS REF 09/15/1995 11:12 splib04a r 1974 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H24 -
Hectorite SHCa-1
Hectorite SHCa-1.Ac-B W1R1Ba ABS REF 03/16/1987 10:33 splib04a r 1985 &ECp013ng

TITLE: Hedenbergite NMNH119197 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH119197

MINERAL_TYPE: Inosilicate

MINERAL: Hedenbergite (Pyroxene group)

FORMULA: CaFe+2Si2O6

FORMULA_NROFF: $CaFe^{+2}Si_2O_6$

COLLECTION_LOCALITY:

ORIGINAL_DONOR:

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Diopside and with Joahnnsenite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure hedenbergite. Do not see opx. exsolution. Norma Vergo

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

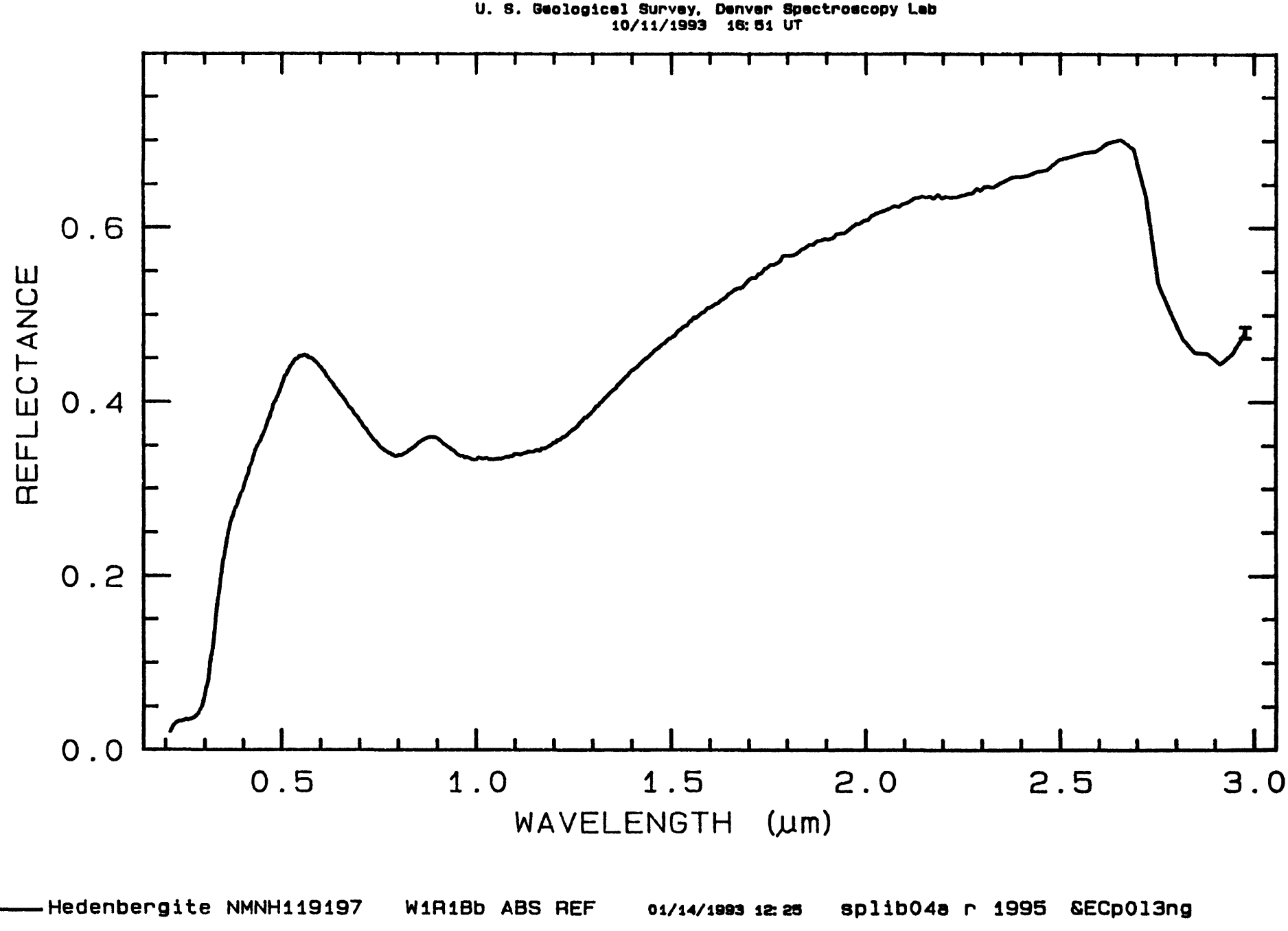
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 1995	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H26 -
Hedenbergite NMNH119197
Hedenbergite NMNH119197 W1R1Bb ABS REF 01/14/1993 12:28 splib04a r 1995 &ECp013ng

TITLE: Hedenbergite HS10 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS10

MINERAL_TYPE: Inosilicate

MINERAL: Hedenbergite (Pyroxene group)

FORMULA: CaFe+2Si2O6

FORMULA_NROFF: $CaFe^{+2}Si_2O_6$

COLLECTION_LOCALITY: Silver Star, Montana

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Diopside and with Johannsenite.

"S-17C. Pyroxene, variety Hedenbergite. Silver Star, Montana (10B). This sample has such strong ferric and ferrous ion bands on either side of 1μ that the reflectivity of the sample is reduced throughout the first half of the near-infrared range. Very weak water bands near 1.9 and 2.3 μ indicate the presence of some fluid inclusions. By contrast, a sample of artificially prepared hedenbergite displays a single strong ferrous ion band near 1.1 μ."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

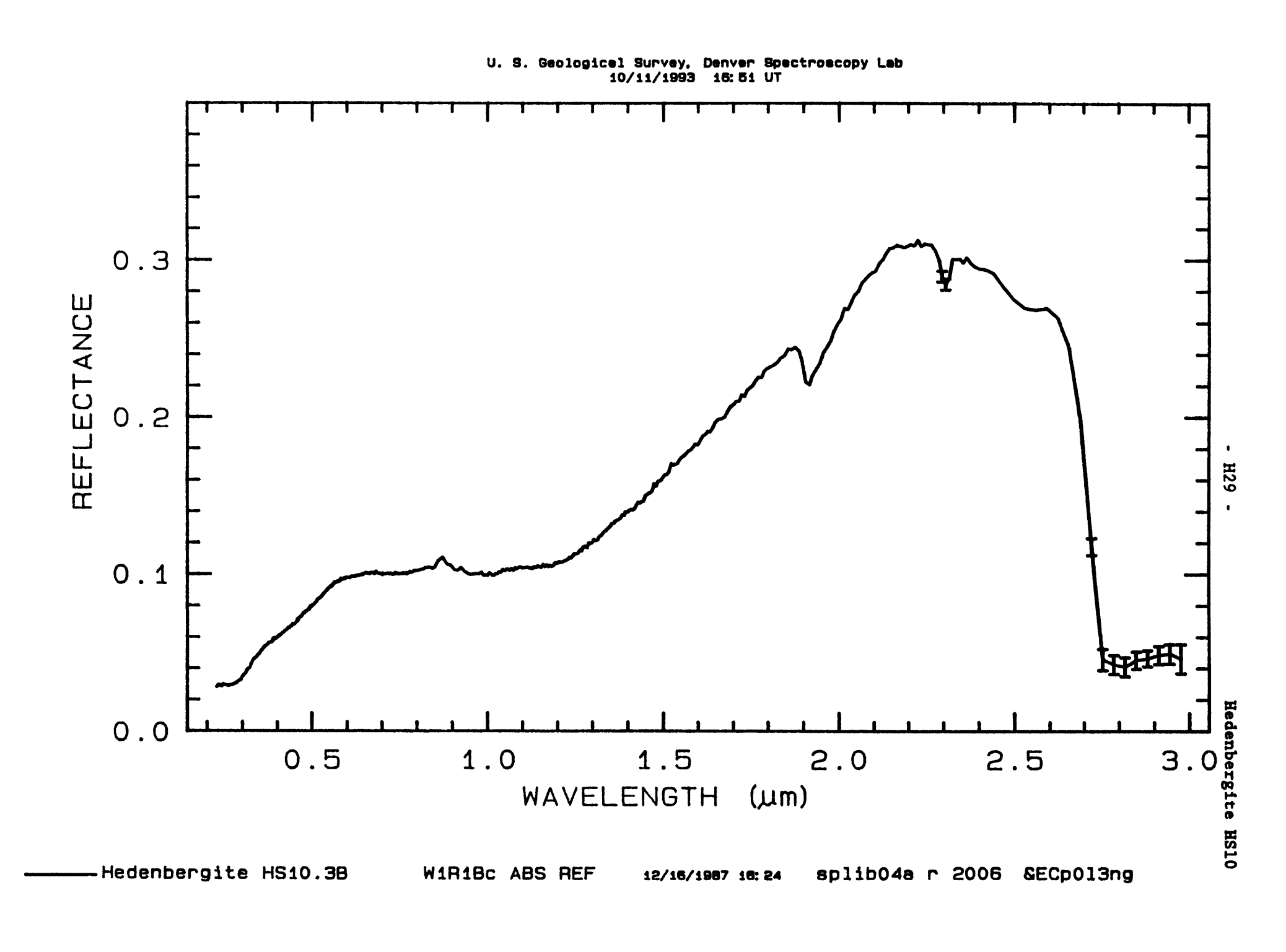
mode:
45 vol% red stained pyroxene
42 vol% clinopyroxene
10 vol% Mica
3 vol% Calcite

Green gains are pleochroic green with prismatic cleavage (slight < 90 degrees) and slightly inclined extinction. Biaxial (+), moderate 2V, all consistent with clinopyroxene. Sample has a considerable number of grains which fizz in HCl indicating significant carbonate contamination of sample. I suggest a cleaner sample be obtained. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2006	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H29 -
Hedenbergite HS10
Hedenbergite HS10.3B W1R1Bc ABS REF 12/16/1987 16:24 splib04a r 2006 &ECp013ng

TITLE: Hematite-2%+98%Qtz GDS76 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS76

MINERAL_TYPE: Oxide

MINERAL: Hematite (2%) + Quartz (98%) (Hematite group)

FORMULA: alpha-Fe2O3 + SiO2

FORMULA_NROFF: α-Fe_2O_3 + SiO_2

COLLECTION_LOCALITY: Laboratory mixture

ORIGINAL_DONOR:

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Hematite GDS27 2 wt% + 98 wt% Pure crystal quartz (<250 grain sizes)

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

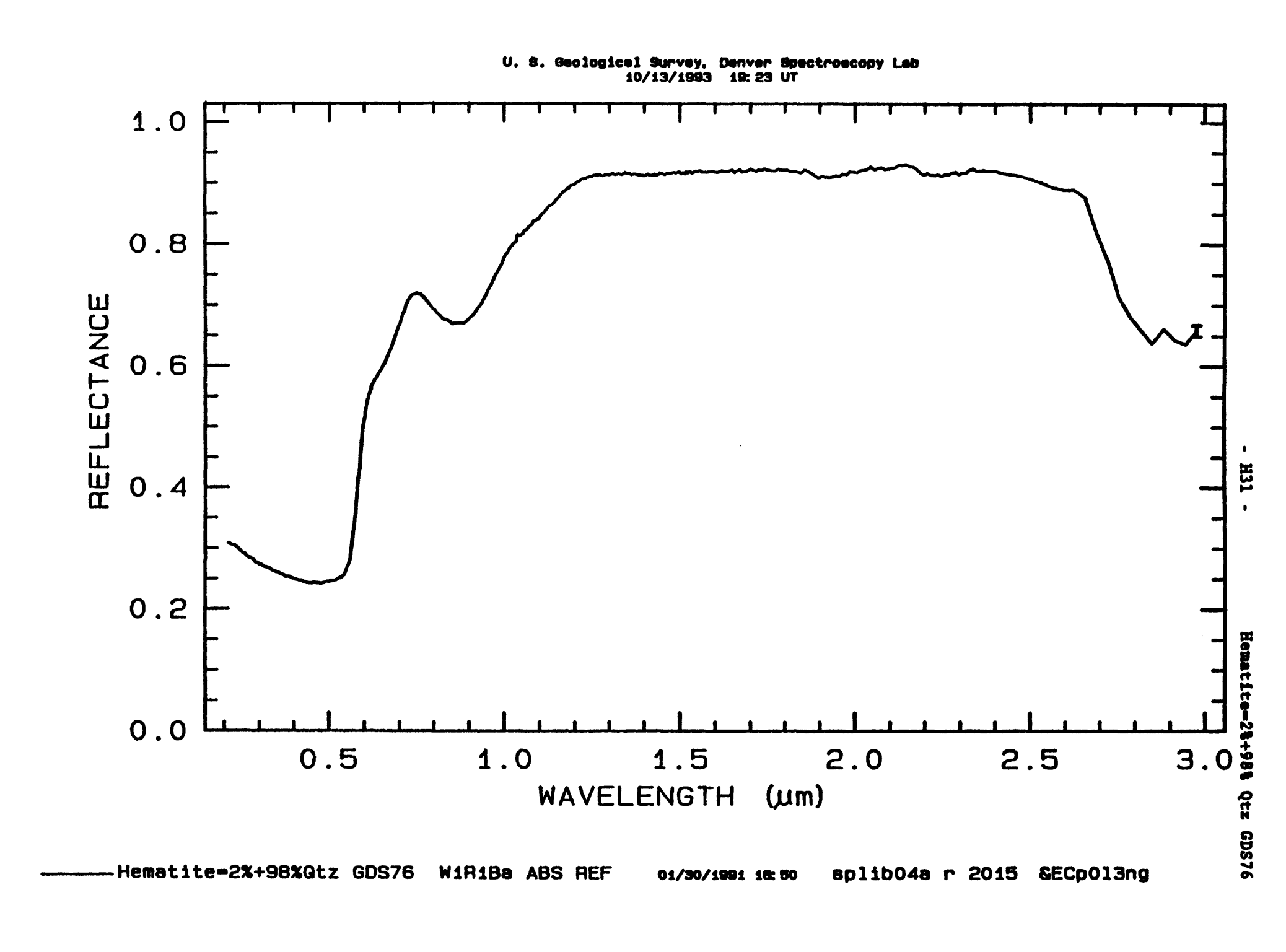
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2015	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 19:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- H31 -
Hematite=2%+98% Qtz GDS76
Hematite=2%+98%Qtz GDS76 W1R1Ba ABS REF 01/30/1991 18:50 splib04a r 2015 &ECp013ng

TITLE: Hematite GDS27 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS27

MINERAL_TYPE: Oxide

MINERAL: Hematite (Hematite group)

FORMULA: alpha-Fe2O3

FORMULA_NROFF: α-Fe_2O_3

COLLECTION_LOCALITY: Baker Analyzed Reagent (synthetic)

ORIGINAL_DONOR: Baker Chemical

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Maghemite.

Baker Analyzed Reagent. Grade: 1-2024. Trace: PO_4, SO_4, Ca, Mn, Zn (< .04% of each)

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure hematite

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

avg grain size = 200 μm (aggregates)

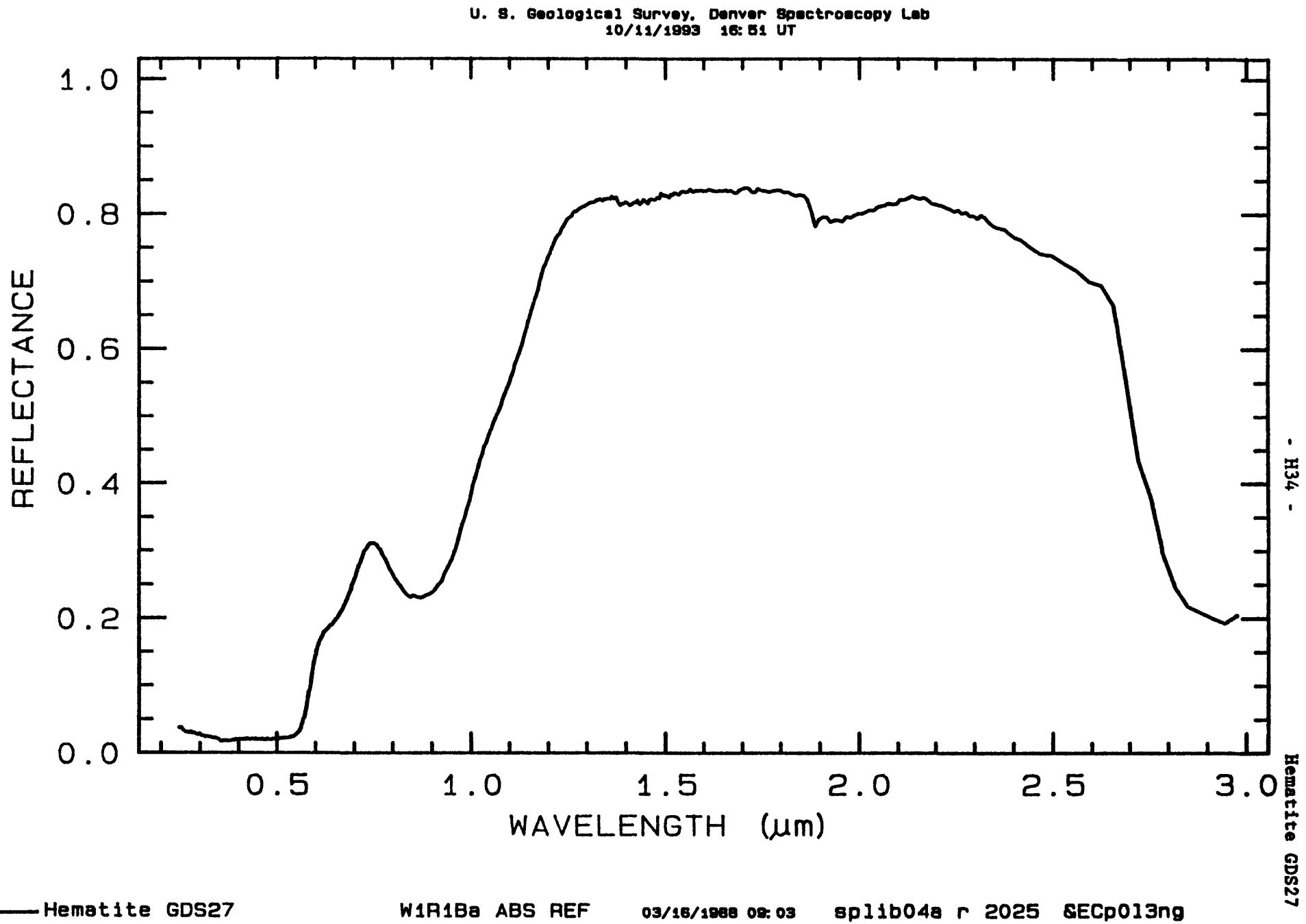
Material opaque, but hematite red in powdered form. No impurities

observed. Large 50-150 μm grain aggregates are composed of 2-3 μm grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2025	0.2-3.0μm	200	g.s.= 200 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/11/1993 16:51 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H34 -
Hematite GDS27
Hematite GDS27 W1R1Ba ABS REF 03/16/1988 09:03 splib04a r 2025 &ECp013ng

TITLE: Hematite GDS69 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS69

MINERAL_TYPE: Oxide

MINERAL: Hematite (Hematite group)

FORMULA: alpha-Fe2O3

FORMULA_NROFF: α-Fe_2O_3

COLLECTION_LOCALITY: Republic, Michigan

ORIGINAL_DONOR: Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Maghemite.

This sample was wet sieved to the following grain size intervals for a study on grain size effects by Roger Clark. The sample was a single rock of specular hematite that appeared pure.

>250μm	
150-250μm	(a)
104-150μm	(b)
60-104μm	(c)
45-60 μm	
30-45 μm	(d)
20-30 μm	(e)
10-20 μm	(f)
<30 μm	
<10 μm	(g)

Letter denotes spectrum designation. Those without a letter were not measured.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Seven grain size intervals were examined:

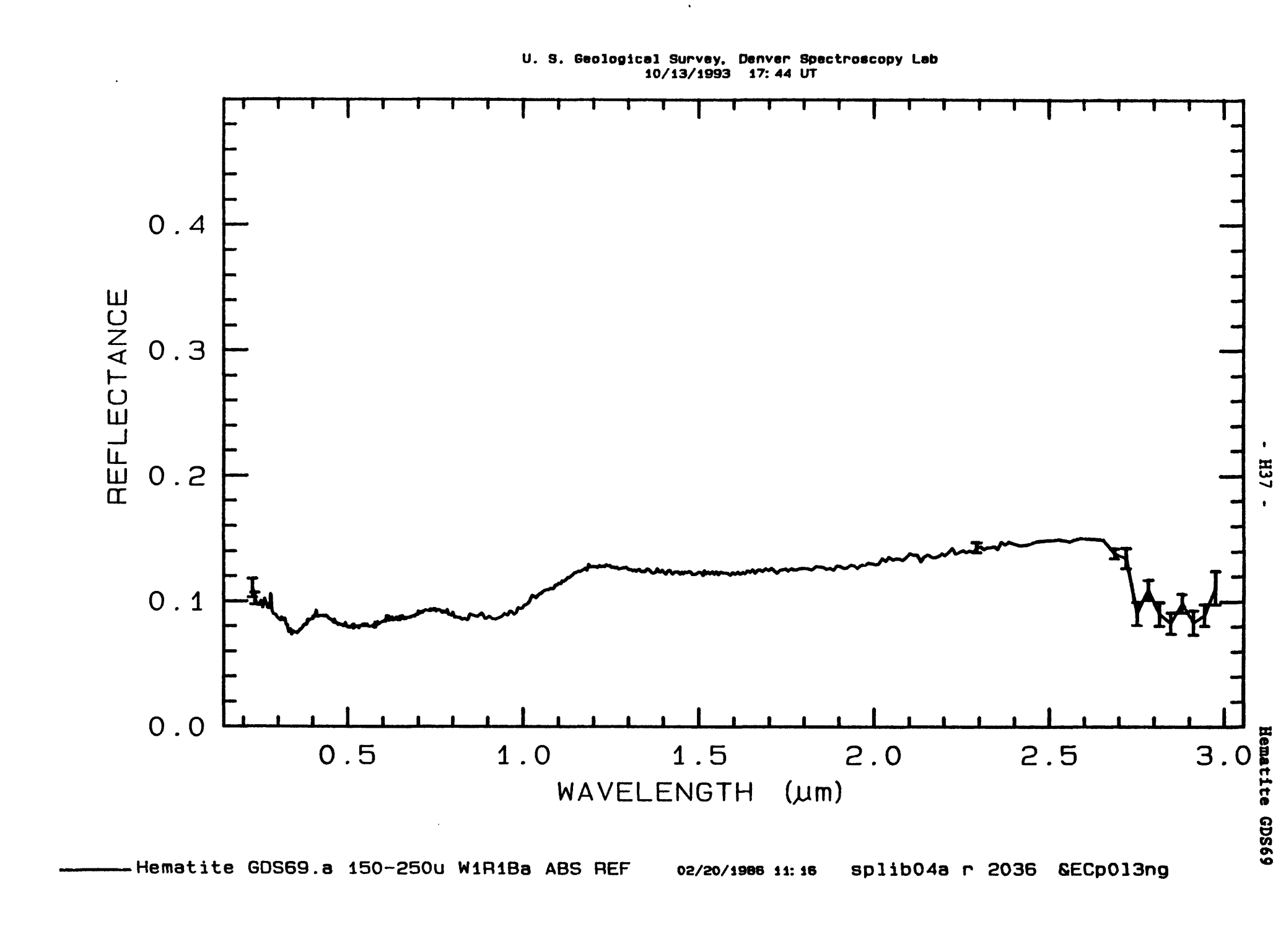
	avg gr sz (μm)	comments
150-250μm	233	tr quartz
104-150μm	171	lg grains prismatic
60-104μm	96	5 vol% quartz
30-45 μm	55	4-5 vol% quartz
20-30 μm	40	3 vol% quartz
10-20 μm	17	trace quartz
<10 μm	10.5	trace quartz

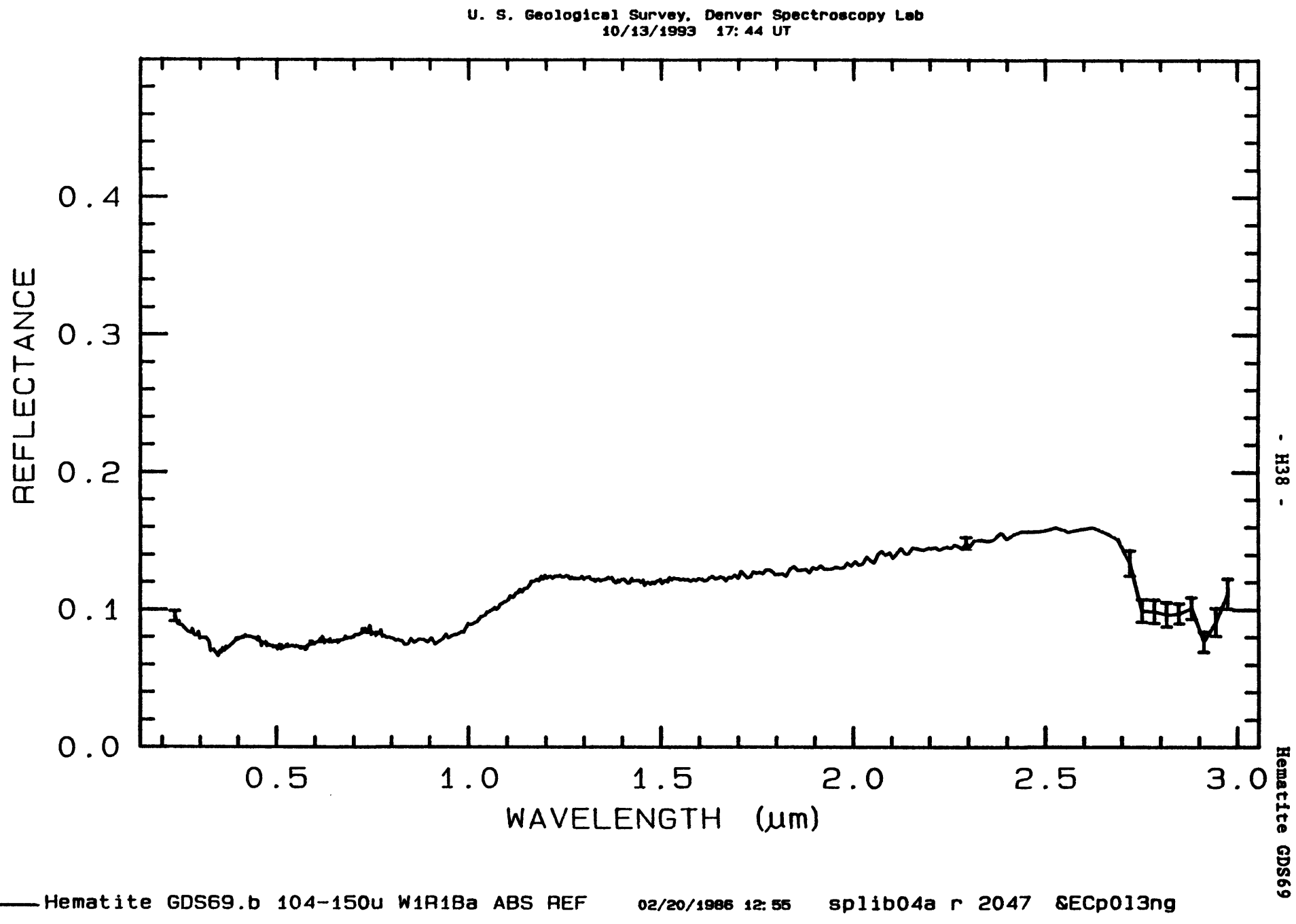
Anhedrally fractured grains, mostly specular, but occasionally massive surfaces. Some grains slightly attracted to magnet. Red color diagnostic of hematite. G. Swayze.

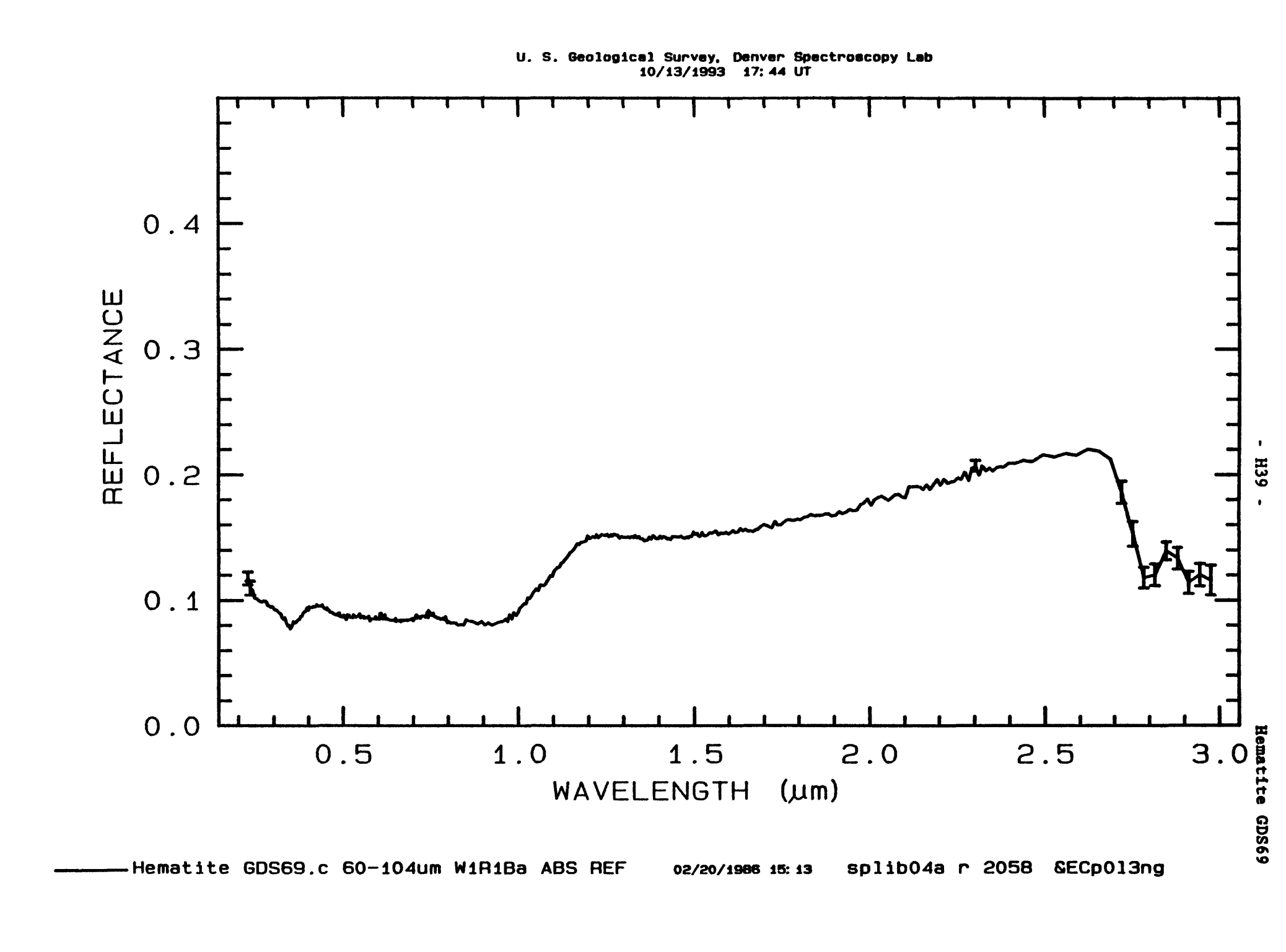
END_MICROSCOPIC_EXAMINATION.

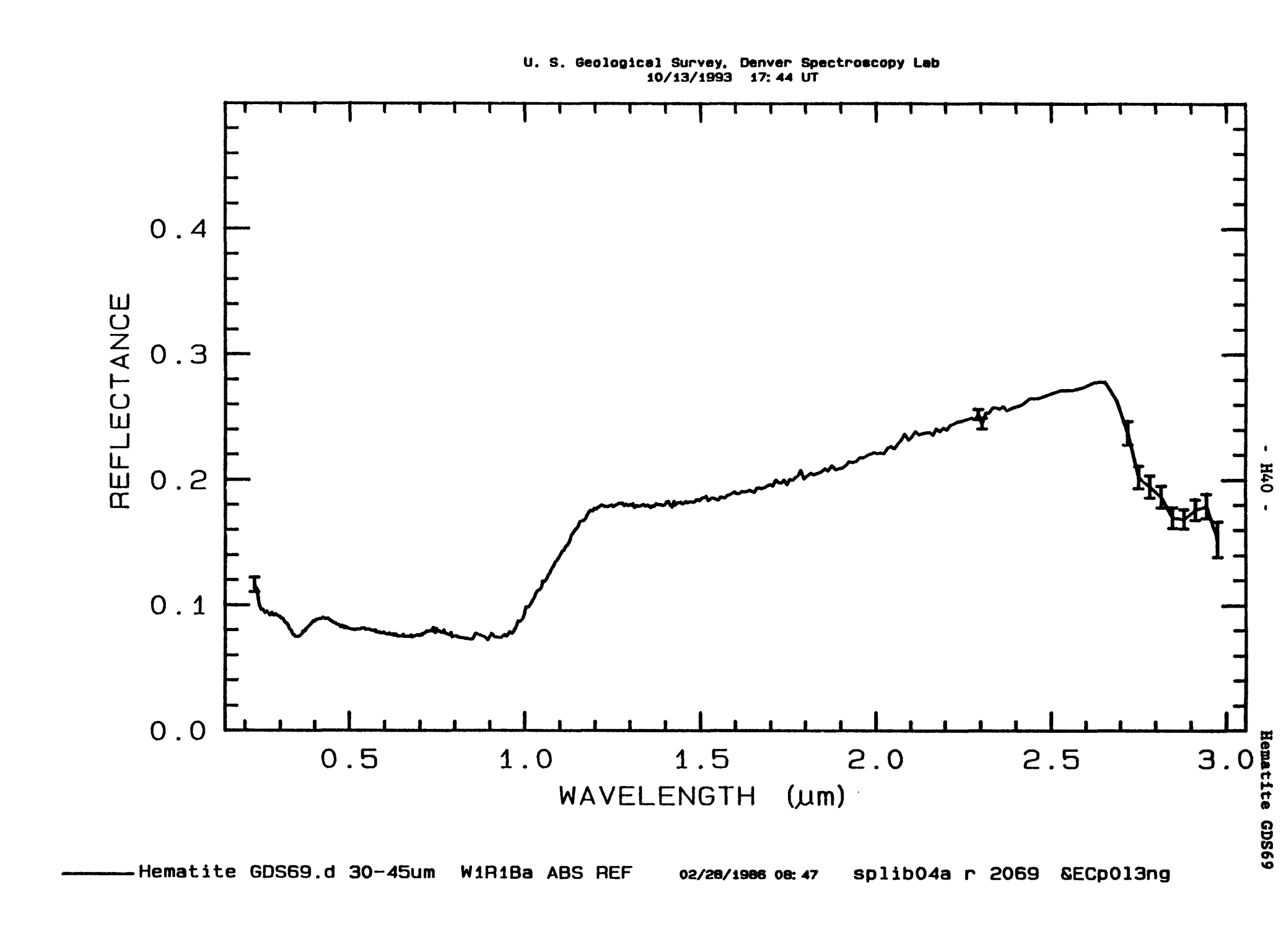
DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

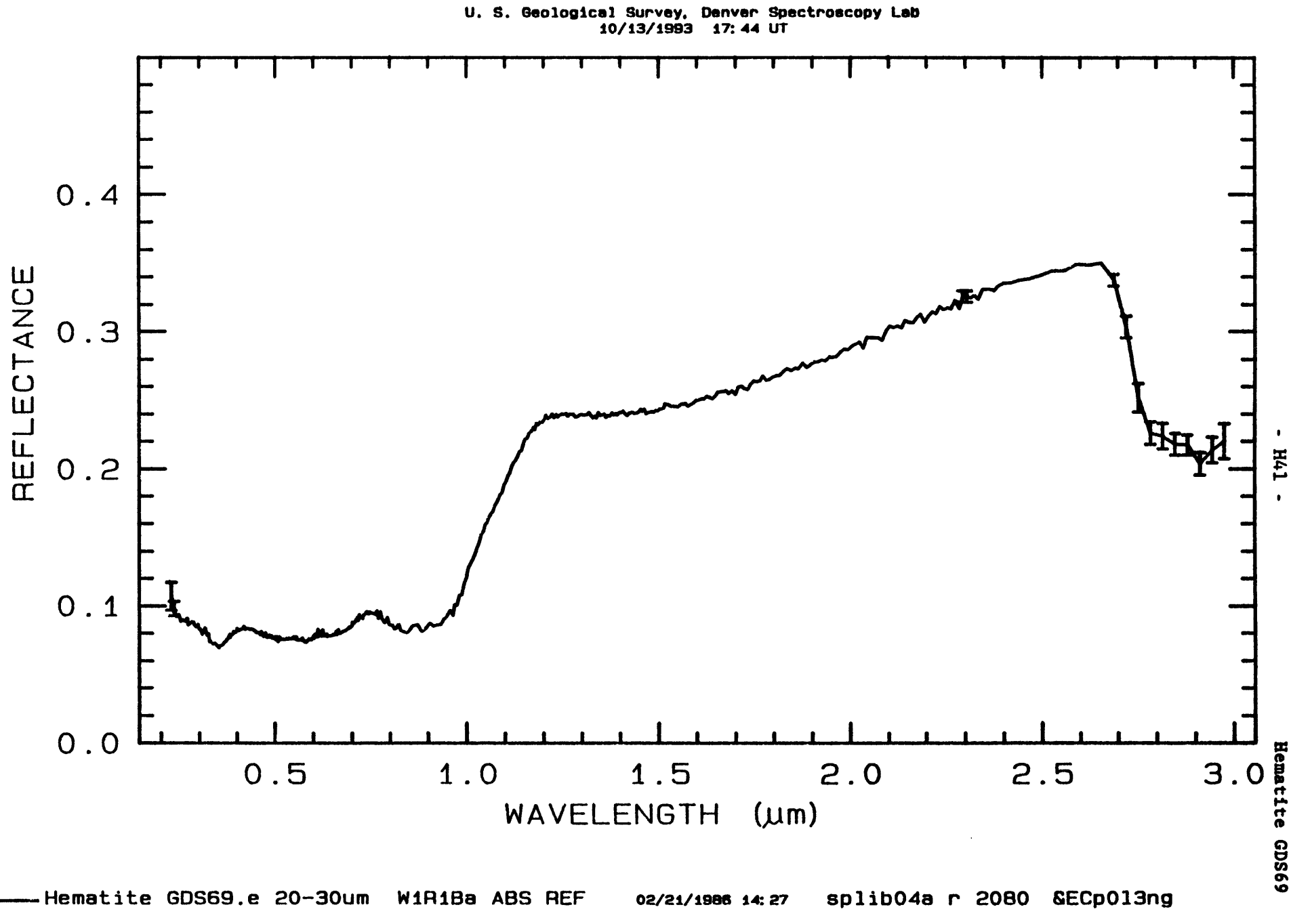
LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2036	0.2-3.0μm	200	g.s.= 233μm
LIB_SPECTRA:	splib04a r 2047	0.2-3.0μm	200	g.s.= 171μm
LIB_SPECTRA:	splib04a r 2058	0.2-3.0μm	200	g.s.= 96μm
LIB_SPECTRA:	splib04a r 2069	0.2-3.0μm	200	g.s.= 55μm
LIB_SPECTRA:	splib04a r 2080	0.2-3.0μm	200	g.s.= 40μm
LIB_SPECTRA:	splib04a r 2091	0.2-3.0μm	200	g.s.= 17μm
LIB_SPECTRA:	splib04a r 2103	0.2-3.0μm	200	g.s.= 10.5μm

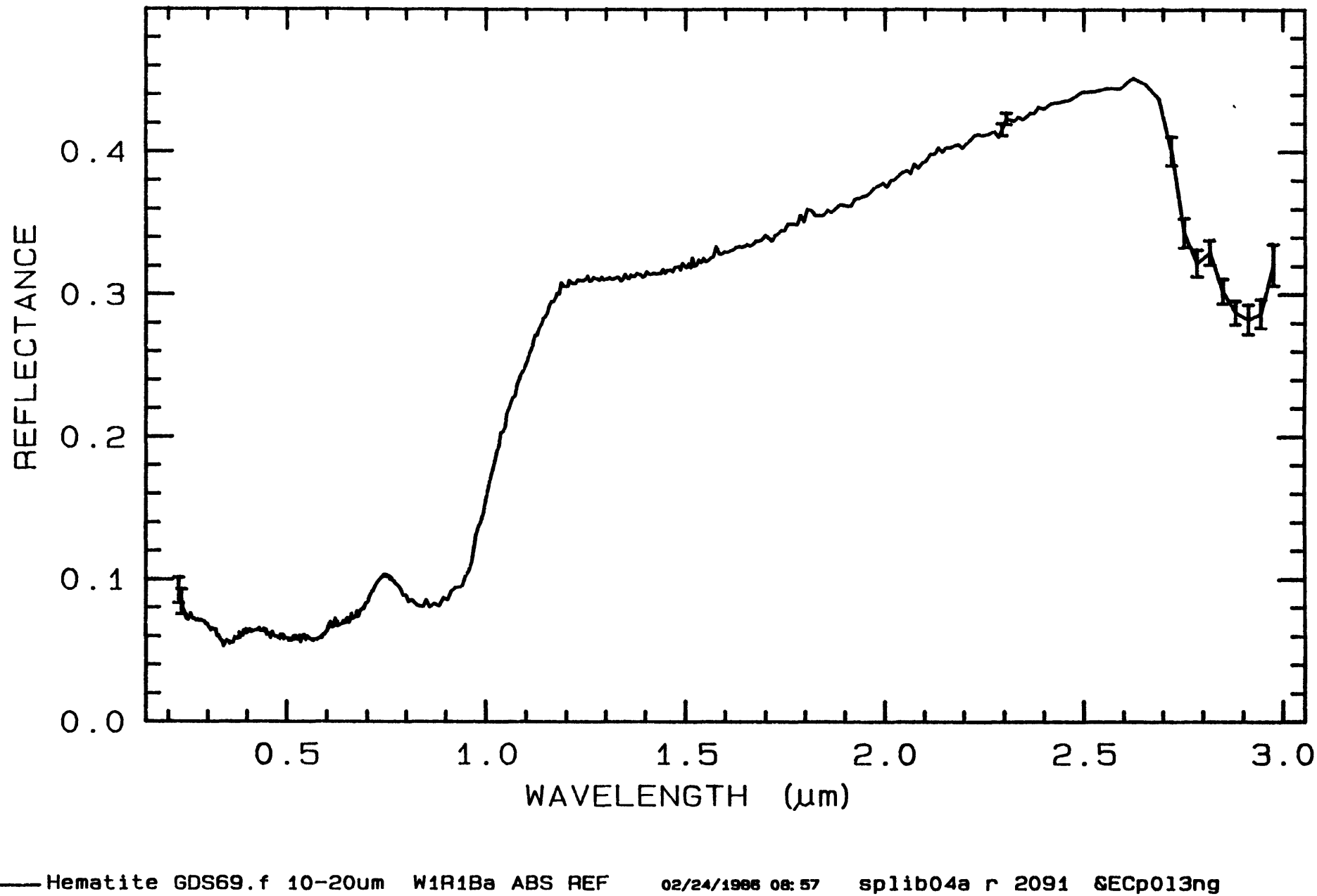

U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H37 -
Hematite GDS69
Hematite GDS69.a 150-250u W1R1Ba ABS REF 02/20/1986 11:16 splib04a r 2036 &ECp013ng

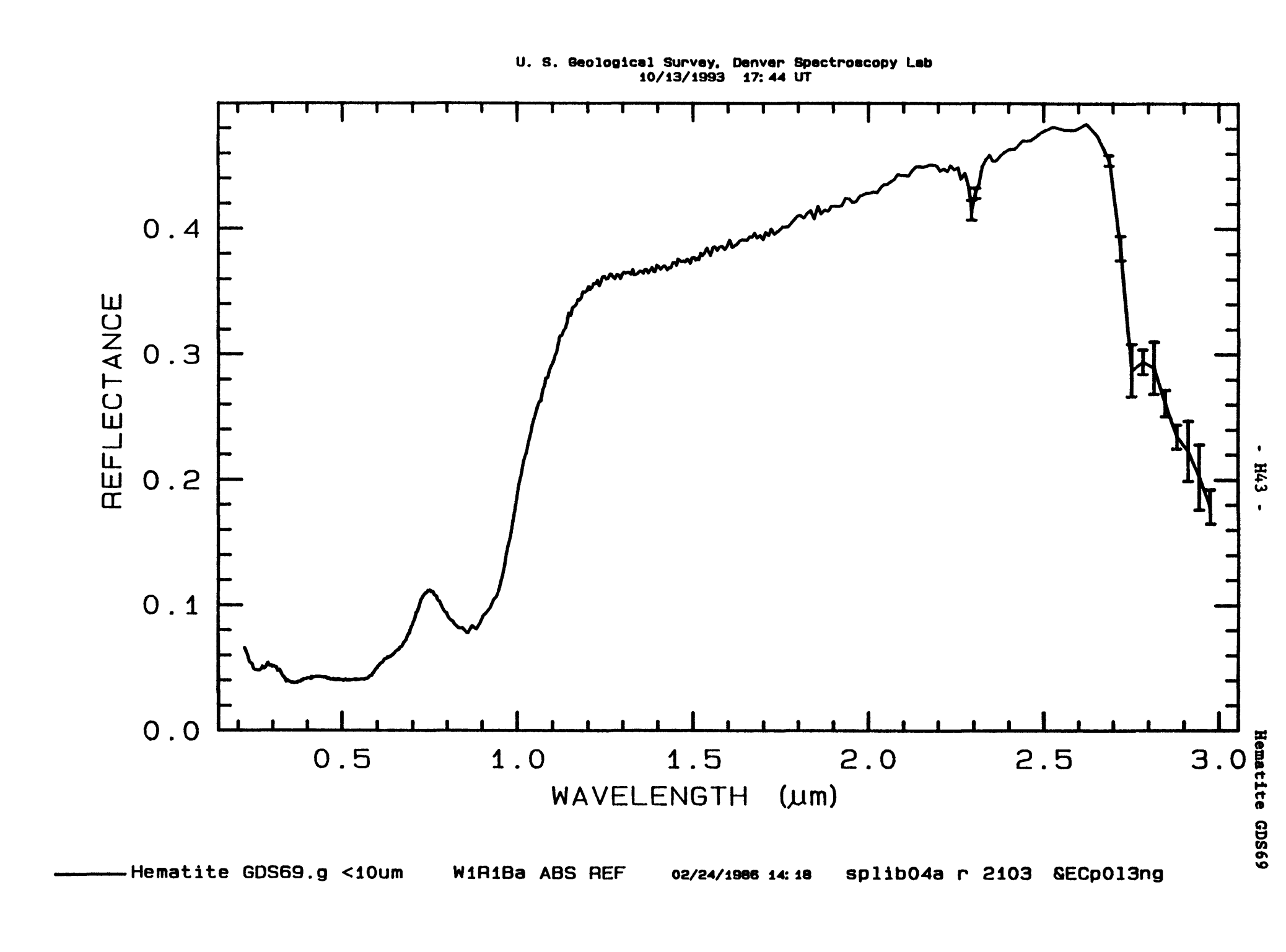

U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- H38 -
Hematite GDS69
Hematite GDS69.b 104-150u W1R1Ba ABS REF 02/20/1986 12:55 splib04a r 2047 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H39 -
Hematite GDS69
Hematite GDS69.c 60-104um W1R1Ba ABS REF 02/20/1986 15:13 splib04a r 2058 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H40 -
Hematite GDS69
Hematite GDS69.d 30-45um W1R1Ba ABS REF 02/28/1986 08:47 splib04a r 2069 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H41 -
Hematite GDS69
Hematite GDS69.e 20-30um W1R1Ba ABS REF 02/21/1986 14:27 splib04a r 2080 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H42 -
Hematite GDS69
Hematite GDS69.f 10-20um W1R1Ba ABS REF 02/24/1986 08:57 splib04a r 2091 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H43 -
Hematite GDS69
Hematite GDS69.g <10um W1R1Ba ABS REF 02/24/1986 14:18 splib04a r 2103 &ECp013ng

TITLE: Hematite HS45 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS45

MINERAL_TYPE: Oxide

MINERAL: Hematite (Hematite group)

FORMULA: alpha-Fe2O3

FORMULA_NROFF: α-Fe_2O_3

COLLECTION_LOCALITY: Ironton, MN

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Maghemite.

The spectrum of this sample was originally published in:

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

With the note that "this sample departs considerably from a pure stoichiometric single crystal, but is typical of naturally occurring hematite."

The sample measured for the library was HS45.3 which was dry sieved to the grain size interval 74-250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None.

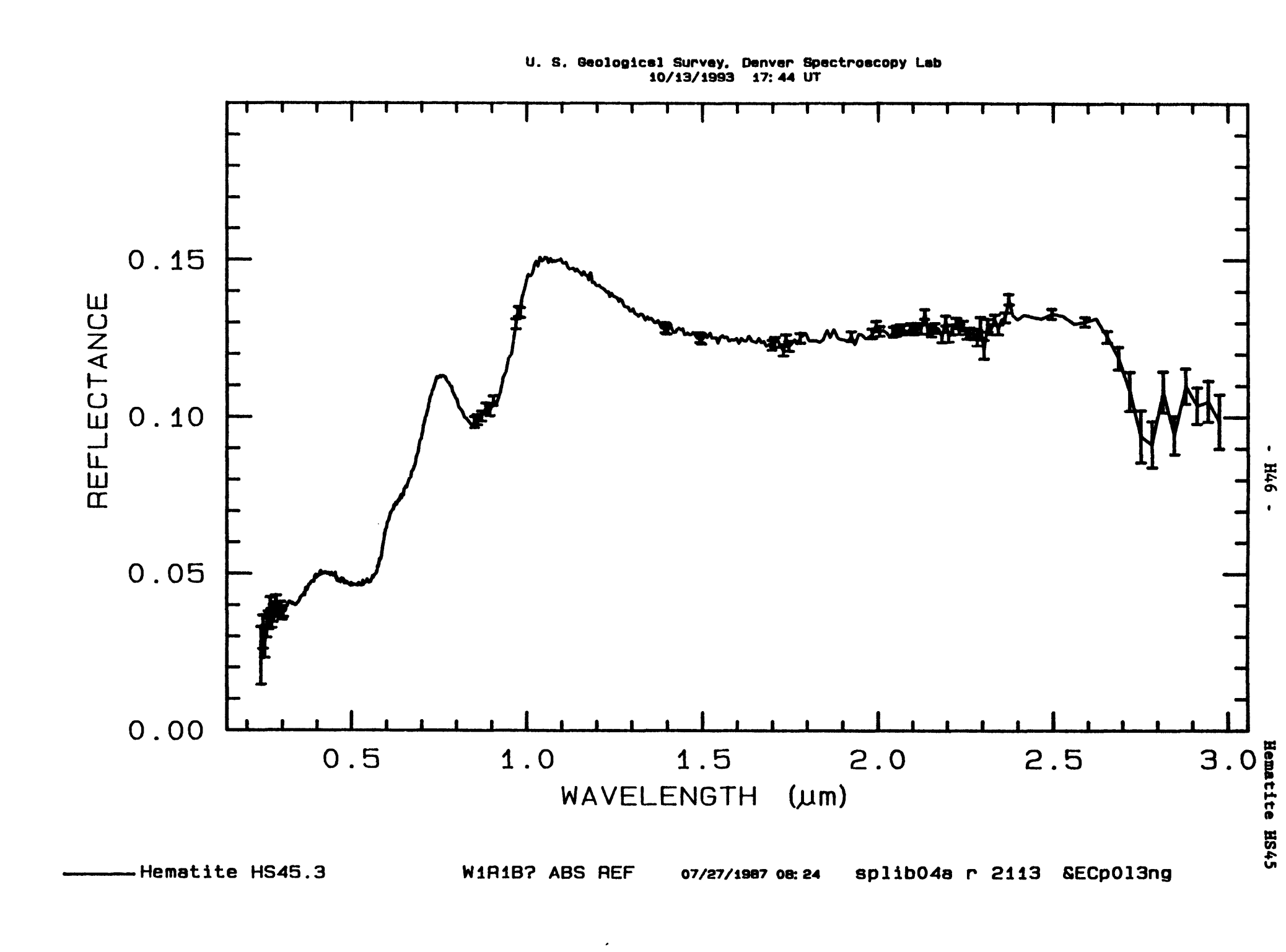
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2113	0.2-3.0μm	200	g.s.= μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H46 -
Hematite HS45
Hematite HS45.3
W1R1B? ABS REF
07/27/1987 08:24
splib04a r 2113 &ECp013ng

TITLE: Hematite WS161 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS161

MINERAL_TYPE: Oxide

MINERAL: Hematite (Hematite group)

FORMULA: alpha-Fe2O3

FORMULA_NROFF: α-Fe_2O_3

COLLECTION_LOCALITY: Cleator Moor, Cumberland, England

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Maghemite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:
80 vol% hematite
20 vol% quartz

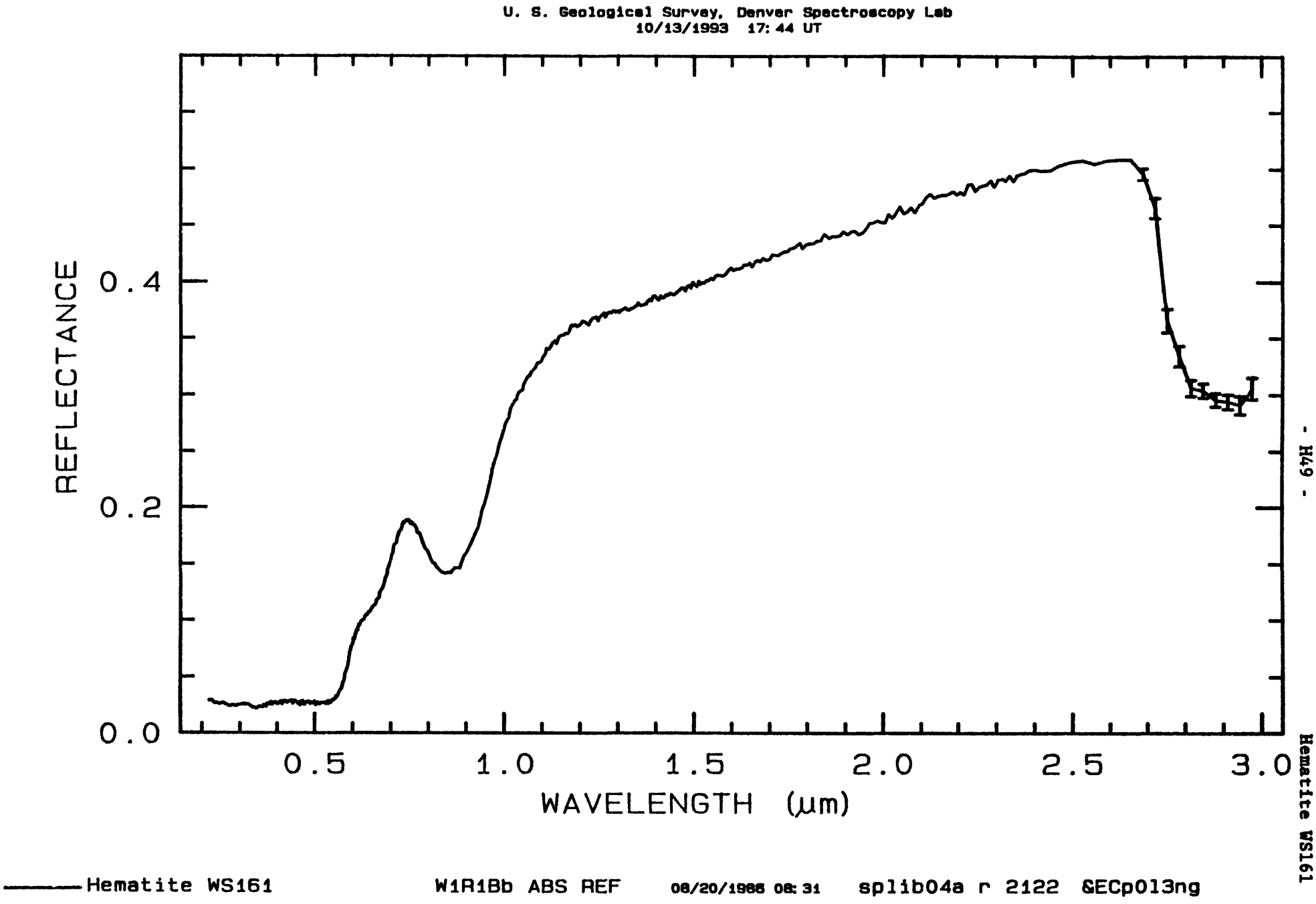
avg grain sz = 6 μm

Sample is extremely fine grained but contains significant quartz? contamination. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2122	0.2-3.0μm	200	g.s.= 6 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- HW9 -
Hematite WS161
Hematite WS161
W1R1Bb ABS REF
08/20/1986 08:31
splib04a r 2122 &ECp013ng

TITLE: Hematite FE2602 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: FE2602

MINERAL_TYPE: Oxide

MINERAL: Hematite (Hematite group)

FORMULA: alpha-Fe2O3

FORMULA_NROFF: α-Fe_2O_3

COLLECTION_LOCALITY: Larimer County, CO

ORIGINAL_DONOR: Colorado School of Mines

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Dimorphous with Maghemite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure (?).

Kruse, F.A., P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

avg gr sz = 18 μm

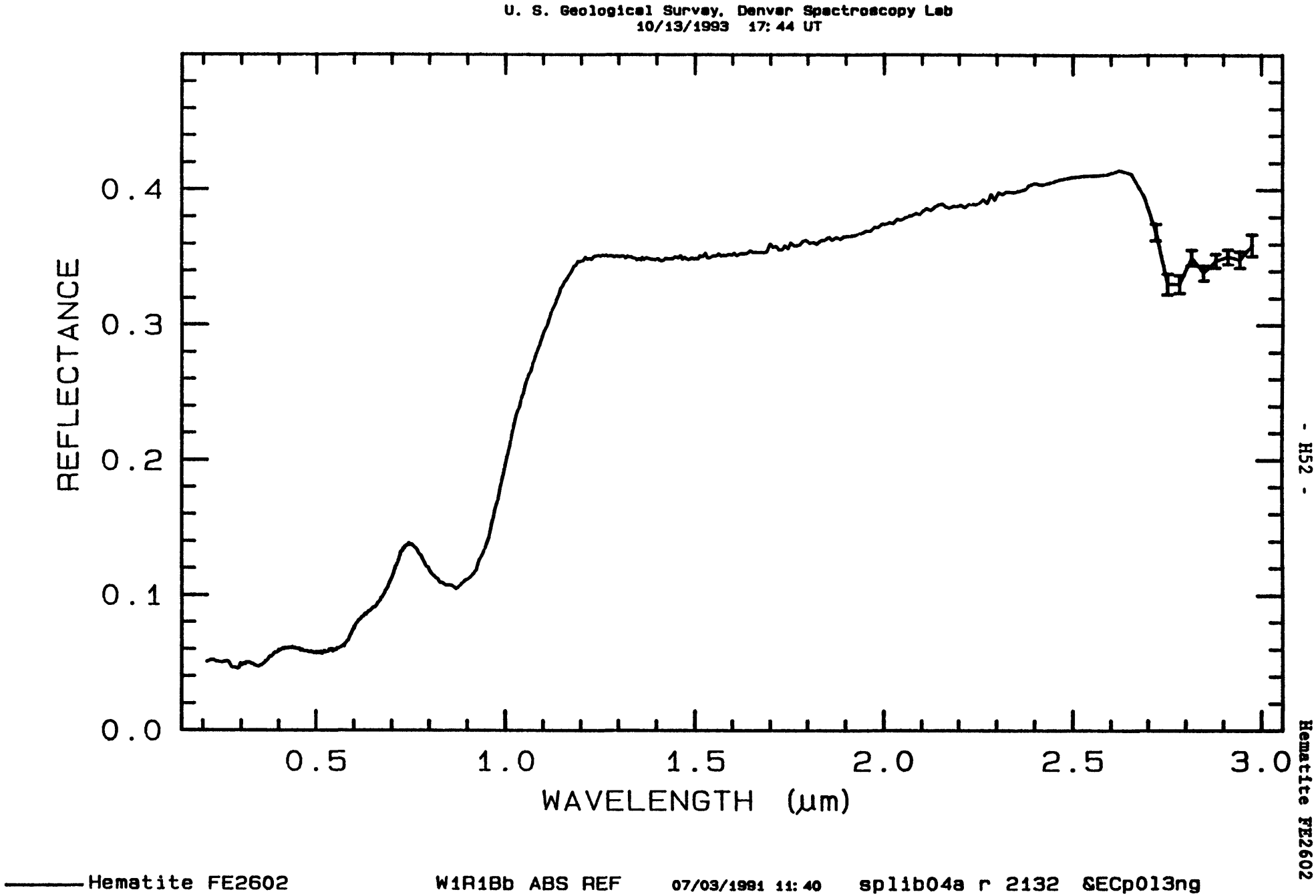
2 vol % pyroxene or feldspar contamination

red luster semi-transparent grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 2132	0.2-3.0μm	200	g.s.= 18 μm

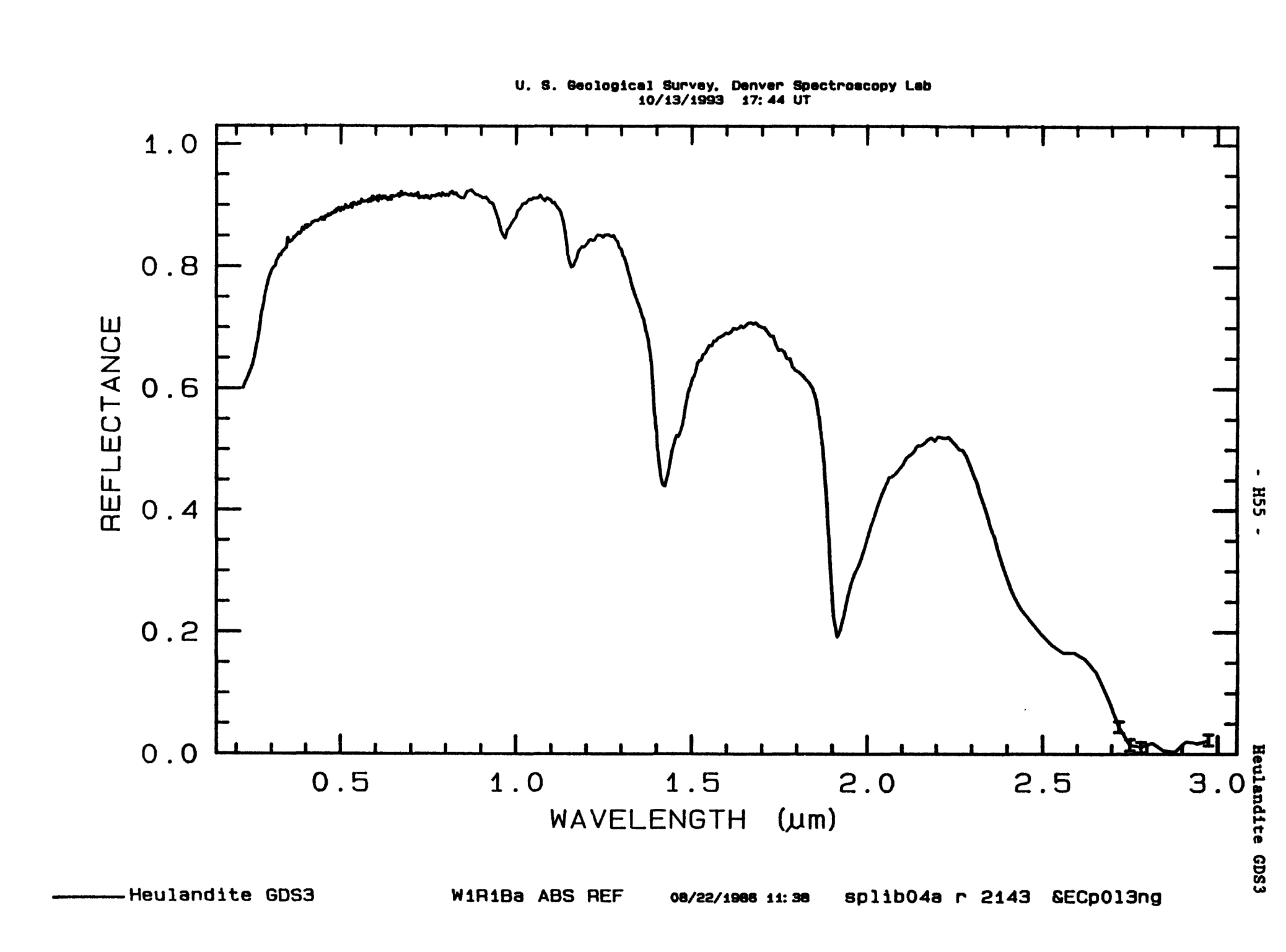

U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H52 -
Hematite FE2602
Hematite FE2602
W1R1Bb ABS REF
07/03/1991 11:40
splib04a r 2132 &ECp013ng

sample being heulandite or clinoptilolite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2143	0.2-3.0μm	200	g.s.= 128 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H55 -
Heulandite GDS3
Heulandite GDS3
W1R1Ba ABS REF
08/22/1986 11:38
splib04a r 2143 &ECp013ng

TITLE: Heulandite GDS3 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS3

MINERAL_TYPE: Tectosilicate

MINERAL: Heulandite (Zeolite group)

FORMULA: (Na,Ca)2-3Al3(Al,Si)2Si13O36*12H2O

FORMULA_NROFF: $(Na,Ca)_{2-3}Al_3(Al,Si)_2Si_{13}O_{36}\bullet 12H_2O$

COLLECTION_LOCALITY: Poona, India

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample appears white and to be spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Zeolites of the heulandite group
Probably a mixture of compositions....best match is clinoptilolite

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Bimodal Grain Size Distribution:
mode 1: 176 μm @ 50 vol%
mode 2: 40 μm @ 50 vol%

avg gr sz = 128 μm

Low relief, one good cleavage, biaxial (+), refractive index < glycerin. No contaminants, sample very clean. All this is consistent with this

TITLE: Heulandite NMNH84534 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH84534

MINERAL_TYPE: Tectosilicate

MINERAL: Heulandite (Zeolite group)

FORMULA: (Na,Ca)2-3Al3(Al,Si)2Si13O36*12H2O

FORMULA_NROFF: $(Na,Ca)_{2-3}Al_3(Al,Si)_2Si_{13}O_{36}\bullet 12H_2O$

COLLECTION_LOCALITY: Teigarhom, Iceland

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure heulandite.

Ehman, W.J. and Norma Vergo, 1986, Spectral discrimination of zeolites and dioctahedral clays in the near-infrared. Remote Sensing for Exploration Geology, 5th Thematic Conference, Reno, Nevada, September 29-October 2, 1986, Proceedings, pp 417-425.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

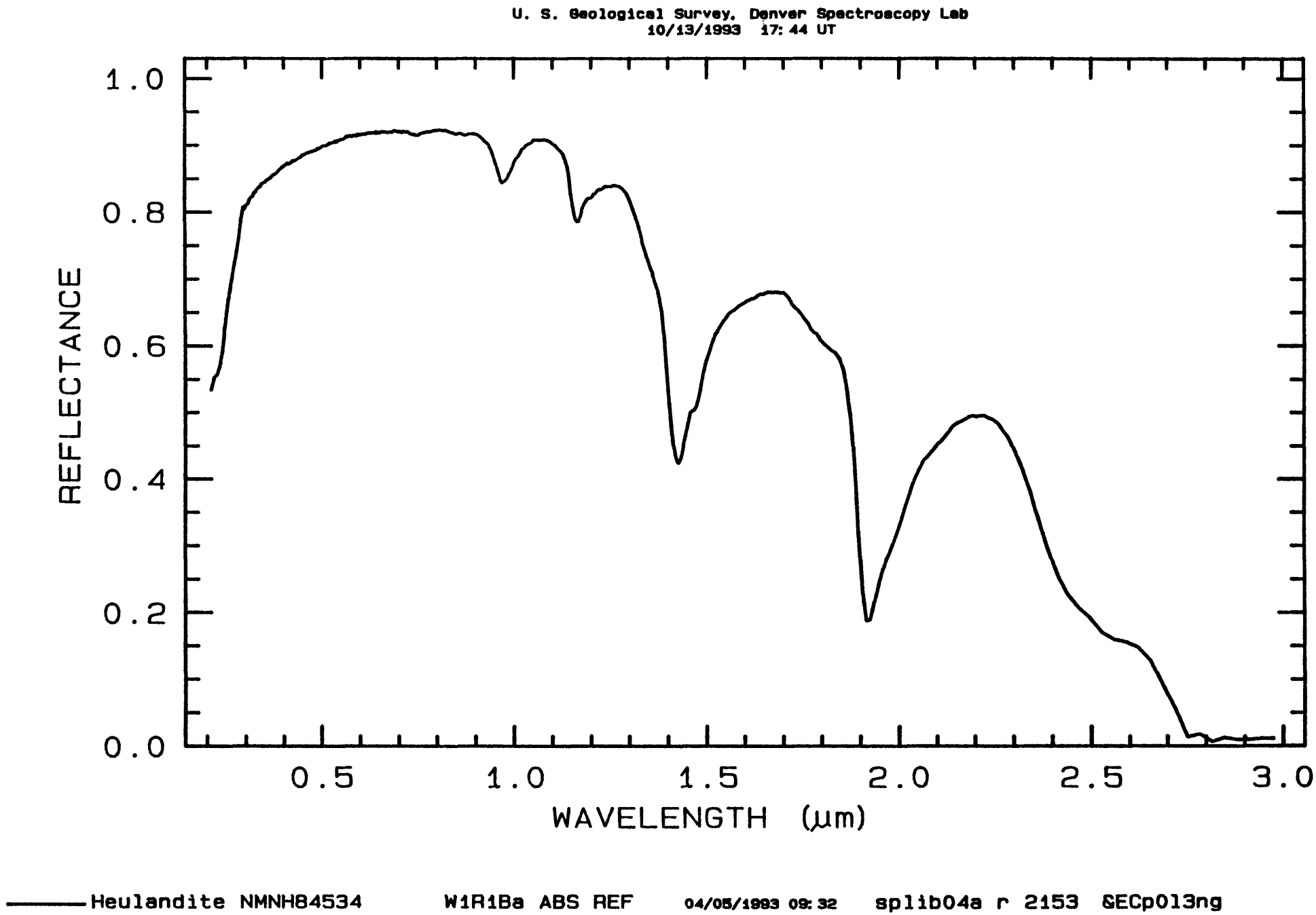
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2153	0.2-3.0μm	200	g.s.=



Heulandite NMNH84534

TITLE: Holmquistite HS291 Amphibole DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS291

MINERAL_TYPE: Inosilicate

MINERAL: Holmquistite (Amphibole group)

FORMULA: Li2(Mg,Fe+2)3Al2Si8O22(OH)2

FORMULA_NROFF: $Li_2(Mg,Fe^{+2})_3Al_2Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Quebec

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Ferroholmquistite and Magnesioholmquistite.
Dimorphous with Clinoholmquistite.

"I-20 Holmquistite 291B--Quebec, $Li_2(Mg,Fe^{2+})_3(Al, Fe^{3+})_2(Si_8O_{22})(OH,F)_2$): Holmquistite is a rare amphibole, the main occurrences of which are located at or close to the contact between lithium-rich pegmatites and country rocks. There are broad general absorption bands in the spectrum of this sample centered near 0.7 and 1.0μ due to Fe^{3+} and Fe^{2+}. The weak OH feature near 1.4μ is accompanied by a considerably stronger OH band at 2.35μ. As in the cases of the tremolite and riebecite above, the additional strength and slight longward shift of the 2.35μ band is due to a small contribution from a carbonate contaminant. The low reflectivity and poorly defined bands are a result of the presence of opaque magnetite and pyrite as impurities."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Sample is very contaminated with:

Mode:

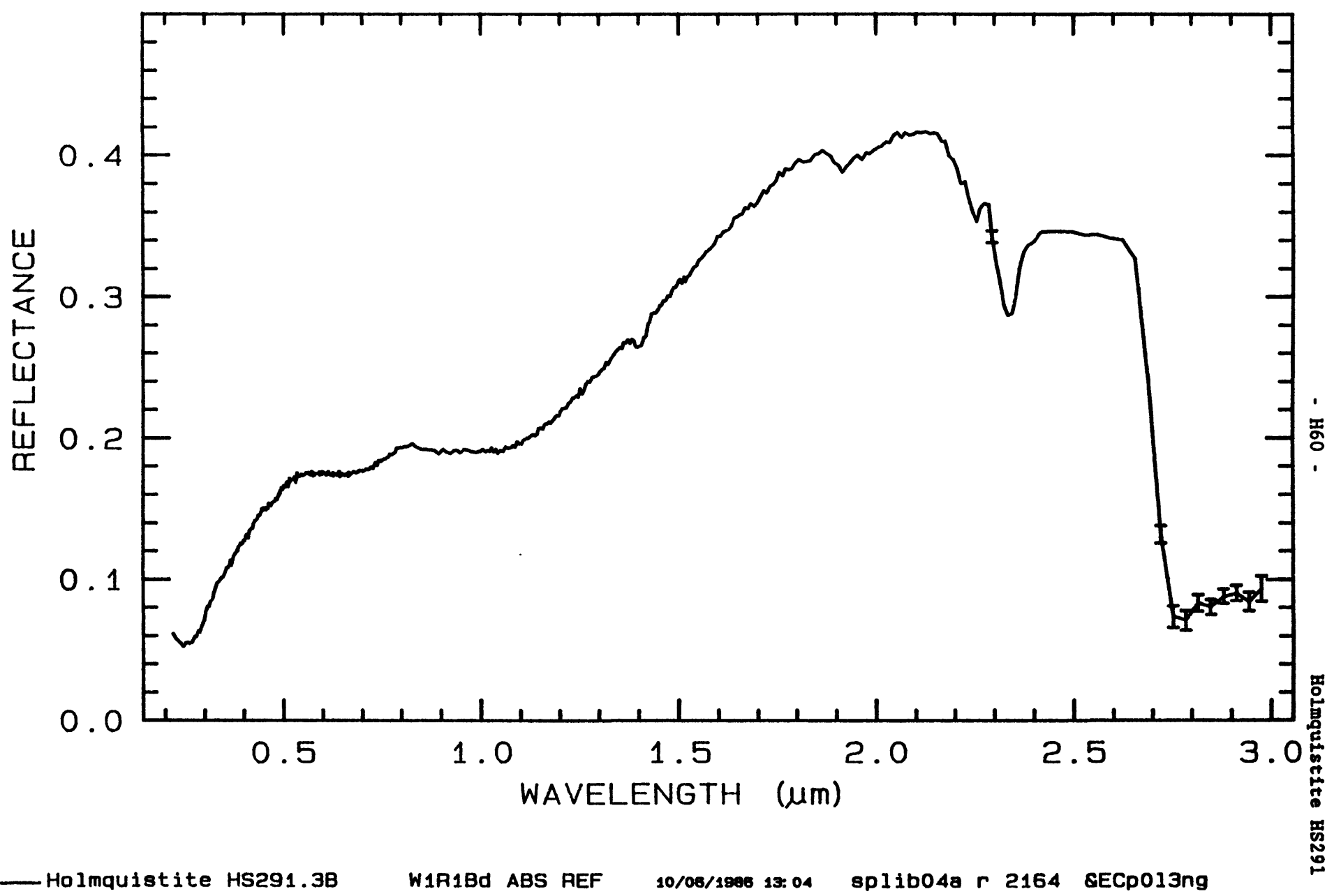
40 vol% Anthophyllite ? biaxial (-), parallel extinction
40 vol% Plagioclase (altered to sericite?)
17 vol% quartz (uniaxial +)
3 vol% Holmquistite (light blue color in plane light)

If Holmquistite is the light blue amphibole with parallel extinction and amphibole cleavage (biaxial -), then this mineral only forms 3 vol% of the contents of this bottle. I suggest sample be X-rayed to see if green amphibole is the Holmquistite or anthophyllite. If the green amphibole turns out to be Holmquistite, then it may be separated using heavy liquids or Franz separator. If blue mineral is Holmquistite then these separation procedures will probably not give enough Holmquistite to make the effort worthwhile.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2164	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H60 -
Holmquistite HS291
Holmquistite HS291.3B W1R1Bd ABS REF 10/06/1986 13:04 splib04a r 2164 &ECp013ng

TITLE: Hornblende_Mg NMNH117329 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH117329

MINERAL_TYPE: Inosilicate

MINERAL: Magnesio-Hornblende (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)4Al(Si7Al)O22(OH,F)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_4Al(Si_7Al)O_{22}(OH,F)_2$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Jack Salisbury

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

This sample fits well with magnesiohornblende. Norma Vergo

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

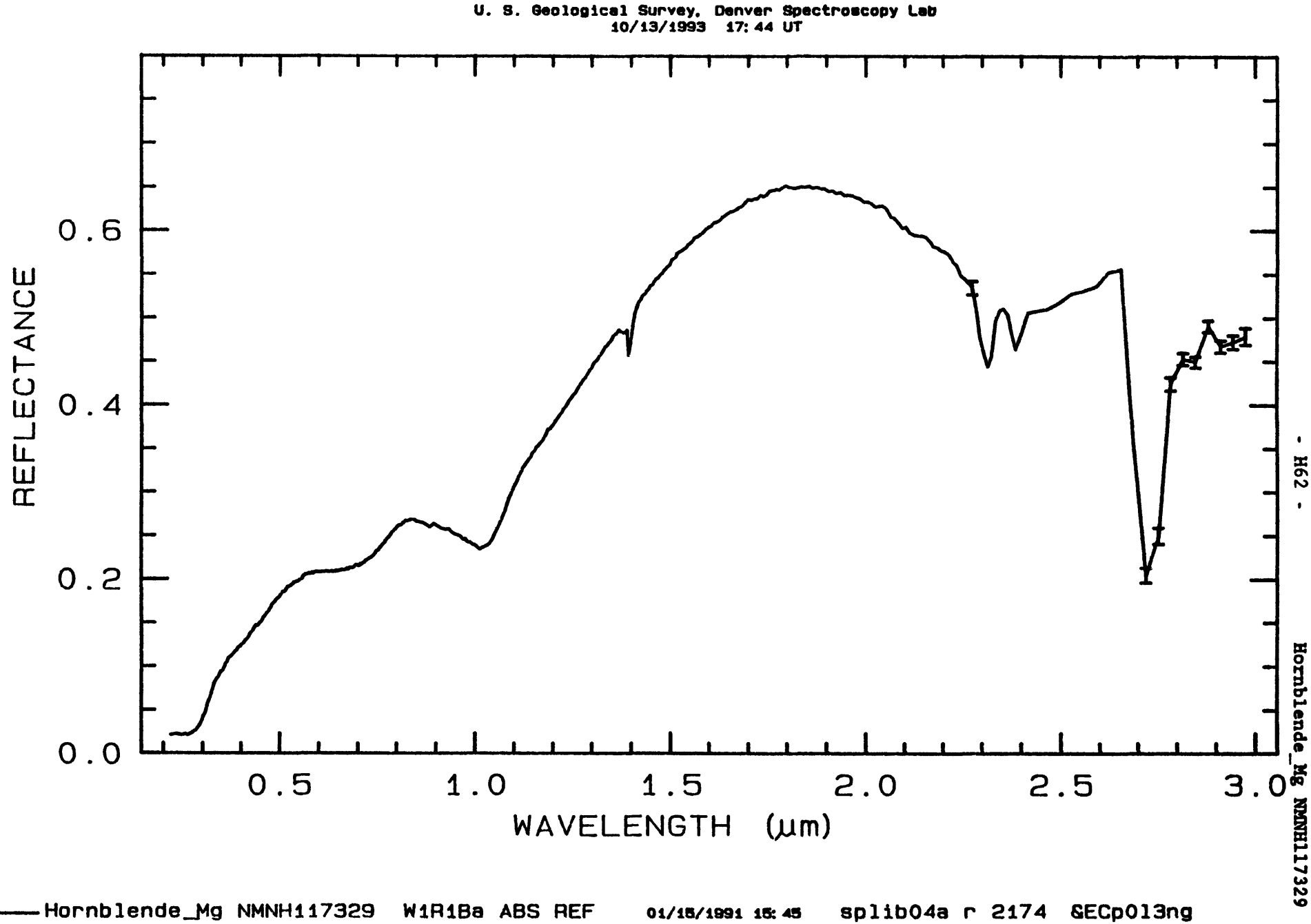
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2174	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H62 -
Hornblende_Mg NMNH117329
Hornblende_Mg NMNH117329 W1R1Ba ABS REF 01/15/1991 15:45 splib04a r 2174 GECp013ng

TITLE: Hornblende_Fe HS115 Amphibole DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS115

MINERAL_TYPE: Inosilicate

MINERAL: Ferro-Hornblende (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)4Al(Si7Al)O22(OH,F)2

FORMULA_NROFF: $(Mg,Fe)_2Mg_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: Brewster, New York

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series from Magnesiohornblende to Ferrohornblende.

"S-1E. Amphibole, variety Hornblende. Brewster, N.Y., (115B). This is an impure sample, deep green in color. It displays the double band structure in the 0.6 to 1.1 μ region that is typical of the presence of both the ferric and ferrous ion. The presence of a light gray contaminant (muscovite) raises the reflectivity of the sample which is most obvious in the largest size range, and explains the anomalous highter reflectivity of that size fraction. The hydroxyl bands are not so strong as in tremolite and actinolite, which is typical of hornblende. The very weak bands in the visible near 0.5, 0.45, and 0.5 μ are due to both the ferrous and ferric ions."

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

Sieve interval 74 - 250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:

90 vol% Hornblende
8 vol% plagioclase + quartz + other (uniaxial -)
1 vol% mica (clear)
1 vol% calcite (fizz with HCl)

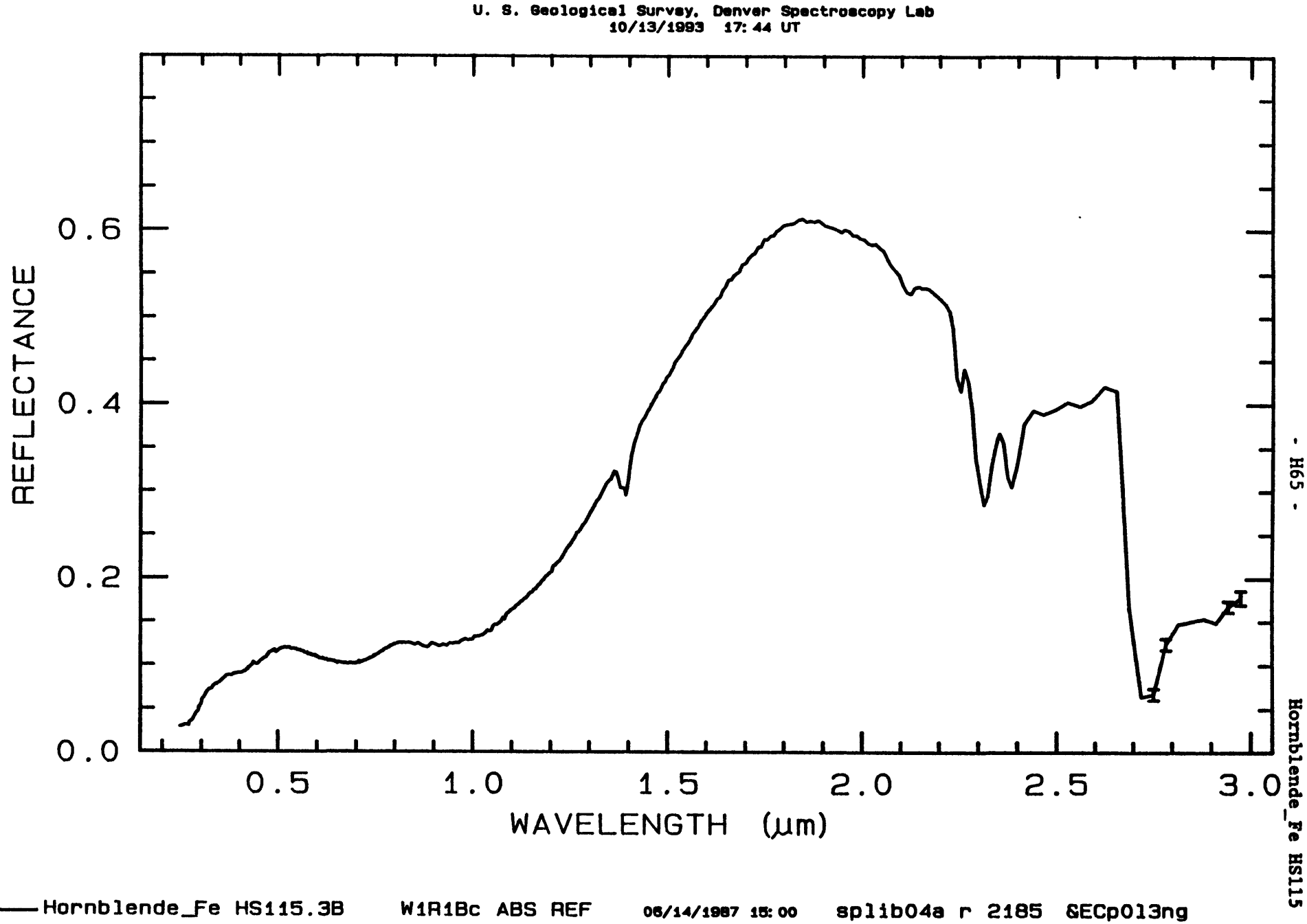
avg grain size = 250 μm

Smaller grains ~5 μm coat larger grains @ 30% surface area. Hornblende has inclined extinction (19 ° for OAP 11 (010)), biaxial (-), strong green-blue pleochroism, and amphibole cleavage. All these properties are consistent with this sample being mostly hornblende. Heavy liquid or Franz separation may sort impurities out. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2185	0.2-3.0μm	200	g.s.= 250μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H65 -
Hornblende_Fe HS115
Hornblende_Fe HS115.3B W1R1Bc ABS REF 06/14/1987 15:00 splib04a r 2185 &ECp013ng

TITLE: Hornblende HS16 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS16

MINERAL_TYPE: Inosilicate

MINERAL: Hornblende (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)4Al(Si7Al)O22(OH,F)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_4Al(Si7Al)O_{22}(OH,F)_2$

COLLECTION_LOCALITY: Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series from Magnesiohornblende to Ferrohornblende.

"I-22 Hornblende 16B--Ontario. $(Ca, Na_9K)_{2-3}$- $(Mg, Fe^{2+}, Fe^{3+}, Al)_5(Si_6(Si, Al)_2O_{22})(OH, F)_2$: Hornblende is the name given to a very complex series which varies with respect to at least ten major components. This spectrum is quite typical of hornblende spectra, which display a rapid fall off in intensity from 2.0μ to the blue due to broad Fe^{2+} and Fe^{3+} absorption near 0.7μ and 1.0μ. The hydroxyl band at 1.4 is also reduced in intensity or missing, leaving only OH features at 2.33μ and 2.4μ."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:
75 vol% Hornblende
20 vol% Chlorite (basal cleav., 1st order gray, biaxial +)
5 vol% Plagioclase
tr Garnet

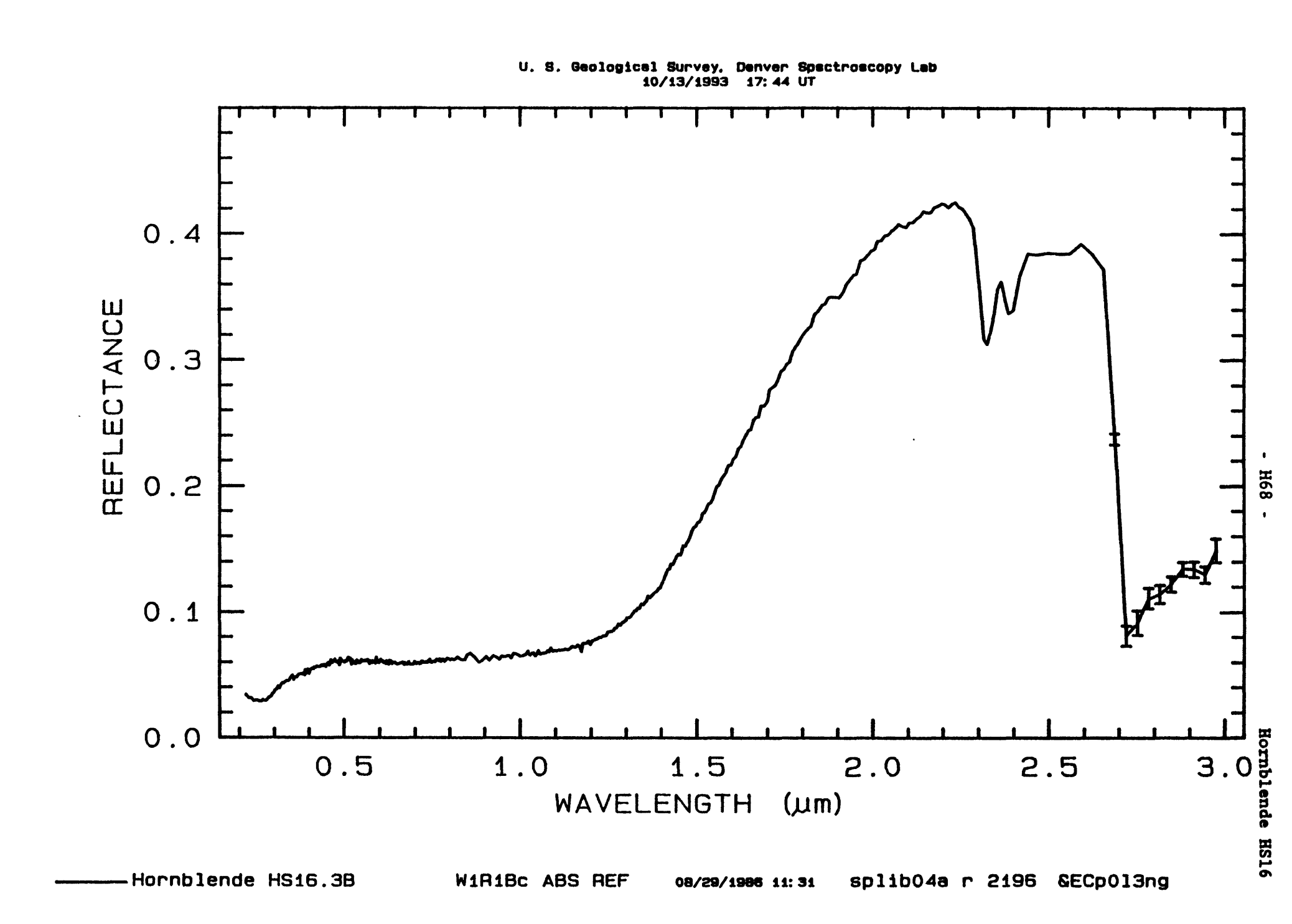
avg gr size = 190 μm

Sample is significantly contaminated with other phases. Franz separator should work on this sample. Roger bets flat micas are pieces of hornblende, I say they are chlorite -- we bet a beer on this one. Hornblende has amphibole cleavage, strong green-blue pleochroism, OAP 11 (010) ~ 30 degrees. All these properties are consistent with this being hornblende. Smaller > 10μm grains coat 10% of larger grain surfaces. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2196	0.2-3.0μm	200	g.s.= 190 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H68 -
Hornblende HS16
Hornblende HS16.3B W1R1Bc ABS REF 08/29/1986 11:31 splib04a r 2196 &ECp013ng

TITLE: Hornblende HS177 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS177

MINERAL_TYPE: Inosilicate

MINERAL: Hornblende (Amphibole group)

FORMULA: Ca2(Mg,Fe+2)4Al(Si7Al)O22(OH,F)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_4Al(Si_7Al)O_{22}(OH,F)_2$

COLLECTION_LOCALITY: Gore Mtn, New York

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series from Magnesiohornblende to Ferrohornblende.

"S-1G. Amphibole, variety Hornblende. Gore Mountain, N.Y. (177B). This sample is exceptionally pure hornblende. As in samples S-1E and S-1F, note weakness of hydroxyl bands and general low reflectivity throughout, but particularly to shorter wavelengths, due to the presence of abundant ferric and ferrous ions."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

"Results of petrographic examination: Specimen is a cluster of very dark green single crystals half a centimeter to one centimeter in length and almost as wide."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Hornblende + trace other (Norma Vergo).

"Hornblende + trace of unidentifiable mineral."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	41.50	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	2.89	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	12.97	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	15.43	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.13	wt%	NROFF: MnO
COMPOSITION:	MgO:	11.49	wt%	NROFF: MgO
COMPOSITION:	CaO:	11.34	wt%	NROFF: CaO
COMPOSITION:	Na2O:	1.61	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	1.71	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.08	wt%	
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S
COMPOSITION:	New Total:		wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

"Microprobe analysis shows the sample to be homogeneous within and between grains. Average of 10 grains."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Mode:
77 vol% Hornblende
15 vol% Biotite? (biaxial -, brown, low 2v)
6 vol% Other amphibole
2 vol% plagioclase (twinning)

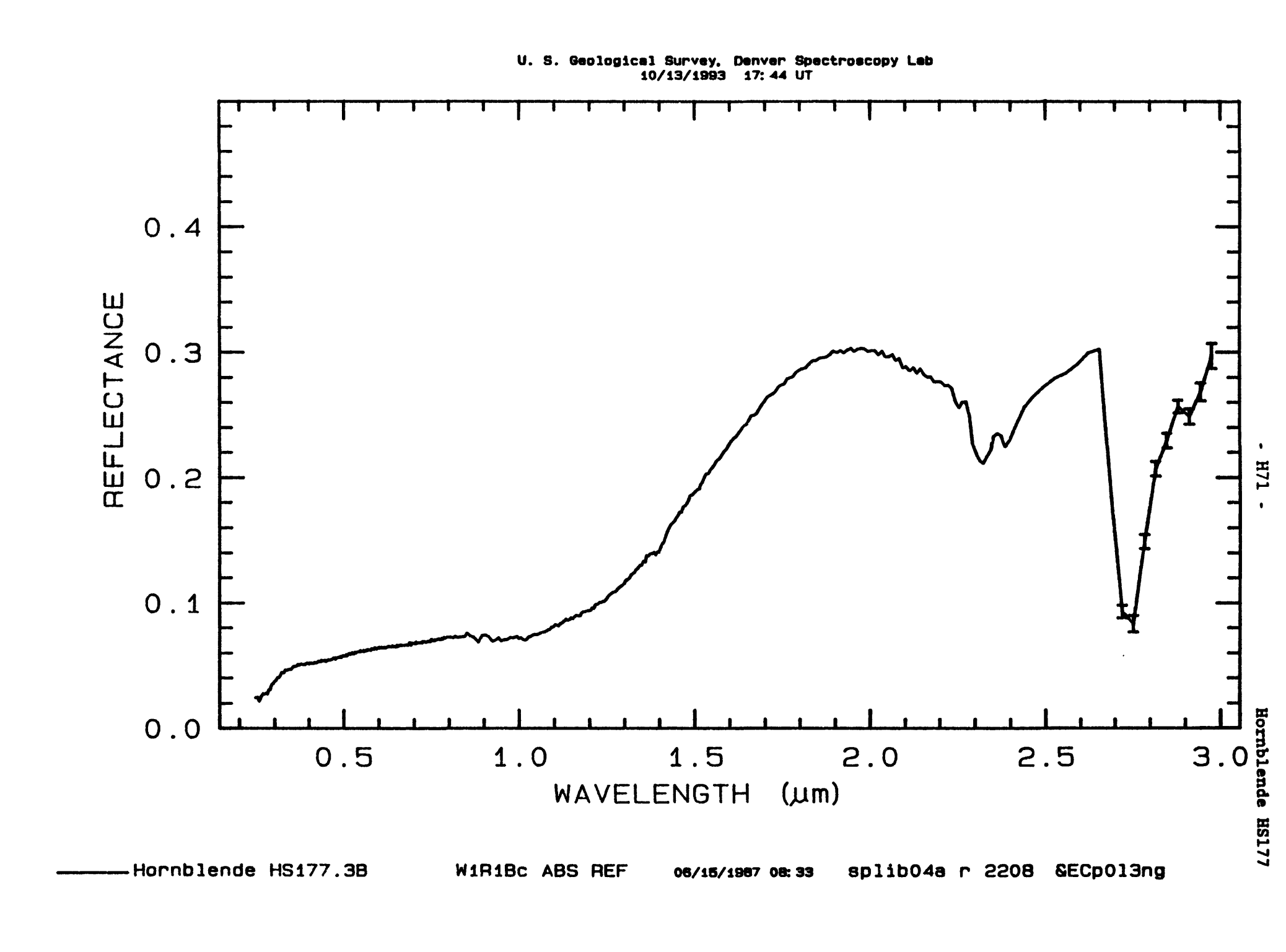
avg grain sz = 190 μm

Hornblende has amphibole cleavage, strongly brown pleochroic, OAP 11 (010) = 10 degrees, biaxial (-), inclinded extinction. All these properties are consistent with hornblende. Biotite or brown mica has basal cleavage, low 2v, and biaxial (-). Other prismatic amphibole? This mineral is clear, non-pleochroic, high order color, biaxial (+), inclinded extinction. Although this sample is contaminated, a combination of Franz Seperator and heavy liquids will probably separate out the hornblende. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2208	0.2-3.0μm	200	g.s.= 190 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H71 -
Hornblende HS177
Hornblende HS177.3B W1R1Bc ABS REF 06/15/1987 08:33 splib04a r 2208 &ECp013ng

TITLE: Howlite GDS155 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS155

MINERAL_TYPE: Borate

MINERAL: Howlite

FORMULA: Ca2B5SiO9(OH)5

FORMULA_NROFF: $Ca_2B_5SiO_9(OH)_5$

COLLECTION_LOCALITY: Barstow, California

ORIGINAL_DONOR: Jim Piper

CURRENT_SAMPLE_LOCATION: USGS USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Howlite occurs as porcelaneous nodules in shale or, less commonly, silty sandstone, and as massive veins ranging from 2 to 30cm in thickness. - from Borates: Econ. Geol. & Prod., Barker and Lefond, eds. Proc. of Soc of Mining Eng, Oct 1984, Denver, p. 181.

Note howlite is very unusual in that it is the only mineral we know of with SiO_9.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

40 kV - 30 mA
Reference: JCPDS #35-630
Found: Howelite
Quartz sought but not found
Comment: Extraordinarily clear pattern, sharp peaks, excellent crystallinity.

J.S. Huebner and J. Pickrell, unpublished data, written communication, USGS, Reston, VA (1993)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

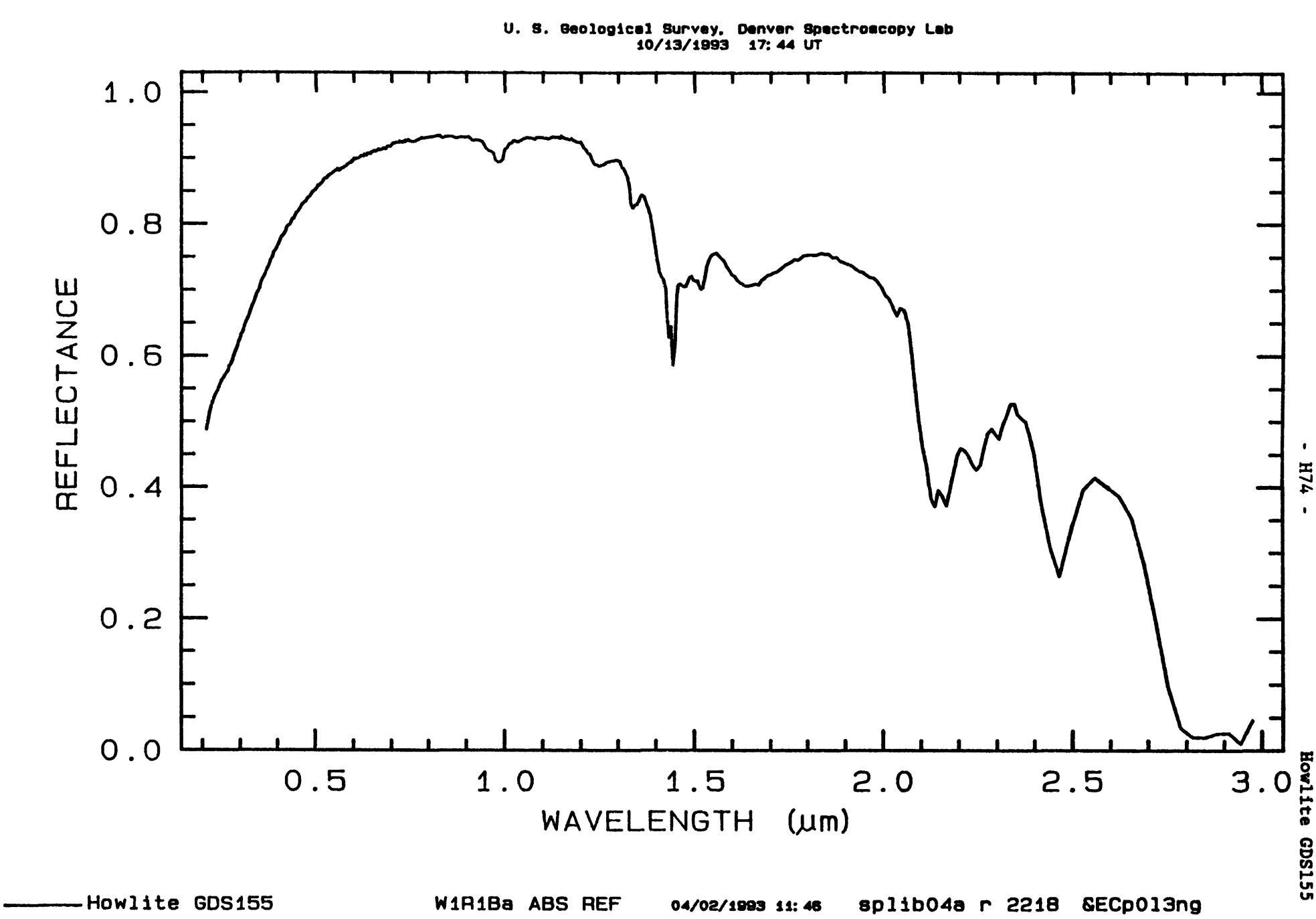
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2218	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H74 -
Howlite GDS155
Howlite GDS155
W1R1Ba ABS REF
04/02/1993 11:46
splib04a r 2218 &ECp013ng

TITLE: Hydrogrossular NMNH120555 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH120555

MINERAL_TYPE: Nesosilicate

MINERAL: Hydrogrossular (Garnet group)

FORMULA: Ca3Al2(SiO4)3-x(OH)4x

FORMULA_NROFF: $Ca_3Al_2(SiO_4)_{3-x}(OH)_{4x}$

COLLECTION_LOCALITY: Rustenberg, South Africa

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscpy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Grossular.

Sample was sieved to the grain size interval <250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	31.44 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.04 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	21.40 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.00 wt%	NROFF:	Cr_2O_3
COMPOSITION:	V2O3:	0.00 wt%	NROFF:	V_2O_3
COMPOSITION:	FeO:	0.46 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.00 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.89 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.17 wt%	NROFF:	MgO
COMPOSITION:	CaO:	36.14 wt%	NROFF:	CaO
COMPOSITION:	---	---		
COMPOSITION:	Total:	90.54 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

EM analysis by Gregg A. Swayze at the USGS Branch of Geophysics, Denver.

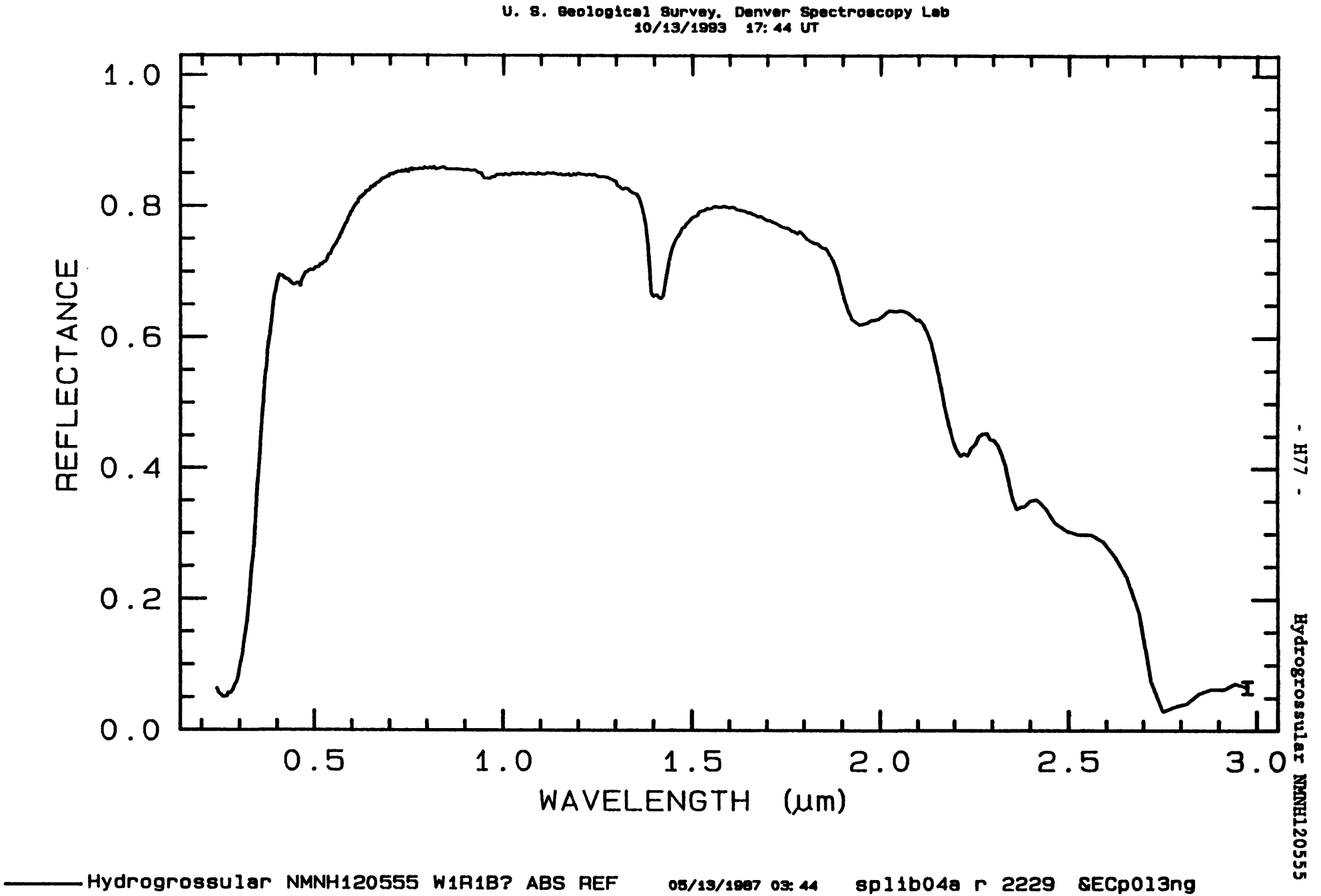
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2229	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:44 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H7 -
Hydrogrossular NMNH120555
Hydrogrossular NMNH120555 W1R1B? ABS REF 05/13/1987 03:44 splib04a r 2229 &ECp013ng

TITLE: Hydroxyl-Apatite WS425 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS425

MINERAL_TYPE: Phosphate

MINERAL: Hydroxylapatite (Apatite group)

FORMULA: Ca5(P04)3(OH)

FORMULA_NROFF: $Ca_5(PO_4)_3(OH)$

COLLECTION_LOCALITY: near Cokeville, Wyoming

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"Found: apatite; very minor quartz [peaks in the position (100) and (101) reflections] plus an additional reflection at 29.7

Cell dimension: a=9.348(2), c=6.883(2) A, using Si internal standard

Comment: It is probable that at least three phases are present. Broad reflections suggest poor crystallinity and/or compositional heterogeneity. This reflected in the poor quality of the cell refinement. Iam not aware of cell dimesions for hydroxylapatite composition with which the dimensions of WS425 might be compared to verify the composition."

J.S. Huebner and J. Randow, unpublished data, written communication, USGS, Reston, VA (1993)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

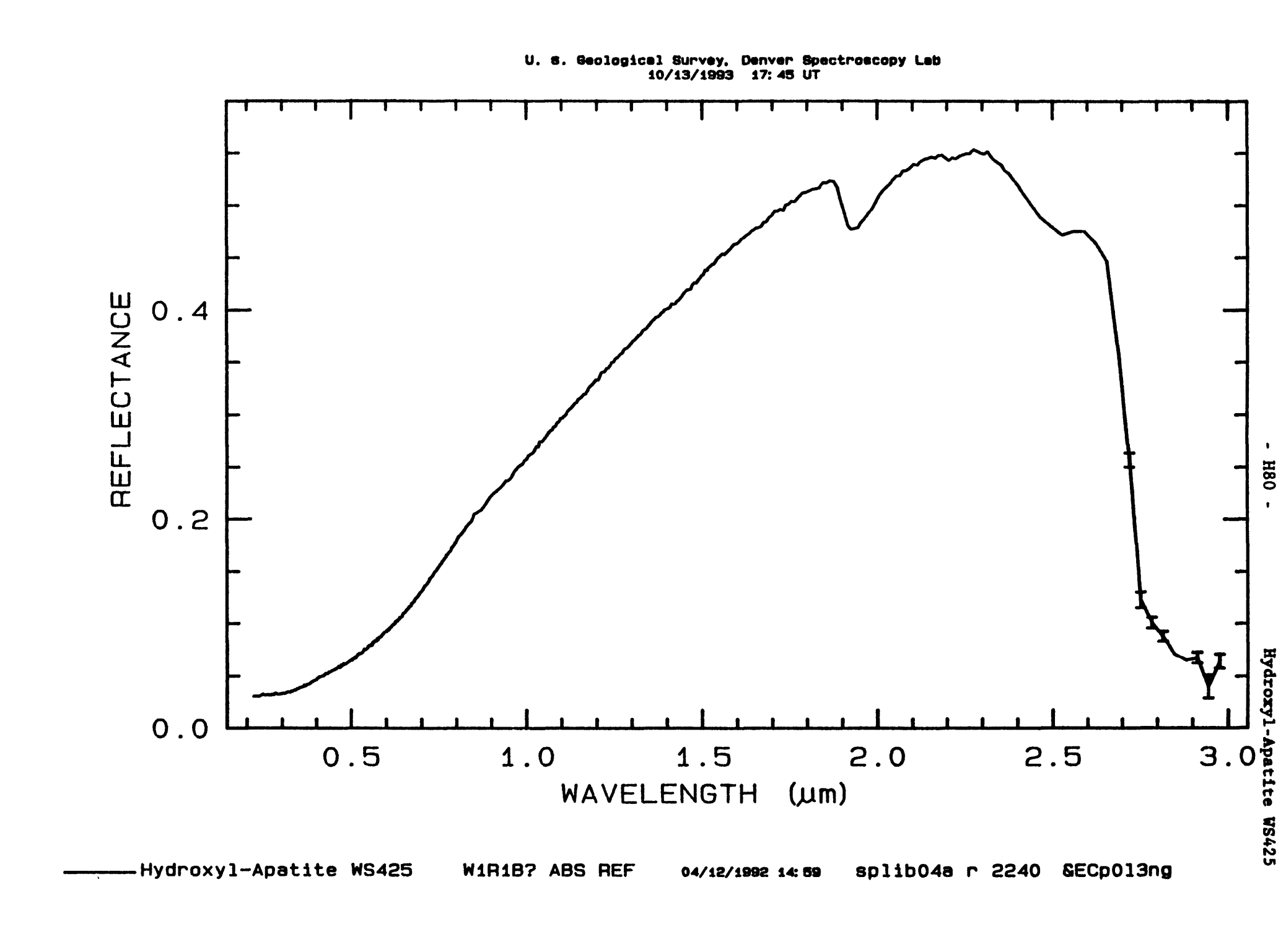
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 2240	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:45 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H80 -
Hydroxyl-Apatite WS425
Hydroxyl-Apatite WS425 W1R1B? ABS REF 04/12/1992 14:59 splib04a r 2240 &ECp013ng

TITLE: Hypersthene NMNHC2368 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNHC2368

MINERAL_TYPE: Inosilicate

MINERAL: Hypersthene (Fe-rich enstatite)(Pyroxene group)

FORMULA: (Mg,Fe+2)2Si2O6

FORMULA_NROFF: $(Mg,Fe^{+2})Si_2O_6$

COLLECTION_LOCALITY: Western Greenland

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Enstatite-orthoferrosilite series member.

"Results of petrographic examination: One piece and one small fragment weighing 21.59 g. Part of single crystal; black. Very small amount of surface contamination which may be removed by scratching. Also some quartz inclusions which may be possible to break free. Under the microscope it is green-brown pleochroic with a relatively high index of refraction. It appears mildly altered with some (2%) iron-stained opaque material present."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

This sample contains hypersthene plus a small amount of talc and some other minerals (small amount). No clinopyroxene exsolution seen. (Norma Vergo)

"This sample is predominantly hypersthene with a small amount of talc and a small amount of other mineral(s). However, the amount of talc appears insufficient to affect the infrared spectrum, because even the strong hydroxyl bands of talc between 3600 and 4600 cm^{-1}, which are extremely prominent in the spectrum of the 0-74 μ size range of talc, are not obvious in the spectrum of the 0-74 um size range of hypersthene."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	51.32	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.29	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	4.89	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	17.07	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.35	wt%	NROFF: MnO
COMPOSITION:	MgO:	26.09	wt%	NROFF: MgO
COMPOSITION:	CaO:	1.27	wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.05	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.02	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	101.33	wt%	
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S
COMPOSITION:	New Total:		wt%	

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

"Microprobe analysis indicates exsolution of a small amount of clinopyroxene as shown by presence of Ca and concomitment loss of magnesium and iron for 2 out of 20 analyses."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_COMPOSITION_DISCUSSION.

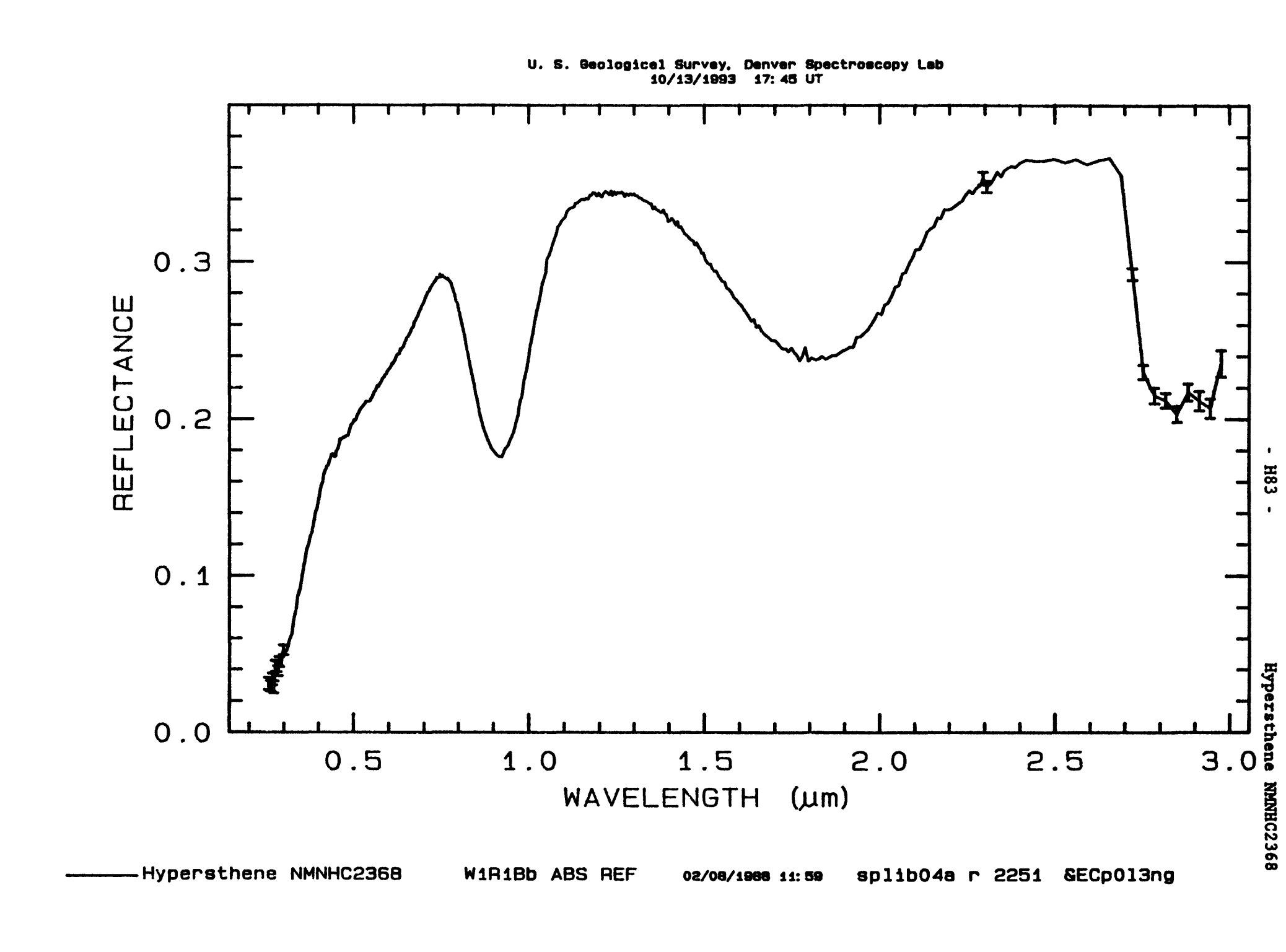
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2251	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:45 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H83 -
Hypersthene NMNHC2368
Hypersthene NMNHC2368 W1R1Bb ABS REF 02/08/1988 11:59 splib04a r 2251 &ECp013ng

TITLE: Hypersthene PYX02 Pyroxene DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: PYX02

MINERAL_TYPE: Inosilicate

MINERAL: Hypersthene (Pyroxene group)

FORMULA: (Mg,Fe+2)2Si2O6 (En86)

FORMULA_NROFF: $(Mg,Fe^{+2})_2Si_2O_6$ (En_{86})

COLLECTION_LOCALITY: Bamble, Norway

ORIGINAL_DONOR: Wards Scientific, and Robert B. Singer

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Intermediate member of the series Enstatite-Orthoferrosilite.

The original sample description and vis-nir spectrum was published by:

Singer, R.B., 1981, Near-Infrared spectral reflectance of mineral mixtures: Systematic combinations of pyroxenes, olivine, and iron oxides: J. Geophys Res., v. 86, p. 7967-7982.

The sample is pure pyroxene except for a small (<2%?) amount of tremolite. The tremoilte shows in the spectra as weak (narrow) bands at 2.3 μm and 1.4 μm. Singer suspected the tremolite, but it is confirmed by higher resolution spectra in this library.

The sample was ground and wet sieved in methanol at the USGS Denver Spectroscopy Laboratory by Roger Clark. Sieve intervals are:

5-10	μm	(g)
10-20	μm	(a)
20-30	μm	(d)
30-45	μm	(e)
45-104	μm	(f)
104-150	μm	(b)
150-250	μm	(c)
>250	μm	(h)

SEM photos were done by R. Clark on each sieve interval to characterize the grain sizes.

Letter denotes spectrum designation.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None
END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	55.30 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.05 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.12 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	(as FeO)wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	9.38 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.15 wt%	NROFF:	MnO
COMPOSITION:	MgO:	32.80 wt%	NROFF:	MgO
COMPOSITION:	Na2O:	0.00 wt%	NROFF:	Na_2O
COMPOSITION:	P2O5:	0.01 wt%	NROFF:	P_2O_5
COMPOSITION:	LOI:	2.00 wt%	NROFF:	LOI
COMPOSITION:	----------			
COMPOSITION:	Total:	100.28 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.28 wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

The compositional analysis is from: Singer, R.B., 1981, Near-Infrared spectral reflectance of mineral mixtures: Systematic combinations of pyroxenes, olivine, and iron oxides: J. Geophys Res., v. 86, p. 7967-7982.

All Fe_2O_3 is reported in the FeO amount. The analysis was performed by XRA Laboratory, Ontario Canada. FeO was by wet chemistry, all else by XRF.

END_COMPOSITION_DISCUSSION.

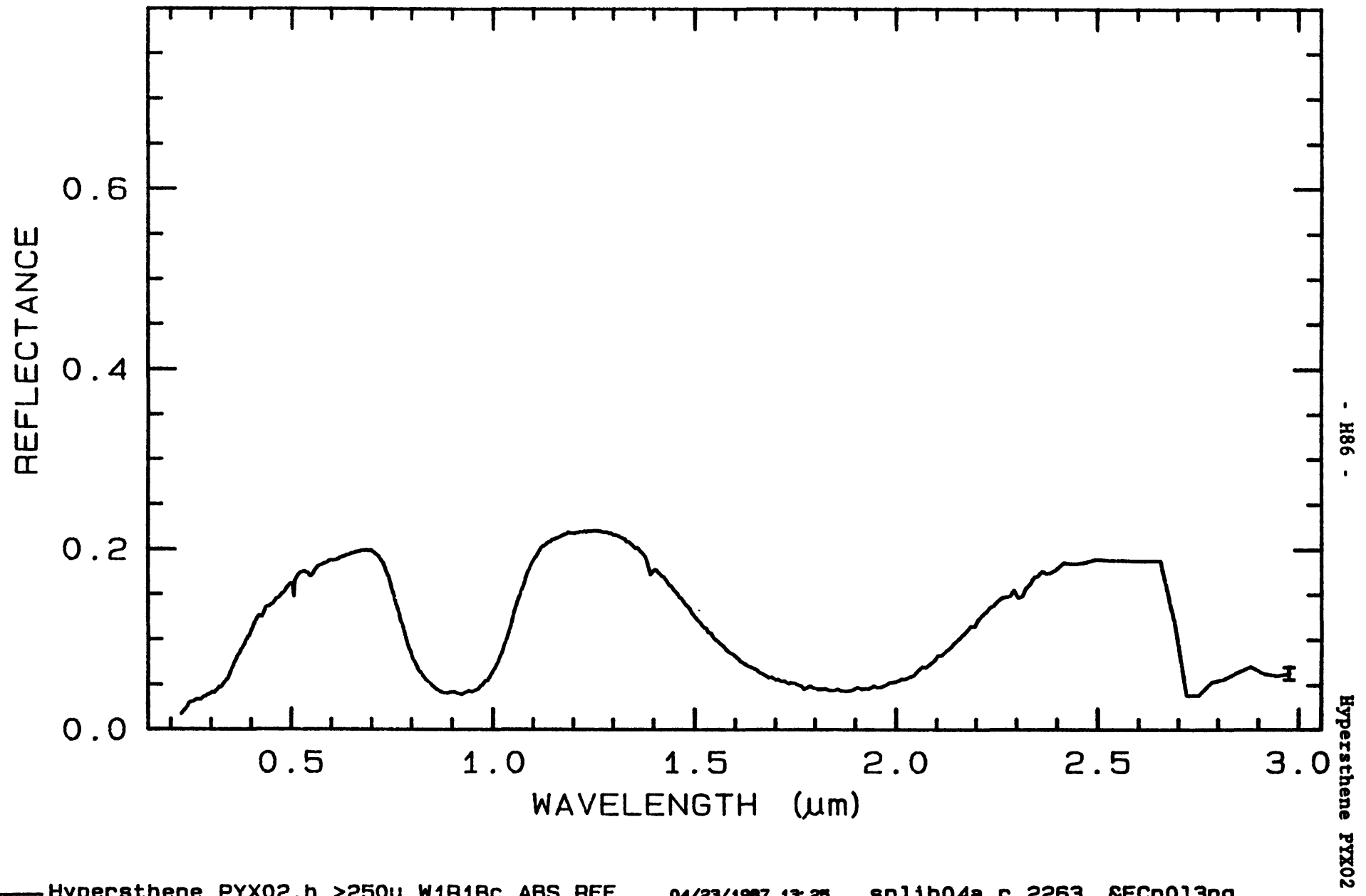
MICROSCOPIC_EXAMINATION:

The sample appears to be pure pyroxene except for a small (<~ 2%) amount of tremolite.

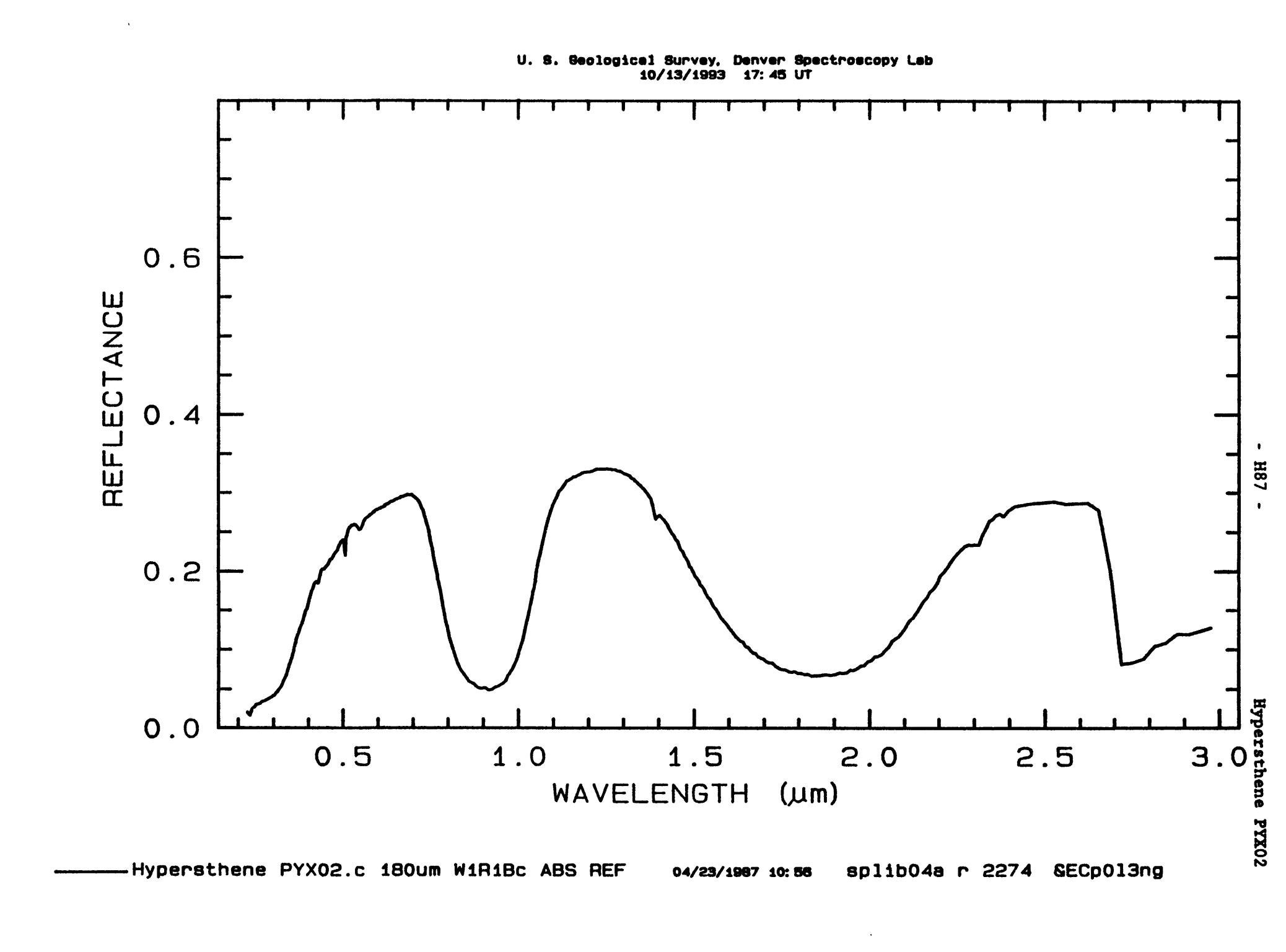
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

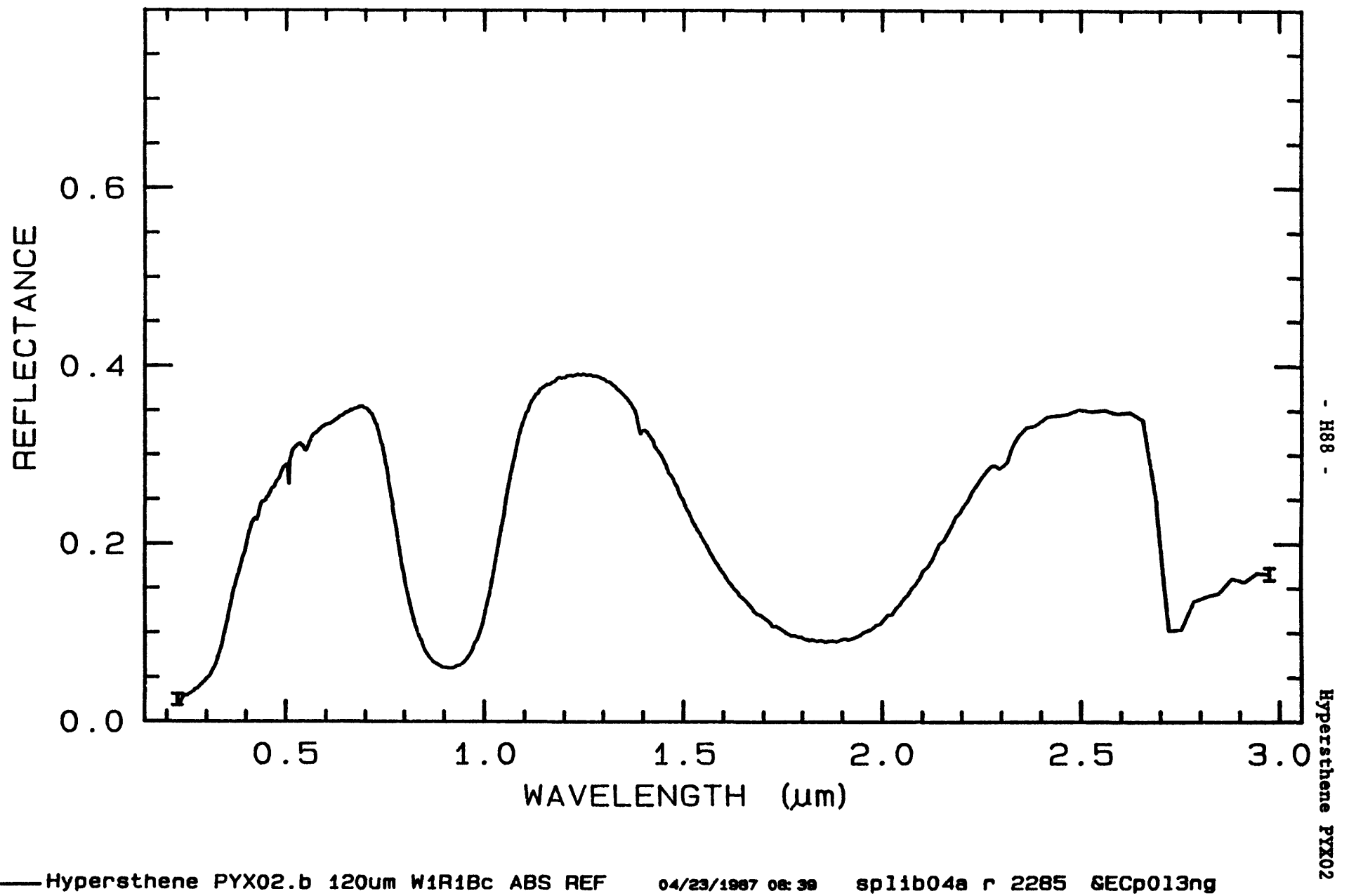
LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2263	0.2-3.0μm	200	g.s.=350 μm
LIB_SPECTRA:	splib04a r 2274	0.2-3.0μm	200	g.s.=180 μm
LIB_SPECTRA:	splib04a r 2285	0.2-3.0μm	200	g.s.=120 μm
LIB_SPECTRA:	splib04a r 2296	0.2-3.0μm	200	g.s.=60 μm
LIB_SPECTRA:	splib04a r 2308	0.2-3.0μm	200	g.s.=34 μm
LIB_SPECTRA:	splib04a r 2319	0.2-3.0μm	200	g.s.=23 μm
LIB_SPECTRA:	splib04a r 2330	0.2-3.0μm	200	g.s.=12 μm
LIB_SPECTRA:	splib04a r 2341	0.2-3.0μm	200	g.s.= 7 μm

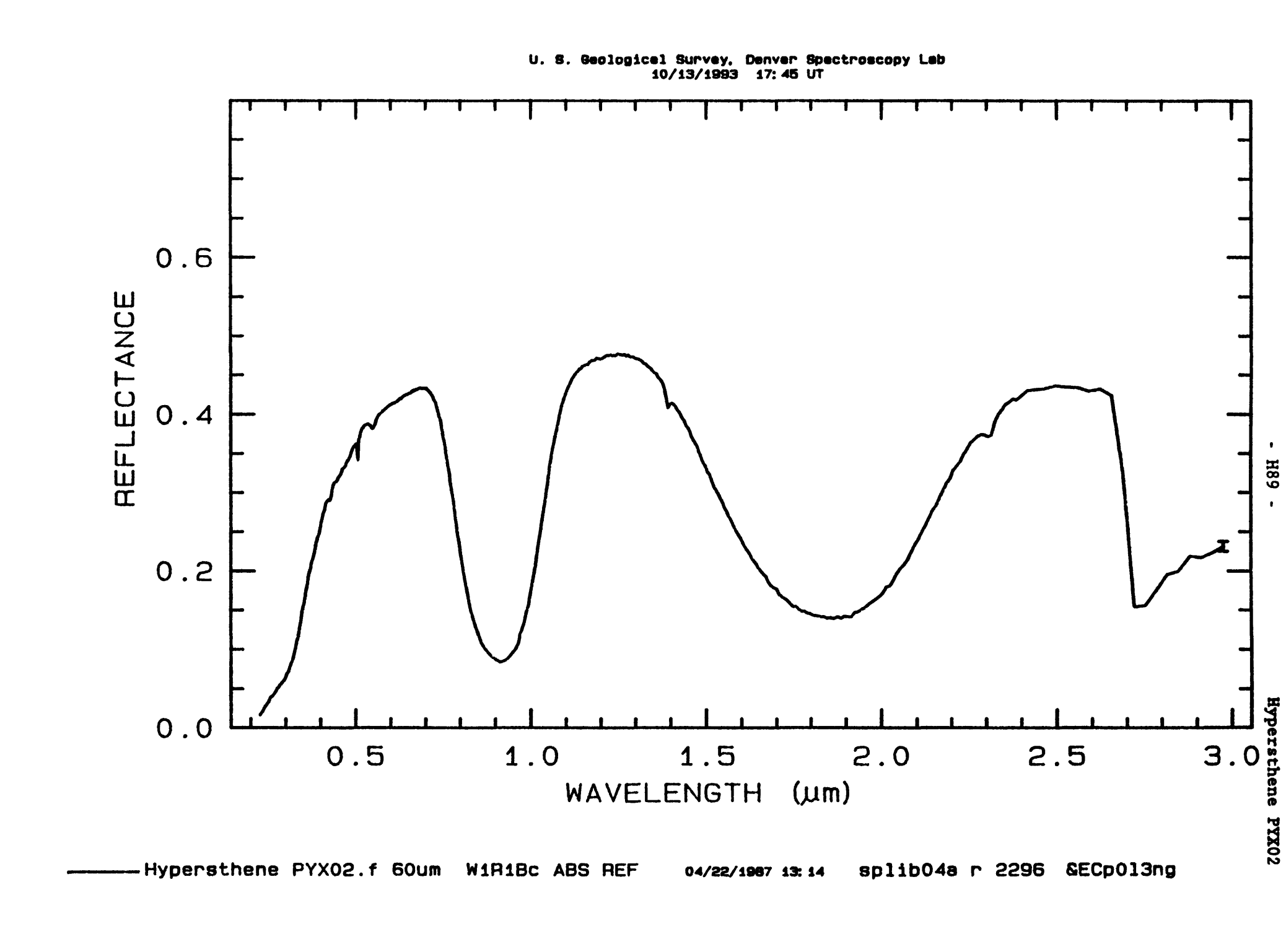


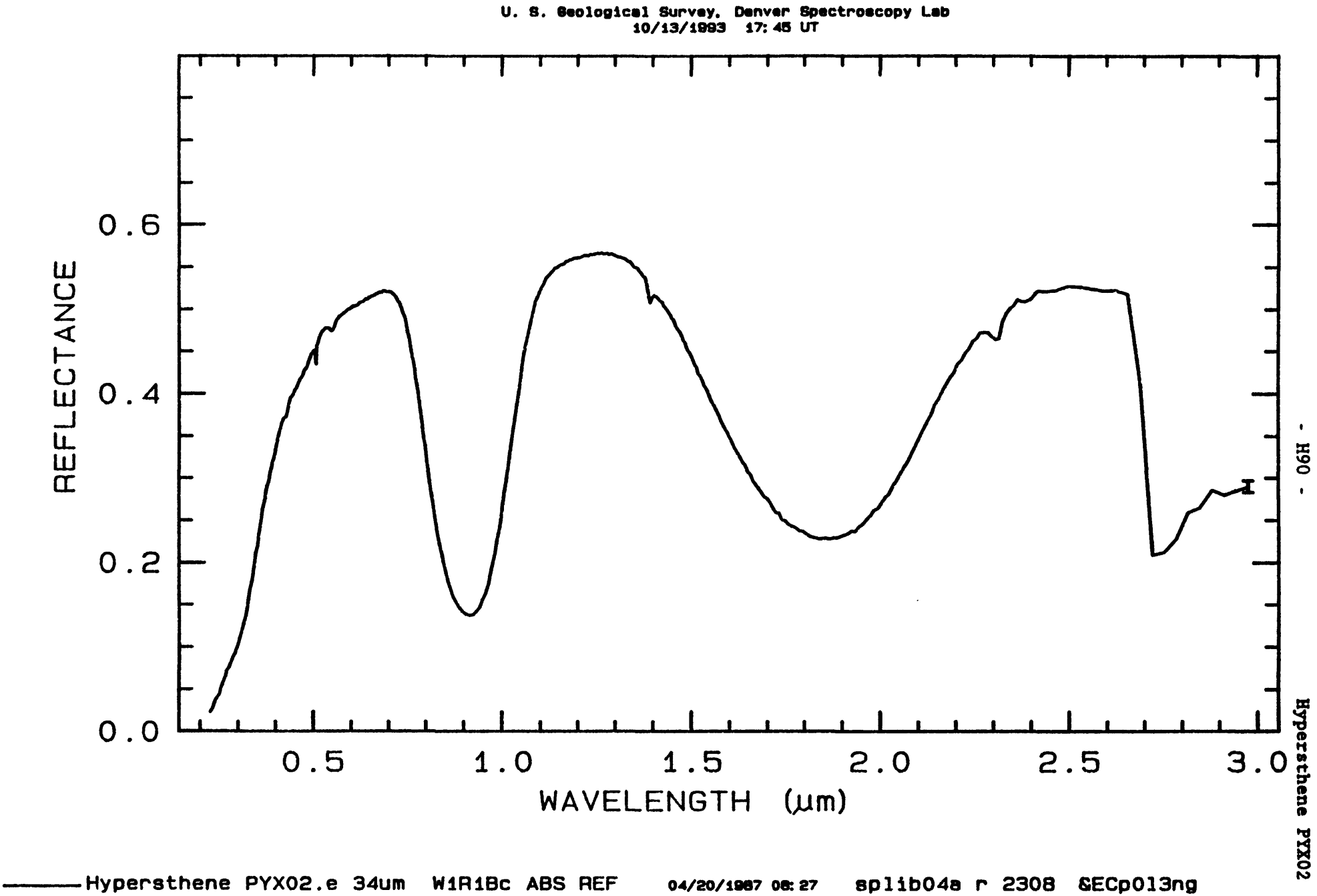
Hypersthene PYX02

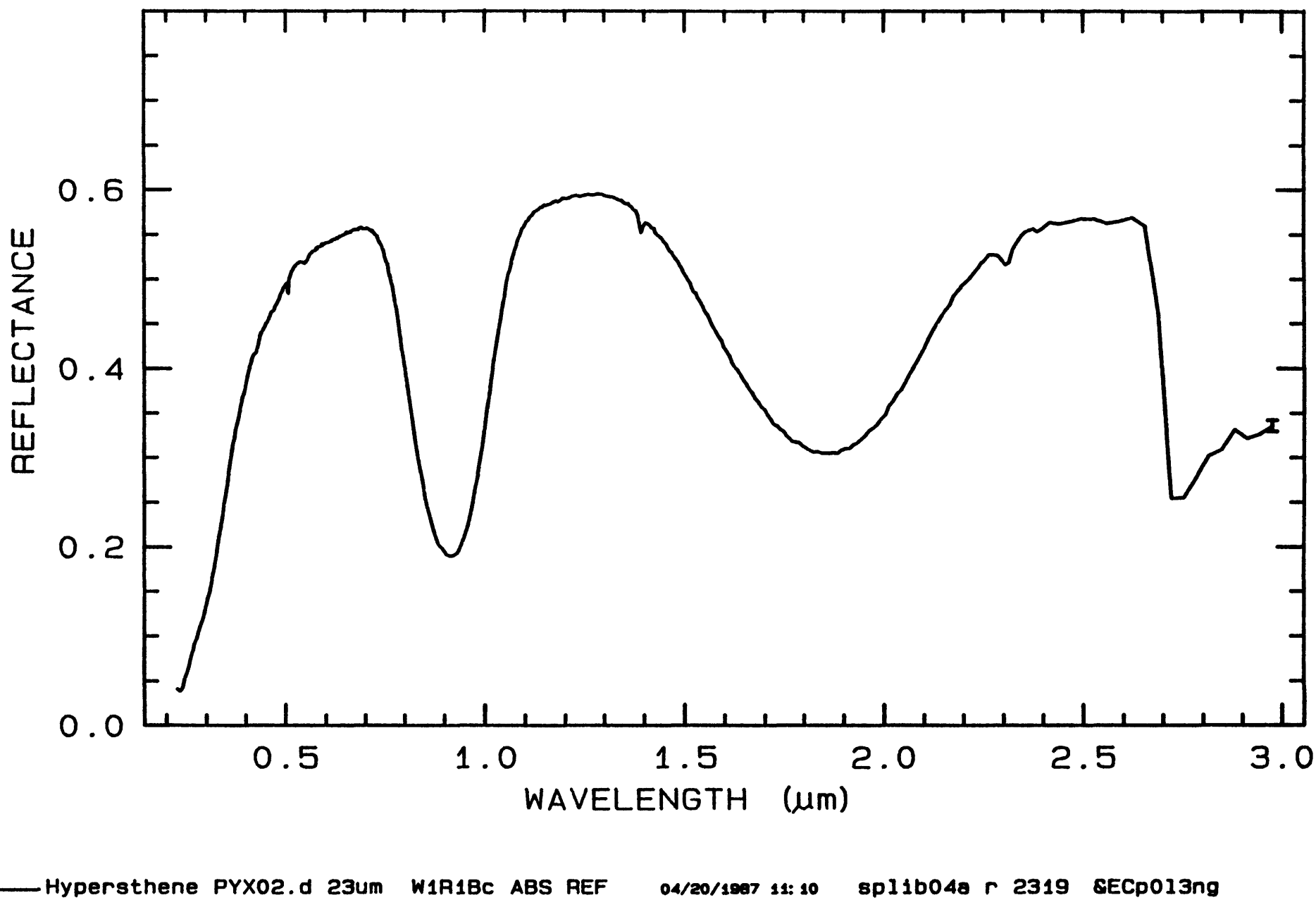


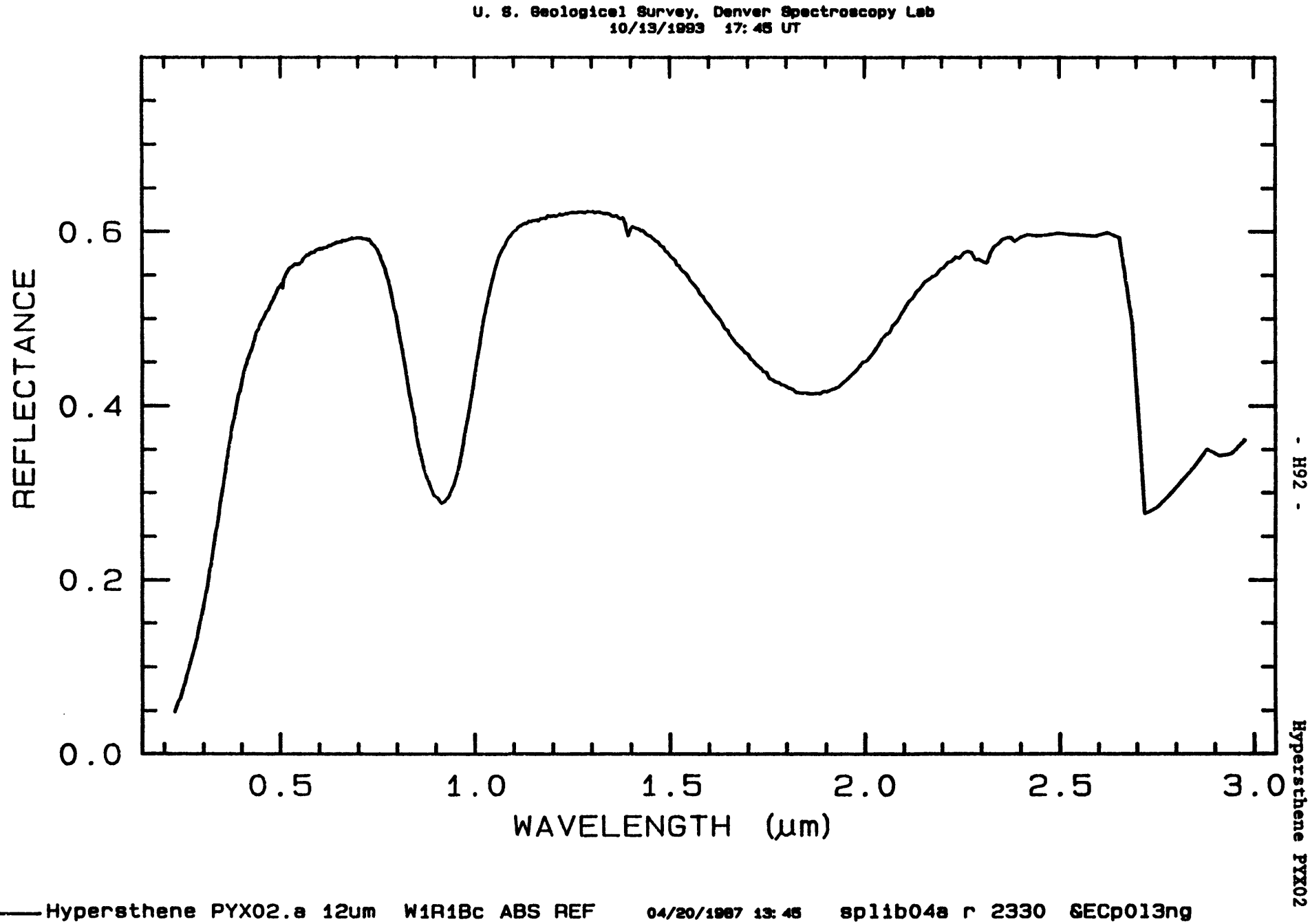
Hypersthene PYX02

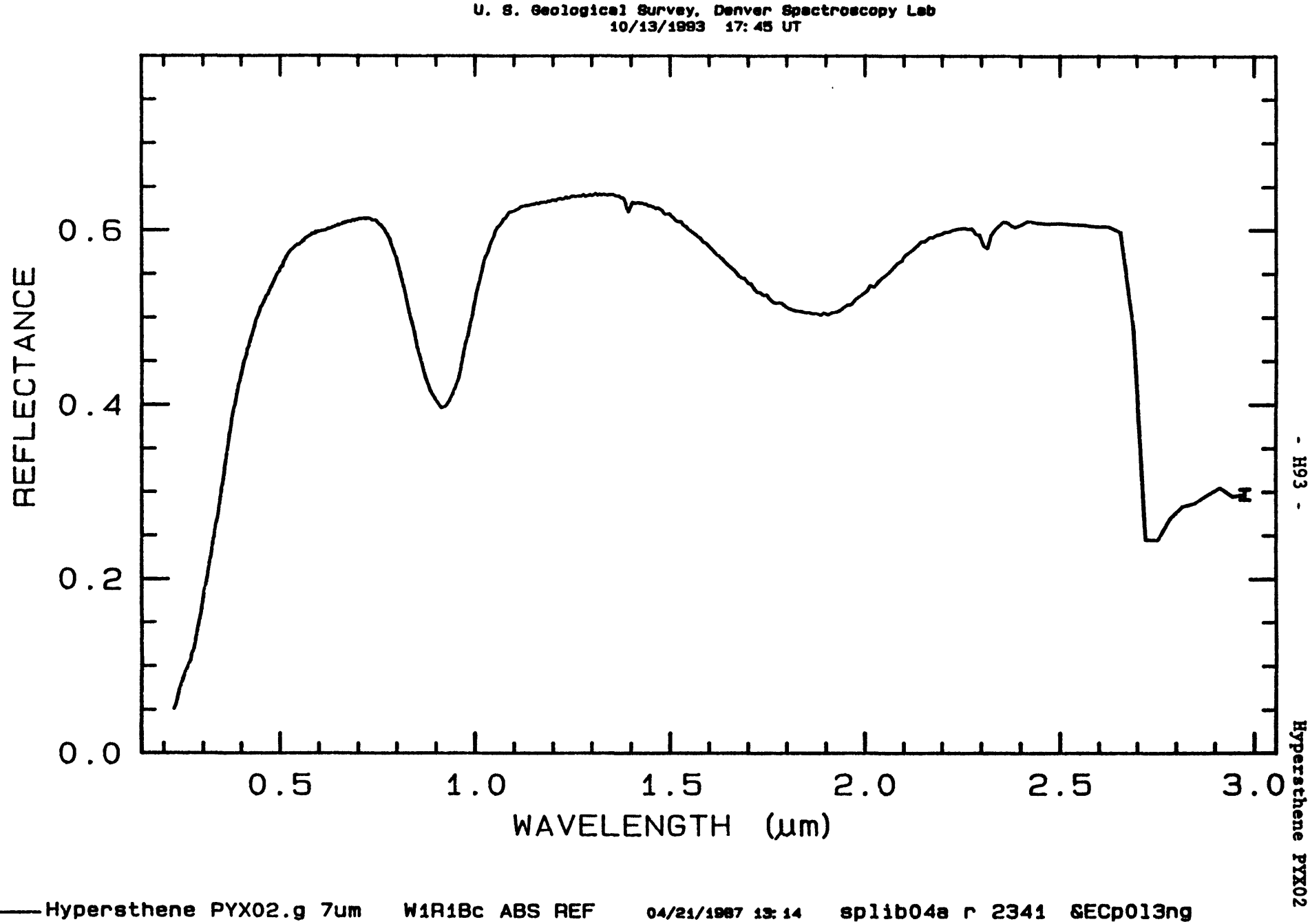

U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:45 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H88 -
Hypersthene PYX02
Hypersthene PYX02.b 120um W1R1Bc ABS REF 04/23/1987 08:38 splib04a r 2285 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:45 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 689 -
Hypersthene PYX02
Hypersthene PYX02.f 60um W1R1Bc ABS REF 04/22/1987 13:14 splib04a r 2296 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:45 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H90 -
Hypersthene PYX02
Hypersthene PYX02.e 34um W1R1Bc ABS REF 04/20/1987 08:27 splib04a r 2308 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:45 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Hypersthene PYX02
Hypersthene PYX02.d 23um W1R1Bc ABS REF 04/20/1987 11:10 splib04a r 2319 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:45 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H92 -
Hypersthene PYX02
Hypersthene PYX02.a 12um W1R1Bc ABS REF 04/20/1987 13:45 splib04a r 2330 GECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 17:45 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- H93 -
Hypersthene PYX02
Hypersthene PYX02.g 7um W1R1Bc ABS REF 04/21/1987 13:14 splib04a r 2341 &ECp013ng

TITLE: Illite GDS4 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS4

MINERAL_TYPE: Phyllosilicate

MINERAL: Illite, a group of hydrated mica-clay minerals

FORMULA: (K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,H2O]

FORMULA_NROFF: $(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,H_2O]$

COLLECTION_LOCALITY: Marble Head, WS

ORIGINAL_DONOR: Jim Crowley, USGS

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum of this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that the sample was darker than normal due to carbonaceous impurities, but was otherwise spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates that the sample is illite/smectite: 80% illite layers, R3 ordered, with trace amounts of feldspar. The <2μm separate is illite + illite/smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	51.62	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.92	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	23.96	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.63	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.29	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.01	wt%	NROFF:	MnO
COMPOSITION:	MgO:	3.83	wt%	NROFF:	MgO
COMPOSITION:	SrO:	0.74	wt%	NROFF:	SrO
COMPOSITION:	CaO:	0.47	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.14	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	8.12	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.09	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	5.00	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	2.90	wt%	NROFF:	H_2O^-
COMPOSITION:	LOI:	6.91	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.41	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

EM analysis by Gregg A. Swayze at the Branch of Geophysics, USGS, Denver.

END_COMPOSITION_DISCUSSION.

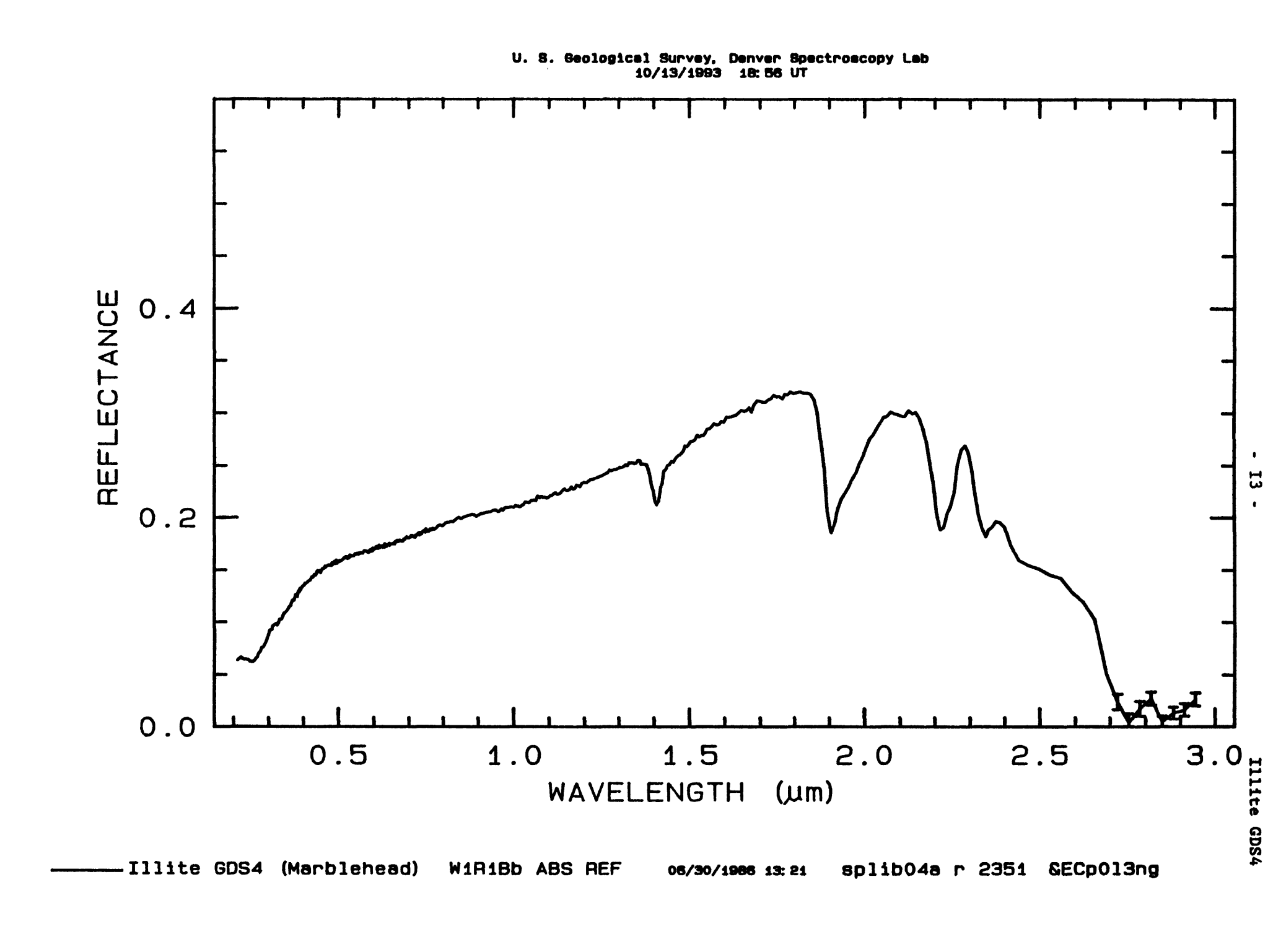
MICROSCOPIC_EXAMINATION:

Sample not available.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2351	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:56 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Illite GDS4
Illite GDS4 (Marblehead) W1R1Bb ABS REF 06/30/1986 13:21 splib04a r 2351 &ECp013ng

TITLE: Illite IMt-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: IMt-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Illite, a group of hydrated mica-clay minerals

FORMULA: (K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,H2O]

FORMULA_NROFF: $(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,H_2O]$

COLLECTION_LOCALITY: Silver Hill, Montana

ORIGINAL_DONOR: Clay Mineral Society Source Clay Mineral Repository

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum of this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure. Samples measured for the library include bulk (a) and <2μm fraction (b).

The spectrum from 2.5 to 25μm for this sample was published in:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates that the bulk sample is illite + quartz, <2μm separate is pure illite/smectite with 95% illite layers.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	52.10 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.79 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	21.90 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	6.44 wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	<0.02 wt%	NROFF:	MnO
COMPOSITION:	MgO:	2.39 wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.07 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.30 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	7.84 wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.10 wt%	NROFF:	P_2O_5
COMPOSITION:	LOI:	6.91 wt%	NROFF:	LOI
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.56 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

EM analysis by Gregg A. Swayze, Branch of Geophysics, USGS, Denver.

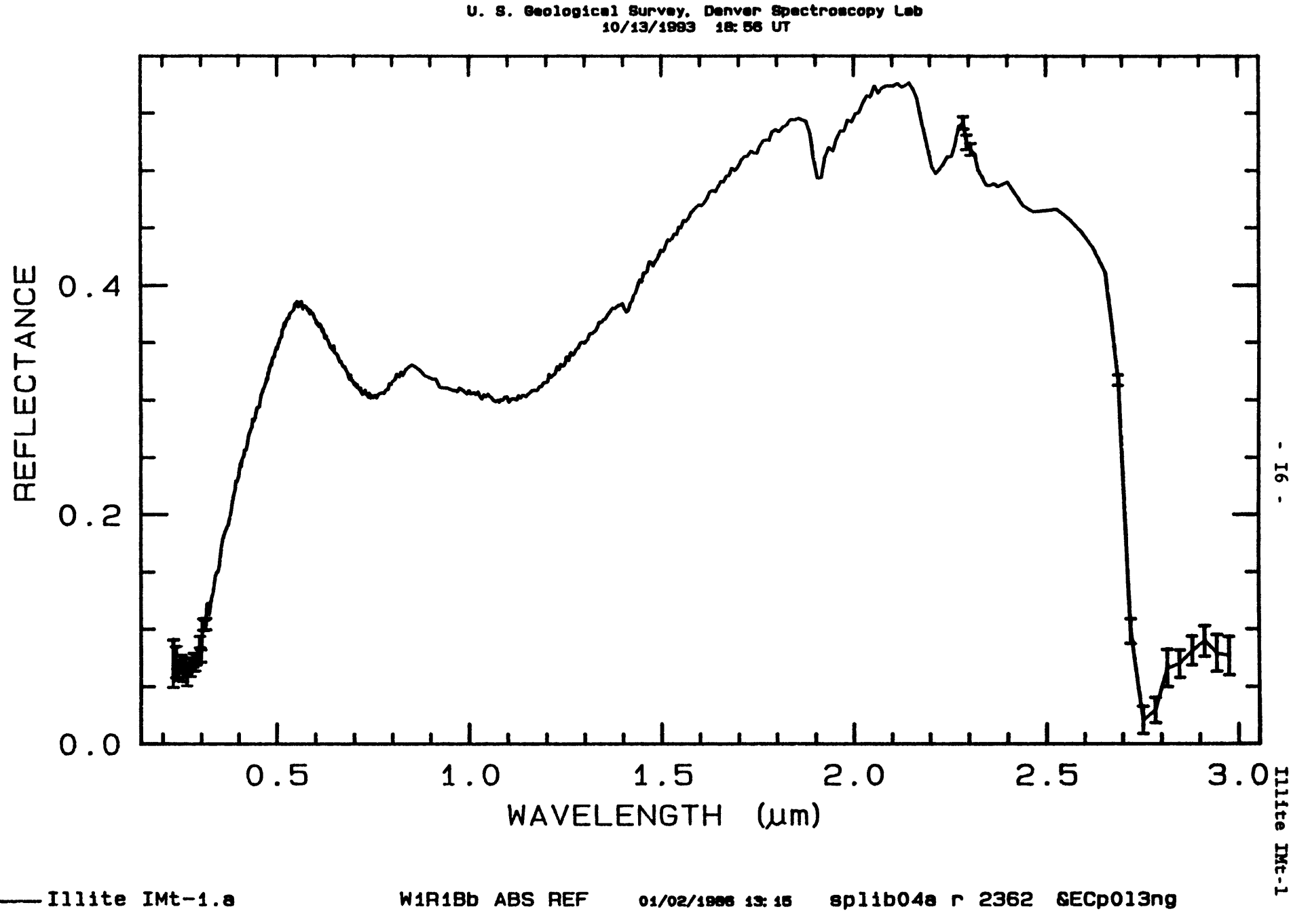
END_COMPOSITION_DISCUSSION.

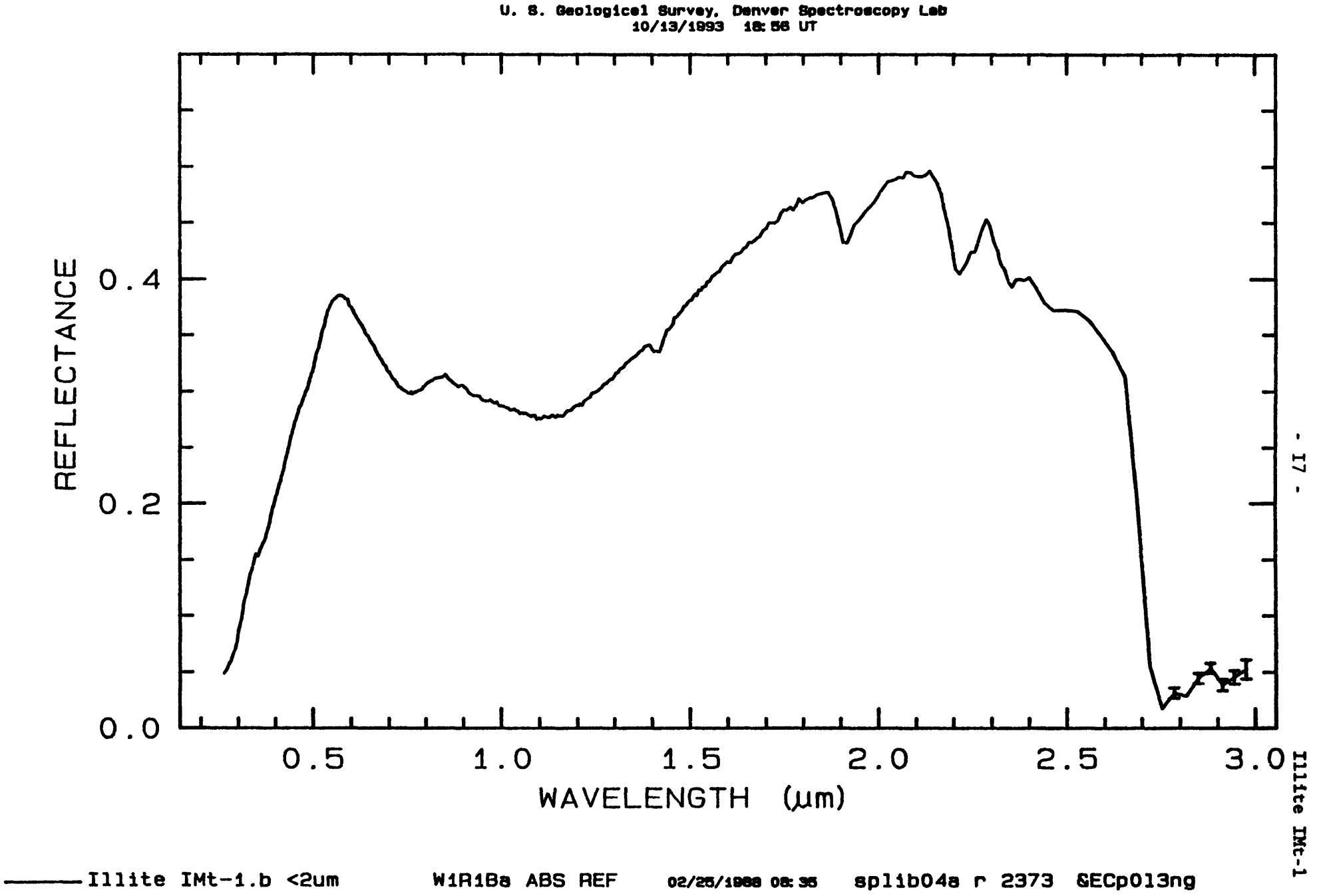
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2362	0.2-3.0μm	200	g.s.=
LIB_SPECTRA:	splib04a r 2373	0.2-3.0μm	200	g.s.= <2μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:56 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Illite IMt-1
Illite IMt-1.a
W1R1Bb ABS REF
01/02/1986 13:15
splib04a r 2362 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:56 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Illite IMt-1.b <2um W1R1B8 ABS REF 02/25/1988 08:35 spl1b04a r 2373 &ECp013ng

TITLE: Illite IL101 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: IL101

MINERAL_TYPE: Phyllosilicate

MINERAL: Illite, a group of hydrated mica-clay minerals

FORMULA: (K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,H2O]

FORMULA_NROFF: $(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4)_{10}[(OH)_2,H_2O]$

COLLECTION_LOCALITY: Shakanai Mine, Akita Prefecture, Japan

ORIGINAL_DONOR: Dr. S. Shimoda, University of Tsukuba

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Illite (2M2-illite)
Contaminant phase: Quartz(?).

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

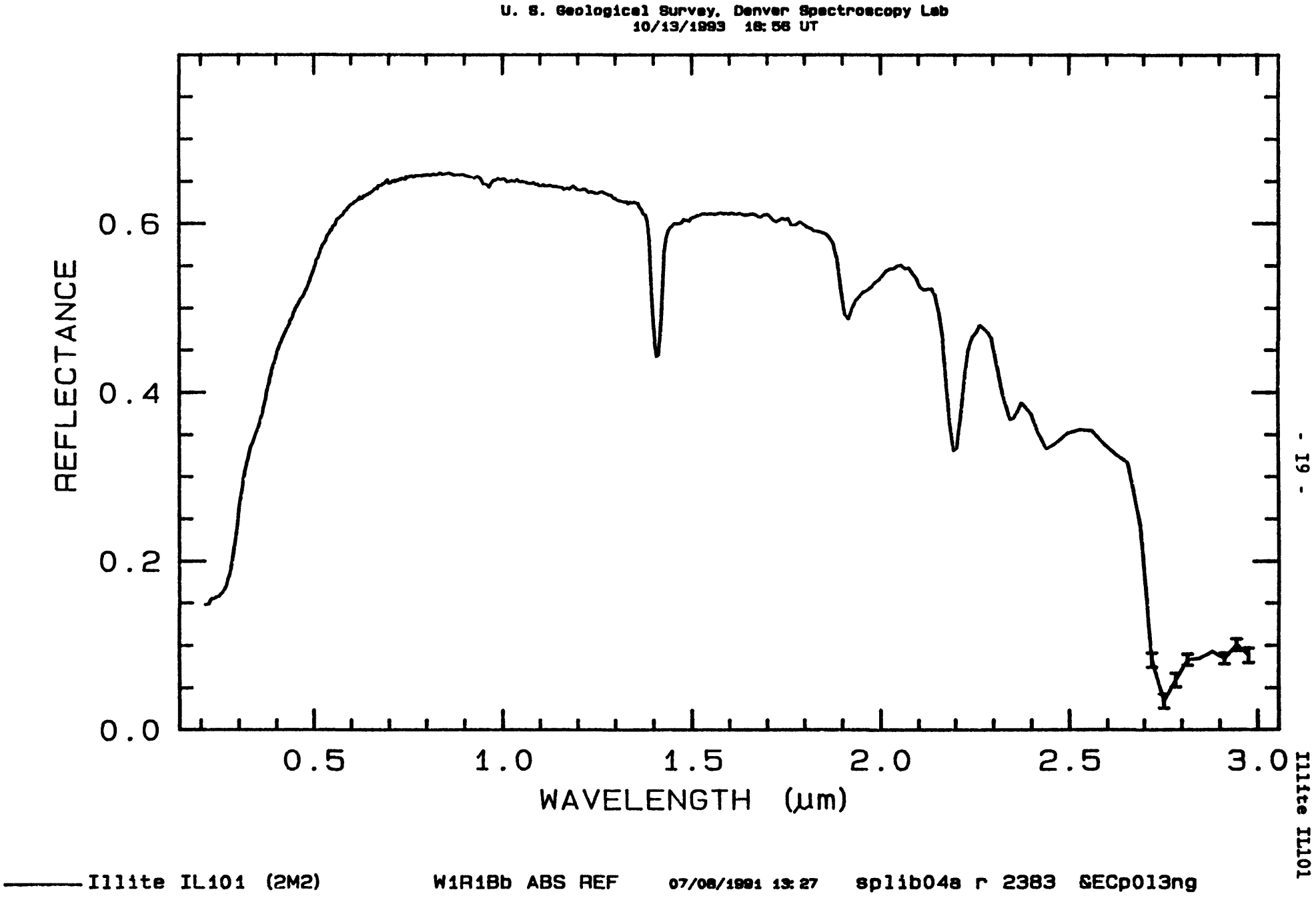
avg gr sz about 5 μm

Sample looks pure. G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2383	0.2-3.0μm	200	g.s.= 5 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:56 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 19 -
Illite IL101
Illite IL101 (2M2)
W1R1Bb ABS REF
07/08/1991 13:27
splib04a r 2383 SECp013ng

TITLE: Illite IL105 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: IL105

MINERAL_TYPE: Phyllosilicate

MINERAL: Illite, a group of hydrated mica-clay minerals

FORMULA: (K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,H2O]

FORMULA_NROFF: $(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4)_{10}[(OH)_2,H_2O]$

COLLECTION_LOCALITY: Fithian, IL

ORIGINAL_DONOR: Phoebe Hauff/USGS Sedimentary Mineralogy Labooratory

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Illite (1Md-illite)
Contaminant phases: Chlorite, dark quartz (?).

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

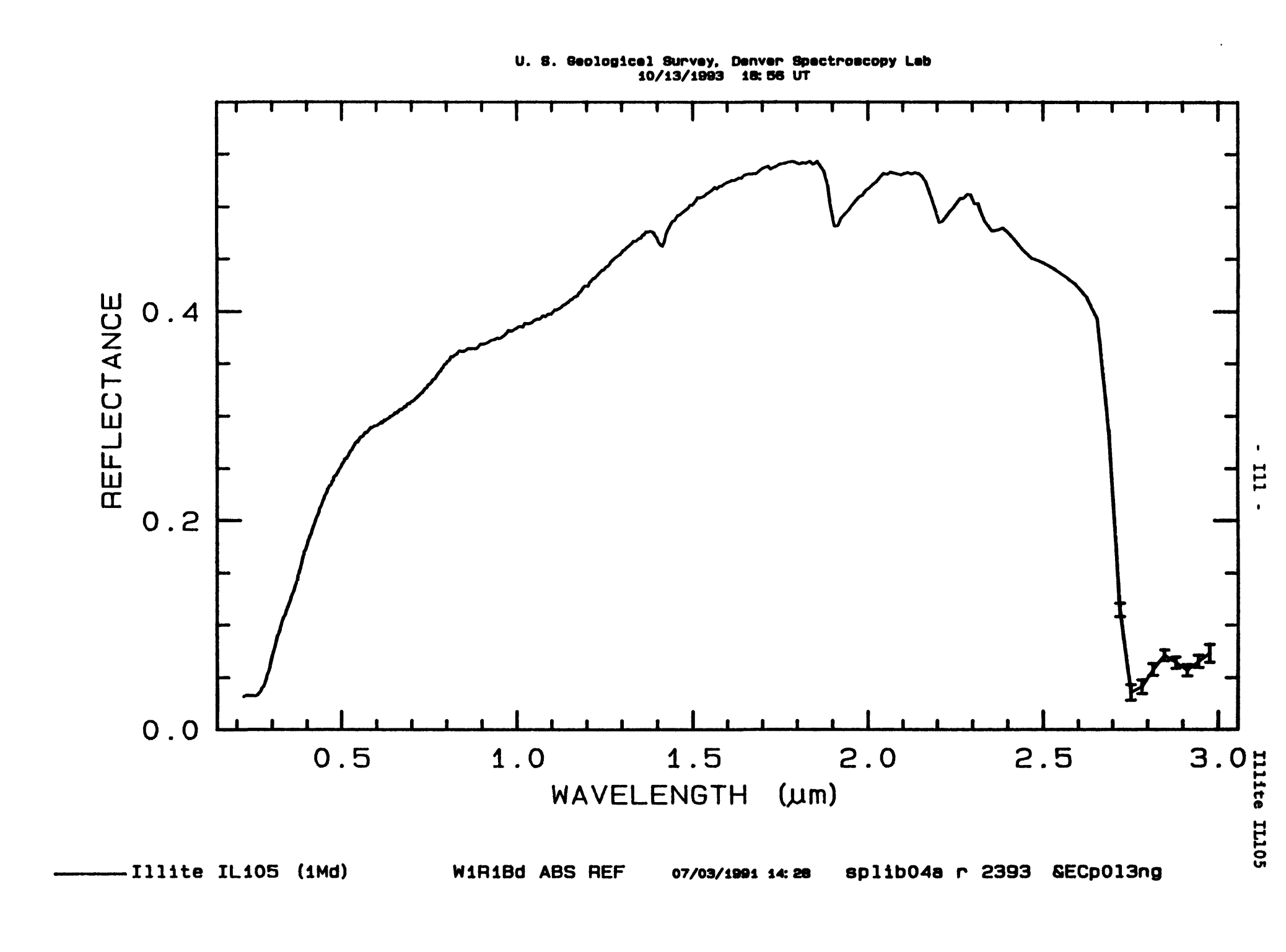
avg gr sz = 10 μm

sample contains 5 vol% quartz. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2393	0.2-3.0μm	200	g.s.= 10 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:56 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- Ill -
Illite IL105
Illite IL105 (1Md) W1R1Bd ABS REF 07/03/1991 14:28 splib04a r 2393 &ECp013ng

TITLE: Ilmenite HS231 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS231

MINERAL_TYPE: Oxide

MINERAL: Ilmenite

FORMULA: Fe+2TiO3

FORMULA_NROFF: $Fe^{+2}TiO_3$

COLLECTION_LOCALITY: Norway

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Geikielite.

"0-10. Ilmenite. Norway (231B). Ilmenite, $FeTiO_3$, is sometimes found in veins or large masses as a product of magmatic segregation, and as beds or lenses in metamorphic rocks. Most commonly, it is an accessory mineral in igneous rocks, and it is frequently associated with the heavy fraction of beach and river sands. As in the case of this sample, ilmenite is typically an opaque, almost spectrally featureless mineral in the visible and near-infrared. The relative reflectivity of the various particle sizes is typical of an opaque mineral--i.e., the smaller the particle size, the lower the reflectivity. Pure ilmenite is considered to be a titanate of ferrous iron (Fe^{2+} $Ti^{4+}O_3$) rather than a double sesquioxide of ferric iron and titanium (Fe^{3+} Ti^{3+} O_3). In ilmenite ferric oxide is often present and can introduce features typical of the Fe^{3+} ion. When as little as 1% Ti is substituted in Fe_2O_3, the titanium acts as a donor and is all ionized to Ti^{4+} and Fe^{2+}, and the Fe^{2+} produces a broad feature centered near 1.5μ. We have already observed a broad feature centered near 1.8μ in the pyroxenes (see Part I) which was attributed to the Fe^{2+} ion in a disordered octahedral site. The hydrated titanium ion (Ti^{3+} $6H_2O$) produces a very broad spectral feature extending from 0.5μ into the infrared with a maximum at 2.0μ. The overall opacity of ilmenite is probably caused by a combination of all these features, broadened by defects, edge effects and the presence of impurities, as well as conduction bands due to both the iron and titanium extending out from the ultraviolet into the visible."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

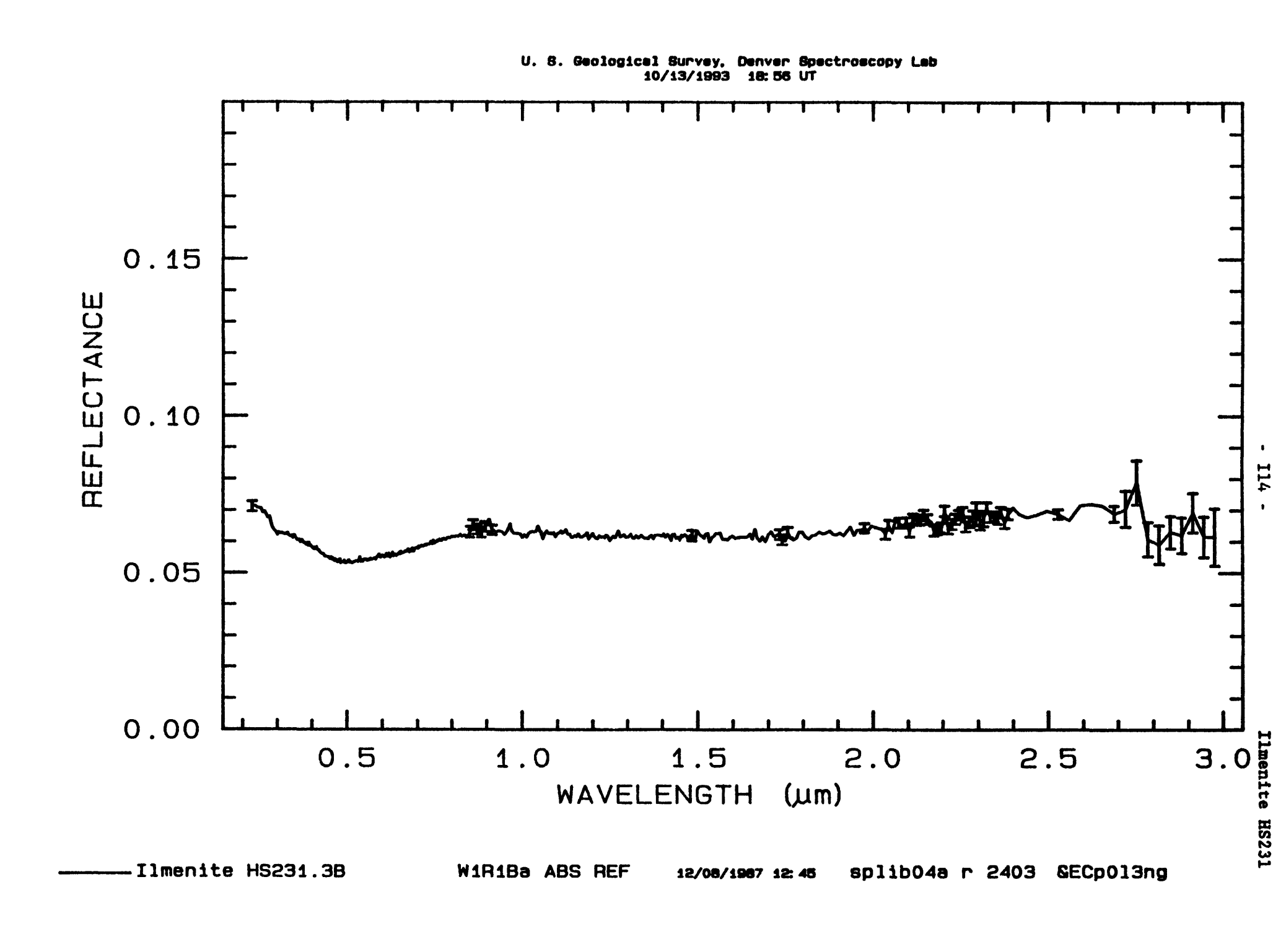
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2403	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:56 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Ilmenite HS231
Ilmenite HS231.3B
W1R1Ba ABS REF
12/08/1987 12:45
splib04a r 2403 &ECp013ng

TITLE: Jadeite HS343 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS343

MINERAL_TYPE: Inosilicate

MINERAL: Jadeite (Pyroxene group)

FORMULA: Na(Al,Fe+3)Si2O6

FORMULA_NROFF: $Na(Al,Fe^{+3})Si_2O_6$

COLLECTION_LOCALITY: California

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"I-9 Jadeite 343B-California. $NaAlSi_2O_6$: Jadeite is a comparatively rare pyroxene of metamorphic origin, which is one source of gem quality jade. Ferric iron commonly substitutes for aluminum, which yields the band near 0.8μ and the fall off to the blue. There are very weak ferrous ion features near 1.0μ, as well as weak water bands from fluid inclusions near 1.9 and 2.25μ."

Sieve interval 74 - $250\mu m$.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

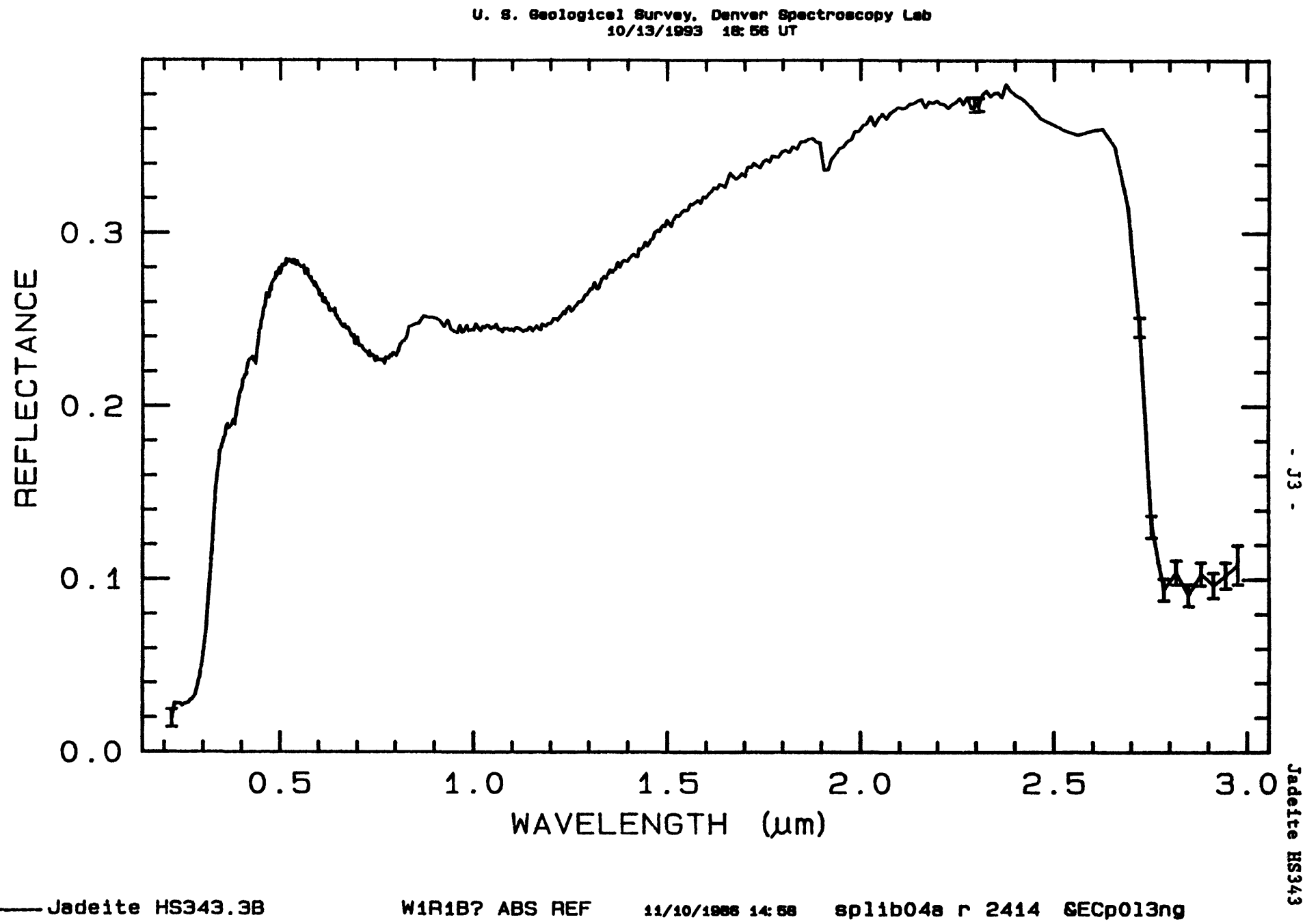
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2414	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:56 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- J3 -
Jadeite HS343
Jadeite HS343.3B
W1R1B? ABS REF
11/10/1986 14:58
splib04a r 2414 GECp013ng

TITLE: Jarosite GDS99 (K, Sy) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS99

MINERAL_TYPE: Sulfate

MINERAL: Jarosite (K-jarosite) (Synthetic) (Alunite group)

FORMULA: K(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $KFe^{+3}_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Roger Stroffregen, SMU

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample synthesized at 200C

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 7.3-6.5 keV
Reference: JCPDS #22-827 (jarosite)
Found: Jarosite
Comment: Sharp patterns (GDS99 is exceptional) indicate good crystallinity and compositional homogeneity. All reflections are accounted for by the JCPDS card. However, the samples are not identical. GDS98 has cell hexagonal dimensions a = 7.313(1) and c = 17.060(4) angstroms whereas GDS99 has a = 7.302(1) and c = 17.214(2) angstroms. The difference in c is significant and suggests a composition difference between the two samples. Are there differences in the optical spectra?"

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

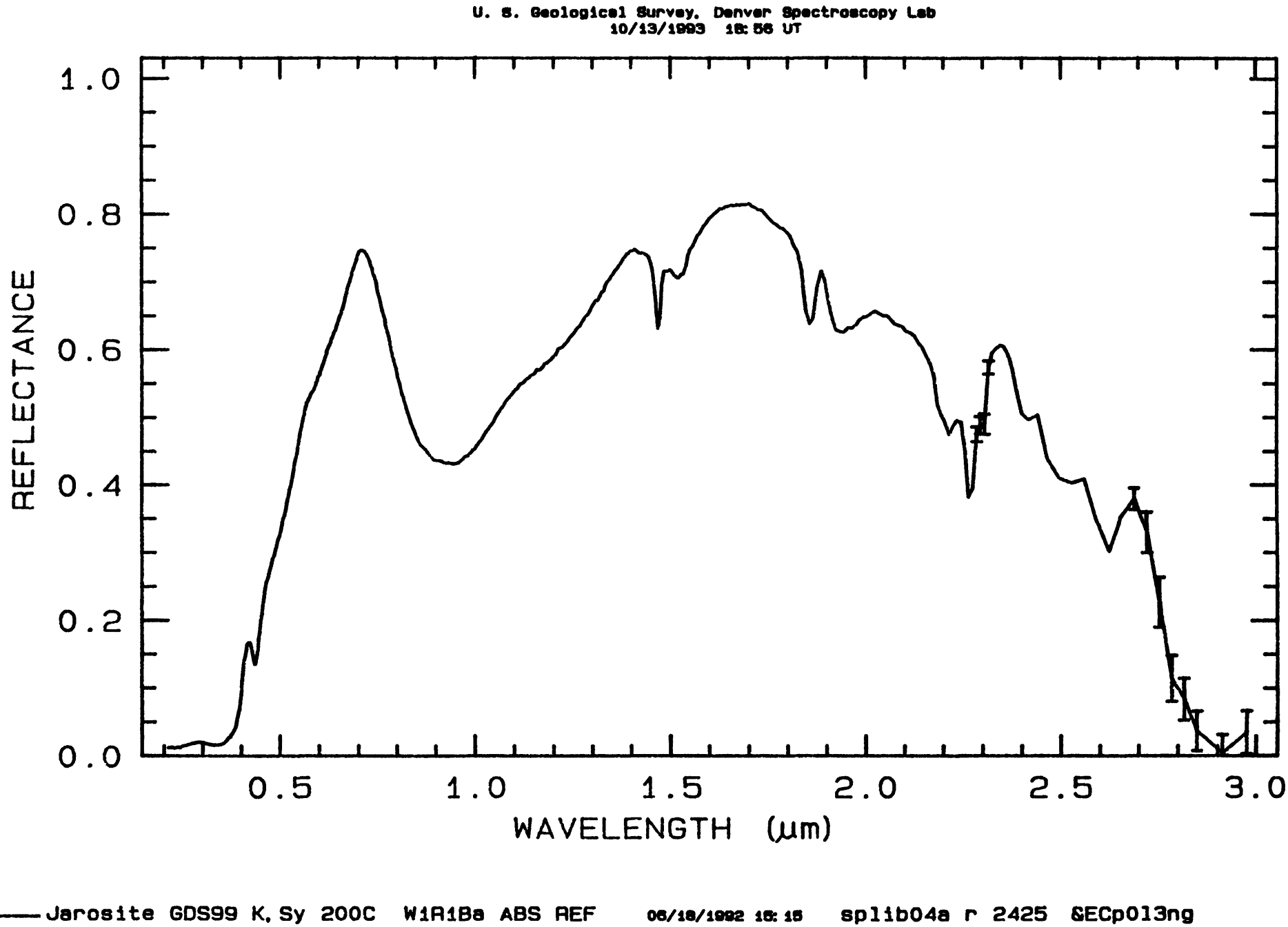
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2425	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:56 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Jarosite GDS99 K, Sy 200C W1R1Ba ABS REF 06/18/1992 16:15 splib04a r 2425 &ECp013ng
Jarosite GDS99

TITLE: Jarosite GDS98 (K, Sy) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS98

MINERAL_TYPE: Sulfate

MINERAL: Jarosite (K-Jarosite) (Synthetic) (Alunite group)

FORMULA: K(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $KFe^{+3}_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Roger Stroffregen, SMU

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample synthesized at 200C

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 7.3-6.5 keV
Reference: JCPDS #22-827 (jarosite)
Found: Jarosite
Comment: Sharp patterns (GDS99 is exceptional) indicate good crystallinity and compositional homogeneity. All reflections are accounted for by the JCPDS card. However, the samples are not identical. GDS98 has cell hexagonal dimensions a = 7.313(1) and c = 17.060(4) angstroms whereas GDS99 has a = 7.302(1) and c = 17.214(2) angstroms. The difference in c is significant and suggests a composition difference between the two samples. Are there differences in the optical spectra?"

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

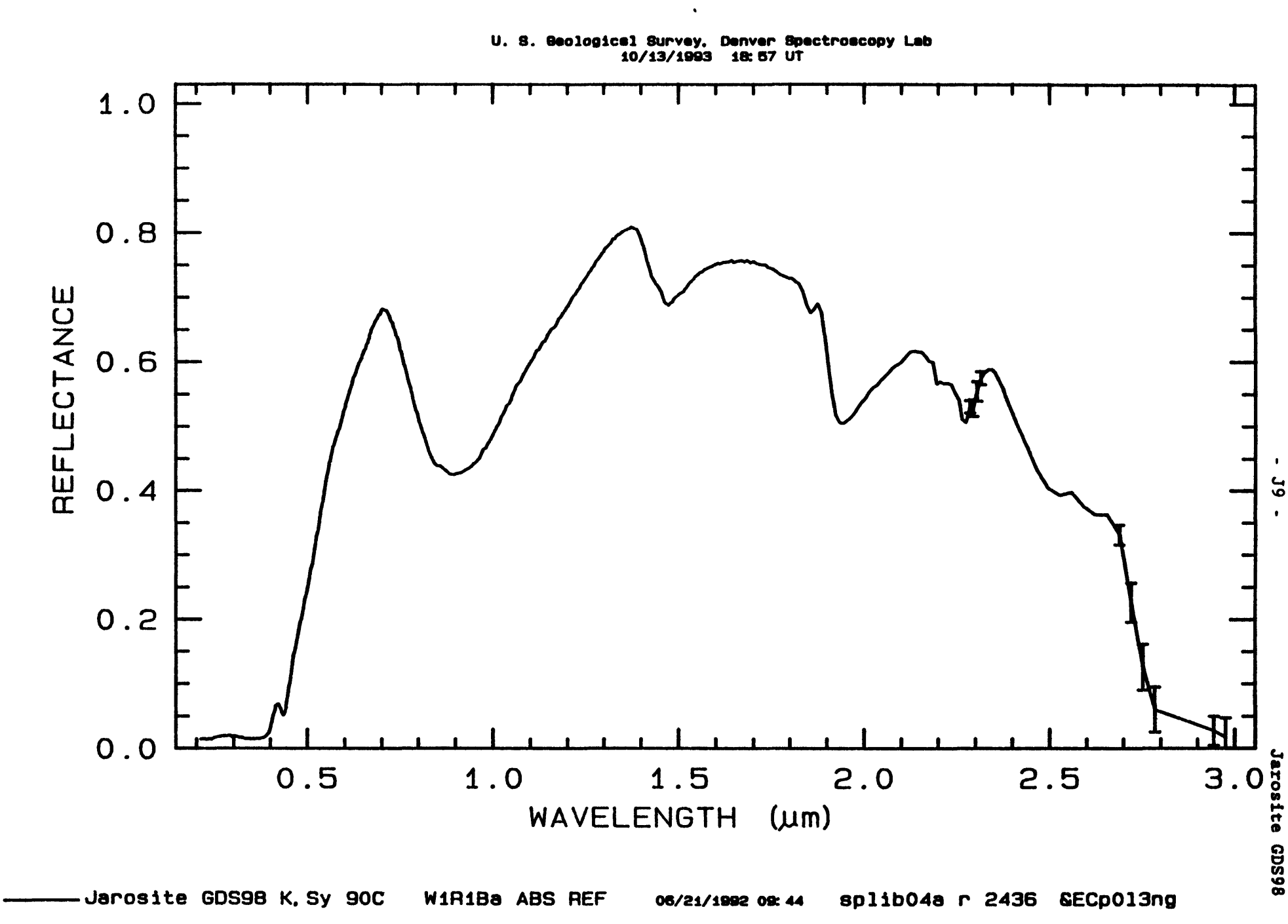
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2436	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Jarosite GDS98 K, Sy 90C W1R1Ba ABS REF 06/21/1992 09:44 splib04a r 2436 &ECp013ng
Jarosite GDS98

TITLE: Jarosite GDS100 (Na, Sy) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS100

MINERAL_TYPE: Sulfate

MINERAL: Jarosite (Natrojarosite) (Synthetic) (Alunite group)

FORMULA: Na(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $NaFe^{+3}_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Roger Stroffregen, SMU

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample synthesized at 90 C

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 7.3-6.5 keV
Reference: JCPDS #30-1203 (natrojorosite)
Found: natrojarosite
Comment: GDS100 is sharp, indicating good crystallinite. GDS is distinctly sharper, with better resolved peaks. Good correspondence with the JCPDS data. No additional reflections observed."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

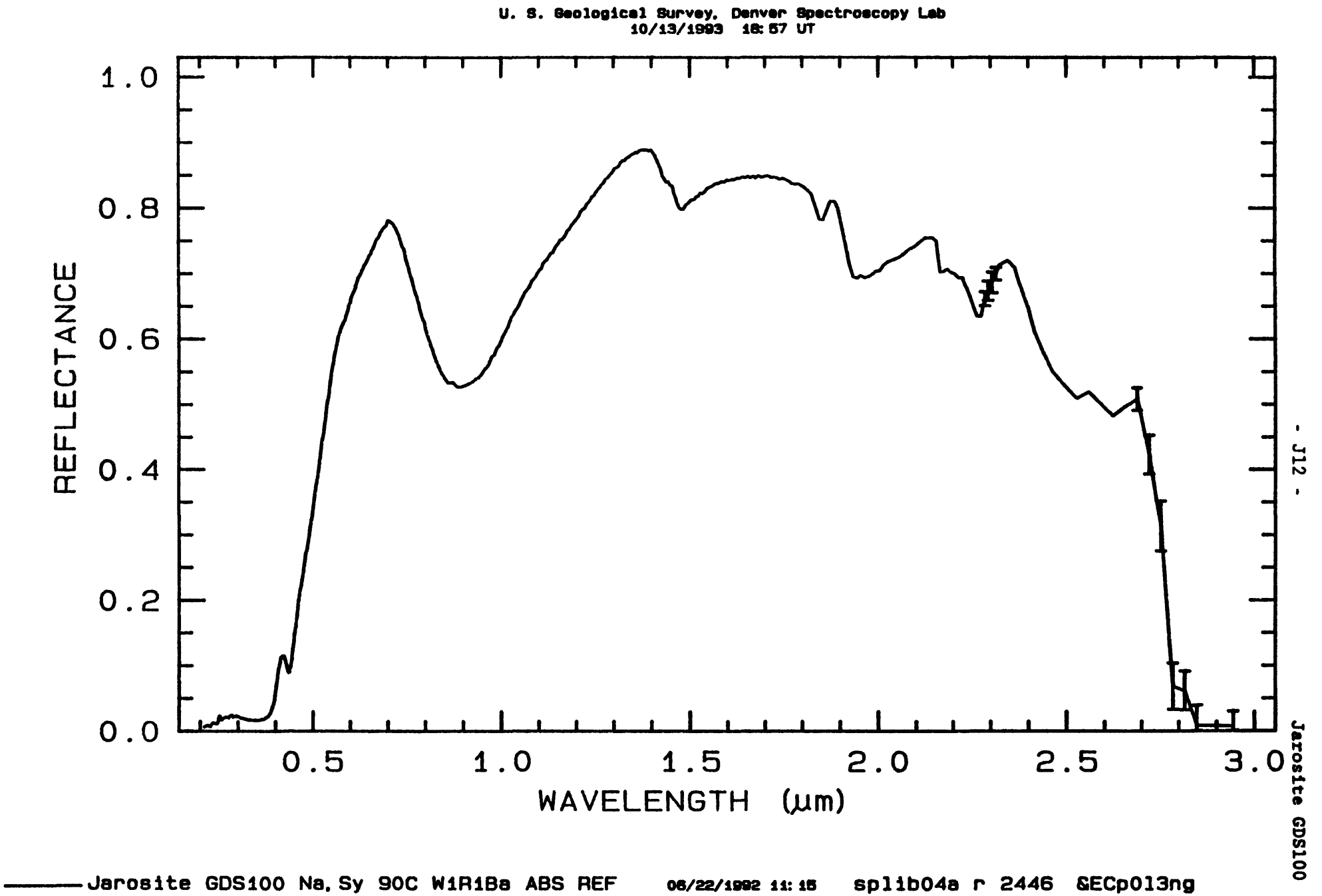
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 2446 0.2-3.0μm 200 g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- J12 -
Jarosite GDS100
Jarosite GDS100 Na, Sy 90C W1R1Ba ABS REF 06/22/1992 11:15 splib04a r 2446 &ECp013ng

TITLE: Jarosite GDS101 (Na, Sy) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS101

MINERAL_TYPE: Sulfate

MINERAL: Jarosite (Natrojarosite) (Synthetic) (Alunite group)

FORMULA: Na(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $NaFe^{+3}_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Roger Stroffregen, SMU

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample synthesized at 200C

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 7.3-6.5 keV
Reference: JCPDS #30-1203 (natrojorosite)
Found: natrojarosite
Comment: GDS100 is sharp, indicating good crystallinite. GDS is distinctly sharper, with better resolved peaks. Good correspondence with the JCPDS data. No additional reflections observed."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

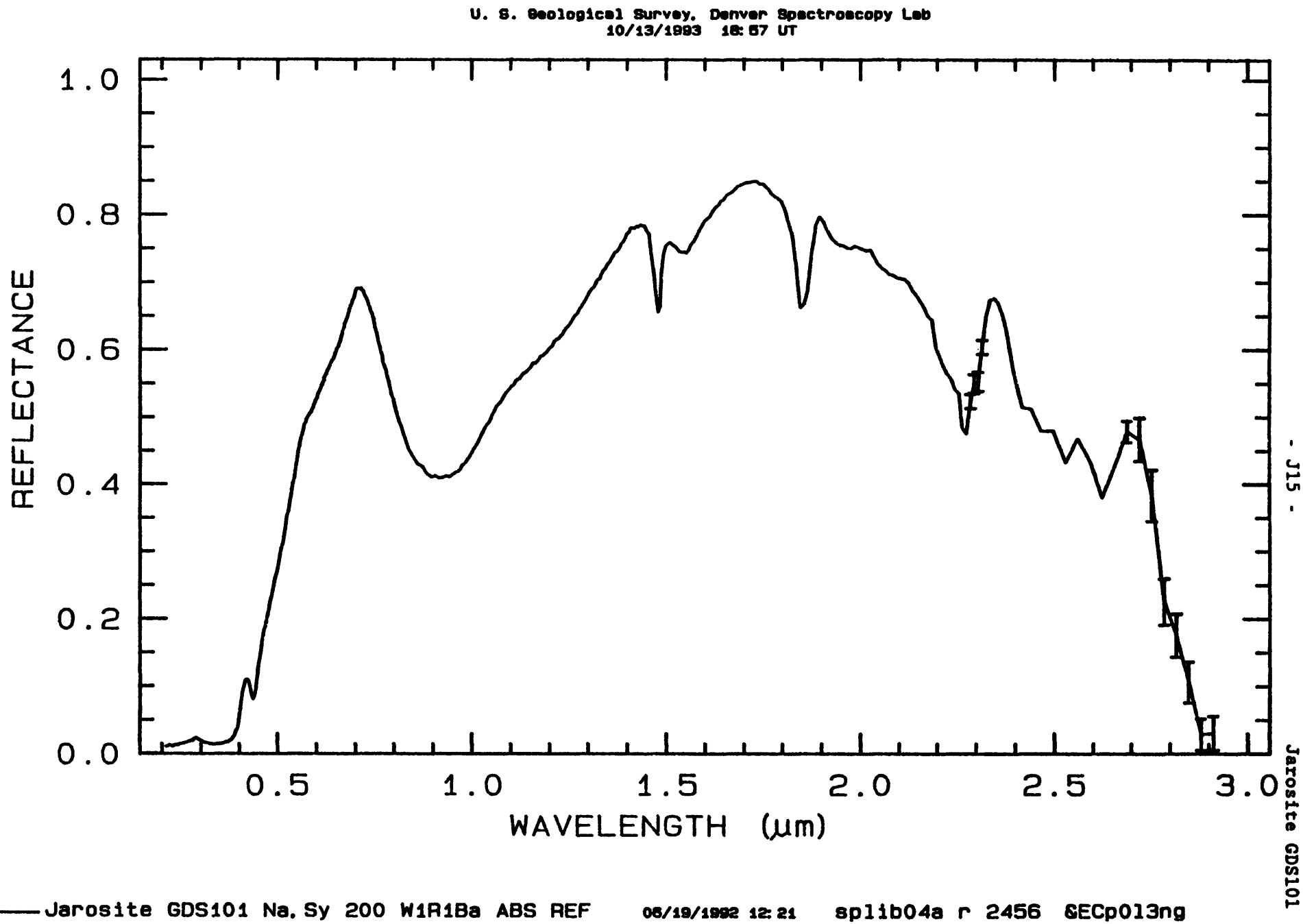
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 2456 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- J15 -
Jarosite GDS101
Jarosite GDS101 Na, Sy 200 W1R1Ba ABS REF 06/19/1992 12:21 splib04a r 2456 &ECp013ng

TITLE: Jarosite GDS24 Na DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS24

MINERAL_TYPE: Sulfate

MINERAL: Natro-Jarosite (Alunite group)

FORMULA: (Na)(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $(Na)Fe_3^{+3}(SO_4)_2(OH)_6$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: MIT Mineral Collection, Dave Sherman

CURRENT_SAMPLE_LOCATION: USGS Denver, Dave Sherman

ULTIMATE_SAMPLE_LOCATION: USGS Denver, Dave Sherman

SAMPLE_DESCRIPTION:

The spectrum looks like a beautiful jarosite spectrum with no contaminants. Roger N. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Jarosite - major

Unidentified residual in appreciable amounts; note peaks at 5.58, 5.5542, 2.769

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Na-jarosite.

END_COMPOSITION_DISCUSSION.

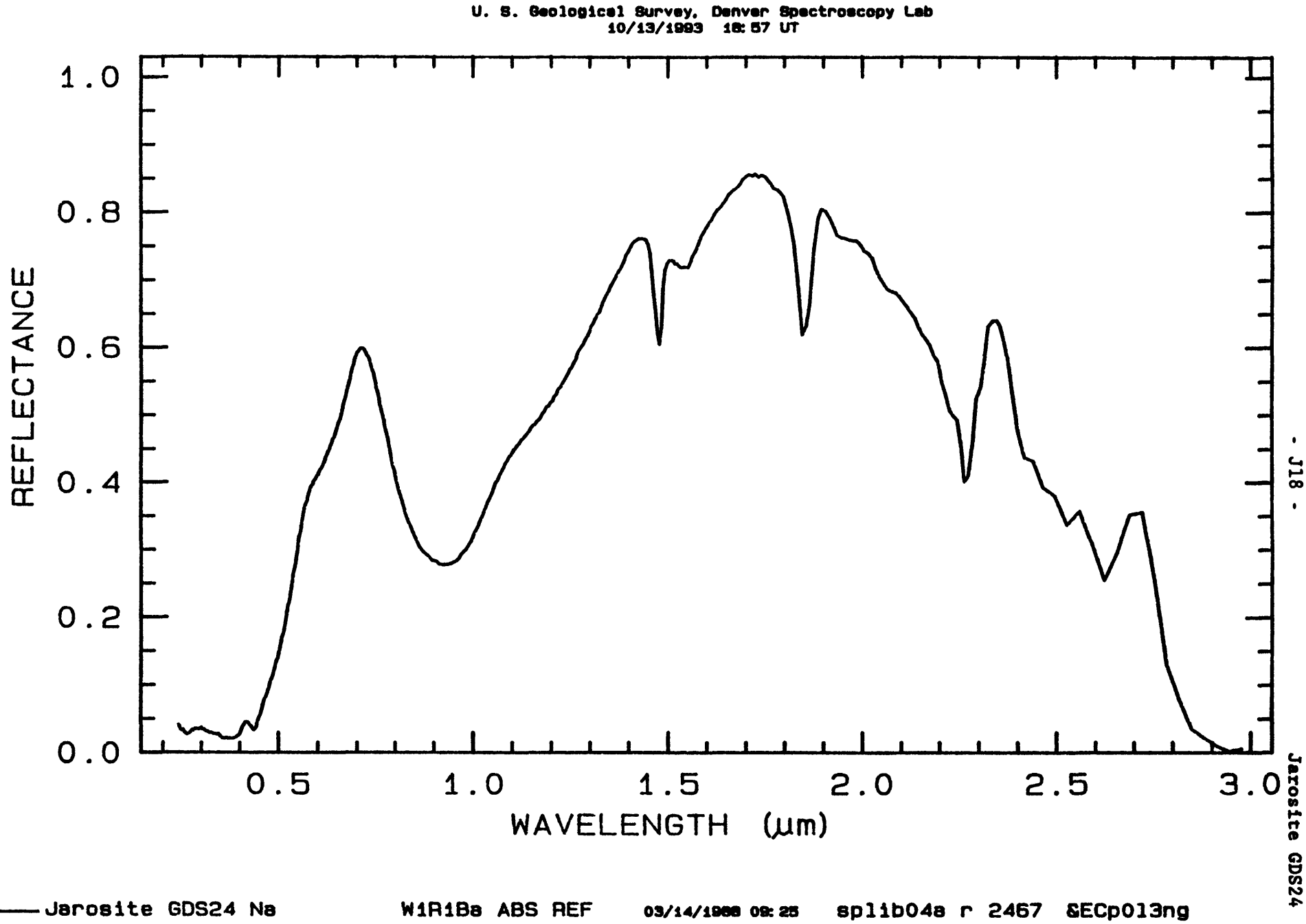
MICROSCOPIC_EXAMINATION:

Rhombohedral plates, moderate relief, straight extinction? Grains too small - may be length slow. All consistent with alunite (hydronium jarosite is part of Alunite Group) except for length slow? G. Swayze

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2467	0.2-3.0μm	200	g.s.= 15 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- J18 -
Jarosite GDS24
Jarosite GDS24 Na
W1R1B8 ABS REF
09/14/1988 09:25
splib04a r 2467 &ECp013ng

TITLE: Jarosite JR2501 (K) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: JR2501

MINERAL_TYPE: Sulfate

MINERAL: Jarosite (Alunite group)

FORMULA: K(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $KFe^{+3}_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Gumma Iron Mine, Gumma Prefecture, Japan

ORIGINAL_DONOR: Colorado School of Mines

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Jarosite
Contaminant phases: quartz(?), trace clay(?).

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

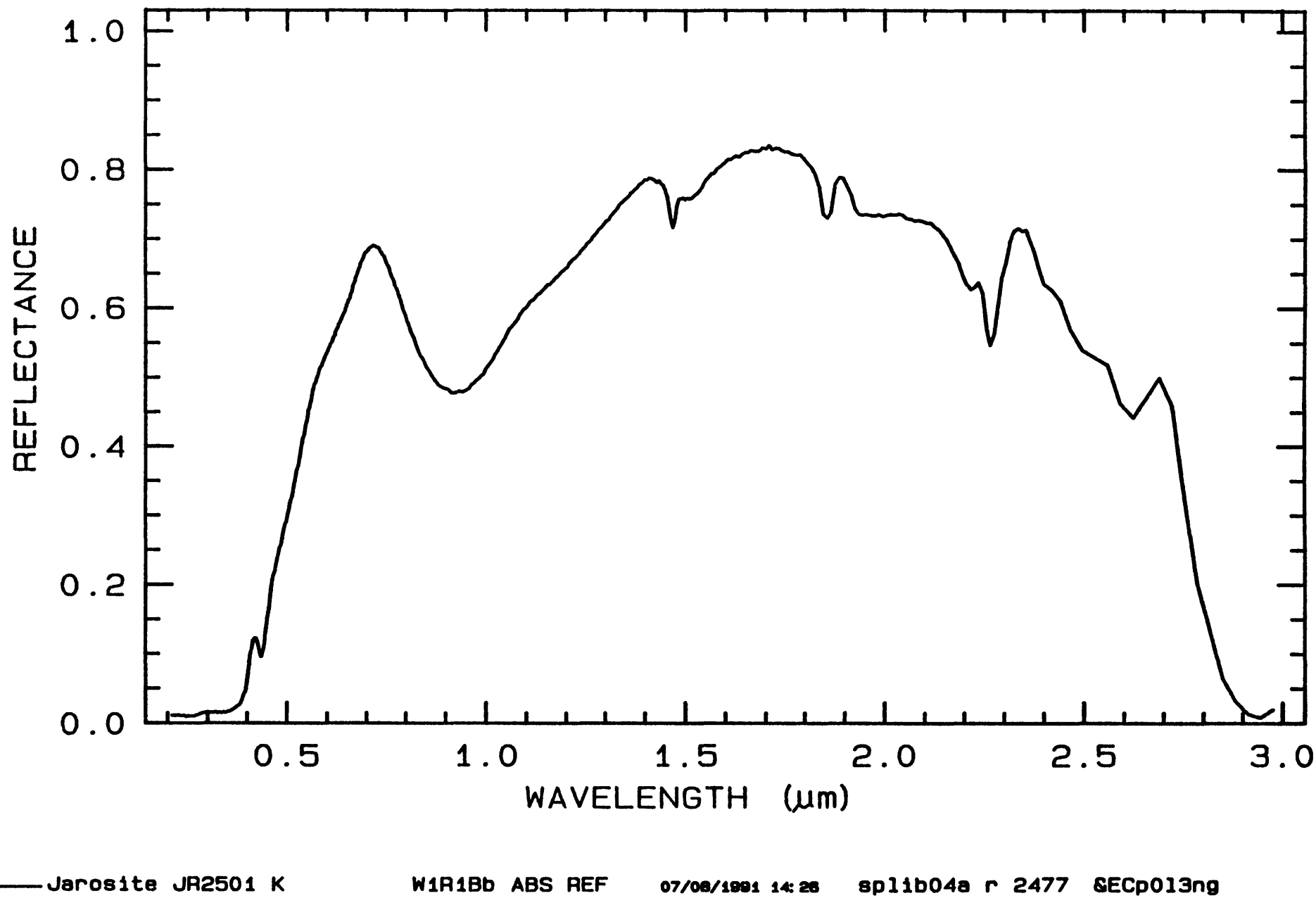
avg gr sz = 5 μm

Sample may have 5 vol% quartz. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2477	0.2-3.0μm	200	g.s.= 5 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- J20 -
Jarosite JR2501
Jarosite JR2501 K
W1R1Bb ABS REF
07/08/1991 14:28
splib04a r 2477 &ECp013ng

TITLE: Jarosite NMNH95074-1 (Na) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH95074-1

MINERAL_TYPE: Sulfate

MINERAL: Jarosite (Natrojarosite) (Alunite group)

FORMULA: Na(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $NaFe^{+3}_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY: Warner Mine, Hot Springs, Mineral County, Nevada

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Fe^{+3} analogue of alunite. Secondary mineral found as crusts and coatings on ferruginous ores.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Natrojarosite ($NaFe_3(SO_4)_2(OH)_6$) + quartz (m).
Spectrally pure. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

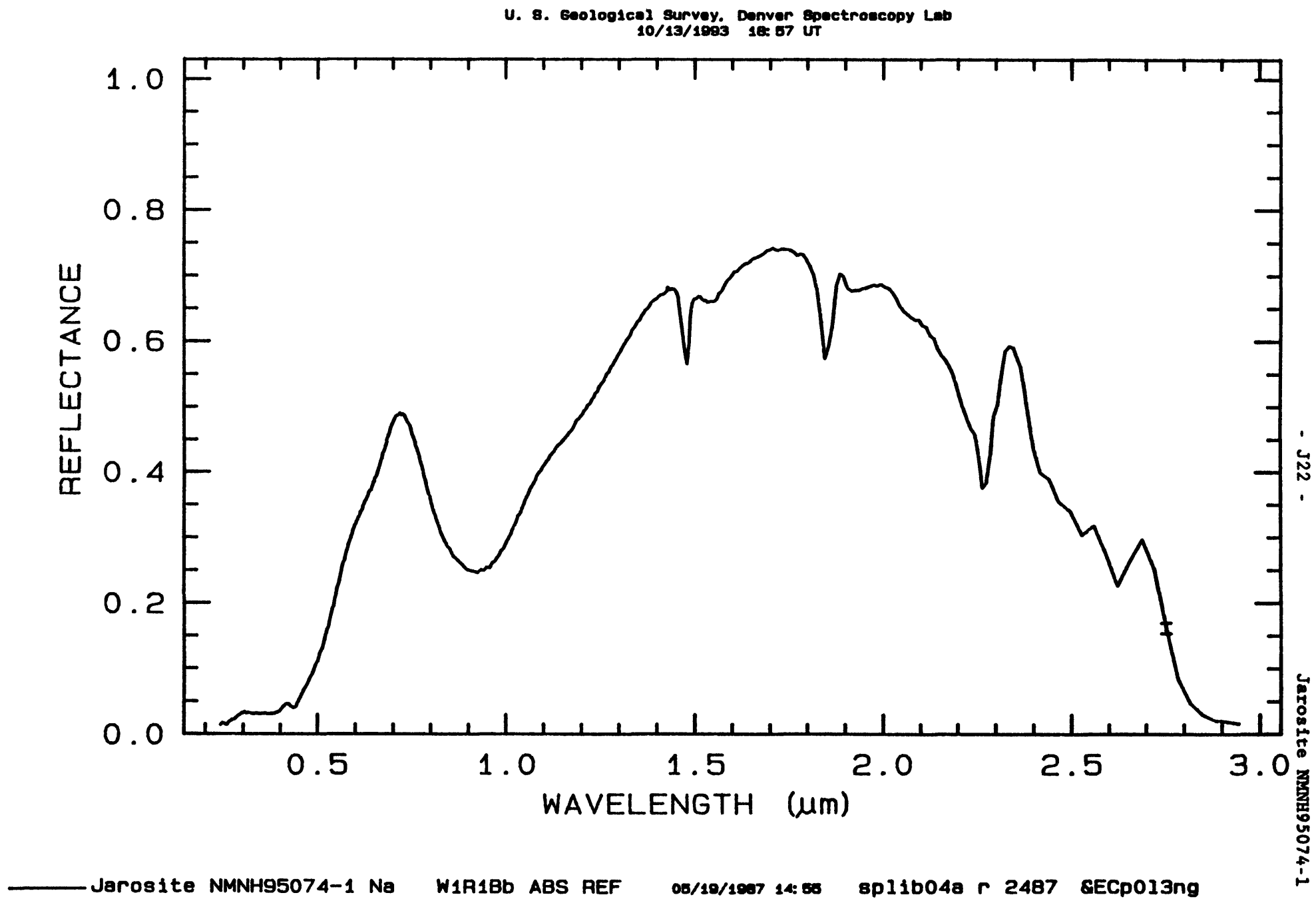
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2487	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- J22 -
Jarosite NMNH95074-1
Jarosite NMNH95074-1 Na W1R1Bb ABS REF 05/19/1987 14:55 splib04a r 2487 &ECp013ng

TITLE: Jarosite WS368 (Pb) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS368

MINERAL_TYPE: Sulfate

MINERAL: Pb-bearing jarosite (Alunite group)

FORMULA: Pb(Fe+3)6(SO4)4(OH)12

FORMULA_NROFF: $PbFe^{+3}_{6}(SO_4)_4(OH)_{12}$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Wards Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

40 kV - 30 mA, 6.5-9.5 keV (plumjaro.out), 7.3-9.5 keV (plumjar2.out, pbjaro3.out)
References: JCPDS #18-698, 22-827, and 5-417; Szymanski (1985); pattern for K-jarosite GDS98
Found: an alunite, probably K-jarosite, plus subordinate cerussite and quartz.
Sought but not found: plumbojarosite
Comments: Three phases found. Uncorrected alunite 2 theta values were refined to a hexagonal/rhombohedral unit cell having a=7.301 (2) and c=17.050(7). These dimensions and the yellowish ochre color suggest that the alunite is Fe-rich; the pattern closely matches that of K-jarosite except that the strong (012) reflection is missing. There is no evidence of the double cell (c=33.8 angstroms) characteristic of plumbojarosite (in which a large divalent cation replaces the alkali).

J.S. Huebner and J. Pickrell, unpublished data, written communication, USGS, Reston, VA (1993).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Comparison with a spectrum of cerussite indicates that any cerussite is not detected spectrally. Since the spectral features of this sample differ from those of low temperature K-jarosite (GDS98), this

may indicate the presence of Pb in the sample. Because this sample also contains some cerussite, any chemical analysis must be done on the jarosite portion only. This has yet to be done. G. Swayze.

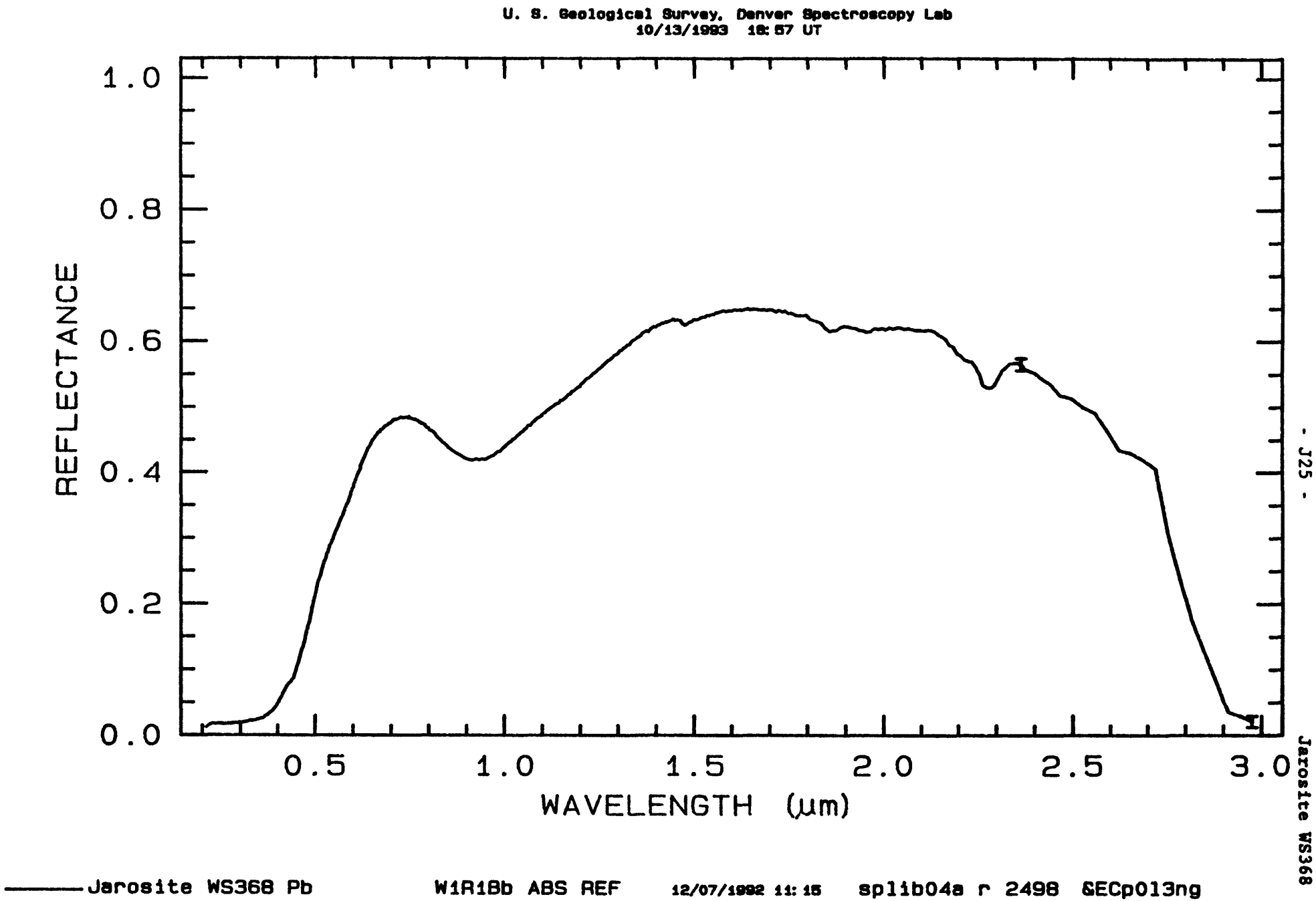
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2498	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- J25 -
Jarosite WS368
Jarosite WS368 Pb
W1R1Bb ABS REF
12/07/1992 11:15
splib04a r 2498 &ECp013ng

TITLE: Jarosite SJ-1 (H3O,10-20%) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SJ-1

MINERAL_TYPE: Sulfate

MINERAL: Jarosite (Alunite group)

FORMULA: (K,H3O)(Fe+3)3(SO4)2(OH)6

FORMULA_NROFF: $(K,H_3O)Fe^{+3}_3(SO_4)_2(OH)_6$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Charlie Alpers

CURRENT_SAMPLE_LOCATION:

ULTIMATE_SAMPLE_LOCATION:

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"SJ-1 H3O-(10-20%) Jarosite, Box #1, 45 kV - 35 mA, 7.4-9.5 keV
SJ-1 H3O-(10-20%) Jarosite, Box #3, 40 kV - 30 mA, 7.3-9.5 keV
Reference: JCPDS #31-650 (hydronium jarosite)
Found: member of alunite group, spacings match hydronium jarosite
Comment: Good correspondence with the JCPDS data for synthetic hydronium jarosite and the brownish color suggest this alunite is iron- and hydronium-rich. The two samples appear to duplicate each other. Both patterns show a very very weak peak at 2.38 angstroms. Sharp peaks indicate good crystallinity."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Sample contains 10-20% hydronium ion.

Charlie Alpers, personal communication.

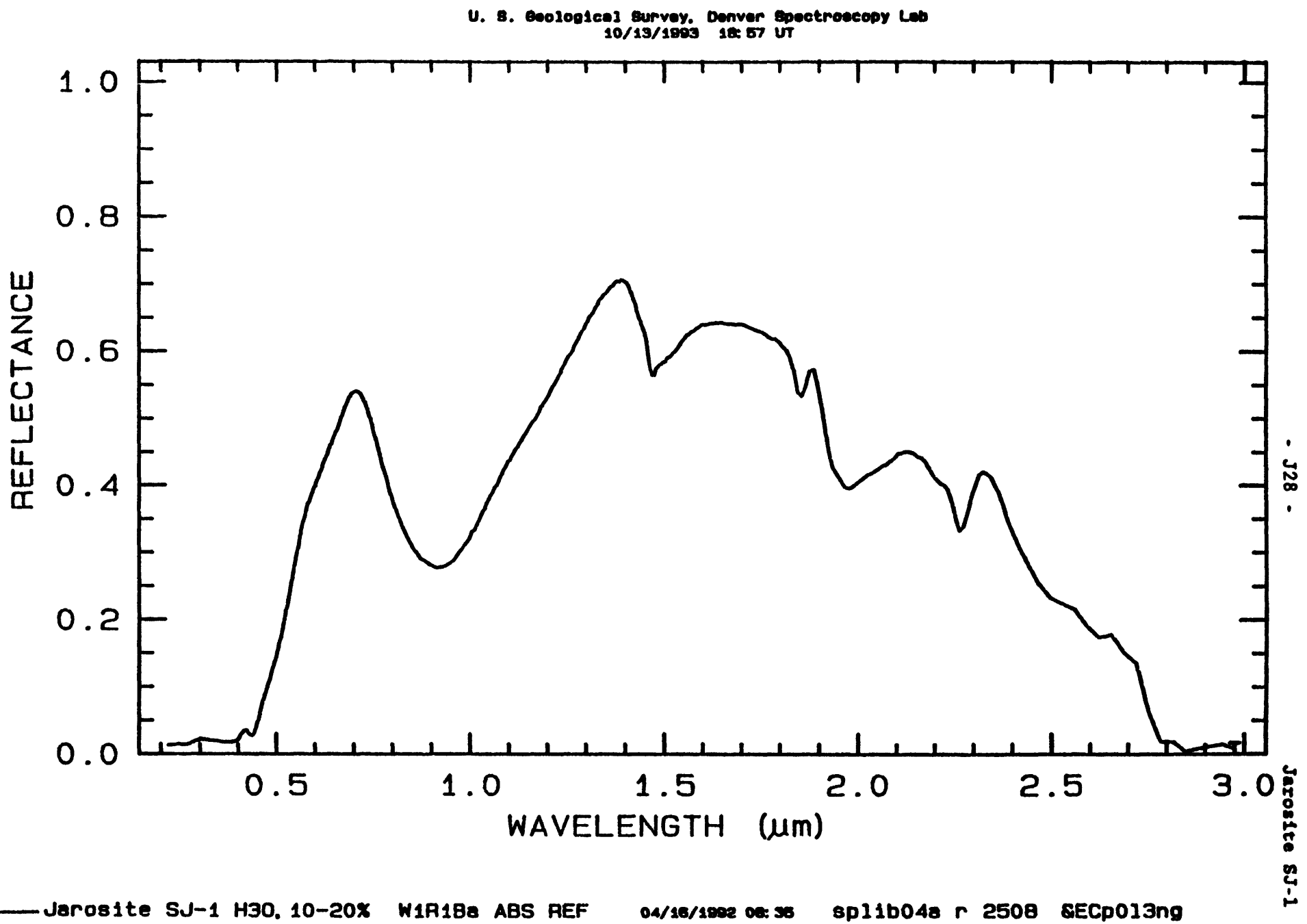
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2508	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 18:57 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Jarosite SJ-1
Jarosite SJ-1 H30, 10-20% W1R1Ba ABS REF 04/16/1992 08:36 splib04a r 2508 SECp013ng

TITLE: Kainite NMNH83904 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH83904

MINERAL_TYPE: Halide (Hydrous Sulfate)

MINERAL: Kainite

FORMULA: MgSO4*KCL*3H2O

FORMULA_NROFF: $MgSO_4 \bullet KCL \bullet 3H_2O$

COLLECTION_LOCALITY: Stassfurt, Germany

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure Kainite (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

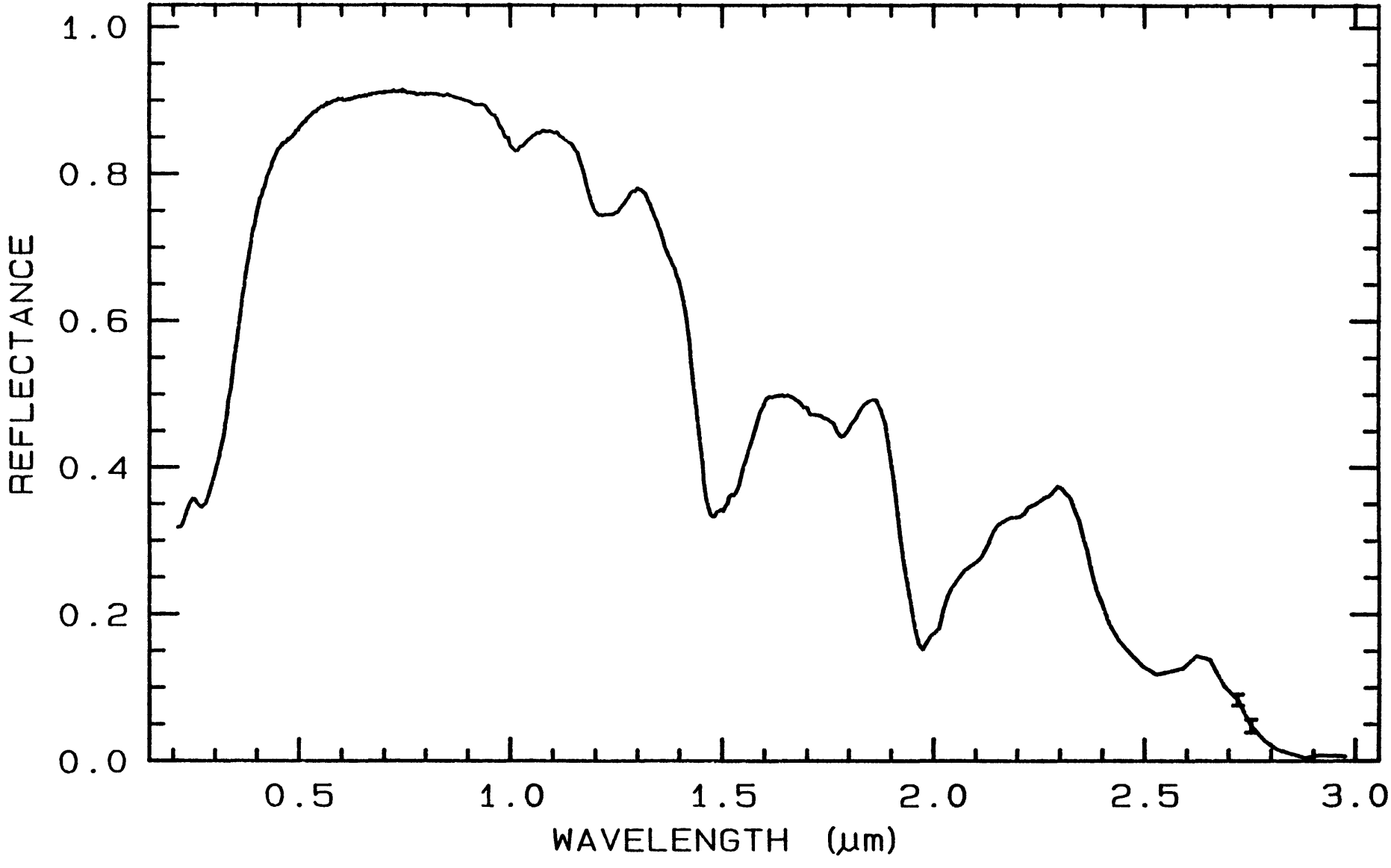
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 2518 0.2-3.0μm 200 g.s.=

U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT



- K3 -

Kainite NMNH83904

——— Kainite NMNH83904 W1R1Ba ABS REF 03/31/1993 12:36 splib04a r 2518 &ECp013ng

TITLE: Kaolinite CM9 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM9

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Mesa Alta, New Mexico

ORIGINAL_DONOR: Clay Mineral Standard from Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Halloysite, and Nacrite.

A spectrum for this sample was published by:

Clark, R.N., King, T.V.V., Klejwa, M., Swayze, G.A., and Vergo, N., 1990, High spectral resolution reflectance spectroscopy of minerals: Journal of Geophysical Research, v. 95, no. 8B, p 12,653-12,680.

who noted that it was spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is well ordered kaolinite. The <2μm cut is kaolinite + small amount of quartz.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	47.1	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.46	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	37.4	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.47	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	<0.01	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.16	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.05	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.08	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	13.8	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	0.12	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	13.9	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	14.1	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.04	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

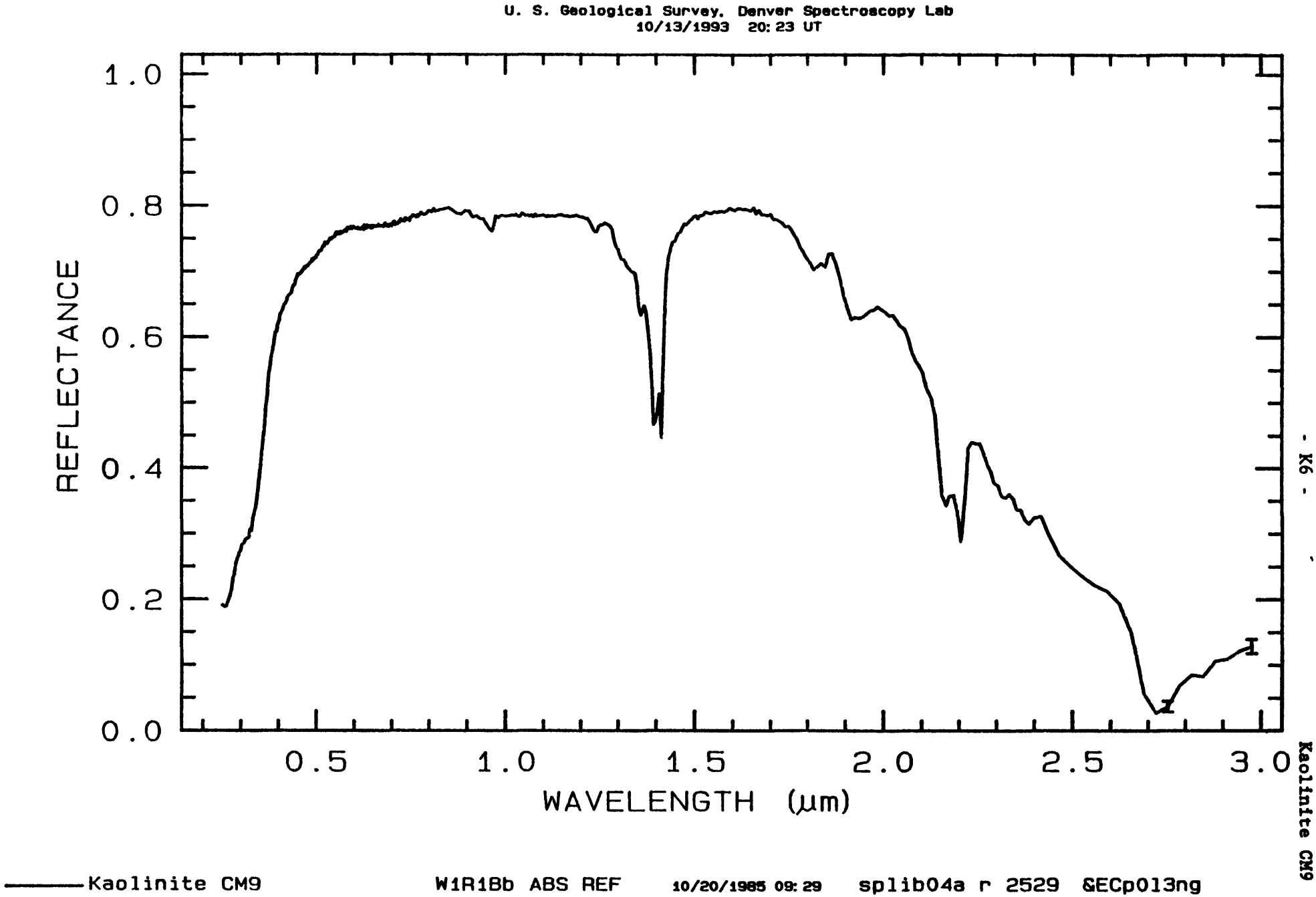
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2529	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K6 -
Kaolinite CM9
Kaolinite CM9
W1R1Bb ABS REF
10/20/1985 09:29
splib04a r 2529 &ECp013ng

TITLE: Kaolinite KGa-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KGa-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Washington County, GA

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Halloysite, and Nacrite.

A spectrum for this sample was published by:

Clark, R.N., King, T.V.V., Klejwa, M., Swayze, G.A., and Vergo, N., 1990, High spectral resolution reflectance spectroscopy of minerals: Journal of Geophysical Research, v. 95, no. 8B, p 12,653-12,680.

who noted that it was spectrally pure.

The spectrum from 2.5-25μm was published in:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is kaolinite + trace anatase, the <2μm cut was pure kaolinite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	45.0	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	1.58	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	38.0	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.26	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.02	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.00	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.02	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.02	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.01	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.04	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	F:	0.013	wt%	NROFF:	F
COMPOSITION:	LOI:	14.31	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.38	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysis by C.V.Clemency, Dept. of Geological Sciences, SUNY at Buffalo, Buffalo N.Y. for the Clay Minerals Society. Fluorine analysis by J. Thomas Jr., Illinois State Geological Survey, Urbana, Ill, and is not included in the total.

Published in: van Olphen, H. and J.J. Fripiat, eds., 1979, Data handbook for clay materials and other non-metallic minerals, Pergamon Press, New York, p128.

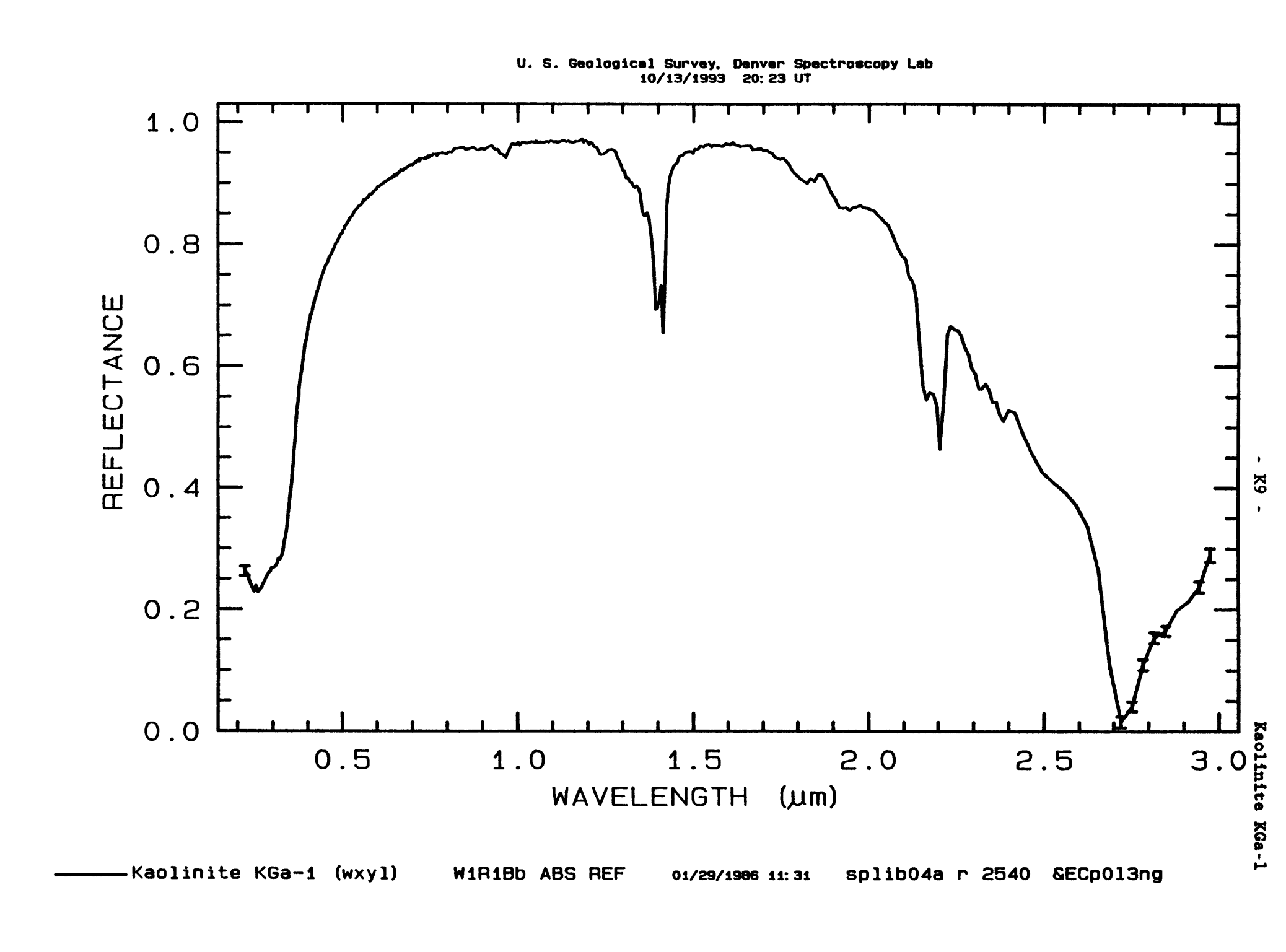
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2540	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K9 -
Kaolinite KGa-1
Kaolinite KGa-1 (wxyl) W1R1Bb ABS REF 01/29/1986 11:31 splib04a r 2540 &ECp013ng

TITLE: Kaolinite KGa-2 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KGa-2

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Warren County, GA

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Halloysite, and Nacrite.

This sample is an excellent example of disordered kaolinite.

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

The spectrum from 2.5-25μm was published in:

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is kaolinite + trace anatase.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	44.2	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	2.17	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	37.2	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.14	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.05	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.00	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.04	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.04	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.02	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.02	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.06	wt%	NROFF:	P_2O_5
COMPOSITION:	F:	0.020	wt%	NROFF:	F
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.18	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysis by C.V.Clemency, Dept. of Geological Sciences, SUNY at Buffalo, Buffalo N.Y. for the Clay Minerals Society. Fluorine analysis by J. Thomas Jr., Illinois State Geological Survey, Urbana, Ill, and is not included in the total.

Published in: van Olphen, H. and J.J. Fripiat, eds., 1979, Data handbook for clay materials and other non-metallic minerals, Pergamon Press, New York, p128.

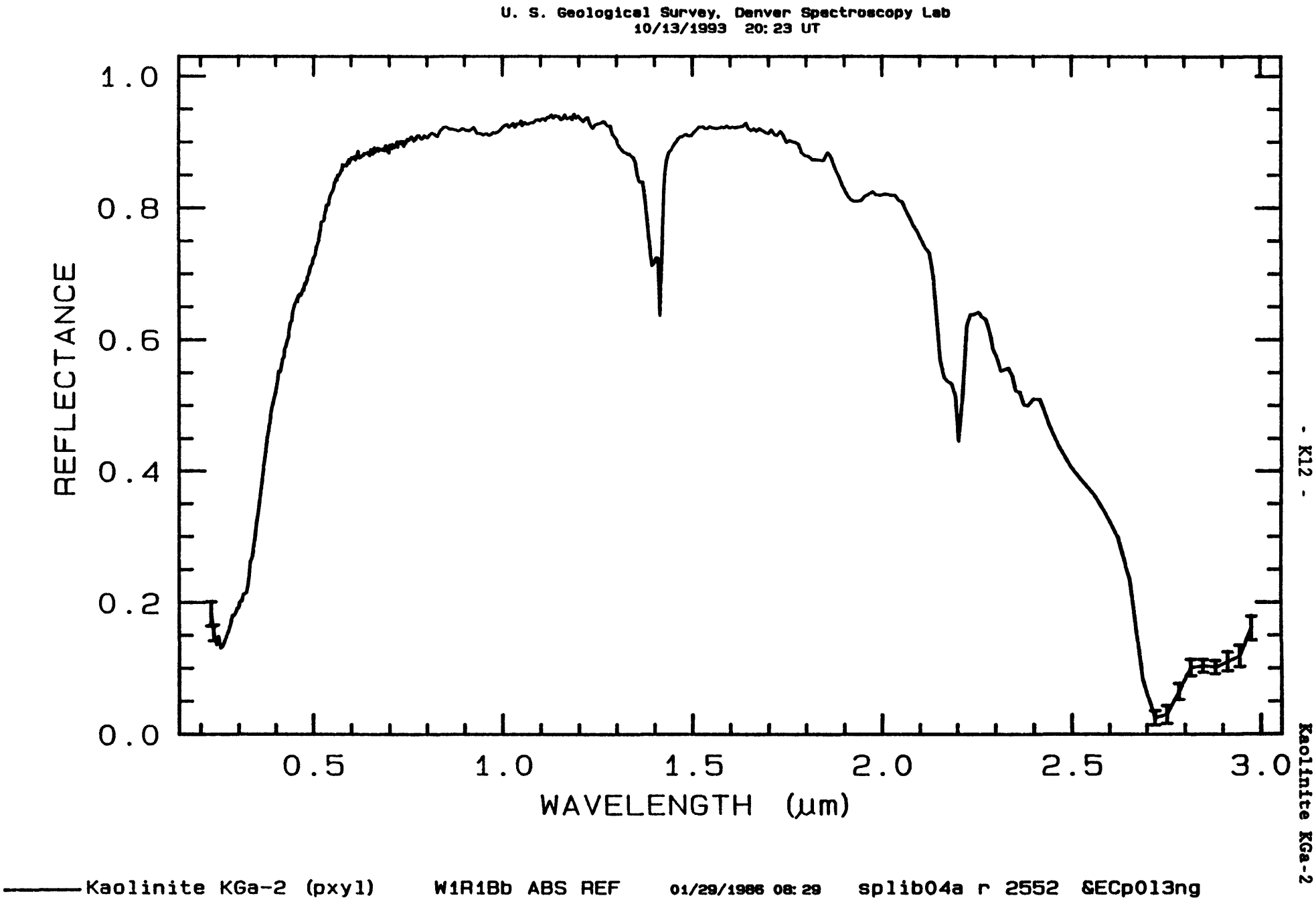
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2552	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K12 -
Kaolinite KGa-2
Kaolinite KGa-2 (pxyl) W1R1Bb ABS REF 01/29/1986 08:29 splib04a r 2552 &ECp013ng

TITLE: Kaolinite KL502 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KL502

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Cripple Creek, CO

ORIGINAL_DONOR: Dan Taranik

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Single phase, veinlet.

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:	
90 vol%	kaolinite
5 vol%	opaques
5 vol%	feldspar or quartz

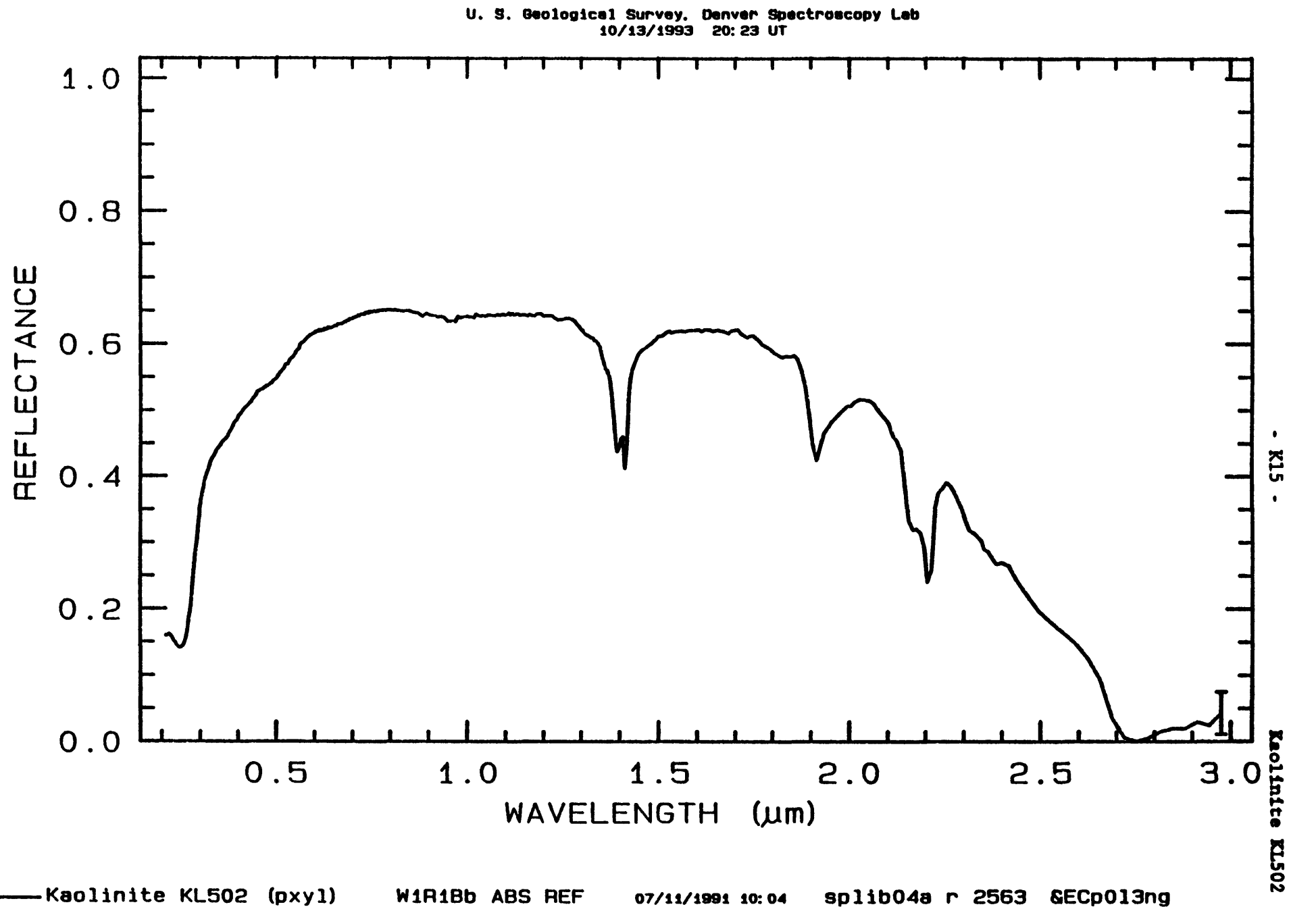
avg gr sz = 15 μm

Grains have mottled extinction probably from fibrous habit. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 2563	0.2-3.0μm	200	g.s.= 15 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- KL5 -
Kaolinite KL502
Kaolinite KL502 (pxyl) W1R1Bb ABS REF 07/11/1991 10:04 splib04a r 2563 &ECp013ng

TITLE: Kaolinite GDS11 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS11

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: unknown

ORIGINAL_DONOR: Wards Natural Science

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Halloysite and Nacrite.

A spectrum for this sample was published by:

Clark, R.N. and P.G. Lucey, 1984, Spectral Properties of Ice-Particulate Mixtures and Implications for Remote Sensing I: Intimate Mixtures: *J. Geophys. Res.*, **89**, 6341-6348.

Dry sieved to < 63 μm. The mean grain size is 10-20 μm according to Clark and Lucey (1984), but is probably closer to 10 μm. From the visible-near-IR spectrum, the kaolinite appears spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Kaolinite + anatase (Norma Vergo, USGS)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

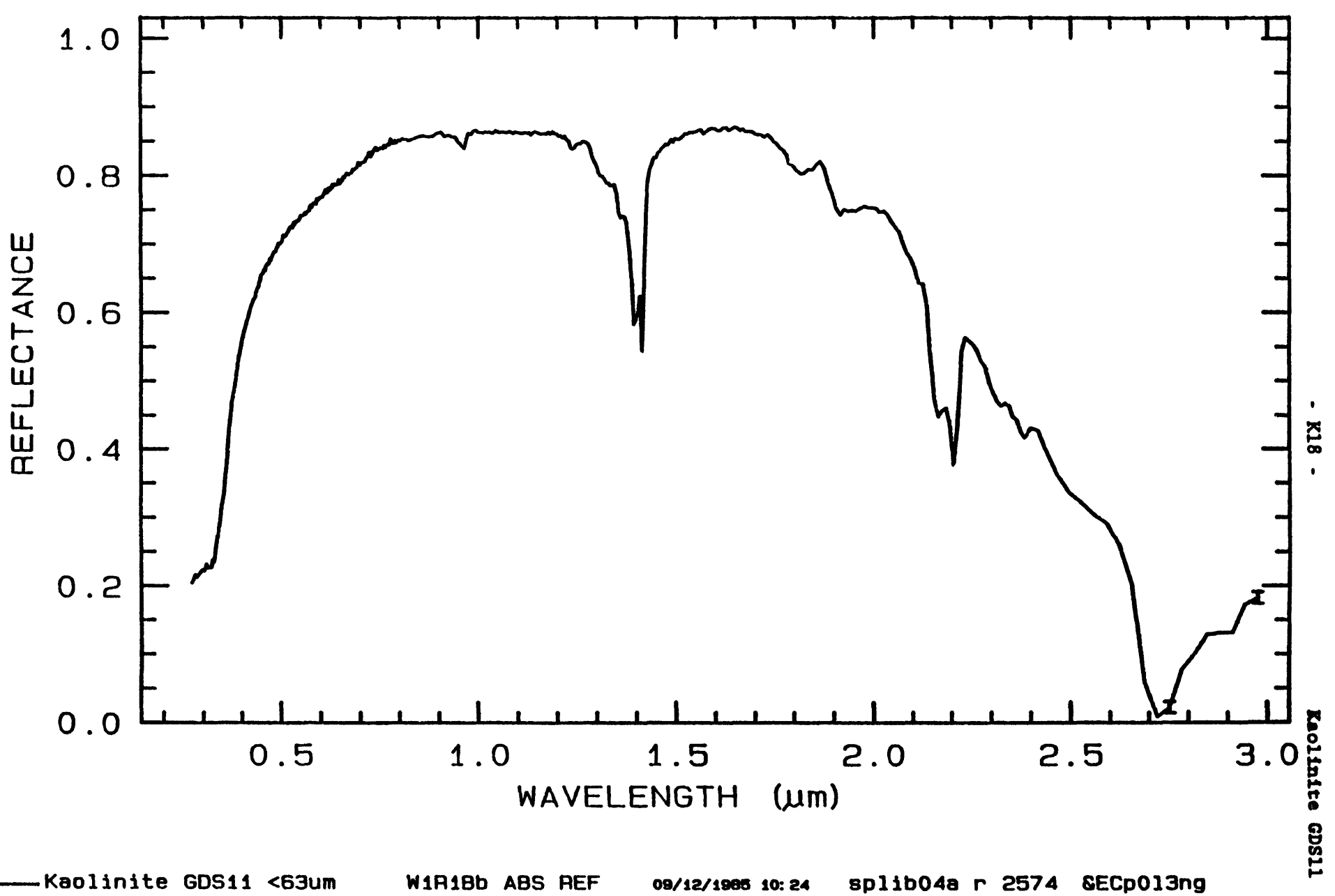
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 2574	0.2-3.0μm	200	g.s.=0.001 cm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K18 -
Kaolinite GDS11
Kaolinite GDS11 <63um W1R1Bb ABS REF 09/12/1986 10:24 splib04a r 2574 &ECp013ng

TITLE: Kaolinite CM3 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM3

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Macon, GA

ORIGINAL_DONOR: Clay Mineral Standard from Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Halloysite, and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Kaolinite partially ordered, < 2μm fraction is pure (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	45.0 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	1.54 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	37.9 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.32 wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	<0.01 wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.20 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.06 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.06 wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.05 wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	13.7 wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	0.63 wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	14.3 wt%	NROFF:	H_2O
COMPOSITION:	LOI:	14.1 wt%	NROFF:	LOI
COMPOSITION:	---	---		
COMPOSITION:	Total:	98.90 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

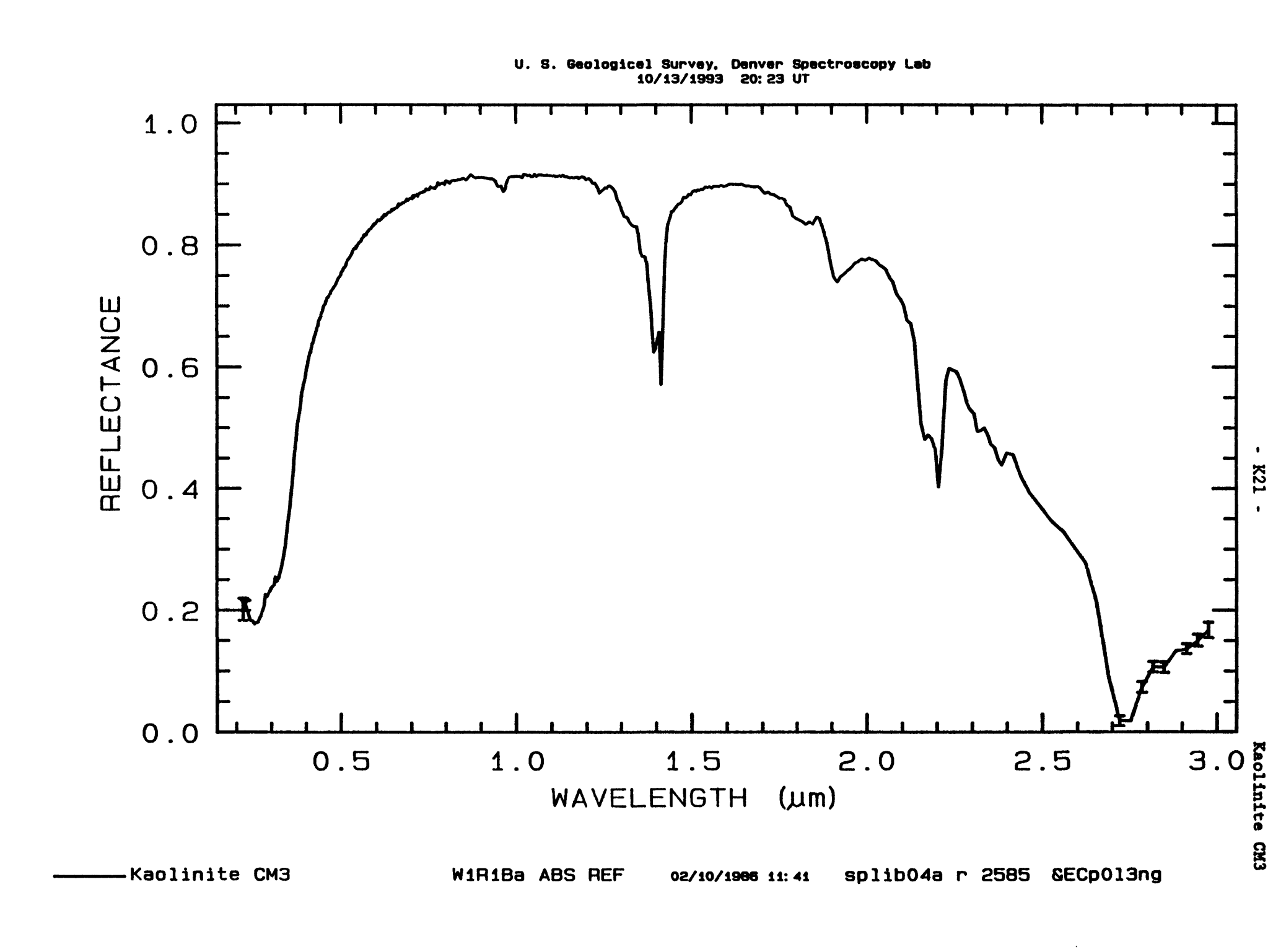
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2585	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K21 -
Kaolinite CM3
Kaolinite CM3
W1R1Ba ABS REF
02/10/1986 11:41
splib04a r 2585 &ECp013ng

TITLE: Kaolinite CM5 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM5

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Lamar Pit, Bath S.C.

ORIGINAL_DONOR: Clay Mineral Standard from Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Halloysite, and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

< 2μm fraction is well ordered kaolinite + tr. muscovite and anatase (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	44.4	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	1.47	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	37.9	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	0.68	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.02	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.11	wt%	NROFF:	MgO
COMPOSITION:	CaO:	<0.02	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.29	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.09	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	13.8	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	0.41	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	14.2	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	14.1	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.23	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

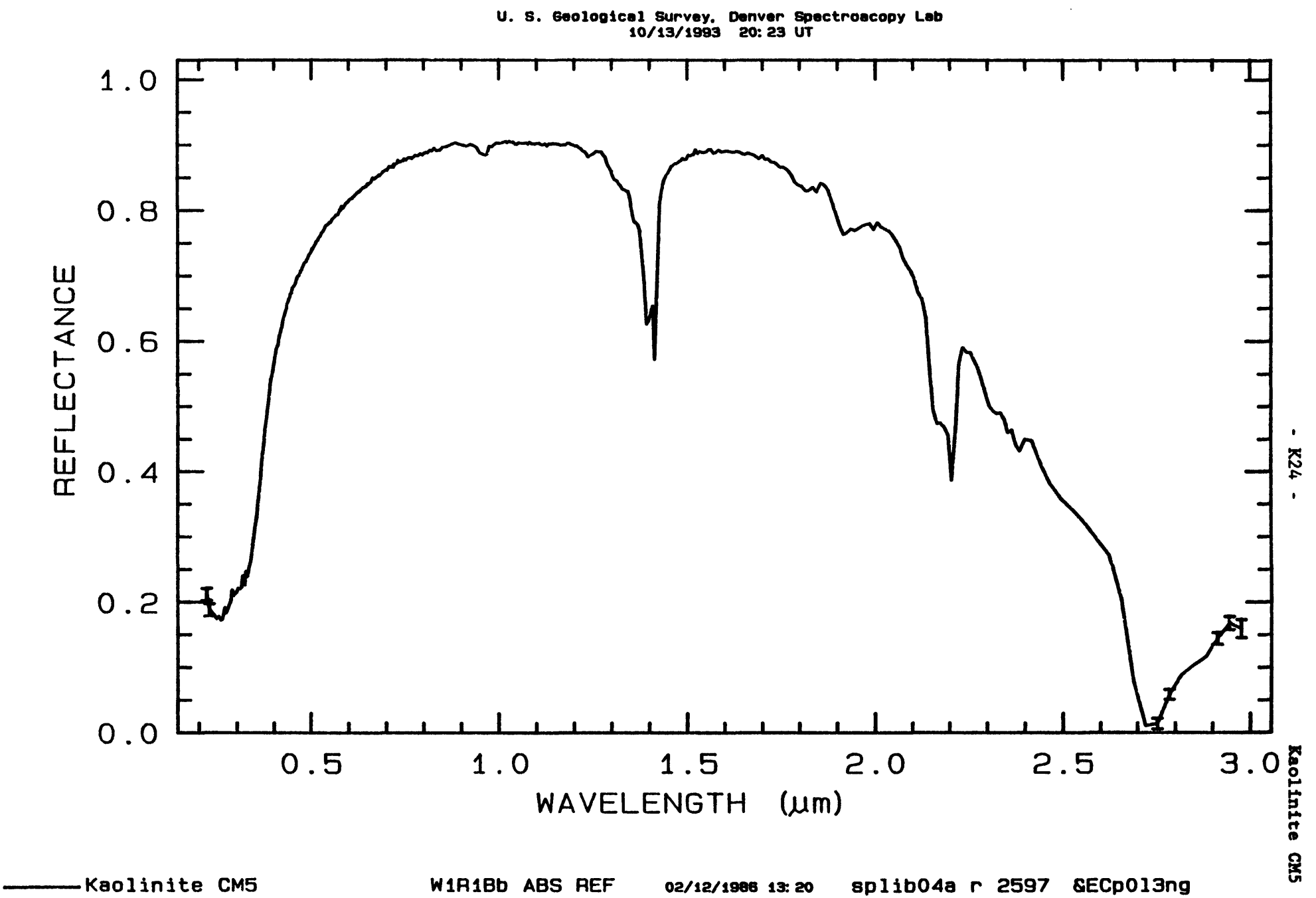
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2597	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K24 -
Kaolinite CM5
Kaolinite CM5
W1R1Bb ABS REF
02/12/1986 13:20
splib04a r 2597 &ECp013ng

TITLE: Kaolinite CM7 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM7

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Bath, South Carolina

ORIGINAL_DONOR: Clay Mineral Standard from Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Dickite, Halloysite, and Nacrite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Disordered kaolinite + tr quartz, same for < 2μm fraction (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	44.6	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	1.43	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	36.4	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.61	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.03	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.14	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.02	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.40	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.11	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	13.6	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	0.61	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	14.2	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	14.0	wt%	NROFF:	LOI
COMPOSITION:	---	---	---		
COMPOSITION:	Total:	98.88	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

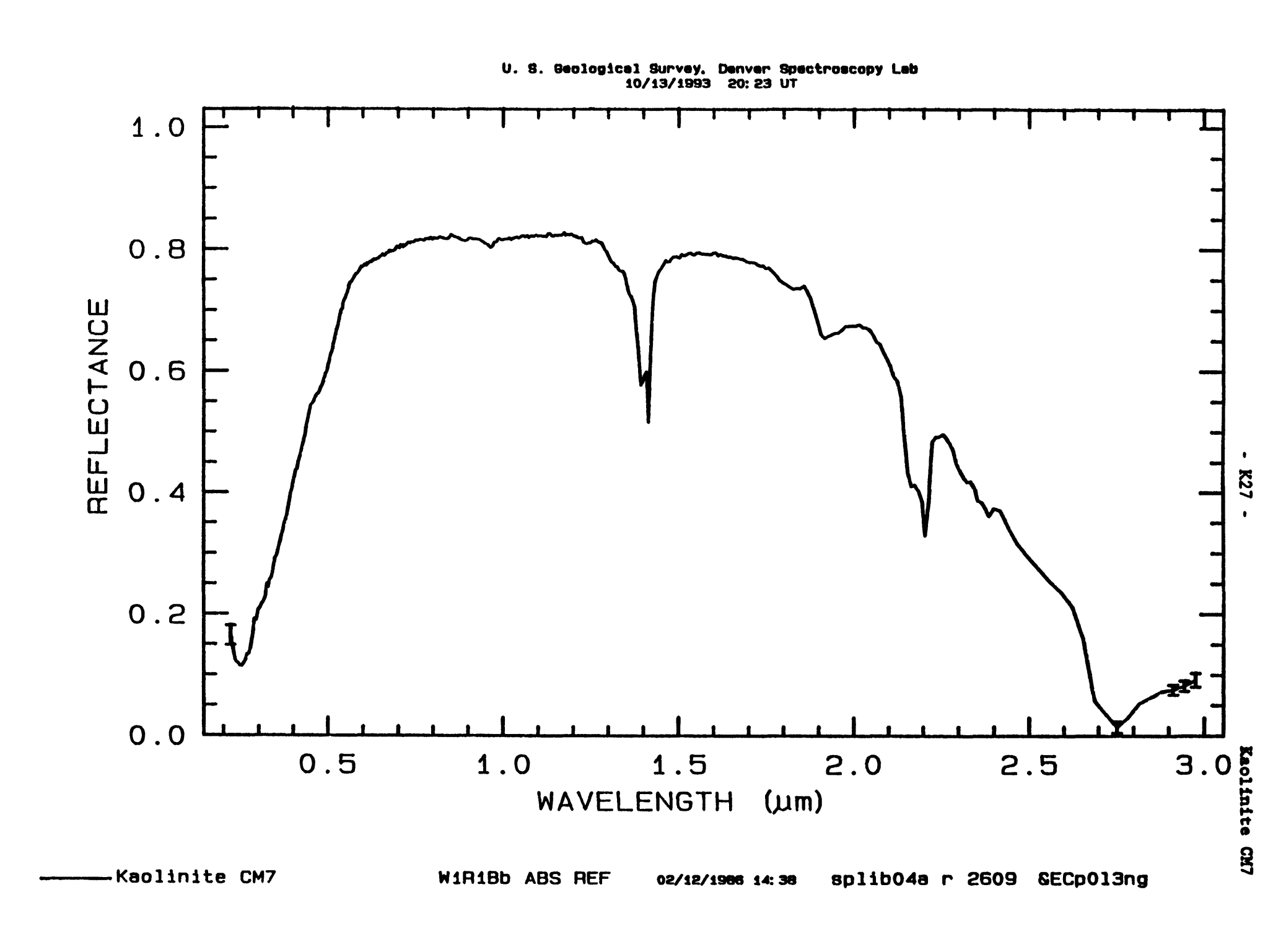
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2609	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K27 -
Kaolinite CM7
Kaolinite CM7
W1R1Bb ABS REF
02/12/1986 14:38
splib04a r 2609 GECp013ng

TITLE: Kaolin/Smectite KLF506 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KLF506

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite/Smectite (95% Kaol.) (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4 + (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$ + $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Paris Basin, France

ORIGINAL_DONOR: Phoebe Hauff, Fred Kruse CSES/CIRES

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Kaolinite/smectite clays are produced as transitional phases as smectite weathers to kaolinite. This sample is from the Argiles Plastique Formation of the Paris Basin. This formation contains a paragentic sequence from smectite to kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

XRD was used to determine the percent kaolinite. This sample is 95% kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

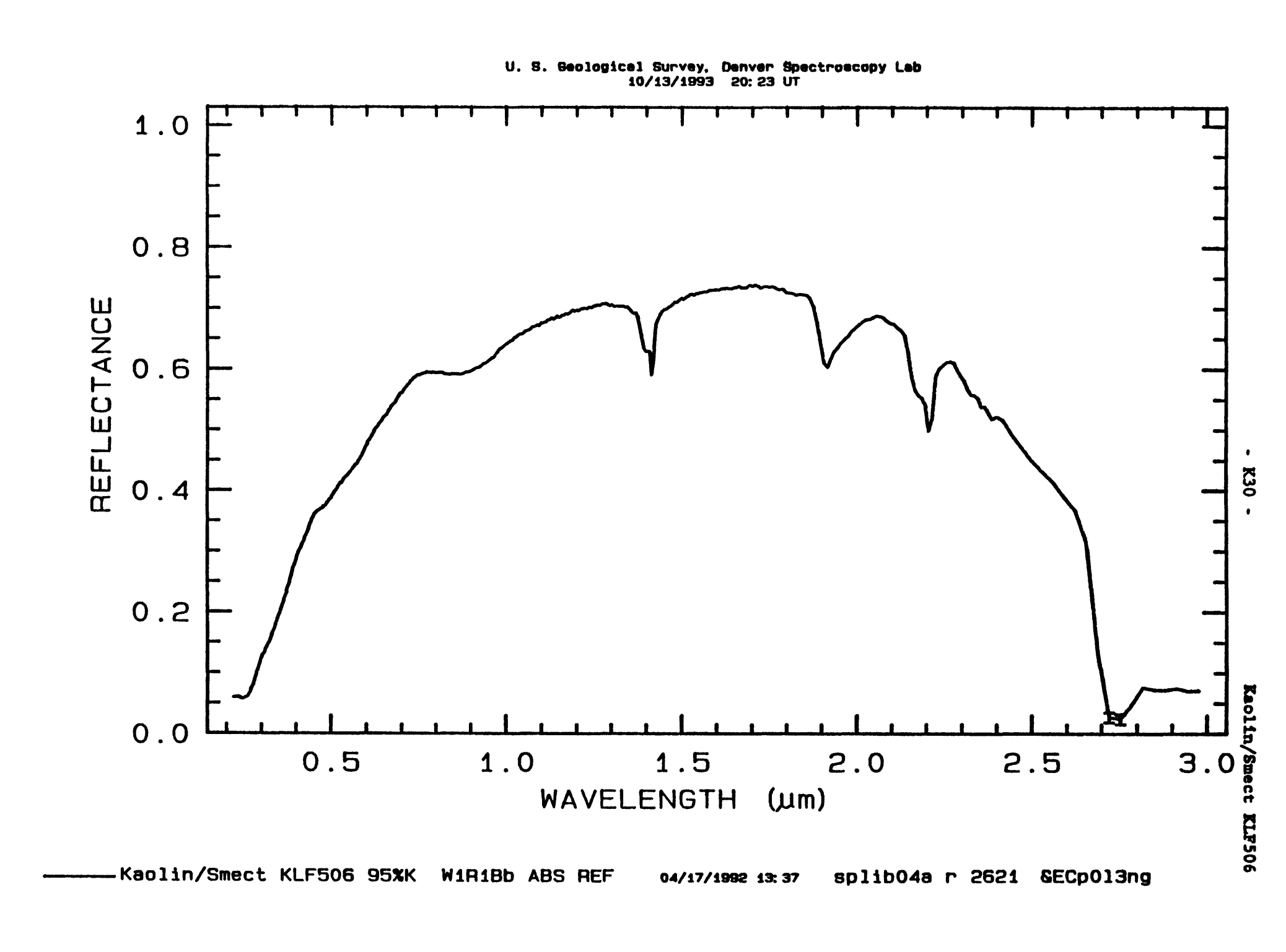
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2621	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K30 -
Kaolin/Smect KLF506
Kaolin/Smect KLF506 95%K W1R1Bb ABS REF 04/17/1992 13:37 splib04a r 2621 &ECp013ng

TITLE: Kaolin/Smectite KLF508 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KLF508

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite/Smectite (85% Kaol.) (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4 + (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$ + $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Paris Basin, France

ORIGINAL_DONOR: Phoebe Hauff, Fred Kruse CSES/CIRES

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Kaolinite/smectite clays are produced as transitional phases as smectite weathers to kaolinite. This sample is from the Argiles Plastique Formation of the Paris Basin. This formation contains a paragentic sequence from smectite to kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

XRD was used to determine the percent kaolinite. This sample is 85% kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

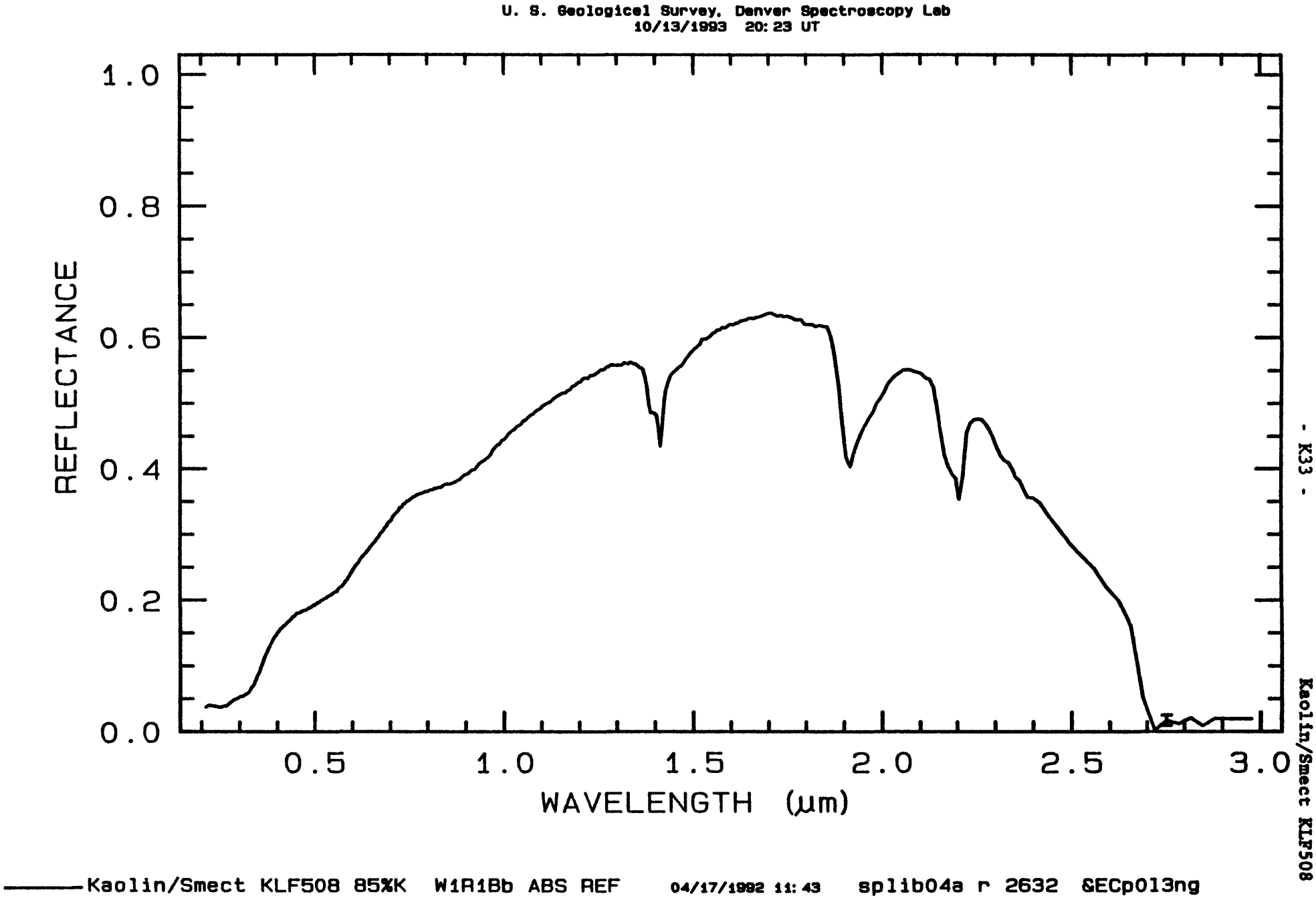
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2632	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K33 -
Kaolin/Smect KLF508
Kaolin/Smect KLF508 85%K W1R1Bb ABS REF 04/17/1992 11:43 splib04a r 2632 &ECp013ng

TITLE: Kaolin/Smectite H89-FR-2 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: H89-FR-2

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite/Smectite (50% Kaol.)(Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4 + (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4 + (Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Paris Basin, France

ORIGINAL_DONOR: Phoebe Hauff, Fred Kruse CSES/CIRES

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Kaolinite/smectite clays are produced as transitional phases as smectite weathers to kaolinite. This sample is from the Argiles Plastique Formation of the Paris Basin. This formation contains a paragentic sequence from smectite to kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

XRD was used to determine the percent kaolinite. In this case, the sample is 50% kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

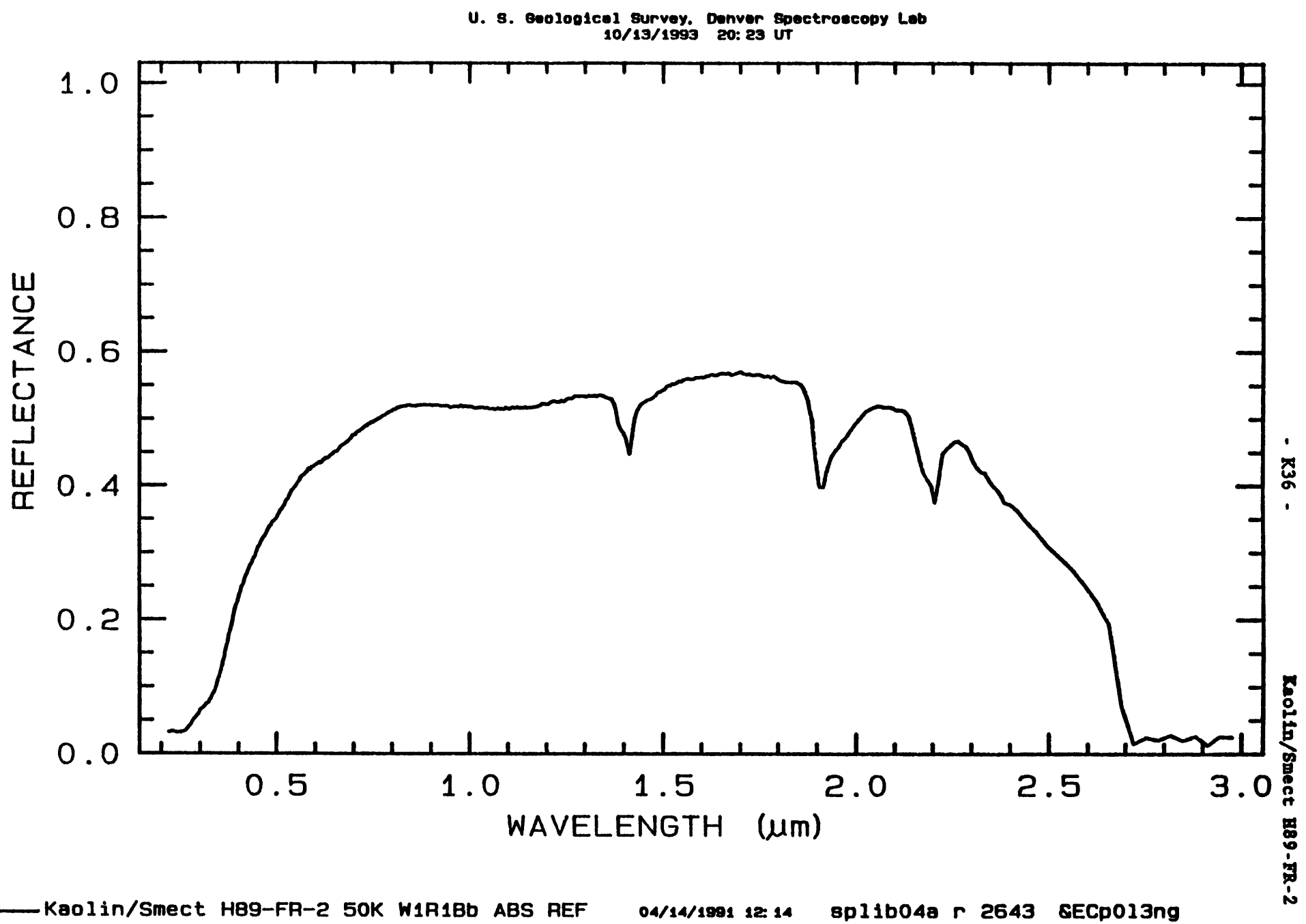
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2643	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K36 -
Kaolin/Smect H89-FR-2
Kaolin/Smect H89-FR-2 50K W1R1Bb ABS REF 04/14/1991 12:14 splib04a r 2643 GECp013ng

TITLE: Kaolin/Smectite H89-FR-5 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HR89-FR-5

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite/Smectite (30% Kaol.) (Montmorillonite group)

FORMULA: Al2Si2O5(OH)4 + (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$ + $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Paris Basin, France

ORIGINAL_DONOR: Phoebe Hauff, Fred Kruse CSES/CIRES

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Kaolinite/smectite clays are produced as transitional phases as smectite weathers to kaolinite. This sample is from the Argiles Plastique Formation of the Paris Basin. This formation contains a paragentic sequence from smectite to kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

XRD was used to determine the percent kaolinite. This sample is 30% kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

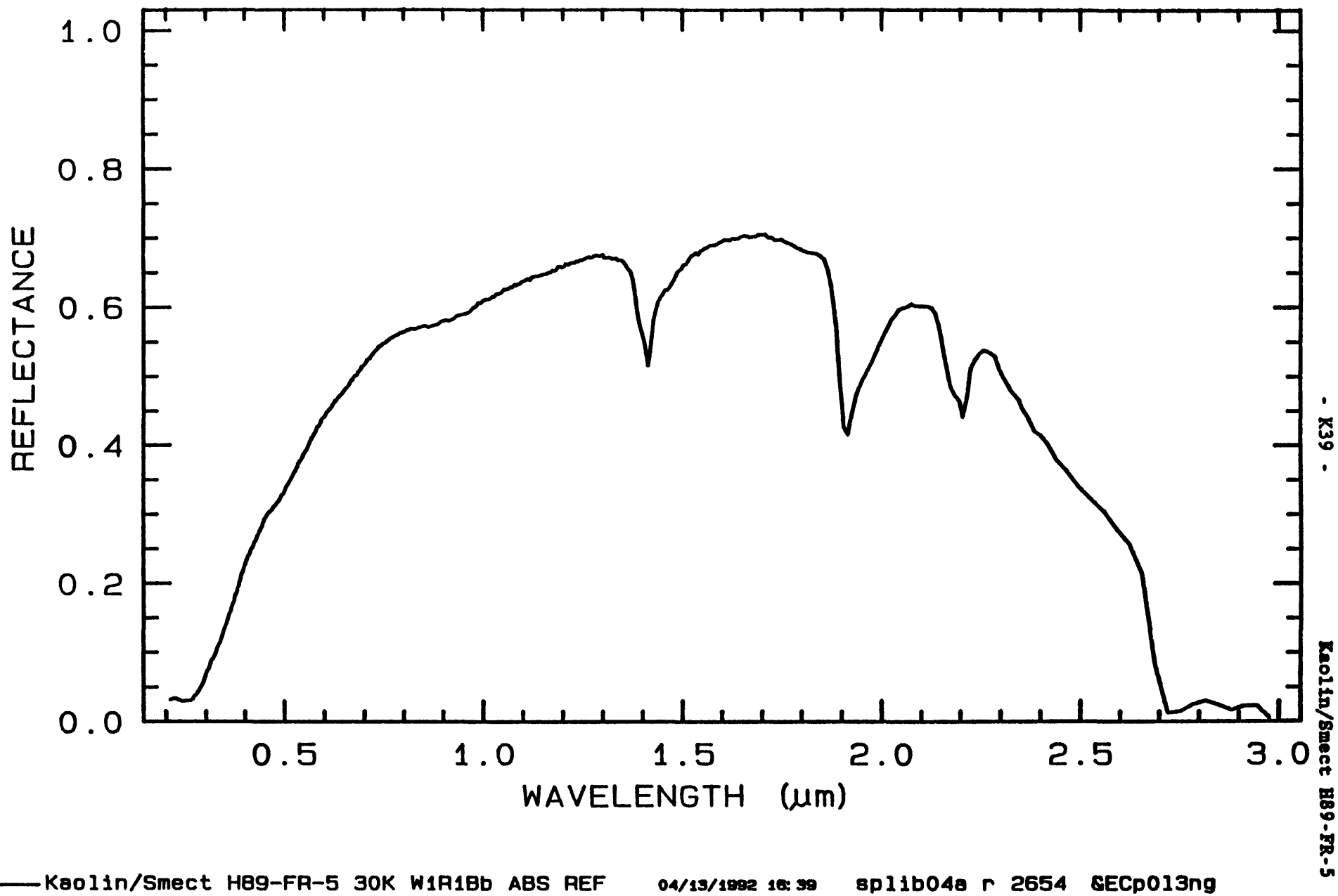
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2654	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
1.0
0.8
0.6
0.4
0.2
0.0
REFLECTANCE
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K39 -
Kaolin/Smect H89-FR-5
Kaolin/Smect H89-FR-5 30K W1R1Bb ABS REF 04/13/1992 16:39 splib04a r 2654 GECp013ng

TITLE: Kaolin/Smectite KLF511 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KLF511

MINERAL_TYPE: Phyllosilicate

MINERAL: Kaolinite/Smectite (12% Kaol.) (Montmorillonite group)

FORMULA: Al2Si2O5(OH)4 + (Na,Ca)0.33(Al,Mg)2Si4O10*nH2O

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$ + $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}{\bullet}nH_2O$

COLLECTION_LOCALITY: Paris Basin, France

ORIGINAL_DONOR: Phoebe Hauff, Fred Kruse CSES/CIRES

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

Kaolinite/smectite clays are produced as transitional phases as smectite weathers to kaolinite. This sample is from the Argiles Plastique Formation of the Paris Basin. This formation contains a paragentic sequence from smectite to kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

XRD was used to determine the percent kaolinite. This sample is 12% kaolinite.

Hauff, P.L., F.A. Kruse, and Medard Thiry, 1990, Spectral identification and characterization of kaolinite/smectite clays in weathering environments. Proceedings of the Fifth Australian Remote Sensing Conference, Perth, Australia, pp. 898-905.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

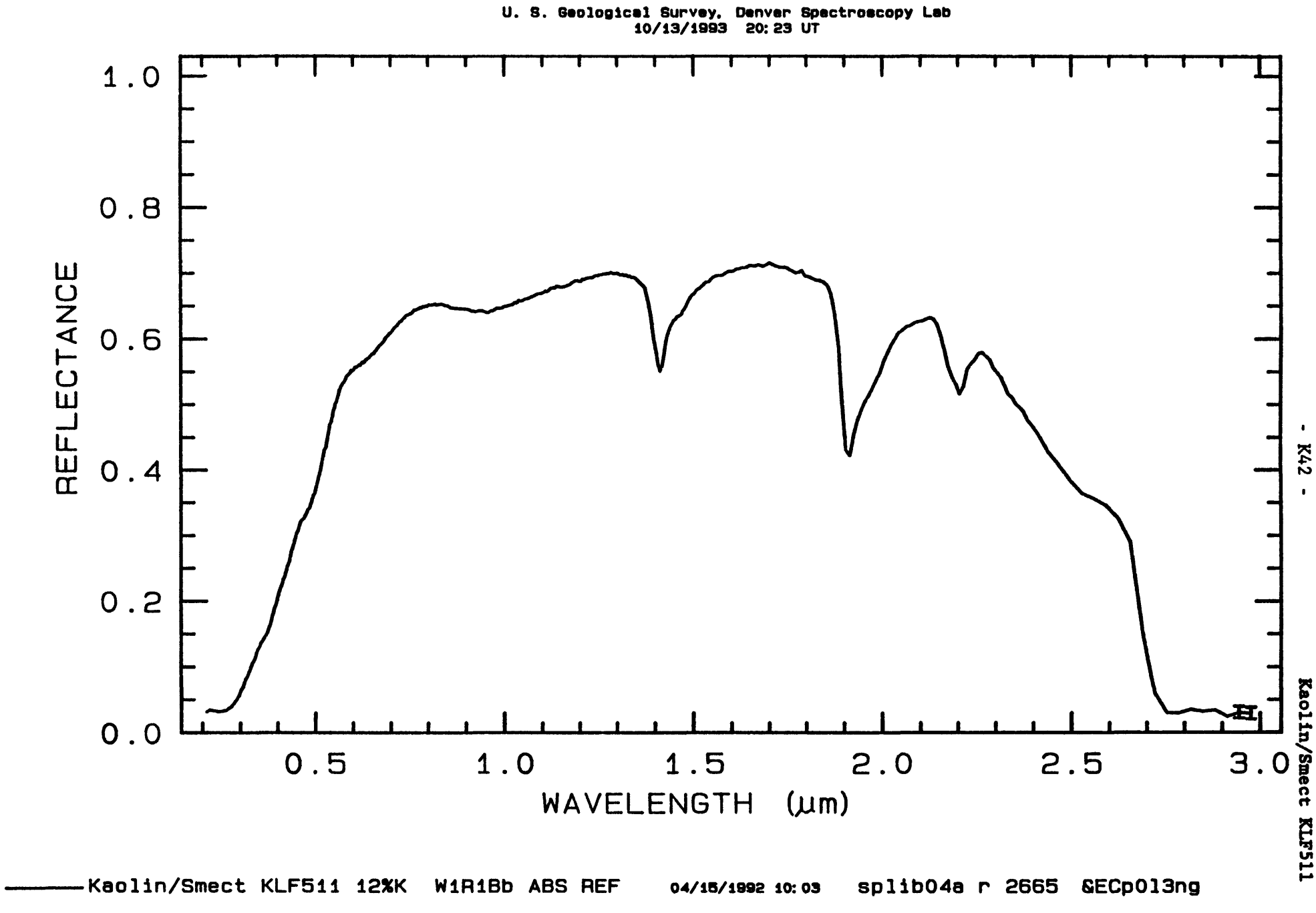
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2665	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 20:23 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- K42 -
Kaolin/Smect KLF511
Kaolin/Smect KLF511 12%K W1R1Bb ABS REF 04/15/1992 10:03 splib04a r 2665 &ECp013ng

TITLE: Kerogen BK-Cornell DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: BK-

MINERAL_TYPE: Organic

MINERAL: Kerogen

FORMULA: Unknown

FORMULA_NROFF: Unknown

COLLECTION_LOCALITY: Unknown

ORIGINAL_DONOR: Unknown

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Insoluble coal-tar residue.

Cruikshank, Dale P., Dark Matter in the Solar System, paper presented at COSPAR, July, 1986.

Cruikshank, Dale P., Clark, Roger N., Salisbury, Jack, & others, in prep.

C.N. Matthews, R. Ludicky, J. Schaefer, E.O. Stejskal, and R.A. McKay, Heteropolypeptides from hydrogen cyanide and water? Solid state 15/N NMR Investigations, Origins of Life 14, 243 (1984).

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2675	0.2-3.0μm	200	g.s.=

The U. S. Geological Survey, Digital Spectral Library: Version 1: 0.2 to 3.0 μm

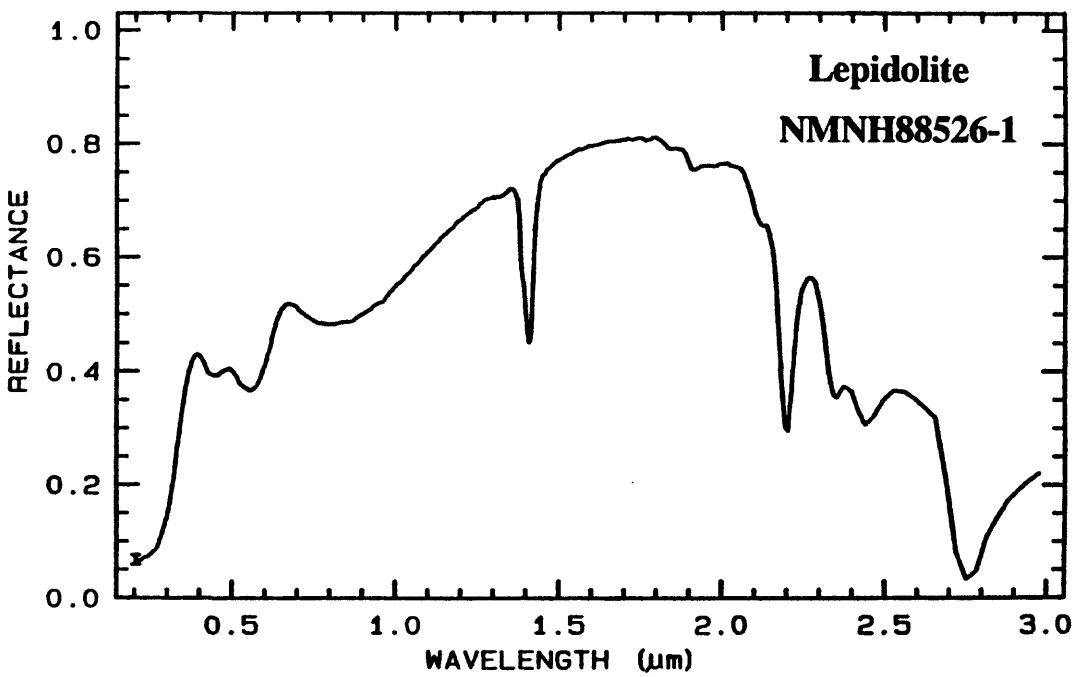
Roger N. Clark, Gregg A. Swayze, Andrea J. Gallagher,

Trude V.V. King, and Wendy M. Calvin

U.S. Geological Survey

Open File Report 93-592

1993



Volume 3: L - P

TITLE: Labradorite HS105 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS105

MINERAL_TYPE: Tectosilicate

MINERAL: Labradorite (Plagioclase)(Feldspar group)

FORMULA: (NaAlSi,CaAl2)Si2O8

FORMULA_NROFF: $(NaAlSi,CaAl_2)Si_2O_8$

COLLECTION_LOCALITY: Essex County, New York

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Part of the albite-anorthite solid solution series.

Sieve interval 74 - 250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

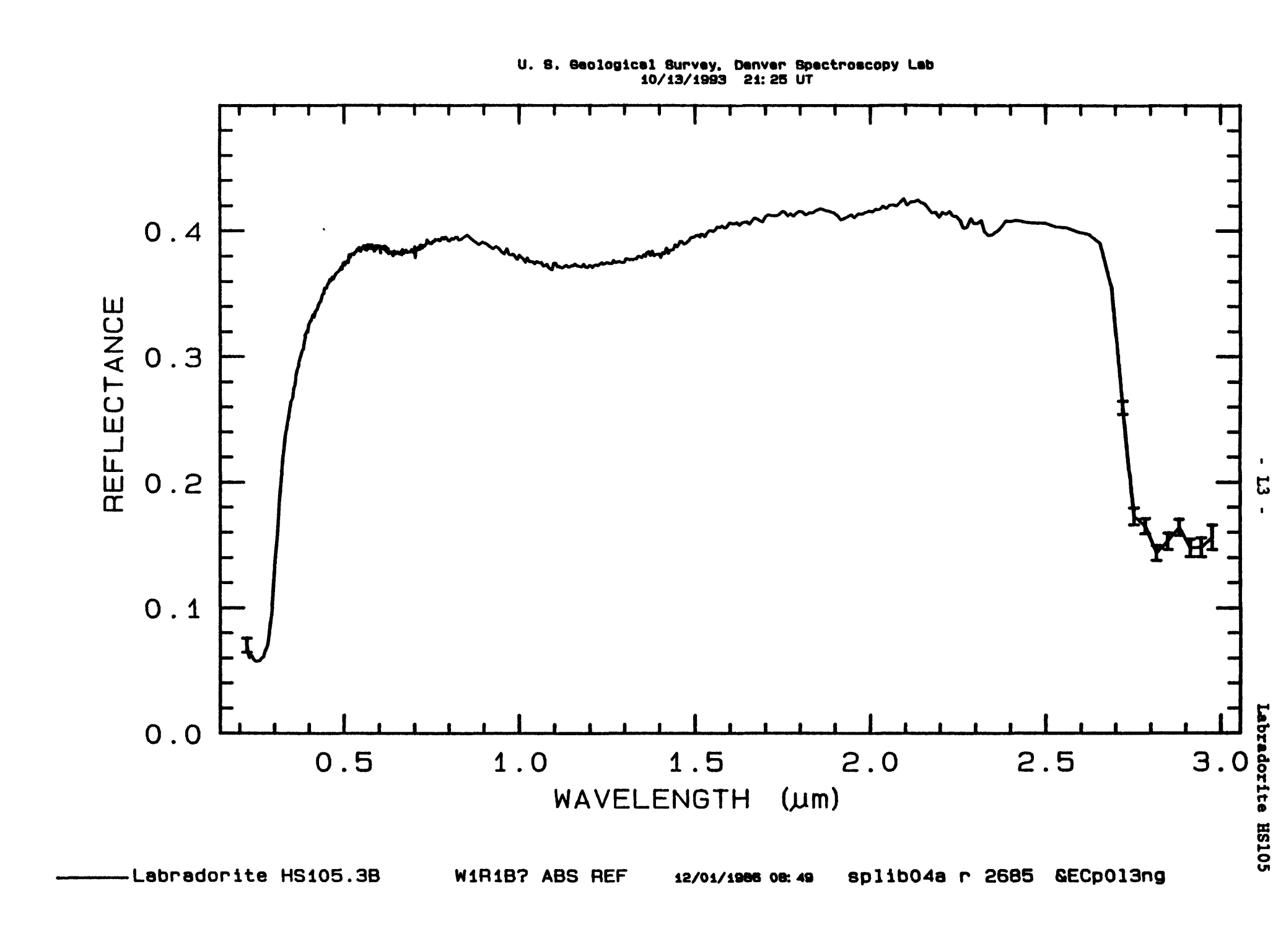
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2685	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:25 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Labradorite HS105.3B W1R1B? ABS REF 12/01/1986 08:49 splib04a r 2685 &ECp013ng
Labradorite HS105

TITLE: Labradorite HS17 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS17

MINERAL_TYPE: Tectosilicate

MINERAL: Labradorite (Plagioclase)(Feldspar group)

FORMULA: (NaAlSi,CaAl2)Si2O8

FORMULA_NROFF: $(NaAlSi,CaAl_2)Si_2O_8$

COLLECTION_LOCALITY: Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"T-10 Labradorite 17B--Ontario. This plagioclase feldspar is composed of 30 to 50% albite. The spectrum of this sample is relatively flat and has a low reflectivity caused by the presence of magnetite as a microscopic disseminated impurity. We cannot account specifically for the maximum in reflectivity near 1.0μ in this spectrum. It is due to exceptionally broad, very weak absorptions on either side."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Labradorite + 6.25, 6.34 Angstroms (small amount) (Norma Vergo, USGS)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

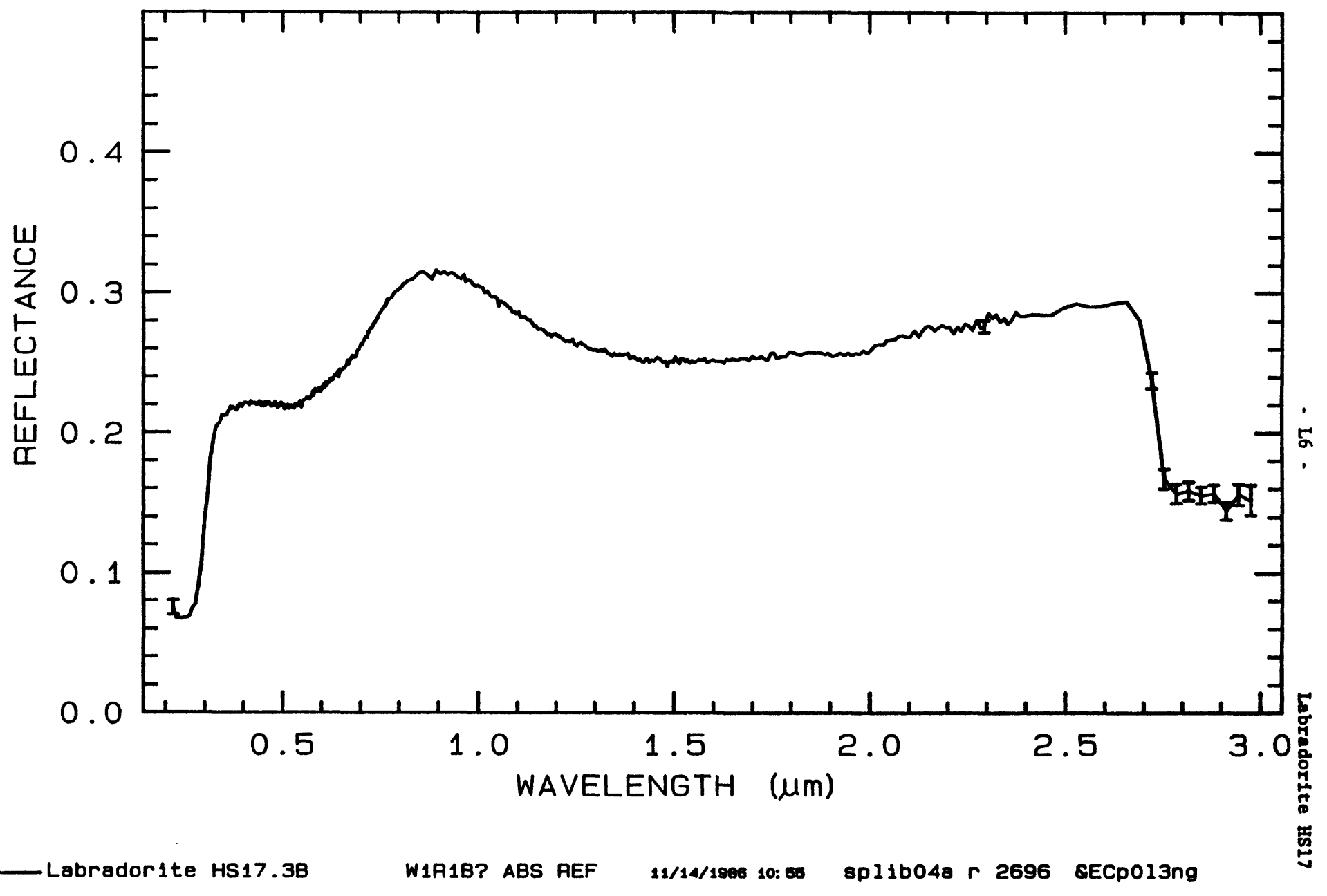
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2696	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:25 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 16 -
Labradorite HS17
Labradorite HS17.3B W1R1B? ABS REF 11/14/1986 10:55 splib04a r 2696 GECp013ng

TITLE: Laumontite GDS5 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS5

MINERAL_TYPE: Tectosilicate

MINERAL: Laumontite (Zeolite group)

FORMULA: CaAl2Si4O12*4H2O

FORMULA_NROFF: $CaAl_2Si_4O_{12} \bullet 4H_2O$

COLLECTION_LOCALITY: Poona, India

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample appears white and to be spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Laumontite - primary component. Possibly some boehmite

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

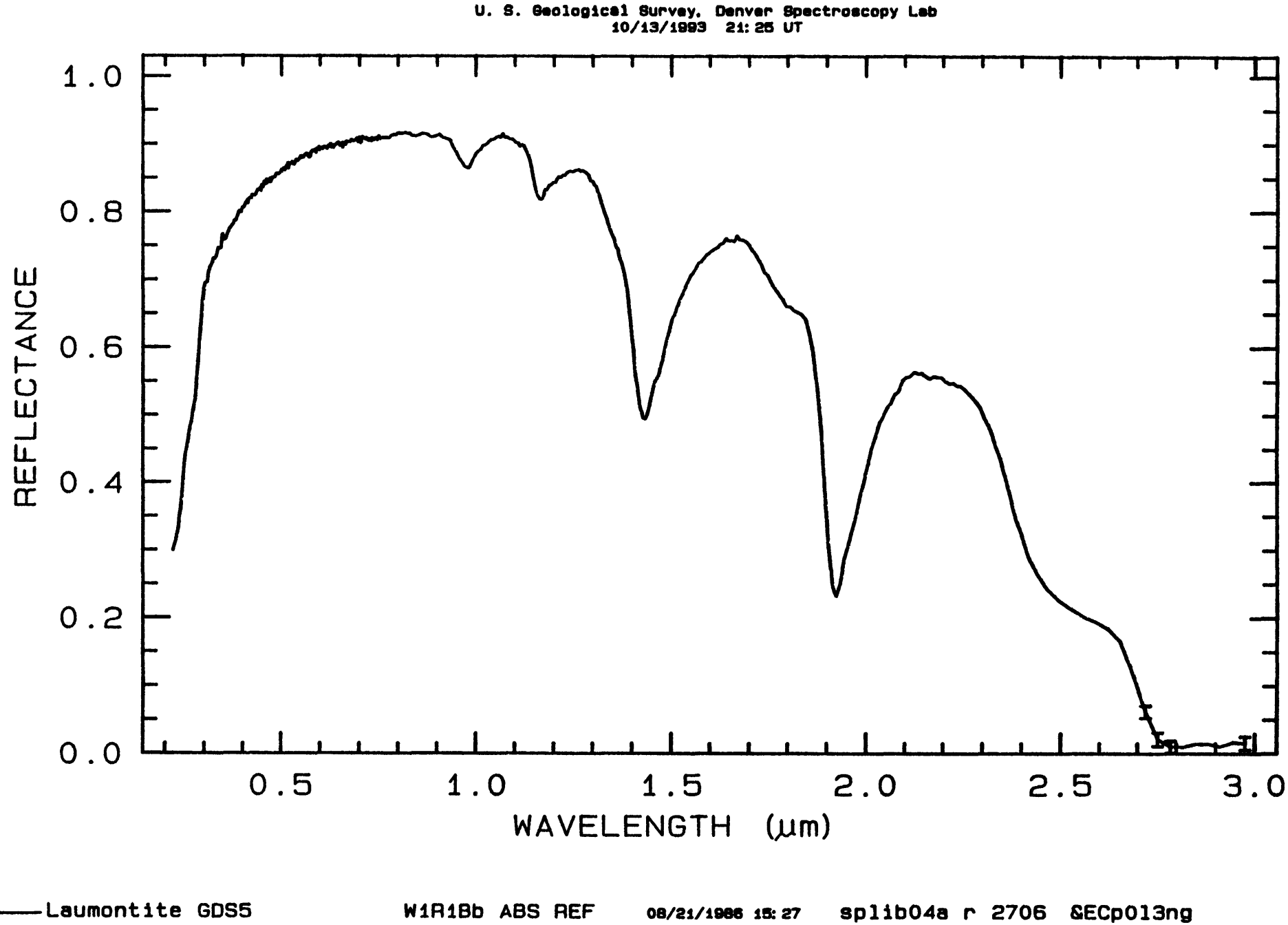
MICROSCOPIC_EXAMINATION:

TBD

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2706	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:25 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Laumontite GDS5
W1R1Bb ABS REF 08/21/1986 15:27 splib04a r 2706 &ECp013ng

TITLE: Lazurite HS418 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS418

MINERAL_TYPE: Tectosilicate

MINERAL: Lazurite (Lapis Lazuli) (Sodalite group)

FORMULA: (Na,Ca)7-8(Al,Si)12(O,S)24[(SO4),Cl2,(OH)2]

FORMULA_NROFF: $(Na,Ca)_{7-8}(Al,Si)_{12}(O,S)_{24}[(SO_4),Cl_2,(OH)_2]$

COLLECTION_LOCALITY: Chile

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

$(Na,Ca)_{7-8}(Al,Si)_{12}(O,S)_{24}[(SO_4),Cl_2Cl_2,(OH)_2(OH)_2]$
Beautiful blue.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

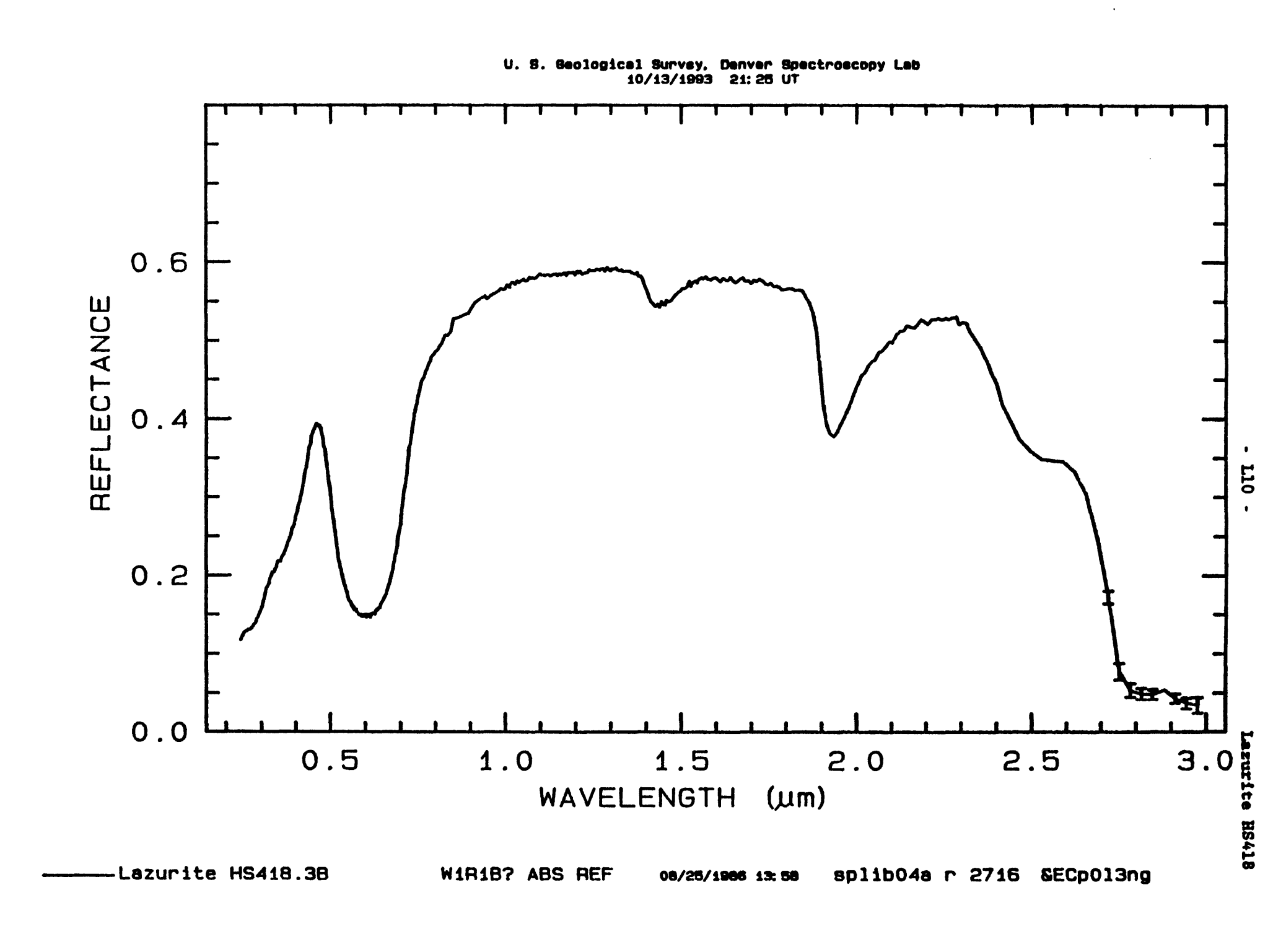
None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:
description goes here.
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2716	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:26 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 110 -
Lazurite HS418
Lazurite HS418.3B W1R1B? ABS REF 08/25/1986 13:58 splib04a r 2716 &ECp013ng

TITLE: Lepidocrosite GDS80 (Sy) DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS80

MINERAL_TYPE: Hydroxide

MINERAL: Lepidocrosite (Synthetic)

FORMULA: gamma-FeO(OH)

FORMULA_NROFF: γ-FeO(OH)

COLLECTION_LOCALITY:

ORIGINAL_DONOR: Dave Sherman

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Akaganeite, Feroxyhyte, and Geothite.

"This sample was synthesized by aerial oxidation of a $FeCl_2$ solution at a pH or 6-7. The X ray dirffration pattern of this sample was extremely well-defined, implying a high degree of crystallinity."

The above description may apply to this sample. This sample was one of a series of samples made for the following paper:

Sherman, D.M., R.G. Burns, and V.M. Burns, 1982, Spectral characteristics of the iron oxides with application to the Martian bright region mineralogy. Journal of Geophysical Research, v. 87, n. B12, pp. 10169-10180.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

FeO(OH) - (lepidocrosite, goethite) - major component
Marcasite - possible small amount
Other unidentifiable residuals

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

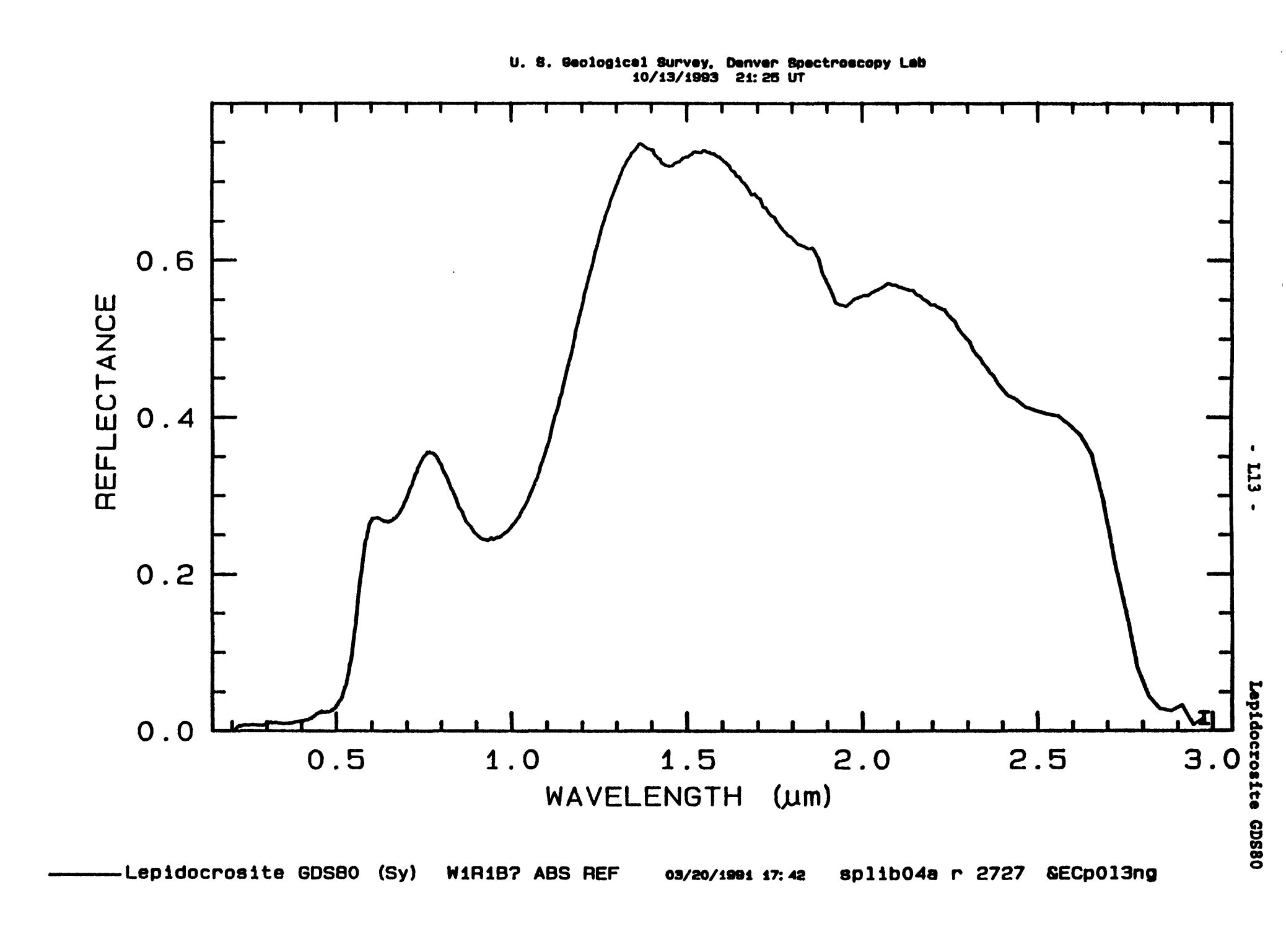
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2727	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:25 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- 113 -
Lepidocrosite GDS80
Lepidocrosite GDS80 (Sy) W1R1B? ABS REF 03/20/1991 17:42 splib04a r 2727 &ECp013ng

TITLE: Lepidolite HS167 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS167

MINERAL_TYPE: Phyllosilicate

MINERAL: Lepidolite (Mica group)

FORMULA: K(Li,Al)3(Si,Al)4O10(F,OH)2

FORMULA_NROFF: $K(Li,Al)_3(Si,Al)_4O_{10}(F,OH)_2$

COLLECTION_LOCALITY: Keystone, S. Dakota

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Original Spectrum published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

With the note:"In addition to the substitutions given in the general formula for lepidolite, considerable amounts of sodium, rubidium and cesium may substitute for potassium; and iron, manganese and magnesium may substitute for aluminum. It is the substituted ferric iron and manganese that give rise to the bands at 0.8μ, 0.55 μ, and 0.45μ, together with the drop off to the extreme blue. The band near 1.4μ is due to the overtone of the OH stretching fundamental, and the very weak band at 1.9μ indicates that a small amount of included water is present. The bands near 2.2μ, 2.35μ, and 2.45μ are also due to combination bands involving the OH stretch and possibly the Al-O-H bending mode (at 2.2μ) as discussed above, and the very weak bands at 1.28μ, 1.33μ, 2.03μ and 2.14μ are OH combined with lattice modes."

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

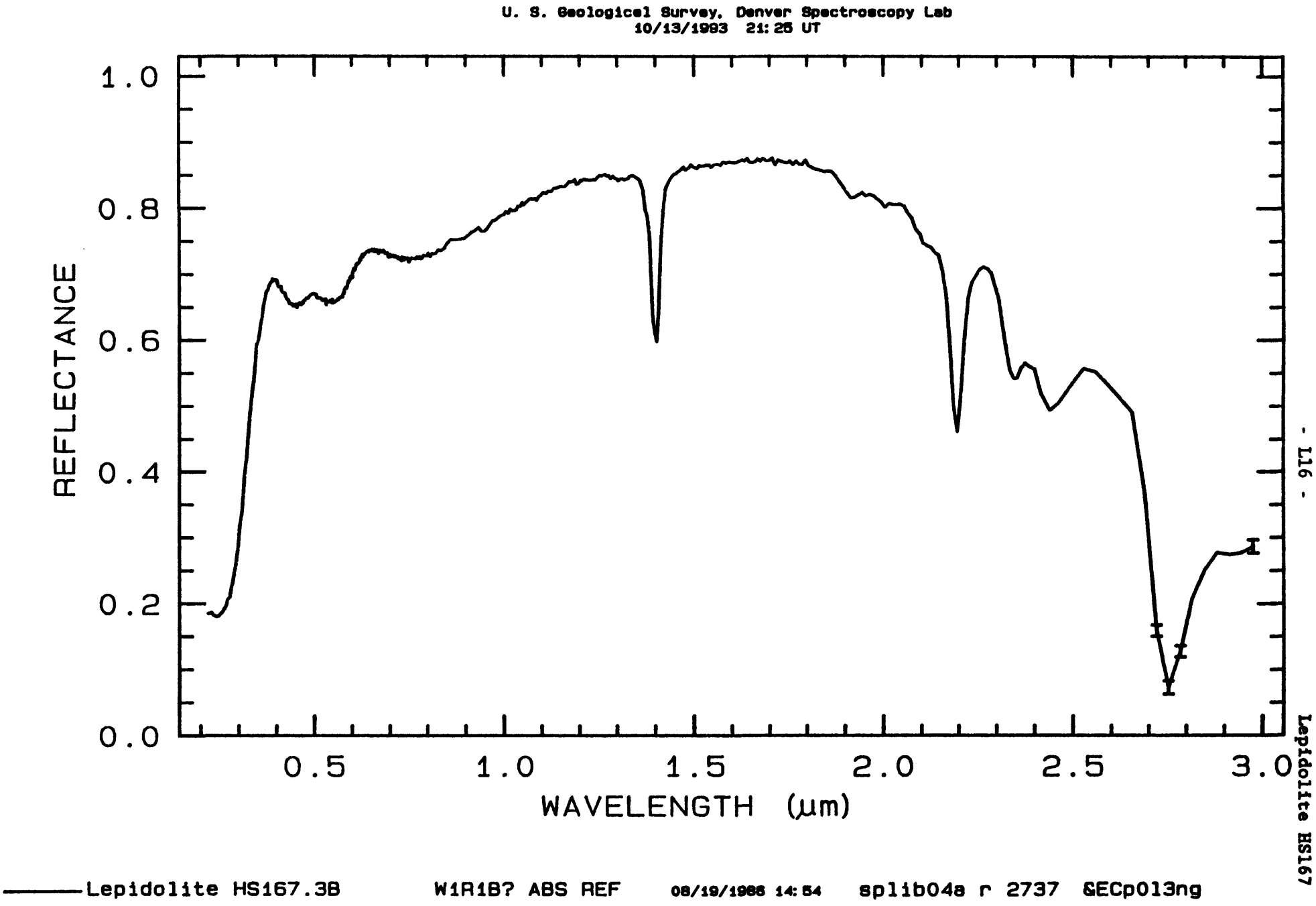
None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:
description goes here.
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2737	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:25 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- LL6 -
Lepidolite HS167
Lepidolite HS167.3B W1R1B? ABS REF 08/19/1986 14:54 splib04a r 2737 &ECp013ng

TITLE: Lepidolite NMNH105538 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH105538

MINERAL_TYPE: Phyllosilicate

MINERAL: Lepidolite (Mica group)

FORMULA: K(Li,Al)3(Si,Al)4O10(F,OH)2

FORMULA_NROFF: $K(Li,Al)_3(Si,Al)_4O_{10}(F,OH)_2$

COLLECTION_LOCALITY: Stewart Mine, San Diego County, California

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Pink, lilac and gray mica.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

None

COMPOSITION_DISCUSSION:

None

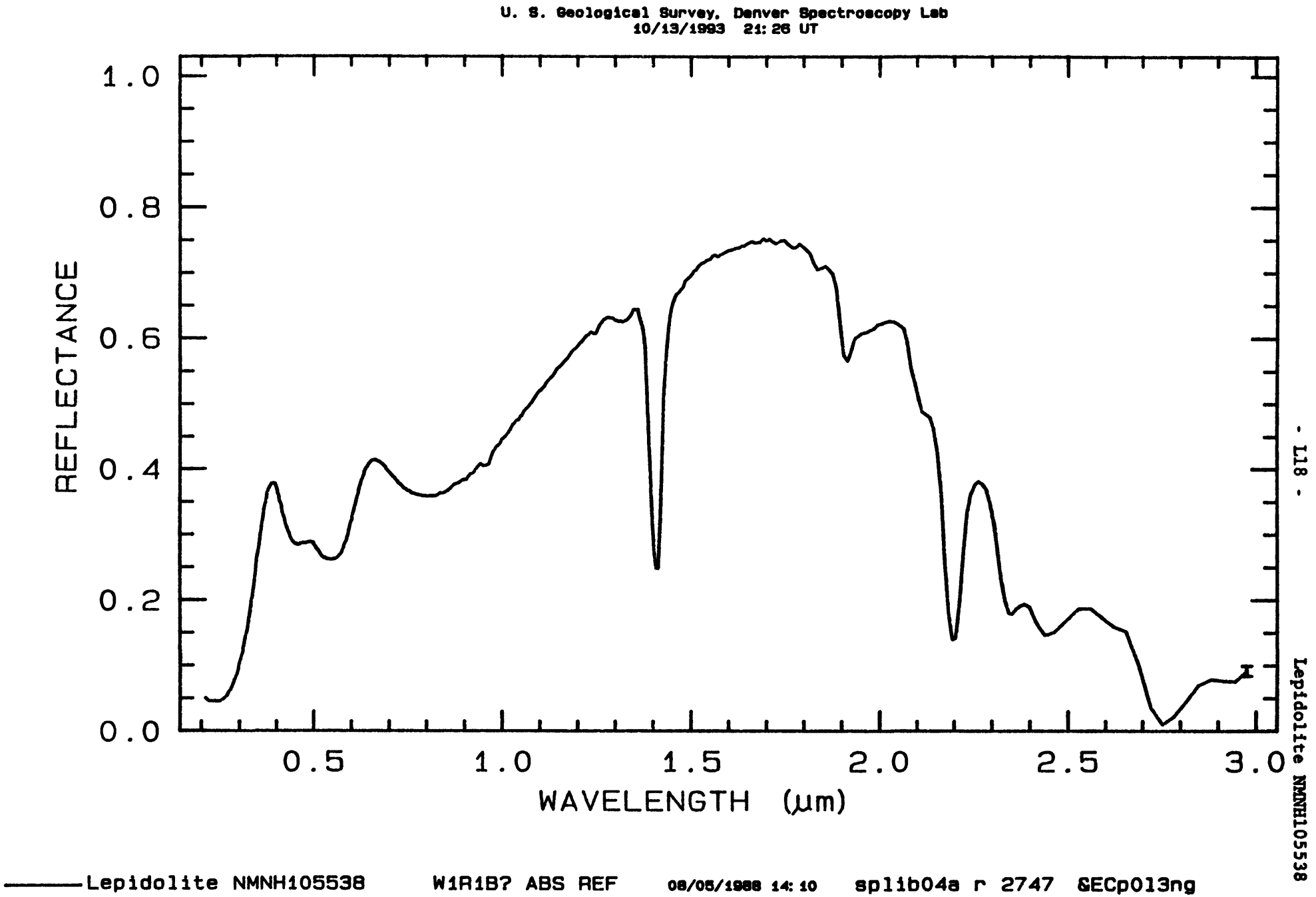
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2747	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:26 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 118 -
Lepidolite NMNH105538
Lepidolite NMNH105538 W1R1B? ABS REF 08/05/1988 14:10 splib04a r 2747 &ECp013ng

TITLE: Lepidolite NMNH105543 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH105543

MINERAL_TYPE: Phyllosilicate

MINERAL: Lepidolite (Mica group)

FORMULA: K(Li,Al)3(Si,Al)4O10(F,OH)2

FORMULA_NROFF: $K(Li,Al)_3(Si,Al)_4O_{10}(F,OH)_2$

COLLECTION_LOCALITY: Madagascar

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Pink, lilac and gray mica.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Trioctahedral mica
Probably a mixture of several...best matches are taeniolite and phlogopite, but not definitive

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

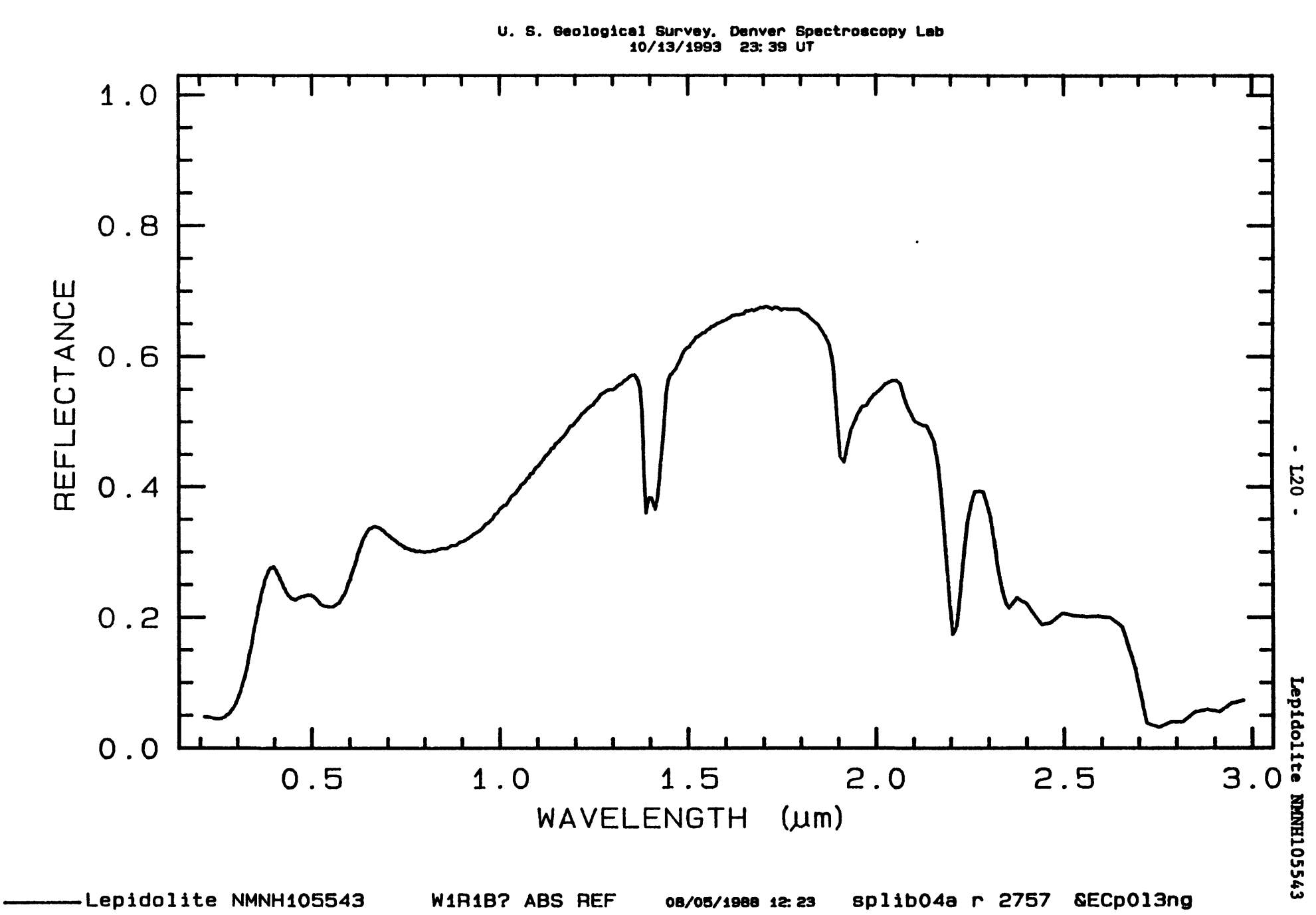
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2757	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 23:39 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 120 -
Lepidolite NMNH105543
Lepidolite NMNH105543 W1R1B? ABS REF 08/05/1988 12:23 splib04a r 2757 &ECp013ng

TITLE: Lepidolite NMNH88526-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH88526-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Lepidolite (Mica group)

FORMULA: K(Li,Al)3(Si,Al)4O10(F,OH)2

FORMULA_NROFF: $K(Li,Al)_3(Si,Al)_4O_{10}(F,OH)_2$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: National Musuem of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure

(Jim Crowley, 1993, written communicaton.)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

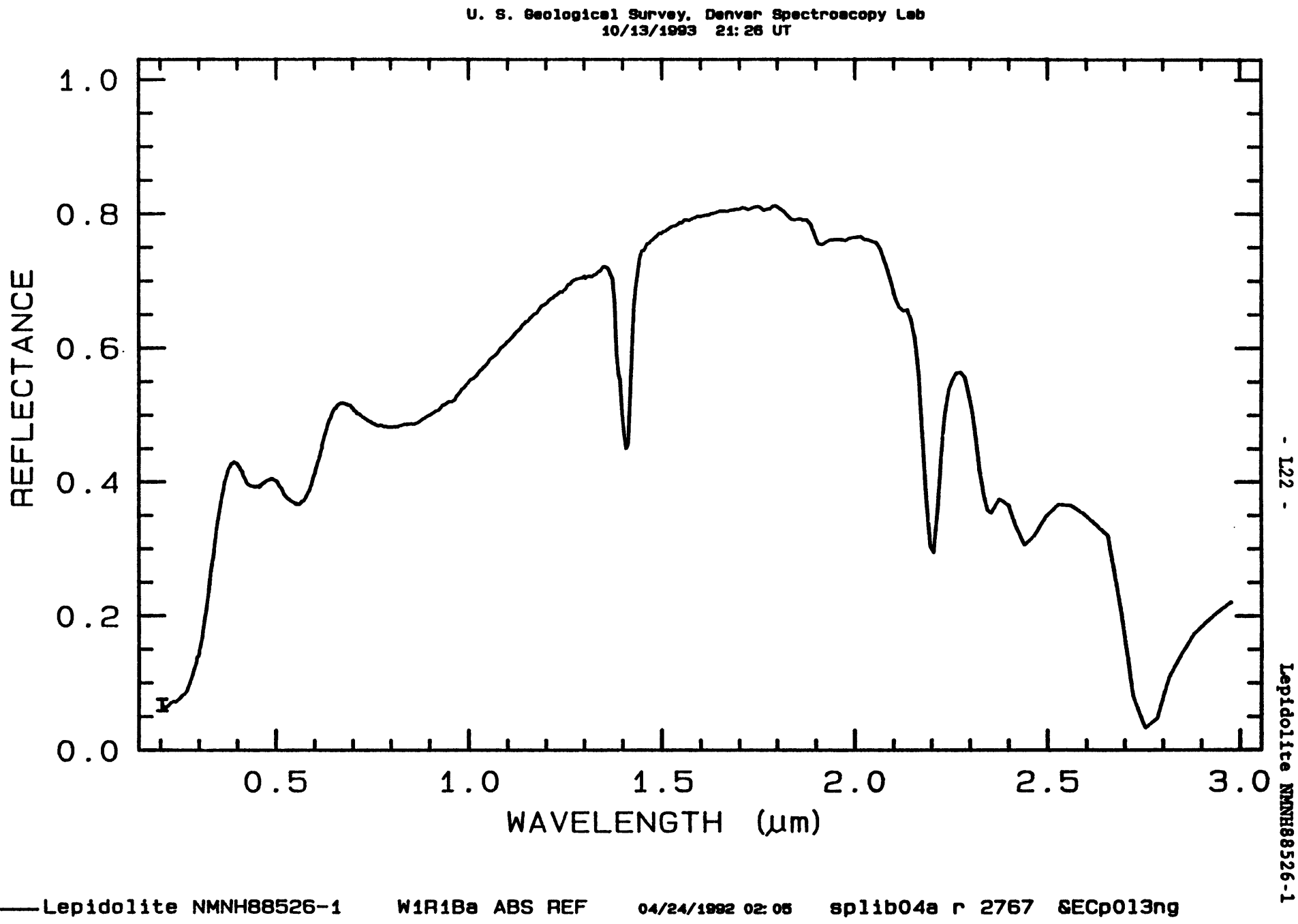
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2767	0.2-3.0μm	200	g.s.=



Lepidolite NMNH88526-1

TITLE: Lepidolite NMNH105541 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH105541

MINERAL_TYPE: Phyllosilicate

MINERAL: Lepidolite (Mica group)

FORMULA: K(Li,Al)3(Si,Al)4O10(F,OH)2

FORMULA_NROFF: $K(Li,Al)_3(Si,Al)_4O_{10}(F,OH)_2$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

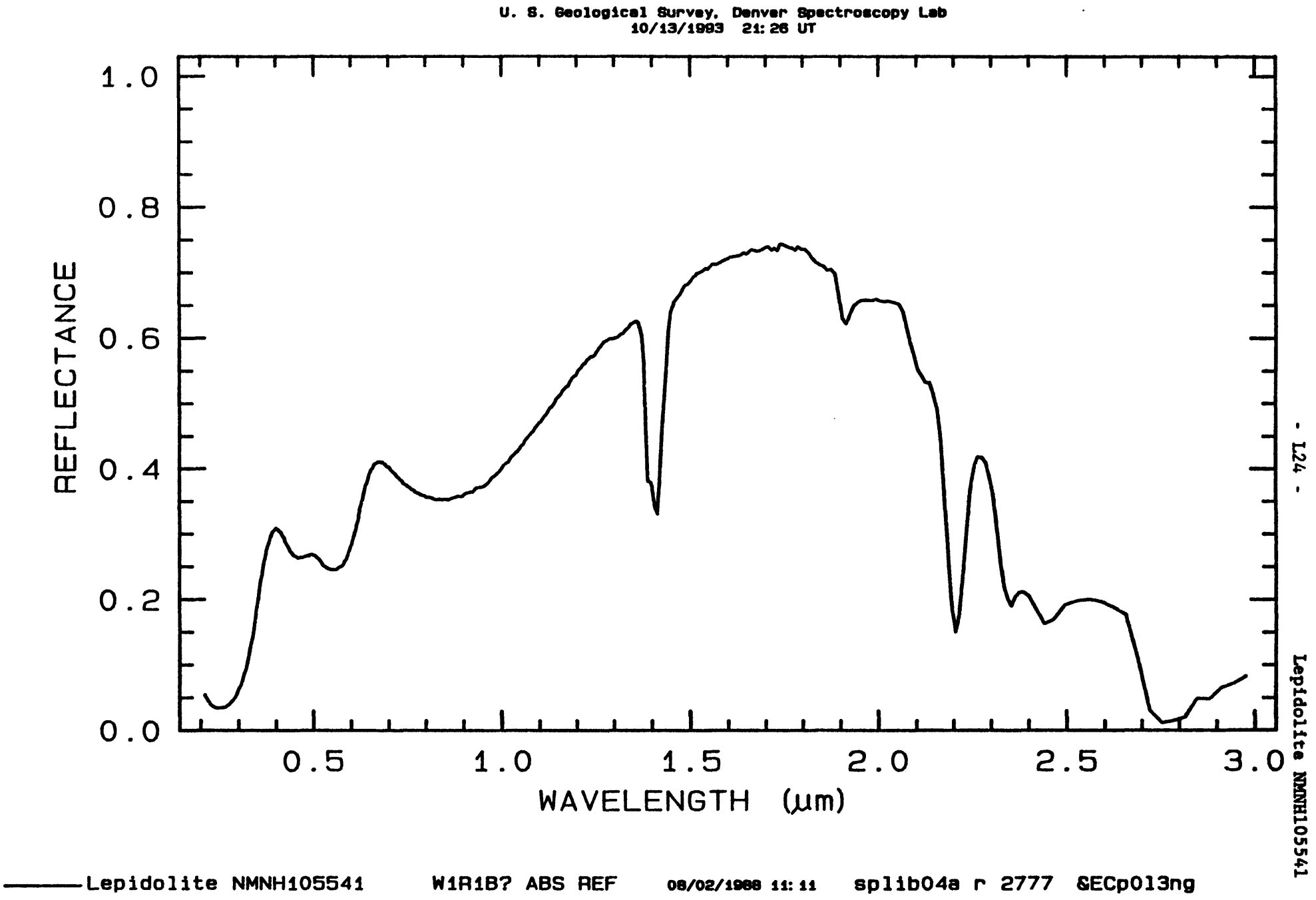
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2777	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:26 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Lepidolite NMNH105541
Lepidolite NMNH105541 W1R1B? ABS REF 08/02/1988 11:11 splib04a r 2777 &ECp013ng

TITLE: Limonite HS41 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS41

MINERAL_TYPE: Hydroxide

MINERAL: Limonite (mixture of hydrated lepidocrocite, goethite, and hematite)

FORMULA: FeO*OH*nH2O

FORMULA_NROFF: $FeO \bullet OH \bullet nH_2O$

COLLECTION_LOCALITY: Tuscaloosa County, Alabama

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Original spectrum published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

With the note:"Much limonite is actually cryptocrystalline goethite or lepidocrocite along with along with hematite, and additional water in some form. Colloidal silica, organic material, phosphates and clay minerals are also often present. Consequently, the name limonite is usually used as a field term for poorly characterized hydrated ferric oxide material. The water content of limonite is variable, but it typically contains 12% to 14% water by weight (Deer et al., 1962). This particular sample displays the change from opaque to transparent behavior near 0.55μm, and the band near 0.9μm typical of the ferric oxides. Because this sample is more transparent, these features are much more clearly resolved here. It also shows quite clearly the water of hydration bands near 1.4 and 1.9 μm for the larger particle size samples."

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Goethite - major
Unidentifiable residual
No evidence of hematite

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

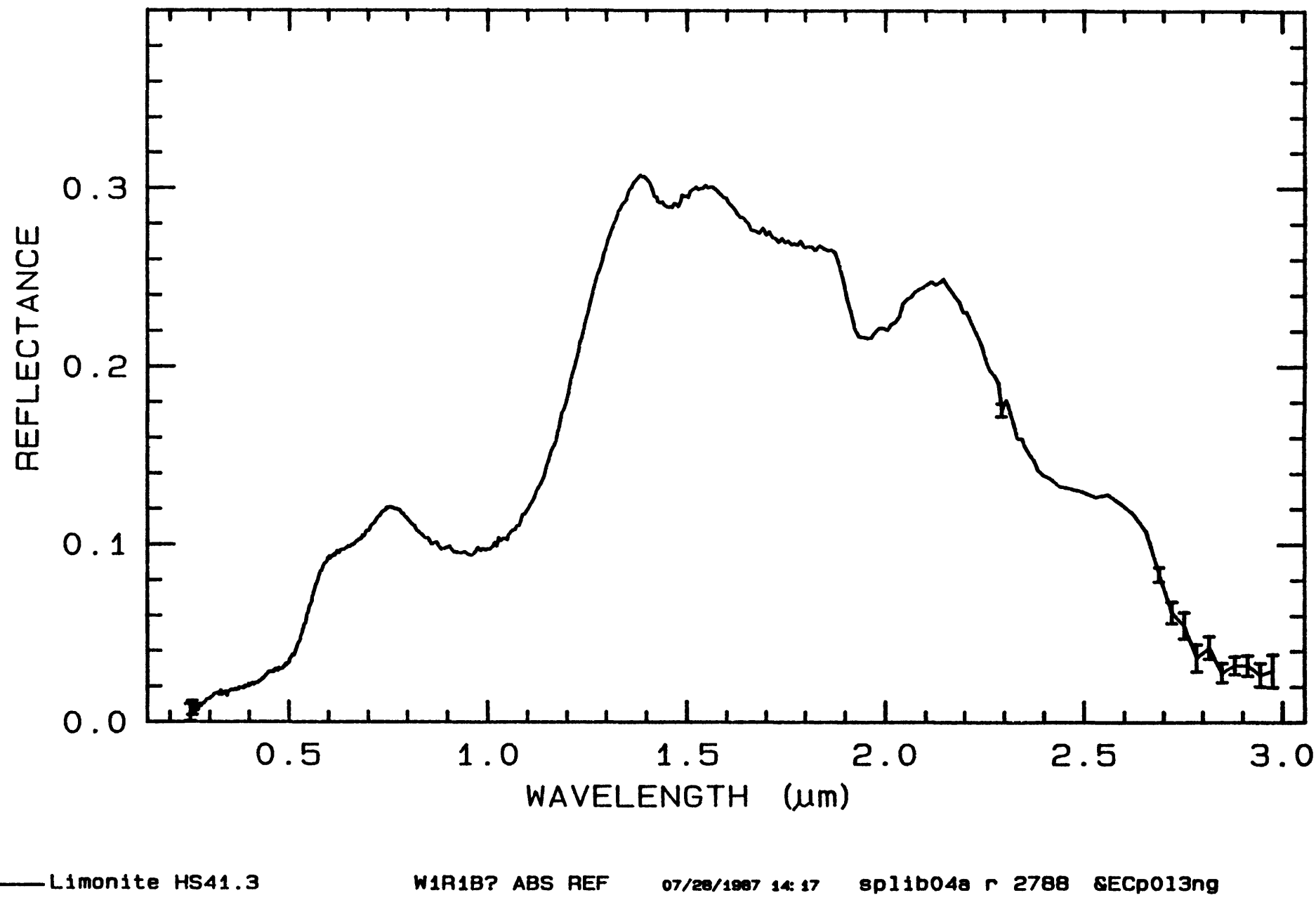
None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:
description goes here.
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2788	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:26 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Limonite HS41
Limonite HS41.3 W1R1B? ABS REF 07/28/1987 14:17 splib04a r 2788 &ECp013ng

TITLE: Lizardite NMNHR4687 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNHR4687

MINERAL_TYPE: Phyllosilicate

MINERAL: Lizardite (Kaolinite-Serpentine group)

FORMULA: Mg3Si2O5(OH)4

FORMULA_NROFF: $Mg_3Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Tyrol, Austria

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Neupouite. Polymorphous with Antigorite, Clinochrysotile, Orthochrysotile, and Parachrysotile.

The sample was ground in an alumina mortar and pestle and wet sieved using methanol into <30μm (d), 60-104mm (c), 150-250μm (b) and >250μm (a) size fractions. The letter denotes spectrum designation.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

This is a pure lizardite. Sample analysis by Norma Vergo.

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	40.97 wt%	NROFF:	SiO_2
COMPOSITION:	Fe2O3:	5.55 wt%	NROFF:	Fe_2O_3
COMPOSITION:	MgO:	40.43 wt%	NROFF:	MgO
COMPOSITION:	H2O:	13.80 wt%	NROFF:	H_2O
COMPOSITION:	----------	----------		
COMPOSITION:	Total:	100.75 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

This is an isochemical end member Mg-rich serpentine. Compositional data provided by Branch of Geochemistry, USGS, Denver.

END_COMPOSITION_DISCUSSION.

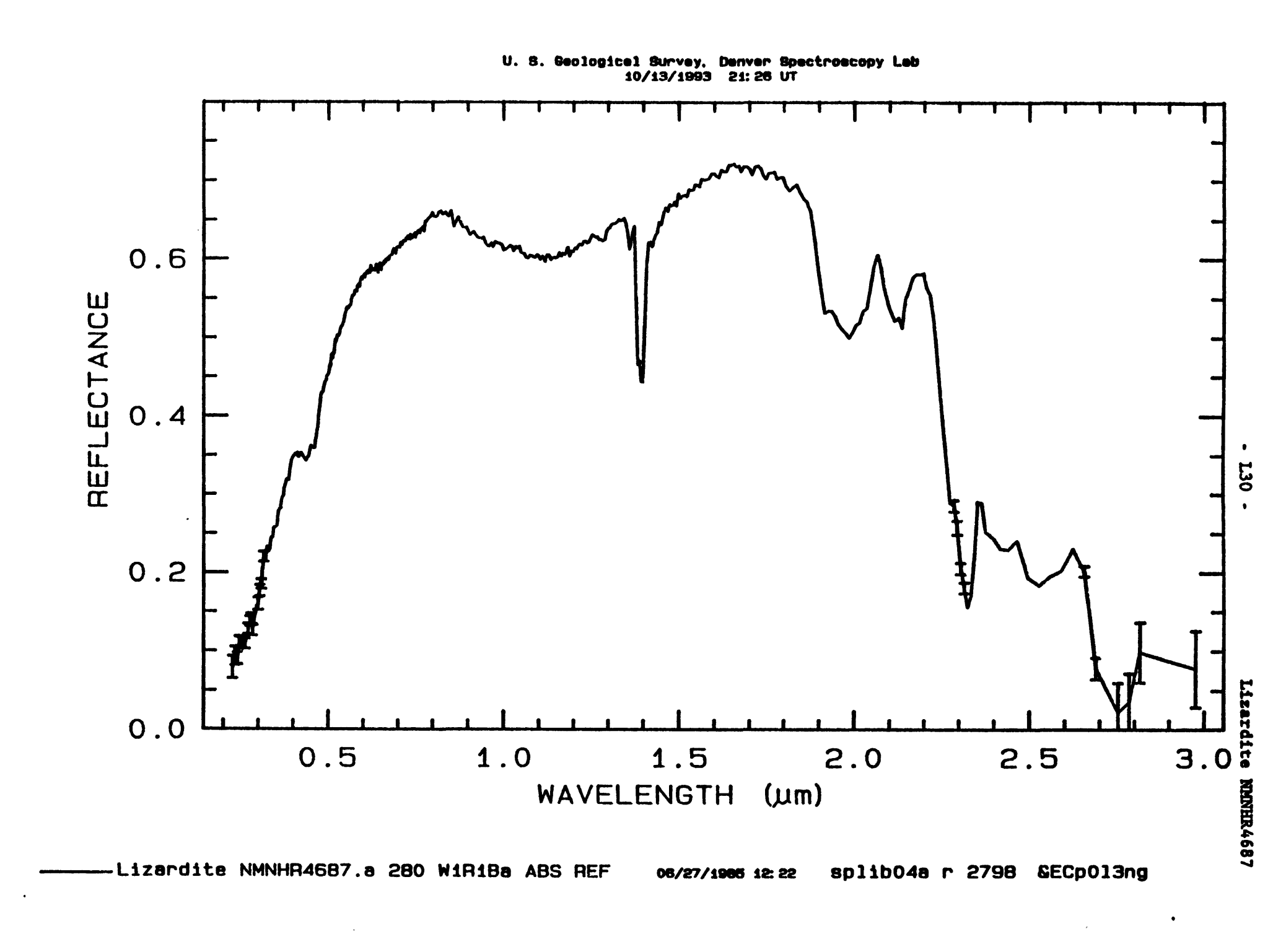
MICROSCOPIC_EXAMINATION:

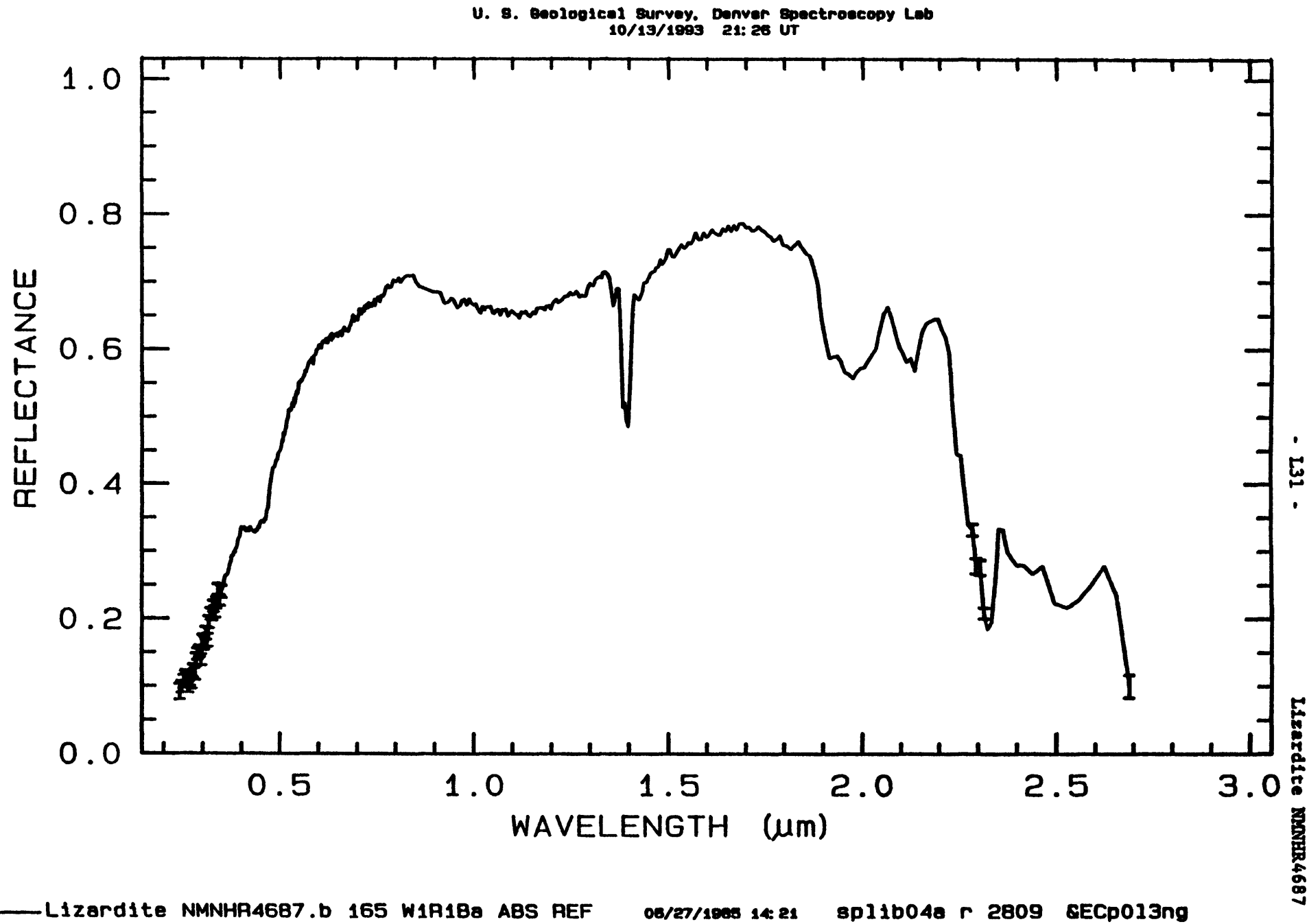
Microscopically this is a pure lizardite.

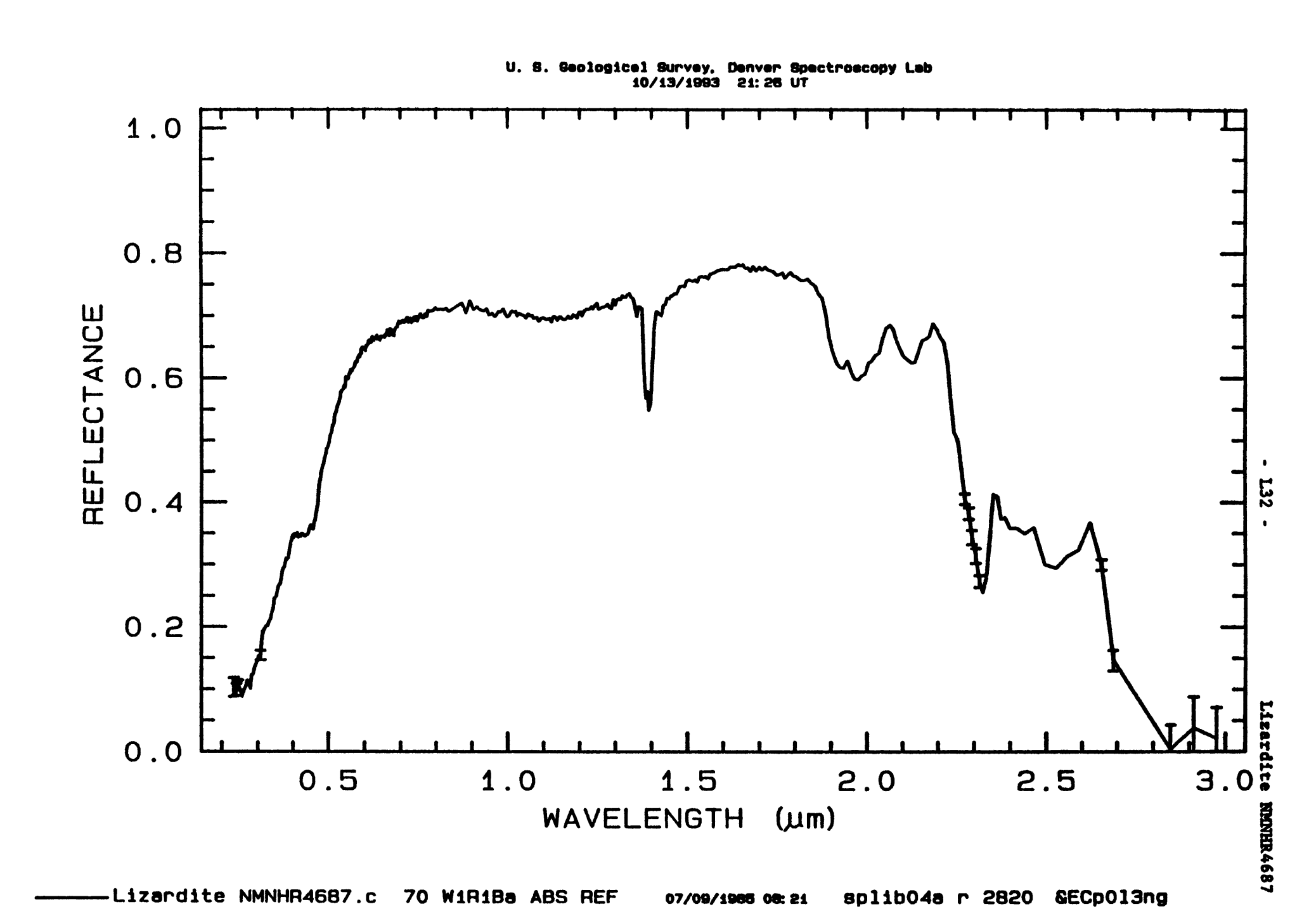
END_MICROSCOPIC_EXAMINATION.

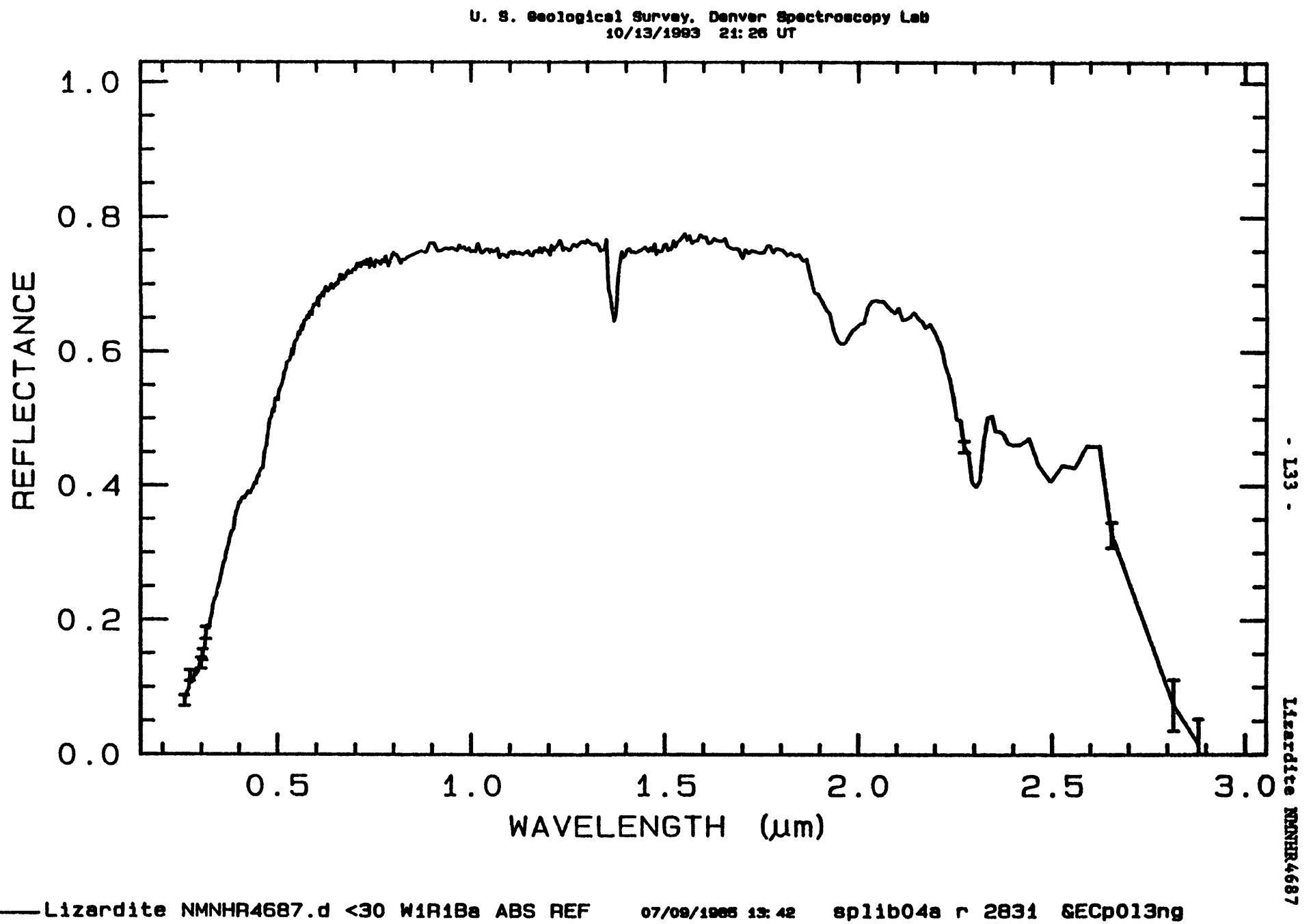
DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2799	0.2-2.7μm	200	g.s.=280μm
LIB_SPECTRA:	splib04a r 2809	0.2-2.7μm	200	g.s.=165μm
LIB_SPECTRA:	splib04a r 2820	0.2-2.7μm	200	g.s.=70μm
LIB_SPECTRA:	splib04a r 2831	0.2-2.7μm	200	g.s.=15μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:26 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 130 -
Lizardite NMNHR4687
Lizardite NMNHR4687.a 280 W1R1Ba ABS REF 06/27/1995 12:22 splib04a r 2798 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:26 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 131 -
Lizardite NMNHR4687
Lizardite NMNHR4687.b 165 W1R1Ba ABS REF 08/27/1985 14:21 splib04a r 2809 GECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:26 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Lizardite NMNHR4687
Lizardite NMNHR4687.c 70 W1R1Ba ABS REF 07/09/1986 08:21 splib04a r 2820 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:26 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Lizardite NMNHR4687
Lizardite NMNHR4687.d <30 W1R1Ba ABS REF 07/09/1986 13:42 splib04a r 2831 GECp013ng

TITLE: Maghemite GDS81 Sy DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS81

MINERAL_TYPE: Oxide

MINERAL: Maghemite (Synthetic)(Hematite group)

FORMULA: gamma-Fe2O3

FORMULA_NROFF: γ-Fe_2O_3

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR:

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample is one of a series of sample synthesized for the following paper:

Sherman, D.M., R.G. Burns, and V.M. Burns, 1982, Spectral characteristics of the iron oxides with application to the Martian bright region mineralogy. Journal of Geophysical Research, v. 87, n. B12, pp. 10169-10180.

Maghemite is formed either by the oxidation of magnetite or by the thermal dehydration of lepidocrosite.

The spectrum of our sample, M-3 most closely matches the spectrum of sample M-4A in the above paper. M-4 was produced by thermal oxidation of magnetite. The Mossbauer spectrum of that sample showed no evidence of a magnetite component. The X-ray patterns confirmed the identity of the sample and the TEM data indicated that the sample was well crystallized.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

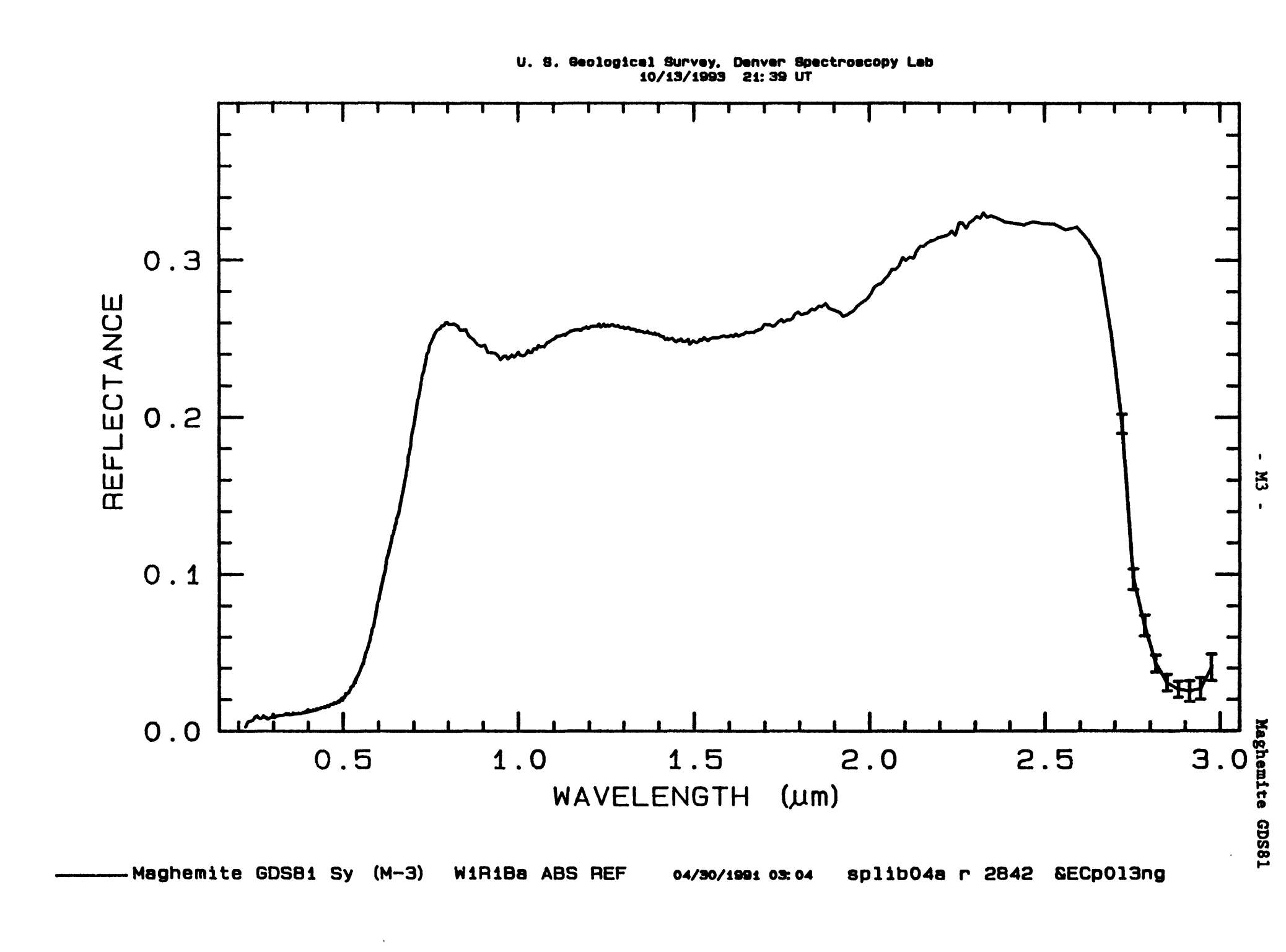
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2842	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M3 -
Maghemite GDS81
Maghemite GDS81 Sy (M-3) W1R1Ba ABS REF 04/30/1991 03:04 splib04a r 2842 &ECp013ng

TITLE: Magnesite+Hydromagnesite HS47 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS47

MINERAL_TYPE: Carbonate

MINERAL: Magnesite + Hydromagnesite (Calcite group)

FORMULA: MgCO3 + Mg5(CO3)4(OH)2*4H2O

FORMULA_NROFF: $MgCO_3$ + $Mg_5(CO_3)_4(OH)_2 \bullet 4H_2O$

COLLECTION_LOCALITY: Victorville, CA

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Gaspeite and with Siderite.

Original spectrum published in: Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

With the following notes: "Magnesite, $MgCO_3$, is a carbonate mineral commonly found in veins, and derived from the alteration of serpentine. Such magnesites are compact and not recognizably crystalline. Crystalline magnesite is found in sedimentary rocks, where it has formed either by primary precipitation or by alteration of dolomite."

"This sample is of the compact, non-crystalline variety. It appears mineralogically pure in hand specimen, but its spectrum displays bands other than those due to the carbonate ion at the longer wavelengths. These bands near 1.4 and 1.9μm are due to water of hydration and so the sample must be, at least in part, composed of hydromagnesite, roughly $Mg_5(OH)_2(CO_3)_4 \bullet 4H_2O$. X-ray diffraction indicates only magnesite, but heating to 800°C shows the presence of 1.78% H_2O by weight, confirming the presence of some water of hydration. The water band near 1.9μm precludes observation of the three weaker vibrational bands of the carbonate radical."

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

pure magnesite - Hunt and Salisbury as noted in above sample description.

"40 kV - 30 mA, 6.5-9.5 keV
Reference: JCPDS #8-479
Found: Member of the calcite group, probably magnesite, plus at

least one additional, poorly crystallized phase.
Sought but not found: brucite
Comment: sharp pattern of crystalline carbonate closely matches the JCPDS card for magnesite. I don't understand why the (012) reflection is missing - but it doesn't appear on the JCPDS card, either. There is a moderately weak, broad peak (doublet) at 21° 2θ - thus the comment about the additional phase. Could opaline silica be present??"

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

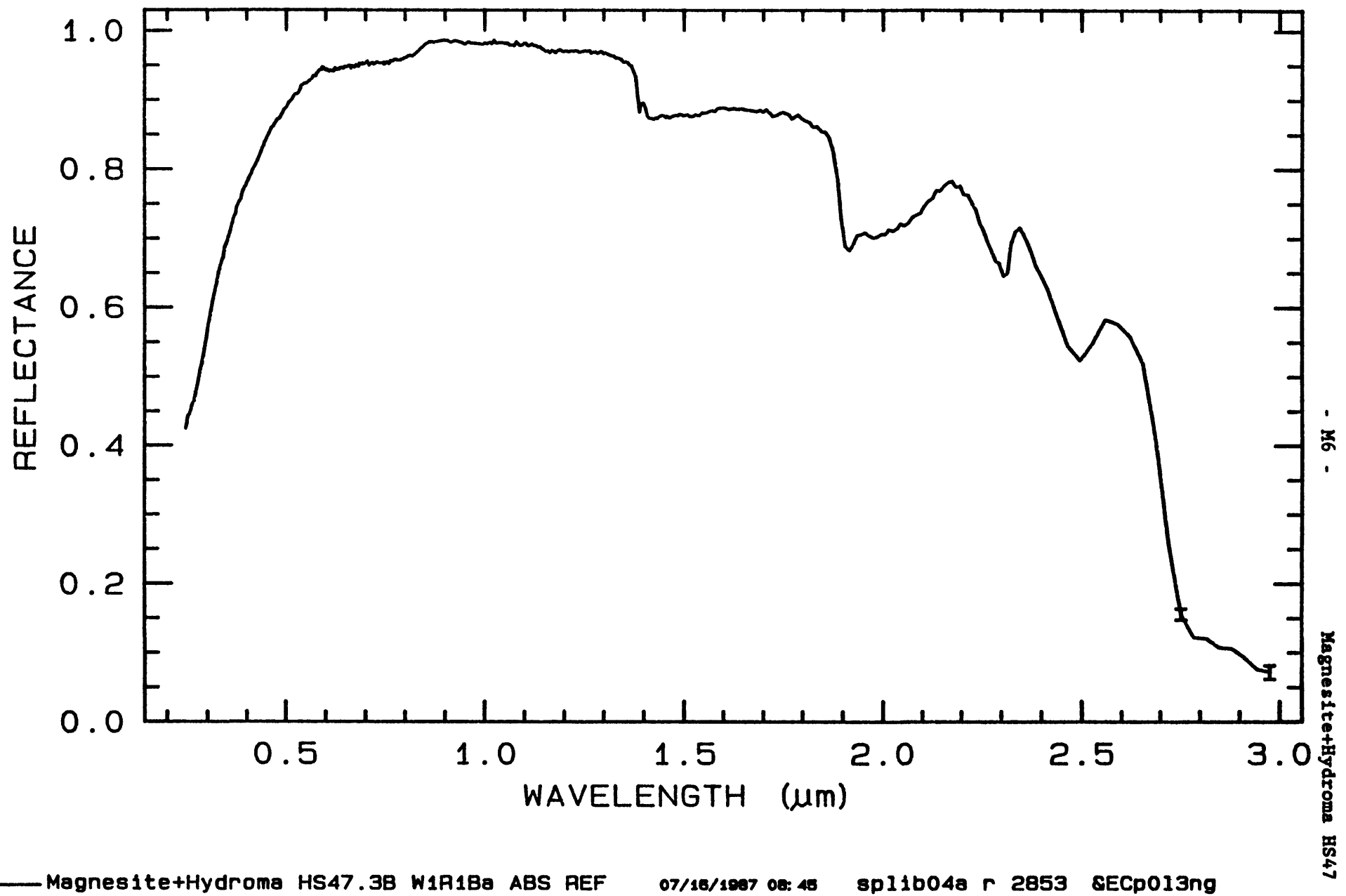
None.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:
description goes here.
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2853	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M6 -
Magnesite+Hydroma HS47
Magnesite+Hydroma HS47.3B W1R1Ba ABS REF 07/16/1997 08:45 splib04a r 2853 &ECp013ng

TITLE: Magnetite HS195 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS195

MINERAL_TYPE: Oxide

MINERAL: Magnetite (Spinel group)

FORMULA: Fe+2(Fe+3)2O4

FORMULA_NROFF: $Fe^{+2}Fe^{+3}_2O_4$

COLLECTION_LOCALITY: Ishpeming, Mich

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms a series with Magnesioferrite and with Jacobsite.

The spectrum of this sample was originally published in:

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

With the note: "This sample is slightly contaminated with (spectrally neutral) quartz. Like the previous sample [HS78], it displays typically opaque behavior, decreasing in reflectivity with decreasing particle size. It is unusual in that it also exhibits a very weak band near 1.0μm due to the ferrous ion. The explanation for its opacity is as given above for [Magnetite HS78]."

The sample measured for the library was HS195.3 which was dry sieved to the grain size interval 74-250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None.

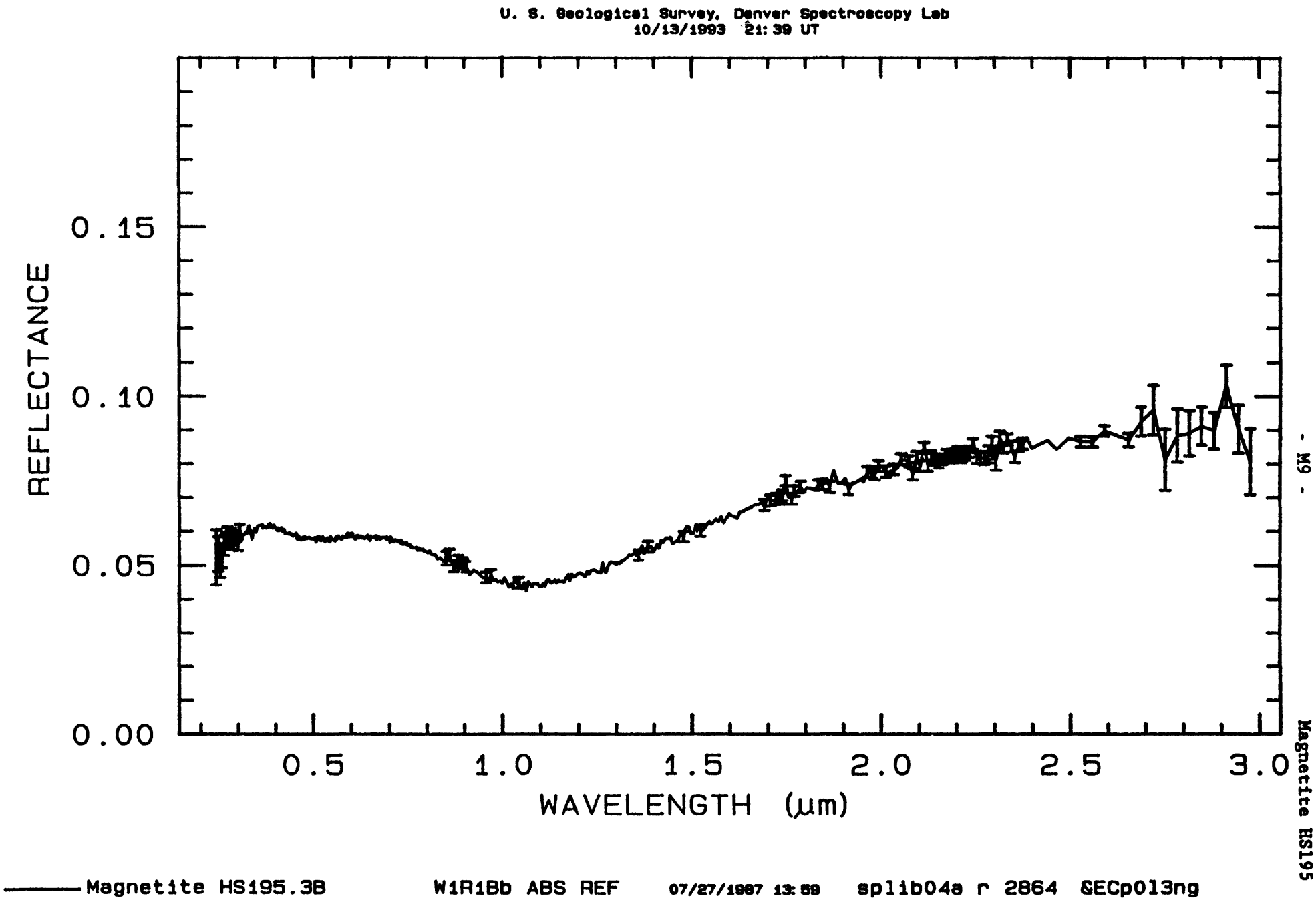
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2864	0.2-3.0μm	200	g.s.= μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M9 -
Magnetite HS195
Magnetite HS195.3B
W1R1Bb ABS REF
07/27/1987 13:59
splib04a r 2864 &ECp013ng

TITLE: Magnetite HS78 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS78

MINERAL_TYPE: Oxide

MINERAL: Magnetite (Spinel group)

FORMULA: Fe+2(Fe+3)2O4

FORMULA_NROFF: $Fe^{+2}Fe^{+3}_2O_4$

COLLECTION_LOCALITY: Farmington County, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Gaspeite and with Siderite.

The spectrum of this sample was originally published in:

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

With the note: "Magnetite, Fe_3O_4, is sometimes found in veins of large masses as a product of magmatic segregation, and as beds or lenses in metamorphic rocks. Most commonly, it is an accessory mineral in igneous rocks, and it is frequently associated with the heavy fraction of beach and river sands because of its resistance to weathering. As in the case of this sample, magnetite is typically an opaque spectrally featureless mineral in the visible and near-infrared. It contains both ferrous and ferric ion, and Al, V, and Cr may substitute for the Fe^{+3}, while Ca, Mn, and Mg, Ni, Ca, and Zr may replace some Fe^{+2}. A considerable amount of Ti can also enter the magnetite structure. Except in rare cases of substantial substitution, however, all magnetites display opaque behavior. This particular sample is titaniferous, and the explanation for its opacity must be similar to that given for ilmenite [HS231], with additional contributions being made to the general absorption property by all the substituents present."

The sample measured for the library was HS78.3 which was dry sieved to the grain size interval 74-250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None.

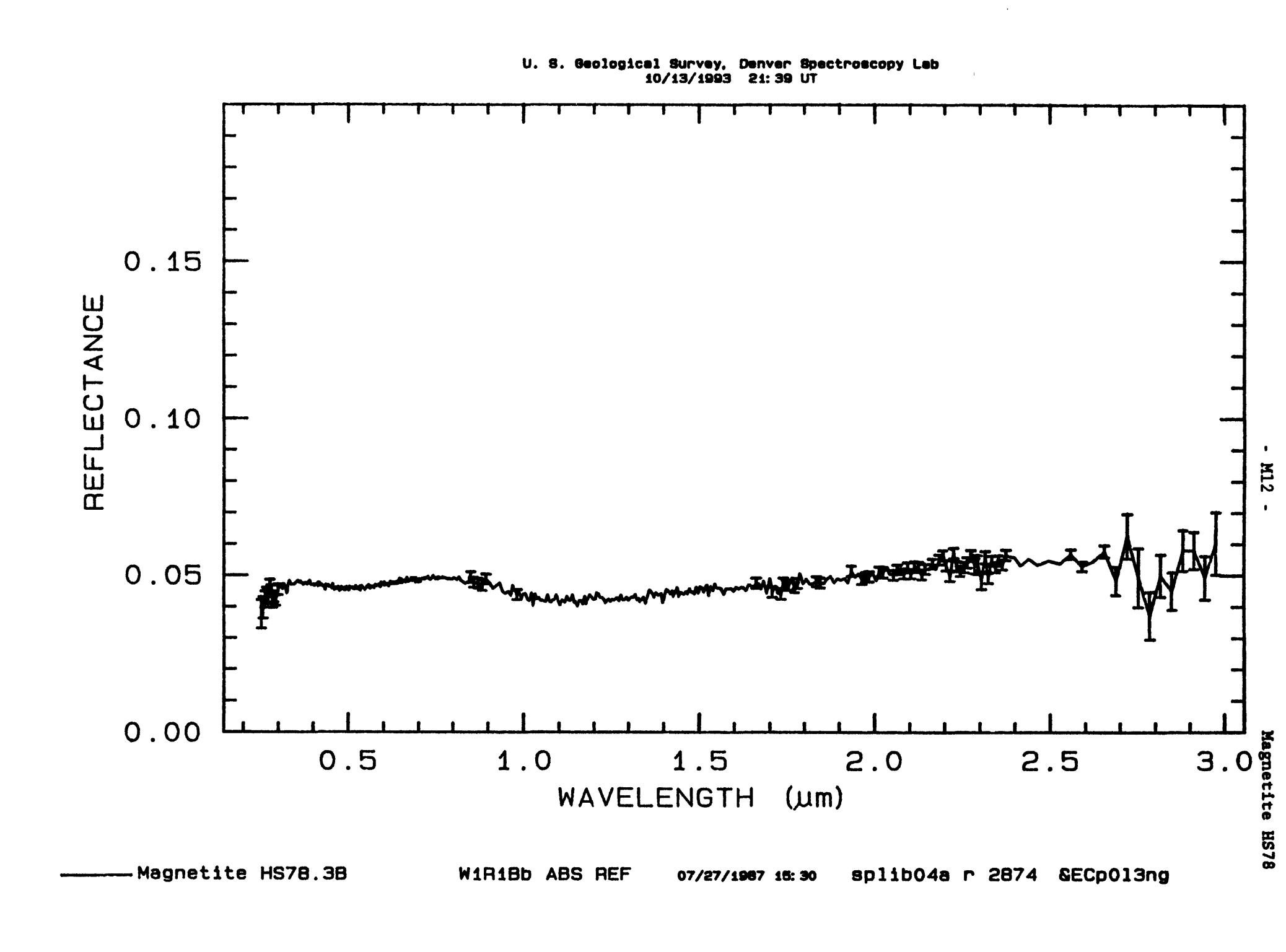
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2874	0.2-3.0μm	200	g.s.= μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M12 -
Magnetite HS78
Magnetite HS78.3B
W1R1Bb ABS REF
07/27/1967 15:30
splib04a r 2874
GECp013ng

TITLE: Malachite HS254 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS254

MINERAL_TYPE: Carbonate

MINERAL: Malachite

FORMULA: Cu2CO3(OH)2

FORMULA_NROFF: $Cu_2CO_3(OH)_2$

COLLECTION_LOCALITY: Bisbee, AZ

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Original spectrum published in: Hunt, G.R., J.W. Salisbury, 1971, Visible and near-infrared spectra of minerals and rocks: II. Carbonates. Modern Geology, v. 2, p. 23-30.

With the following notes: "Malachite, $CuCO_3 \bullet Cu(OH)_2$, like azurite is a basic carbonate of copper. More common than azurite, it is still only a minor ore of copper, occurring as a secondary mineral in the upper oxidized zone of copper deposits. This particular sample appears to be relatively pure."

"Like, azurite, malachite presents an atypical carbonate ion spectrum. Apart from the broad 0.8μm band and the short wavelength fall-off below 0.52μm, due to electronic transitions in the Cu^{2+} ion, only 3 bands are present. By analogy with the spectrum of pure $CuCO_3$, we assign all three at 2.29, 2.37 and 2.52μm to the CO_3" radical. Some contribution to the 2.37μm band may come from OH', but no other hydroxyl bands are visible in the spectrum, a circumstance for which we have no explanation."

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Malachite - major component
Possibility of some Mcguinnessite can't be ruled out
Trace of undetermined phase

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None.

END_COMPOSITION_DISCUSSION.

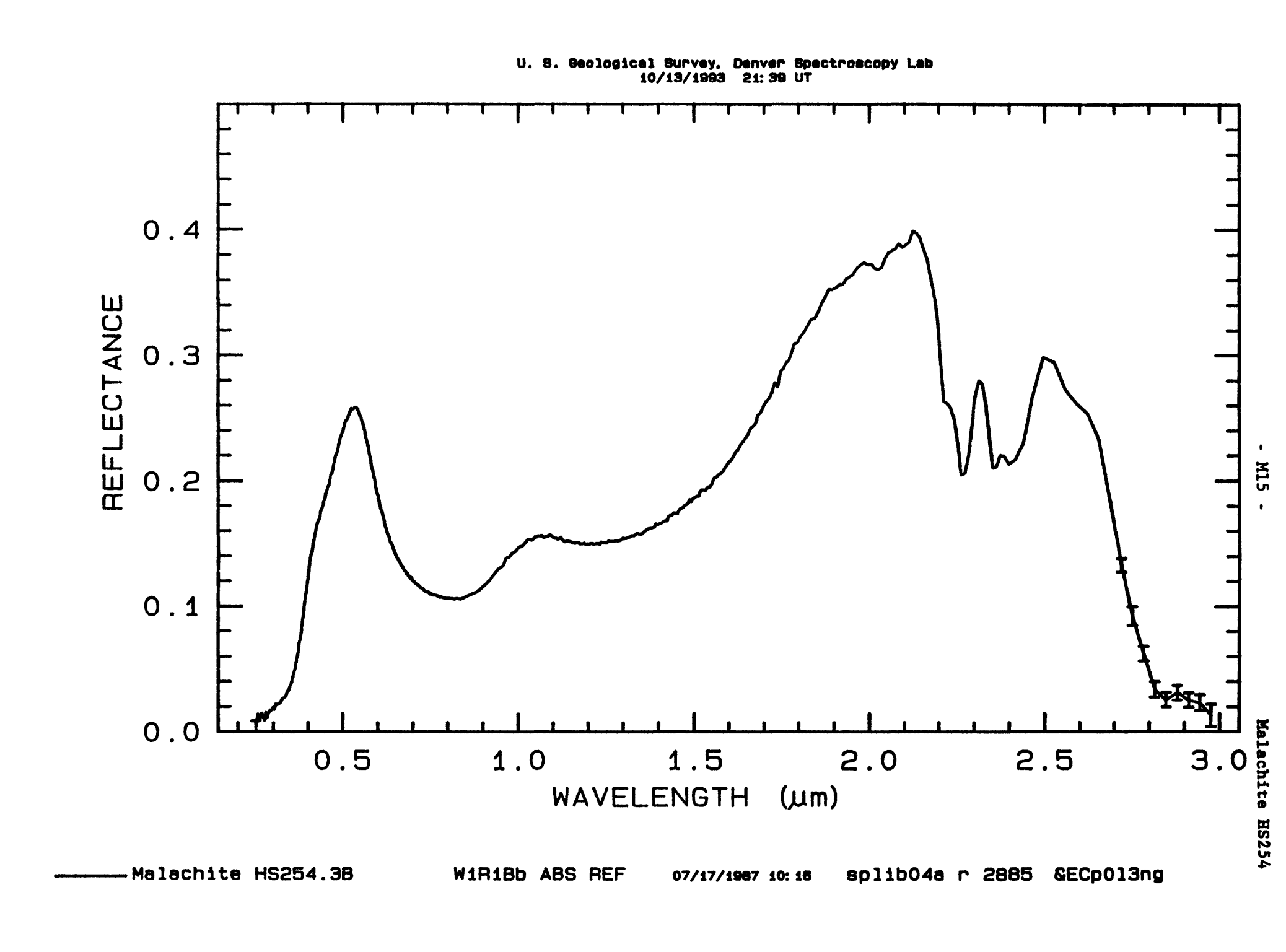
MICROSCOPIC_EXAMINATION:

description goes here.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2885	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M15 -
Malachite HS254
Malachite HS254.3B W1R1Bb ABS REF 07/17/1987 10:16 splib04a r 2885 &ECp013ng

TITLE: Manganite HS138 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS138

MINERAL_TYPE: Hydroxide

MINERAL: Manganite

FORMULA: MnO(OH)

FORMULA_NROFF: MnO(OH)

COLLECTION_LOCALITY: Villa Grove, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Trimorphous with Feitknechtite and Groutite.

The sample measured for the library was HS138.3 which was dry sieved to the grain size interval 74-250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None.

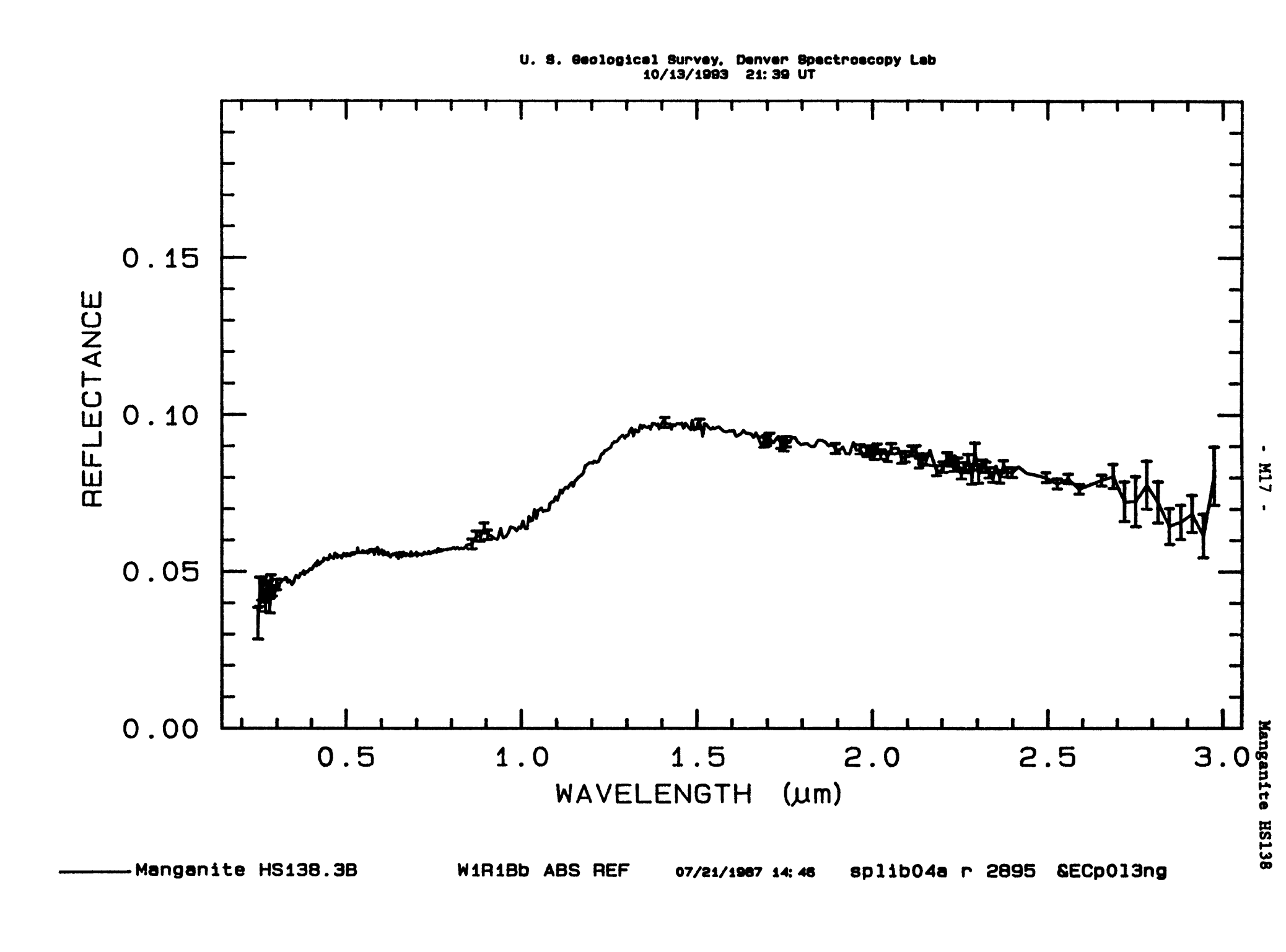
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2895	0.2-3.0μm	200	g.s.= μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M17 -
Manganite HS138
Manganite HS138.3B
W1R1Bb ABS REF
07/21/1987 14:46
splib04a r 2895 &ECp013ng

TITLE: Margarite GDS106 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS106

MINERAL_TYPE: Phyllosilicate

MINERAL: Margarite (Mica group)

FORMULA: CaAl2(Al2Si2)O10(OH)2

FORMULA_NROFF: $CaAl_2(Al_2Si_2)O_{10}(OH)_2$

COLLECTION_LOCALITY: Chester, MA

ORIGINAL_DONOR: Jim Crowley, USGS Reston

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Margarite
Moderate Clinochlore

(Jim Crowley, 1993, written communication.)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

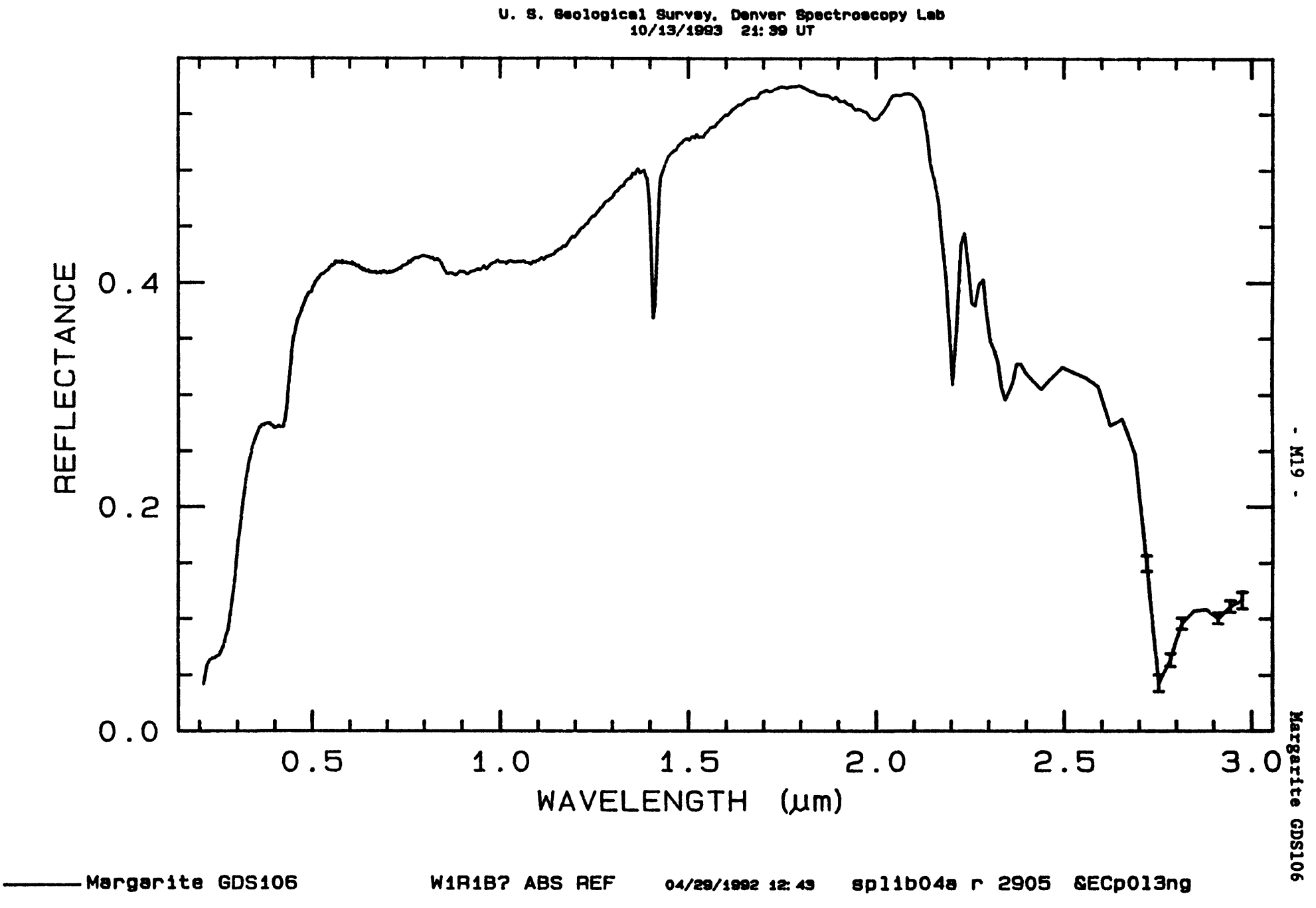
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2905	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M19 -
Margarite GDS106
Margarite GDS106 W1R1B? ABS REF 04/29/1992 12:49 spl1b04a r 2905 &ECp013ng

TITLE: Marialite NMNH126018-2 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH126018-2

MINERAL_TYPE: Tectosilicate

MINERAL: Marialite (Scapolite group)

FORMULA: 3NaAlSi3O8*NaCl

FORMULA_NROFF: $3NaAlSi_3O_8 \bullet NaCl$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Scapolites are metamorphic minerals with compositions similar to feldspars. Marialite is an end member of the solid solution series marialite-meionite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Scapolite + laumontite + other(s). (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	59.8800 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.0010 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	20.5900 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.0040 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.0090 wt%	NROFF:	MnO
COMPOSITION:	CaO:	3.8780 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	10.8700 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	1.3210 wt%	NROFF:	K_2O
COMPOSITION:	Cl:	3.5390 wt%	NROFF:	Cl
COMPOSITION:	F:	0.0480 wt%	NROFF:	F
COMPOSITION:	CO2:	1.2200 wt%	NROFF:	CO_2
COMPOSITION:	---	---		
COMPOSITION:	Total:	101.362 wt%		
COMPOSITION:	O=Cl,F,S:	0.819 wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.55 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

X_{Me} = Ca/(Ca+Na) = 16 Me

END_COMPOSITION_DISCUSSION.

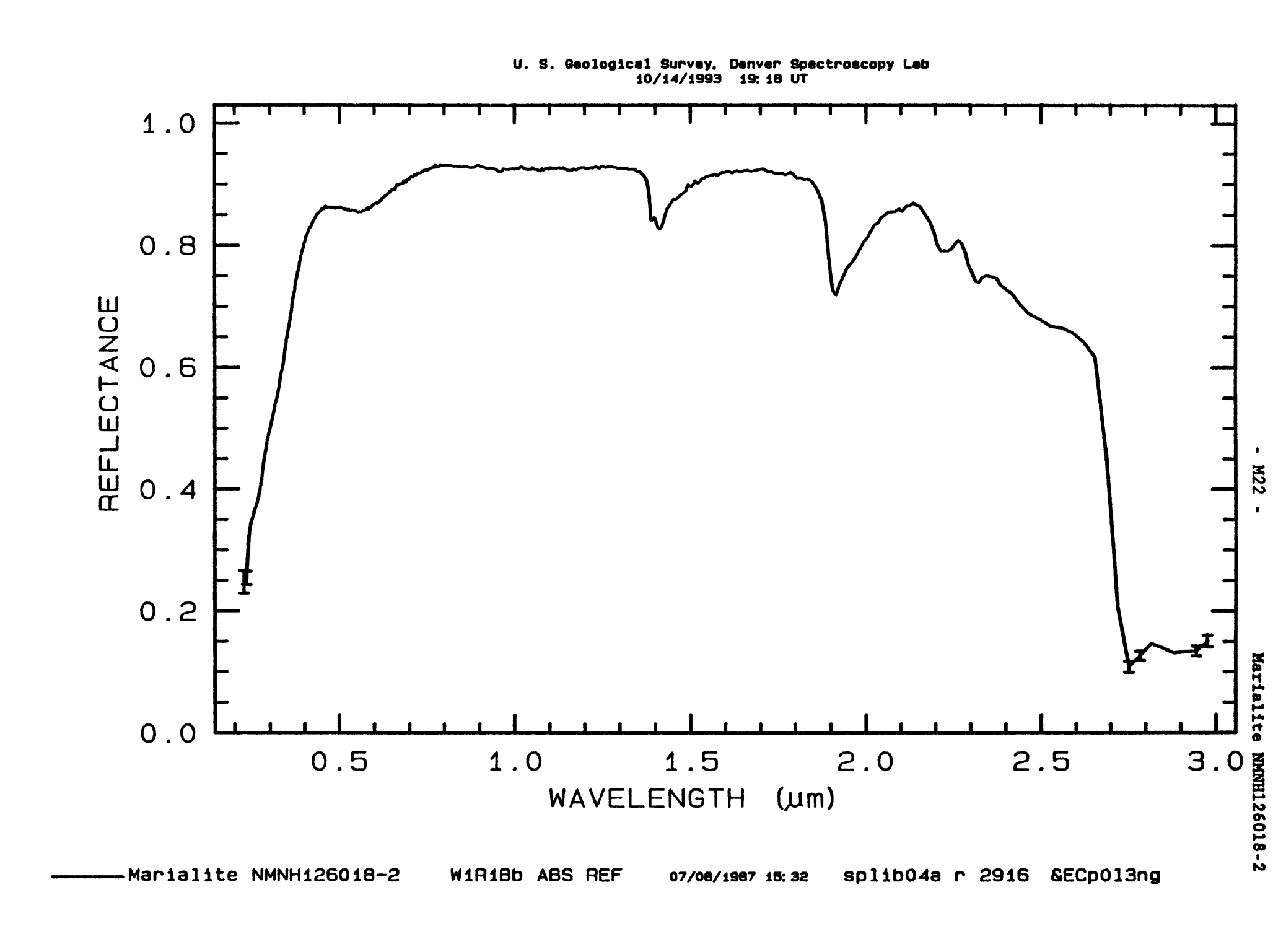
MICROSCOPIC_EXAMINATION:

Heavy liquid separation removed laumonite.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2916	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M22 -
Marialite NMNH126018-2
Marialite NMNH126018-2 W1R1Bb ABS REF 07/08/1987 15:32 splib04a r 2916 &ECp013ng

TITLE: Mascagnite GDS65 Ammon Sulfate DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS65

MINERAL_TYPE: Sulfate

MINERAL: Mascagnite (Ammonium Sulfate)

FORMULA: (NH4)2SO4

FORMULA_NROFF: $(NH_4)_2SO_4$

COLLECTION_LOCALITY: None, Chemical Reagent

ORIGINAL_DONOR: None

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample is from a chemical reagent, pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Chemical Reagent, pure.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Crystals appear pure under the microscope.

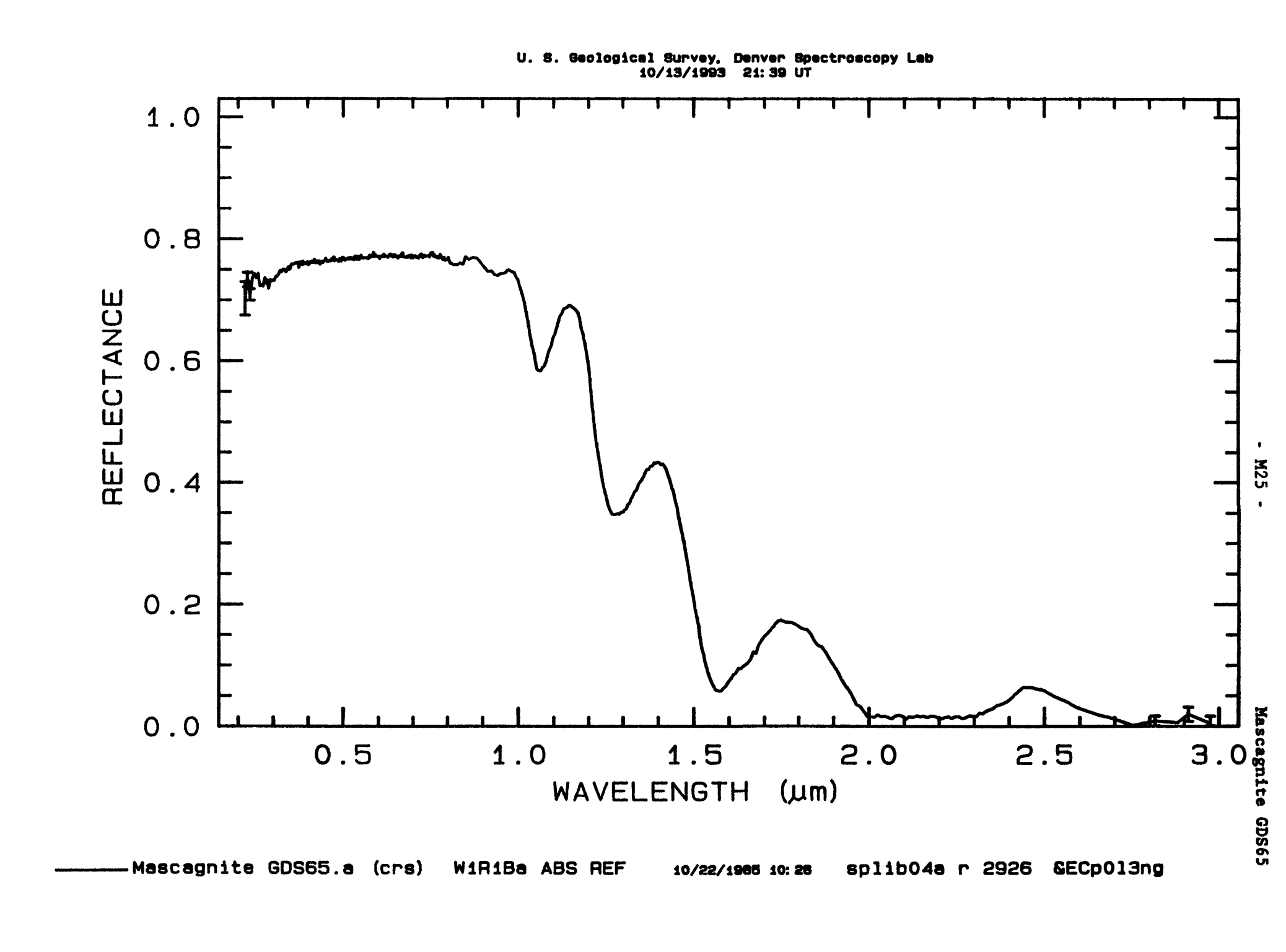
The coarse fraction: Clumps of average grain size 300μm are in polygranular masses with average size of 600μm. G. Swayze

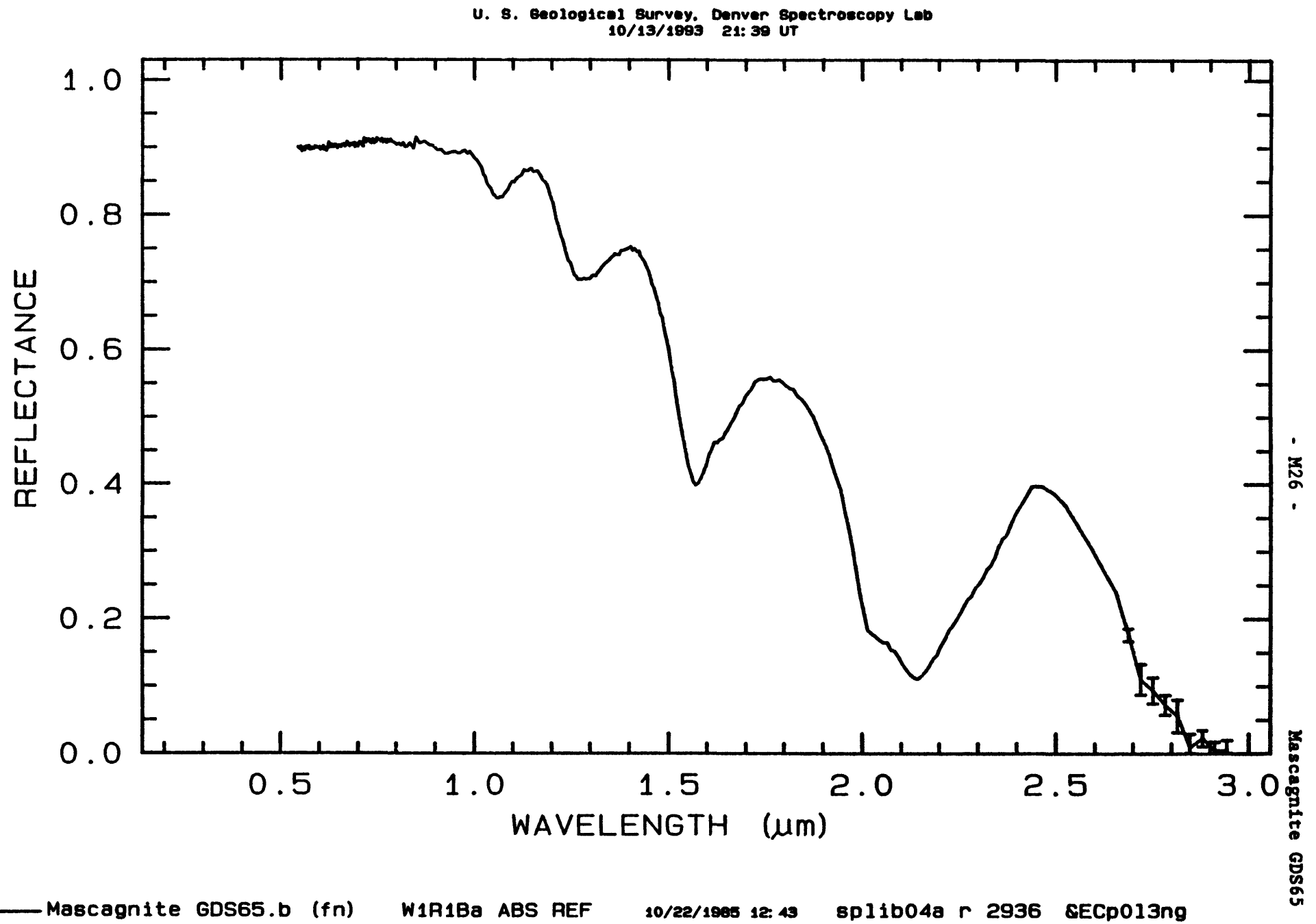
The fine fraction: average grain size = 150μm R. Clark

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2926	0.2-3.0μm	200	g.s.=600 μm
LIB_SPECTRA:	splib04a r 2936	0.2-3.0μm	200	g.s.=150 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M25 -
Mascagnite GDS65
Mascagnite GDS65.a (crs) W1R1Ba ABS REF 10/22/1965 10:26 splib04a r 2926 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M26 -
Mascagnite GDS65
Mascagnite GDS65.b (fn) W1R1Ba ABS REF 10/22/1985 12:43 splib04a r 2936 &ECp013ng

TITLE: Meionite WS700 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS700

MINERAL_TYPE: Tectosilicate

MINERAL: Meionite (Scapolite group)

FORMULA: 3CaAl2Si2O8*CaCO3

FORMULA_NROFF: $3CaAl_2Si_2O_8 \bullet CaCO_3$

COLLECTION_LOCALITY: Otter Lake, Quebec Canada

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Scapolite solid solution series (marialite-wernerite-meionite) end member.
Metamorphic mineral with composition suggestive of feldspars.

For samples marked WS700.HL, the HL stands for Heavy Liquid separation

END_SAMPLE_DESCRIPTION.

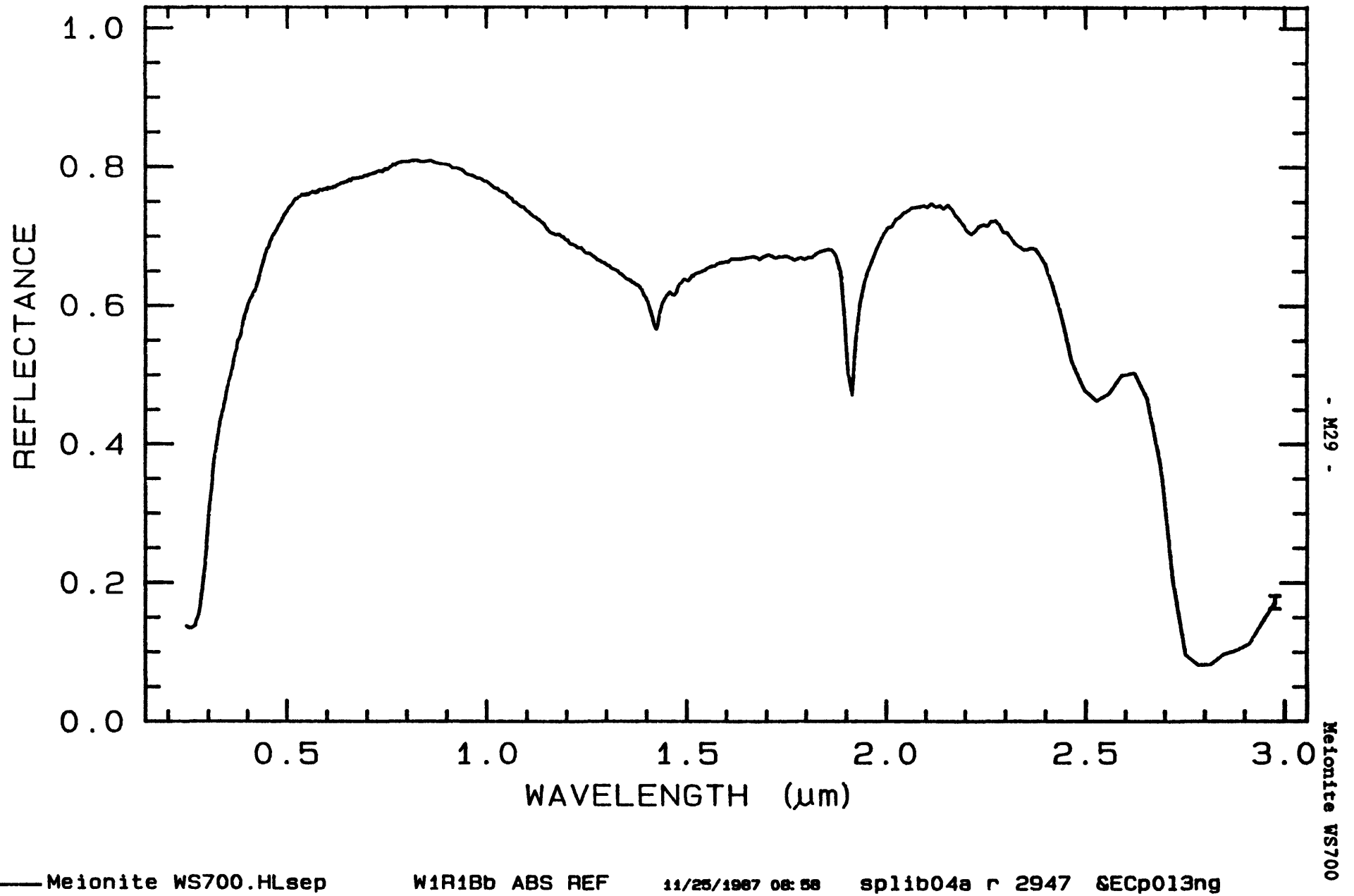
XRD_ANALYSIS:

Scapolite + analcime + other(m) (Norma Vergo)
* analcime causing band in 2.3μ region

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:      SiO2: 52.5600 wt%    NROFF: SiO2
COMPOSITION:      TiO2:  0.0220 wt%    NROFF: TiO2
COMPOSITION:     Al2O3: 24.7100 wt%    NROFF: Al2O3
COMPOSITION:       FeO:  0.0720 wt%    NROFF: FeO
COMPOSITION:       MnO:  0.0360 wt%    NROFF: MnO
COMPOSITION:       MgO:  0.0200 wt%    NROFF: MgO
COMPOSITION:       CaO: 12.5800 wt%    NROFF: CaO
COMPOSITION:      Na2O:  5.5320 wt%    NROFF: Na2O
COMPOSITION:       K2O:  0.7760 wt%    NROFF: K2O
COMPOSITION:        Cl:  1.7520 wt%    NROFF: Cl
COMPOSITION:         F:  0.0140 wt%    NROFF: F
COMPOSITION:       SO3:  1.1880 wt%    NROFF: SO3
COMPOSITION:       CO2:  0.2000 wt%    NROFF: CO2
COMPOSITION: ----------------------
COMPOSITION:     Total: 99.4620 wt%
COMPOSITION:  O=Cl,F,S:  0.4012 wt%  #correction for Cl, F, S
COMPOSITION: New Total: 99.0608 wt%

COMPOSITION_TRACE:  None

COMPOSITION_DISCUSSION:

These values may be suspect because acid dissolution did not remove all
CO3.

Average of 5 spots.


END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:  where          Wave Range  Av_Rs_Pwr  Comment

LIB_SPECTRA:  splib04a r 2947    0.2-3.0μm       200      g.s.=
```


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M29 -
Meionite WS700
Meionite WS700.HLsep W1R1Bb ABS REF 11/25/1987 08:58 splib04a r 2947 &ECp013ng

TITLE: Meionite WS701 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS701

MINERAL_TYPE: Tectosilicate

MINERAL: Meionite (Scapolite group)

FORMULA: 3CaAl2Si2O8*CaCO3

FORMULA_NROFF: $3CaAl_2Si_2O_8 \bullet CaCO_3$

COLLECTION_LOCALITY: Greenville, Quebec Canada

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Marialite.

Metamorphic mineral with composition suggestive of feldspars.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Scapolite + feldspar + quartz (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EMP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	49.6000 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.0420 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	25.4500 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.0100 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.0280 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.0640 wt%	NROFF:	MgO
COMPOSITION:	CaO:	15.4300 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	4.6460 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.5220 wt%	NROFF:	K_2O
COMPOSITION:	Cl:	0.3940 wt%	NROFF:	Cl
COMPOSITION:	F:	0.0180 wt%	NROFF:	F
COMPOSITION:	SO3:	2.3140 wt%	NROFF:	SO_3
COMPOSITION:	CO2:	0.7000 wt%	NROFF:	CO_2
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.2180 wt%		
COMPOSITION:	O=Cl,F,S:	.0965 wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	99.1215 wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Average of 5 spots.

Wet chemical analysis indicates a wt% of 0.57 for CO2. (These values may be suspect because acid dissolution did not remove all CO_3)

1. Mol % SiO_2 includes .0160 mol % SiF_4.
   Mol % SiO_2 includes .1880 mol % $SiCl_2$.
2. Fe oxide in analysis is total Fe^{+2} + Fe^{+3}.
3. Number of tetrahedral sites per formula set at 12.
4. Number anions per formula unit = 25.04397.
   Number of oxygen equivalents per formula unit = 24.98935.
5. Cation site assignments: Standard clay-mineral default with changes.
   Must occupy tetrahedral sites: Si Al
   To big cation sites: Ti Fe^{+2} Mn Mg

X_{Me} = 63.3 Me
X_{Me} = Ca/(Ca+Na) = 64.7 % Me

Sample: Mizzonite

END_COMPOSITION_DISCUSSION.

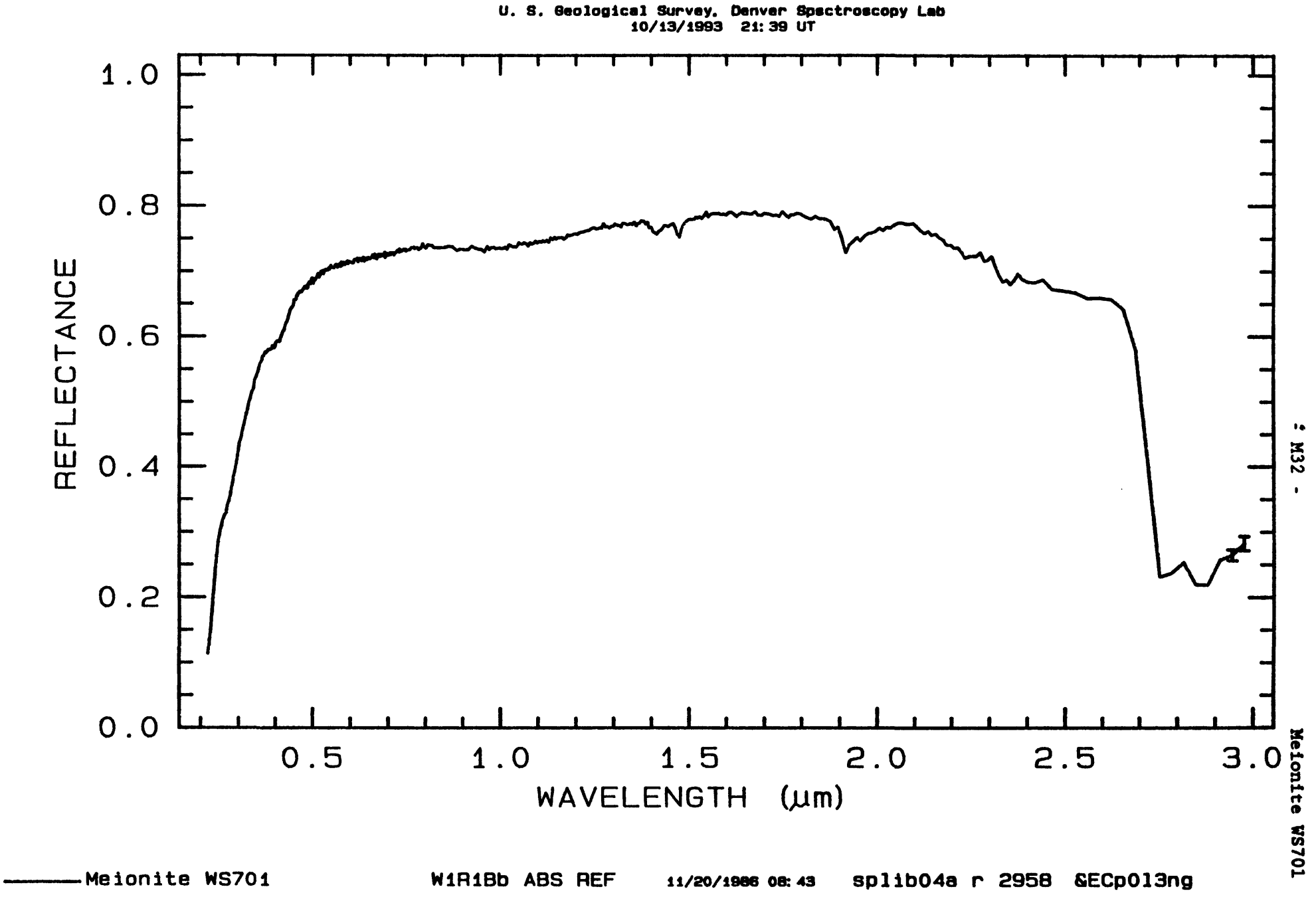
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2958	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:39 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
; M32 -
Meionite WS701
Meionite WS701
W1R1Bb ABS REF
11/20/1986 08:43
splib04a r 2958 &ECp013ng

TITLE: Mesolite+Hydroxyapophyll. GDS6 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS6

MINERAL_TYPE: Tectosilicate

MINERAL: Mesolite + Hydroxyapophyllite (Zeolite group)

FORMULA: Na2Ca2Al6Si9O30*8H2O + KCa4Si8O20(OH,F)*8H2O

FORMULA_NROFF: $Na_2Ca_2Al_6Si_9O_{30}\bullet 8H_2O + KCa_4Si_8O_{20}(OH,F)\bullet 8H_2O$

COLLECTION_LOCALITY: Hampton, Nova Scotia

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample appears white and to be spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Mesolite - major
Hydroxyapophyllite - major
Unidentifiable residuals

Konnert Judith, and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

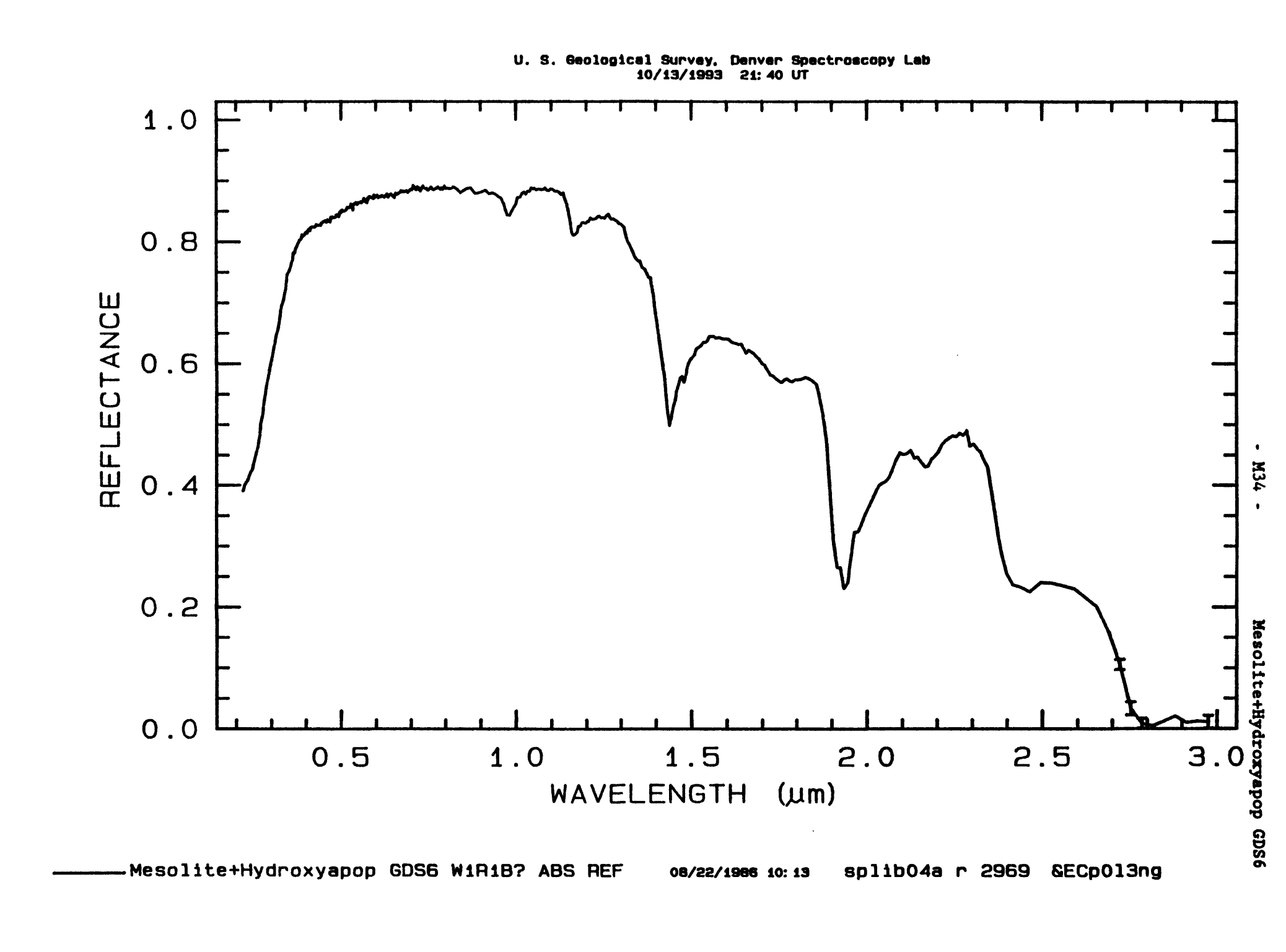
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: rclark@speclab (Roger N. Clark)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2969	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M34 -
Mesolite+Hydroxyapop GDS6
Mesolite+Hydroxyapop GDS6 W1R1B? ABS REF 08/22/1996 10:13 splib04a r 2969 &ECp013ng

TITLE: Microcline HS82 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS82

MINERAL_TYPE: Tectosilicate

MINERAL: Microcline (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Custer County, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Max. microcline + albite(L)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

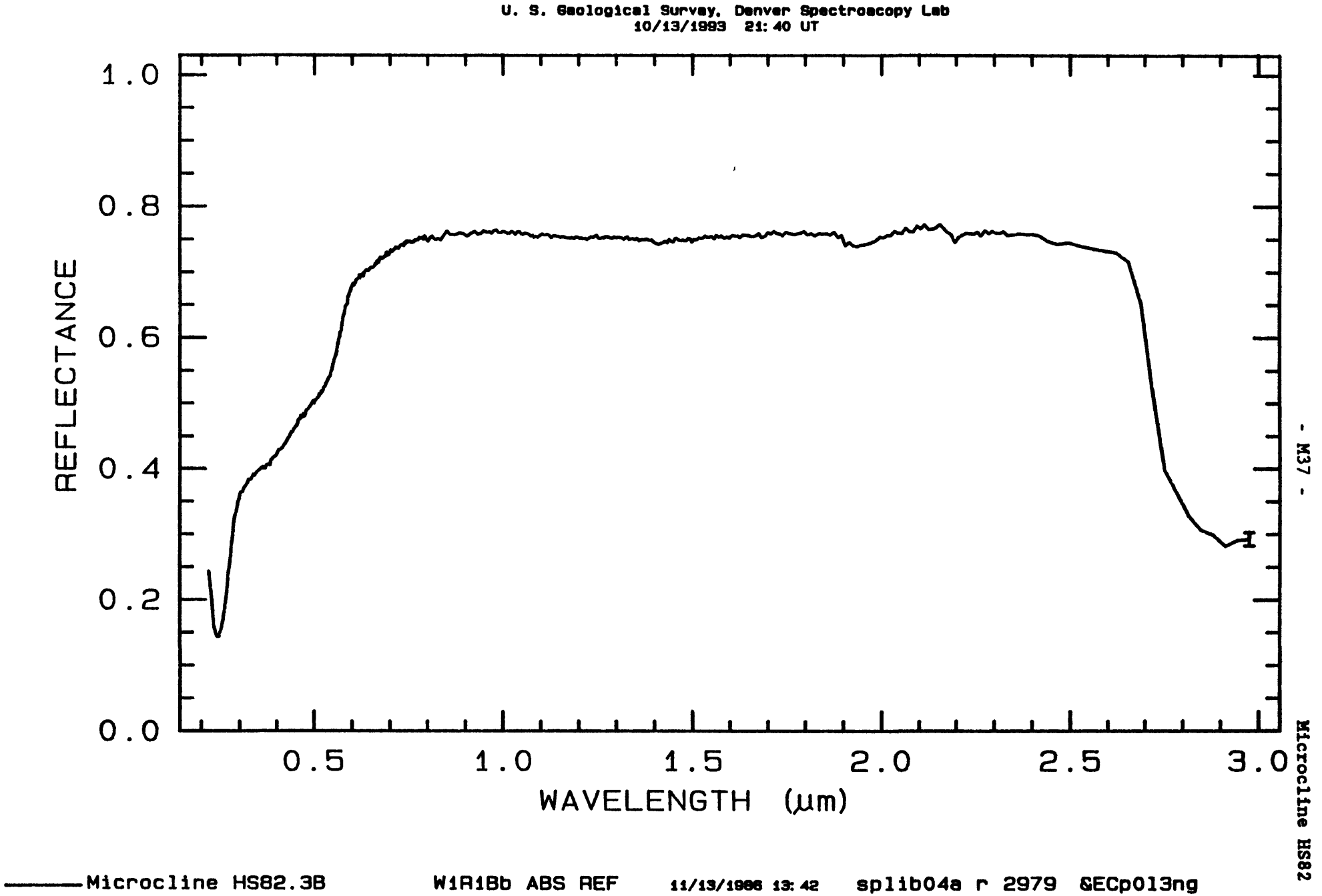
Sample composed largely of microcline with 20% low order gray interference color albite? G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 2979 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M37 -
Microcline HS82
Microcline HS82.3B
W1R1Bb ABS REF
11/13/1986 13:42
splib04a r 2979 &ECp013ng

TITLE: Microcline HS103 Feldspar DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS103

MINERAL_TYPE: Tectosilicate

MINERAL: Microcline (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Crystal Peak, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Orthoclase.

"This spectrum (103B) displays as its major feature a broad band near 1.3μ similar to the ferrous ion band in the two anorthites above. This sample is quite pure in hand specimen, but Deer et al. (1963) note that alkali feldspars are a series varying from pure $KAlSi_3O_8$ (microcline) to pure $NaAlSi_3O_8$ (albite) but they normally also contain a small amount of $CaAl_2Si_2O_8$ (anorthite). It appears that the anorthite fraction of this microcline contains substituted ferrous iron as in the anorthites above, which also accounts for the bands in the visible at 0.38 and 0.42μ. Weak bands at 1.9 and 2.5μ are due to included water, while the 2.2μ band is due to the combination involving the AlOH bend."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Max. microcline + albite(L) + quartz(m)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

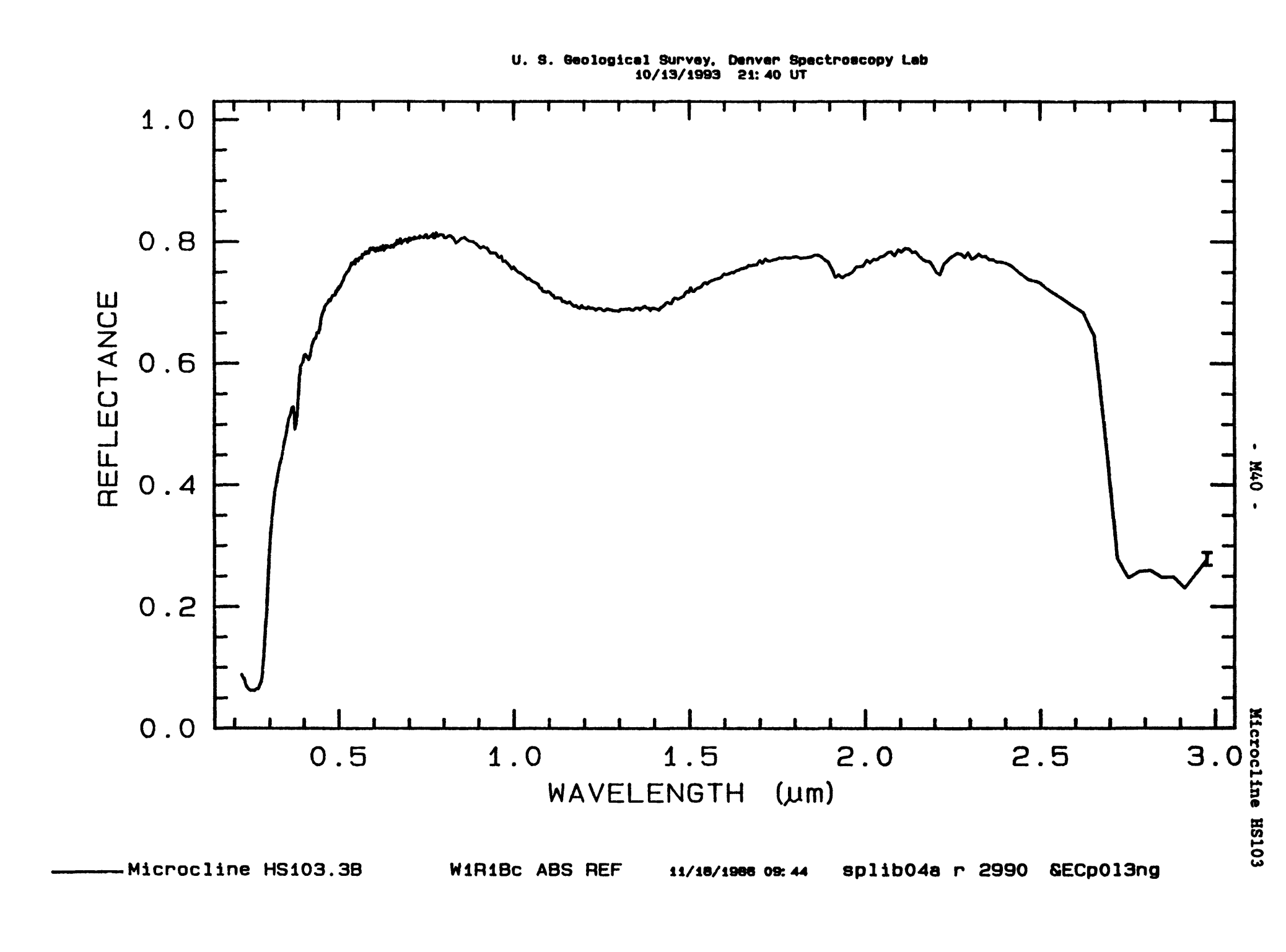
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 2990	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M40 -
Microcline HS103
Microcline HS103.3B
W1R1Bc ABS REF
11/18/1986 09:44
splib04a r 2990 &ECp013ng

TITLE: Microcline HS107 Feldspar DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS107

MINERAL_TYPE: Tectosilicate

MINERAL: Microcline (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Keystone, South Dakota

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Orthoclase.

"The spectrum (107B) displays a very intense OH band near 1.4μ with an accompanying feature near 2.2μ. The very weak band near 1.9μ indicates only a very small amount of H_2O. The bands are consistent with the incipient alteration of this sample to kaolinite."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

Note, however, that the 2.2-2.4 μm bands are those of muscovite (or similar mica), not kaolinite as noted by Hunt et al. That is confirmed by XRD below.
- R. Clark

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Max. microcline + albite(L) + muscovite(m)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

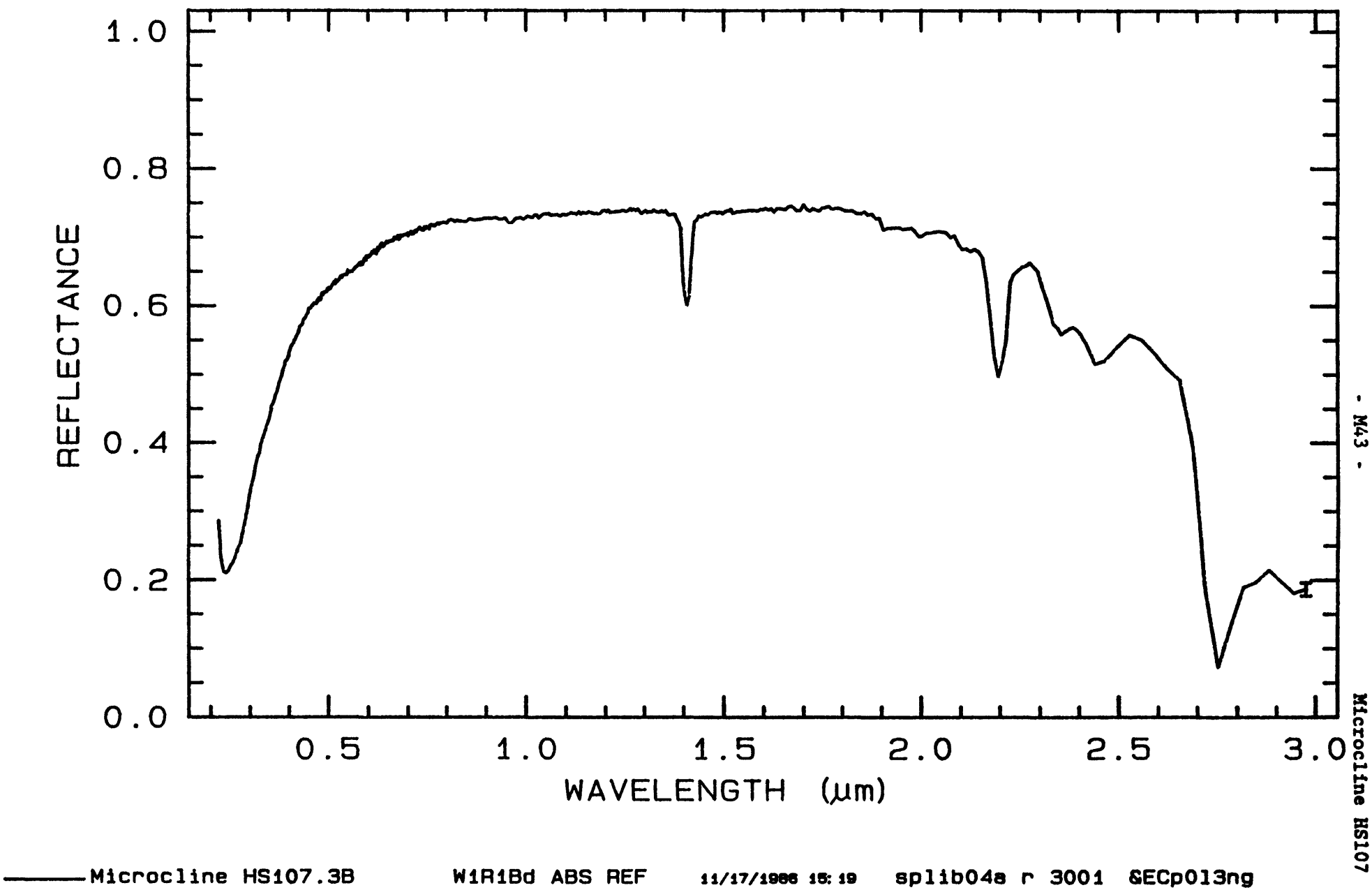
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3001	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M43 -
Microcline HS107
Microcline HS107.3B
W1R1Bd ABS REF
11/17/1986 15:19
splib04a r 3001 &ECp013ng

TITLE: Microcline HS108 Feldspar DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS108

MINERAL_TYPE: Tectosilicate

MINERAL: Microcline (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Perth, Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Orthoclase.

"The microcline spectra (108B) shows fairly weak H_2O features near 1.4 and 1.9μ, and a very weak feature near 2.2μ due to the OH stretch-AlOH bend combination. It also displays a quite sharp drop off at approximately 0.55μ which is typical of the ferric oxides. Sample is pinkish in color, which is not due to an alteration coating of ferric oxide. Deer et al. (1963) point out that Fe^{3+} may substitute for Al in limited amount in normal alkali feldspars, but excess Fe^{3+} will exsolve either as discrete particles of iron-bearing mineral, or as an iron staining on grain boundaries and cleavage planes. The latter appears to be the case for this microcline, which explains the ferric oxide type of visible spectrum. There is, however, insufficient ferric oxide present to yield a discernible near-infrared feature."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Max. microcline + albite(L)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

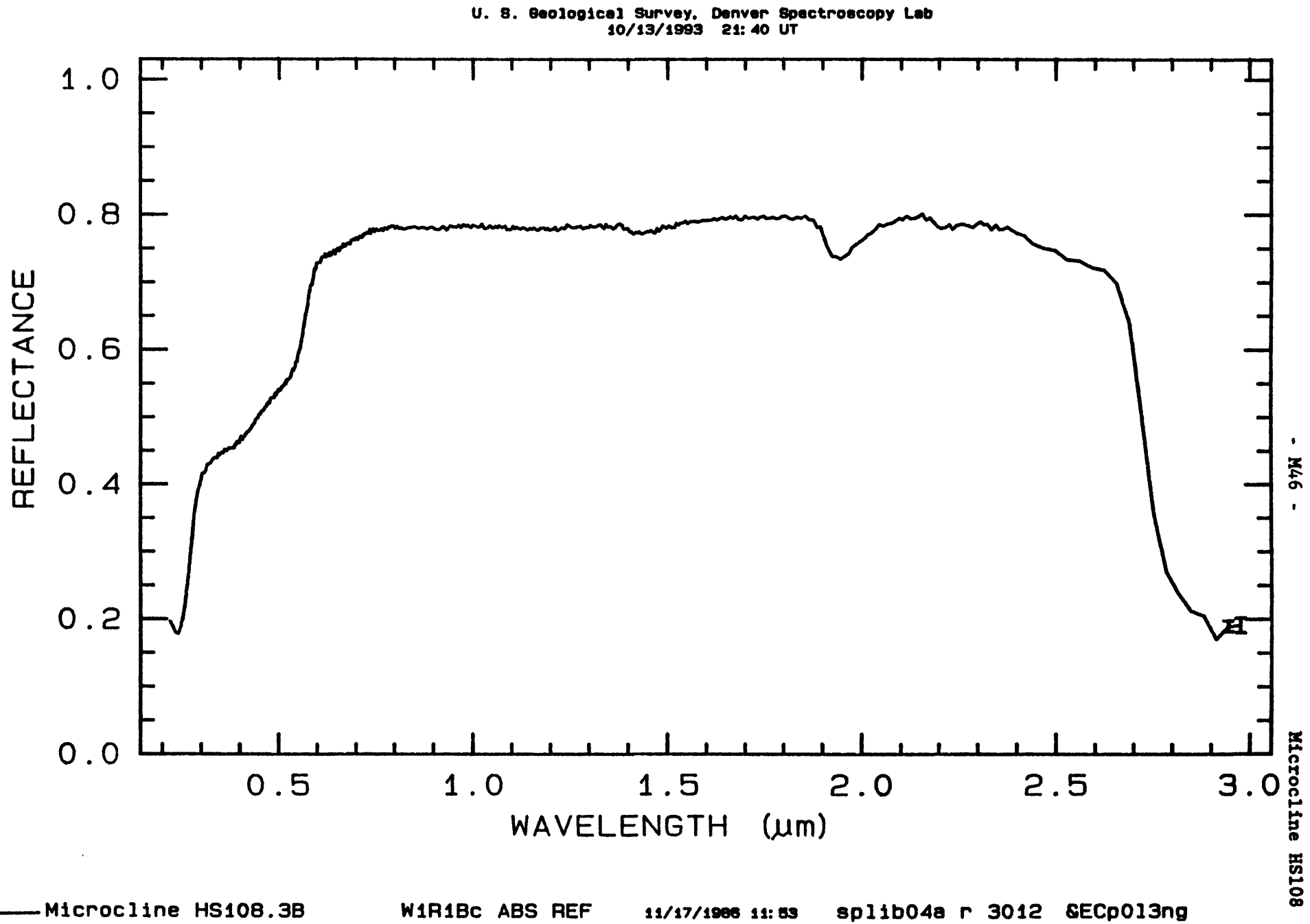
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3012	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M46 -
Microcline HS108
Microcline HS108.3B
W1R1Bc ABS REF
11/17/1986 11:53
splib04a r 3012 &ECp013ng

TITLE: Microcline HS151 Feldspar DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS151

MINERAL_TYPE: Tectosilicate

MINERAL: Microcline (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Custer County, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Orthoclase.

"The microcline spectra shows fairly weak H_2O features near 1.4 and 1.9μ, and a very weak feature near 2.2μ due to the OH stretch-AlOH bend combination. It also displays a quite sharp drop off at approximately 0.55μ which is typical of the ferric oxides. Sample is pinkish in color, which is not due to an alteration coating of ferric oxide. Deer et al. (1963) point out that Fe^{3+} may substitute for Al in limited amount in normal alkali feldspars, but excess Fe^{3+} will exsolve either as discrete particles of iron-bearing mineral, or as an iron staining on grain boundaries and cleavage planes. The latter appears to be the case for this microcline, which explains the ferric oxide type of visible spectrum. There is, however, insufficient ferric oxide present to yield a discernible near-infrared feature."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Max. microcline + albite(l) + mica(s)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

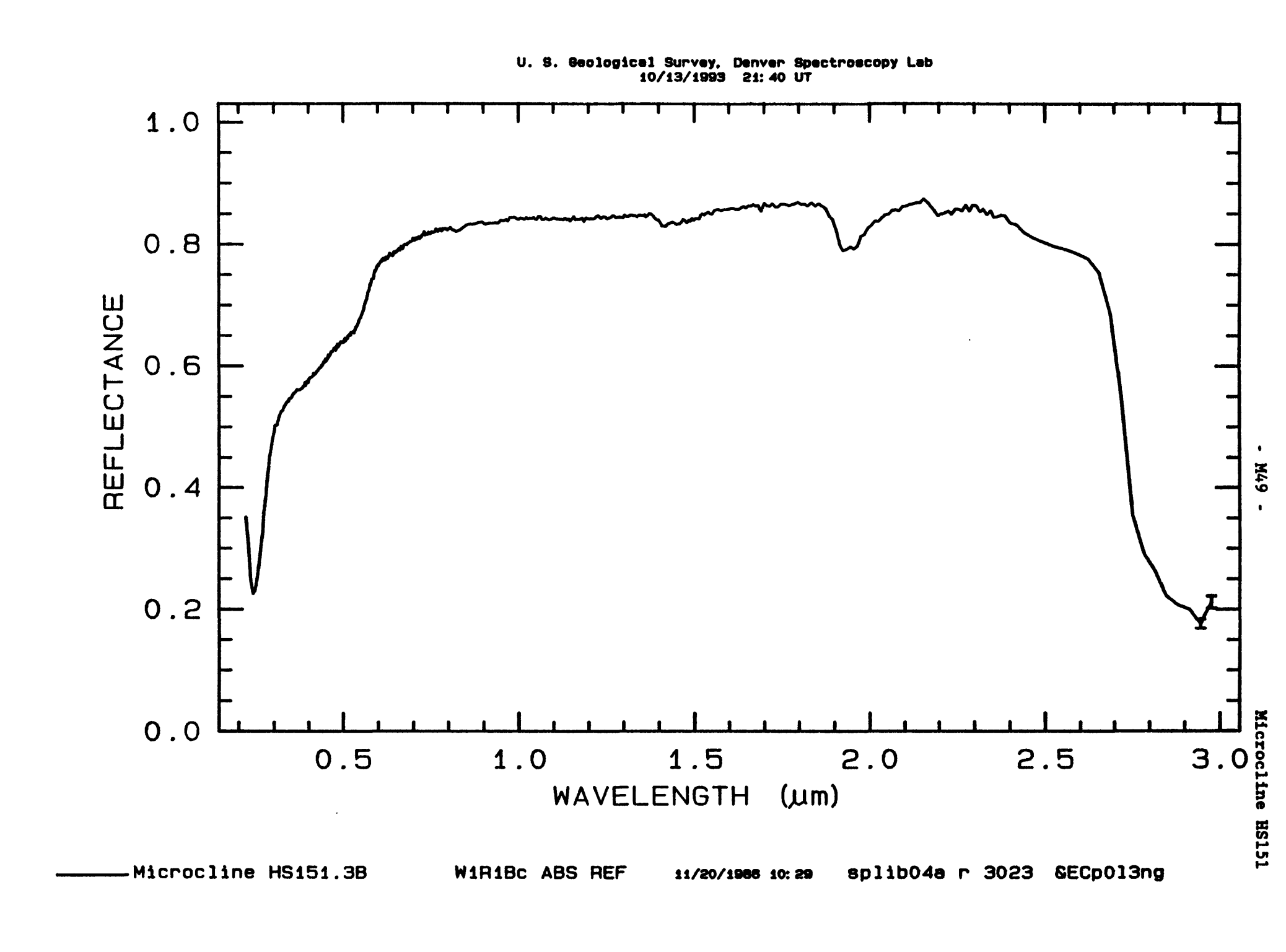
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3023	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M49 -
Microcline HS151
Microcline HS151.3B
W1R1Bc ABS REF
11/20/1986 10:29
splib04a r 3023 &ECp013ng

TITLE: Microcline NMNH135231 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH135231

MINERAL_TYPE: Tectosilicate

MINERAL: Microcline (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Park County, Colorado

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Orthoclase.

Sieve interval 0 - 74μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Contains microcline plus a small amount of albite (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

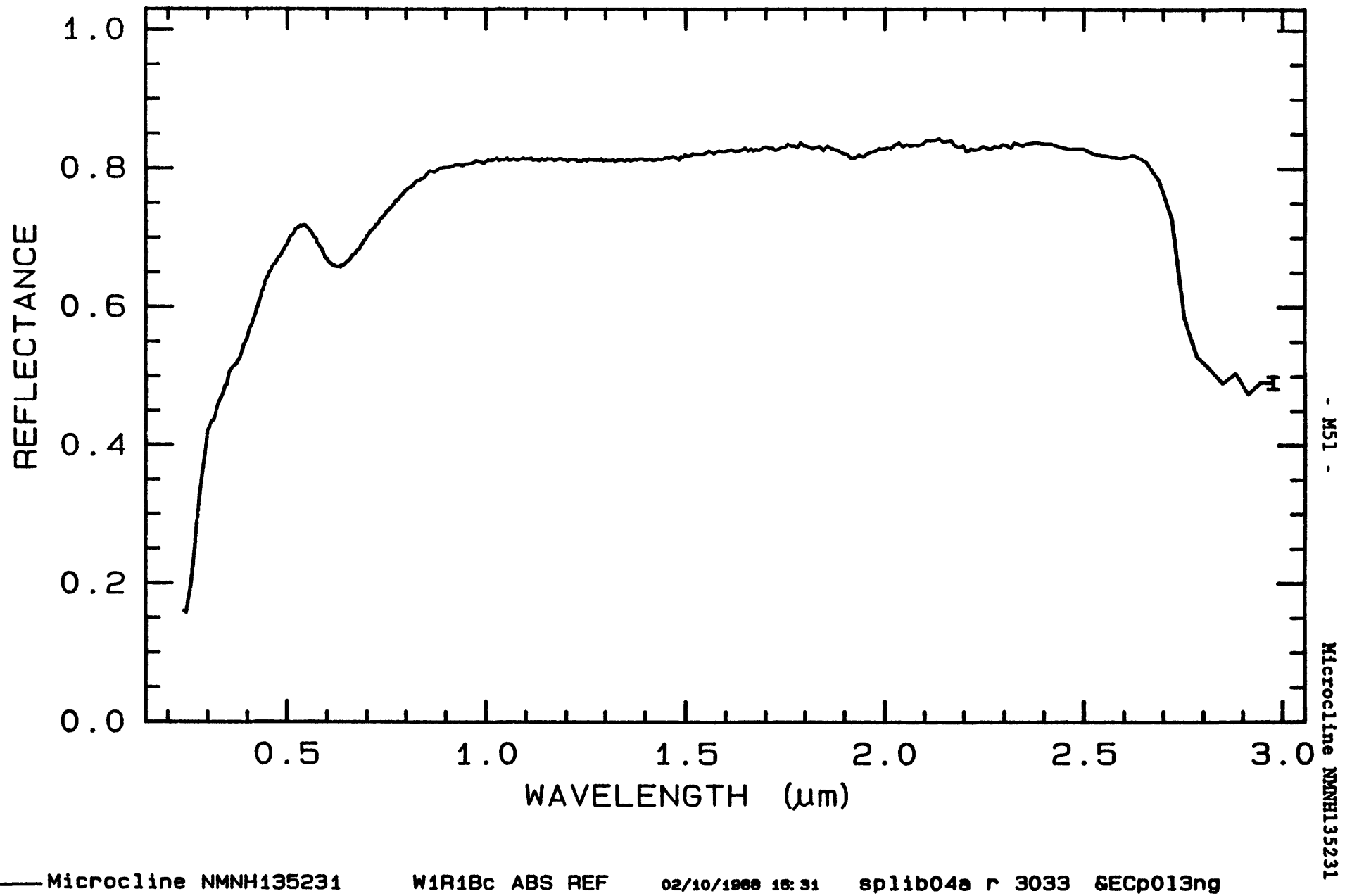
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3033	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M51 -
Microcline NMNH135231
Microcline NMNH135231 W1R1Bc ABS REF 02/10/1988 16:31 splib04a r 3033 &ECp013ng

TITLE: Mirabilite GDS150 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS150

MINERAL_TYPE: Hydrous Sulfate

MINERAL: Mirabilite

FORMULA: Na2SO4*10H2O

FORMULA_NROFF: $Na_2SO_4 \bullet 10H_2O$

COLLECTION_LOCALITY: Chemical Reagent

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Evaporation of Na_2SO_4 solution at room temperature

Spectrum originally published in
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure Mirabilite (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Evaporation of Na_2SO_4 solution at room temperature

END_COMPOSITION_DISCUSSION.

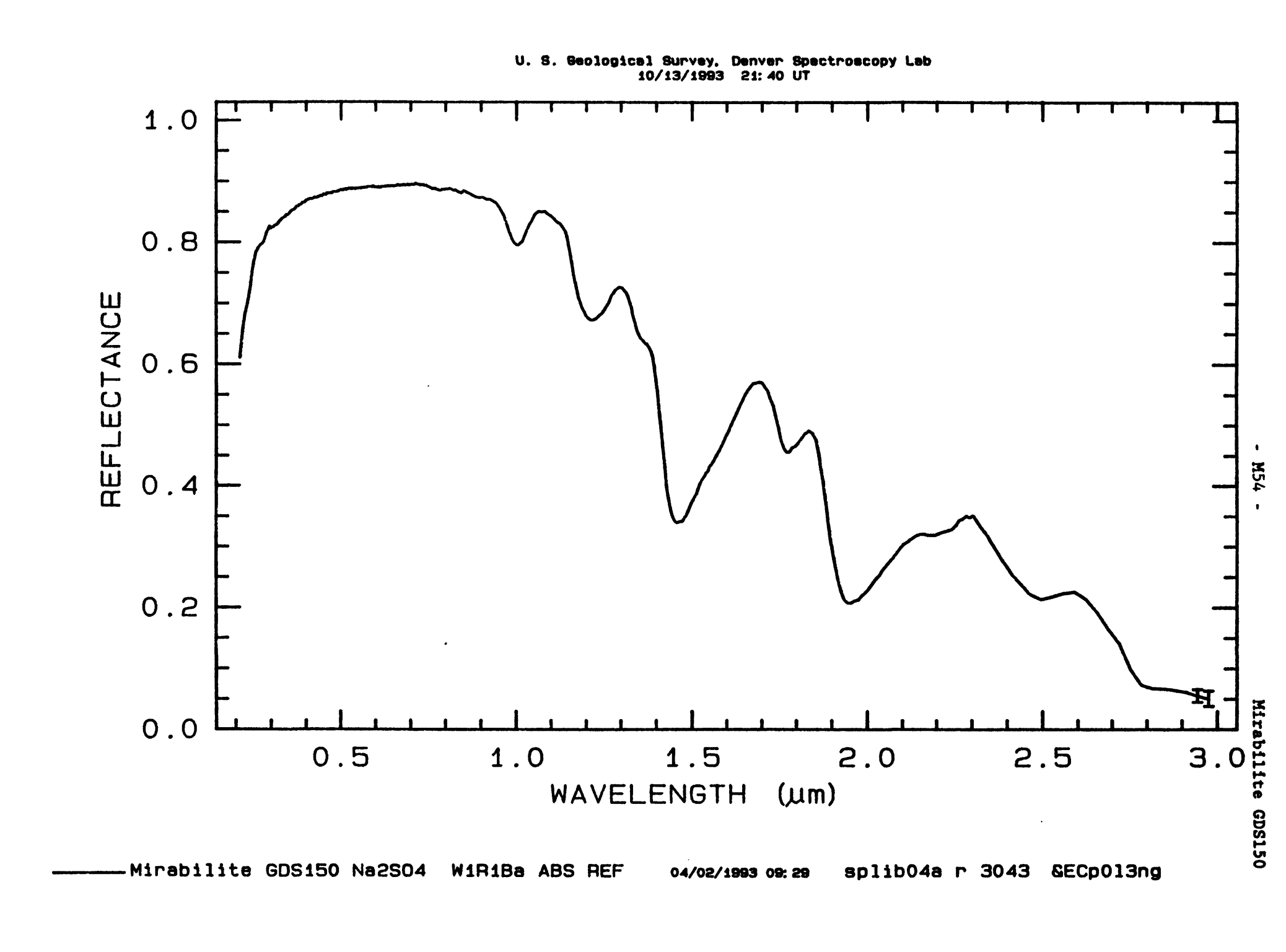
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where Wave Range Av_Rs_Pwr Comment

LIB_SPECTRA: splib04a r 3043 0.2-3.0μm 200 g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M54 -
Mirabilite GDS150
Mirabilite GDS150 Na2SO4 W1R1Ba ABS REF 04/02/1993 09:29 splib04a r 3043 &ECp013ng

TITLE: Mizzonite NMNH113775-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH113775-1

MINERAL_TYPE: Tectosilicate

MINERAL: Mizzonite (Me57) (Scapolite group)

FORMULA: 3NaAlSi3O8*NaCl - 3CaAl2Si2O8*CaCO3 (Me57)

FORMULA_NROFF: $3NaAlSi_3O_8 \bullet NaCl - 3CaAl_2Si_2O_8 \bullet CaCO_3$

COLLECTION_LOCALITY:

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Mizzonite is an intermediate composition between marialite and meionite.

The band centered around 0.6μm give the sample a blue color.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Scapolite + laumontite + other(s) (Norma Vergo, USGS)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	49.60 wt%	NROFF:	SiO_2
COMPOSITION:	Al2O3:	25.43 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.09 wt%	NROFF:	FeO
COMPOSITION:	MgO:	0.03 wt%	NROFF:	MgO
COMPOSITION:	CaO:	13.89 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	5.65 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.39 wt%	NROFF:	K_2O
COMPOSITION:	Cl:	0.88 wt%	NROFF:	Cl
COMPOSITION:	SO3:	1.52 wt%	NROFF:	SO_3
COMPOSITION:	CO2:	2.66 wt%	NROFF:	CO_2
COMPOSITION:	----------			
COMPOSITION:	Total:	100.14 wt%		
COMPOSITION:	O=Cl,F,S:	0.19 wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	99.94 wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

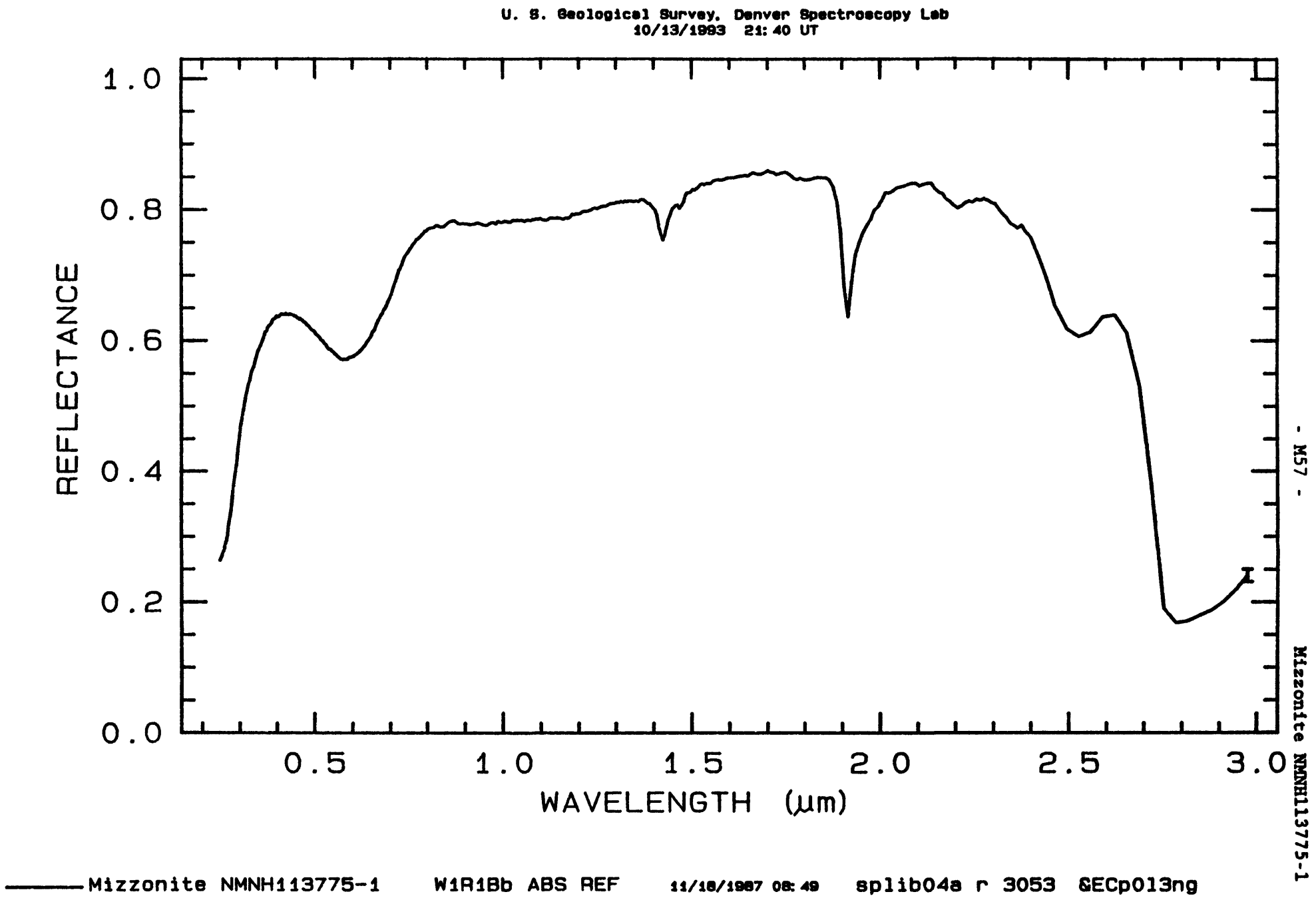
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3053	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M57 -
Mizzonite NMNH113775-1
Mizzonite NMNH113775-1 W1R1Bb ABS REF 11/18/1997 08:49 splib04a r 3053 &ECp013ng

TITLE: Mizzonite BM1931,12 Scapolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: BM1931,12

MINERAL_TYPE: Tectosilicate

MINERAL: Mizzonite (Scapolite group)

FORMULA: Solid solution series: 3NaAlSi3O8*NaCl - 3CaAl2Si2O8*CaCO3 (Me80)

FORMULA_NROFF: Solid solution: $3NaAlSi_3O_8 \bullet NaCl$ - $3CaAl_2Si_2O_8 \bullet CaCO_3$ (Me_{80})

COLLECTION_LOCALITY: Grenville, Argenteuil County, Quebec, Canada

ORIGINAL_DONOR: British Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Scapolites are metamorphic minerals with compositions suggestive of feldspars. There is a complete solid solution series between marialite and meionite.

Sample description, NIR, MID-IR spectra and analysis published in:

Swayze,G.A., and R.N. Clark, 1990, Infrared Spectra and Crystal Chemistry of Sacpolites: Implications for Martian Mineralogy. J. Geophys Res. v. 95, pp. 14481-14495.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Scapolite + muscovite + other(m). (Norma Vergo)

Note that spectrum does not show effect of muscovite. "Other" may be plagioclase. This spectrum closely resembles that of cleaned sample run on a Nicolet FTIR spectrometer. Therefore the features presented here are due to those of the scapolite. G. Swayze.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	44.84	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.0	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	28.77	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.01	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.0	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.0	wt%	NROFF:	MgO
COMPOSITION:	CaO:	19.74	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	2.57	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.33	wt%	NROFF:	K_2O
COMPOSITION:	Cl:	0.02	wt%	NROFF:	Cl
COMPOSITION:	F:	0.0	wt%	NROFF:	F
COMPOSITION:	SO3:	0.9	wt%	NROFF:	SO_3
COMPOSITION:	CO2:	3.43	wt%	NROFF:	CO_2
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.64	wt%		
COMPOSITION:	O=Cl,F,S:	0.004	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.636	wt%		

COMPOSITION_TRACE: Exists but is not included.

COMPOSITION_DISCUSSION:

%Me = 80. End-Member: Mizzonite.

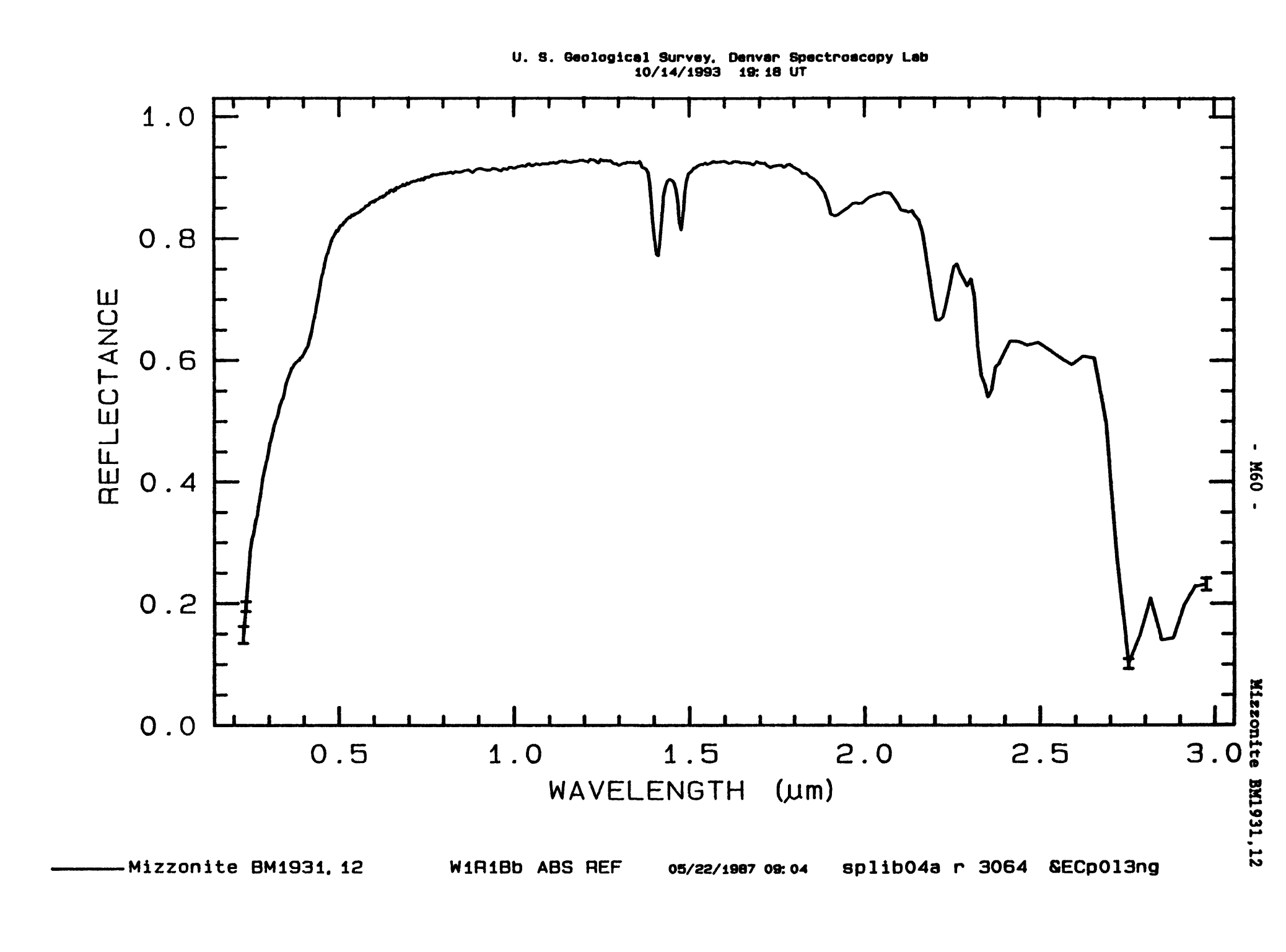
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3064	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M60 -
Mizzonite BM1931,12
Mizzonite BM1931, 12 W1R1Bb ABS REF 05/22/1987 09:04 splib04a r 3064 &ECp013ng

TITLE: Mizzonite HS350 Scapolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS350

MINERAL_TYPE: Tectosilicate

MINERAL: Mizzonite (Scapolite group)

FORMULA: Solid solution series: 3NaAlSi3O8*NaCl - 3CaAl2Si2O8*CaSO4 (Me54)

FORMULA_NROFF: Solid solution: $3NaAlSi_3O_8 \bullet NaCl$ - $3CaAl_2Si_2O_8 \bullet CaSO_4$ (Me_{54})

COLLECTION_LOCALITY: Quebec, Canada

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"T-17 Scapolite 350B--Quebec. $(Na,Ca,K)_4Al_3(Al,Si)_3Si_6O_{24}(Cl,F,OH,CO_3,SO_4)$: This mineral occurs in metamorphosed limestones around intrusive igneous rocks, and also in calcium-rich schists and gneisses. This sample displays a weak feature near 0.6μ similar to that in lazurite as well as water bands and a CO_3 band near 2.35μ."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

Sample description, NIR, MID-IR spectra and analysis published in:

Swayze,G.A., and R.N. Clark, 1990, Infrared Spectra and Crystal Chemistry of Sacpolites: Implications for Martian Mineralogy. J. Geophys Res. v. 95, pp. 14481-14495.

The band centered at 0.6μm gives this sample a blue color.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Scapolite + feldspar + analcime (Norma Vergo, USGS)
Heavy liquid separation of scapolite from contaminants after XRD analyses has proved successful. G. Swayze.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	50.39	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.00	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	25.14	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.02	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.00	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.00	wt%	NROFF:	MgO
COMPOSITION:	CaO:	13.44	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	6.02	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.52	wt%	NROFF:	K_2O
COMPOSITION:	Cl:	1.09	wt%	NROFF:	Cl
COMPOSITION:	F:	0.06	wt%	NROFF:	F
COMPOSITION:	SO3:	1.45	wt%	NROFF:	SO_3
COMPOSITION:	CO2:	2.23	wt%	NROFF:	CO_2
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.36	wt%		
COMPOSITION:	O=Cl,F,S:	0.27	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.09	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

%Me= 54 Sample: Mizzonite

END_COMPOSITION_DISCUSSION.

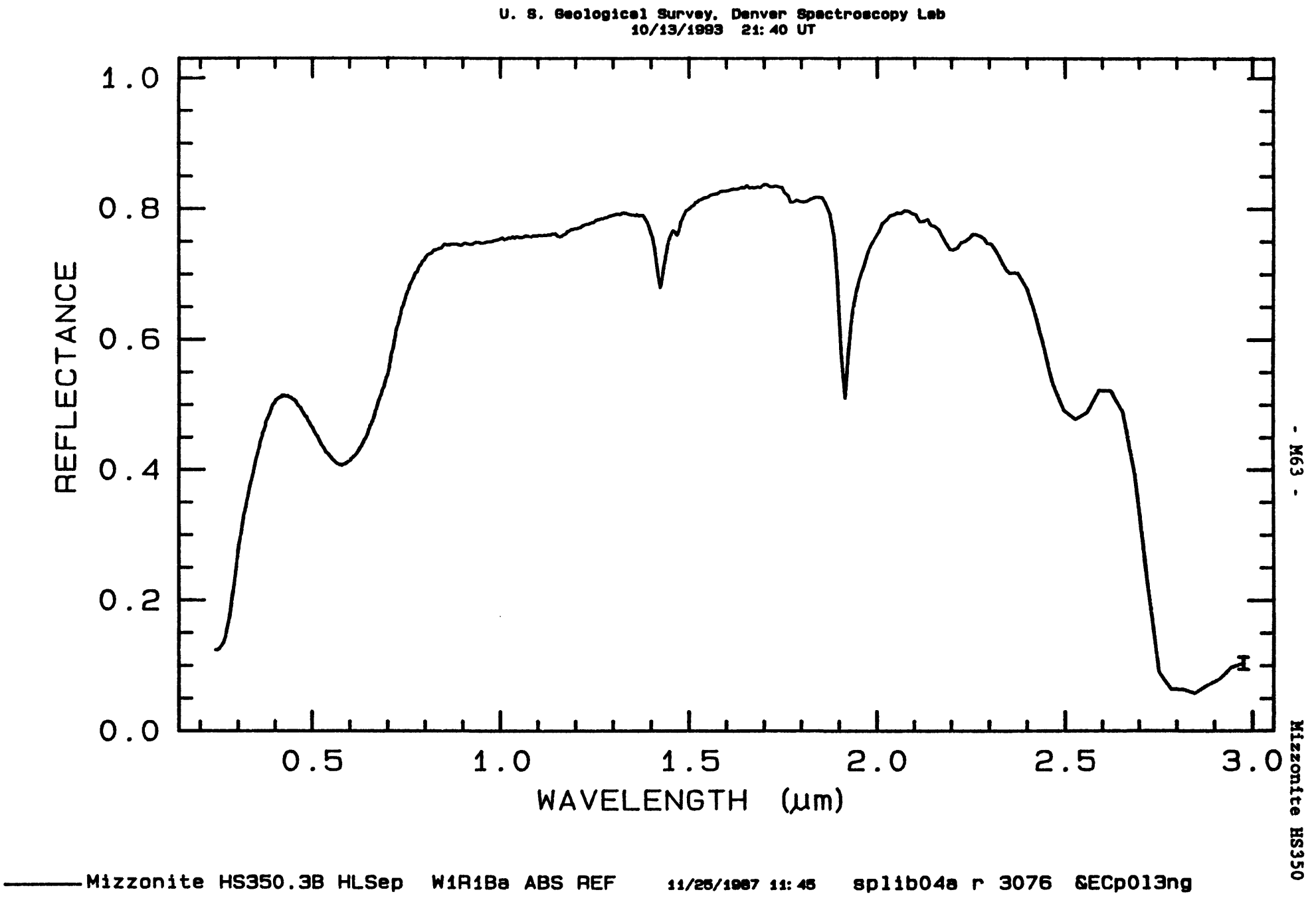
MICROSCOPIC_EXAMINATION:

Pure scapolite after heavy liquid separation. The spectrum shown here is of the heavy liquid separate of scapolite. G. Swayze. It does not contain contaminants.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3076	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M63 -
Mizzonite HS350
Mizzonite HS350.3B HLSep W1R1Ba ABS REF 11/26/1987 11:45 splib04a r 3076 &ECp013ng

TITLE: Mizzonite HS351 Scapolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS351

MINERAL_TYPE: Tectosilicate

MINERAL: Mizzonite (Scapolite group)

FORMULA: Solid solution series: 3NaAlSi3O8*NaCl - 3CaAl2Si2O8*CaCO3 (Me65)

FORMULA_NROFF: Solid solution: $3NaAlSi_3O_8 \bullet NaCl$ - $3CaAl_2Si_2O_8 \bullet CaCO_3$ (Me_{65})

COLLECTION_LOCALITY: Quebec, Canada

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This mineral occurs in metamorphosed limestones around intrusive igneous rocks, and also in calcium-rich schists and gneisses. This sample displays weak water bands and a strong CO_3 band near 2.35μ.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

Sample description, NIR, MID-IR spectra and analysis published in:

Swayze,G.A., and R.N. Clark, 1990, Infrared Spectra and Crystal Chemistry of Scapolites: Implications for Martian Mineralogy. J. Geophys Res. v. 95, pp. 14481-14495.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Scapolite + large amount other; M: ~2% pyrrhotite; slight HCl fizz. Spectrally pure: no calcite bands. (Norma Vergo)

Sample was subsequently purified with heavy liquid separation and "large amount other" was found to be plagioclase. Present spectrum was run on hand-picked grains. G. Swayze.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	48.55	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.14	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	25.59	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.0	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.0	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.05	wt%	NROFF:	MgO
COMPOSITION:	CaO:	16.35	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	4.59	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.48	wt%	NROFF:	K_2O
COMPOSITION:	Cl:	0.09	wt%	NROFF:	Cl
COMPOSITION:	F:	0.41	wt%	NROFF:	F
COMPOSITION:	SO3:	1.89	wt%	NROFF:	SO_3
COMPOSITION:	CO2:	2.82	wt%	NROFF:	CO_2
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.96	wt%		
COMPOSITION:	O=Cl,F,S:	0.13	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.82	wt%		

COMPOSITION_TRACE: Exists but is not included.

COMPOSITION_DISCUSSION:

%Me= 65 End member: Mizzonite.
present spectrum was run on pure hand-picked grains. BS on end of catalogue no. indicates that this sample was hand-separated. G. Swayze.

END_COMPOSITION_DISCUSSION.

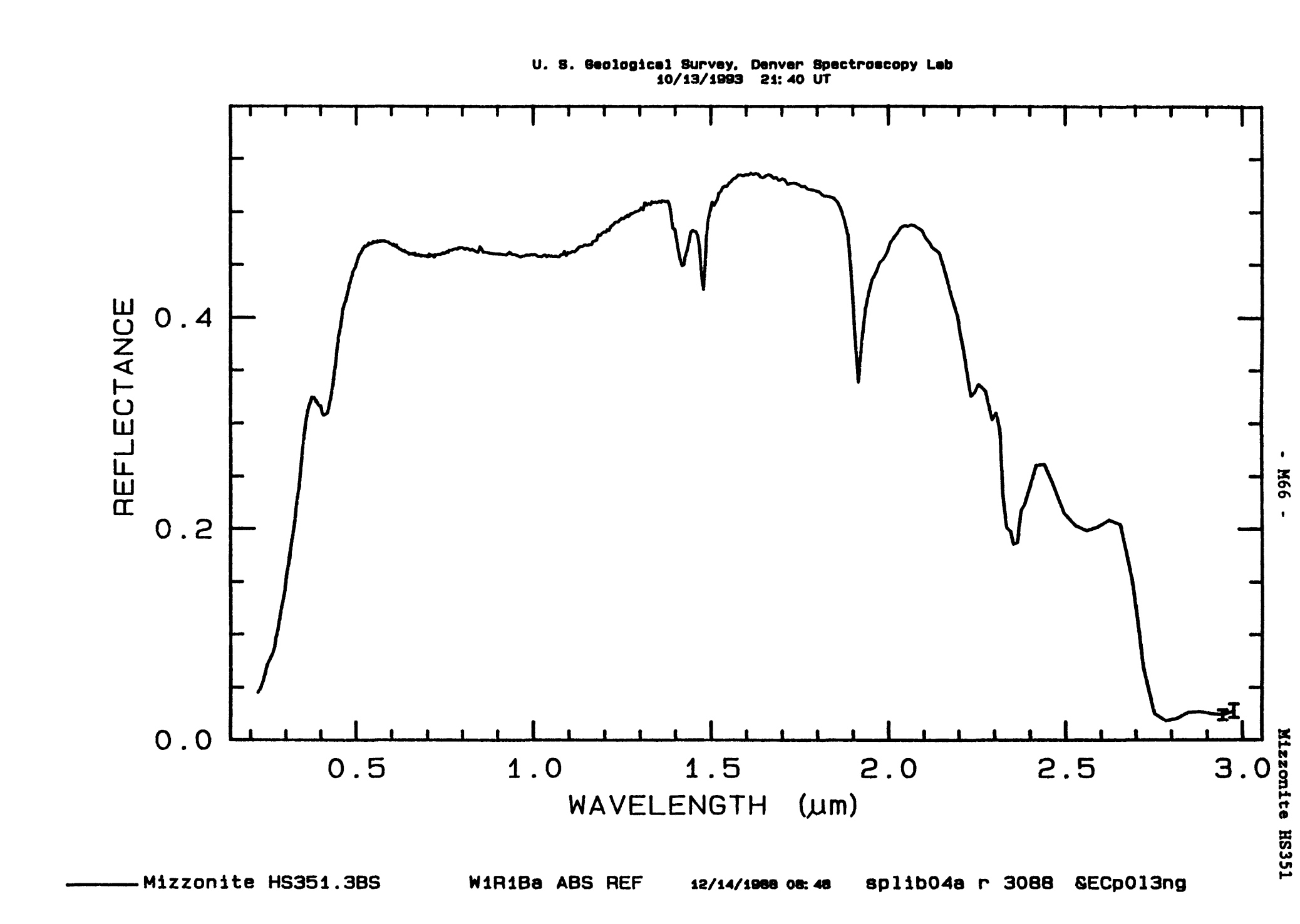
MICROSCOPIC_EXAMINATION:

Sample is scapolite that was handpicked for purity. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3088	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M66 -
Mizzonite HS351
Mizzonite HS351.3BS W1R1Ba ABS REF 12/14/1988 08:48 splib04a r 3088 &ECp013ng

TITLE: Monazite HS255 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS255

MINERAL_TYPE: Phosphate

MINERAL: Monazite

FORMULA: (Ce,La,Nd,Th)PO4

FORMULA_NROFF: $(Ce,La,Nd,Th)PO_4$

COLLECTION_LOCALITY: Miguel County, New Mexico

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Labortory

SAMPLE_DESCRIPTION:

Original spectrum published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1972, Visible and near-infrared spectra of minerals and rocks: V. Halides, phosphates, arsenates, vanadates and borates. Modern Geology, v. 3, p. 121-132.

With the following notes: "Monazite, (Ce, La, Y, Th)PO_4, is a phosphate of the rare earth metals usually found as a comparatively rare accessory mineral in granitic rocks and pegmatites. Because of its resistance to weathering and high specific gravity, it is also found concentrated in some beach sands."

"This sample is complicated not only by this multitudenous possiblilty for substitution, but also because there appears to be considerable apatite present as a contaminant."

"From the spectrum it would appear that at least some hydroxyl apatite and molecular water must be present. The bands at 0.55, 0.68, 0.75, 0.81, and 0.88μm are all due to electronic transitions in the divalent lanthanum ion. The two smaller peaks at 0.68 and 0.88μm spanning the intense doublet at 0.75 and 0.81 are evident in the flame emission spectrum of lanthanum, and are perceptible in spectrum [Apatite HS253]. The features occurring between 1 and 2μm indicate the presence of both molecular water and hydroxyl groups. This contention is supported by the mid-infrared spectrum of this sample which displays a very broad and intense band throughout the OH fundamental stretching region and a much weaker band at 1630cm^{-1}, indicating the presence of molecular water. The bands near 1.0 and 1.2 microns are surprisingly well resolved and are probably due to combinations of various hydroxyl stretching modes, together with contribuions from the overtone of the water bending mode combining with the stretching mode. The three bands between 1.4 and 1.6μm indicates that there are probably several different OH groups present in very different environments. This sample is obviously far from pure monazite and the assignment of these vibrational overtone and combination tones is very tentative. Mass spectrographic analyses of this sample showed that the

lanthanum to Ce ratio is 0.4, and that other rare earths were present in 1 to 10% quantitites. It is possible that some contribution from these rare earth ions could be affecting the spectrum between 1 and 2 microns."

Note: Nd^{3+} and Sm^{3+} are the source of the narrow absorption features, not lanthanum as described above.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None.

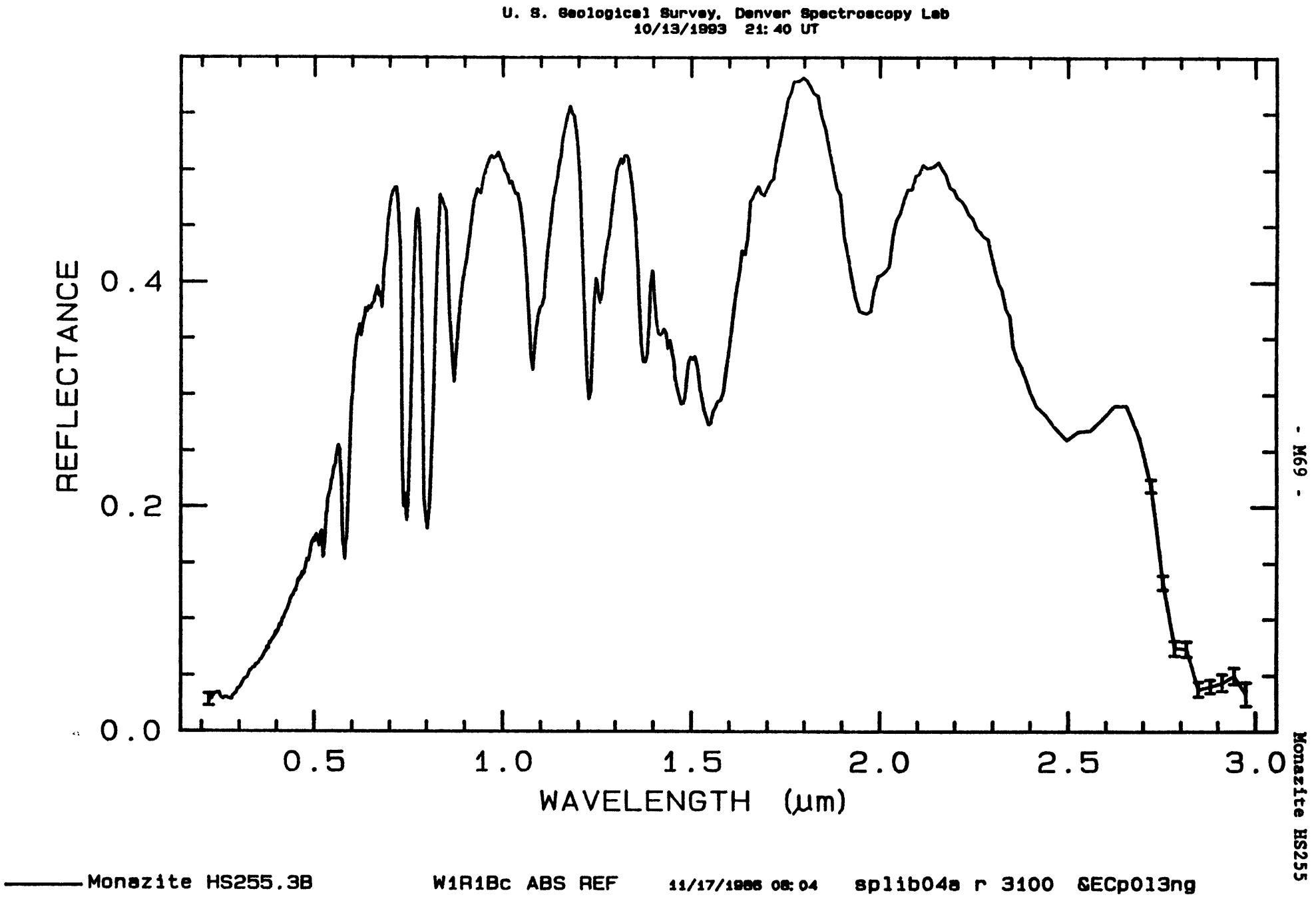
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3100	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M69 -
Monazite HS255
Monazite HS255.3B
W1R1Bc ABS REF
11/17/1986 08:04
splib04a r 3100 &ECp013ng

TITLE: Monticellite HS339 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS339

MINERAL_TYPE: Nesosilicate

MINERAL: Monticellite (Olivine group)

FORMULA: CaMgSiO4

FORMULA_NROFF: $CaMgSiO_4$

COLLECTION_LOCALITY: Texas

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Kirschsteinite.

Original spectrum published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

With the comment:"This sample is spectrally quite featureless except for a very weak band near 1.0μm and weak features in the visible. Although monticellite typically shows remarkably small departures from ideal composition, it is obvious that a small amount of Fe^{2+} has substituted for the Mg, producing both the 1μm band and the fall off toward the blue in the visible."

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

None.

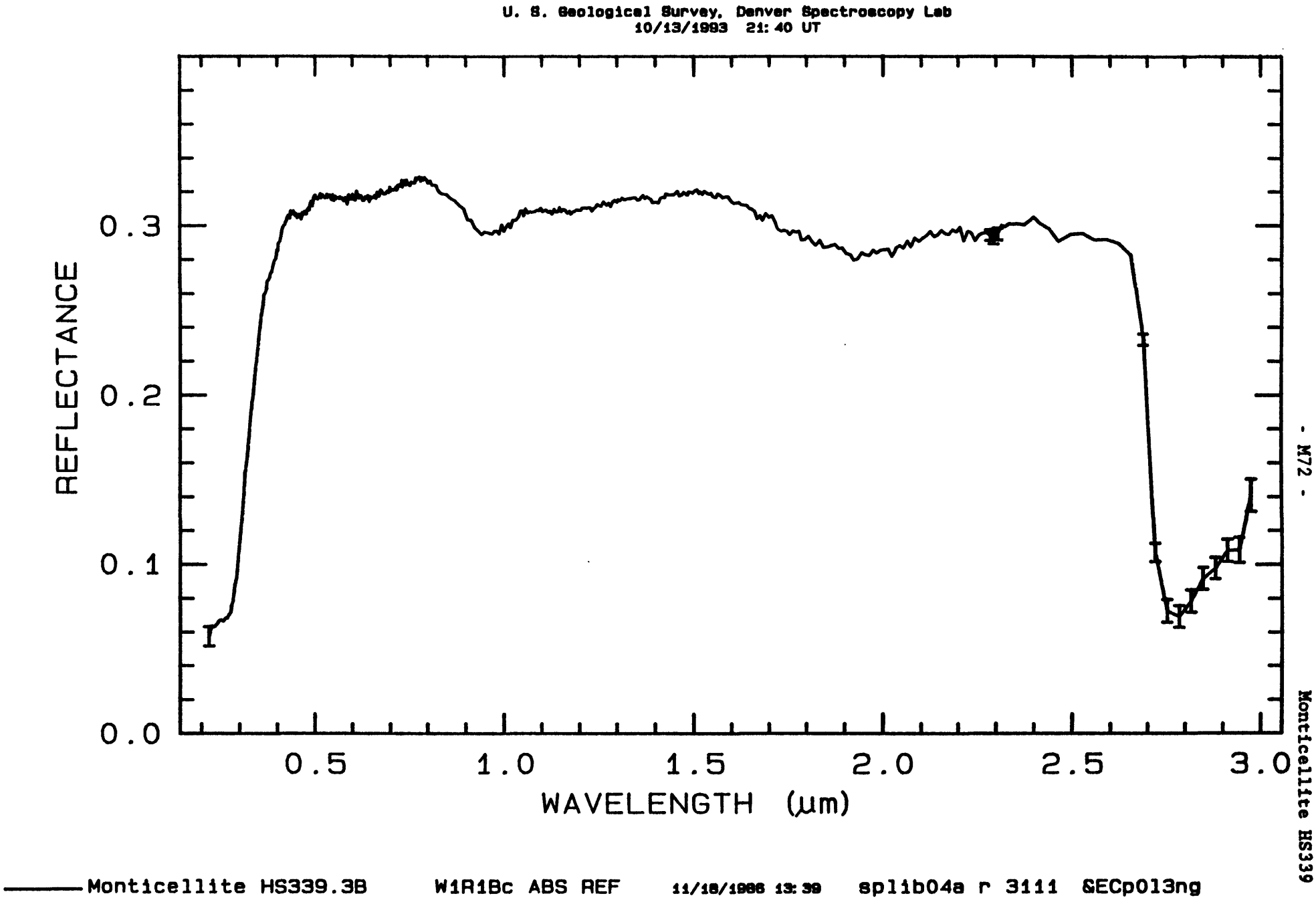
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 3111	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- M72 -
Monticellite HS339
Monticellite HS339.3B W1R1Bc ABS REF 11/18/1986 13:39 splib04a r 3111 GECp013ng

TITLE: Montmorillonite SWy-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SWy-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite (Smectite) (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Crook, Wyoming

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is smectite + quartz + feldspar; the <2μm cut is smectite + quartz.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	62.9	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.16	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	19.3	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.85	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.12	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.01	wt%	NROFF:	MnO
COMPOSITION:	MgO:	2.80	wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.80	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	1.54	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.56	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.06	wt%	NROFF:	P_2O_5
COMPOSITION:	F:	0.111	wt%	NROFF:	F
COMPOSITION:	CO2:	1.33	wt%	NROFF:	CO_2
COMPOSITION:	LOI:	5.10	wt%	NROFF:	LOI
COMPOSITION:	----------				
COMPOSITION:	Total:	99.54	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysis by C. V. Clemency, Dept. of Geological Sciences, SUNY at Buffalo, Buffalo NY for the Clay Minerals Society. Fluorine analysis by J. Thomas Jr., Illinois State Geological Survey, Urbana, Ill, and is not included in the total.

Published in: van Olphen, H. and J.J. Fripiat, eds., 1979, Data handbook for clay materials and other non-metallic minerals, Pergamon Press, New York, p128.

END_COMPOSITION_DISCUSSION.

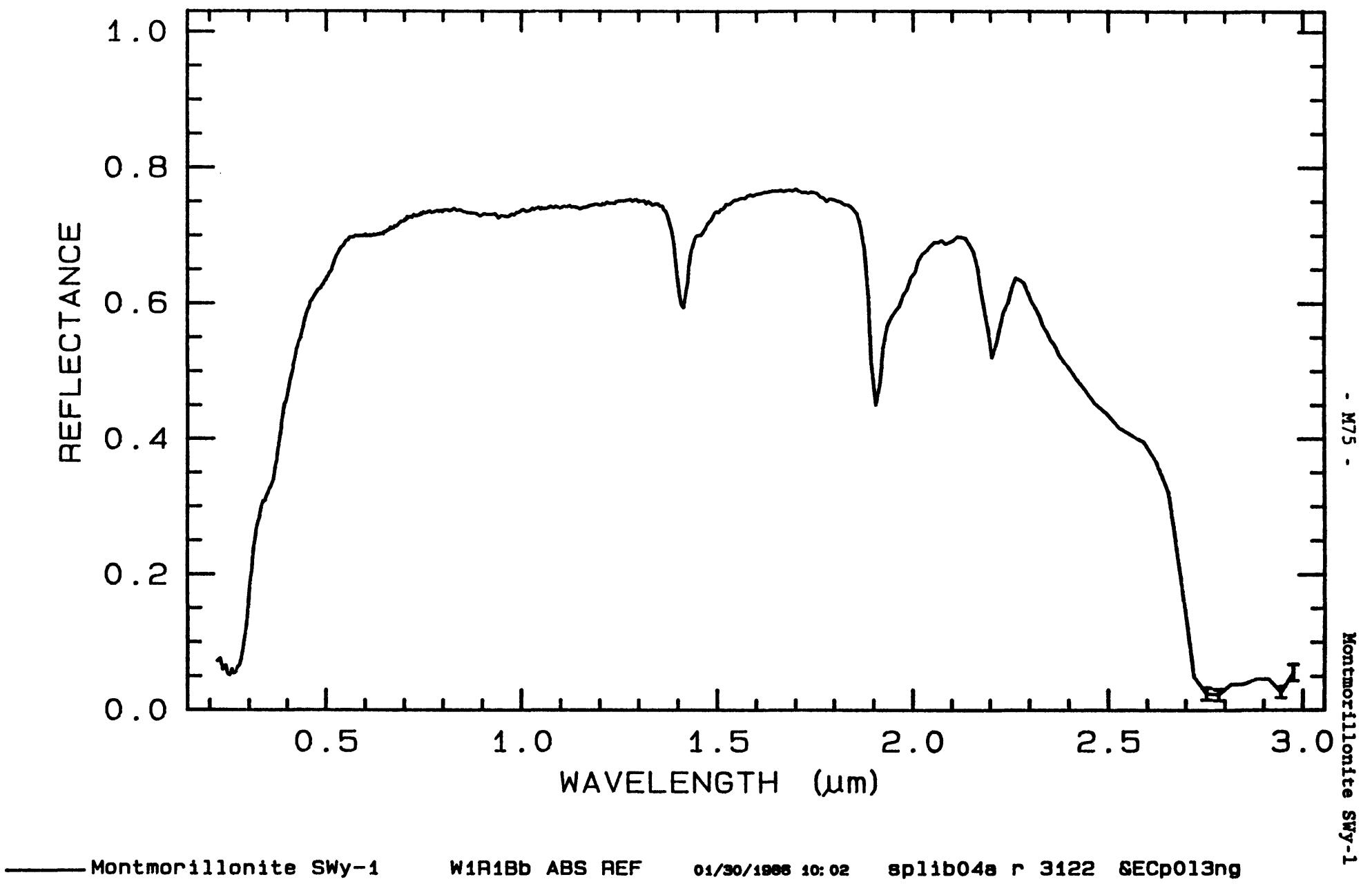
MICROSCOPIC_EXAMINATION:

Trace amounts of magnetite or biotite, no HCl fizz, no visible quartz or feldspar.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3122	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M75 -
Montmorillonite SWy-1
Montmorillonite SWy-1 W1R1Bb ABS REF 01/30/1986 10:02 splib04a r 3122 &ECp013ng

TITLE: Montmorillonite SAz-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SAz-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH20

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Apache County, Arizona

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

The spectrum from 2.5-25μm was published in: Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is smectite + medium amounts of quartz, the <2μm cut is pure smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	60.4	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.24	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	17.6	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.42	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.08	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.10	wt%	NROFF:	MnO
COMPOSITION:	MgO:	6.46	wt%	NROFF:	MgO
COMPOSITION:	CaO:	2.82	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.06	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.19	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.02	wt%	NROFF:	P_2O_5
COMPOSITION:	F:	0.287	wt%	NROFF:	F
COMPOSITION:	LOI:	9.91	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.30	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysis by Haydn H. Murray, Dept. of Geology, Indiana University, Bloomington, Indiana for the Clay Minerals Society. Fluorine analysis by J. Thomas Jr., Illinois State Geological Survey, Urbana, Ill, and is not included in the total.

Published in: van Olphen, H. and J.J. Fripiat, eds., 1979, Data handbook for clay materials and other non-metallic minerals, Pergamon Press, New York, p128.

END_COMPOSITION_DISCUSSION.

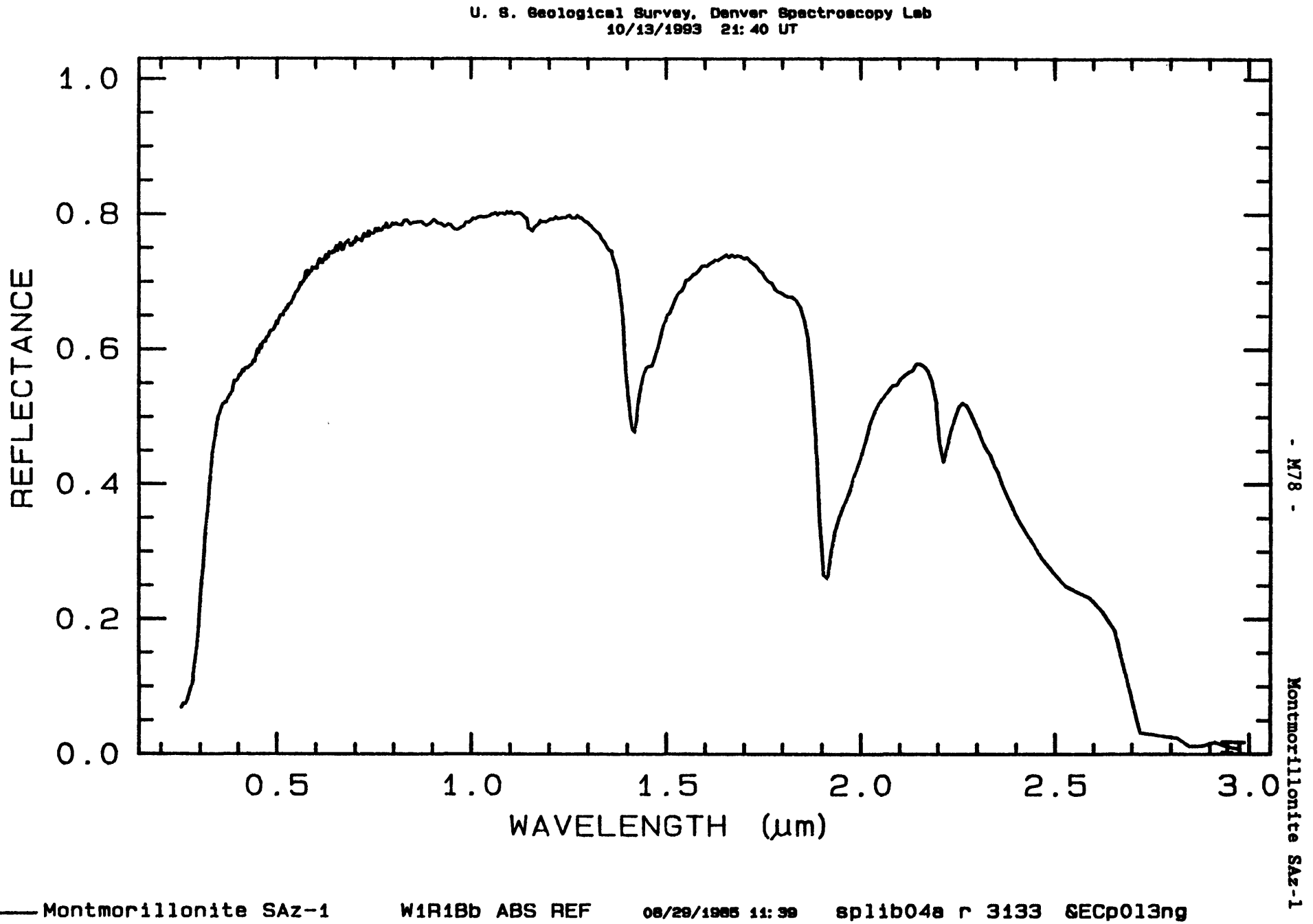
MICROSCOPIC_EXAMINATION:

Trace amounts of opaques, no HCl fizz.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3133	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M78 -
Montmorillonite SAz-1
Montmorillonite SAz-1 W1R1Bb ABS REF 08/29/1985 11:39 splib04a r 3133 GECp013ng

TITLE: Montmorillonite SCa-2 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SCa-2

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: San Diego County, CA

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

The spectrum from 2.5-25μm was published in: Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is smectite + trace amounts of quartz, the <2μm cut is pure smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	52.4	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.32	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	15.0	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.75	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	<0.01	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.16	wt%	NROFF:	MnO
COMPOSITION:	MgO:	6.68	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.81	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	1.21	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.33	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	6.78	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	12.5	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	19.3	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	19.5	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	98.21	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

END_COMPOSITION_DISCUSSION.

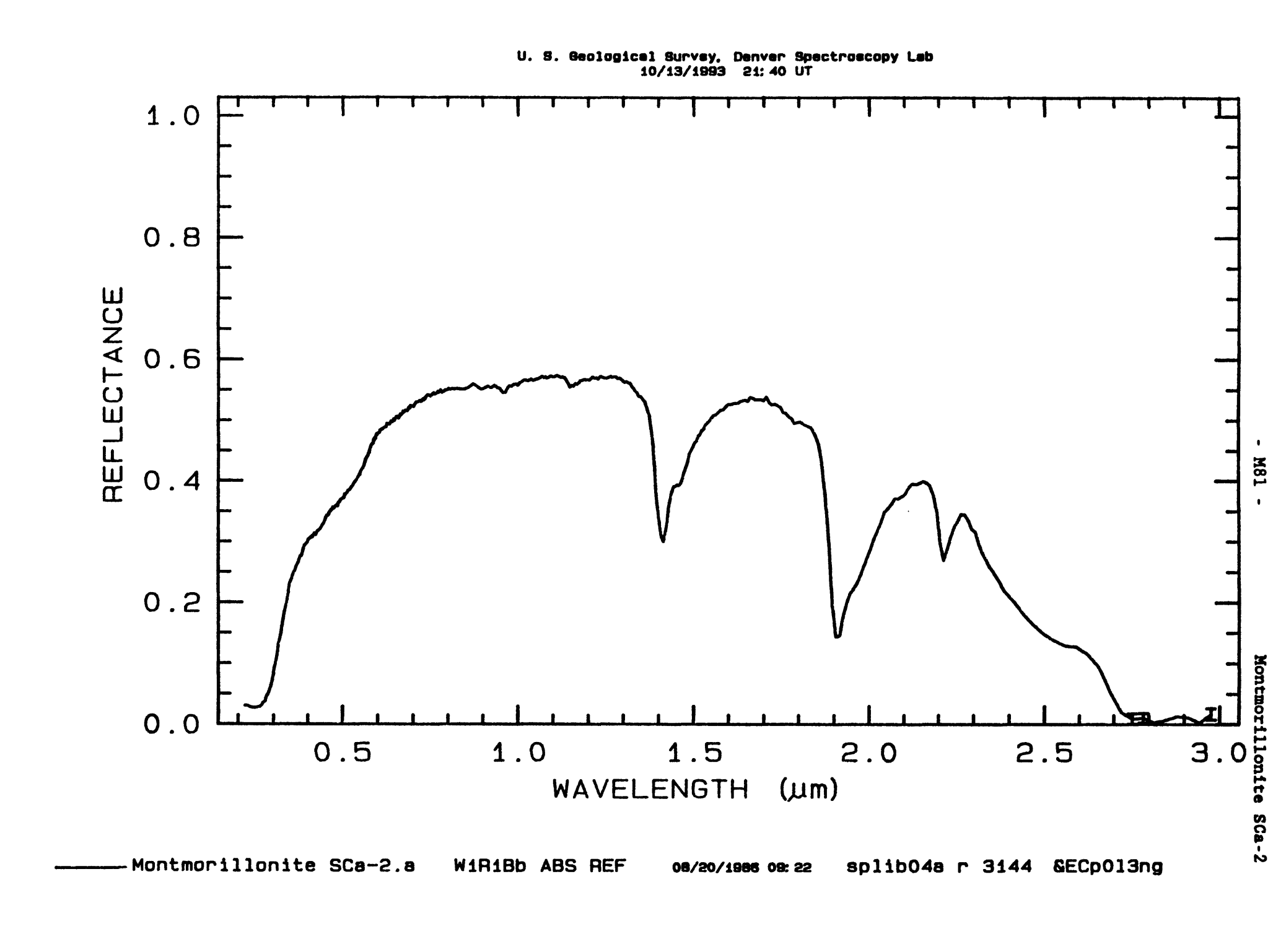
MICROSCOPIC_EXAMINATION:

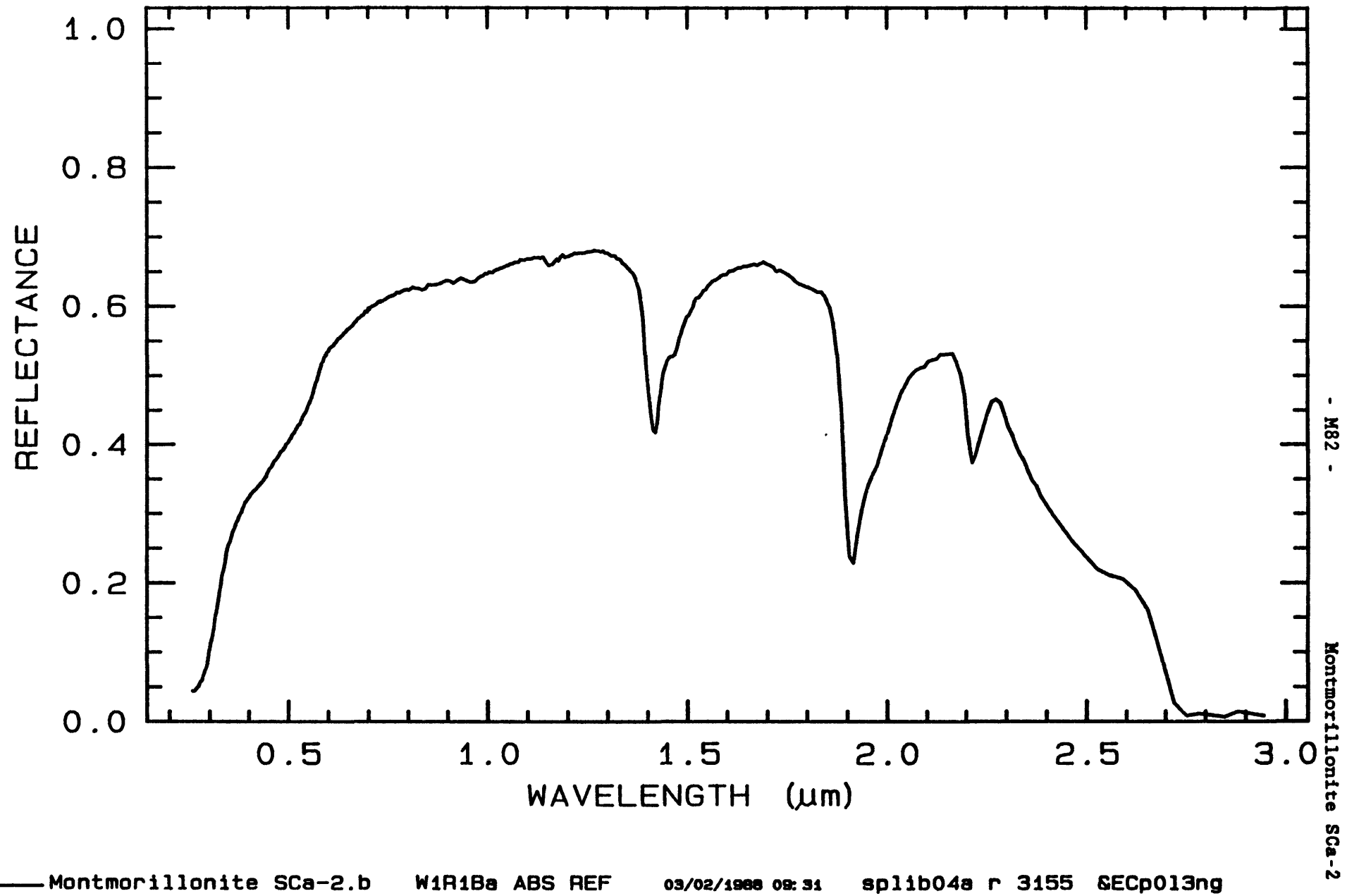
~1% opaques.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3144	0.2-3.0μm	200	g.s.=
LIB_SPECTRA:	splib04a r 3155	0.2-3.0μm	200	g.s.=<2μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M81 -
Montmorillonite SCa-2
Montmorillonite SCa-2.a W1R1Bb ABS REF 08/20/1986 09:22 splib04a r 3144 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M82 -
Montmorillonite SCa-2
Montmorillonite SCa-2.b W1R1Ba ABS REF 03/02/1988 08:31 splib04a r 3155 &ECp013ng

TITLE: Montmorillonite CM27 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM27

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite (Bentonite) (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Belle Fourche, South Dakota

ORIGINAL_DONOR: Clay Mineral Standard, Wards Natural Science Inc

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is bentonite + quartz + feldspar + bassanite; the <2μm cut is pure smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	57.6	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.12	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	20.9	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.54	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.09	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	2.66	wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.04	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	1.81	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.35	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	5.94	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	5.46	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	11.4	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	11.3	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.39	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

END_COMPOSITION_DISCUSSION.

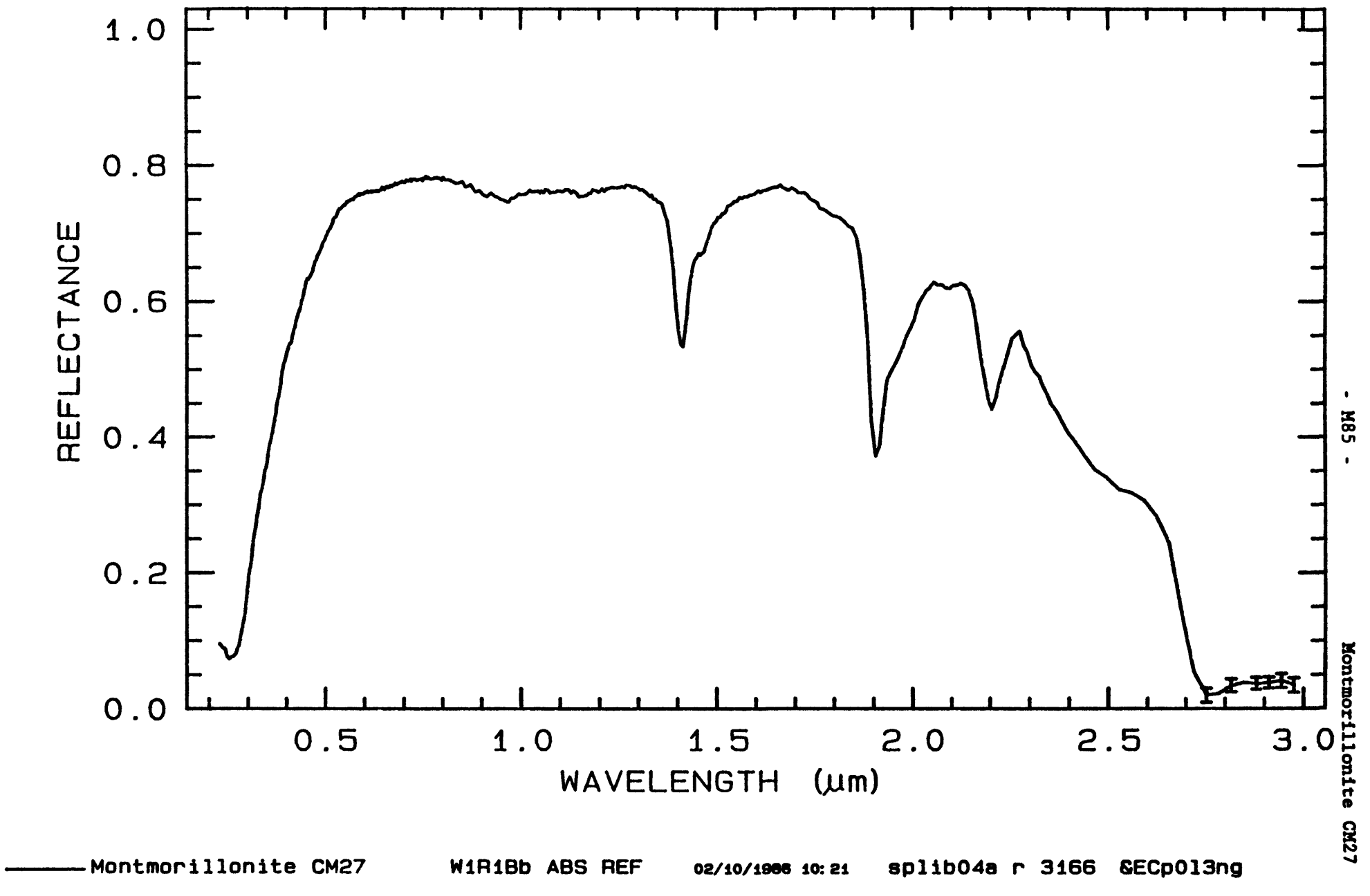
MICROSCOPIC_EXAMINATION:

Trace amounts of limonite, no visible feldspar or quartz, slight HCl fizz.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3166	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M85 -
Montmorillonite CM27
Montmorillonite CM27 W1R1Bb ABS REF 02/10/1986 10:21 splib04a r 3166 &ECp013ng

TITLE: Montmorillonite CM20 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM20

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Husband Mine, Polkville, Mississippi

ORIGINAL_DONOR: Clay Mineral Standard, Wards Natural Science Inc

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is smectite + trace quartz, the <2μm cut was pure smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	52.0	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.17	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	18.3	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	5.18	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.02	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.06	wt%	NROFF:	MnO
COMPOSITION:	MgO:	3.32	wt%	NROFF:	MgO
COMPOSITION:	CaO:	2.19	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.02	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	7.56	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	12.6	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	20.2	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	18.9	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.34	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

END_COMPOSITION_DISCUSSION.

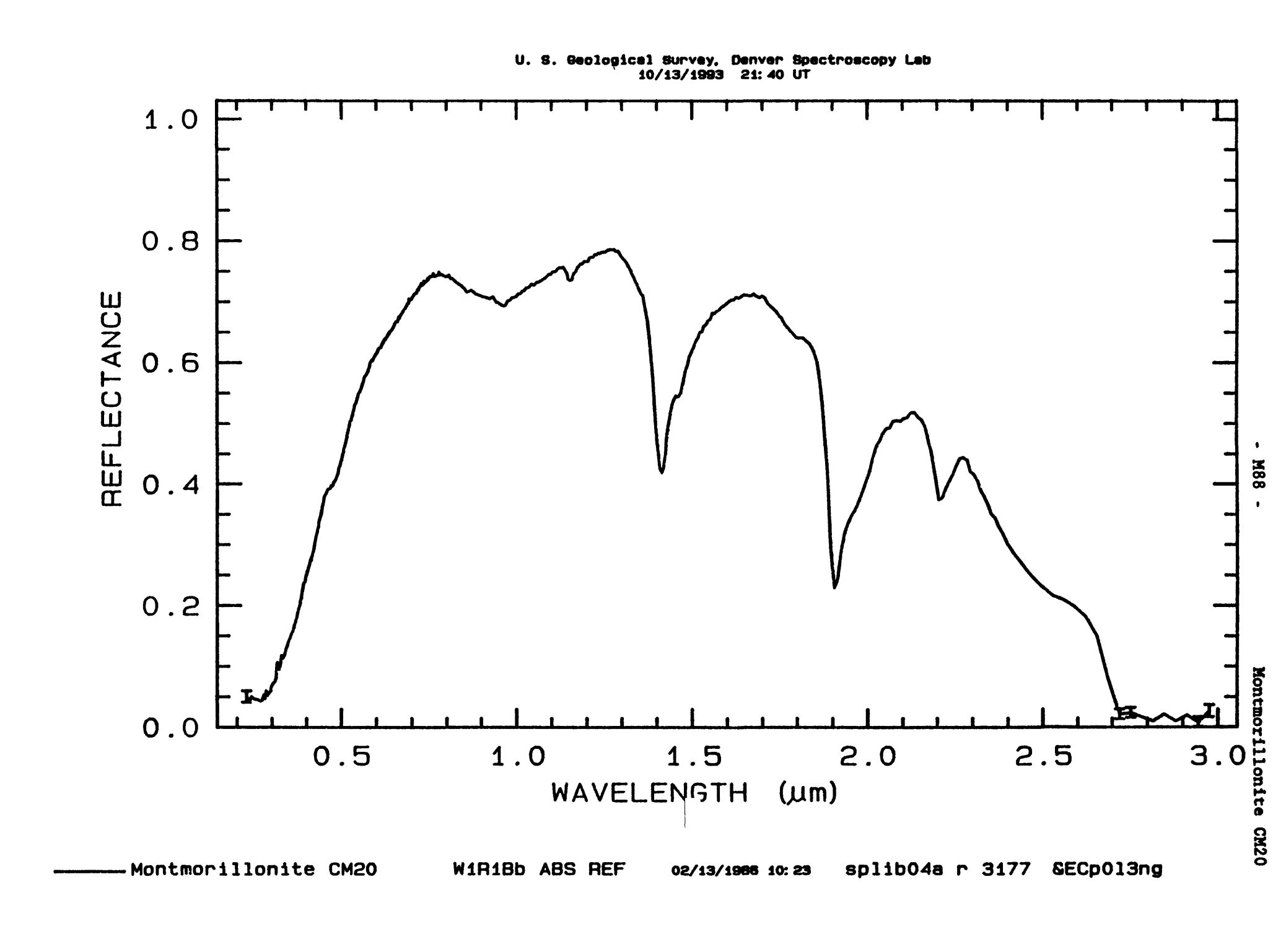
MICROSCOPIC_EXAMINATION:

Indicates no visible quartz, ~1% limonite individual grains.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3177	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M88 -
Montmorillonite CM20
Montmorillonite CM20 W1R1Bb ABS REF 02/13/1986 10:23 splib04a r 3177 &ECp013ng

TITLE: Montmorillonite CM26 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM26

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Clay Spar, Wyoming

ORIGINAL_DONOR: Clay Mineral Standard, Wards Natural Science Inc

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is smectite + large amounts of quartz, the <2μm cut is pure smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	63.5	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.11	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	18.2	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.22	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.09	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	2.26	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.56	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	2.31	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.35	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	5.15	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	4.66	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	9.81	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	9.29	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.87	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

END_COMPOSITION_DISCUSSION.

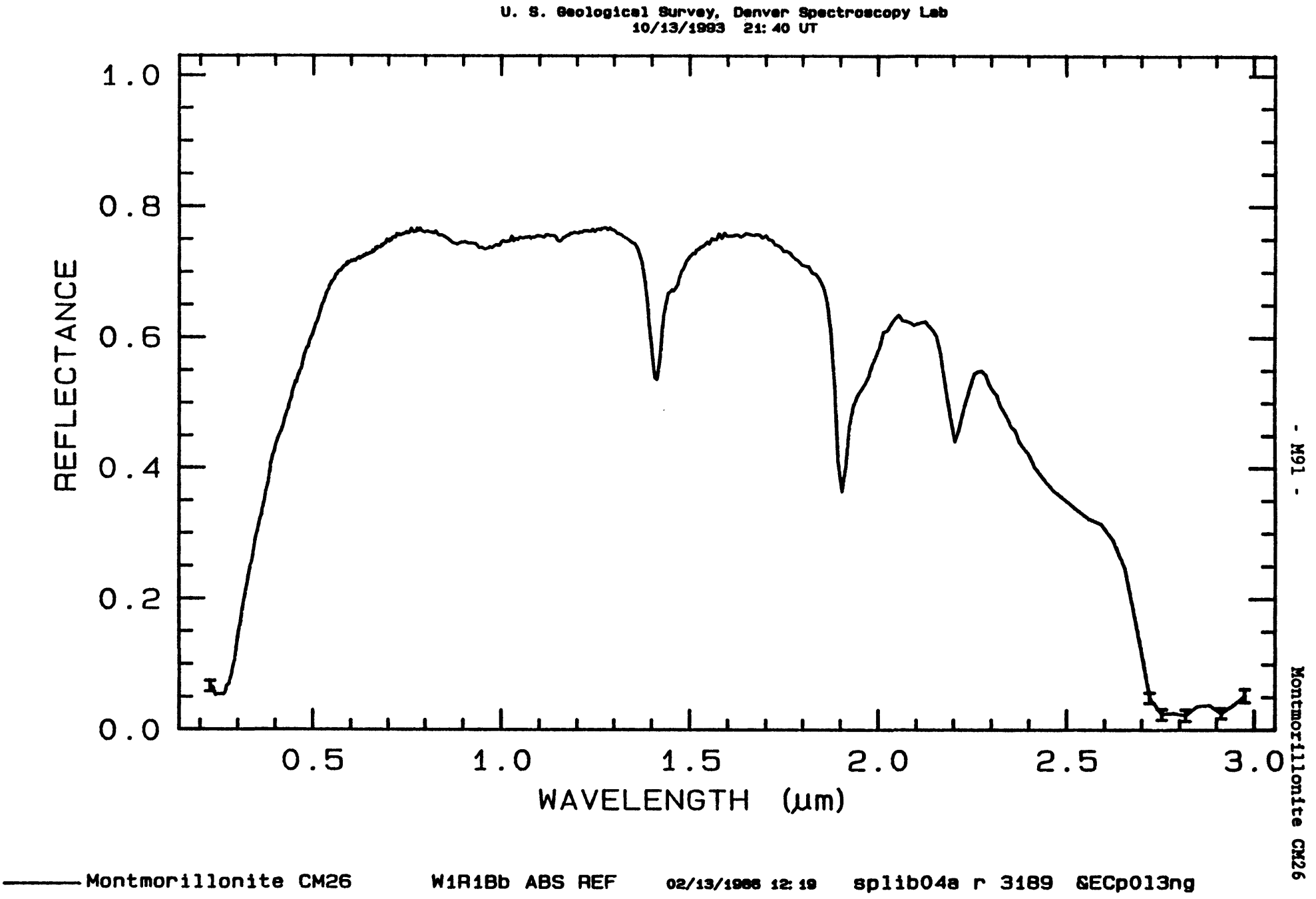
MICROSCOPIC_EXAMINATION:

Trace amounts of limonite, no visible quartz, slight HCl fizz.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3189	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:40 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M91 -
Montmorillonite CM26
Montmorillonite CM26 W1R1Bb ABS REF 02/13/1998 12:19 splib04a r 3189 GECp013ng

TITLE: Montmorillonite STx-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: STx-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite (Smectite) (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$

COLLECTION_LOCALITY: Gonzales County, Texas

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

The spectrum from 2.5-25μm was published in: Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is smectite + trace amounts of quartz, the <2μm cut is pure smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	69.6	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.29	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	16.3	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.17	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.04	wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.01	wt%	NROFF:	MnO
COMPOSITION:	MgO:	3.56	wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.73	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.33	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.15	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.03	wt%	NROFF:	P_2O_5
COMPOSITION:	F:	0.084	wt%	NROFF:	F
COMPOSITION:	CO2:	0.16	wt%	NROFF:	CO_2
COMPOSITION:	LOI:	7.50	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.87	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysis by C. V. Clemency, Dept. of Geological Sciences, SUNY at Buffalo, Buffalo NY for the Clay Minerals Society. Fluorine analysis by J. Thomas Jr., Illinois State Geological Survey, Urbana, Ill, and is not included in the total.

Published in: van Olphen, H. and J.J. Fripiat, eds., 1979, Data handbook for clay materials and other non-metallic minerals, Pergamon Press, New York, p128.

END_COMPOSITION_DISCUSSION.

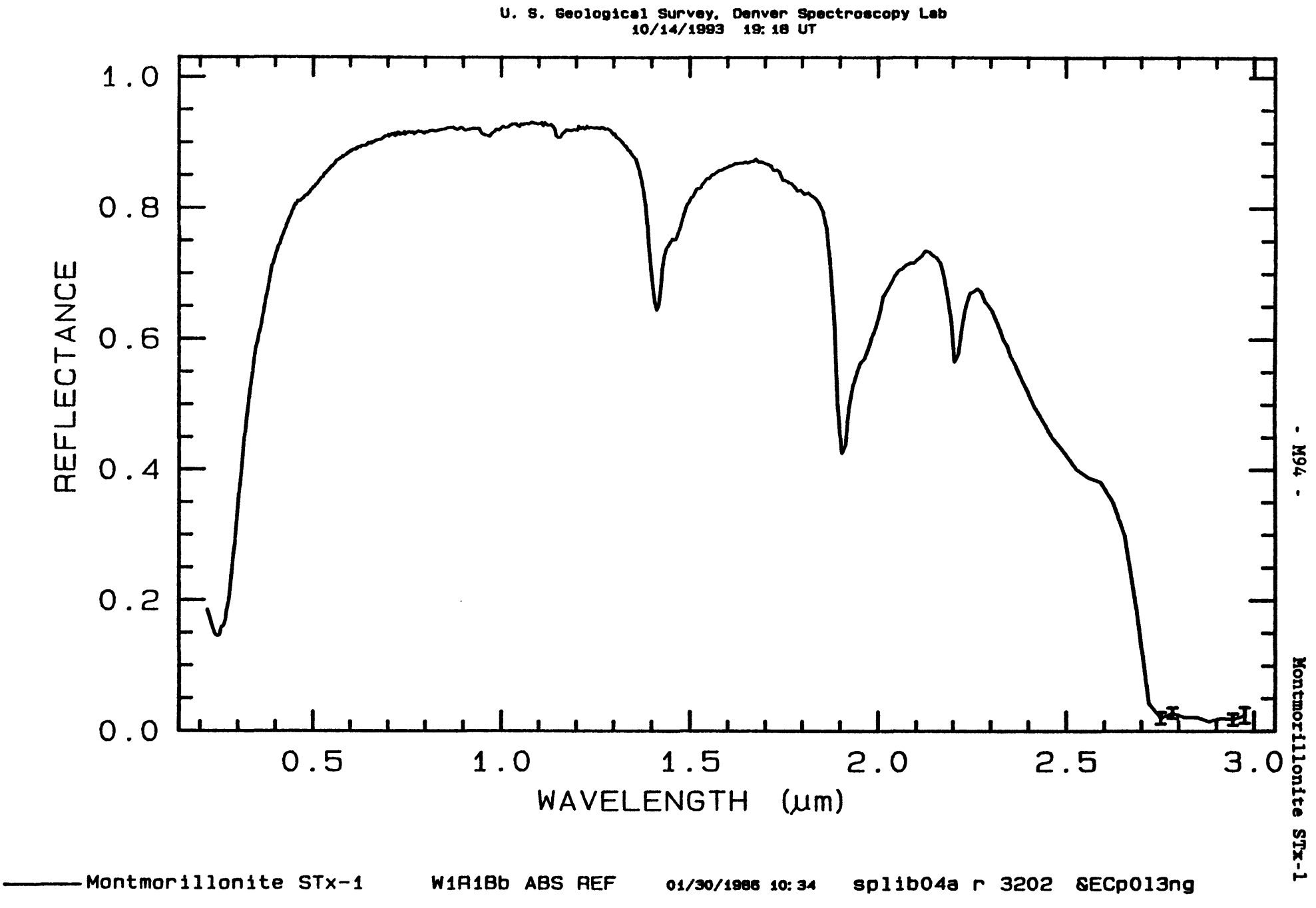
MICROSCOPIC_EXAMINATION:

Trace amounts of opaques, no HCl fizz.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3202	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M94 -
Montmorillonite STx-1
Montmorillonite STx-1 W1R1Bb ABS REF 01/30/1986 10:34 splib04a r 3202 &ECp013ng

TITLE: Montmorillonite+Illite CM37 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM37

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite + Illite (Metabentonite) (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O +
(K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,H2O]

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$ +
$(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,H_2O]$

COLLECTION_LOCALITY: Strasburg, Virginia

ORIGINAL_DONOR: Clay Mineral Standard, Wards Natural Science Inc

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample is tan in color.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is clay + quartz + calcite + trace feldspar? The <2μm cut has illite/smectite 96%, illite + trace amounts of quartz.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	46.5	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	1.05	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	22.7	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.19	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.29	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	2.74	wt%	NROFF:	MgO
COMPOSITION:	CaO:	5.86	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.31	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	5.92	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.12	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	6.18	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	1.52	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	7.70	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	11.2	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.61	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

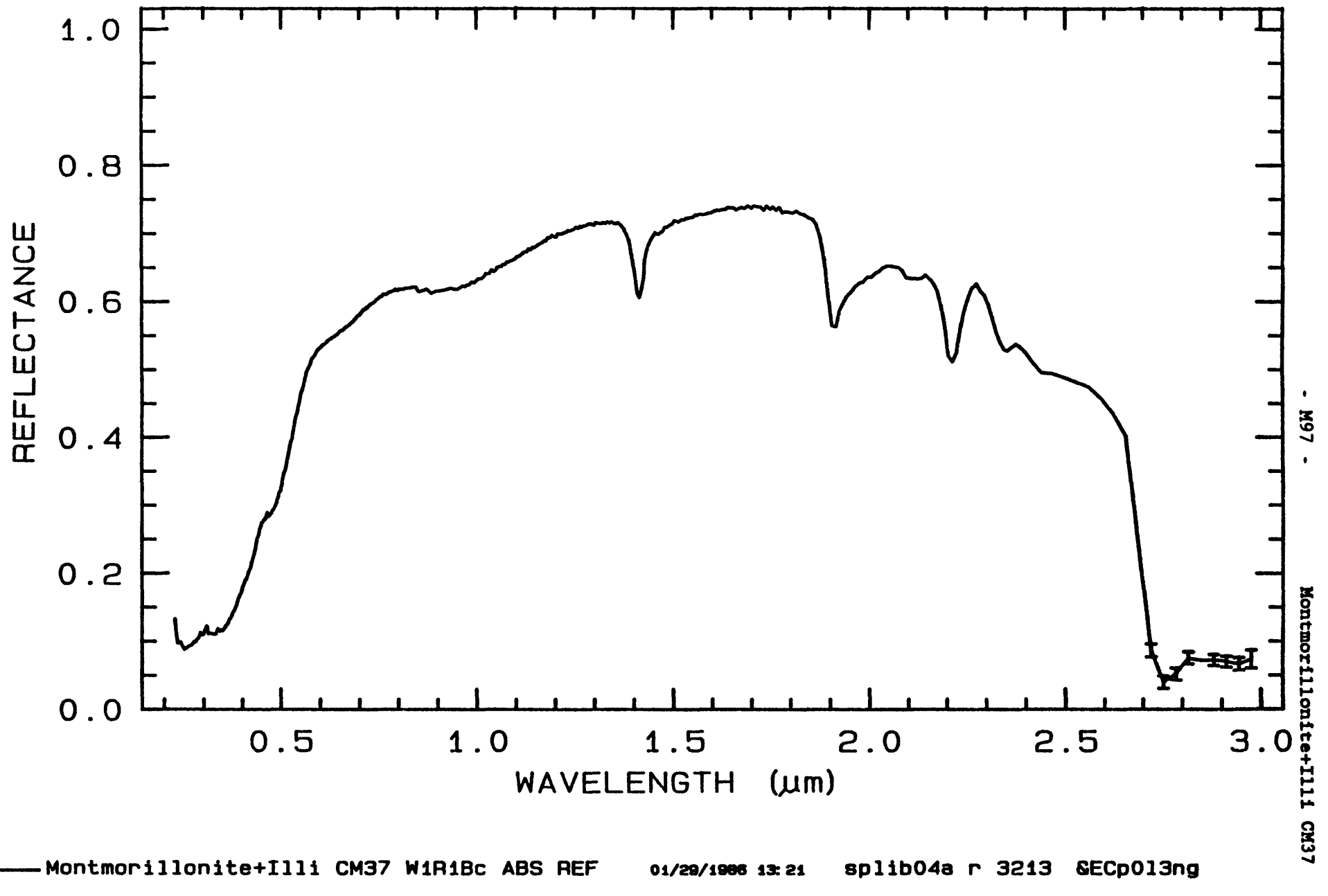
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3213	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M97 -
Montmorillonite+Illi CM37
Montmorillonite+Illi CM37 W1R1Bc ABS REF 01/29/1986 13:21 splib04a r 3213 &ECp013ng

TITLE: Montmorillonite+Illite CM42 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM42

MINERAL_TYPE: Phyllosilicate

MINERAL: Montmorillonite + Illite (Metabentonite) (Montmorillonite group)

FORMULA: (Na,Ca)0.33(Al,Mg)2Si4O10(OH)2*nH2O +
(K,H3O)(Al,Mg,Fe)2(Si,Al)4O10[(OH)2,H2O]

FORMULA_NROFF: $(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet nH_2O$ +
$(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,H_2O]$

COLLECTION_LOCALITY: Highbridge, Kentucky

ORIGINAL_DONOR: Clay Mineral Standard, Wards Natural Science Inc

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample is tan in color.
Note: The absorption band at .9um may be due to Fe-bearing illite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is clay + quartz + others.
The <2μm cut has quartz, R1, illite/smectite layers, 70% illite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	54.8	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.28	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	21.0	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.75	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.05	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	3.40	wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.52	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	6.73	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.33	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	5.52	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	4.92	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	10.4	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	10.1	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.08	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H_2O values, and does not include value for FeO as it was determined at same time as H_2O. Trace analysis was performed and will be added later.

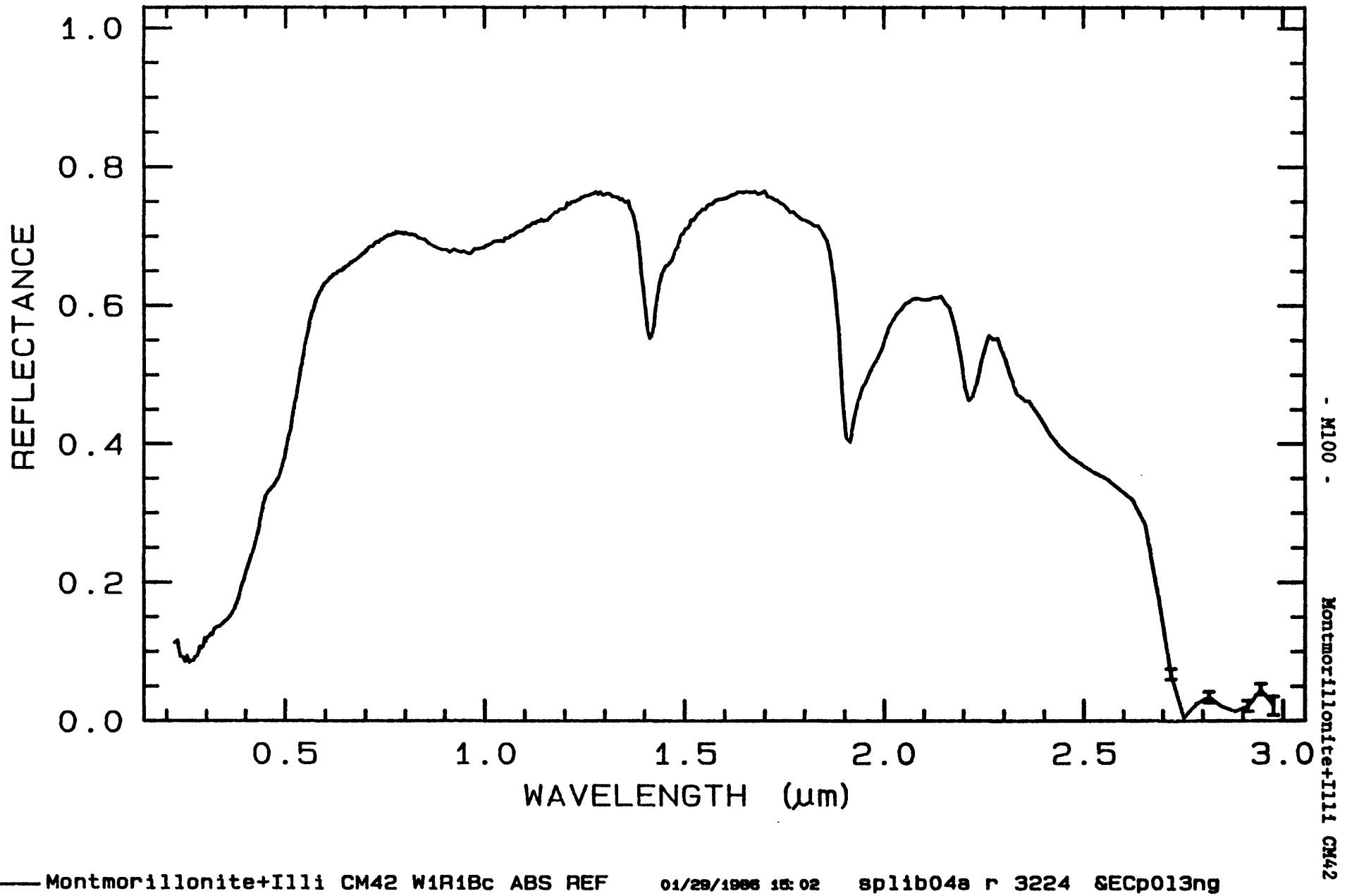
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3224	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M100 -
Montmorillonite+Illi CM42
Montmorillonite+Illi CM42 W1R1Bc ABS REF 01/29/1986 15:02 splib04a r 3224 &ECp013ng

TITLE: Mordenite GDS18 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS18

MINERAL_TYPE: Tectosilicate

MINERAL: Mordenite (Zeolite Group)

FORMULA: (Ca,Na2,K2)Al2Si10O24*7H2O

FORMULA_NROFF: $(Ca,Na_2,K_2)Al_2Si_{10}O_{24}\bullet 7H_2O$

COLLECTION_LOCALITY: Challis, Idaho

ORIGINAL_DONOR: Dick Sheppard

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Mordentite - primary component
Probable small amount of plagioclase

Konnert, Judith and Marta Flohr, 1992, unpublished data, USGS Reston, VA.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

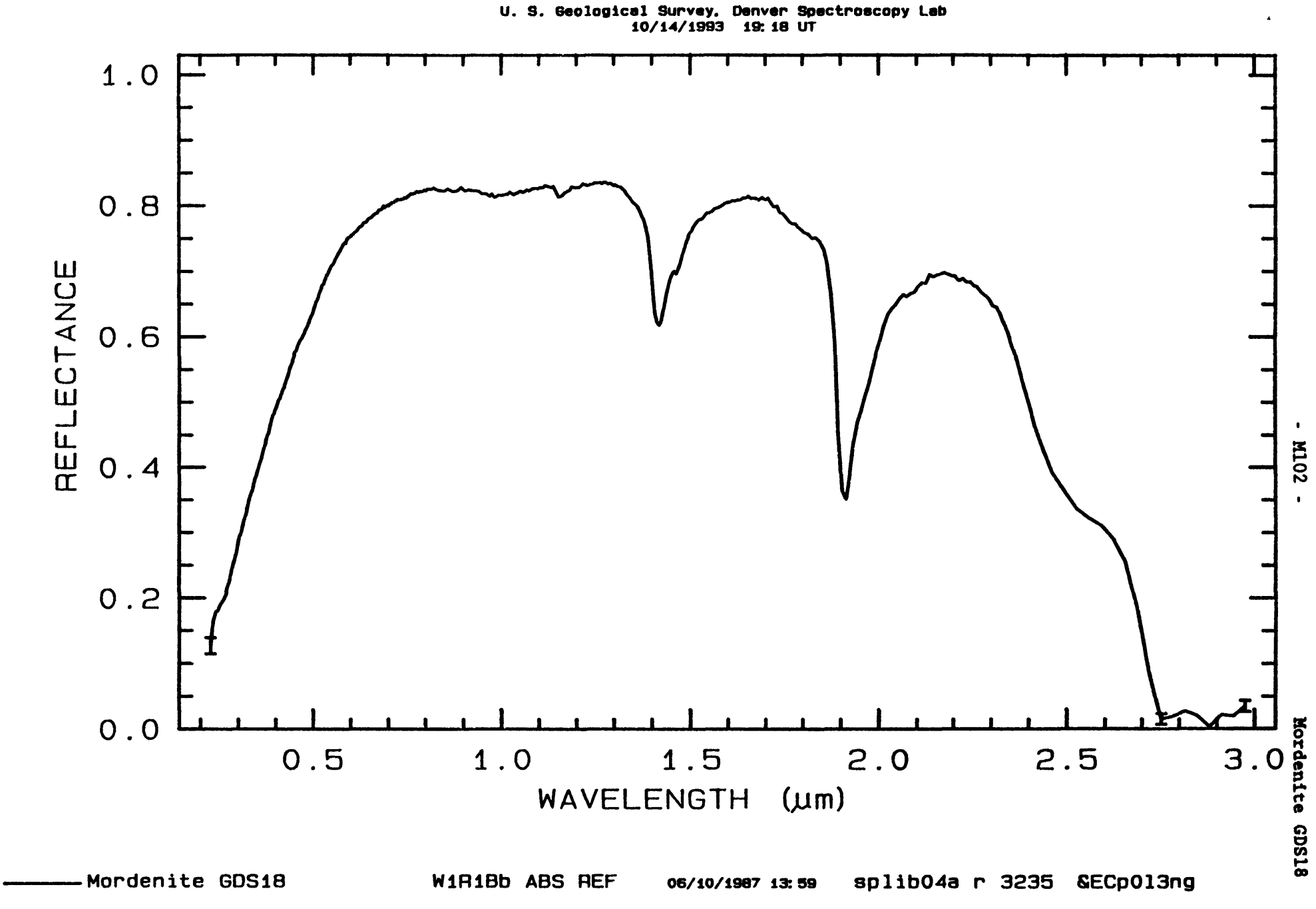
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3235	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 19:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M102 -
Mordenite GDS18
Mordenite GDS18 W1R1Bb ABS REF 06/10/1987 13:59 splib04a r 3235 &ECp013ng

TITLE: Mordenite+Clinopt. GDS151 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS151

MINERAL_TYPE: Tectosilicate

MINERAL: Mordenite+Clinoptilolite (Zeolite group)

FORMULA: (Ca,Na2,K2)Al2Si10O24*7H2O

FORMULA_NROFF: $(Ca,Na_2,K_2)Al_2Si_{10}O_{24}\bullet 7H_2O$

COLLECTION_LOCALITY: Lander Co. NV

ORIGINAL_DONOR: Jim Crowley

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Mordenite with Clinoptilolite as a major contaminant.

Jim Crowley, USGS, 1993, personal communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

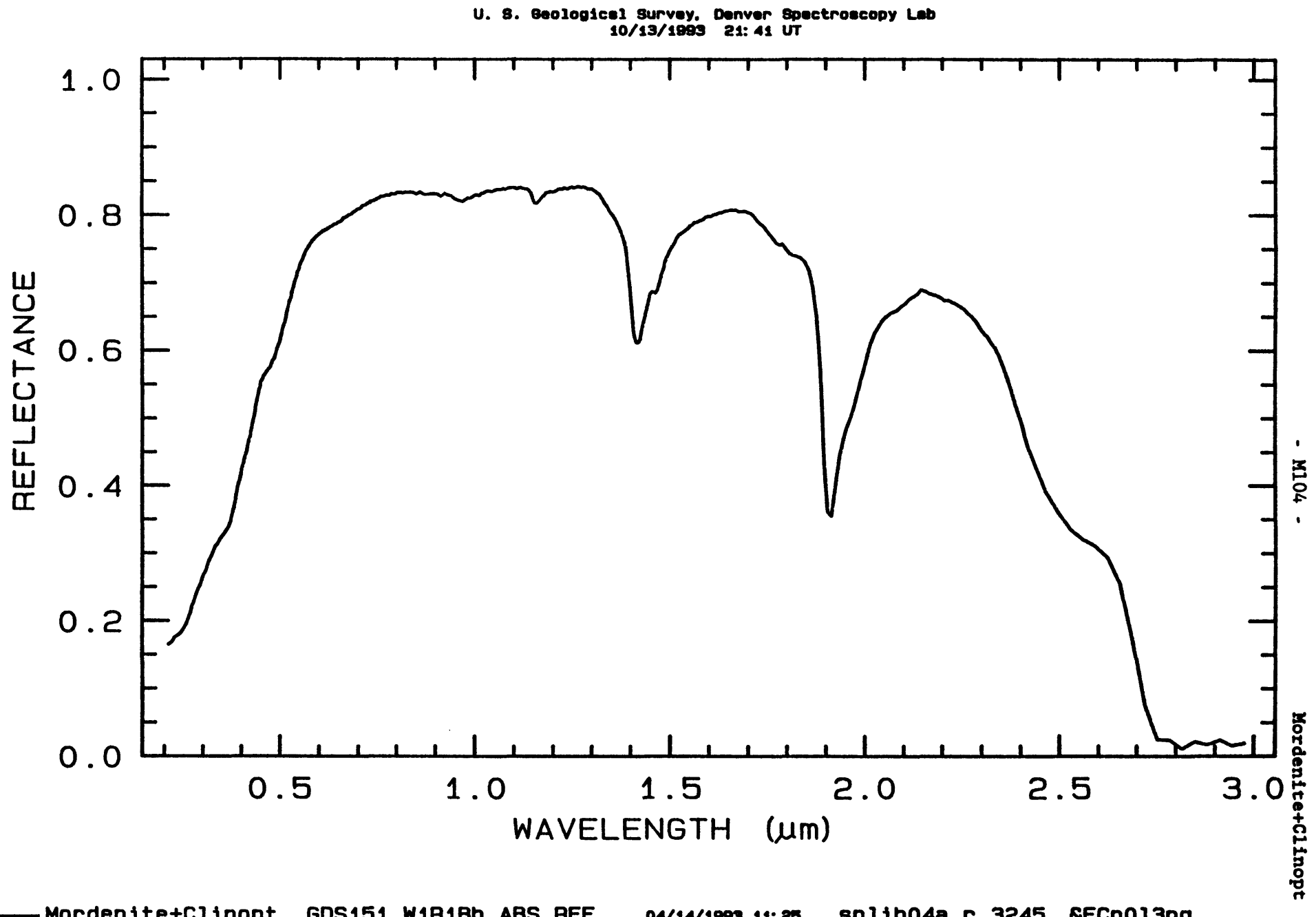
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3245	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M104 -
Mordenite+Clinopt
Mordenite+Clinopt. GDS151 W1R1Bb ABS REF 04/14/1993 11:25 splib04a r 3245 &ECp013ng

TITLE: Muscovite GDS107 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS107

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Mt. Turner, Australia

ORIGINAL_DONOR: Jim Crowley, USGS Reston

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

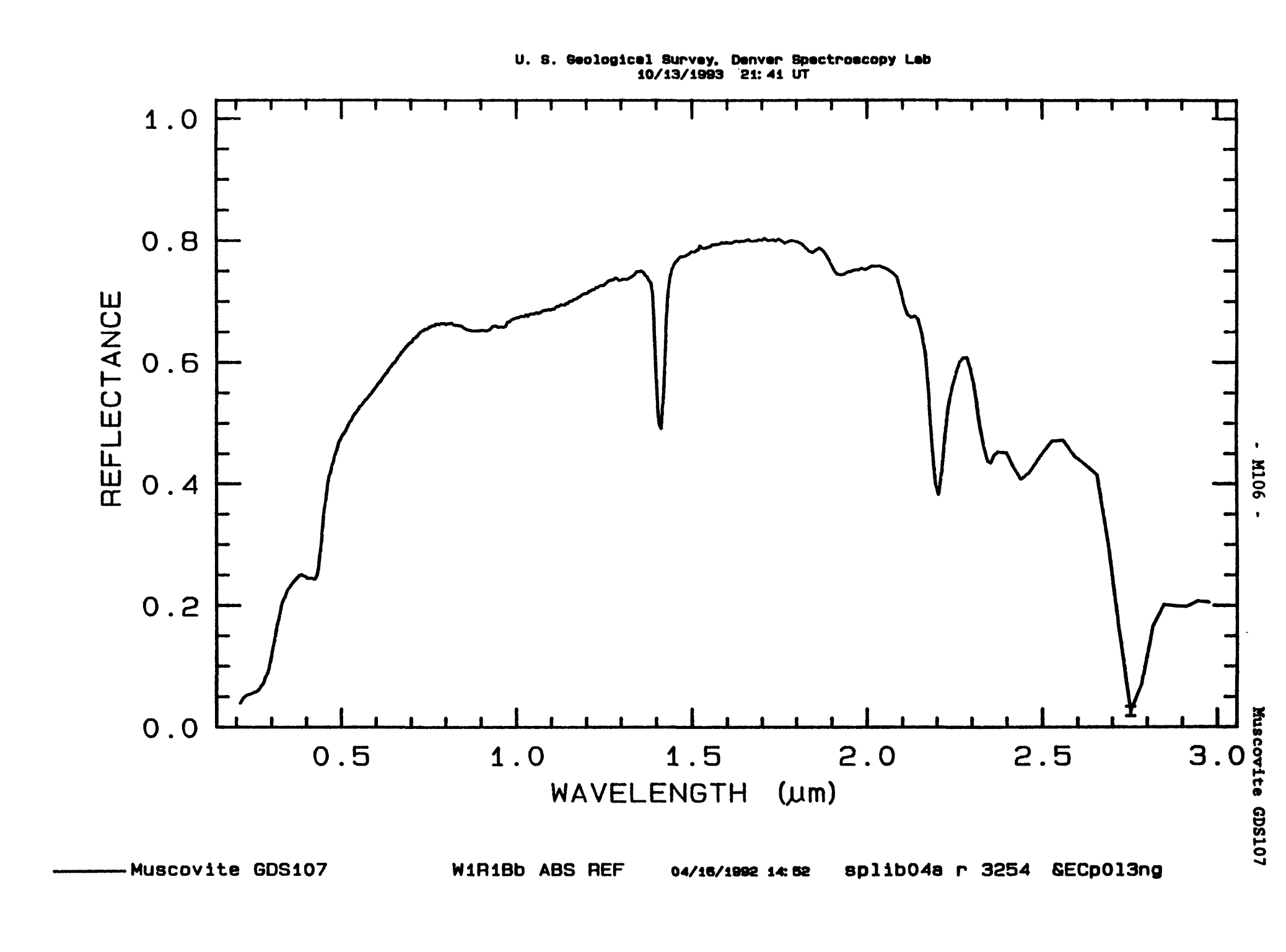
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3254	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M106 -
Muscovite GDS107
Muscovite GDS107 W1R1Bb ABS REF 04/16/1992 14:52 splib04a r 3254 &ECp013ng

TITLE: Muscovite GDS108 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS108

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Methulu, Ontario

ORIGINAL_DONOR: Jim Crowley, USGS Reston

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"The unit-cell parameters for this muscovite, determined by Robert Fournier, U.S. Geological Survey, are a=5.203±0.005 angstroms, b=9.003±0.01 angstroms, c=20.031±0.001 angstroms, β=94.47°±0.17°, using fluorite, a=5.4626 angstrom, as an internal standard."

Robie, R.A., Hemingway, B.S., and Wilson, W.H., 1976, The heat capacites of calorimetry conference copper and of muscovite $KAl_2(AlSi_3)O_{10}(OH)_2$, pyrophyllite $Al_2Si_4O_{10}(OH)_2$, and illite $K_3(Al_7Mg)(Si_{14}Al_2)O_{40}(OH)_8$ between 15 and 375 K and their standard entropies at 298.15K. U.S. Geological Survey Journal of Research, v. 4, no. 6, p.631-644.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	44.0	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	.13	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	35.0	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	2.2	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	.26	wt%	NROFF:	FeO
COMPOSITION:	MnO:	.07	wt%	NROFF:	MnO
COMPOSITION:	MgO:	.57	wt%	NROFF:	MgO
COMPOSITION:	CaO:	.22	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	.72	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	9.6	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	.01	wt%	NROFF:	P_2O_5
COMPOSITION:	F:	.29	wt%	NROFF:	F
COMPOSITION:	CO2:	.01	wt%	NROFF:	CO_2
COMPOSITION:	H2O+:	5.6	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	2.0	wt%	NROFF:	H_2O^-
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.68	wt%		

Rapid rock analysis from:

Robie, R.A., Hemingway, B.S., and Wilson, W.H., 1976, The heat capacites of calorimetry conference copper and of muscovite $KAl_2(AlSi_3)O_{10}(OH)_2$, pyrophyllite $Al_2Si_4O_{10}(OH)_2$, and illite $K_3(Al_7Mg)(Si_{14}Al_2)O_{40}(OH)_8$ between 15 and 375 K and their standard entropies at 298.15K. U.S. Geological Survey Journal of Research, v. 4, no. 6, p.631-644.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

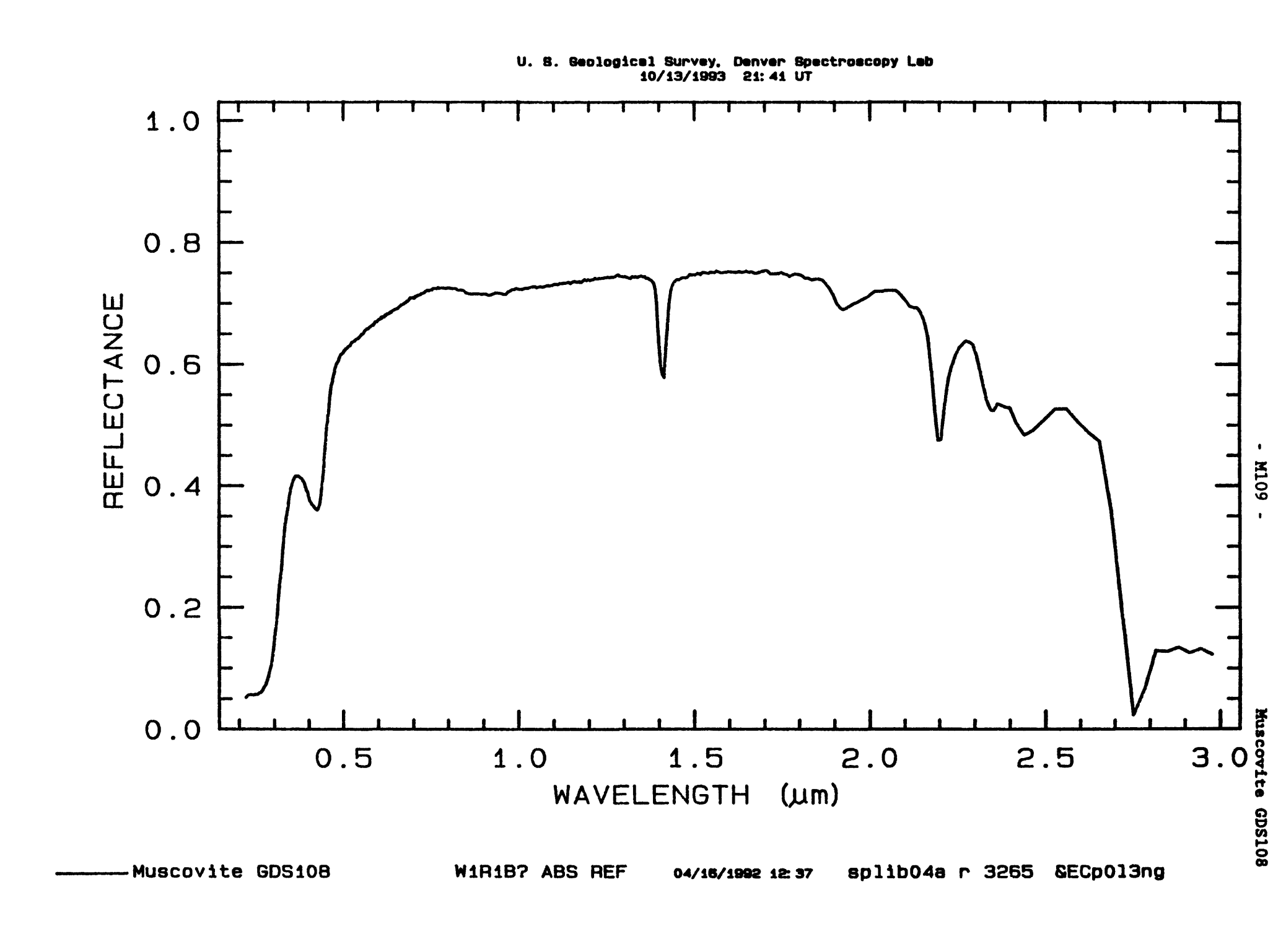
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3265	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M109 -
Muscovite GDS108
Muscovite GDS108 W1R1B? ABS REF 04/16/1992 12:37 splib04a r 3265 &ECp013ng

TITLE: Muscovite GDS111 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS111

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Fe-rich)(Mica group)

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Guatamala

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 7.2-9.5 keV
References: Bailey (1984, p. 574), Huebner's reference patterns
Found: dioctahedral mica, 2M1 polytype
Sought but not found: quartz, (100) would be distinct if present
Comments: Very similar patterns. Only mica detected. The mica (004) reflection is at 17.6-17.9°2θ , indicating a large alkali such as potassium (the dioctahedral Na-mica, paragonite, has the (004) reflection at 18.4°). The small sample size required smear mounts, which are responsible for a strong preferred basal orientation in each of the patterns. I'd be surprised if you found any differences in the optical spectra of these eight micas."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	47.87 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.69 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	28.03 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	7.20 wt%	NROFF:	Fe_2O_3
COMPOSITION:	NiO:	0.01 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.07 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.94 wt%	NROFF:	MgO
COMPOSITION:	ZnO:	0.06 wt%	NROFF:	ZnO
COMPOSITION:	BaO:	0.28 wt%	NROFF:	BaO
COMPOSITION:	CaO:	0.24 wt%	NROFF:	CaO
COMPOSITION:	K2O:	10.16 wt%	NROFF:	K_2O
COMPOSITION:	H2O+:	4.44 wt%	NROFF:	H_2O^+
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.99 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

Jim Post, personnal communication, 1991.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

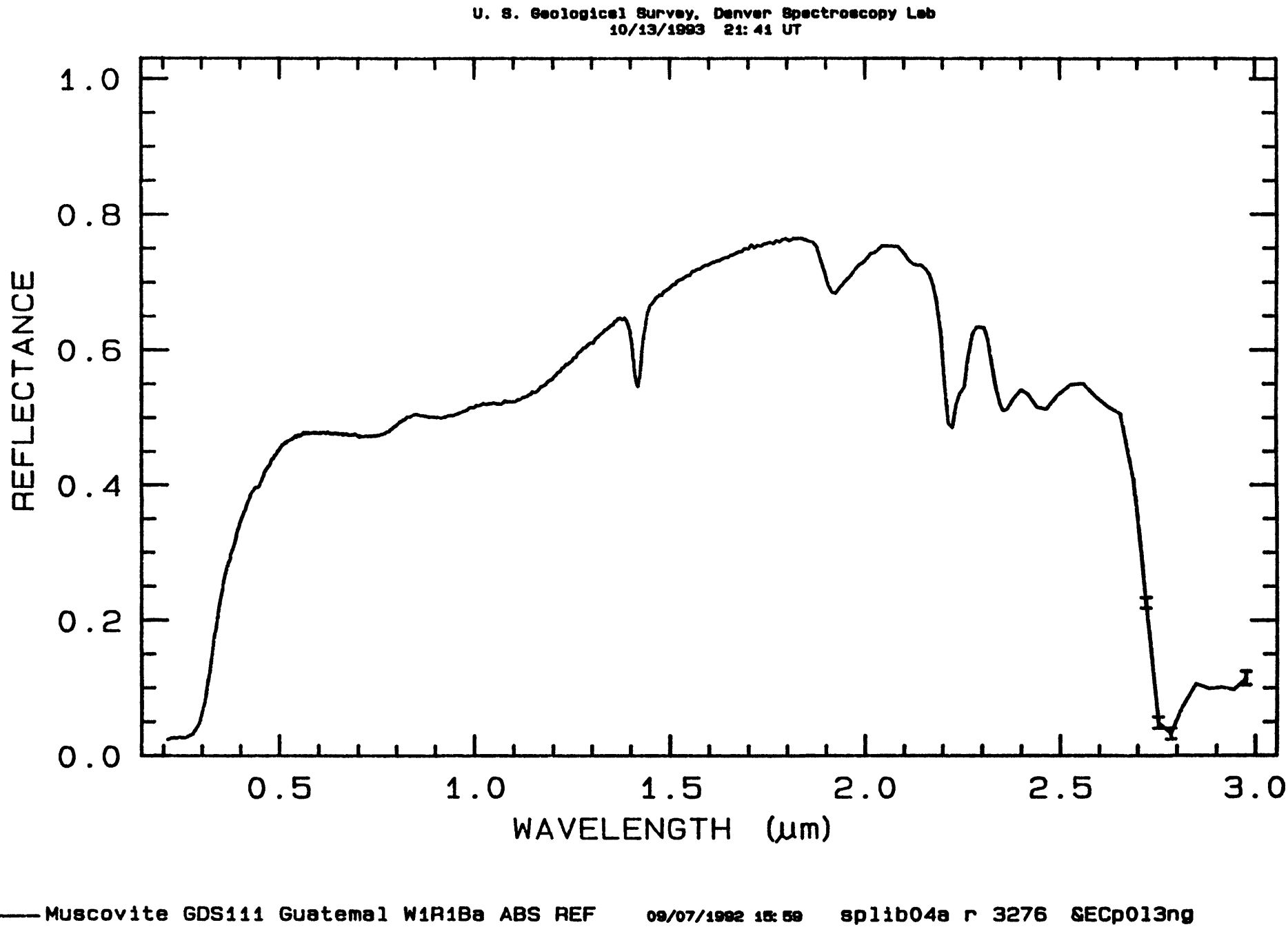
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3276	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M112 -
Muscovite GDS111
Muscovite GDS111 Guatemal W1R1Ba ABS REF 09/07/1992 15:59 splib04a r 3276 &ECp013ng

TITLE: Muscovite GDS113 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS113

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Brazil

ORIGINAL_DONOR: C.V. Clemency, SUNY

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV
References: Bailey (1984, p. 574), Huebner's reference patterns
Found: dioctahedral mica, 2M1 polytype
Sought but not found: quartz, (100) would be distinct if present
Comments: Very similar patterns. Only mica detected. The mica (004) reflection is at 17.6-17.9°2θ , indicating a large alkali such as potassium (the dioctahedral Na-mica, paragonite, has the (004) reflection at 18.4°). The small sample size required smear mounts, which are responsible for a strong preferred basal orientation in each of the patterns. I'd be surprised if you found any differences in the optical spectra of these eight micas."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	45.89 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.32 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	35.64 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	1.08 wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.81 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.02 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.56 wt%	NROFF:	MgO
COMPOSITION:	Na2O:	0.78 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	10.00 wt%	NROFF:	K_2O
COMPOSITION:	F:	0.23 wt%	NROFF:	F
COMPOSITION:	H2O+:	4.84 wt%	NROFF:	H_2O^+
COMPOSITION:	----------			
COMPOSITION:	Total:	100.17 wt%		
COMPOSITION:	O=Cl,F,S:	0.10 wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.07 wt%		

Lin, F.C. and C.V. Clemency, 1981, Geochimica et Cosmochimica Acta 45, no. 4.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

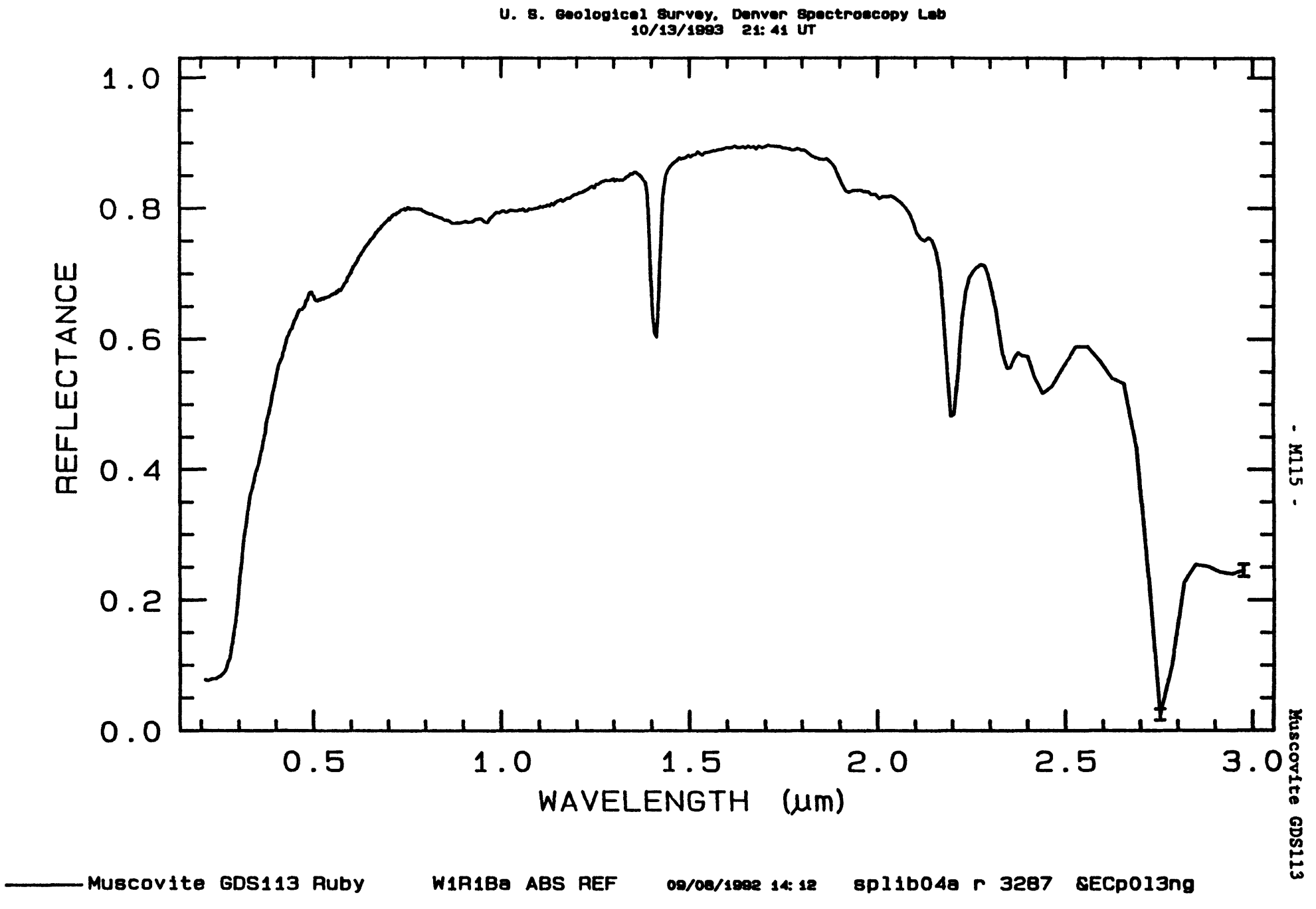
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3287	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M115 -
Muscovite GDS113
Muscovite GDS113 Ruby W1R1Ba ABS REF 09/08/1992 14:12 splib04a r 3287 &ECp013ng

TITLE: Muscovite GDS114 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS114

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Marshall Gulch, Santa Catalina Mtns, AZ

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 7.2-9.5 keV
References: Bailey (1984, p. 574), Huebner's reference patterns
Found: dioctahedral mica, 2M1 polytype
Sought but not found: quartz, (100) would be distinct if present
Comments: Very similar patterns. Only mica detected. The mica (004) reflection is at 17.6-17.9°2θ , indicating a large alkali such as potassium (the dioctahedral Na-mica, paragonite, has the (004) reflection at 18.4°). The small sample size required smear mounts, which are responsible for a strong preferred basal orientation in each of the patterns. I'd be surprised if you found any differences in the optical spectra of these eight micas."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:      SiO2:  44.93  wt%    NROFF: SiO2
COMPOSITION:      TiO2:   0.13  wt%    NROFF: TiO2
COMPOSITION:     Al2O3:  33.09  wt%    NROFF: Al2O3
COMPOSITION:     Fe2O3:   5.62  wt%    NROFF: Fe2O3
COMPOSITION:       NiO:   0.007 wt%    NROFF: NiO
COMPOSITION:       MnO:   0.03  wt%    NROFF: MnO
COMPOSITION:       MgO:   0.71  wt%    NROFF: MgO
COMPOSITION:       ZnO:   0.02  wt%    NROFF: ZnO
COMPOSITION:       BaO:   0.04  wt%    NROFF: BaO
COMPOSITION:       CaO:   0.07  wt%    NROFF: CaO
COMPOSITION:      Na2O:   0.70  wt%    NROFF: Na2O
COMPOSITION:       K2O:  10.09  wt%    NROFF: K2O
COMPOSITION:     H2O+:    4.47  wt%    NROFF:    H2O+
COMPOSITION: ----------------------
COMPOSITION:     Total:  99.91  wt%
COMPOSITION:  O=Cl,F,S:         wt%  #correction for Cl, F, S
COMPOSITION: New Total:         wt%
```

Jim Post, 1991, personal communication.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

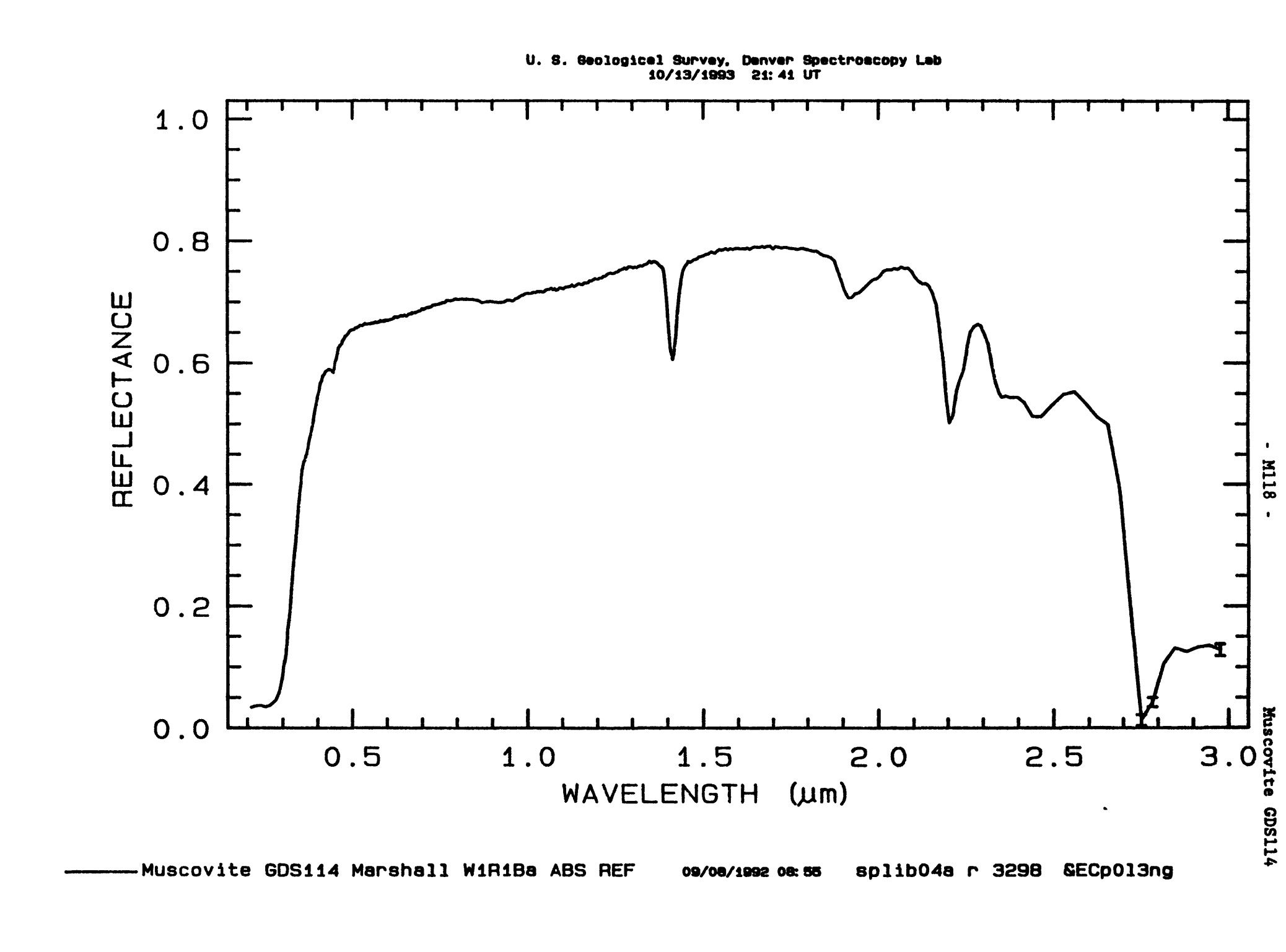
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3298	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M118 -
Muscovite GDS114
Muscovite GDS114 Marshall W1R1B8 ABS REF 09/08/1992 08:55 splib04a r 3298 &ECp013ng

TITLE: Muscovite GDS116 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS116

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Brazil

ORIGINAL_DONOR: C.V. Clemency, SUNY

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 7.2-9.5 keV
References: Bailey (1984, p. 574), Huebner's reference patterns
Found: dioctahedral mica, 2M1 polytype
Sought but not found: quartz, (100) would be distinct if present
Comments: Very similar patterns. Only mica detected. The mica (004) reflection is at 17.6-17.9°2θ , indicating a large alkali such as potassium (the dioctahedral Na-mica, paragonite, has the (004) reflection at 18.4°). The small sample size required smear mounts, which are responsible for a strong preferred basal orientation in each of the patterns. I'd be surprised if you found any differences in the optical spectra of these eight micas."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	45.90 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.46 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	31.06 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	4.35 wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	1.42 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.05 wt%	NROFF:	MnO
COMPOSITION:	MgO:	1.38 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.07 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.43 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	10.21 wt%	NROFF:	K_2O
COMPOSITION:	F:	0.11 wt%	NROFF:	F
COMPOSITION:	H2O+:	4.82 wt%	NROFF:	H_2O^+
COMPOSITION:	---	---		
COMPOSITION:	Total:	100.26 wt%		
COMPOSITION:	O=Cl,F,S:	0.05 wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.21 wt%		

Lin, F.C. and C.V. Clemency, 1981, Geochimica and Cosmochimica Acta, v.45, no.4.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

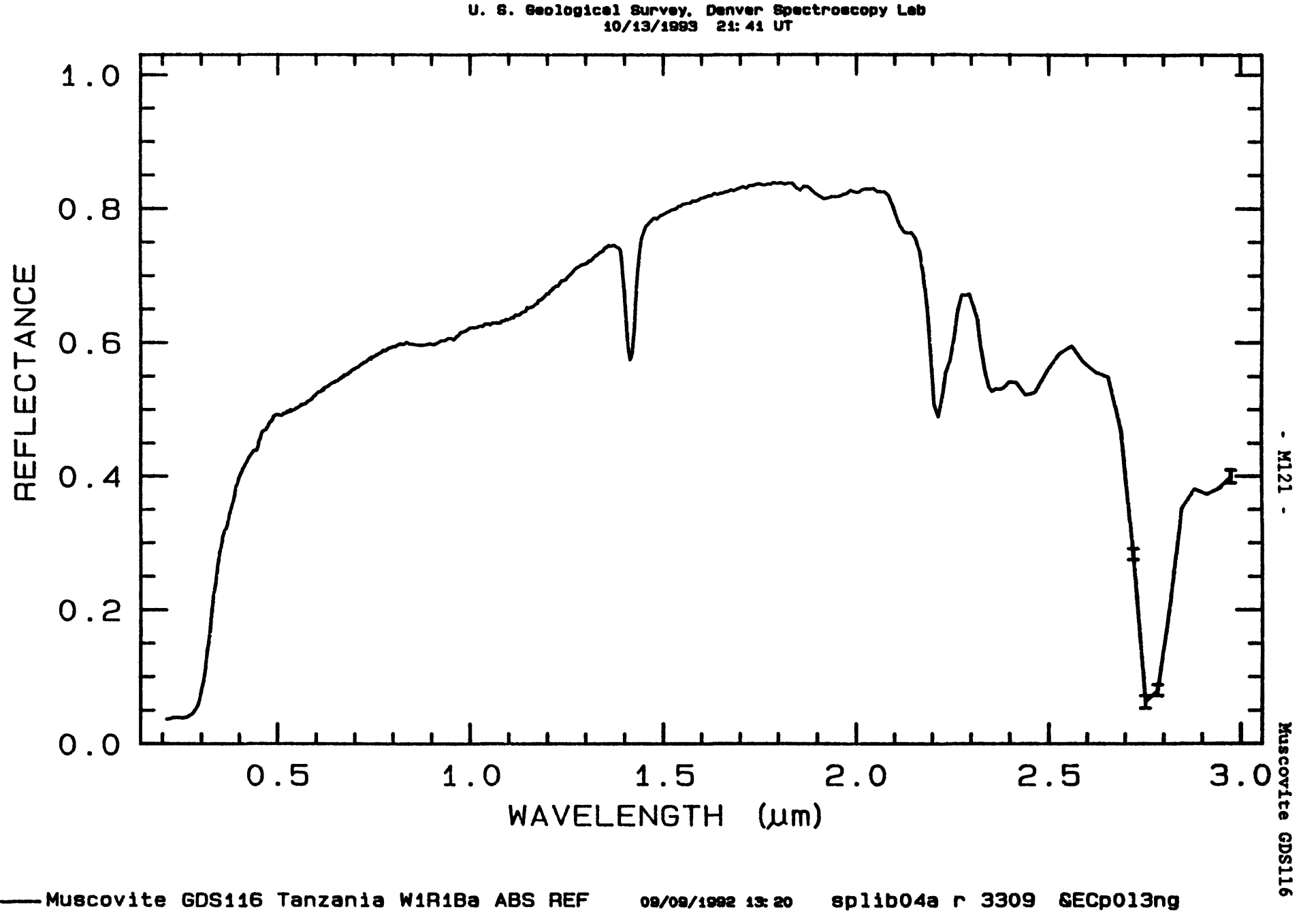
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3309	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M121 -
Muscovite GDS116
Muscovite GDS116 Tanzania W1R1Ba ABS REF 09/09/1992 13:20 splib04a r 3309 GECp013ng

TITLE: Muscovite GDS117 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS117

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KA12Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Isinglass Mine, Siskiyou Co., CA

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV
References: Bailey (1984, p. 574), Huebner's reference patterns
Found: dioctahedral mica, 2M1 polytype
Sought but not found: quartz, (100) would be distinct if present
Comments: Very similar patterns. Only mica detected. The mica (004) reflection is at 17.6-17.9°2θ , indicating a large alkali such as potassium (the dioctahedral Na-mica, paragonite, has the (004) reflection at 18.4°). The small sample size required smear mounts, which are responsible for a strong preferred basal orientation in each of the patterns. I'd be surprised if you found any differences in the optical spectra of these eight micas."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	45.28 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.01 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	35.54 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.34 wt%	NROFF:	Fe_2O_3
COMPOSITION:	NiO:	0.01 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.28 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.19 wt%	NROFF:	MgO
COMPOSITION:	ZnO:	0.12 wt%	NROFF:	ZnO
COMPOSITION:	BaO:	0.08 wt%	NROFF:	BaO
COMPOSITION:	CaO:	0.06 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.19 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	9.75 wt%	NROFF:	K_2O
COMPOSITION:	H2O+:	4.51 wt%	NROFF:	H_2O^+
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.92 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

Jim Post, personnal communication, 1991.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

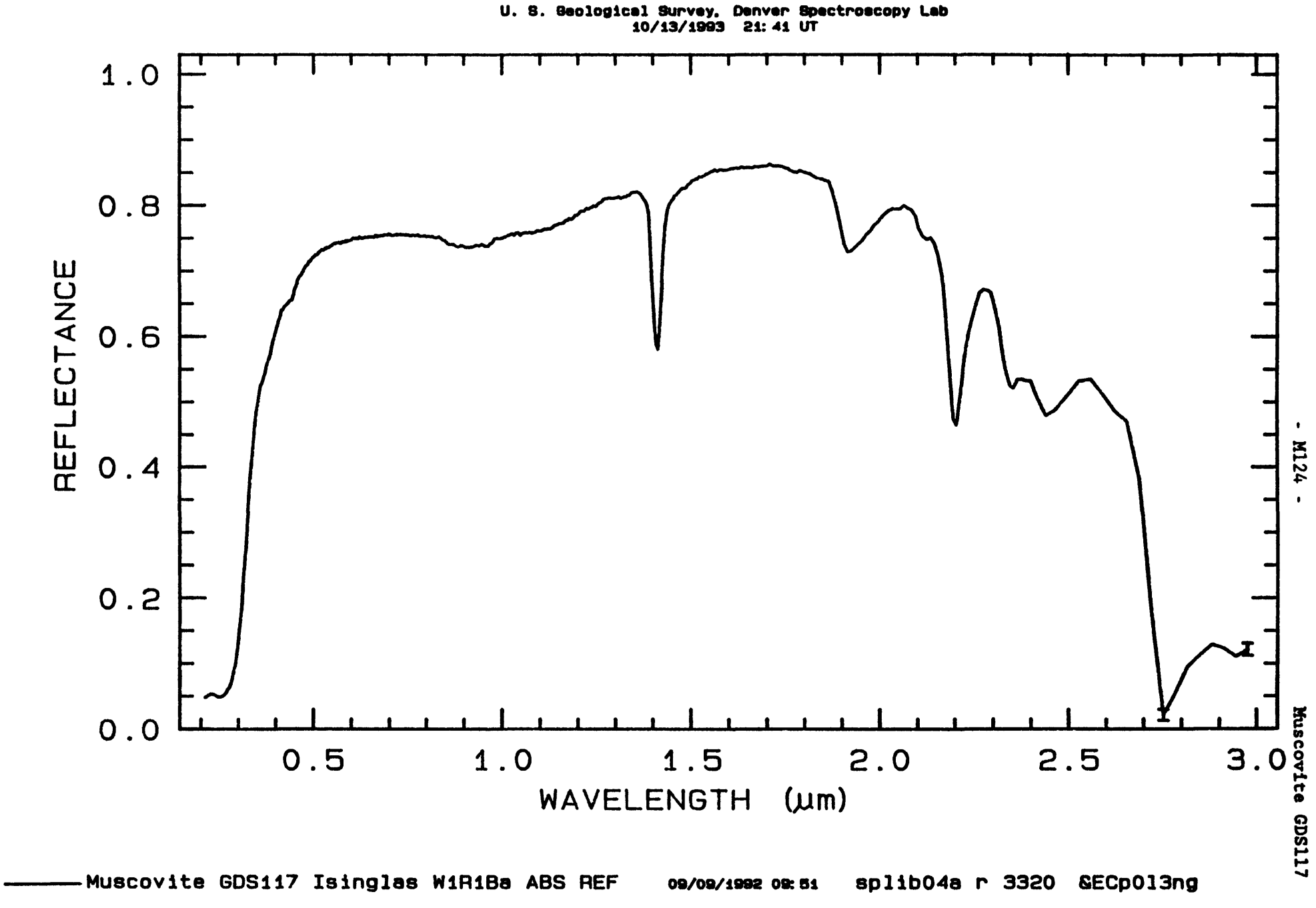
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3320	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M124 -
Muscovite GDS117
Muscovite GDS117 Isinglas W1R1Ba ABS REF 09/09/1992 09:51 splib04a r 3320 &ECp013ng

TITLE: Muscovite GDS118 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS118

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Capitan Mine, Petaca District, NM

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"45 kV - 35 mA, 7.3-9.5 keV
References: Bailey (1984, p. 574), Huebner's reference patterns
Found: dioctahedral mica, 2M1 polytype
Sought but not found: quartz, (100) would be distinct if present
Comments: Very similar patterns. Only mica detected. The mica (004) reflection is at 17.6-17.9°2θ , indicating a large alkali such as potassium (the dioctahedral Na-mica, paragonite, has the (004) reflection at 18.4°). The small sample size required smear mounts, which are responsible for a strong preferred basal orientation in each of the patterns. I'd be surprised if you found any differences in the optical spectra of these eight micas."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION: SiO2: 46.05 wt% NROFF: SiO_2
COMPOSITION: TiO2: 0.29 wt% NROFF: TiO_2
COMPOSITION: Al2O3: 31.31 wt% NROFF: Al_2O_3
COMPOSITION: Fe2O3: 6.46 wt% NROFF: Fe_2O_3
COMPOSITION: MnO: 0.26 wt% NROFF: MnO
COMPOSITION: MgO: 0.13 wt% NROFF: MgO
COMPOSITION: ZnO: 0.09 wt% NROFF: ZnO
COMPOSITION: BaO: 0.02 wt% NROFF: BaO
COMPOSITION: CaO: 0.05 wt% NROFF: CaO
COMPOSITION: Na2O: 0.34 wt% NROFF: Na_2O
COMPOSITION: K2O: 10.08 wt% NROFF: K_2O
COMPOSITION: H2O+: 4.43 wt% NROFF: H_2O^+
COMPOSITION: ----------
COMPOSITION: Total: 99.58 wt%
COMPOSITION: O=Cl,F,S: wt% #correction for Cl, F, S
COMPOSITION: New Total: wt%

Jim Post, personal communication, 1991.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

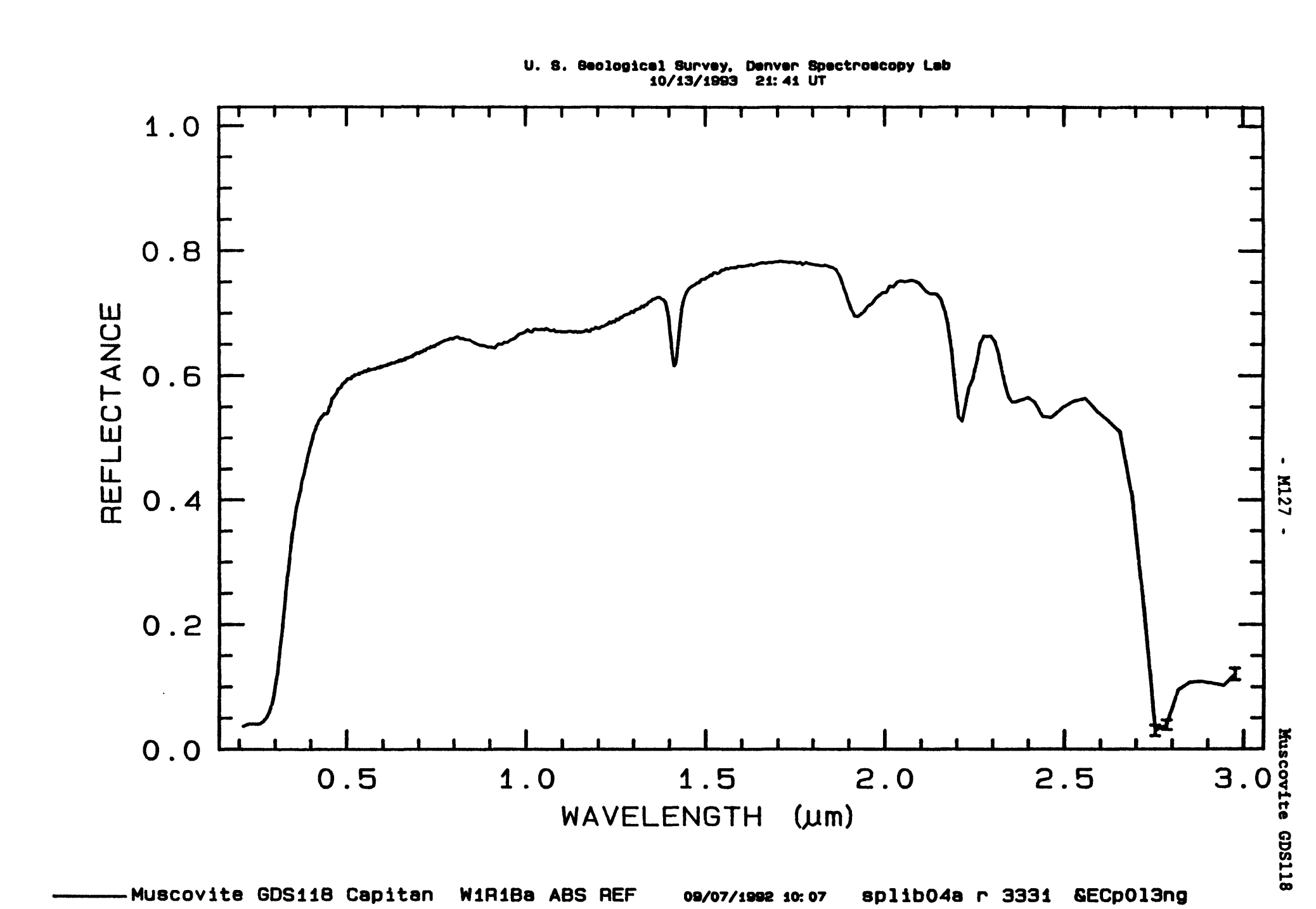
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3331	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- M127 -
Muscovite GDS118
Muscovite GDS118 Capitan W1R1Ba ABS REF 09/07/1992 10:07 splib04a r 3331 GECp013ng

TITLE: Muscovite GDS119 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS119

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KA12Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Mt. Alamo Mine, Ventura Co. CA

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV
References: Bailey (1984, p. 574), Huebner's reference patterns
Found: dioctahedral mica, 2M1 polytype
Sought but not found: quartz, (100) would be distinct if present
Comments: Very similar patterns. Only mica detected. The mica (004) reflection is at 17.6-17.9°2θ , indicating a large alkali such as potassium (the dioctahedral Na-mica, paragonite, has the (004) reflection at 18.4°). The small sample size required smear mounts, which are responsible for a strong preferred basal orientation in each of the patterns. I'd be surprised if you found any differences in the optical spectra of these eight micas."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	46.28	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.13	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	33.34	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.85	wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	0.04	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.55	wt%	NROFF:	MgO
COMPOSITION:	ZnO:	0.03	wt%	NROFF:	ZnO
COMPOSITION:	BaO:	0.03	wt%	NROFF:	BaO
COMPOSITION:	CaO:	0.10	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.64	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	9.97	wt%	NROFF:	K_2O
COMPOSITION:	H2O+:	4.47	wt%	NROFF:	H_2O^+
COMPOSITION:	----------				
COMPOSITION:	Total:	99.66	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

Jim Post, personal communication, 1991.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

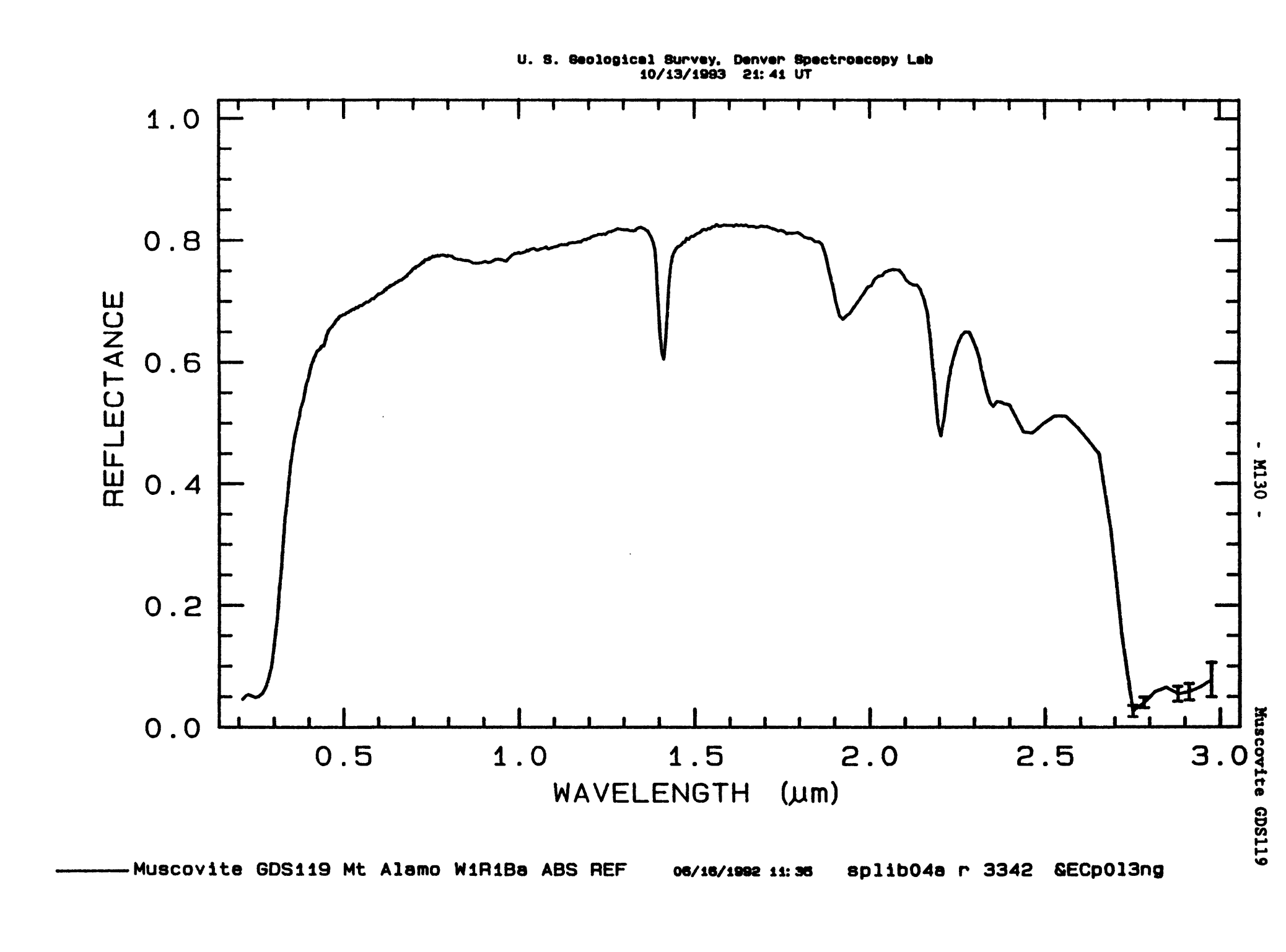
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3342	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M130 -
Muscovite GDS119
Muscovite GDS119 Mt Alamo W1R1B8 ABS REF 06/16/1992 11:36 splib04a r 3342 &ECp013ng

TITLE: Muscovite GDS120 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS120

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KA12Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Pegma Mine, Inyo Co., California

ORIGINAL_DONOR: Jim Post

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 7.2-9.5 keV
References: Bailey (1984, p. 574), Huebner's reference patterns
Found: dioctahedral mica, 2M1 polytype
Sought but not found: quartz, (100) would be distinct if present
Comments: Very similar patterns. Only mica detected. The mica (004) reflection is at 17.6-17.9°2θ , indicating a large alkali such as potassium (the dioctahedral Na-mica, paragonite, has the (004) reflection at 18.4°). The small sample size required smear mounts, which are responsible for a strong preferred basal orientation in each of the patterns. I'd be surprised if you found any differences in the optical spectra of these eight micas."

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	45.89 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.29 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	35.69 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	2.33 wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	0.03 wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.25 wt%	NROFF:	MgO
COMPOSITION:	ZnO:	0.02 wt%	NROFF:	ZnO
COMPOSITION:	BaO:	0.01 wt%	NROFF:	BaO
COMPOSITION:	CaO:	0.10 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.47 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	9.94 wt%	NROFF:	K_2O
COMPOSITION:	H2O+:	4.38 wt%	NROFF:	H_2O^+
COMPOSITION:	----------			
COMPOSITION:	Total:	99.75 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

Jim Post, personal communication, 1991.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

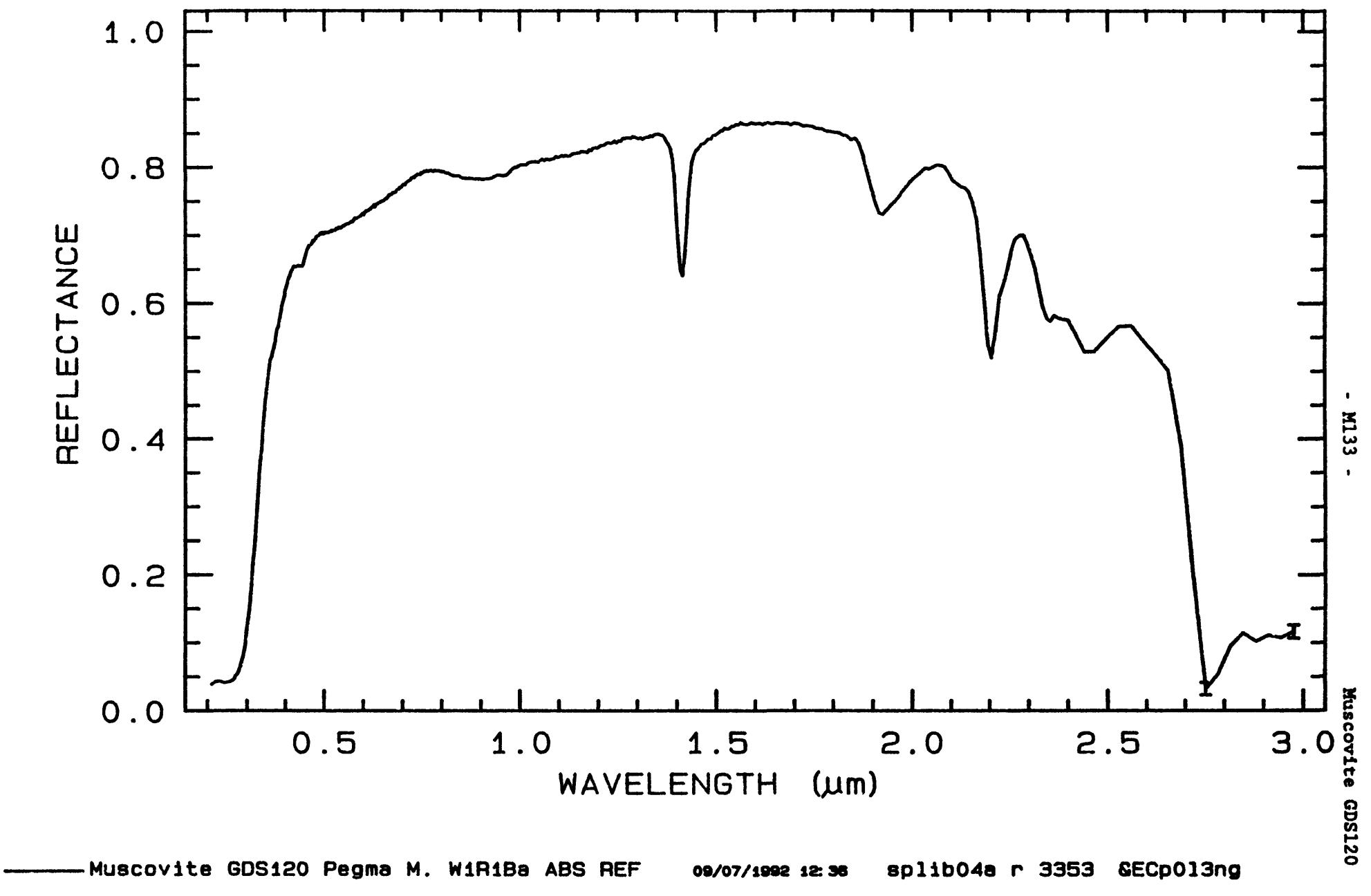
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3353	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M133 -
Muscovite GDS120
Muscovite GDS120 Pegma M. W1R1Ba ABS REF 09/07/1992 12:36 splib04a r 3353 &ECp013ng

TITLE: Muscovite HS146 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS146

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Fremont County, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"P-14 Muscovite 146B--Fremont Co., Colorado. $K_2Al_4(Si_6Al_2O_{20})(OH,F)_4$: Muscovite is one of the most common micas, occurring in acidic rocks, granitic pegmatites, schists etc. It frequently contains small amounts of ferrous and ferric iron, magnesium, manganese, chromium, calcium, sodium, lithium, vanadium and titanium. This spectrum is essentially identical with that of muscovite 24B (see Part I, p. 294, spectrum S-12). The weak broad band near 0.9μ, the very weak sharp feature near 0.44μ and the fall off to the blue are due to a small amount of ferrous iron substituting for aluminum. The near infrared bands due to the hydroxyl ion are essentially identical with those in the lepidolite spectrum, and the explanation is the same."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Muscovite - pure. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

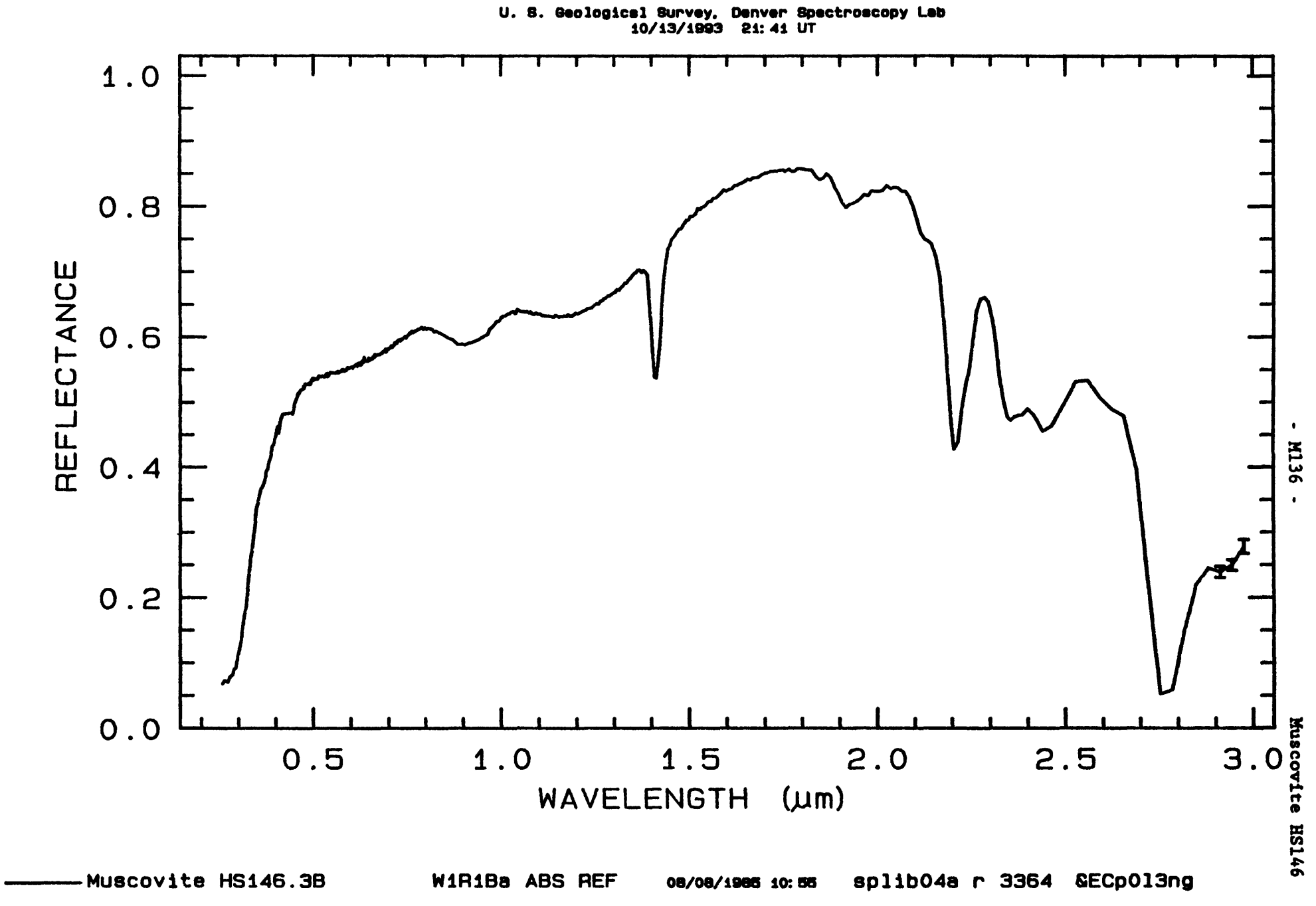
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3364	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M136 -
Muscovite HS146
Muscovite HS146.3B W1R1Ba ABS REF 08/08/1986 10:55 splib04a r 3364 &ECp013ng

TITLE: Muscovite HS24 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS24

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KAl3Si3O10(OH)2

FORMULA_NROFF: $KAl_3Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Effingham Twp., Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"S-12. Muscovite. Effingham, Twp., Ontario (24). This light colored mica is essentially $KAl_3Si_3O_{10}(OH)_3$, but frequently contains small amounts of Fe^{+2} and Fe^{+3}, Mg, Ca, Na, Li, F, and Ti. It is a widespread and very common accessory mineral in igneous rocks, particularly acidic ones. It is also common in metamorphic rocks. This sample displays hydroxyl bands at 1.4μ and between 2.2 and 2.6μ. There is the suggestion of a ferrous ion band near 0.95μ. The two cross-overs of the larger size ranges are not significant, probably being caused by the tendency of the flat mica flakes to orient themselves horizontally, resulting in specular effects."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

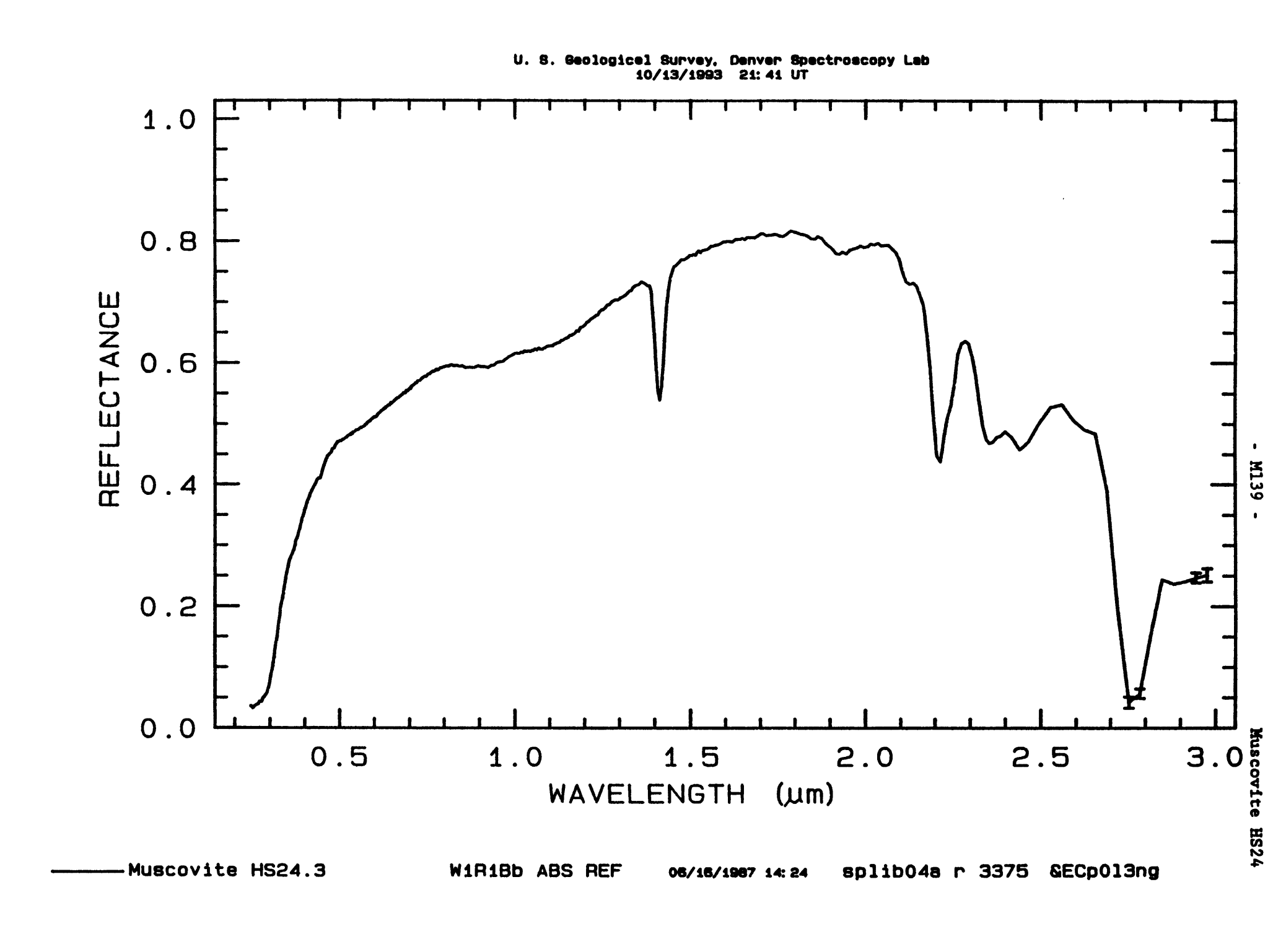
MICROSCOPIC_EXAMINATION:

Not done yet

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3375	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M139 -
Muscovite HS24
Muscovite HS24.3
W1R1Bb ABS REF
06/16/1987 14:24
splib04a r 3375 &ECp013ng

TITLE: Muscovite IL107 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: IL107

MINERAL_TYPE: Phyllosilicate

MINERAL: Muscovite (Mica group)

FORMULA: KAl2Si3O10(OH)2

FORMULA_NROFF: $KAl_2Si_3O_{10}(OH)_2$

COLLECTION_LOCALITY: Pegmatite, North Carolina

ORIGINAL_DONOR: Don Harville, Core Laboratories, Dallas, Texas

CURRENT_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

ULTIMATE_SAMPLE_LOCATION: CSES/CIRES, Univ. of CO, Boulder

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure (?). (2M2-mica)

Kruse, F.A., and P.L. Hauff, eds., 1992, The IGCP-264 Spectral Properties Database. IUGS/UNESCO, Special Publication, 211 p., (in press).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

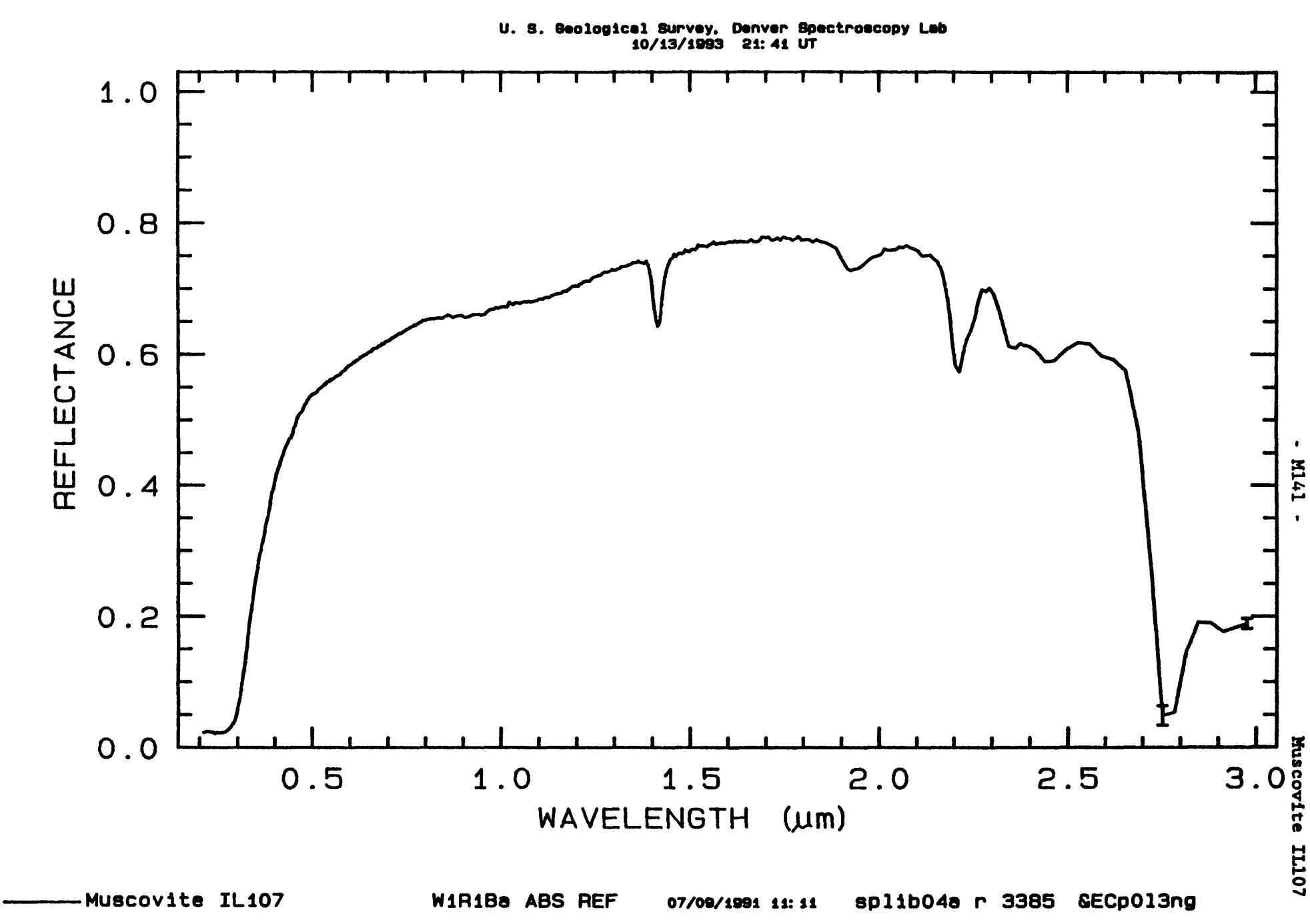
av gr sz = 13 μm

Single platy cleavage, 1st order grey, length slow, nearly straight extinction. All consistent with muscovite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3385	0.2-3.0μm	200	g.s.= 13 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/13/1993 21:41 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- M141 -
Muscovite IL107
Muscovite IL107 W1R1Ba ABS REF 07/09/1991 11:11 splib04a r 3385 &ECp013ng

TITLE: Nacrite GDS88 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS88

MINERAL_TYPE: Phyllosilicate

MINERAL: Nacrite (Kaolinite-Serpentine group)

FORMULA: Al2Si2O5(OH)4

FORMULA_NROFF: $Al_2Si_2O_5(OH)_4$

COLLECTION_LOCALITY: Nayarite, Mexico

ORIGINAL_DONOR: Jim Crowley, USGS Reston, VA

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Polymorphous with Kaolinite, Dickite, and Halloysite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

See compositional discussion.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

This sample appears to be nearly pure nacrite according to the XRD. The spectrum of the sample, however, shows a splitting of the 1.41μm feature into a major band near 1.40μm and a side band at 1.41μm. This suggest that the sample is a mixture of nacrite and dickite.

Crowley, James and Norma Vergo, 1986, Disorder in kaolin minerals: Observations using near-infrared reflectance spectroscopy. International Mineralogical Association Fourteenth General Meeting, Abstracts with Program, July 1986, Stanford University, Stanford, CA p. 84.

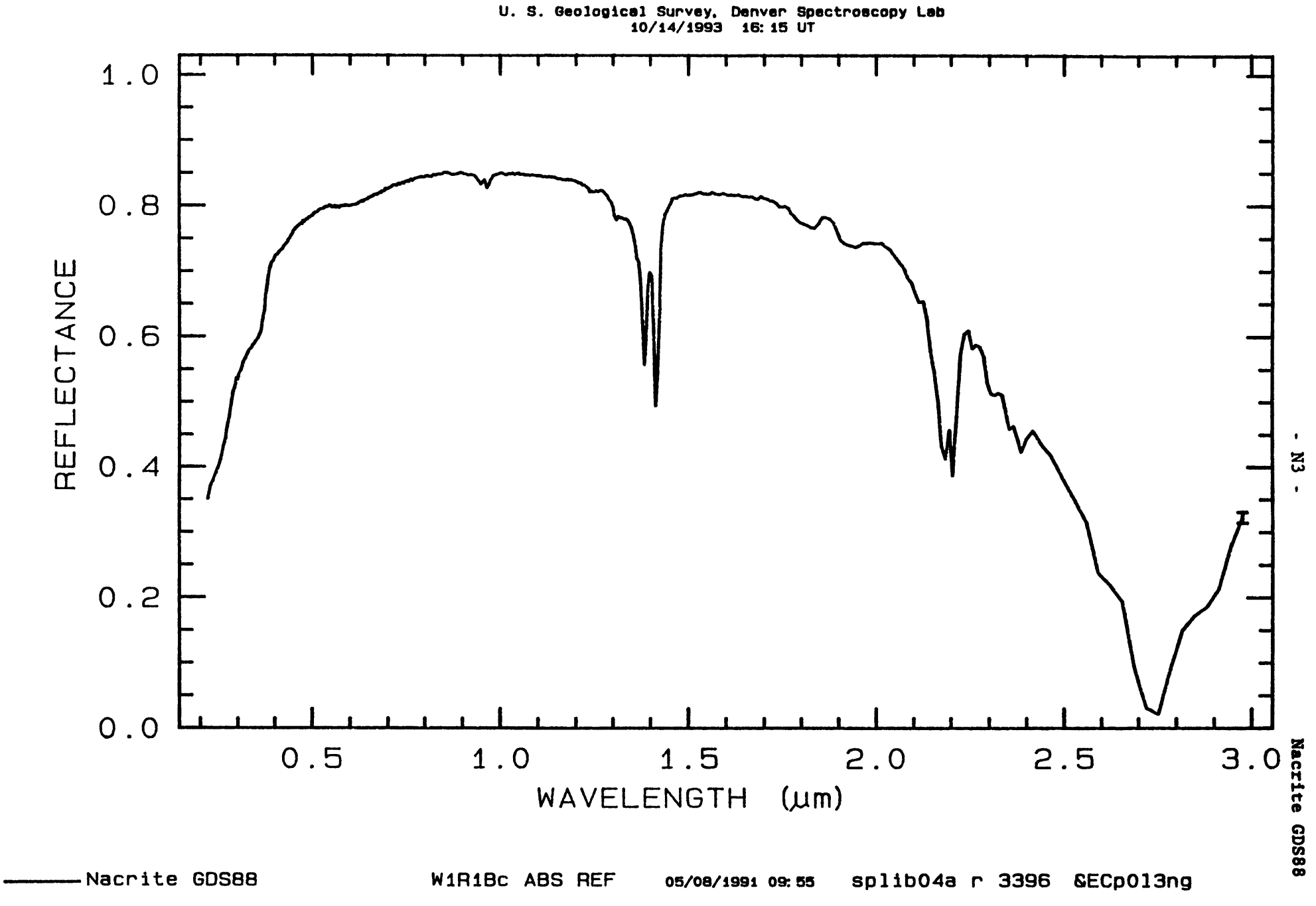
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3396	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N3 -
Nacrite GDS88
Nacrite GDS88
W1R1Bc ABS REF
05/08/1991 09:55
splib04a r 3396 &ECp013ng

TITLE: Natrolite HS169 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS169

MINERAL_TYPE: Tectosilicate

MINERAL: Natrolite (Zeolite group)

FORMULA: Na2Al2Si3O10*2H2O

FORMULA_NROFF: $Na_2Al_2Si_3O_{10} \bullet 2H_2O$

COLLECTION_LOCALITY: Poonah, India

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Tetranantrolite.

"T-22 Natrolite 169B--Poonah, India. $Na_2Al_2Si_3O_{10}2H_2O$: The spectral features in this sample are very well resolved and the spectrum displays multiple sharp and weak features, all due to H_2O throughout the entire mid- infrared. The main features are at 0.98μ, 1.19μ, 1.46μ, 1.95μ, 2.2μ, and 2.44μ. The differences in these natrolite spectra indicate that the water is less randomly located in the Poonah sample than in the Springfield sample."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure natrolite. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:

100 vol% Natrolite
tr Fe-oxide scale

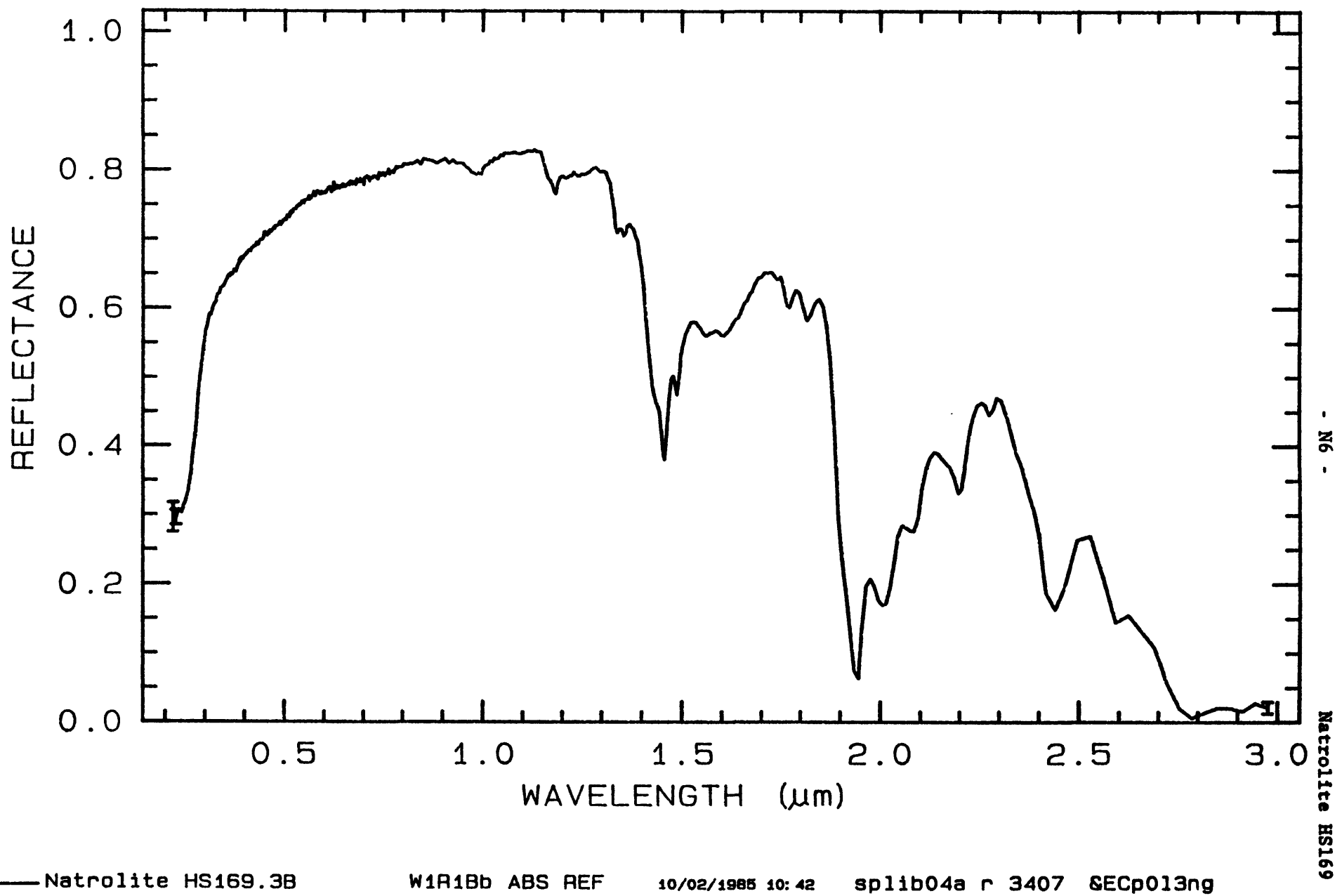
avg gr sz = 225 μm

Some clear grains 10% vol, the rest are cloudy white. Grains have micron sized fluid or gas inclusions comprising 40 vol% of zeolite grains. Cannot get optic sign. Low relief grains with straight extinction, and sub-rounded habit (not fibrous). These properties are consistent with this sample being natrolite. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3407	0.2-3.0μm	200	g.s.= 225 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N6 -
Natrolite HS169
Natrolite HS169.3B W1R1Bb ABS REF 10/02/1985 10:42 splib04a r 3407 &ECp013ng

TITLE: Natrolite+Zeolites HS168 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS168

MINERAL_TYPE: Tectosilicate

MINERAL: Natrolite + Zeolites (Zeolite group)

FORMULA: Na2Al2Si3O10*2H2O

FORMULA_NROFF: $Na_2Al_2Si_3O_{10} \bullet 2H_2O$

COLLECTION_LOCALITY: Springfield, Oregon

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Dimorphous with Tetranatrolite.

"T-21 Natrolite 168B--Springfield, Ore. Na_2Al_2- $Si_3O_{10}.2H_2O$: This zeolige occurs in cavities in basalts and related rocks and also as an alteration product of nepheline, sodalite or plagioclase. Its major features occur at 0.85μ, 1.165μ, 1.44μ, and 1.95μ. These bands are considerably sharper than in the stilbite."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Natrolite + lg. amount of analcime + sm. amount of clinoptilolite + lg. amount other. (Norma Vergo)

Spectrally contaminated by other zeolites. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

mode:

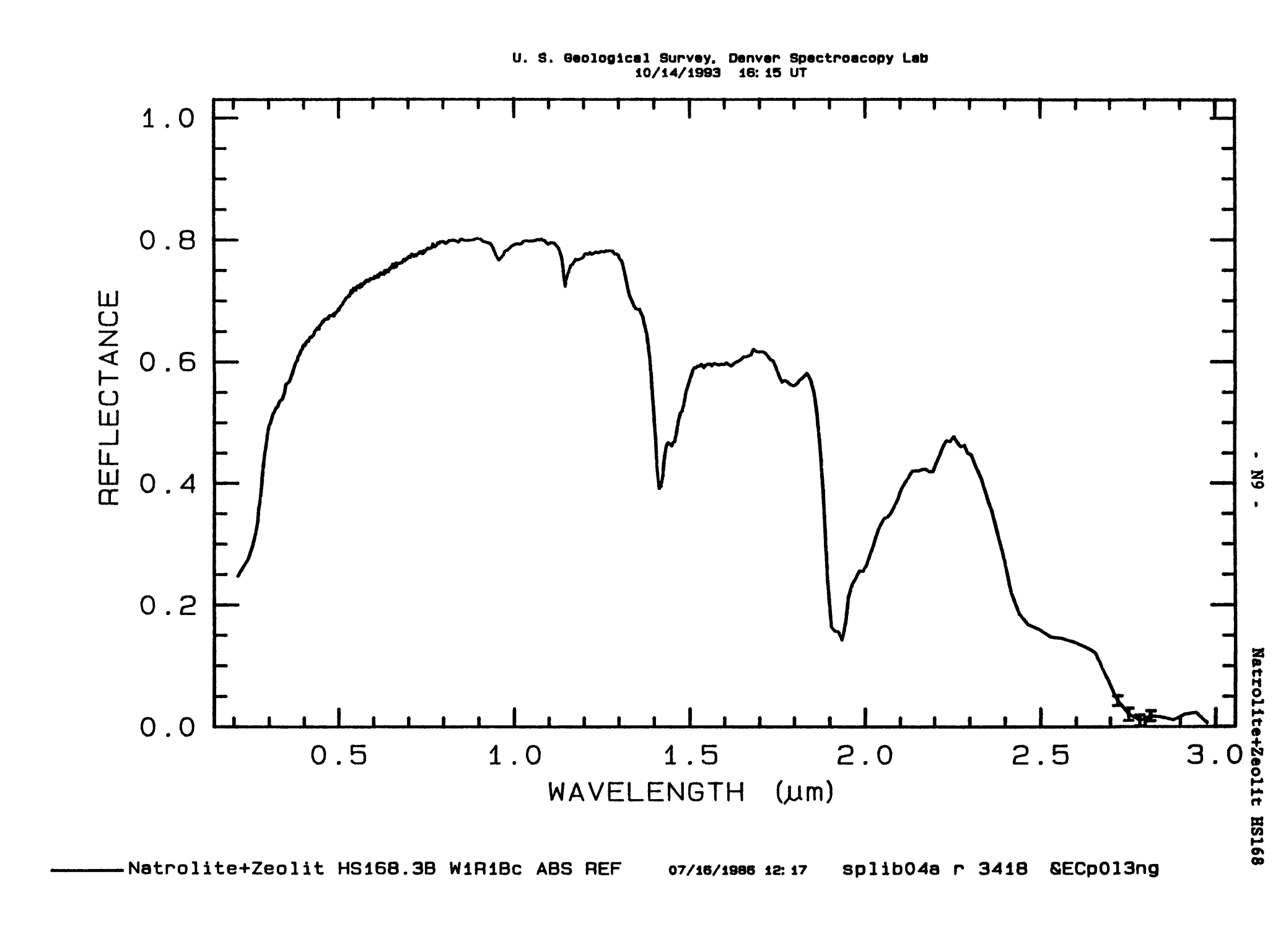
40 vol% Natrolite
30 vol% Analcime (isotropic, low relief, concoidal fracture)
20 vol% Clinoptilolite
10 vol% Calcite
tr Fe-oxide scale

Not many gas or fluid inclusions in natrolite. Straight extinction, prismatic habit, length slow, all properties consistent with natrolite. Clear conchoidally fractured grains have low relief, 1st order gray (nearly isotropic), undulose extinction, and rutile inclusions, and are probably analcime grains. Flat blades with length slow character are probably Clinoptilolite. Calcite fizzes in HCl. This sample is very contaminated in a modal sense. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3418	0.2-3.0μm	200	g.s.= 180 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N9 -
Natrolite+Zeolit HS168
Natrolite+Zeolite HS168.3B W1R1Bc ABS REF 07/16/1986 12:17 splib04a r 3418 &ECp013ng

TITLE: Natrolite NMNH83380 Zeolite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH83380

MINERAL_TYPE: Tectosilicate

MINERAL: Natrolite (Zeolite group)

FORMULA: Na2Al2Si3O10*2H2O

FORMULA_NROFF: $Na_2Al_2Si_3O_{10} \bullet 2H_2O$

COLLECTION_LOCALITY: Nova Scotia, Canada

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

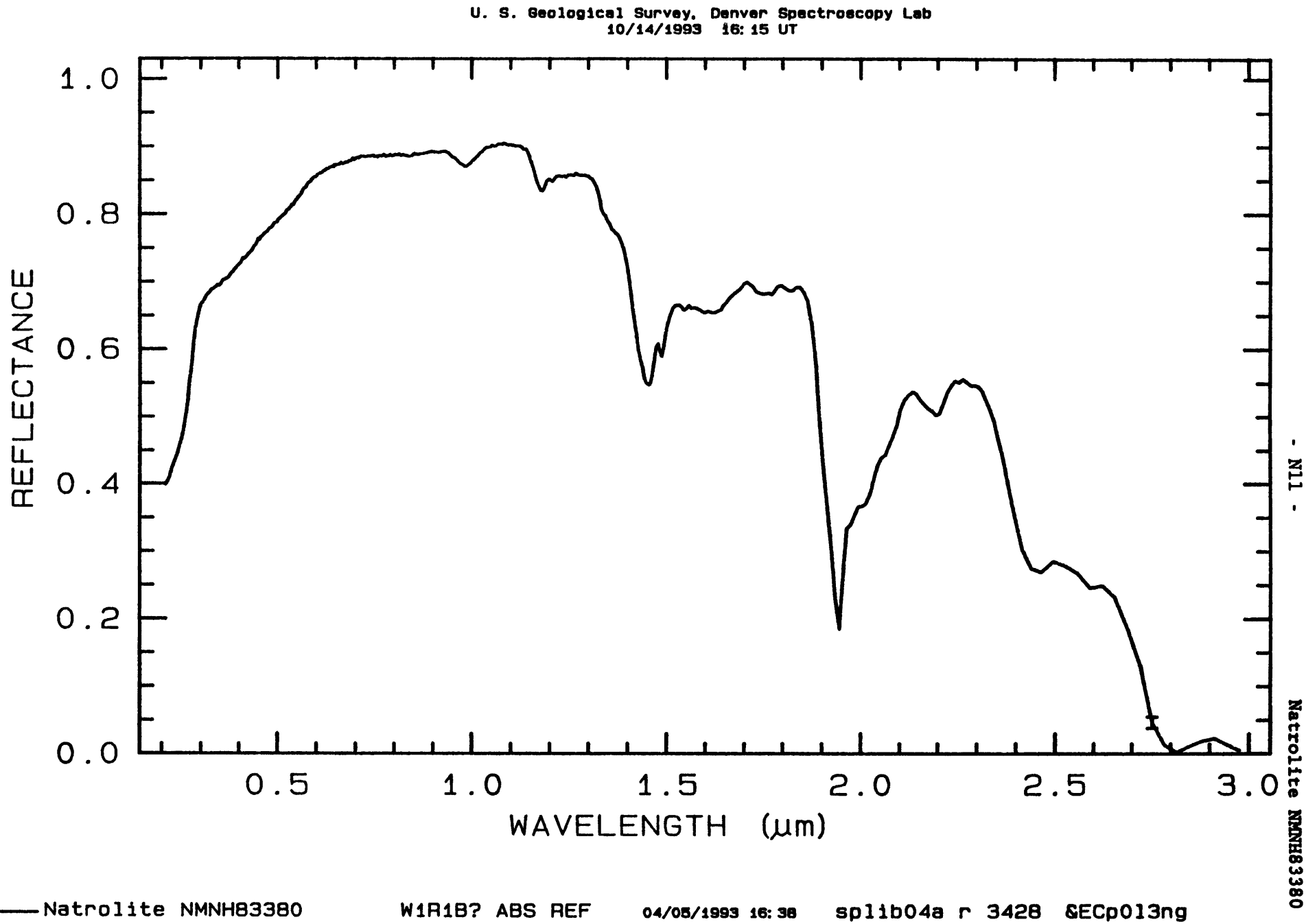
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3428	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N11 -
Natrolite NMNH83380
Natrolite NMNH83380 W1R1B? ABS REF 04/05/1993 16:38 splib04a r 3428 &ECp013ng

TITLE: Neodymium_Oxide GDS34 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS34

MINERAL_TYPE: Oxide

MINERAL: Neodymium_Oxide

FORMULA: Nd2O3

FORMULA_NROFF: Nd_2O_3

COLLECTION_LOCALITY: REE Standard Reagent

ORIGINAL_DONOR: None

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spex Standard 84.3% Nd Lot No. 02831R

"Reflectance spectra for reagent-grade Eu_2O_3, Nd_2O_3, Sm_2O_3, and Pr_2O_3 (Fig. 2) show the intense, narrow absorption bands caused by electronic transitions in trivalent rare earth elements (White, 1967; Dieke and Crosswhite, 1963). The absorption patterns produced by each of these oxides is distinctive for the particular rare earth element involved. The positions of the major bands for Nd_2O_3 and Sm_2O_3 are indicated in Table 2. Absorption features that occur near 1.4 and 1.9 μ cannot be unambiguously assigned to water or hydroxyl since some rare earth element oxides, notably Sm_2O_3 and Pr_2O_3, have electronic bands in these wavelength regions (Fig. 2). The cause of the 2.35μ bands in two of the rare earth element oxide samples (Fig. 2) also has not been determined. Although White (1967) tentatively attributed similar features to water, the bands could be produced by minor amounts of CO_3 or possibly by an undocumented REE-OH vibratiosnal overtone. No carbonate or hydroxyl-bearing phases were detected by X-ray diffraction analysis of the rare earth element oxide samples."

Rowan, Lawrence C., Kingston, Marguerite J., Crowley, James K., Spectral Reflectance of Carbonatites and Related Alkalic Igneous Rocks: Selected Samples from Four North American Localities, Economic Geology, Vol 81, 1986, pp. 857-871.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

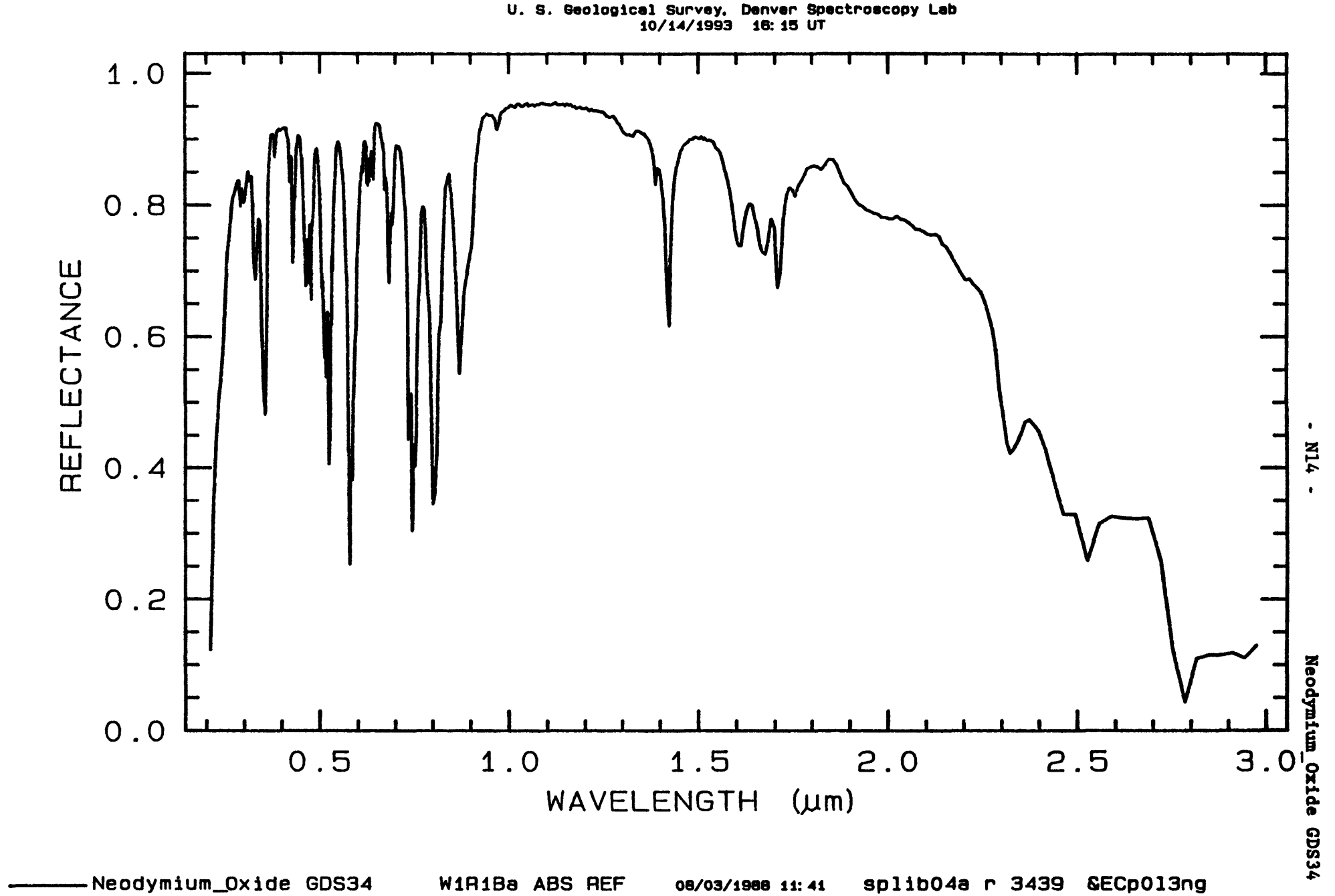
No visible impurities. G. Swayze.

avg grain sz = 4 μm

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3439	0.2-3.0μm	200	g.s.= 4 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N14 -
Neodymium Oxide GDS34
Neodymium_Oxide GDS34 W1R1Ba ABS REF 08/03/1988 11:41 splib04a r 3439 &ECp013ng

TITLE: Nepheline HS19 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS19

MINERAL_TYPE: Tectosilicate

MINERAL: Nepheline (Nepheline group)

FORMULA: (Na,K)AlSiO4

FORMULA_NROFF: $(Na,K)AlSiO_4$

COLLECTION_LOCALITY: Bancroft, Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"S-13. Nepheline. Bancroft, Ontario (19). This sodium-potassium aluminum silicate, $(Na,K)(Al,Si)_2O_4$, is found in igneous rocks whose magmas contained insufficient silica to combine with the soda present to form feldspar. This nepheline sample illustrates very clearly the effect of grinder steel contamination. Note that the two contaminated finer particle size fractions have both reduced reflectivity and their near-infrared bands eliminated. In contrast, the uppermost curve of uncontaminated 0.5μ nepheline is both highly reflective and retains its spectral features. The bands near 1.4, 1.9 and 2.5μ are due to water, presumable present as fluid inclusions in microscopic vesicles within the nepheline. The water is not present as part of the nepheline lattice, and the only contaminant (a very small amount of biotite) would not produce these bands."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

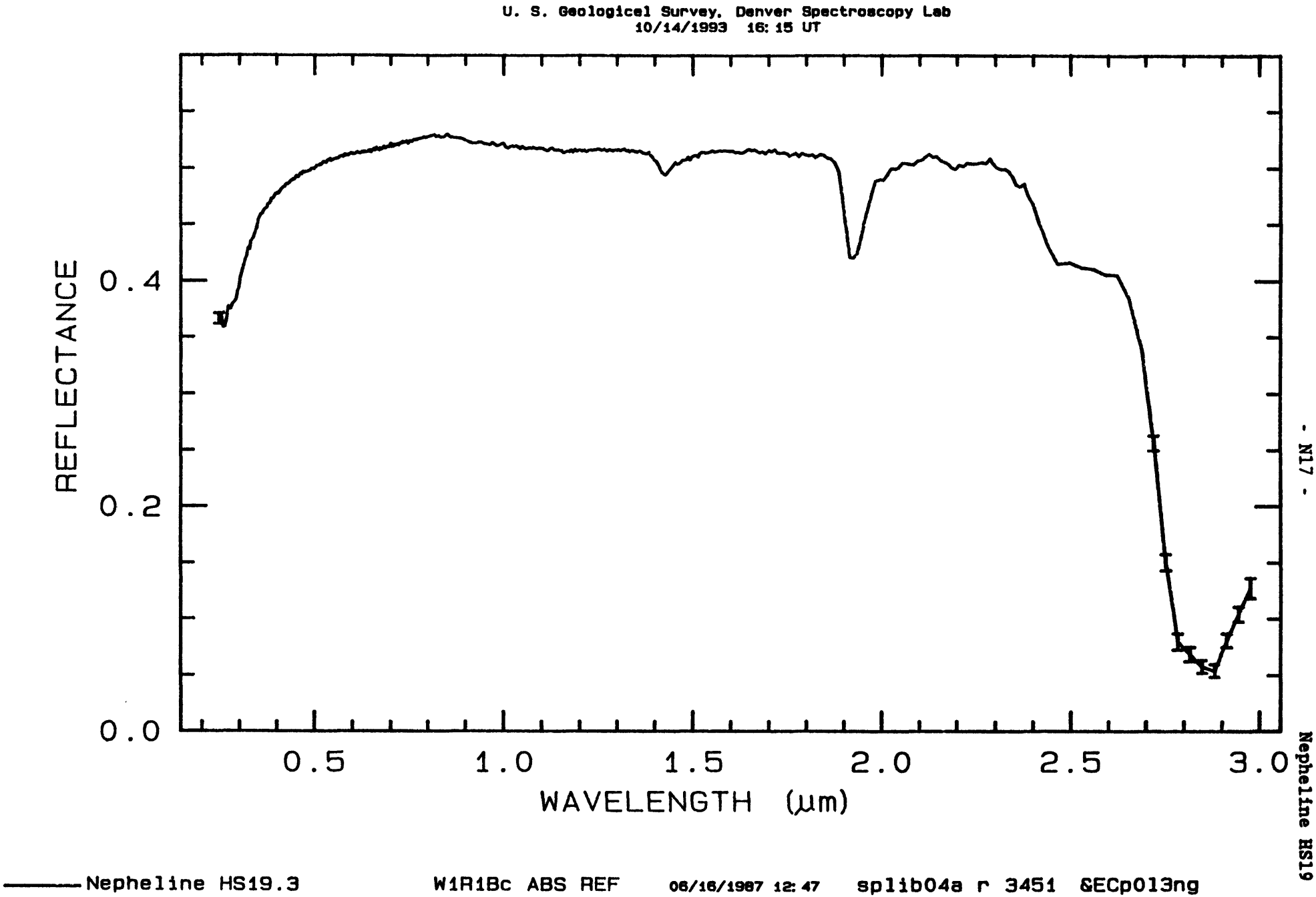
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3451	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N17 -
Nepheline HS19
Nepheline HS19.3
W1R1Bc ABS REF
06/16/1987 12:47
splib04a r 3451 &ECp013ng

TITLE: Nephrite HS296 Amphibole DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS296

MINERAL_TYPE: Inosilicate

MINERAL: Nephrite (Jade)(Actinolite)(Amphibole group)

FORMULA: Ca2(Mg,Fe+2)5Si8O22(OH)2

FORMULA_NROFF: $Ca_2(Mg,Fe^{+2})_5Si_8O_{22}(OH)_2$

COLLECTION_LOCALITY: British Columbia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"I-19 Nephrite 296B--British Columbia: Nephrite is a tough compact variety of either tremolite or actinolite, which is used as the second source of gem quality jade (see inosilicate, I-9 for other source, jadeite). This sample contains magnetite as an impurity, which contributes to its low reflectivity, but the ferric and ferrous features are still apparent at 0.7μ and 1.0μ, as is the accompanying fall off to the blue. The hydroxyl features are quite evident at 1.4μ and 2.33μ with a small feature at 1.9μ indicating including water."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

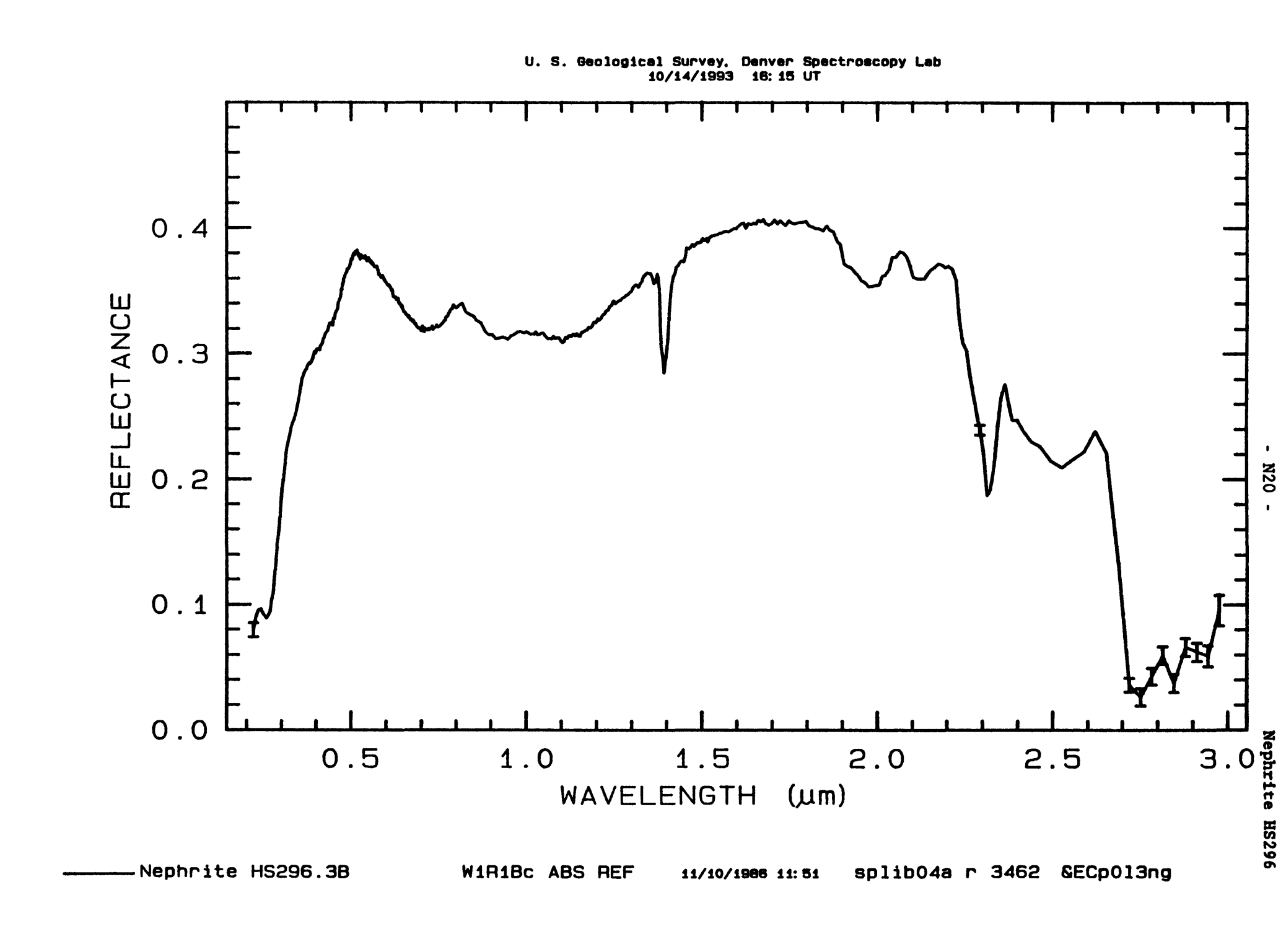
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3462	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N20 -
Nephrite HS296
Nephrite HS296.3B W1R1Bc ABS REF 11/10/1986 11:51 splib04a r 3462 &ECp013ng

TITLE: Niter GDS43 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS43

MINERAL_TYPE: Nitrate

MINERAL: Niter (Saltpeter)

FORMULA: KNO3

FORMULA_NROFF: KNO_3

COLLECTION_LOCALITY: Chemical Reagent

ORIGINAL_DONOR: McKesson Laboratory

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

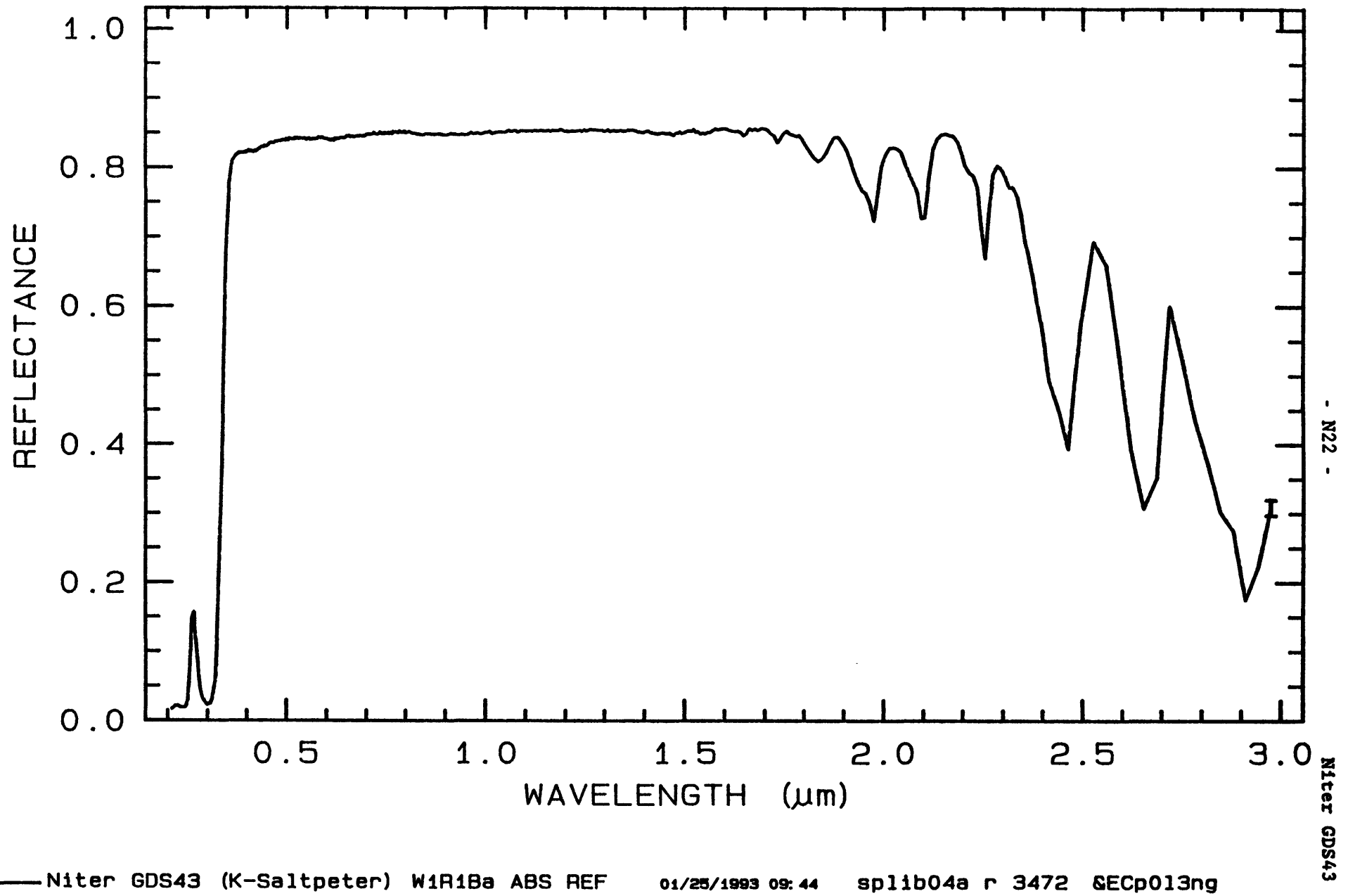
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3472	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N22 -
Niter GDS43
Niter GDS43 (K-Saltpeter) W1R1Ba ABS REF 01/25/1993 09:44 splib04a r 3472 &ECp013ng

TITLE: Nontronite GDS41 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS41

MINERAL_TYPE: Phyllosilicate

MINERAL: Nontronite (Fe-bearing Smectite) (Montmorillonite group)

FORMULA: Na0.33(Fe+3)2(Si,Al)4O10*nH2O

FORMULA_NROFF: $Na_{0.33}Fe^{+3}{}_2(Si,Al)_4O_{10}\bullet nH_2O$

COLLECTION_LOCALITY: Wigwam Creek

ORIGINAL_DONOR: None

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Chartruse nontronite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	30.7	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	<0.02	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	20.1	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	23.0	wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	0.19	wt%	NROFF:	MnO
COMPOSITION:	MgO:	12.5	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.77	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.62	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	LOI:	12.70	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.58	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.58	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Sample from Eugene Foord, USGS, Denver, Colorado.

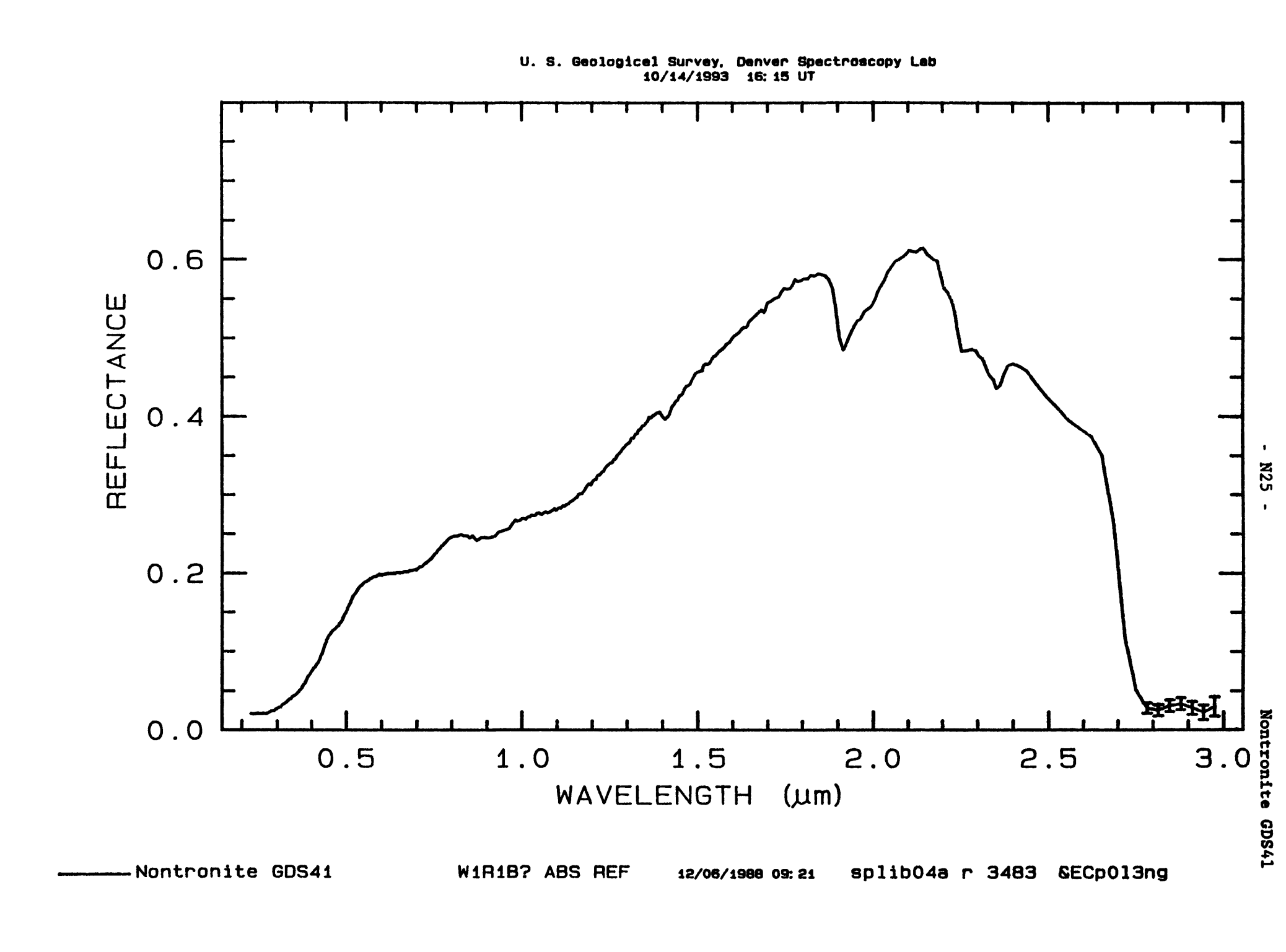
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3483	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N25 -
Nontronite GDS41
Nontronite GDS41 W1R1B? ABS REF 12/06/1988 09:21 splib04a r 3483 &ECp013ng

TITLE: Nontronite NG-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NG-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Nontronite (Fe-bearing Smectite) (Montmorillonite group)

FORMULA: Na0.33(Fe+3)2(Si,Al)4O10*nH2O

FORMULA_NROFF: $Na_{0.33}Fe^{+3}{}_2(Si,Al)_4O_{10}\bullet nH_2O$

COLLECTION_LOCALITY: Holen Hagen, Germany

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

The spectrum from 2.5-25μm was published in: Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Two spectra for this sample are in the library, (a) - bulk, and (b) - <2μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is nontronite + quartz + other; the <2μm cut was nontronite + trace quartz.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	80.0	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.05	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	2.00	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	11.1	wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	0.42	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.56	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.72	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	LOI:	5.28	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.35	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.35	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver.

END_COMPOSITION_DISCUSSION.

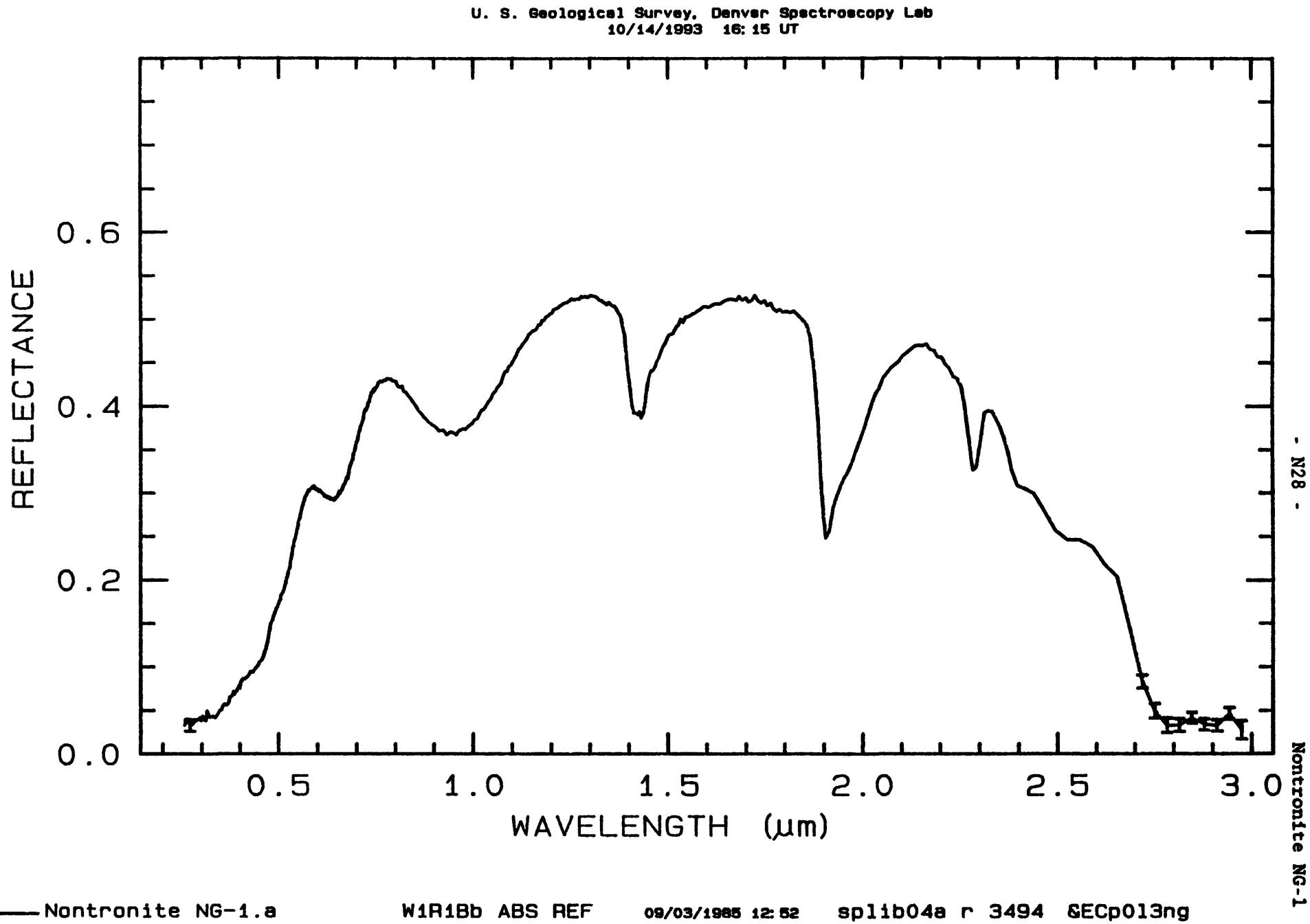
MICROSCOPIC_EXAMINATION:

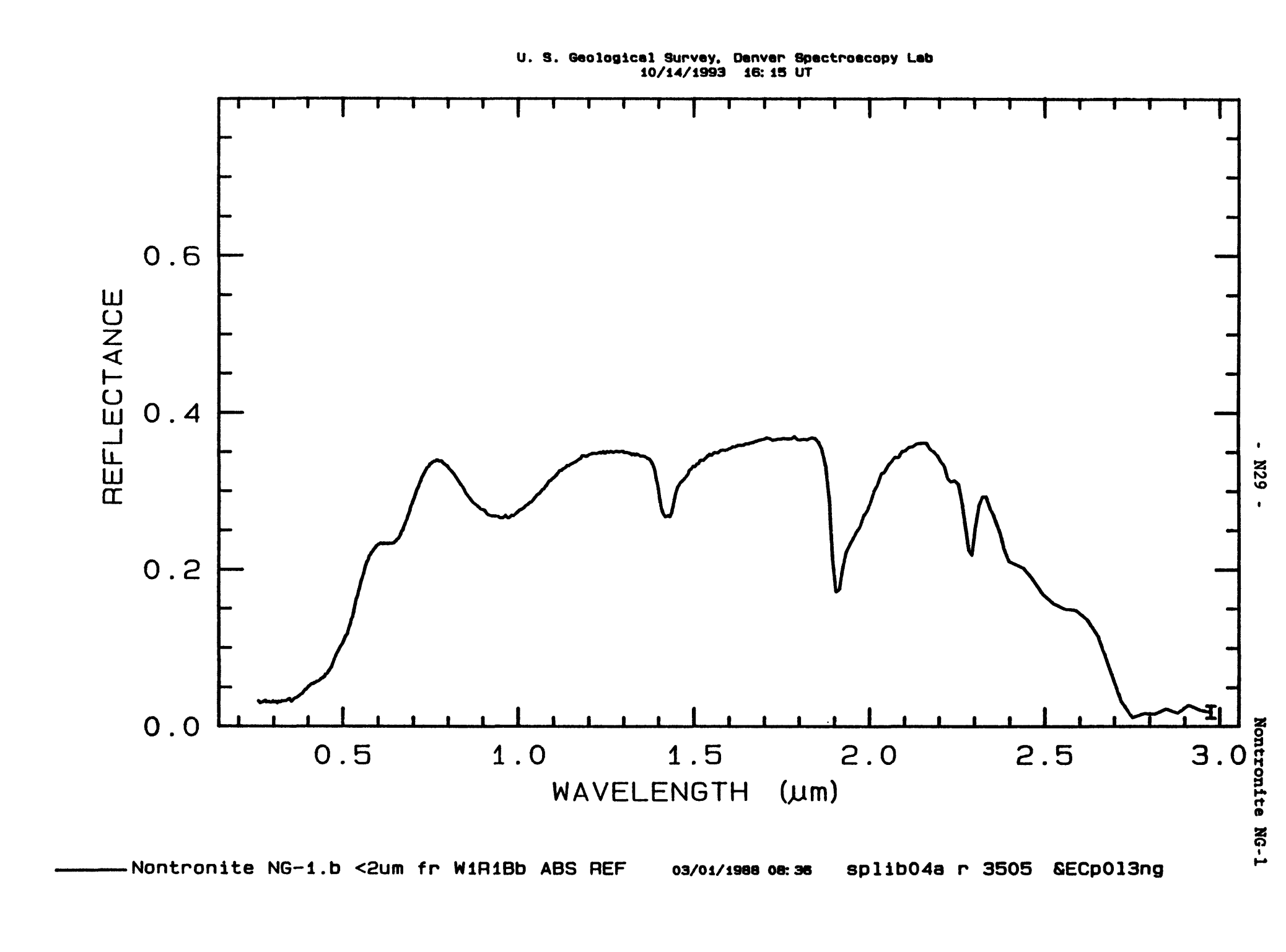
50% quartz, 1-2% opaques, no HCl fizz.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3494	0.2-3.0μm	200	g.s.=
LIB_SPECTRA:	splib04a r 3505	0.2-3.0μm	200	g.s.=<2μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N28 -
Nontronite NG-1
Nontronite NG-1.a W1R1Bb ABS REF 09/03/1985 12:52 splib04a r 3494 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N29 -
Nontronite NG-1
Nontronite NG-1.b <2um fr W1R1Bb ABS REF 03/01/1988 08:36 splib04a r 3505 &ECp013ng

TITLE: Nontronite SWa-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SWa-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Nontronite (Fe-bearing Smectite) (Montmorillonite group)

FORMULA: Na0.33(Fe+3)2(Si,Al)4O10*nH2O

FORMULA_NROFF: $Na_{0.33}Fe^{+3}{}_2(Si,Al)_4O_{10}\bullet nH_2O$

COLLECTION_LOCALITY: Grant County, Washington

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published by:

Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* 95, 12653-12680.

who noted that it was spectrally pure.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates the sample is Fe-smectite + small amounts of quartz, the <2μm cut was pure smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	47.6	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.54	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	7.69	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	23.0	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	0.05	wt%	NROFF:	FeO
COMPOSITION:	MnO:	<0.02	wt%	NROFF:	MnO
COMPOSITION:	MgO:	3.32	wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.88	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.03	wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	<0.05	wt%	NROFF:	P_2O_5
COMPOSITION:	H2O+:	6.32	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	11.9	wt%	NROFF:	H_2O^-
COMPOSITION:	H2O:	18.2	wt%	NROFF:	H_2O
COMPOSITION:	LOI:	17.9	wt%	NROFF:	LOI
COMPOSITION:	---	---			
COMPOSITION:	Total:	100.60	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.60	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

XRF Analysis by Branch of Analytical Chemistry, USGS, Denver. Total above includes LOI value rather than H2O values, and does not include value for FeO as it was determined at same time as H2O. Trace analysis was performed and will be added later.

END_COMPOSITION_DISCUSSION.

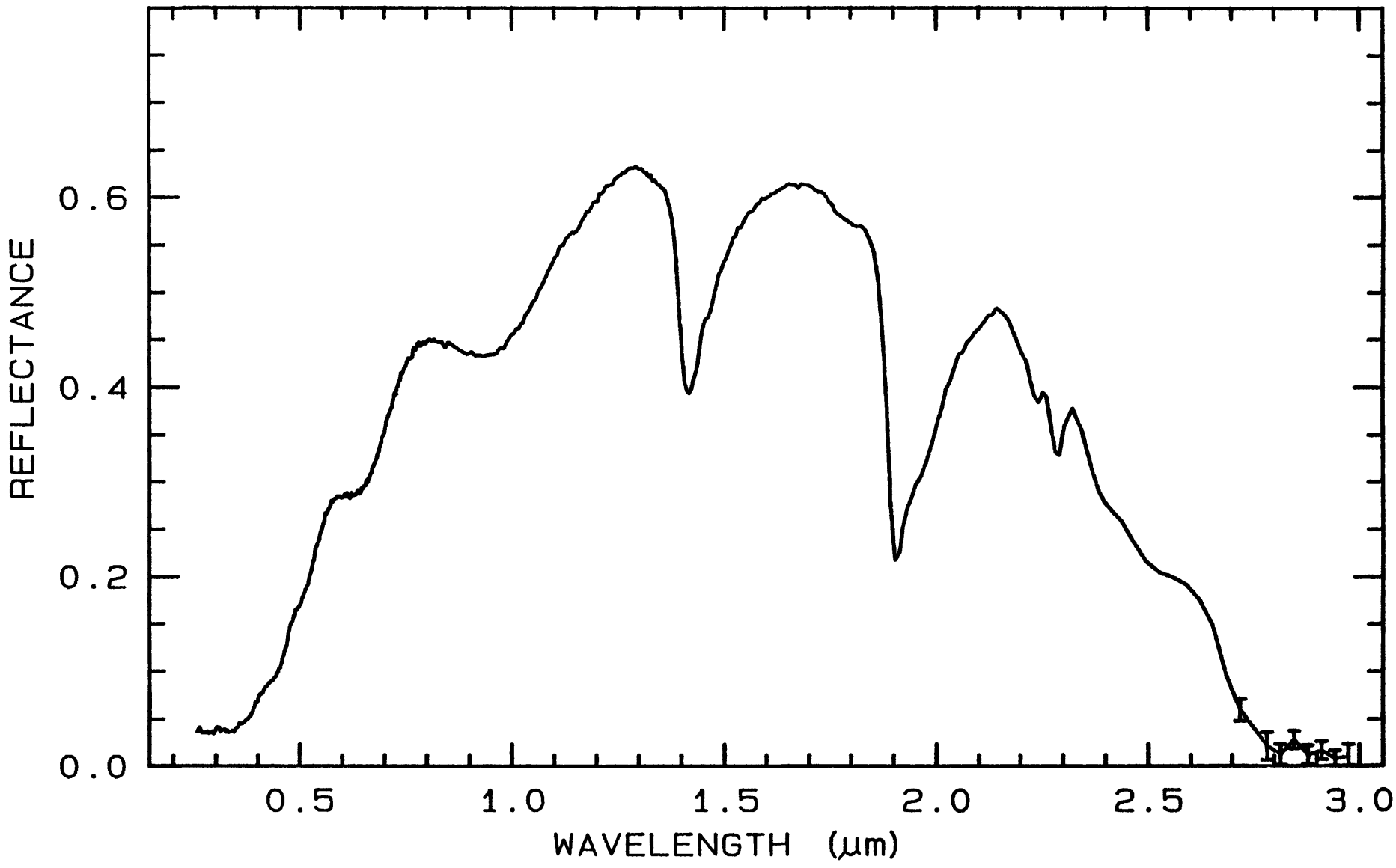
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3516	0.2-3.0μm	200	g.s.=
LIB_SPECTRA:	splib04a r 3527	0.2-3.0μm	200	g.s.=<2μm

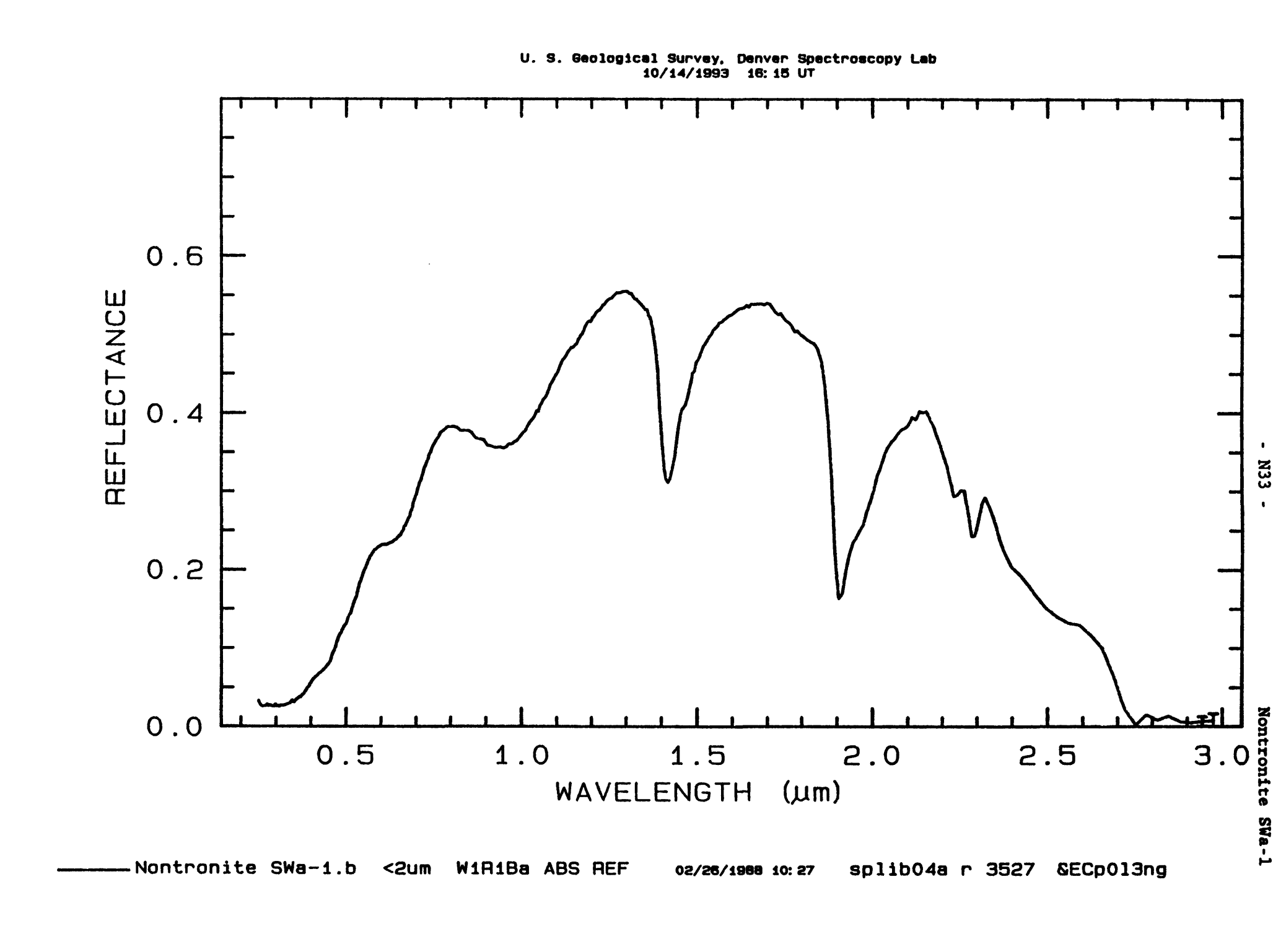
U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT



- N32 -

Nontronite SWa-1

Nontronite SWa-1.a W1R1Bb ABS REF 09/03/1985 12:01 splib04a r 3516 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:15 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- N33 -
Nontronite SWa-1
Nontronite SWa-1.b <2um W1R1Ba ABS REF 02/26/1988 10:27 splib04a r 3527 &ECp013ng

TITLE: Oligoclase HS110 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS110

MINERAL_TYPE: Tectosilicate

MINERAL: Oligoclase (Plagioclase)(Feldspar group)

FORMULA: (Na,Ca)Al(Al,Si)Si2O8

FORMULA_NROFF: $(Na,Ca)Al(Al,Si)Si_2O_8$

COLLECTION_LOCALITY: Mitchell Co., New York

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Most analyses contain small amounts of Na, but a complete solid solution series is possible from orthoclase toward intermediate albite. Crystallizes at intermediate temperatures and has a partially ordered Al-Si distribution.

Sieve interval 74-250μm.

"Oligoclases are composed of from 70 to 90% albite and 30 to 10% anorthite. This pure white sample contains very little muscovite impurity. Its spectrum is quite flat with broad 1.4μm, 1.9μm, and weak 2.2μm features. The 1.9 band is indicative of the presence of a small amount of included H_2O, while the 2.2μm feature is due to the OH stretch-AlOH bending combination."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

No compositional analyses.

END_COMPOSITION_DISCUSSION.

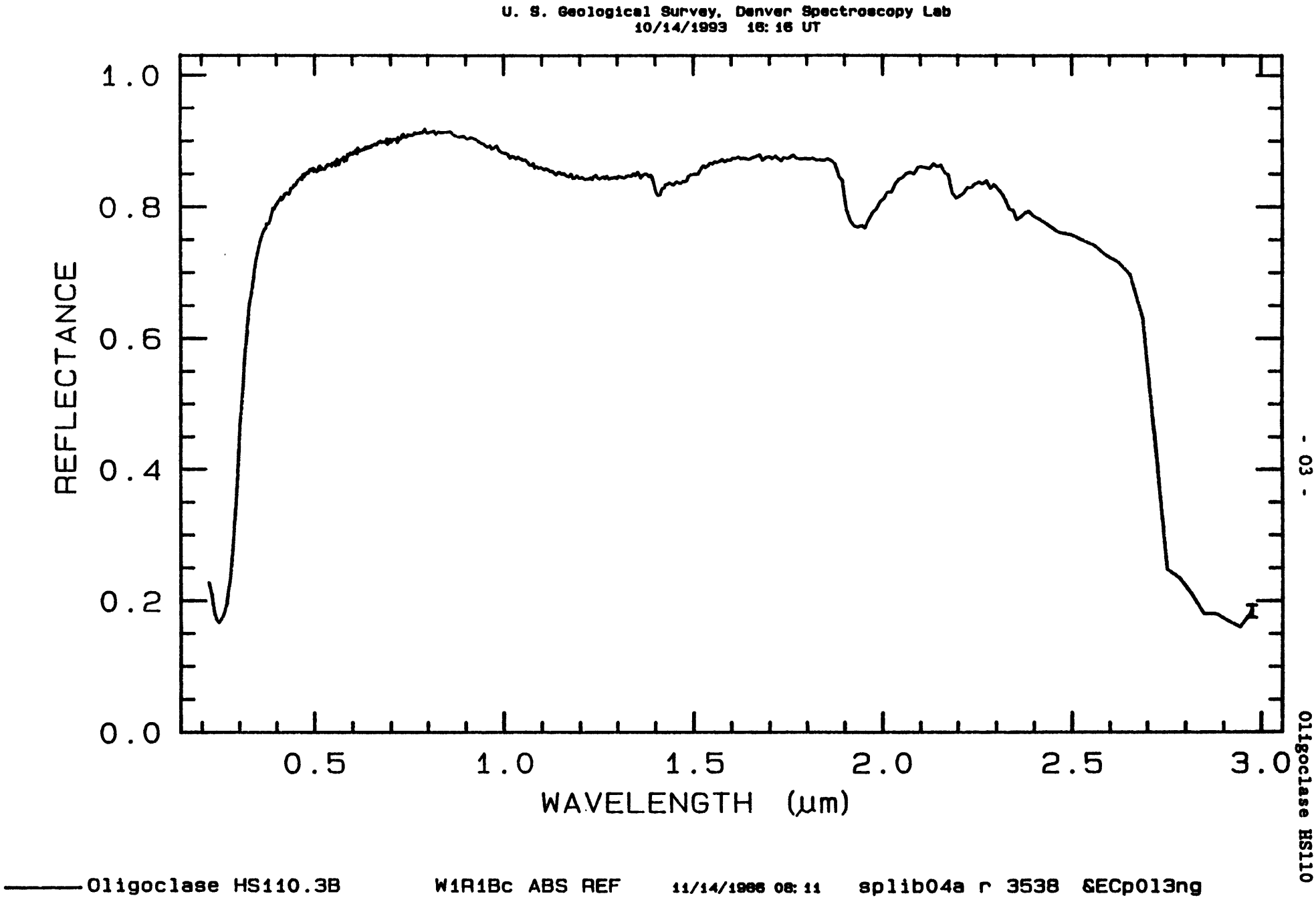
MICROSCOPIC_EXAMINATION:

Clear to white translucent. 0% opaque. No contamination visually apparent.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3538	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 03 -
Oligoclase HS110
Oligoclase HS110.3B W1R1Bc ABS REF 11/14/1986 08:11 splib04a r 3538 &ECp013ng

TITLE: Oligoclase HS143 Plagioclase DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS143

MINERAL_TYPE: Tectosilicate

MINERAL: Oligoclase (Plagioclase)(Feldspar group)

FORMULA: (Na,Ca)Al(Al,Si)Si2O8

FORMULA_NROFF: $(Na,Ca)Al(Al,Si)Si_2O_8$

COLLECTION_LOCALITY: Norway

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Most analyses contain small amounts of Na, but a complete solid solution series is possible from orthoclase toward intermediate albite. Crystallizes at intermediate temperatures and has a partially ordered Al-Si distribution. Sieve interval 74-250μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Albite + microcline (s) (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

No compositional analyses.

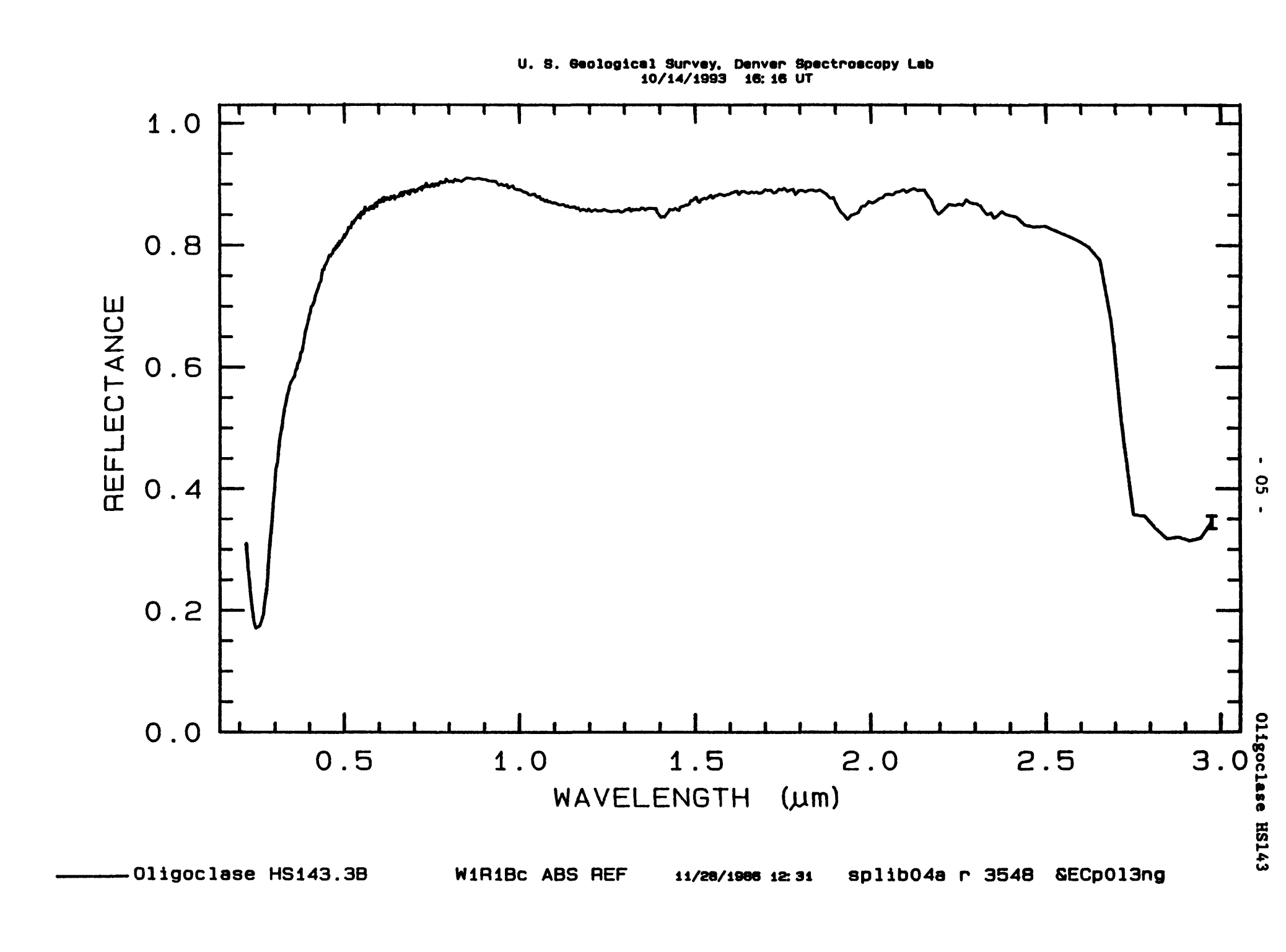
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3548	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 05 -
Oligoclase HS143
Oligoclase HS143.3B
W1R1Bc ABS REF
11/28/1988 12:31
splib04a r 3548 &ECp013ng

TITLE: Olivine NMNH137044 Fo92 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH137044

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Fosterite-Fayalite series)(Olivine group)

FORMULA: (Mg,Fe)2SiO4 Fo92

FORMULA_NROFF: $(Mg,Fe)_2SiO_4$ Fo_{92}

COLLECTION_LOCALITY: Chavira Mine, Kamargo (nr), Chihuahau, Mexico

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

The sample consists of many 0.5cm particles plus one large fragment. Under petrographic microscope, the hand-picked sample appears clean but one of the grains may be pyroxene.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Sample is in two sieve intervals: (a) 74-250μm and (b) <74μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure forsterite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	40.27 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.01 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.02 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	8.70 wt%	NROFF:	FeO
COMPOSITION:	MnO:	0.15 wt%	NROFF:	MnO
COMPOSITION:	MgO:	52.28 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.06 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.02 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.01 wt%	NROFF:	K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	101.52 wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis of hand-picked grains showed the sample to be homogenous within and between grains. Average of 10 analyses showed the sum of the divalent cations too high, but Fo content is approximately 92 mole percent.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

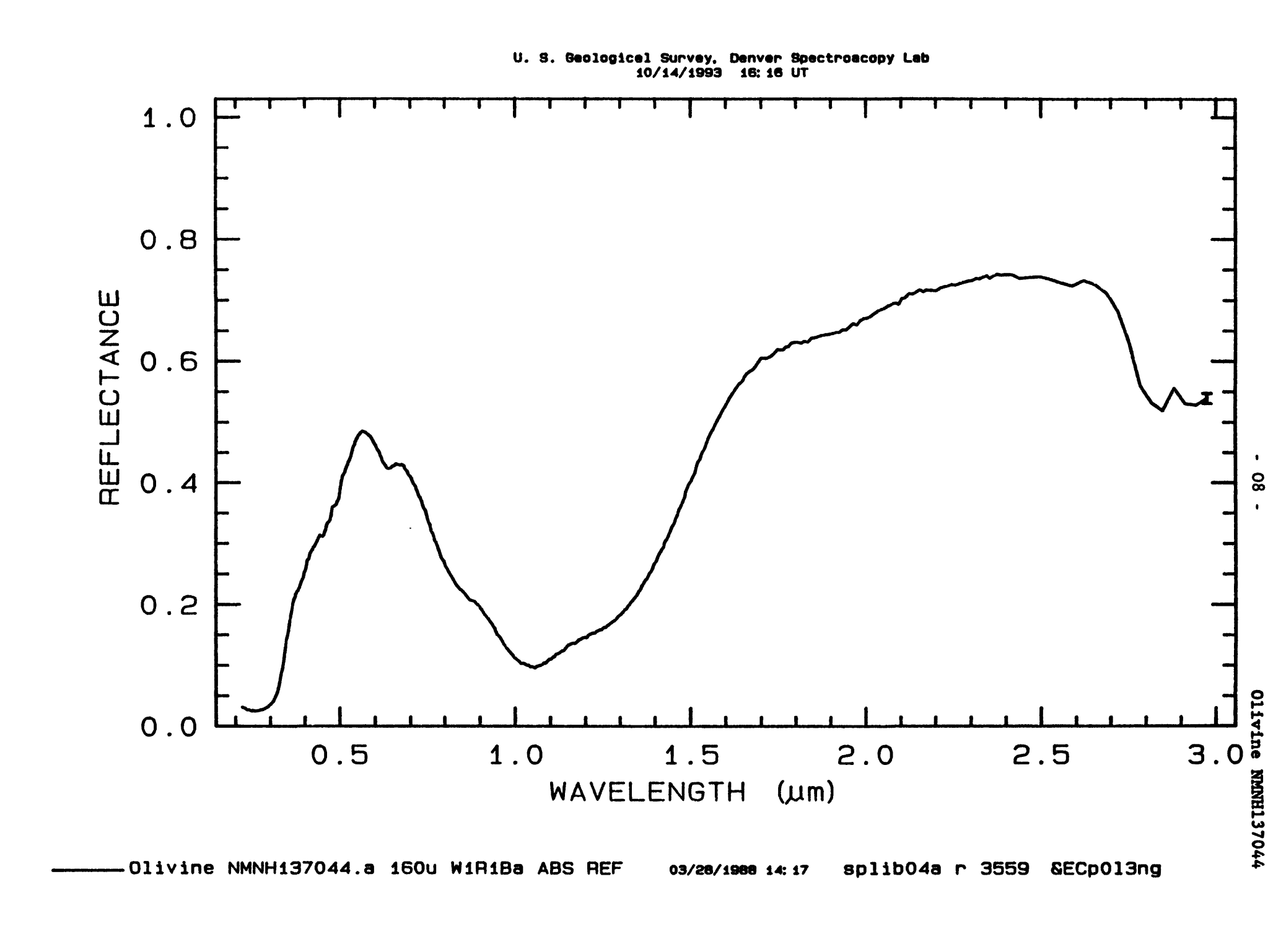
END_COMPOSITION_DISCUSSION.

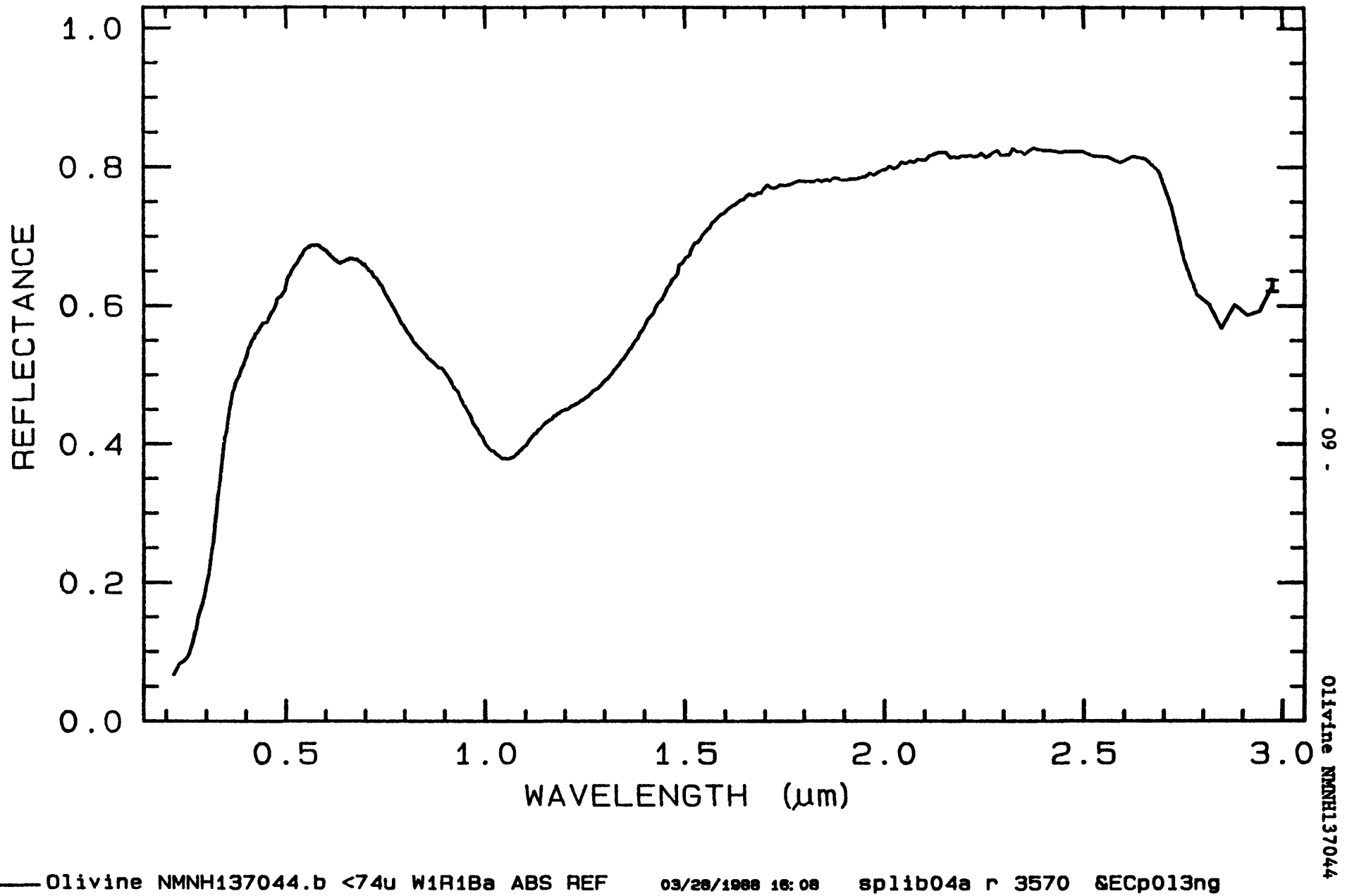
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3559	0.2-3.0μm	200	160μm
LIB_SPECTRA:	splib04a r 3577	0.2-3.0μm	200	<74μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 08 -
Olivine NMNH137044
Olivine NMNH137044.a 160u W1R1Ba ABS REF 03/28/1988 14:17 splib04a r 3559 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 60 -
Olivine NMNH137044
Olivine NMNH137044.b <74u W1R1Ba ABS REF 03/28/1988 16:08 splib04a r 3570 &ECp013ng

TITLE: Olivine GDS70 Fo89 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS70

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2Si04-Fe2Si04 Fo89

FORMULA_NROFF: Mg_2Si_4-Fe_2SiO_4 Fo_{89}

COLLECTION_LOCALITY: South Point, Hawaii, Hawaii

ORIGINAL_DONOR: Roger N. Clark

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

This sample is commonly referred to as the "green sand beach" olivine. The sample was sieved into <60μm (d), 60-104μm (c), 104-150μm (b), and 150-250μm (a) size fractions. All samples were examined using a petrographic microscope and hand-picked prior to wet-sieving.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	41.09 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.01 wt%	NROFF:	TiO_2
COMPOSITION:	Cr2O3:	0.05 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	9.16 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.39 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.21 wt%	NROFF:	MnO
COMPOSITION:	MgO:	49.29 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.03 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	100.23 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis by W.I. Ridley at the USGS microprobe facility in Denver, Colorado.

END_COMPOSITION_DISCUSSION.

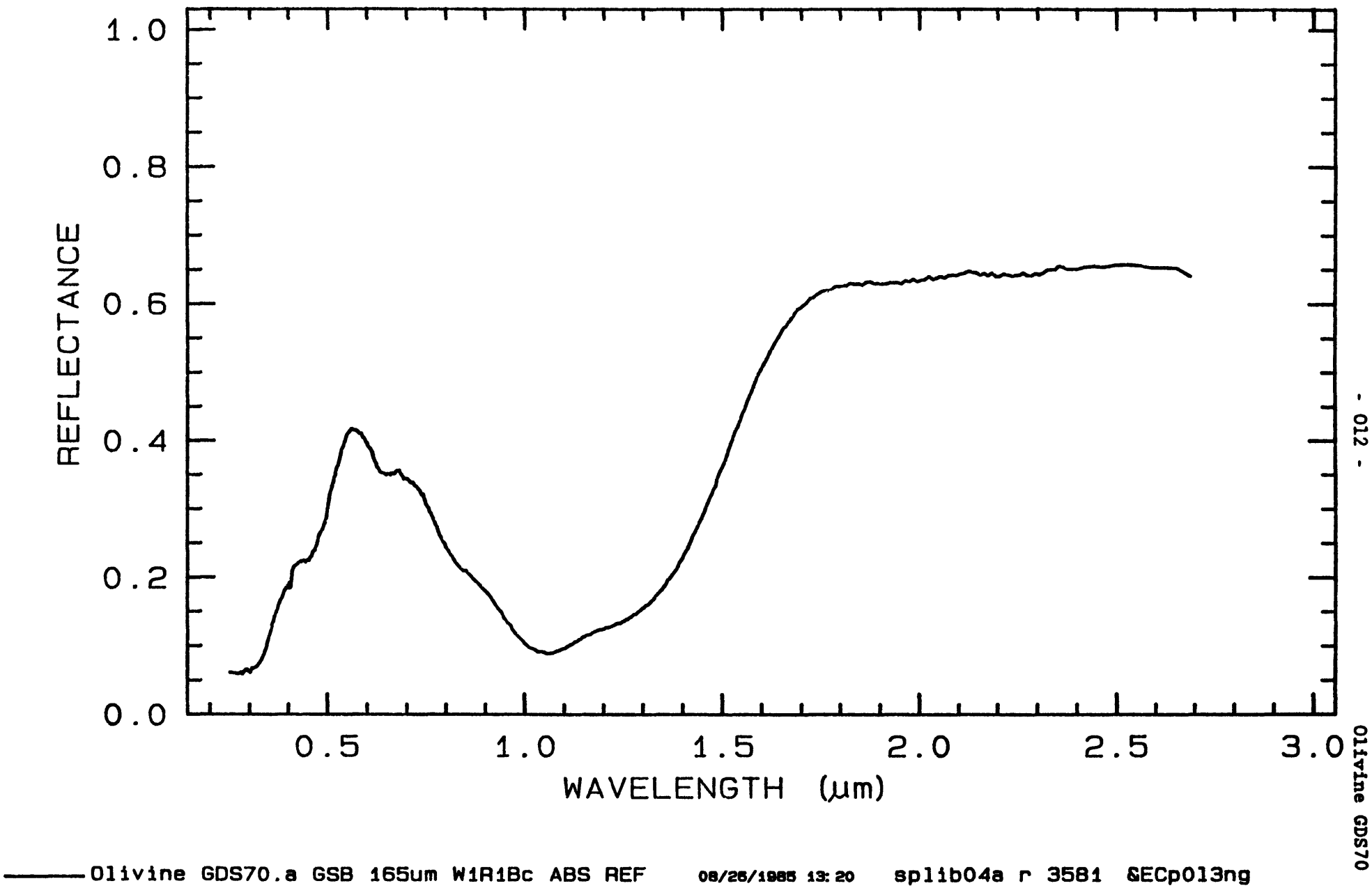
MICROSCOPIC_EXAMINATION:

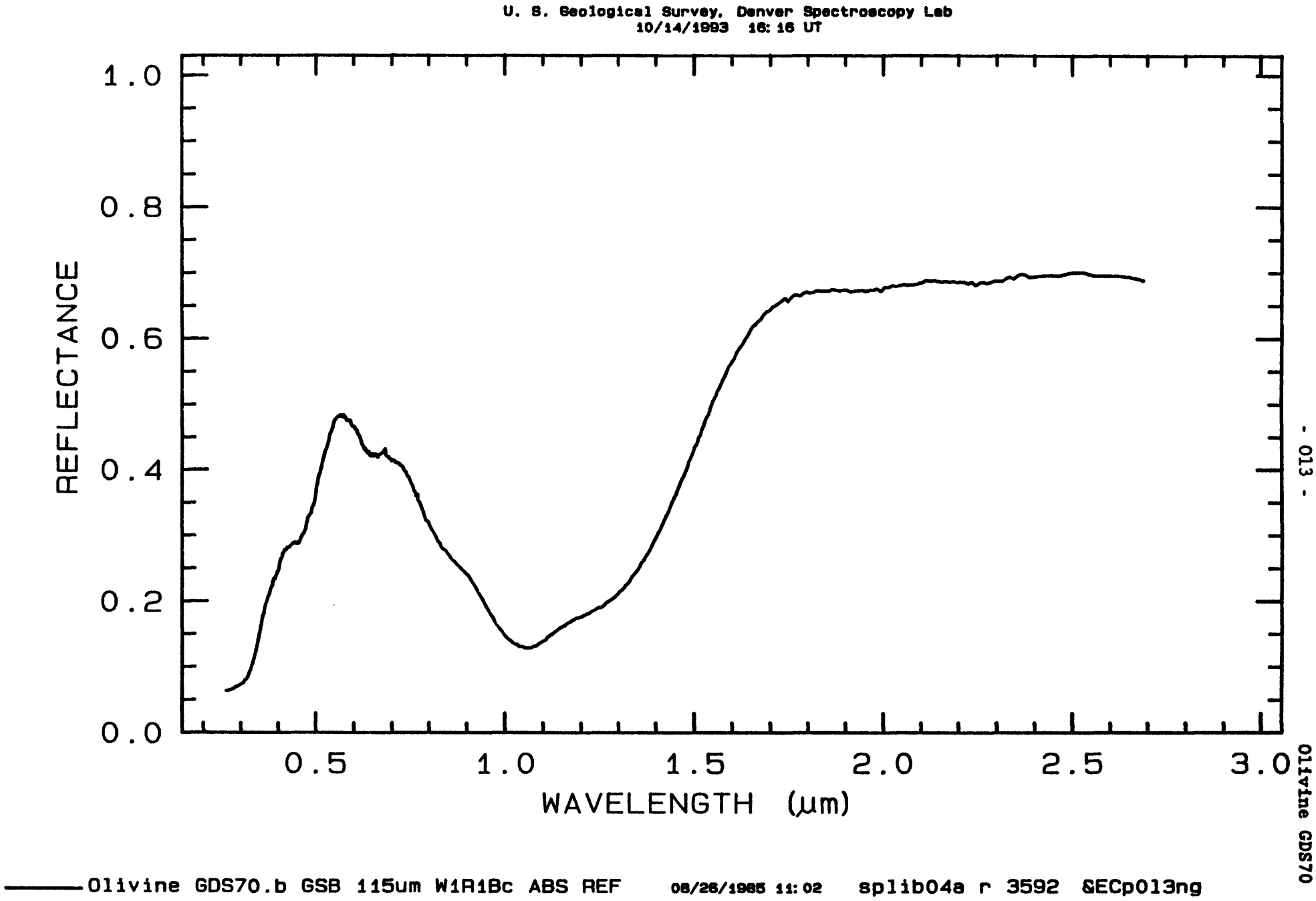
This is a pure mineral separate. Some spectra show weak 2.3 μm alteration features. The rest of the spectrum rates an a on the spectral purity scale.

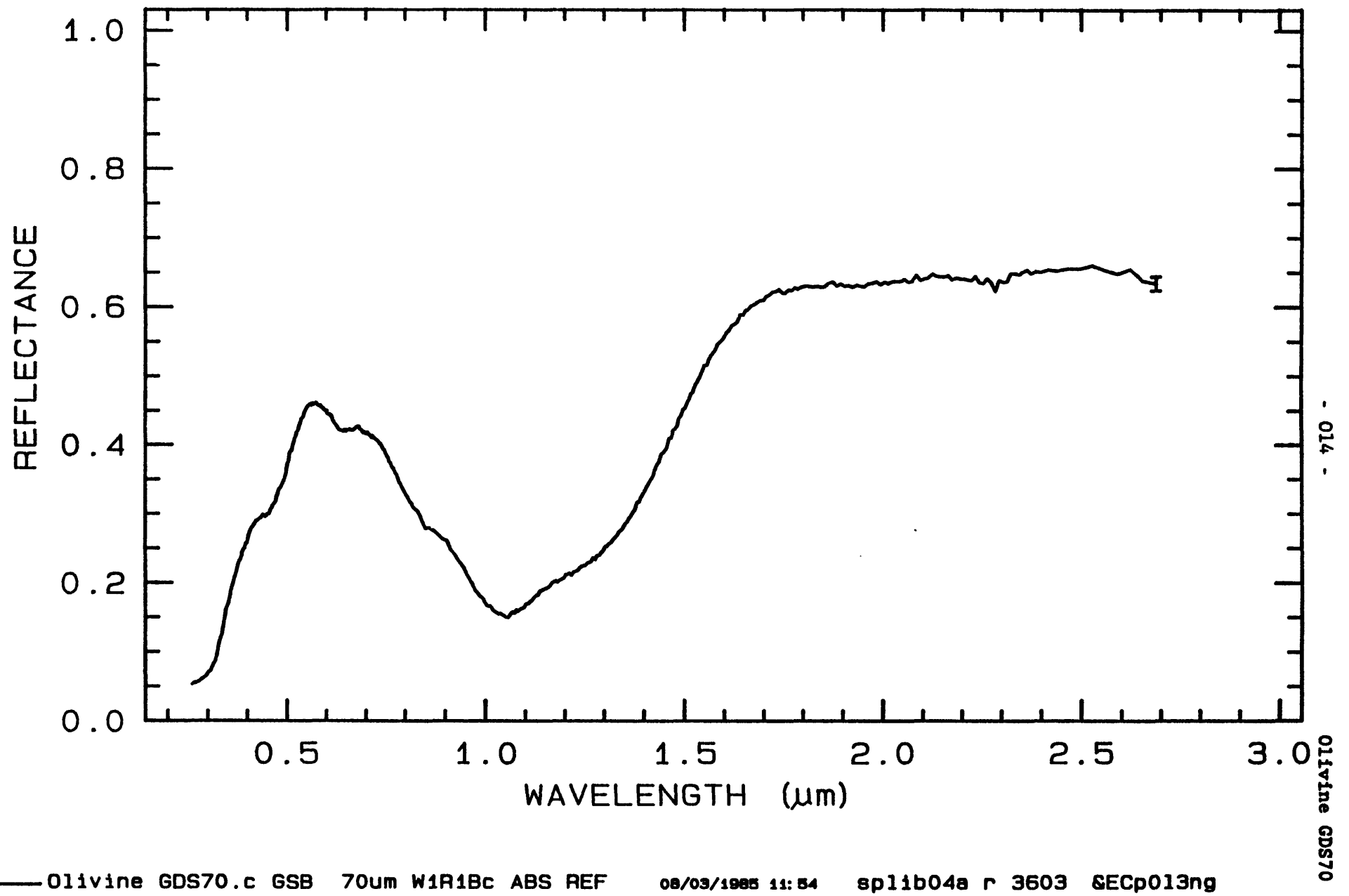
END_MICROSCOPIC_EXAMINATION.

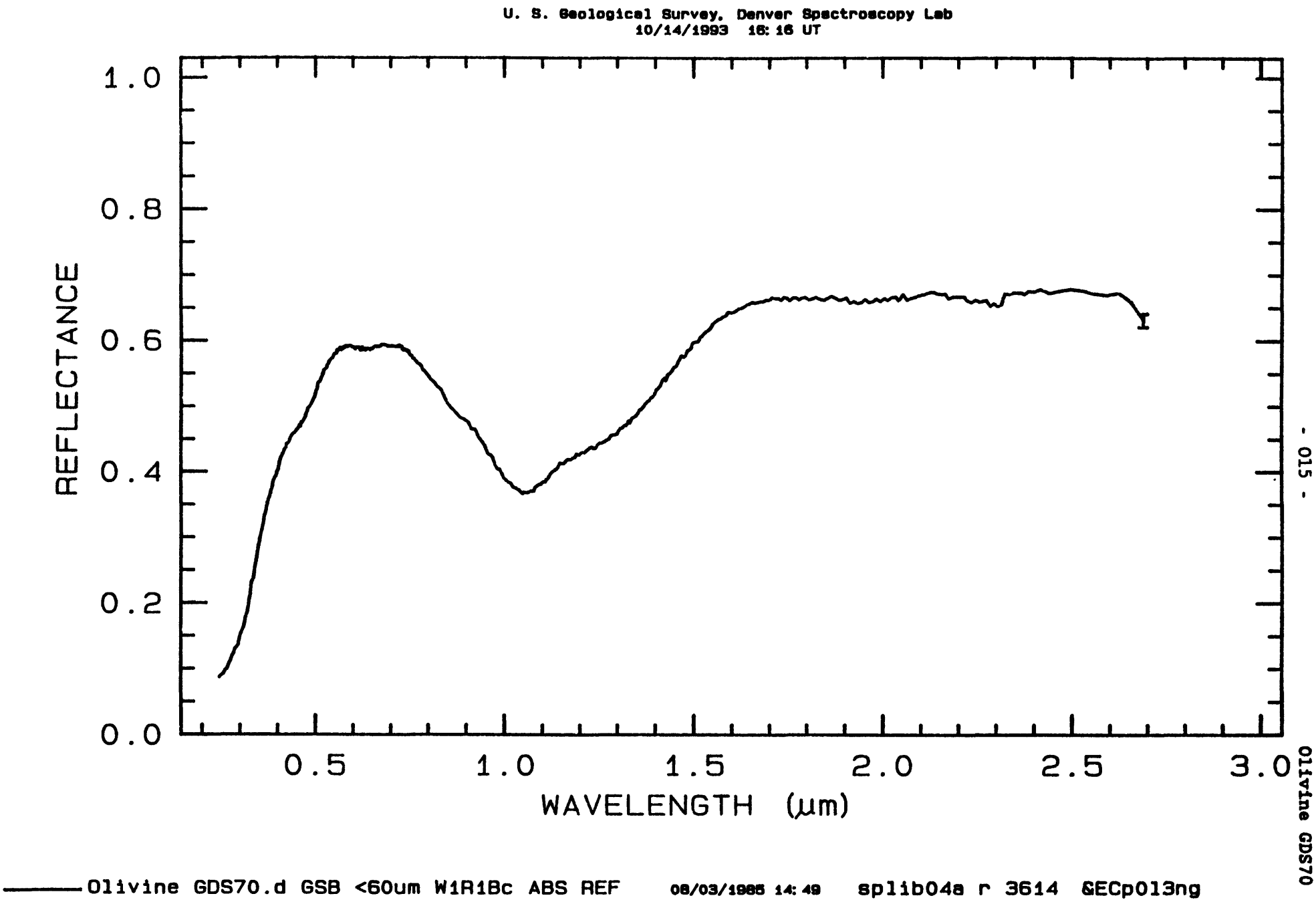
DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3581	0.2-3.0μm	200	g.s.=165μm
LIB_SPECTRA:	splib04a r 3592	0.2-3.0μm	200	g.s.=115μm
LIB_SPECTRA:	splib04a r 3603	0.2-3.0μm	200	g.s.=70μm
LIB_SPECTRA:	splib04a r 3614	0.2-3.0μm	200	g.s.=25μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 012 -
Olivine GDS70
Olivine GDS70.a GSB 165um W1R1Bc ABS REF 08/26/1985 13:20 splib04a r 3581 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 013 -
Olivine GDS70
Olivine GDS70.b GSB 115um W1R1Bc ABS REF 08/26/1985 11:02 splib04a r 3592 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 014 -
Olivine GDS70
Olivine GDS70.c GSB 70um W1R1Bc ABS REF 08/03/1995 11:54 splib04a r 3603 &ECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 015 -
Olivine GDS70
Olivine GDS70.d GSB <60um W1R1Bc ABS REF 08/03/1995 14:49 splib04a r 3614 GECp013ng

TITLE: Olivine HS285 Fo80 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS285

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2Si04-Fe2Si04 Fo80

FORMULA_NROFF: Mg_2SiO_4-Fe_2SiO_4 Fo_{80}

COLLECTION_LOCALITY: Arizona

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

With the note that the sample is Peridot, and the following comment: "This is a gem quality olivine which is 80Fo-20Fa. It contains a small amount of spinel as well as displaying a trace of iron oxide stain. The ferric iron band at 0.64μm is prominent in the larger particle size sample."

The sample measured for the library was the largest sieve interval, 4B, 250-1200μm.

For additional information on the spectra of olivines see: King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

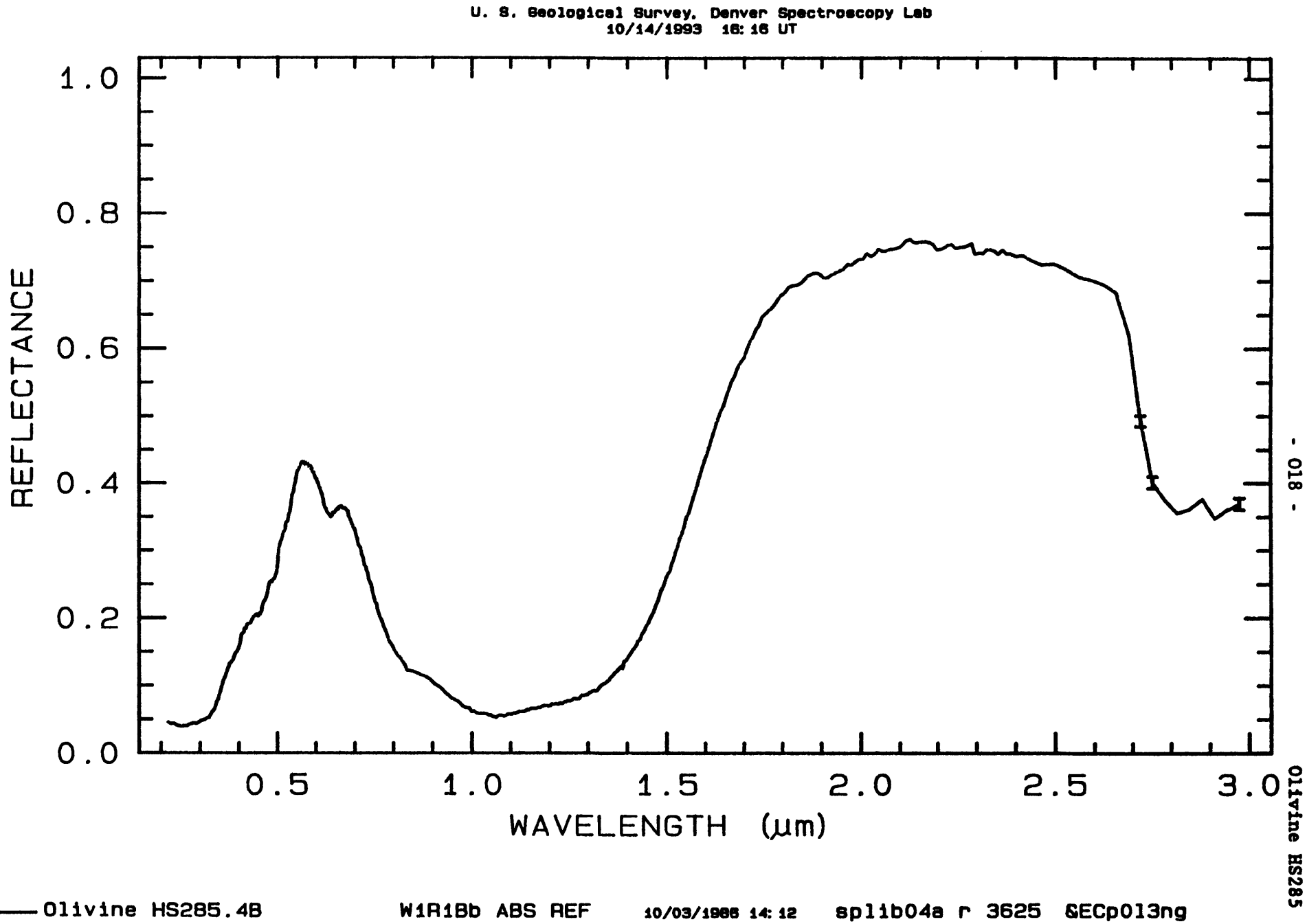
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av Reslv. Power	Comment
LIB_SPECTRA:	splib04a r 3625	0.2-3.0um	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 018 -
Olivine HS285
Olivine HS285.4B
W1R1Bb ABS REF
10/03/1986 14:12
splib04a r 3625 &ECp013ng

TITLE: Olivine HS420 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS420

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2Si04-Fe2Si04

FORMULA_NROFF: Mg_2SiO_4-Fe_2SiO_4

COLLECTION_LOCALITY: Washington

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

A spectrum for this sample was published in: Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

With the note: " This sample contains some magnetite impurity. The 0.63μm ferric iron band is particularly evident in the size III spectrum.

The sample measured for the library was the sieve interval, 3B, 74-250μm.

For additional information on the spectra of olivines see: King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

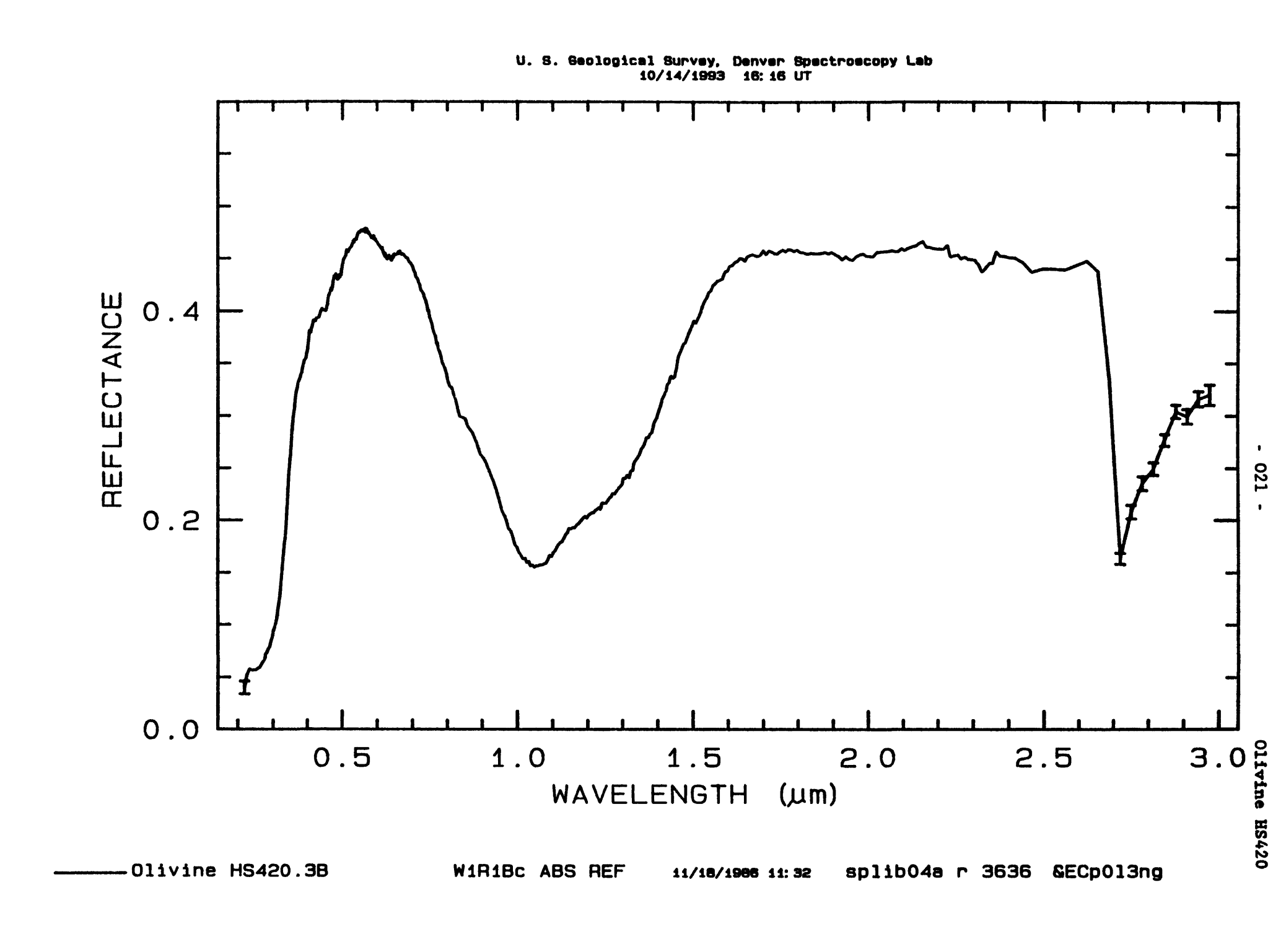
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED: where	Wave Range	Av Reslv. Power	Comment
LIB_SPECTRA: splib04a r 3636	0.2-3.0um	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 021 -
Olivine HS420
Olivine HS420.3B
W1R1Bc ABS REF
11/18/1986 11:32
splib04a r 3636 GECp013ng

TITLE: Olivine KI3005 Fo11 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KI3005

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2SiO4-Fe2SiO4 Fo11

FORMULA_NROFF: Mg_2SiO_4-Fe_2SiO_4 Fo_{11}

COLLECTION_LOCALITY: Kiglapait intrusive, Labrador

ORIGINAL_DONOR: S.A. Morse, University of Massachusetts, Amherst

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample has been subjected to Franz Isodynamic Magnetic Separator, heavy liquid (Clerici) separation and hand-picking. Mineral separated is at least 98% pure olivine. Samples sieved to <60μm, prior to spectral characterization. Fe-rich (Fo_{11}) end member of a suite of Kiglapait olivines.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	30.11 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.07 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	0.00 wt%	NROFF:	Al_2O_3
COMPOSITION:	Cr2O3:	0.06 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	62.82 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.12 wt%	NROFF:	NiO
COMPOSITION:	MnO:	1.55 wt%	NROFF:	MnO
COMPOSITION:	MgO:	4.42 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.14 wt%	NROFF:	CaO
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.29 wt%		
COMPOSITION:	O=Cl,F,S:	wt%		
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis by W.I. Ridley,
USGS Denver microprobe facility.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_COMPOSITION_DISCUSSION.

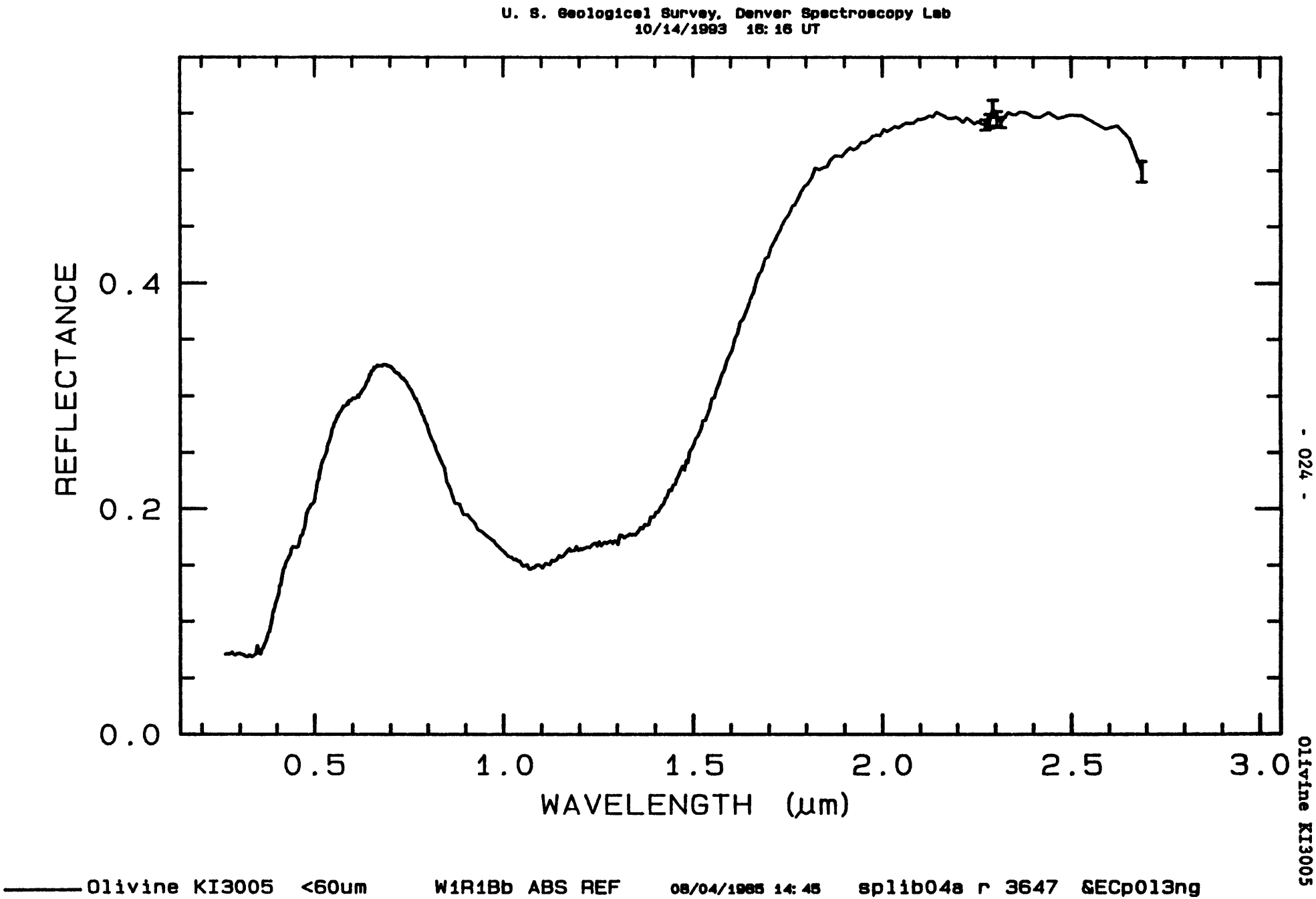
MICROSCOPIC_EXAMINATION:

This sample is visually and spectrally a pure olivine. There may be a weak 2.3 μm alteration feature. The rest of the spectra is excellent, rating an a.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3647	0.2-3.0μm	200	g.s.=30μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 15:16 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 024 -
Olivine KI3005
Olivine KI3005 <60um W1R1Bb ABS REF 08/04/1986 14:45 splib04a r 3647 &ECp013ng

TITLE: Olivine KI3054 Fo66 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KI3054

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2SiO4-Fe2SiO4 Fo66

FORMULA_NROFF: Mg_2Si_4-Fe_2SiO_4 Fo_{66}

COLLECTION_LOCALITY: Kiglapait intrusive, Labrador

ORIGINAL_DONOR: S.A. Morse, Universith of Massachusetts, Amherst

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample has been subjected to Franz Isodynamic Magnetic Separator, heavy liquid (Clerici) separation and hand-picking. Mineral separated is 100% pure olivine. Samples sieved to <60μm, prior to spectral characterization. Sample (fo_{66}) is part of a of solid solution suite of Kiglapait samples.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	36.30 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.03 wt%	NROFF:	TiO_2
COMPOSITION:	Cr2O3:	0.03 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	30.59 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.09 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.05 wt%	NROFF:	MnO
COMPOSITION:	MgO:	32.62 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.04 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	99.75 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis by W.I. Ridley, USGS microprobe facility.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_COMPOSITION_DISCUSSION.

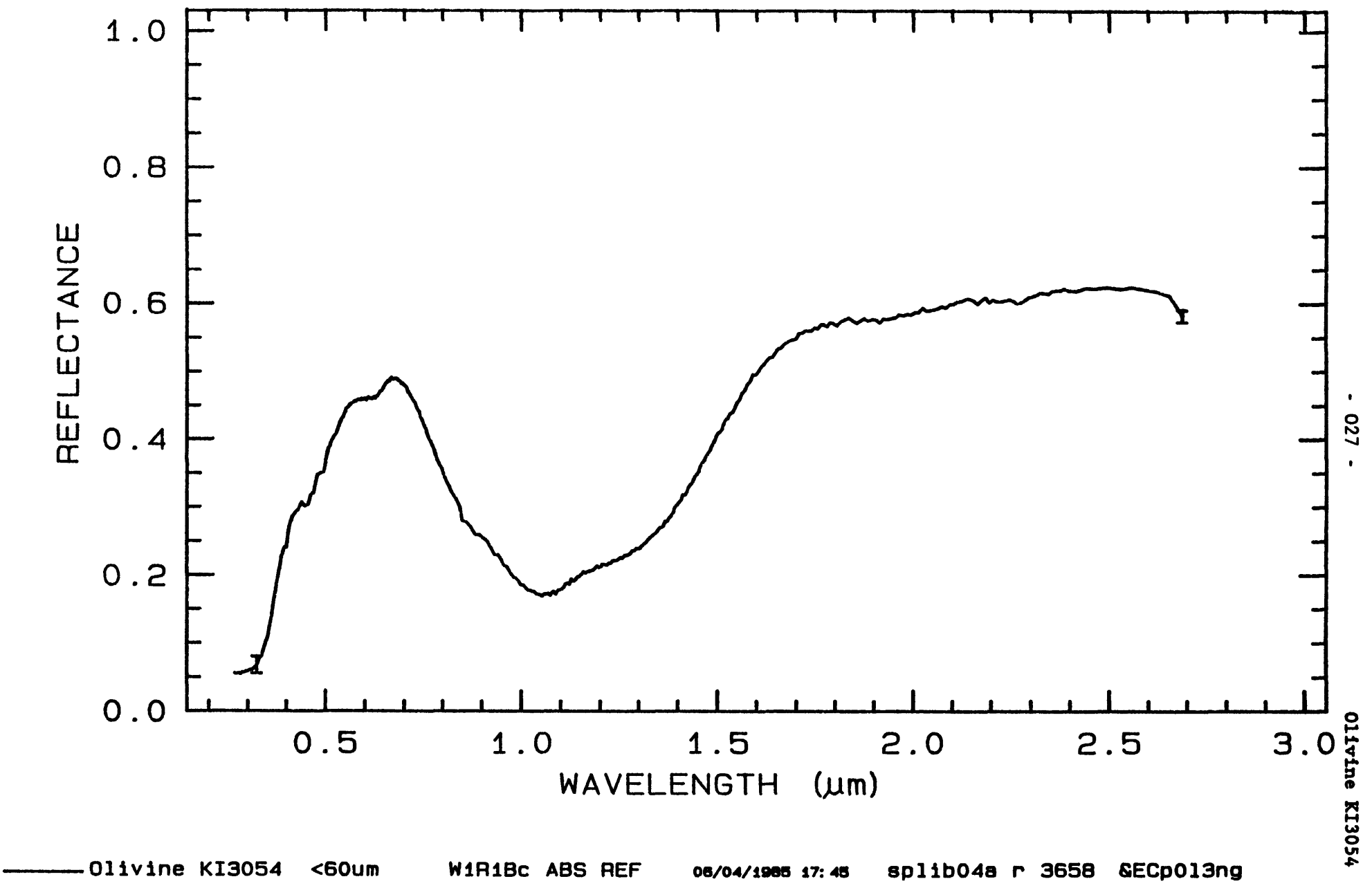
MICROSCOPIC_EXAMINATION:

This is visually and spectrally a pure olivine mineral separate. There are weak 2.3-μm alteration features, The rest of the spectrum rates an a.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3658	0.2-3.0μm	200	g.s.=25μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 027 -
Olivine KI3054
Olivine KI3054 <60um W1R1Bc ABS REF 06/04/1986 17:46 splib04a r 3658 &ECp013ng

TITLE: Olivine KI3188 Fo51 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KI3188

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2SiO4-Fe2SiO4 Fo51

FORMULA_NROFF: Mg_2Si_4-Fe_2SiO_4 Fo_{51}

COLLECTION_LOCALITY: Kiglapait intrusive, Labrador

ORIGINAL_DONOR: S.A. Morse, Universith of Massachusetts, Amherst

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample has been subjected to Franz Isodynamic Magnetic Separator, heavy liquid (Clerici) separation and hand-picking. Mineral separated is 100% pure olivine. Samples sieved to <60μm, prior to spectral characterization. Sample (Fo_{51}) is part of a of solid solution suite of Kiglapait samples.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	34.34 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.04 wt%	NROFF:	TiO_2
COMPOSITION:	Cr2O3:	0.04 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	41.43 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.07 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.73 wt%	NROFF:	MnO
COMPOSITION:	MgO:	23.80 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.05 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	99.41 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis by W.I. Ridley, USGS microprobe facility.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_COMPOSITION_DISCUSSION.

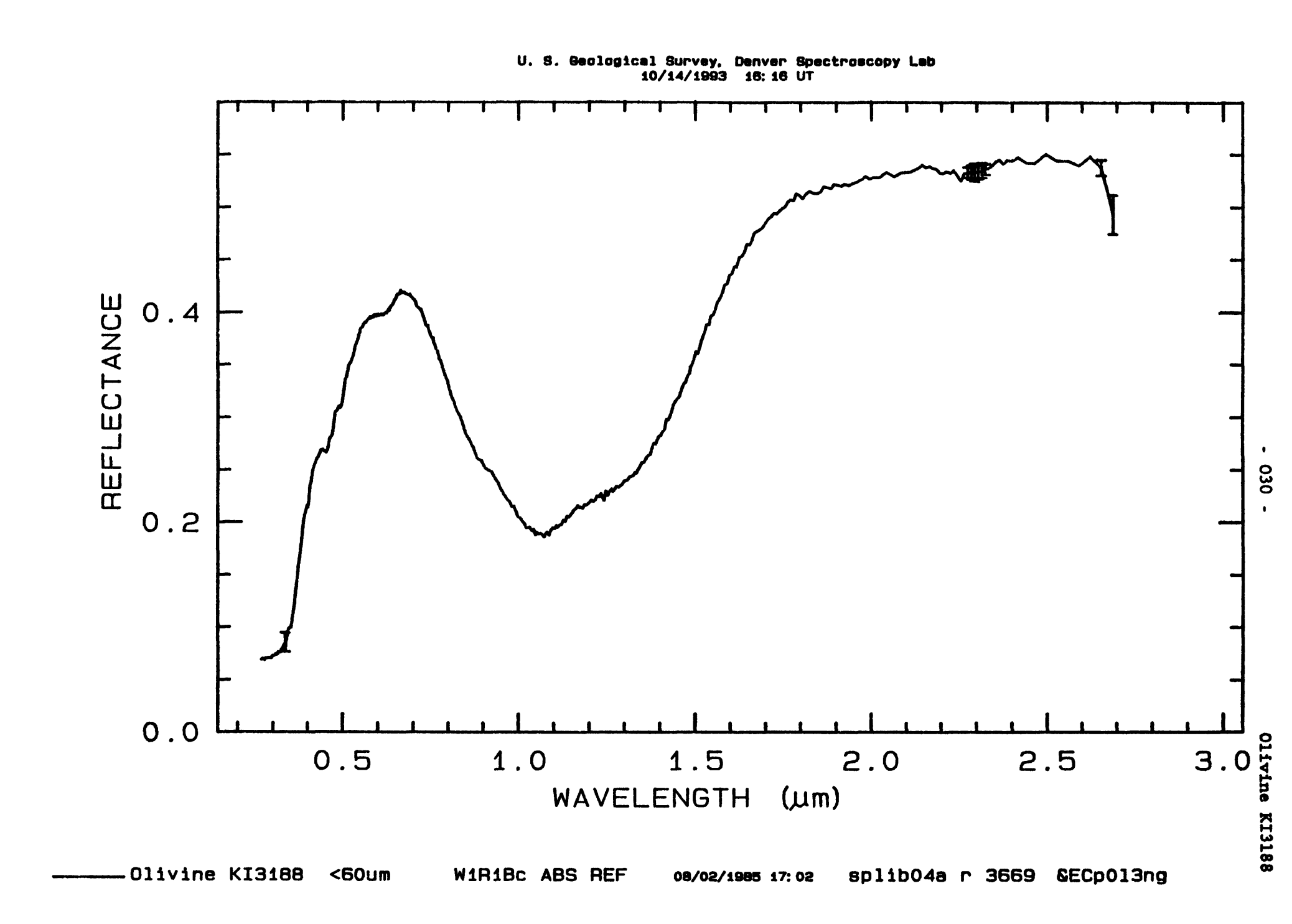
MICROSCOPIC_EXAMINATION:

This is a pure olivine mineral separate both microscopically and spectrally. There are weak 2.3-μm alteration features, The rest of the spectrum rates an a.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3669	0.2-3.0μm	200	g.s.=25μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:16 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 030 -
Olivine KI3188
Olivine KI3188 <60um W1R1Bc ABS REF 08/02/1985 17:02 splib04a r 3669 &ECp013ng

TITLE: Olivine KI3189 Fo60 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KI3189

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2Si04-Fe2Si04 Fo60

FORMULA_NROFF: Mg_2Si_4-Fe_2SiO_4 Fo_{60}

COLLECTION_LOCALITY: Kiglapait intrusive, Labrador

ORIGINAL_DONOR: S.A. Morse, Universith of Massachusetts, Amherst

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample has been subjected to Franz Isodynamic Magnetic Separator, heavy liquid (Clerici) separation and hand-picking. Mineral separated is 100% pure olivine. Samples sieved to <60μm, prior to spectral characterization. Sample (Fo_{60}) is part of a of solid solution suite of Kiglapait samples.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	35.47 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.03 wt%	NROFF:	TiO_2
COMPOSITION:	Cr2O3:	0.04 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	34.63 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.05 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.55 wt%	NROFF:	MnO
COMPOSITION:	MgO:	29.49 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.09 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	100.35 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis by W.I. Ridley, USGS microprobe facility.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_COMPOSITION_DISCUSSION.

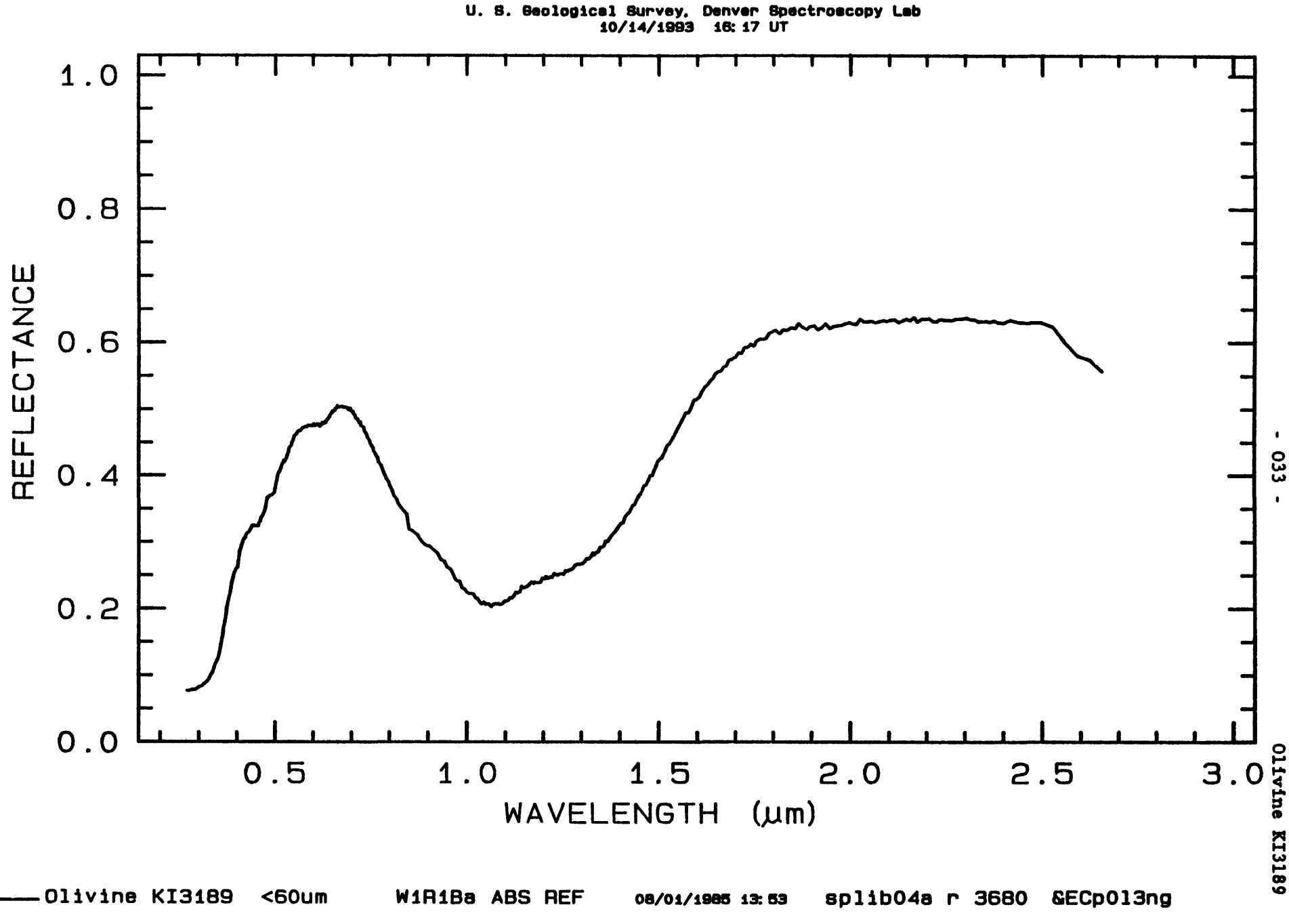
MICROSCOPIC_EXAMINATION:

This is a pure mineral separate.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3680	0.2-3.0μm	200	g.s.=25μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 033 -
Olivine KI3189
Olivine KI3189 <60um W1R1B8 ABS REF 08/01/1985 13:53 splib04a r 3680 &ECp013ng

TITLE: Olivine KI3291 Fo29 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KI3291

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2Si04-Fe2Si04 Fo29

FORMULA_NROFF: Mg_2Si_4-Fe_2SiO_4 Fo_{29}

COLLECTION_LOCALITY: Kiglapait intrusive, Labrador

ORIGINAL_DONOR: S.A. Morse, Universith of Massachusetts, Amherst

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample has been subjected to Franz Isodynamic Magnetic Separator, heavy liquid (Clerici) separation and hand-picking. Mineral separated is 100% pure olivine. Samples sieved to <60μm, prior to spectral characterization. Sample is Fo_{29} and is part of a solid solution suite.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	31.98 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.06 wt%	NROFF:	TiO_2
COMPOSITION:	Cr2O3:	0.05 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	53.65 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.11 wt%	NROFF:	NiO
COMPOSITION:	MnO:	1.23 wt%	NROFF:	MnO
COMPOSITION:	MgO:	12.61 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.35 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	100.04 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis by W.I. Ridley, USGS microprobe facility.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_COMPOSITION_DISCUSSION.

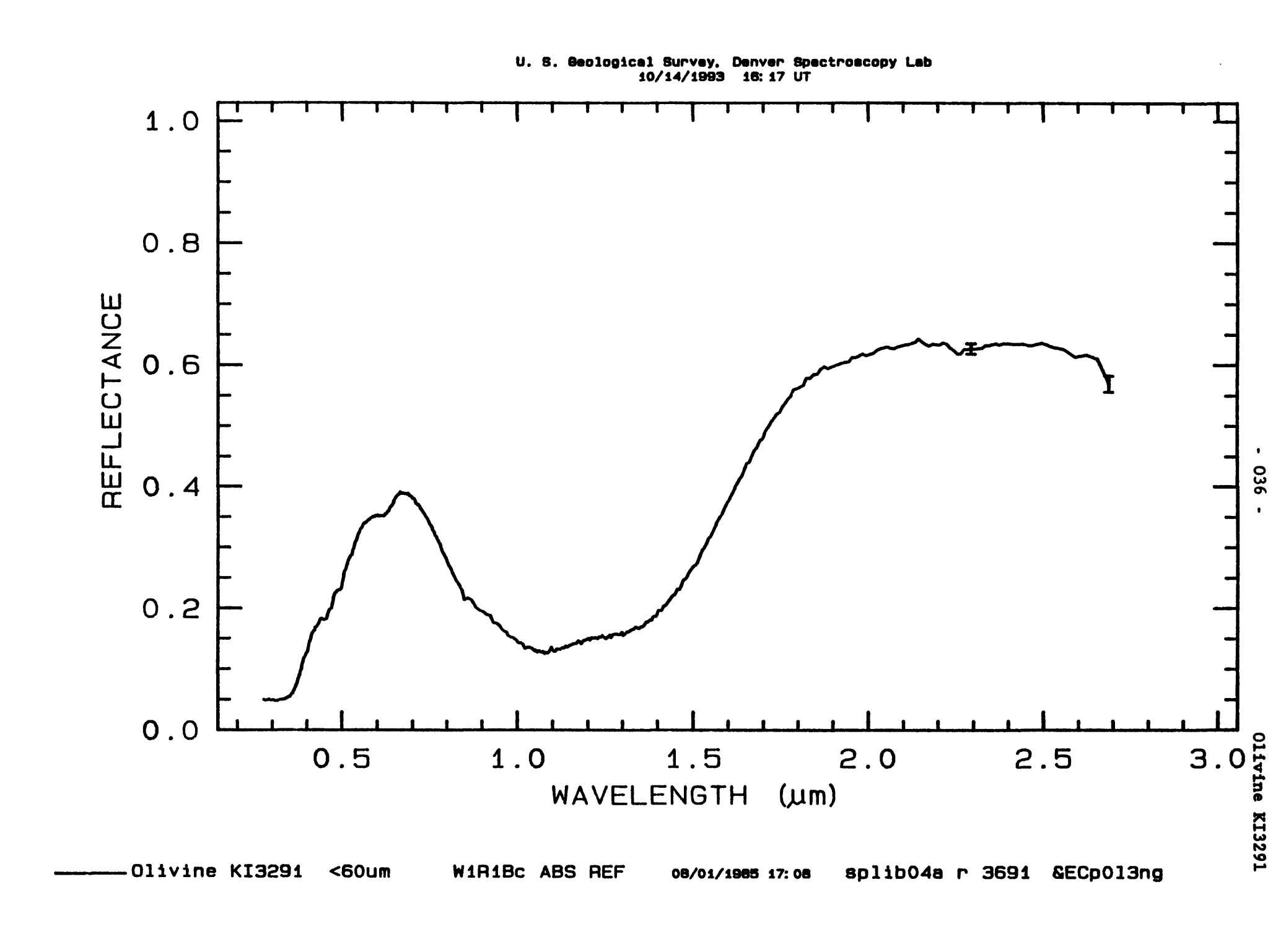
MICROSCOPIC_EXAMINATION:

This is a pure mineral separate. There are weak 2.3-μm alteration features, The rest of the spectrum rates an a.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3691	0.2-3.0μm	200	g.s.=25μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 036 -
Olivine KI3291
Olivine KI3291 <60um W1R1Bc ABS REF 08/01/1985 17:08 splib04a r 3691 &ECp013ng

TITLE: Olivine KI3377 Fo18 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KI3377

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2Si04-Fe2Si04 Fo18

FORMULA_NROFF: Mg_2Si_4-Fe_2SiO_4 Fo_{18}

COLLECTION_LOCALITY: Kiglapait intrusive, Labrador

ORIGINAL_DONOR: S.A. Morse, Universith of Massachusetts, Amherst

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample has been subjected to Franz Isodynamic Magnetic Separator, heavy liquid (Clerici) separation and hand-picking. Mineral separated is 100% pure olivine. Samples sieved to <60μm, prior to spectral characterization. Sample is Fo_{18} and is part of a solid solution suite.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	31.11 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.06 wt%	NROFF:	TiO_2
COMPOSITION:	Cr2O3:	0.07 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	59.75 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.12 wt%	NROFF:	NiO
COMPOSITION:	MnO:	1.30 wt%	NROFF:	MnO
COMPOSITION:	MgO:	7.71 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.09 wt%	NROFF:	CaO
COMPOSITION:	---	---		
COMPOSITION:	Total:	100.21 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis by W.I. Ridley, USGS microprobe facility.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_COMPOSITION_DISCUSSION.

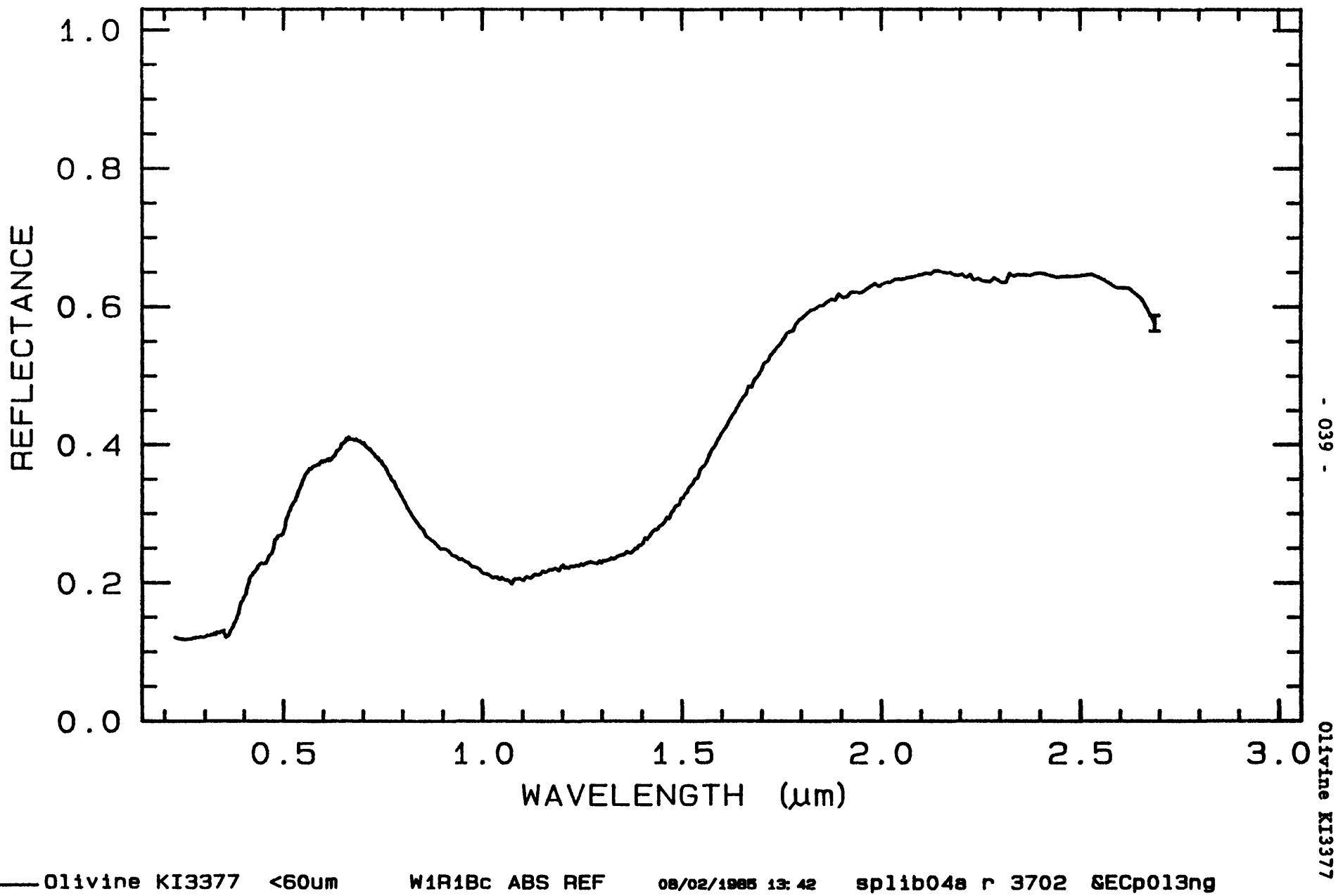
MICROSCOPIC_EXAMINATION:

This is a pure mineral separate both microscopically and spectrally. There are weak 2.3-μm alteration features, The rest of the spectrum rates an a.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3702	0.2-3.0μm	200	g.s.=25μm



Olivine KI3377

TITLE: Olivine KI4143 Fo41 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: KI4143

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine (Olivine group)

FORMULA: Mg2SiO4-Fe2SiO4 Fo41

FORMULA_NROFF: Mg_2Si_4-Fe_2SiO_4 Fo_{41}

COLLECTION_LOCALITY: Kiglapait intrusive, Labrador

ORIGINAL_DONOR: S.A. Morse, Universith of Massachusetts, Amherst

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample has been subjected to Franz Isodynamic Magnetic Separator, heavy liquid (Clerici) separation and hand-picking. Mineral separated is 100% pure olivine. Samples sieved to <60μm, prior to spectral characterization. Sample is part of a of solid solution suite of Kiglapait samples. Sample is Fo_{41}.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	33.15 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.04 wt%	NROFF:	TiO_2
COMPOSITION:	Cr2O3:	0.04 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	47.65 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.10 wt%	NROFF:	NiO
COMPOSITION:	MnO:	1.23 wt%	NROFF:	MnO
COMPOSITION:	MgO:	18.43 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.20 wt%	NROFF:	CaO
COMPOSITION:	----------			
COMPOSITION:	Total:	100.51 wt%		
COMPOSITION:	O=Cl,F,S:	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Microprobe analysis by W.I. Ridley, USGS microprobe facility.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_COMPOSITION_DISCUSSION.

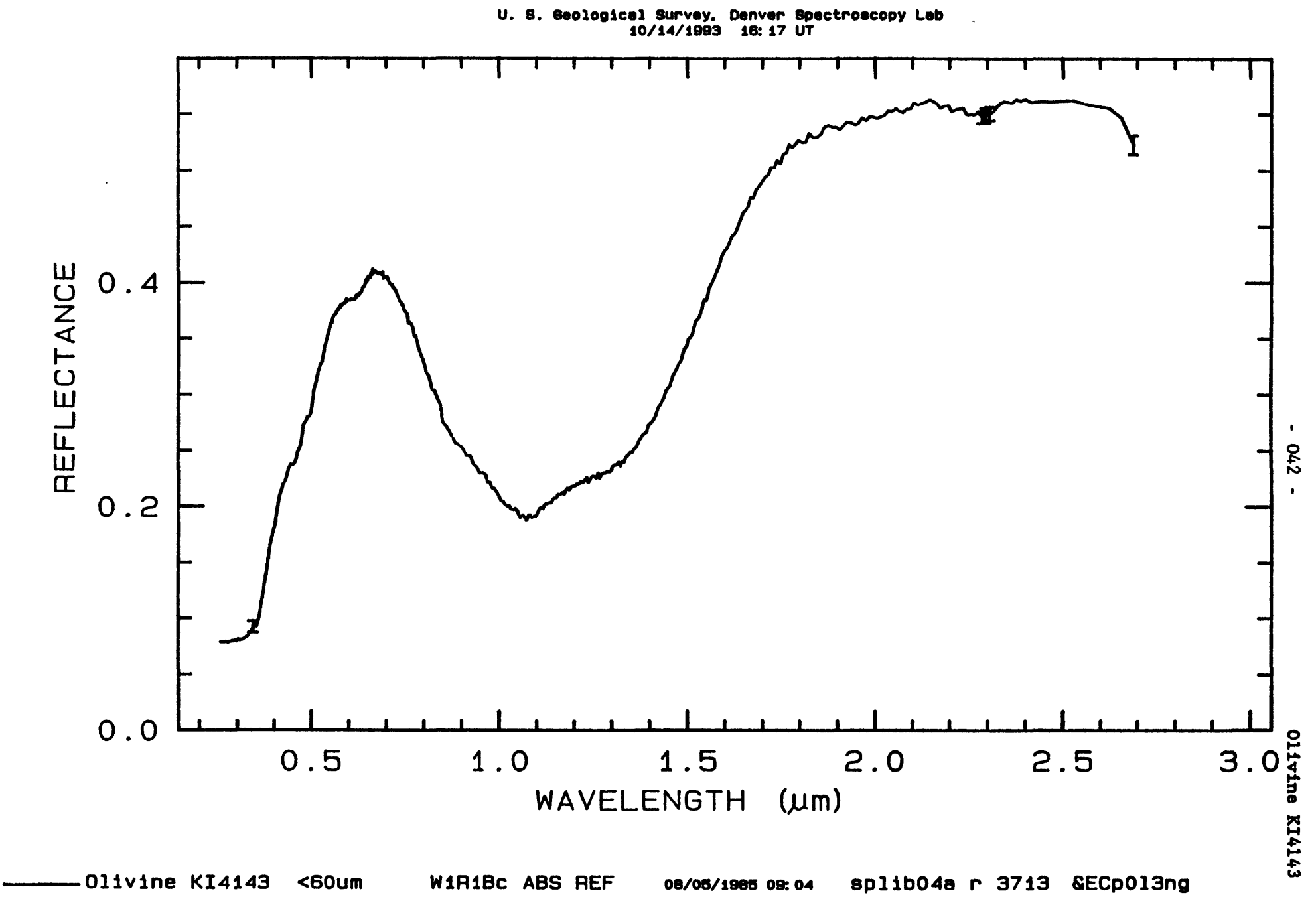
MICROSCOPIC_EXAMINATION:

This is a pure mineral separate. There are weak 2.3-μm alteration features, The rest of the spectrum rates an a.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3713	0.2-3.0μm	200	g.s.=25μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:17 UT
REFLECTANCE
0.0
0.2
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 042 -
Olivine KI4143
Olivine KI4143 <60um W1R1Bc ABS REF 08/05/1985 09:04 splib04a r 3713 &ECp013ng

TITLE: Olivine GDS71 Fo91 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS71

MINERAL_TYPE: Nesosilicate

MINERAL: Olivine

FORMULA: Mg2Si04-Fe2Si04

FORMULA_NROFF: Mg_2Si_4-Fe_2SiO_4 Fo_{91}

COLLECTION_LOCALITY: Twin Sisters Peak, Washington

ORIGINAL_DONOR: Trude V.V. King

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Samples were wet-sieved into <60μm (b) and 60-104μm (a) size fractions and hand-picked prior to spectral measurements. This sample was derived from a dunite.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

None

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	40.06 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.14 wt%	NROFF:	TiO_2
COMPOSITION:	Cr2O3:	0.06 wt%	NROFF:	Cr_2O_3
COMPOSITION:	FeO:	7.93 wt%	NROFF:	FeO
COMPOSITION:	NiO:	0.28 wt%	NROFF:	NiO
COMPOSITION:	MnO:	0.12 wt%	NROFF:	MnO
COMPOSITION:	MgO:	50.70 wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.06 wt%	NROFF:	CaO
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.94 wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

This is a USGS microprobe standard analysis of Twin Sister Peak, Washington, dunite.

King, T.V.V. and W.I. Ridley, 1987, Relation of the Spectroscopic Reflectance of Olivine to Mineral Chemistry and Some Remote Sensing Implications. J. Geophys. Res., 11,457-11,469.

END_COMPOSITION_DISCUSSION.

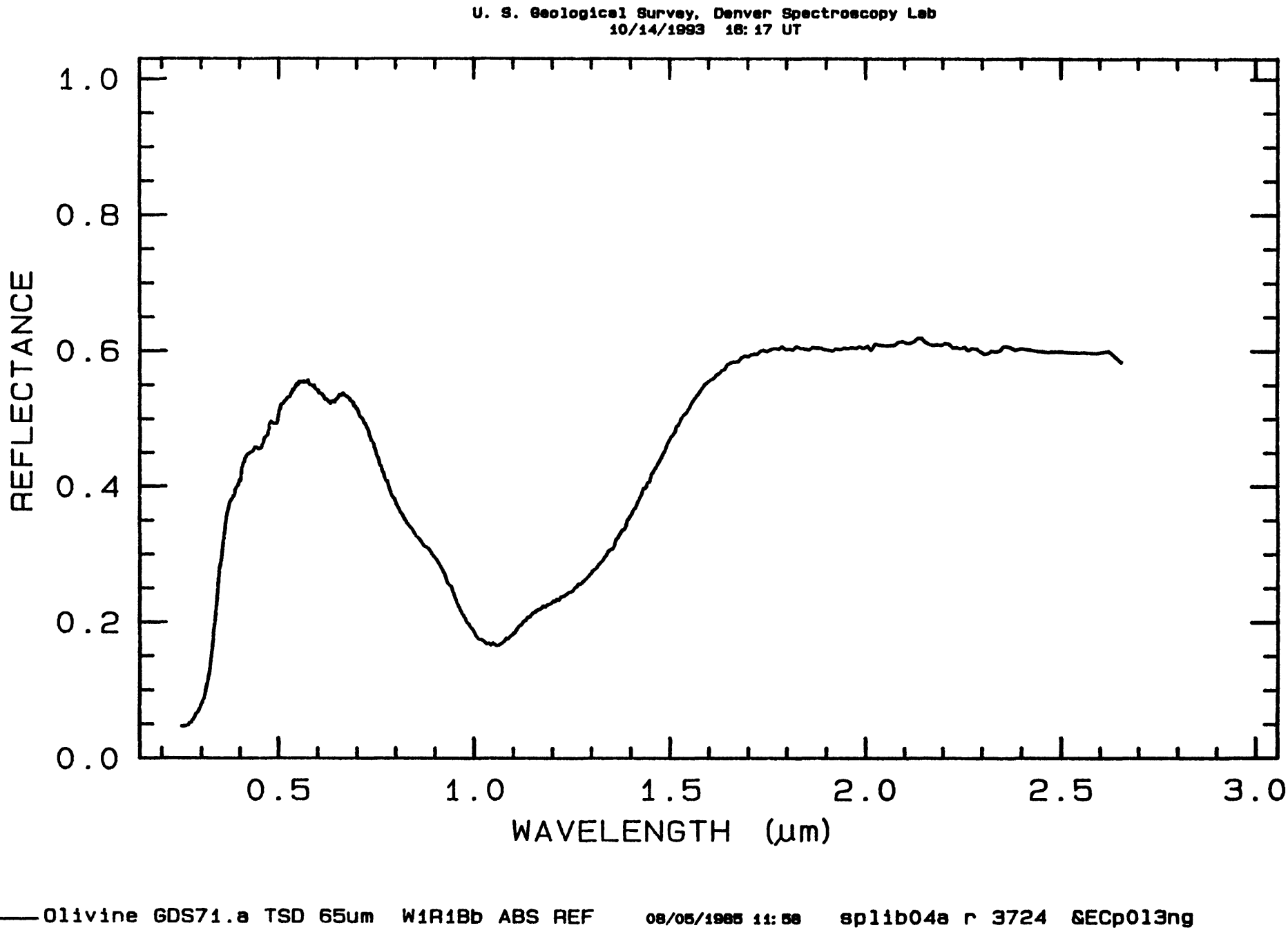
MICROSCOPIC_EXAMINATION:

This is a pure mineral separate. There are weak 2.3-μm alteration features, The rest of the spectrum rates an a.

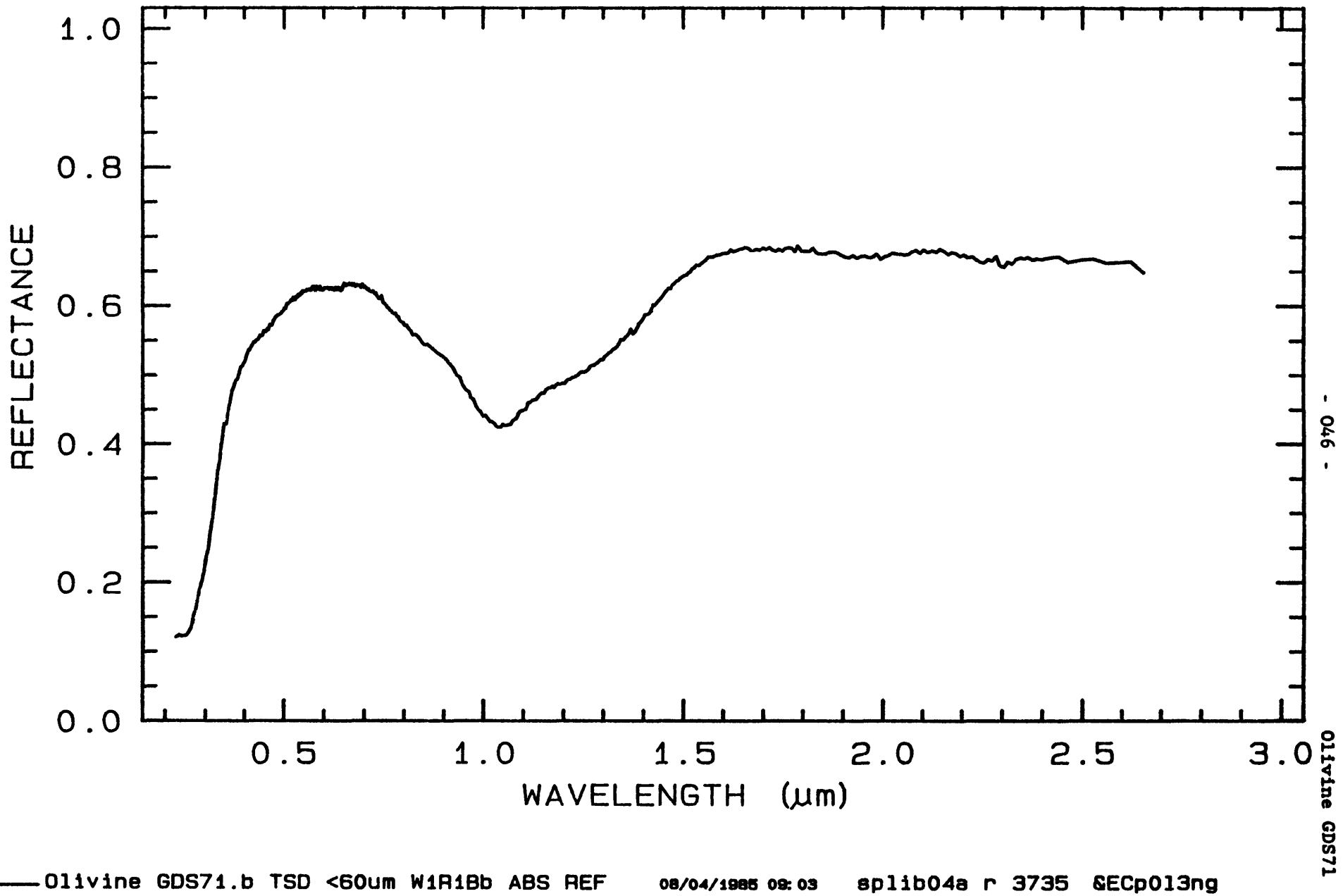
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3724	0.2-3.0μm	200	g.s.=65μm
LIB_SPECTRA:	splib04a r 3735	0.2-3.0μm	200	g.s.=30μm



Olivine GDS71



Olivine GDS71

TITLE: Opal WS732 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS732

MINERAL_TYPE: Tectosilicate

MINERAL: Opal

FORMULA: SiO2*nH2O

FORMULA_NROFF: $SiO_2 \bullet nH_2O$

COLLECTION_LOCALITY: Pershing Co., Nevada

ORIGINAL_DONOR: Wards Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

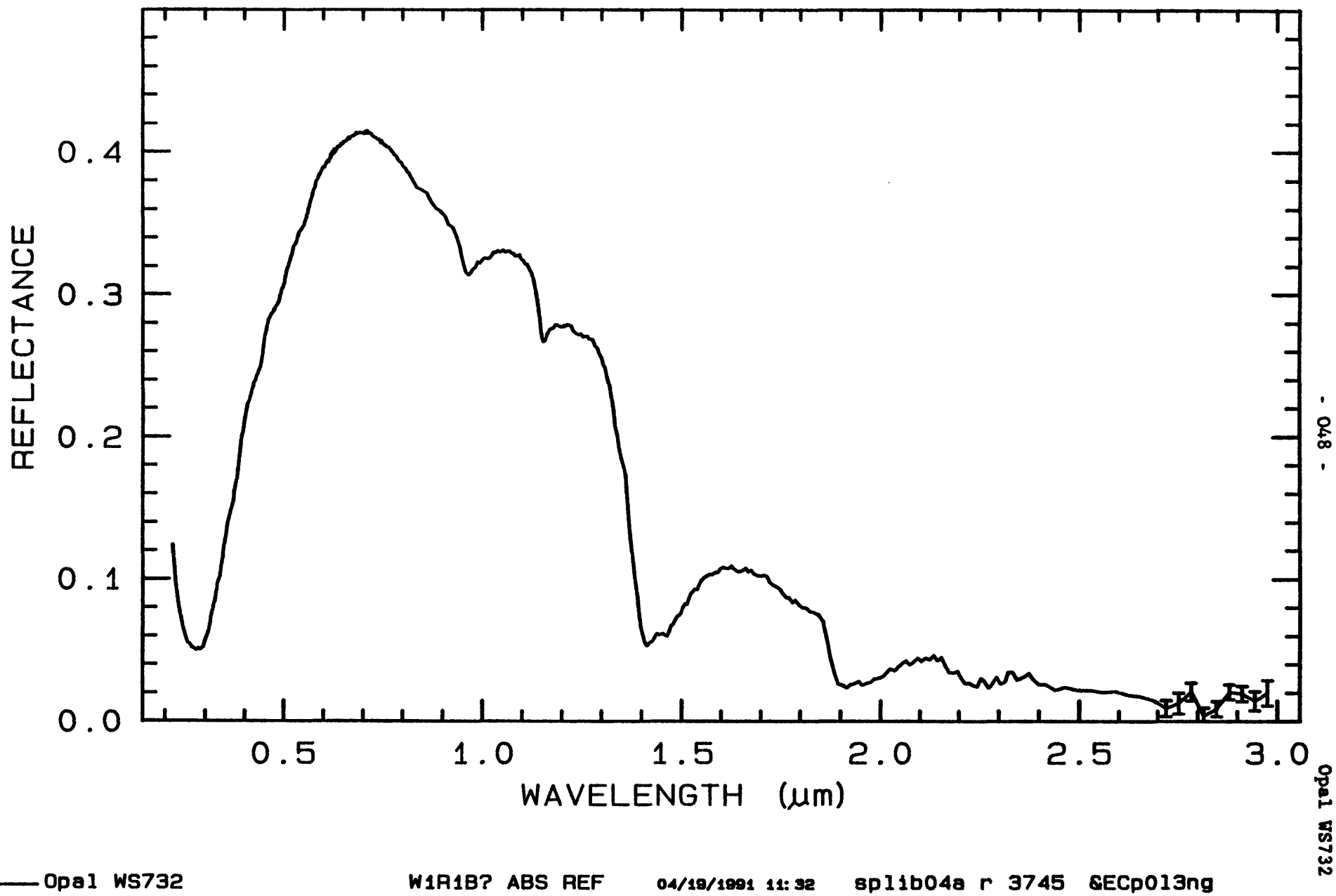
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3745	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:17 UT
REFLECTANCE
0.0
0.1
0.2
0.3
0.4
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 048 -
Opal WS732
Opal WS732
W1R1B? ABS REF
04/19/1991 11:32
splib04a r 3745 &ECp013ng

TITLE: Opal (Hyalite) TM8896 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: TM8896

MINERAL_TYPE: Tectosilicate

MINERAL: Opal

FORMULA: SiO2*nH2O

FORMULA_NROFF: $SiO_2 \bullet nH_2O$

COLLECTION_LOCALITY: Beaver Co., UT.

ORIGINAL_DONOR: Jim Piper

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure hyalite opal. (Analysis by Jim Piper, Colorado Sch. of Mines, writen communication, 1993)

Mixture of opal-A and opal-CT (opal-CT has a very weak reflection at position of quartz (101)). Broad maximum centered at 22 degrees, very poor degree of crystallinity.

J.S. Huebner and J. Pickrell, unpublished data, written communication, USGS, Reston, VA (1993)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

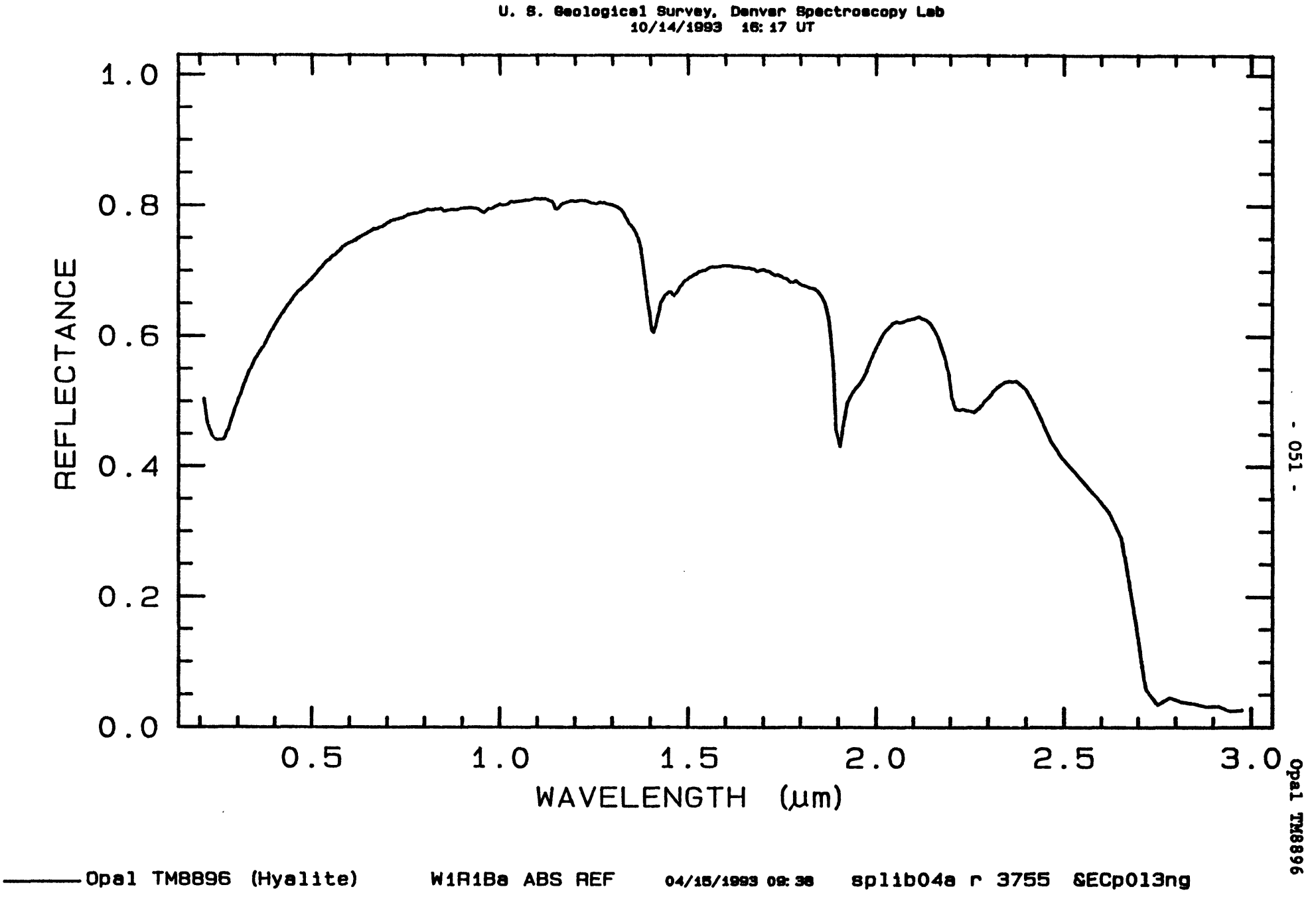
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 3755	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 051 -
Opal TM8896
Opal TM8896 (Hyalite) W1R1Ba ABS REF 04/15/1993 09:38 splib04a r 3755 &ECp013ng

TITLE: Orthoclase NMNH113188 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH113188

MINERAL_TYPE: Tectosilicate

MINERAL: Orthoclase (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Unknown

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with celsian. Dimorphous with Microcline.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo at USGS, Reston indicates pure orthoclase.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

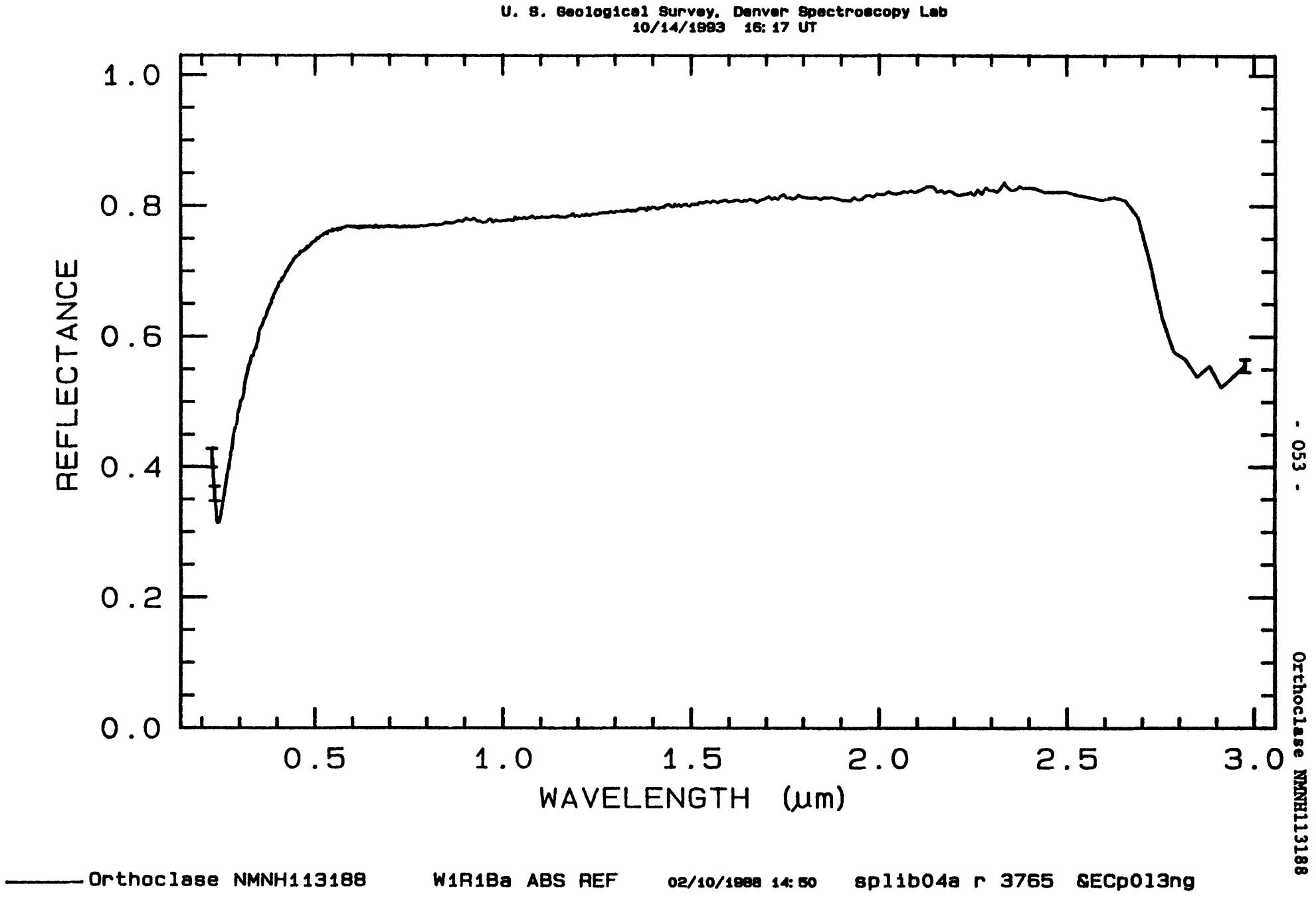
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3765	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 053 -
Orthoclase NMNH113188
Orthoclase NMNH113188 W1R1Ba ABS REF 02/10/1988 14:50 splib04a r 3765 &ECp013ng

TITLE: Orthoclase NMNH142137 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH142137

MINERAL_TYPE: Tectosilicate

MINERAL: Orthoclase (Ferrian) (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Unknown

ORIGINAL_DONOR: National Museum of Natural History

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with celsian. Dimorphous with Microcline.
Ferrian orthoclase.

Sieve interval 0 - 74μm.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Contains orthoclase plus small amount of anorthite. No oligoclase seen.
(Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

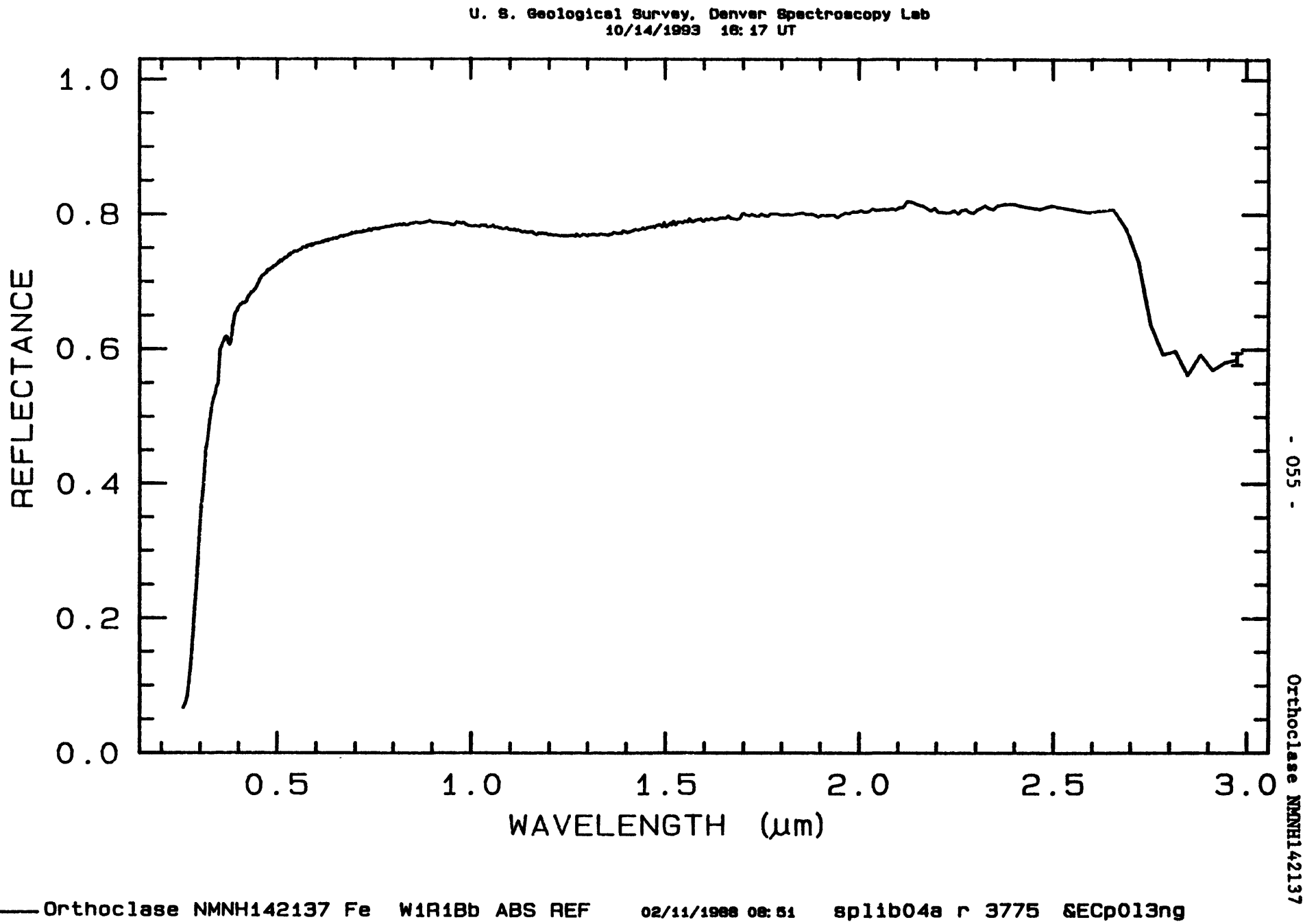
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3775	0.2-3.0μm	200	g.s.=



Orthoclase NMNH142137

TITLE: Orthoclase HS13 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS13

MINERAL_TYPE: Tectosilicate

MINERAL: Orthoclase (Feldspar group)

FORMULA: KAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$

COLLECTION_LOCALITY: Ruggles Mine, New Hampshire

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Celsian. Dimorphous with Microcline.

"S-15. Orthoclase. Ruggles Mine, New Hampshire (13B). Orthoclase, $KAlSi_3O_8$, is a very common igneous rock-forming mineral, particularly in acidic and intermediate rock. Usually it contains 10 to 25% $NaAlSi_3O_8$. Orthoclase should be spectrally featureless in the near-infrared. The bands near 1.4 and 2.0μ are due to water present in microscopic fluid inclusions within the mineral grains."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, 1970, Visible and near-infrared spectra of minerals and rocks: I. Silicate minerals. Modern Geology, v. 1, p. 283-300.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Na-feldspar(L) + K-feldspar(L) + mica(m)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

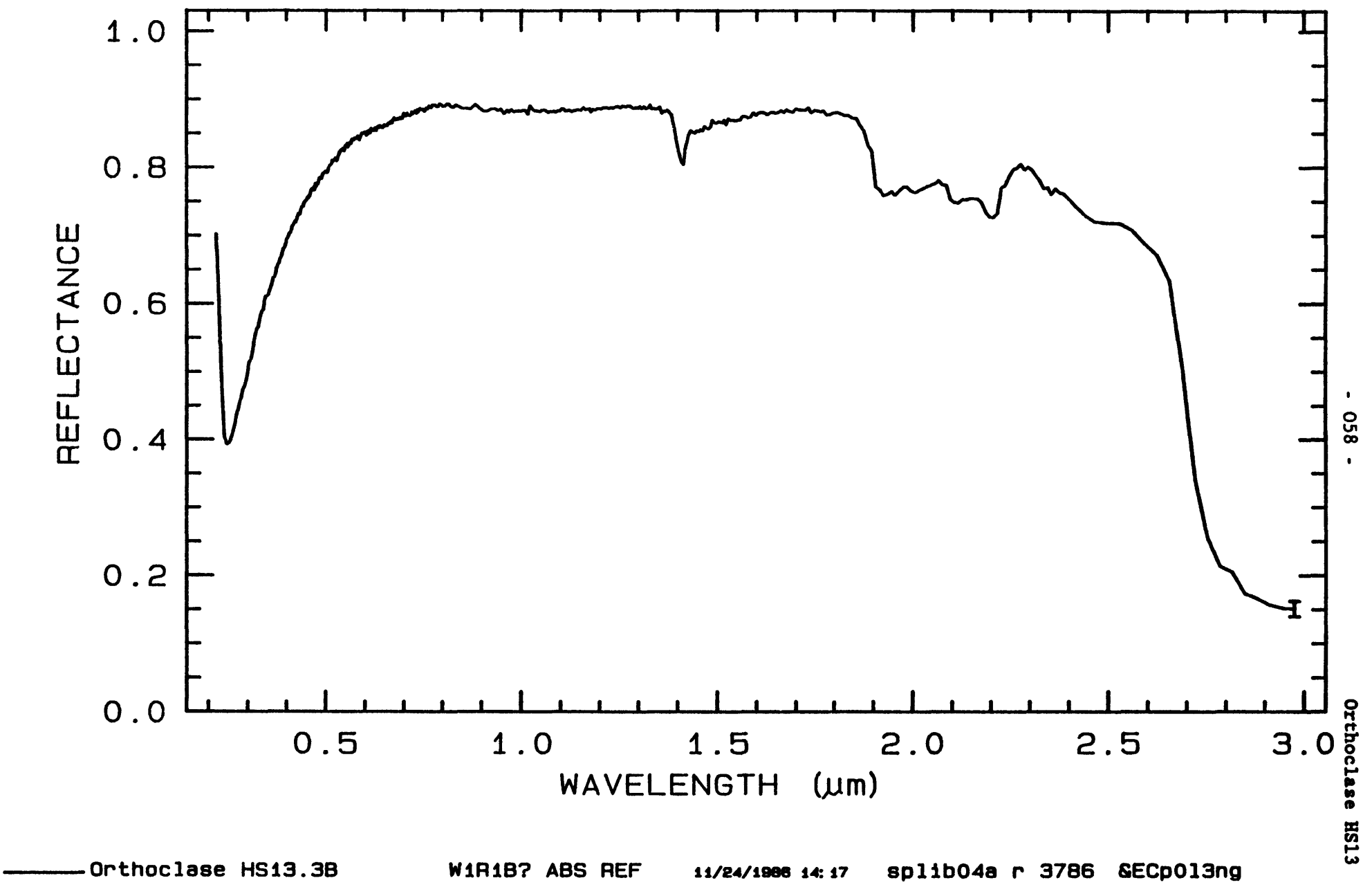
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3786	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:17 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- 058 -
Orthoclase HS13
Orthoclase HS13.3B
W1R1B? ABS REF
11/24/1986 14:17
splib04a r 3786 &ECp013ng

TITLE: Palygorskite CM46 Attapulgite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: CM46

MINERAL_TYPE: Phyllosilicate

MINERAL: Palygorskite (Attapulgite)

FORMULA: (Mg,Al)2Si4O10(OH)*4H2O

FORMULA_NROFF: $(Mg,Al)_2Si_4O_{10}(OH)\bullet 4H_2O$

COLLECTION_LOCALITY: Quincy, Florida

ORIGINAL_DONOR: Clay Mineral Standard from Wards Natural Science Inc.

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spectrum published in: Clark, R.N., T.V.V. King, M. Klejwa, G. Swayze, and N. Vergo, 1990, High spectral resolution reflectance spectroscopy of minerals: *J. Geophys Res.* **95**, 12653-12680.

Who note the sample is spectrally pure, no smectite bands.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Analysis by Norma Vergo indicates Palygorskite, medium amount of quartz, trace amount of smectite.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: XRF # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	56.0 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.48 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	10.6 wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	3.76 wt%	NROFF:	Fe_2O_3
COMPOSITION:	MnO:	<0.02 wt%	NROFF:	MnO
COMPOSITION:	MgO:	8.56 wt%	NROFF:	MgO
COMPOSITION:	CaO:	1.35 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	<0.15 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.95 wt%	NROFF:	K_2O
COMPOSITION:	P2O5:	0.59 wt%	NROFF:	P_2O_5
COMPOSITION:	LOI:	17.0 wt%	NROFF:	LOI
COMPOSITION:	---	---		
COMPOSITION:	Total:	99.46 wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Analysis by E. Brandt, and J. H. Christie at USGS Branch of Geophysics, Denver

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

90-95 vol% palygorskite
5-10 vol% quartz
tr opaque grains

Bimodal grain size distribution:

pop 1 430μm 70 vol%
pop 2 30μm 30 vol%

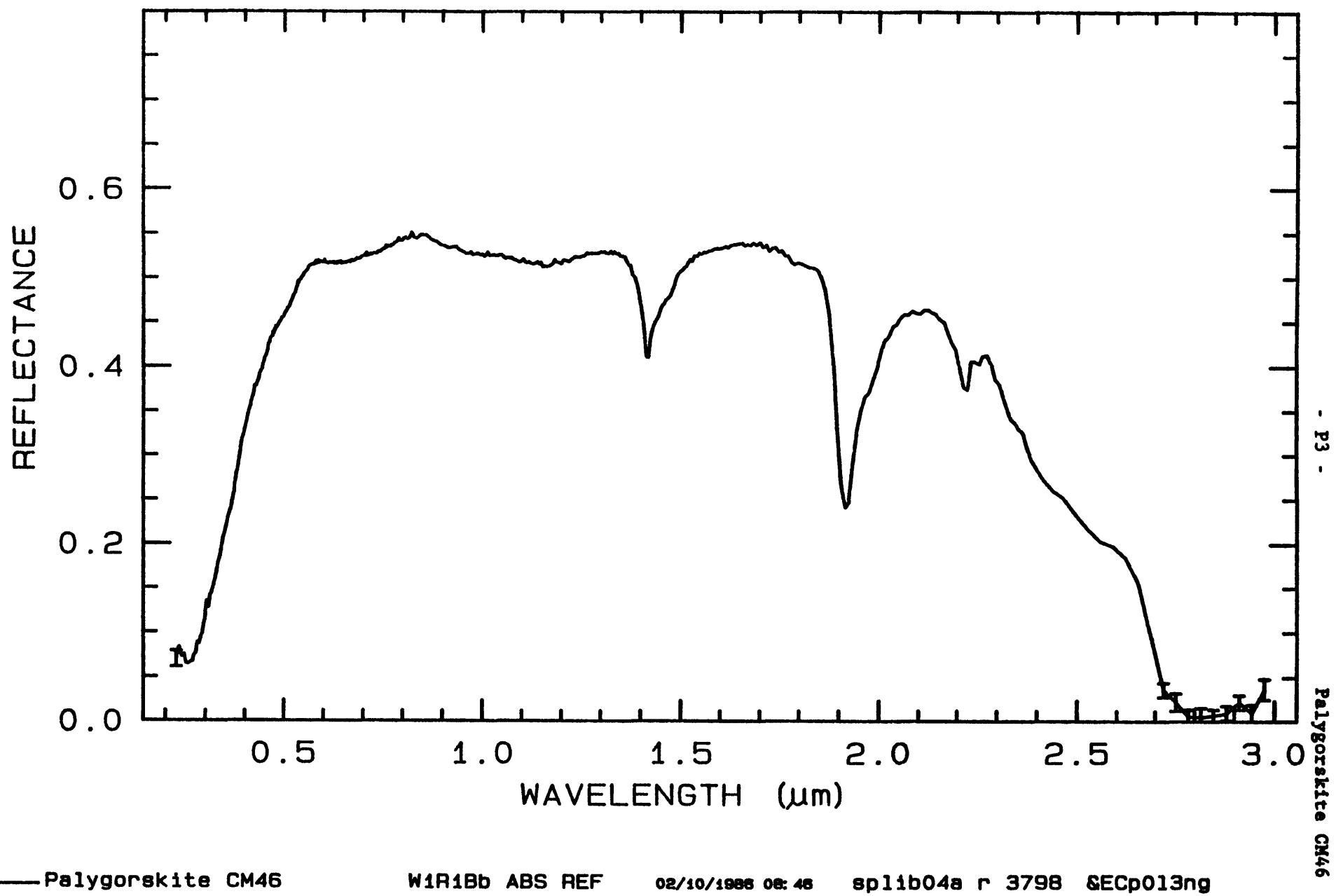
av gr size = 176μm

Light greyish white color, quartz grains do not have palygorskite coatings. Trace opaques sparsely spot palygorskite grains. G. Swayze.

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: wcalvin@speclab (Wendy M. Calvin)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3798	0.2-3.0μm	200	g.s.= 176μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Palygorskite CM46
W1R1Bb ABS REF 02/10/1986 08:46 splib04a r 3798 &ECp013ng

TITLE: Palygorskite PFL-1 Attapulgite DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: PFL-1

MINERAL_TYPE: Phyllosilicate

MINERAL: Palygorskite (Attapulgite)

FORMULA: (Mg,Al)2Si4O10(OH)*4H2O

FORMULA_NROFF: $(Mg,Al)_2Si_4O_{10}(OH)\bullet 4H_2O$

COLLECTION_LOCALITY: Florida

ORIGINAL_DONOR: Clay Mineral Society

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Palygorskite plus quartz (G. Swayze and Ken Esposito, USGS)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

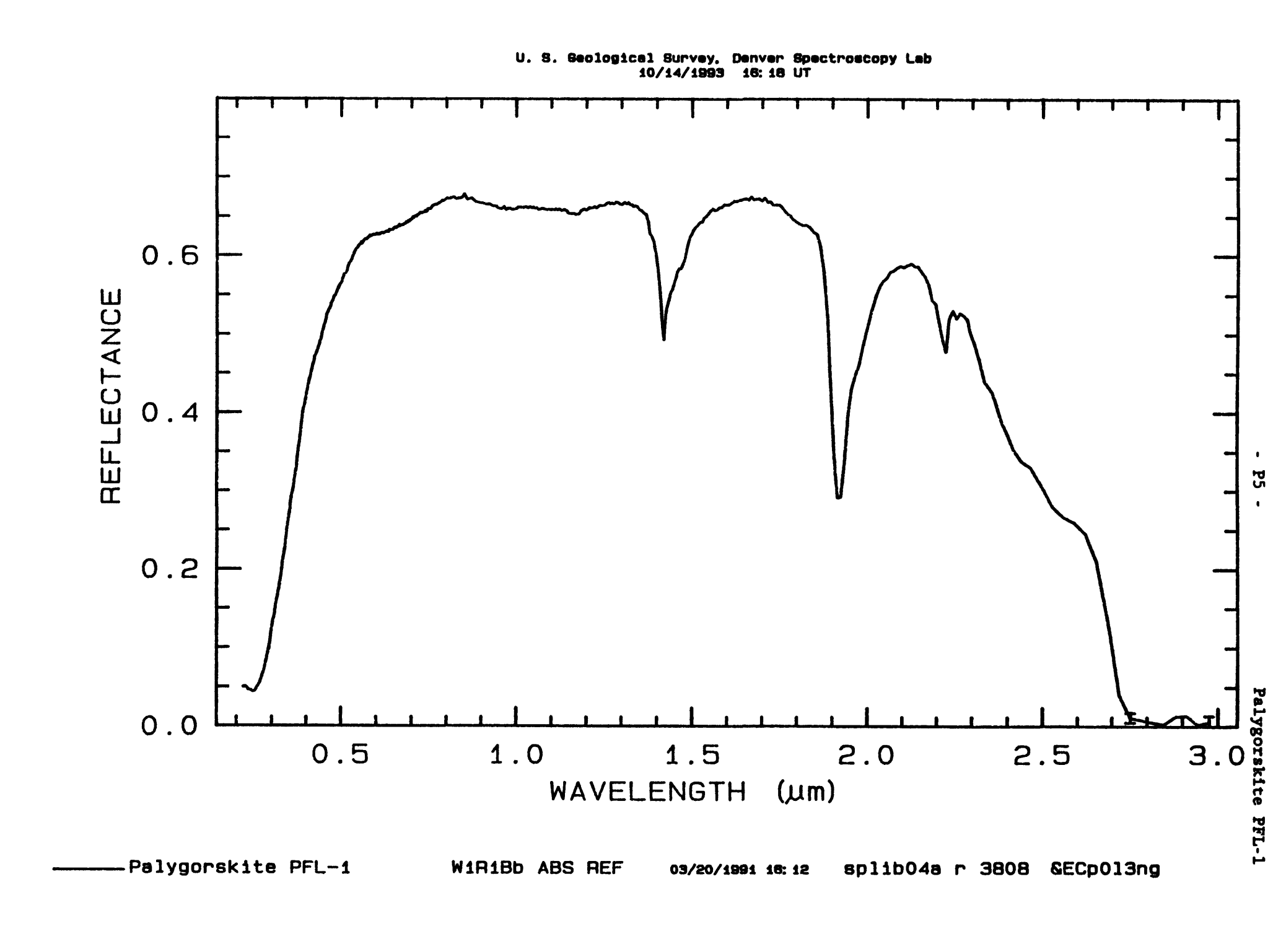
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3808	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P5 -
Palygorskite PFL-1
Palygorskite PFL-1 W1R1Bb ABS REF 03/20/1991 16:12 splib04a r 3808 &ECp013ng

TITLE: Paragonite GDS109 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS109

MINERAL_TYPE: Phyllosilicate

MINERAL: Paragonite (Mica group)

FORMULA: NaAl2(Si3Al)O10(OH)2

FORMULA_NROFF: $NaAl_2(Si_3Al)O_{10}(OH)_2$

COLLECTION_LOCALITY: Ilas de Margarita, Venezula

ORIGINAL_DONOR: Jim Crowley, USGS Reston

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

see:

Robie, R.A., and B.S. Hemingway, 1984, Heat capacities and entropies of phlogopite and paragonite between 5 and 900 K and estimates of the enthalpies and Gibbs free energies of formation. American Mineralogist, v.69, pp. 858-868.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"40 kV - 30 mA, 6.5-9.5 keV (smear mount of GDS109 = parag.out;
smear mount of GDS109 ground with glass = parag2.out)
References: Bailey (1988, p. 201); calculated $2M_1$ paragonite pattern of Borg and Smith (1969); Huebner's reference patterns
Found: dioctahedral mica
Sought but not found: quartz, muscovite, chlorite
Comments: Many expected reflections were not resolved, even following grinding with glass; non-basal reflections are broad. The position of the (004) reflection indicates the presence of a small cation such as sodium. The polytype could not be determined. Even allowing for preferred basal orientation, GDS109 is poorly crystallized. It is not of the same quality as the "muscovites" and probably should not be compared with them to attempt to ascertain K/Na from spectra. However, poorly crystallized material such as GDS109 may be more representative of micas in sedimentary environments than is the suite of "muscovites".

J.S. Huebner, J. Pickrell, and J. Randow, 1993, written communication.

"Unit cell parameters are a = 0.5130±0.0010 nm, b = 0.8905±0.0017 nm, c =

1.9342±0.0039 nm, and β = 94.50.2° and the structure type is $2M_1$ (M.R. Ross, written communication, August 1982). These parameters are in good agreement with those reported by Chatterjee (1974) and Holland (1979) for synthetic $2M_1$ paragonite."

Robie, R.A., and B.S. Hemingway, 1984, Heat capacities and entropies of phlogopite and paragonite between 5 and 900 K and estimates of the enthalpies and Gibbs free energies of formation. American Mineralogist, v.69, pp. 858-868.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: see discussion # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	46.70 wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	0.46 wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	40.50 wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	0.32 wt%	NROFF:	FeO
COMPOSITION:	CaO:	0.40 wt%	NROFF:	CaO
COMPOSITION:	Na2O:	6.90 wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	0.73 wt%	NROFF:	K_2O
COMPOSITION:	H2O+:	5.20 wt%	NROFF:	H_2O^+
COMPOSITION:	----------			
COMPOSITION:	Total:	101.21 wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Composition information from:

Robie, R.A., and B.S. Hemingway, 1984, Heat capacities and entropies of phlogopite and paragonite between 5 and 900 K and estimates of the enthalpies and Gibbs free energies of formation. American Mineralogist, v.69, pp. 858-868. (J. Marinenko, analyst. Rapid-rock method.)

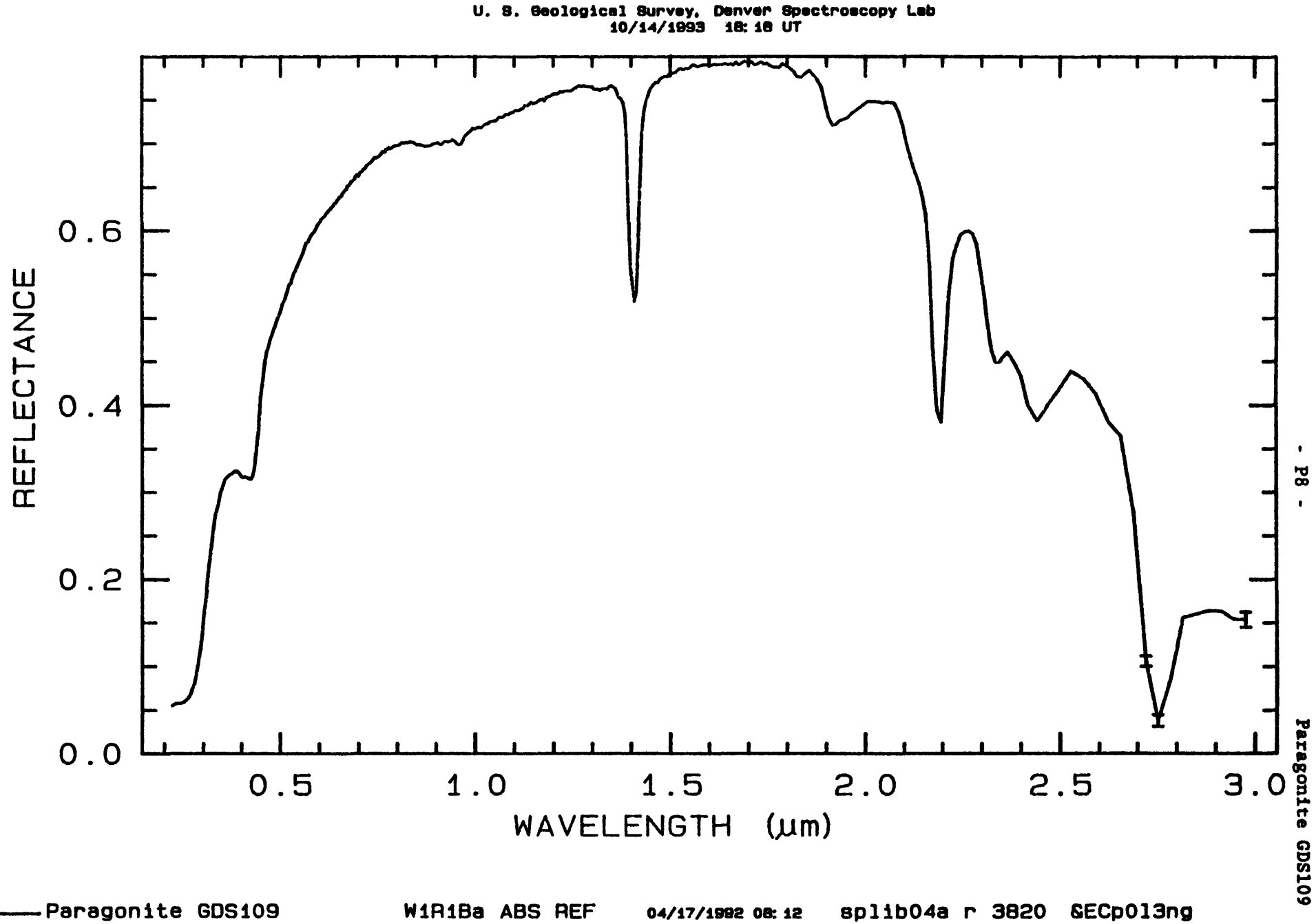
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3820	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 18:18 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (µm)
- P8 -
Paragonite GDS109
Paragonite GDS109 W1R1Ba ABS REF 04/17/1992 08:12 splib04a r 3820 &ECp013ng

TITLE: Pectolite NMNH94865 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH94865

MINERAL_TYPE: Inosilicate

MINERAL: Pectolite

FORMULA: NaCa2Si3O8(OH)

FORMULA_NROFF: $NaCa_2Si_3O_8(OH)$

COLLECTION_LOCALITY: Thetford, Ontario, Canada

ORIGINAL_DONOR: Smithsonian Institution

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Serandite.

"Results of petrographic examination: Hand specimen consists of one small (1mm x 1cm) and one larger (5mm x 6mm x 1cm) fragment. The larger one has a large area of albite (1/4 of the sample). The rest is composed of pectolite needles. Under petrographic microscope, sample has 2% of an isotropic mineral. Fibrous nature of mineral precludes effective sieving. Fine fraction separated from coarse fraction by elutriation in acetone."

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure pectolite.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

Pure (Norma Vergo).

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM (WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	53.37	wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	0.01	wt%	NROFF: TiO_2
COMPOSITION:	Al2O3:	0.03	wt%	NROFF: Al_2O_3
COMPOSITION:	FeO:	0.11	wt%	NROFF: FeO
COMPOSITION:	MnO:	0.03	wt%	NROFF: MnO
COMPOSITION:	MgO:	0.03	wt%	NROFF: MgO
COMPOSITION:	CaO:	33.84	wt%	NROFF: CaO
COMPOSITION:	Na2O:	9.61	wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.01	wt%	NROFF: K_2O
COMPOSITION:	---	---		
COMPOSITION:	Total:	94.04	wt%	

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

Microprobe analysis found the sample homogeneous within and between grains of pectolite. Average of 8 samples.

Salisbury, J. W., Walter, L. W., and Vergo, N., 1987, Mid-Infrared (2.1-25μm) Spectra of Minerals: First Edition, U.S. Geological Survey Open File Report 87-263.

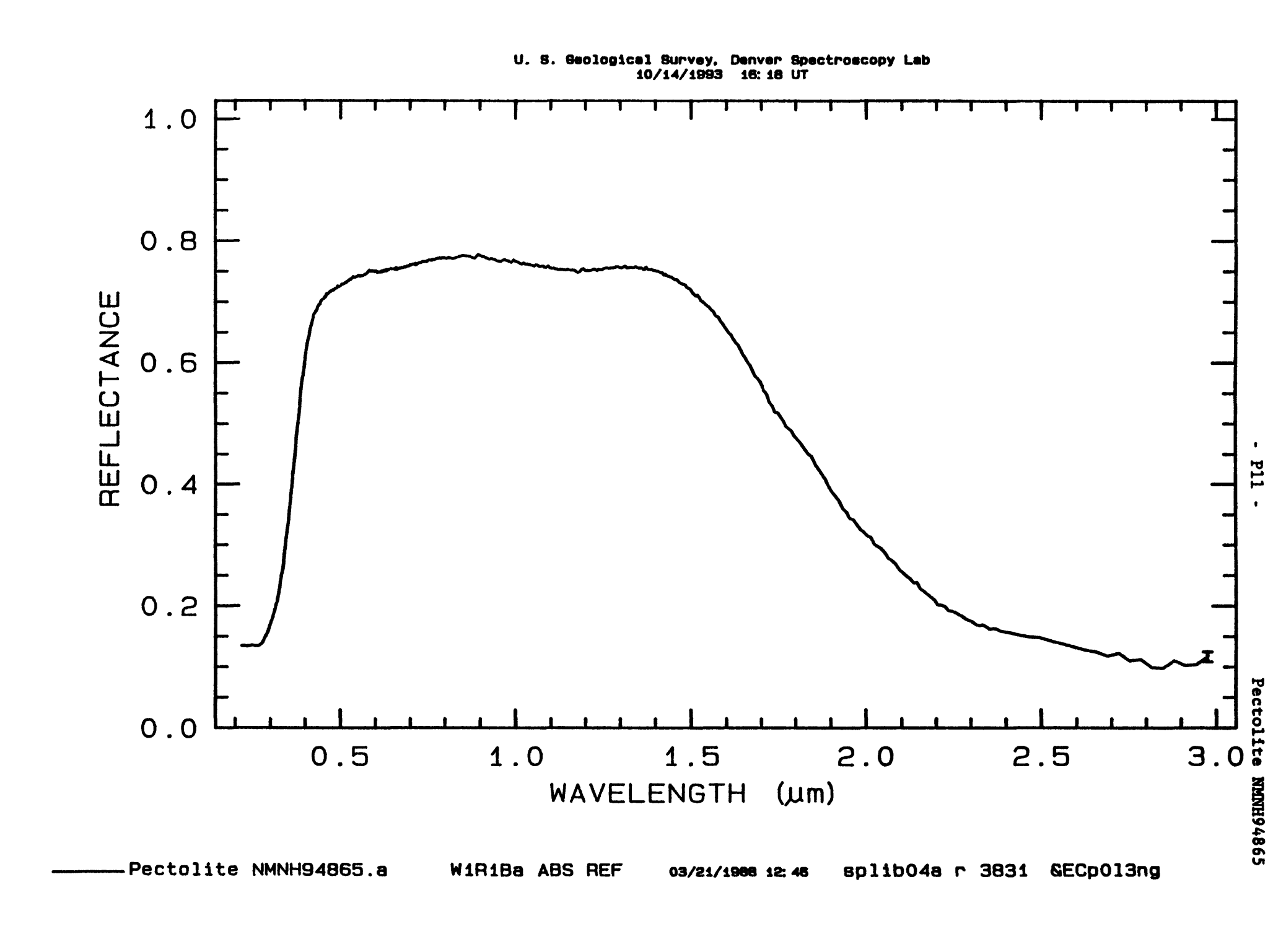
END_COMPOSITION_DISCUSSION.

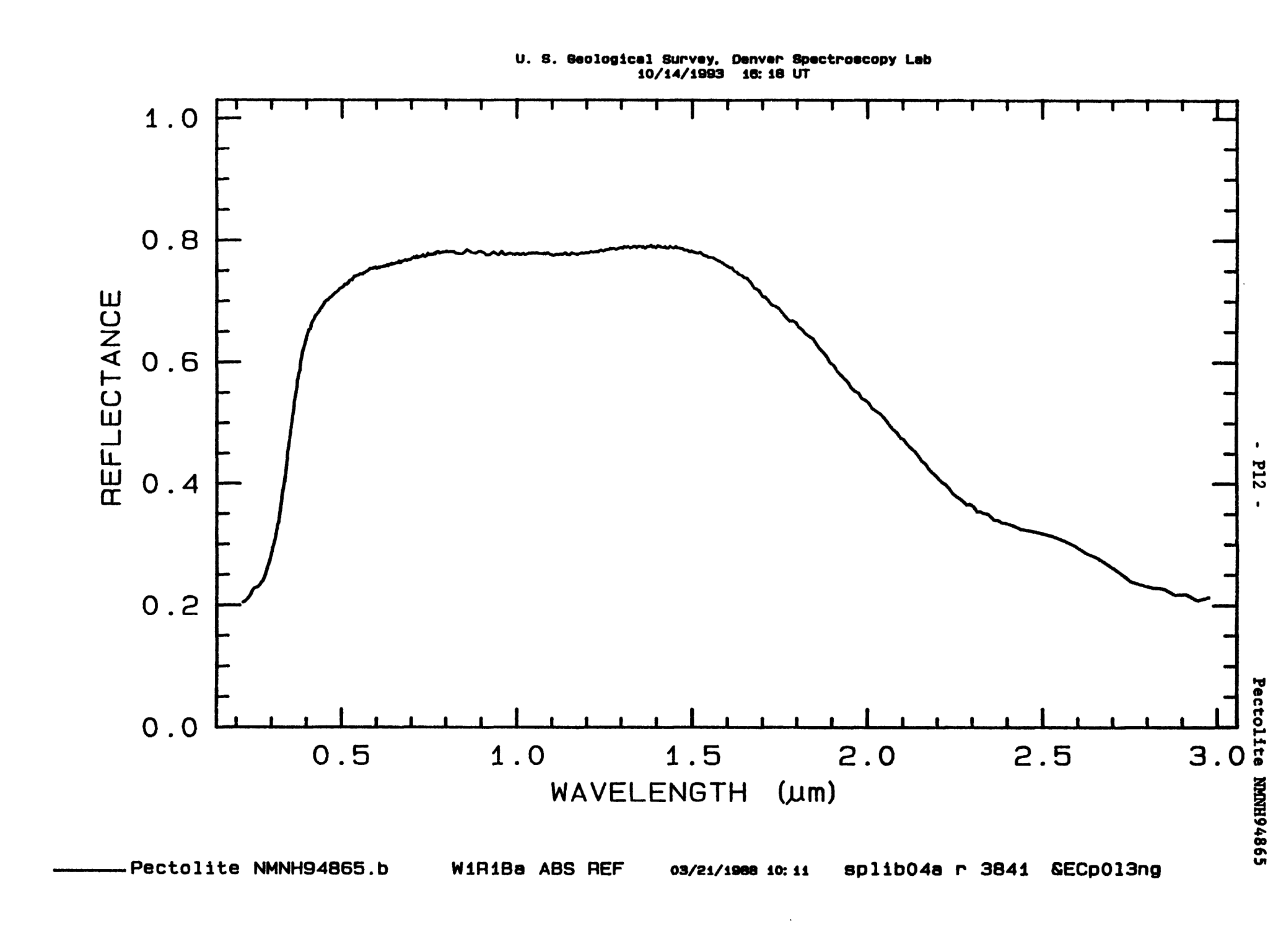
MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where		Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a	r 3831	0.2-3.0μm	200	g.s.= crs gr
LIB_SPECTRA:	splib04a	r 3841	0.2-3.0μm	200	g.s.= fn gr


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- Pll -
Pectolite NMNH94865
Pectolite NMNH94865.a W1R1Ba ABS REF 03/21/1966 12:46 splib04a r 3831 GECp013ng


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P12 -
Pectolite NMNH94865
Pectolite NMNH94865.b W1R1Ba ABS REF 03/21/1988 10:11 splib04a r 3841 &ECp013ng

TITLE: Perthite HS415 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS415

MINERAL_TYPE: Tectosilicate

MINERAL: Microcline with exsolved albite (Feldspar group)

FORMULA: KAlSi3O8 + NaAlSi3O8

FORMULA_NROFF: $KAlSi_3O_8$ + $NaAlSi_3O_8$

COLLECTION_LOCALITY: Perth, Ontario

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"T-13 Perthite 415B--Perth, Ontario. perthite is a name given to intergrown orthoclase or microcline with albite. The spectrum indicates a small amount of water, plus the fall off at 0.55μ similar to the feature discussed for microclines 151B and 108B, and for orthoclase 82B."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

A weak 2.2-μm feature is present, indicating some alteration. Otherwise the spectrum rates an a.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Albite + microcline(L)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

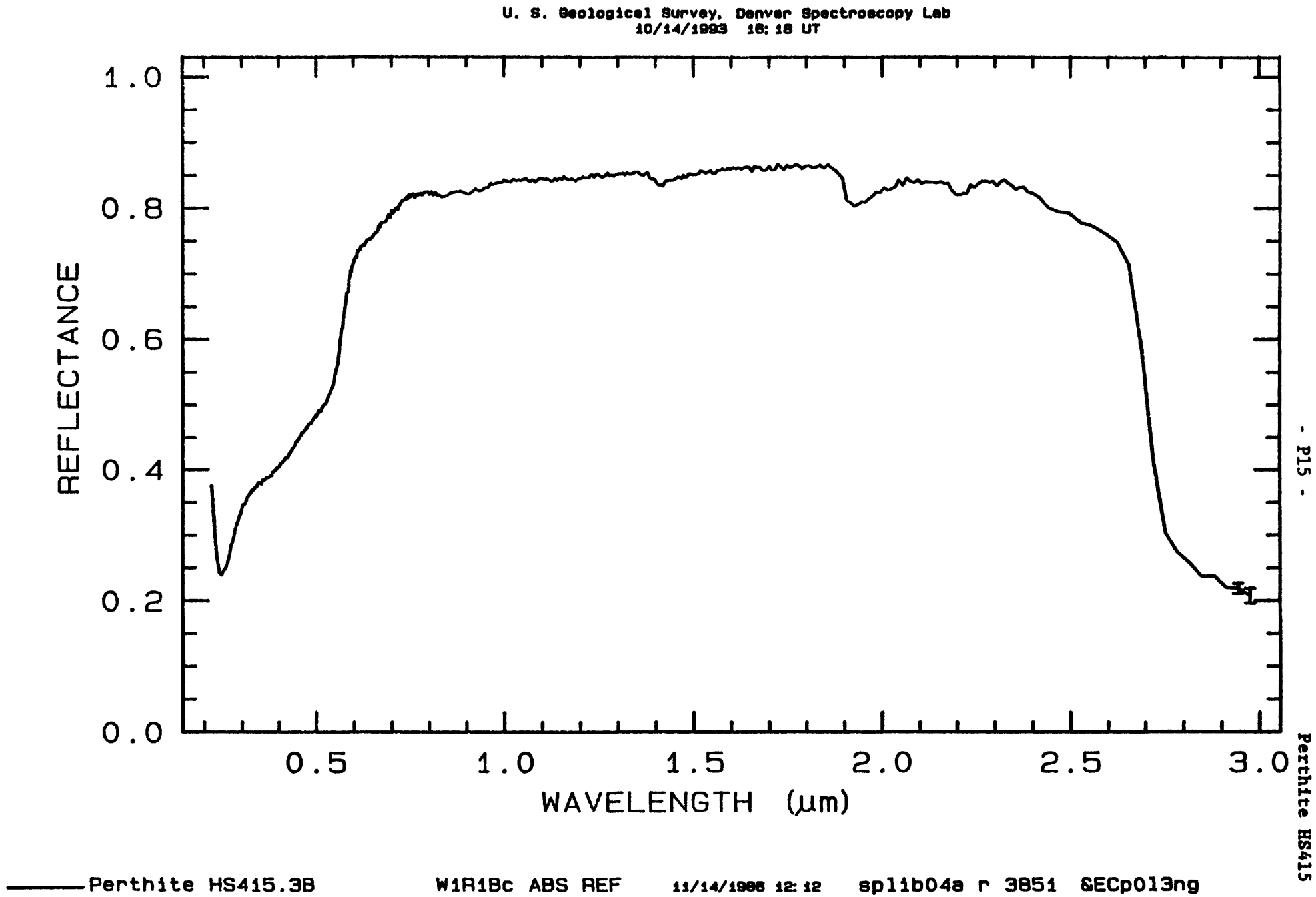
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3851	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P15 -
Perthite HS415
Perthite HS415.3B
W1R1Bc ABS REF
11/14/1986 12:12
splib04a r 3851 &ECp013ng

TITLE: Phlogopite GDS20 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS20 (NMNH124158)

MINERAL_TYPE: Phyllosilicate

MINERAL: Phlogopite (Mica group)

FORMULA: KMg3Si3AlO10(F,OH)2

FORMULA_NROFF: $KMg_3Si_3AlO_{10}(F,OH)_2$

COLLECTION_LOCALITY: Burgess, Ontario (Cp sample)

ORIGINAL_DONOR: Bruce Hemingway

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Form series with Biotite.

Sieve interval: coarse

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

"Unit cell parameters are: a = 0.531±0.002 nm, b = 0.922±0.003 nm, c = 1.022±0.003 nm, and β = 100.00±0.03°, and the structure type is 1M (M.R. Ross, U.S. Geol. Survey, personal communication, 1982) determined by single crystal methods."

Robie, R.A. and Hemingway, B.S., 1984, Heat capacites and entropies of phlogopite ($KMg_3[AlSi_3O_{10}](OH)_2$) and paragonite ($NaAl_2[AlSi_3O_{10}](OH)_2$) between 5 and 900 K and estimates of the enthalpies and Gibbs free energies of formation. American Mineralogist, v. 69, pp.858-868.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	40.3	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	1.32	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	14.3	wt%	NROFF:	Al_2O_3
COMPOSITION:	Fe2O3:	.63	wt%	NROFF:	Fe_2O_3
COMPOSITION:	FeO:	1.11	wt%	NROFF:	FeO
COMPOSITION:	MnO:	.03	wt%	NROFF:	MnO
COMPOSITION:	MgO:	26.4	wt%	NROFF:	MgO
COMPOSITION:	BaO:	.16	wt%	NROFF:	BaO
COMPOSITION:	CaO:	<.07	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	.43	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	10.1	wt%	NROFF:	K_2O
COMPOSITION:	F:	3.2	wt%	NROFF:	F
COMPOSITION:	H2O+:	2.63	wt%	NROFF:	H_2O^+
COMPOSITION:	H2O-:	.91	wt%	NROFF:	H_2O^-
COMPOSITION:	---	---			
COMPOSITION:	Total:	101.59	wt%		
COMPOSITION:	O=Cl,F,S:	1.34	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	100.25	wt%		

Rapid rock analysis from:

Robie, R.A. and Hemingway, B.S., 1984, Heat capacites and entropies of phlogopite ($KMg_3[AlSi_3O_{10}](OH)_2$) and paragonite ($NaAl_2[AlSi_3O_{10}](OH)_2$) between 5 and 900 K and estimates of the enthalpies and Gibbs free energies of formation. American Mineralogist, v. 69, pp.858-868.

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

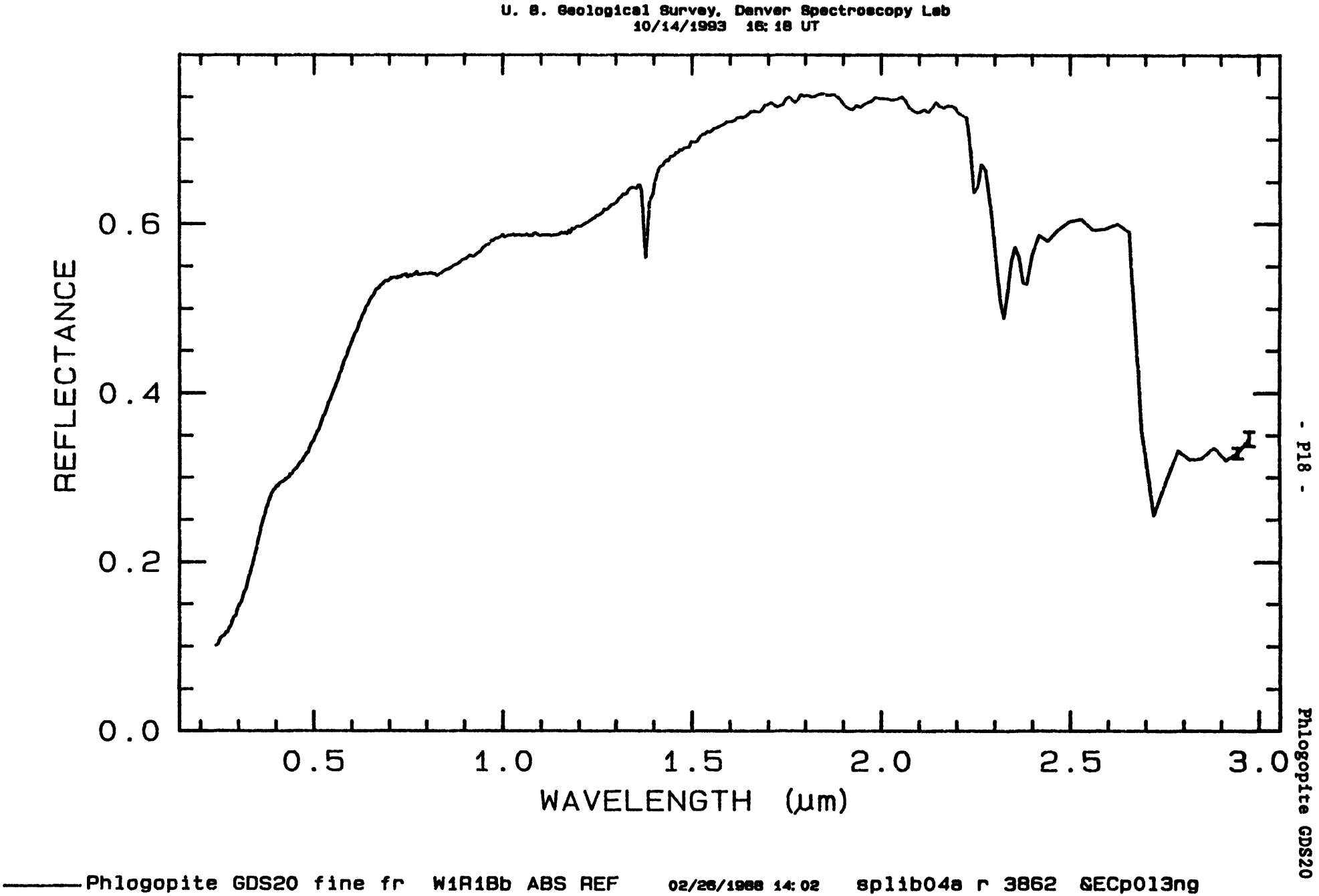
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3862	0.2-3.0μm	200	g.s.=



Phlogopite GDS20

TITLE: Phlogopite HS23 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS23

MINERAL_TYPE: Phyllosilicate

MINERAL: Phlogopite (Mica group)

FORMULA: KMg3Si3AlO10(F,OH)2

FORMULA_NROFF: $KMg_3Si_3AlO_{10}(F,OH)_2$

COLLECTION_LOCALITY: Ontario

ORIGINAL_DONOR: Hunt and Salibury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Biotite.

"P-15 Phlogopite 23B--Ontario. $K_2(Mg, Fe^{2+})_6 (Si_6Al_2P_{20})(OH, F)_4$. Phlogopite occurs most commonly in metamorphosed limestones and in ultrabasic rocks. It is difficult to obtain a reliable spectrum from this sample because of interference bands. The spectrum falls off quite steadily from 2.0μ into the blue of the visible, although no electronic features are well resolved. The absorption is, however, due to generalized absorption by both Fe^{2+} and Fe^{3+}, the latter substituting for Al. The important features in the spectrum are the OH vibrational features at 1.38μ, 2.325μ, and 2.385μ. The latter two features are displaced from the location of the most intense bands in the other micas, as a result of the trioctahedral structure which provides for the domination of the MgOH bending modes combinations rather than the AlOH bending modes in the dioctahedral micas. However, there is still evidence for the possibility of some AlOH bending mode combination displayed by the weak features near 2.2μ, being present although these features could be due to the more common OH-lattice combinations."

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Phlogopite - pure. Spectrally pure. (Norma Vergo)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDA) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	39.690	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	1.233	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	14.350	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	1.799	wt%	NROFF:	FeO
COMPOSITION:	MnO:	.0285	wt%	NROFF:	MnO
COMPOSITION:	MgO:	25.540	wt%	NROFF:	MgO
COMPOSITION:	CaO:	0.015	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	0.262	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	10.020	wt%	NROFF:	K_2O
COMPOSITION:	Cl:	0.072	wt%	NROFF:	Cl
COMPOSITION:	F:	3.864	wt%	NROFF:	F
COMPOSITION:	---	---			
COMPOSITION:	Total:	96.874	wt%		
COMPOSITION:	O=Cl,F,S:	1.643	wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:	95.231	wt%		

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

avg of 6 spot analyses

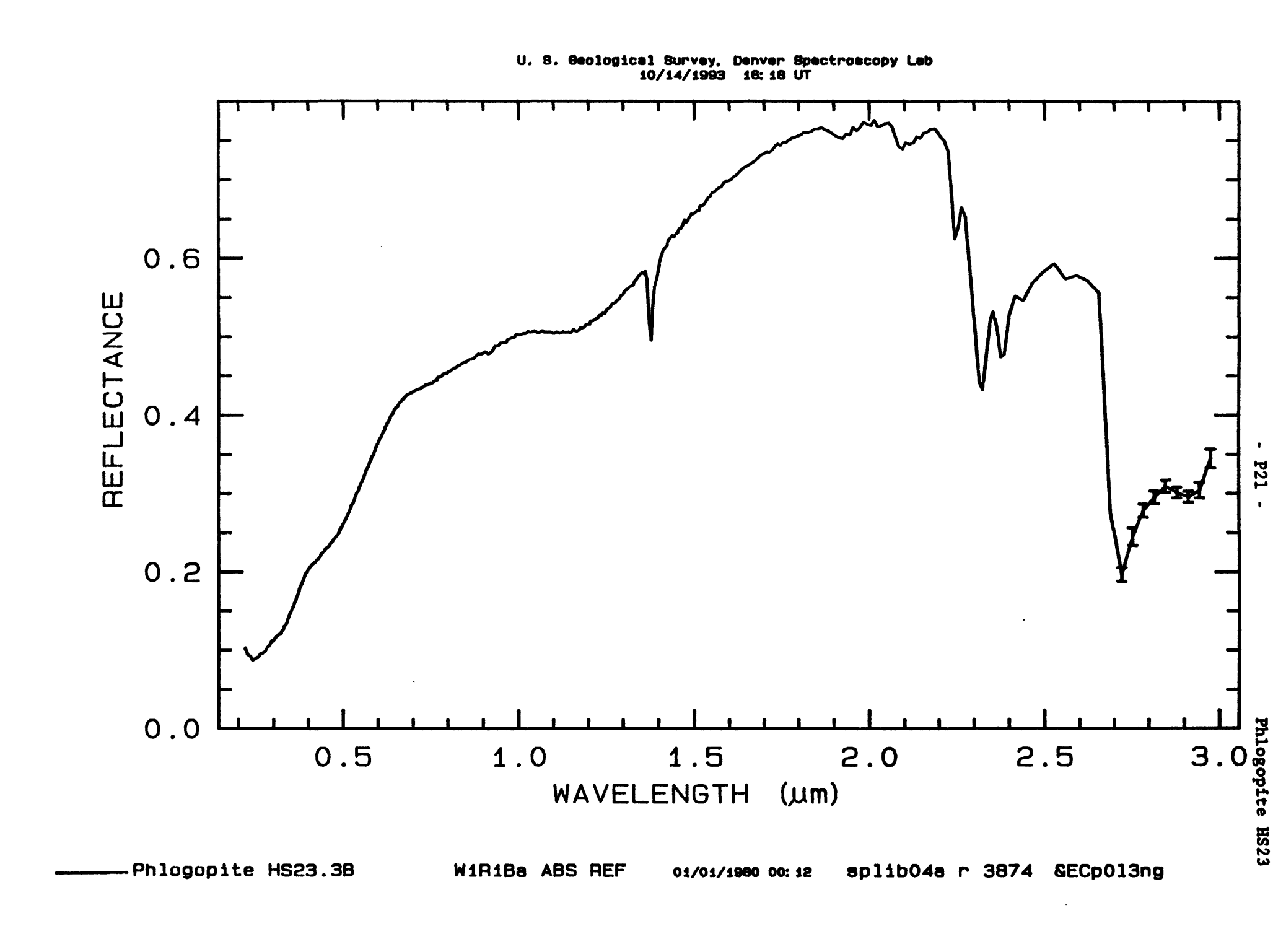
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3874	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P21 -
Phlogopite HS23
Phlogopite HS23.3B W1R1Ba ABS REF 01/01/1980 00:12 splib04a r 3874 &ECp013ng

TITLE: Phlogopite WS496 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS496

MINERAL_TYPE: Phyllosilicate

MINERAL: Phlogopite (Mica group)

FORMULA: KMg3Si3AlO10(F,OH)2

FORMULA_NROFF: $KMg_3Si_3AlO_{10}(F,OH)_2$

COLLECTION_LOCALITY: Mt. Vesuvius, Italy

ORIGINAL_DONOR: Ward's Scientific

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Biotite.

Original sample labeled as humite and phlogopite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	43.015	wt%	NROFF:	SiO_2
COMPOSITION:	TiO2:	.075	wt%	NROFF:	TiO_2
COMPOSITION:	Al2O3:	11.605	wt%	NROFF:	Al_2O_3
COMPOSITION:	FeO:	3.444	wt%	NROFF:	FeO
COMPOSITION:	MnO:	.435	wt%	NROFF:	MnO
COMPOSITION:	MgO:	29.624	wt%	NROFF:	MgO
COMPOSITION:	CaO:	.052	wt%	NROFF:	CaO
COMPOSITION:	Na2O:	.322	wt%	NROFF:	Na_2O
COMPOSITION:	K2O:	9.073	wt%	NROFF:	K_2O
COMPOSITION:	Cl:	.005	wt%	NROFF:	Cl
COMPOSITION:	F:	2.193	wt%	NROFF:	F
COMPOSITION:	---	---			
COMPOSITION:	Total:	99.84	wt%		
COMPOSITION:	O=Cl,F,S:		wt%	#correction for Cl, F, S	
COMPOSITION:	New Total:		wt%		

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

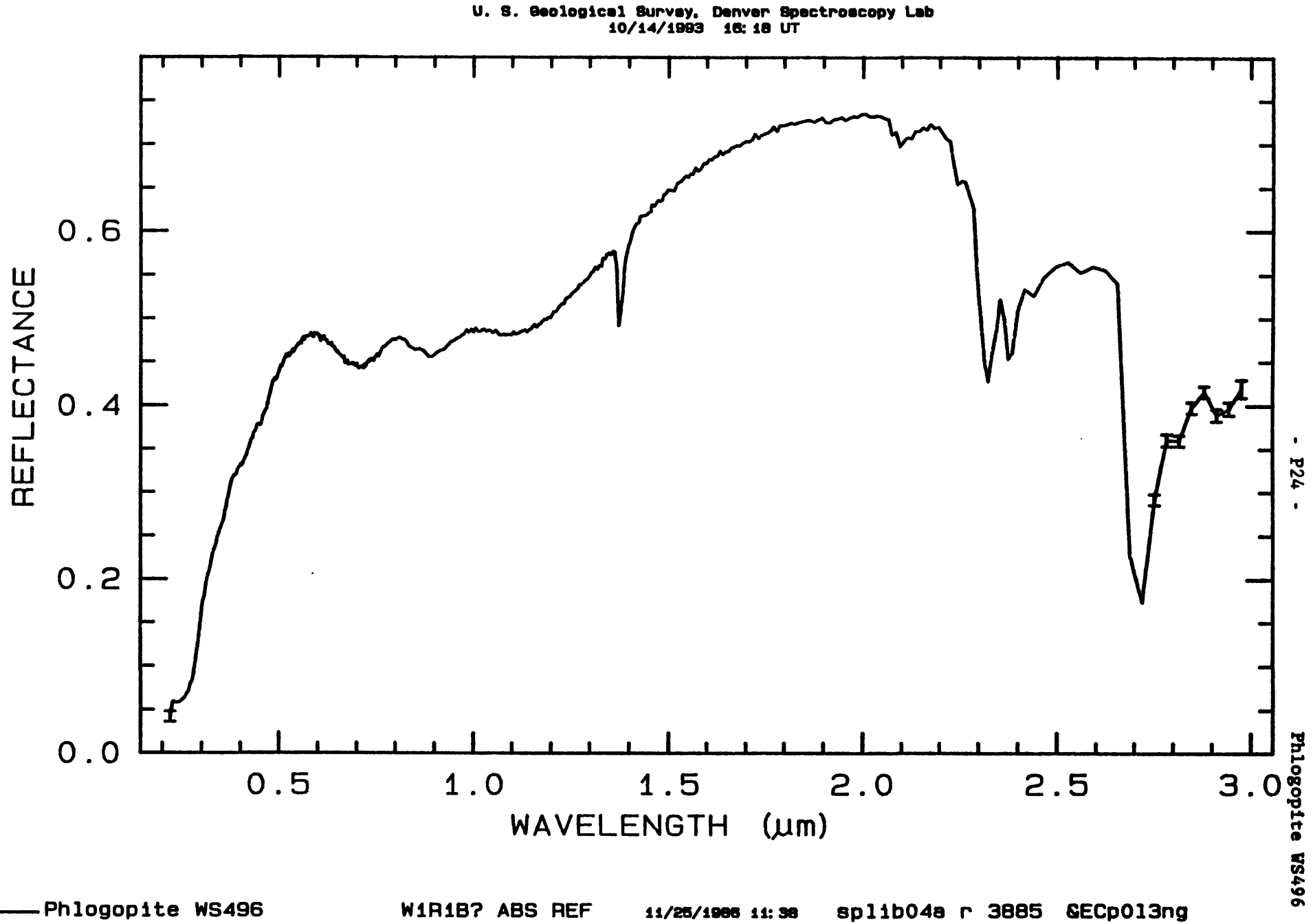
Microprobe analysis by Gregg Swayze using USGS microprobe facility.

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:
description goes here.
END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3885	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P24 -
Phlogopite WS496
Phlogopite WS496 W1R1B? ABS REF 11/25/1986 11:38 splib04a r 3885 &ECp013ng

TITLE: Phlogopite WS675 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: WS675

MINERAL_TYPE: Phyllosilicate

MINERAL: Phlogopite (Mica group)

FORMULA: KMg3Si3AlO10(F,OH)2

FORMULA_NROFF: $KMg_3Si_3AlO_{10}(F,OH)_2$

COLLECTION_LOCALITY: Bancroft, Ontario, Cananda

ORIGINAL_DONOR: Ward Science Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Biotite.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

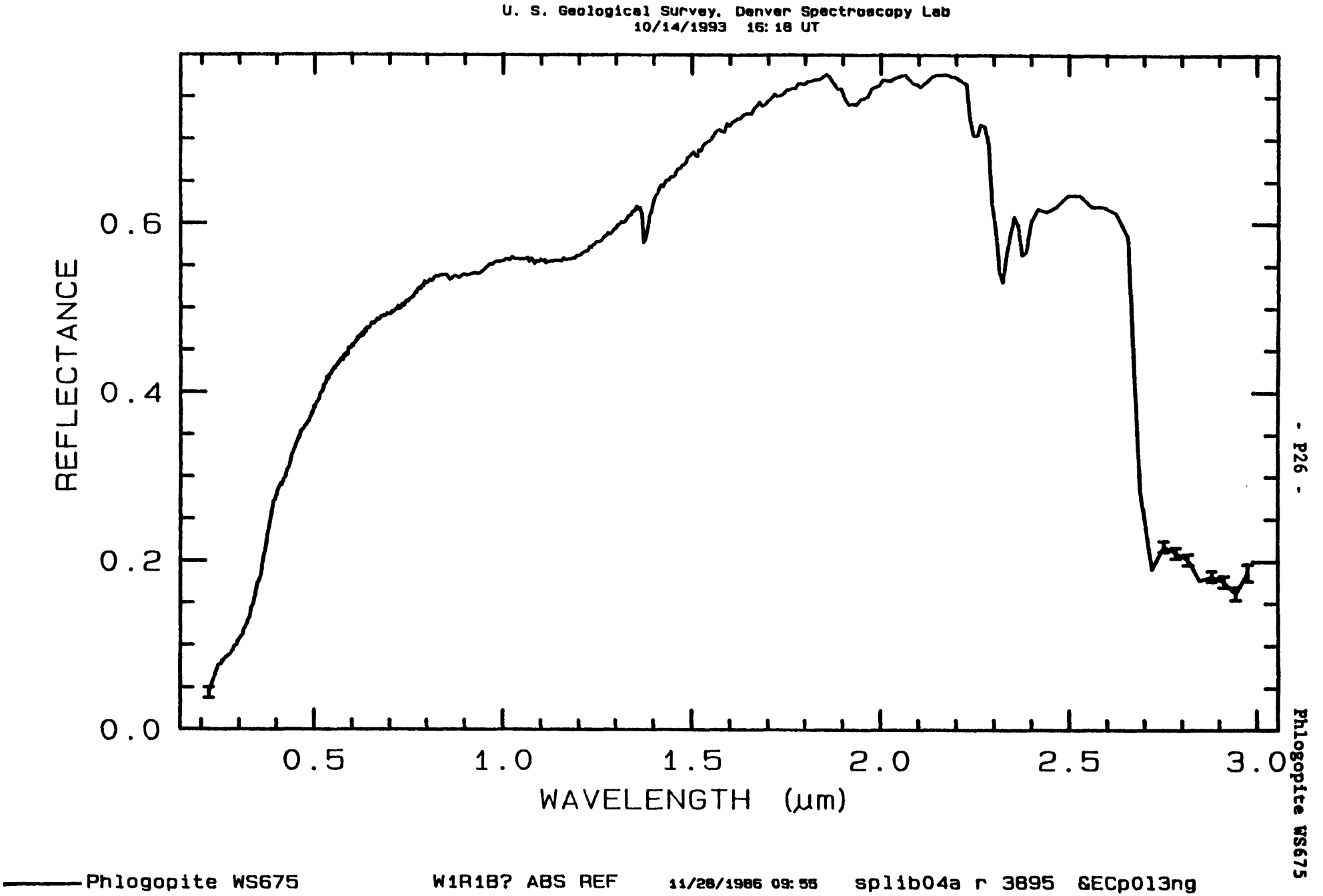
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3895	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Phlogopite WS675
Phlogopite WS675 W1R1B? ABS REF 11/28/1986 09:55 splib04a r 3895 &ECp013ng

TITLE: Pigeonite HS199 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS199

MINERAL_TYPE: Inosilicate

MINERAL: Pigeonite (Pyroxene group)

FORMULA: (Mg,Fe+2,Ca)(Mg,Fe+2)Si2O6

FORMULA_NROFF: $(Mg,Fe^{+2},Ca)(Mg,Fe^{+2})Si_2O_6$

COLLECTION_LOCALITY: Loudoun County, Virginia

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

I-6 Pigeonite 199B-Londoun Co., Va. (Mg, Fe^{2+}, Ca) (Mg, Fe^{2+}) (Si_2O_6): This mineral is common in igneous rocks of the extrusive volcanic type, particularly in andesites and dacites. Its spectrum is quite flat with a broad feature at 0.95μ, typical of six-fold coordinated ferrous iron.

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1973, Visible and near-infrared spectra of minerals and rocks: VI. Additional silicates. Modern Geology, v. 4, p. 85-106.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

```
COMPOSITION:       FeO: 25.31   wt%    NROFF: FeO
COMPOSITION:       MnO: 40.86   wt%    NROFF: MnO
COMPOSITION:       CaO: 33.93   wt%    NROFF: CaO
COMPOSITION: ----------------------
COMPOSITION:     Total:         wt%
COMPOSITION:  O=Cl,F,S:         wt%  #correction for Cl, F, S
COMPOSITION: New Total:         wt%
```

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

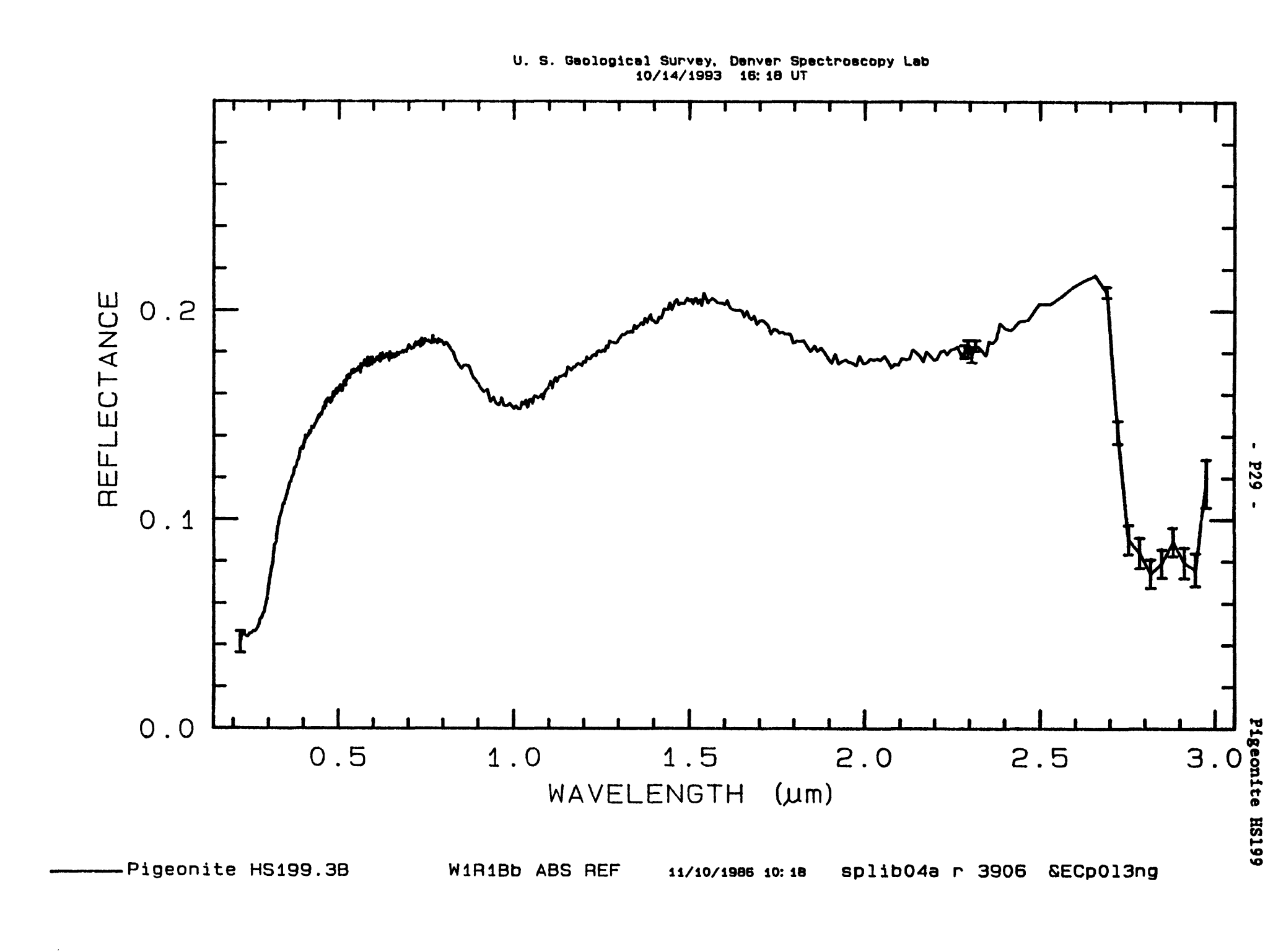
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3906	0.2-3.0μm	200	g.s.-


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
0.0
0.1
0.2
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Pigeonite HS199
Pigeonite HS199.3B W1R1Bb ABS REF 11/10/1986 10:18 splib04a r 3906 &ECp013ng

TITLE: Pinnoite NMNH123943 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH123943

MINERAL_TYPE: Hydrous Borate

MINERAL: Pinnoite

FORMULA: MgB2O4*3H2O

FORMULA_NROFF: $MgB_2O_4 \bullet 3H_2O$

COLLECTION_LOCALITY: Synthetic

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1993, Mapping playa evaporite minerals with AVIRIS data: A first Report from Death Valley, California: Remote Sensing of Environment, vol 44, p 337-356.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure pinnoite.

Crowley, J.K., 1993, Mapping playa evaporite minerals with AVIRIS data: A first Report from Death Valley, California: Remote Sensing of Environment, vol 44, p 337-356.

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

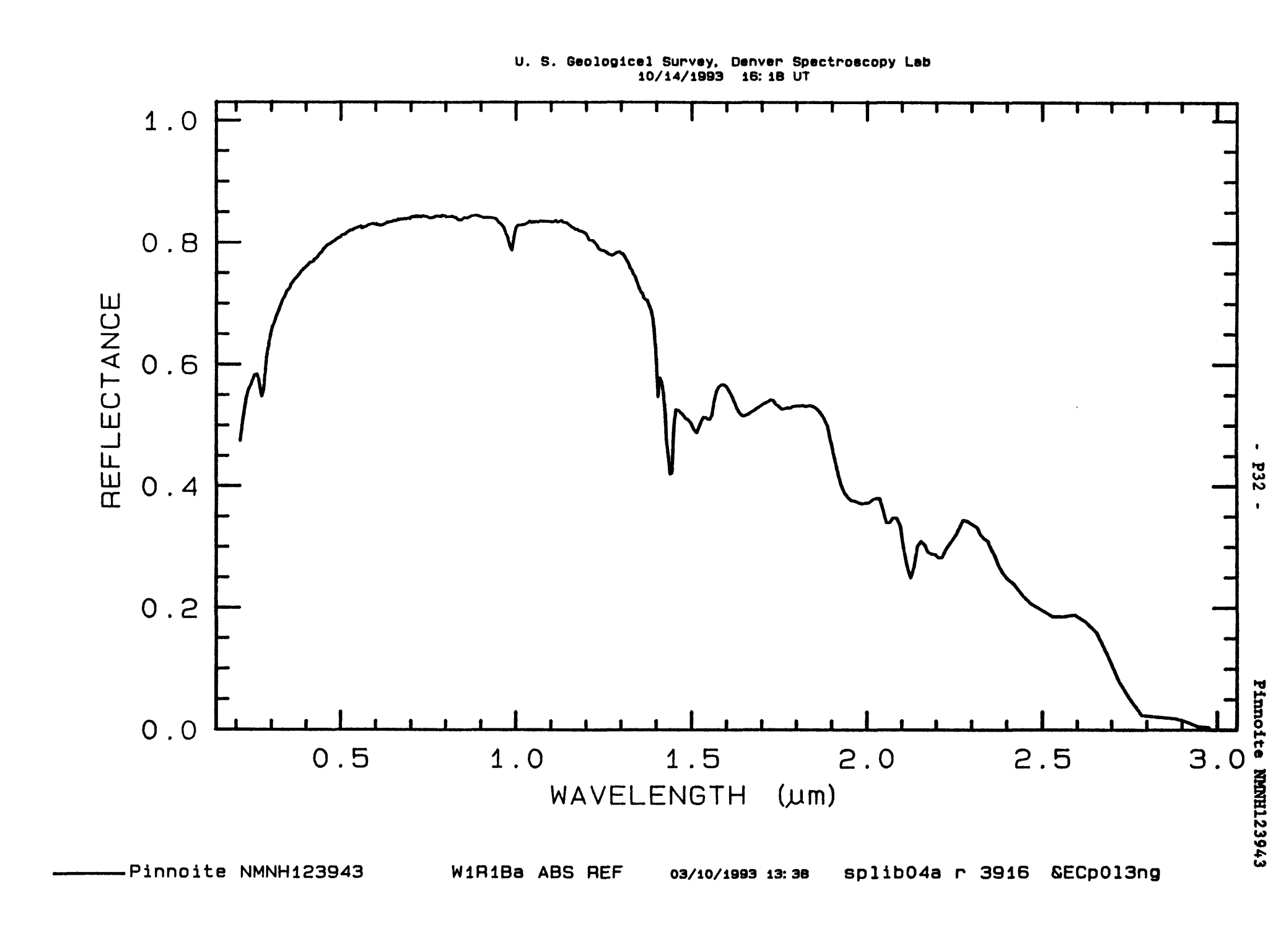
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED: where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA: splib04a r 3916	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Pinnoite NMNH123943
W1R1Ba ABS REF
03/10/1993 13:38
splib04a r 3916 &ECp013ng
- P32 -
Pinnoite NMNH123943

TITLE: Pitch_Limonite GDS104 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS104

MINERAL_TYPE: Hydroxide

MINERAL: Pitch Limonite

FORMULA: [H(Cu,Fe)O2]

FORMULA_NROFF: [H(Cu,Fe)O_2]

COLLECTION_LOCALITY: Yerrington, NV

ORIGINAL_DONOR: Bill Atkinson, Univ. of Colorado, Boulder

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Bill Atkinson believes that this sample contains significant Cu replacing Fe in the goethite.

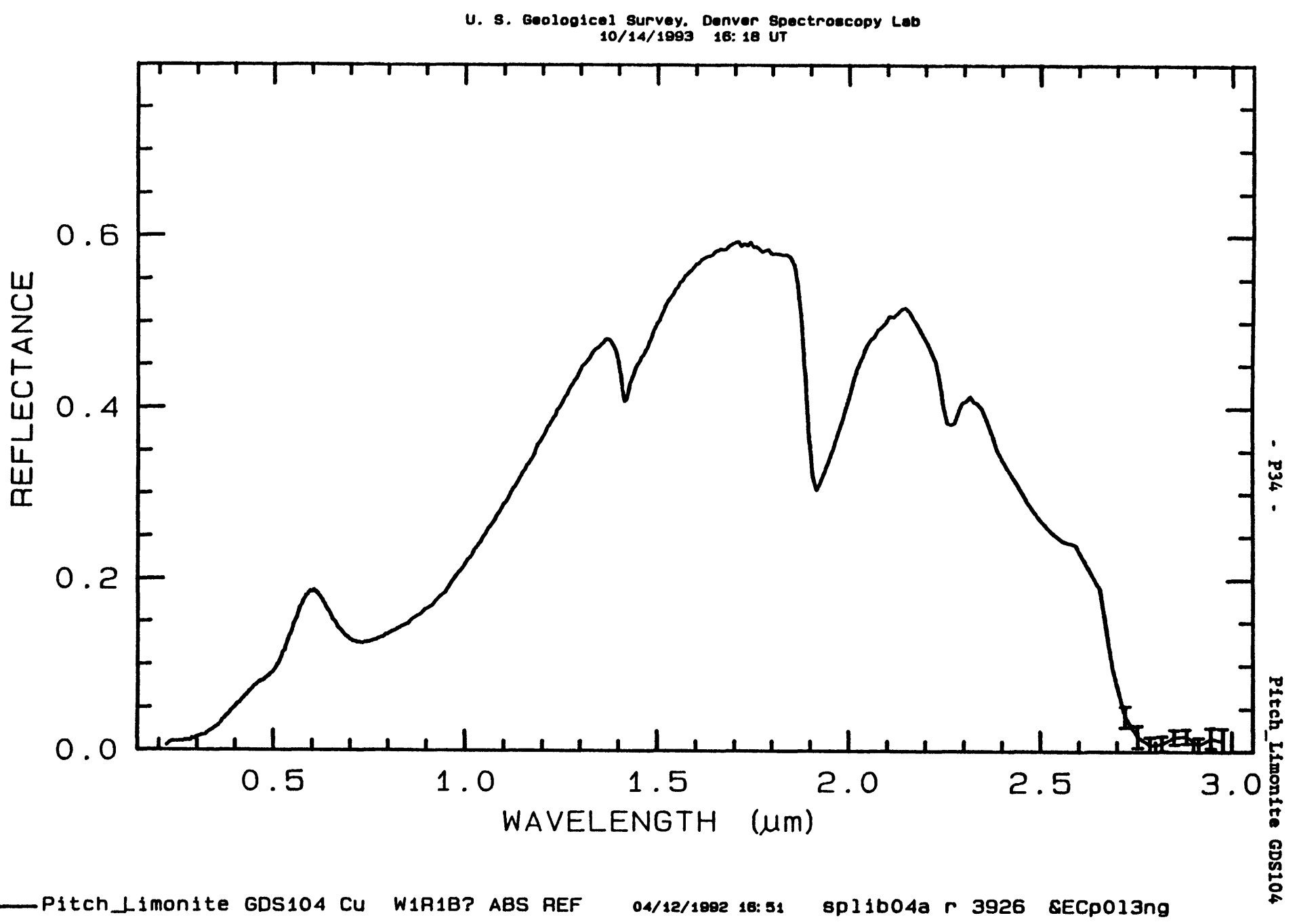
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: agall@speclab (Andrea J. Gallagher)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3926	0.2-3.0μm	200	g.s.=



Pitch_Limonite GDS104

TITLE: Polyhalite NMNH92669-4 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: NMNH92669-4

MINERAL_TYPE: Hydrous Sulfate

MINERAL: Polyhalite

FORMULA: K2Ca2Mg(SO4)4*2H2O

FORMULA_NROFF: $K_2Ca_2Mg(SO_4)_4 \bullet 2H_2O$

COLLECTION_LOCALITY: Carlsbad, New Mexico

ORIGINAL_DONOR: Smithsonian

CURRENT_SAMPLE_LOCATION: USGS Reston, Virginia

ULTIMATE_SAMPLE_LOCATION: USGS Reston, Virginia

SAMPLE_DESCRIPTION:

Spectrum originally published in:
Crowley, J.K., 1991, Visible and Near-Infrared (0.4 - 2.5μm) Reflectance Spectra of Playa Evaporite Minerals: Journal of Geophysical Research, vol 96, no.B10, p. 16,231-16,240.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

Pure polyhalite. (Crowley, 1991)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE: None

COMPOSITION_DISCUSSION:

None

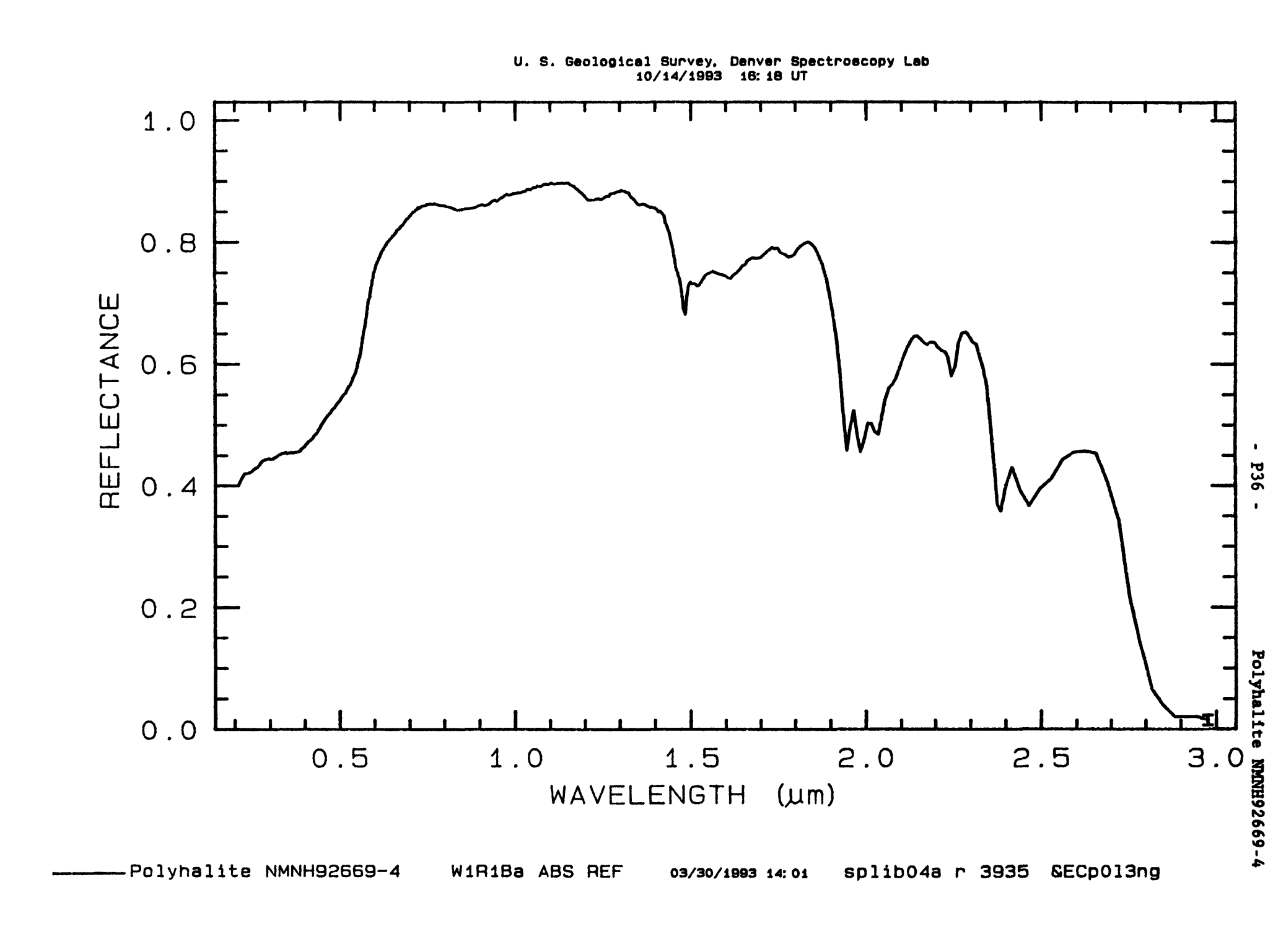
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: smoore@speclab (Shelley Moore)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3935	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
1.0
0.8
0.6
0.4
0.2
0.0
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Polyhalite NMNH92669-4 W1R1Ba ABS REF 03/30/1993 14:01 splib04a r 3935 &ECp013ng
- P36 -
Polyhalite NMNH92669-4

TITLE: Praseodymium_Oxide GDS35 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: GDS35

MINERAL_TYPE: Oxide

MINERAL: Praseodymium Oxide

FORMULA: Pr2O3

FORMULA_NROFF: Pr_2O_3

COLLECTION_LOCALITY: REE Standard 81.6% Pr Lot No. 05791

ORIGINAL_DONOR: None

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Spex standard 81.6% Pr Lot No. 05791

Reflectance spectra for reagent-grade Eu_2O_3, Nd_2O_3, Sm_2O_3, and Pr_2O_3 show the intense, narrow absorption bands caused by electronic transitions in trivalent rare earth elements (White, 1967; Dieke and Crosswhite, 1963). The absorption patterns produced by each of these oxides is distinctive for the particular rare earth element involved. The positions of the major bands for Nd_2O_3 and Sm_2O_3 are indicated in Table 2. Absorption features that occur near 1.4 and 1.9 μ cannot be unambiguously assigned to water or hydroxyl since some rare earth element oxides, notably Sm_2O_3 and Pr_2O_3, have electronic bands in these wavelength regions. The cause of the 2.35μ bands in two of the rare earth element oxide samples also has not been determined. Although White (1967) tentatively attributed similar features to water, the bands could be produced by minor amounts of CO_3 or possibly by an undocumented REE-OH vibratiosnal overtone. No carbonate or hydroxyl-bearing phases were detected by X-ray diffraction analysis of the rare earth element oxide samples.

Rowan, Lawrence C., Kingston, Marguerite J., Crowley, James K., Spectral Reflectance of Carbonatites and Related Alkalic Igneous Rocks: Selected Samples from Four North American Localities, Economic Geology, Vol 81, 1986, pp. 857-871.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

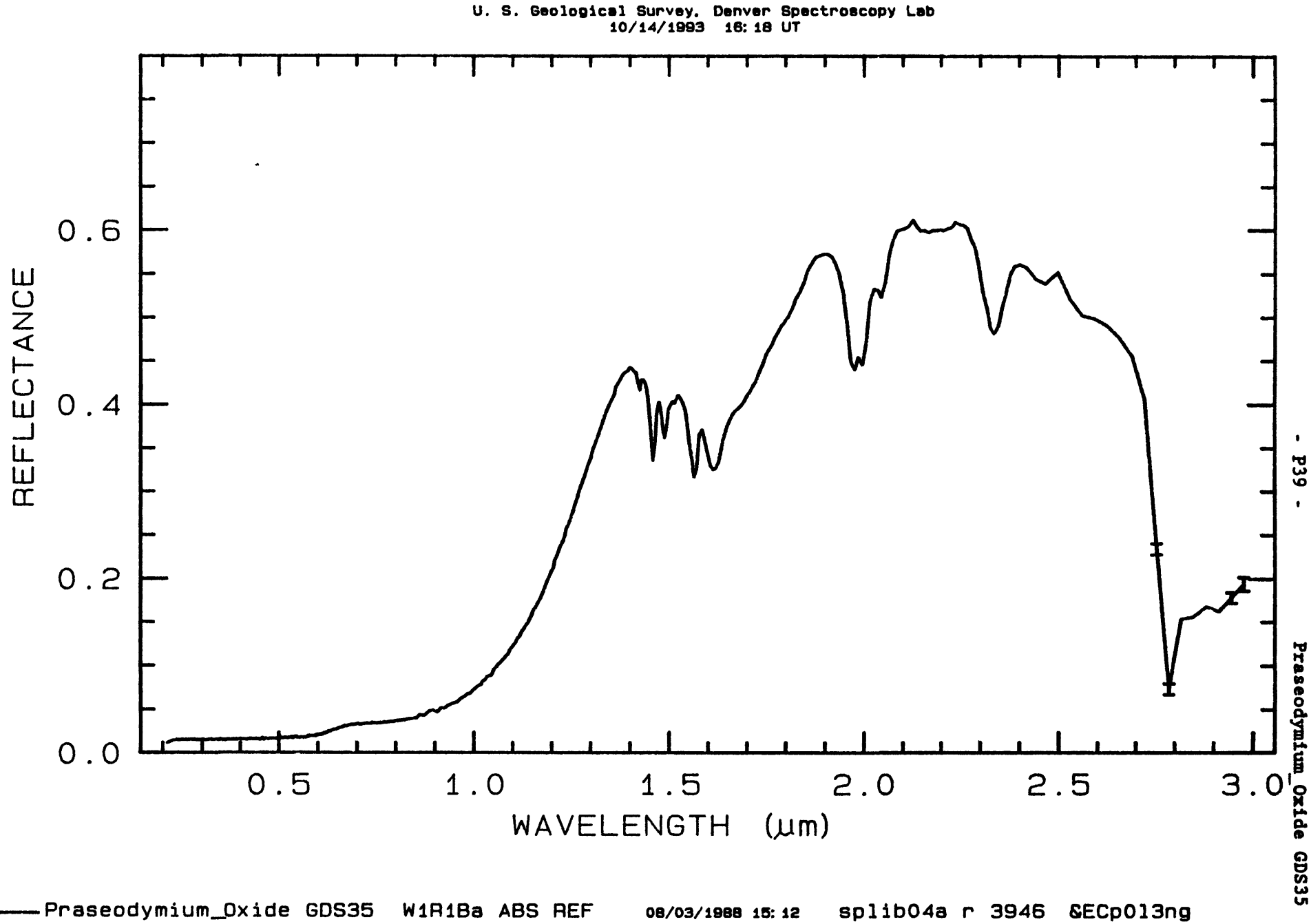
No observed Impurities. G. Swayze.

avg gr sz = 5 μm

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3946	0.2-3.0μm	200	g.s.= 5 μm


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:18 UT
REFLECTANCE
0.0
0.2
0.4
0.6
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Praseodymium_Oxide GDS35 W1R1Ba ABS REF 08/03/1988 15:12 splib04a r 3946 &ECp013ng
- P39 -
Praseodymium_Oxide GDS35

TITLE: Prochlorite SMR-14 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: SMR-14

MINERAL_TYPE: Phyllosilicate

MINERAL: Prochlorite (Chlorite group)

FORMULA: (Mg,Fe)3(Si,Al)4O10(OH)2-(Mg,Fe)3(OH)6

FORMULA_NROFF: $(Mg,Fe)_3(Si,Al)_4O_{10}(OH)_2$-$(Mg,Fe)_3(OH)_6$

COLLECTION_LOCALITY: unknown

ORIGINAL_DONOR: Gene Whitney, USGS, Denver

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Sample was ground in an alumina mortar and pestle and wet sieved with methanol into <30μm (c), 30-45μm (b), and 104-150μm (a) size fractions.

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

This sample was found to be representative of its structural classification. (King and Clark, 1989)

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: EM(WDS) # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION:	SiO2:	19.90 wt%	NROFF: SiO_2
COMPOSITION:	TiO2:	5.38 wt%	NROFF: TiO_2
COMPOSITION:	Al2O3	15.20 wt%	NROFF: Al_2O_3
COMPOSITION:	Fe2O3:	35.10 wt%	NROFF: Fe_2O_3
COMPOSITION:	MnO:	0.57 wt%	NROFF: MnO
COMPOSITION:	MgO:	16.80 wt%	NROFF: MgO
COMPOSITION:	CaO:	0.02 wt%	NROFF: CaO
COMPOSITION:	Na2O:	0.20 wt%	NROFF: Na_2O
COMPOSITION:	K2O:	0.02 wt%	NROFF: K_2O
COMPOSITION:	P2O5:	0.05 wt%	NROFF: P_2O_5
COMPOSITION:	LOI:	7.10 wt%	NROFF: LOI
COMPOSITION:	---	---	
COMPOSITION:	Total:	100.34 wt%	

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

Compositional data provided by Gene Whitney, USGS, Denver, CO

King, T.V.V. and R.N. Clark, 1989, Spectral Characteristics of Chlorites and Mg-Serpentines Using high-Resolution Reflectance Spectroscopy. Jour. Geophys. Res., 13.997-14,008.

END_COMPOSITION_DISCUSSION.

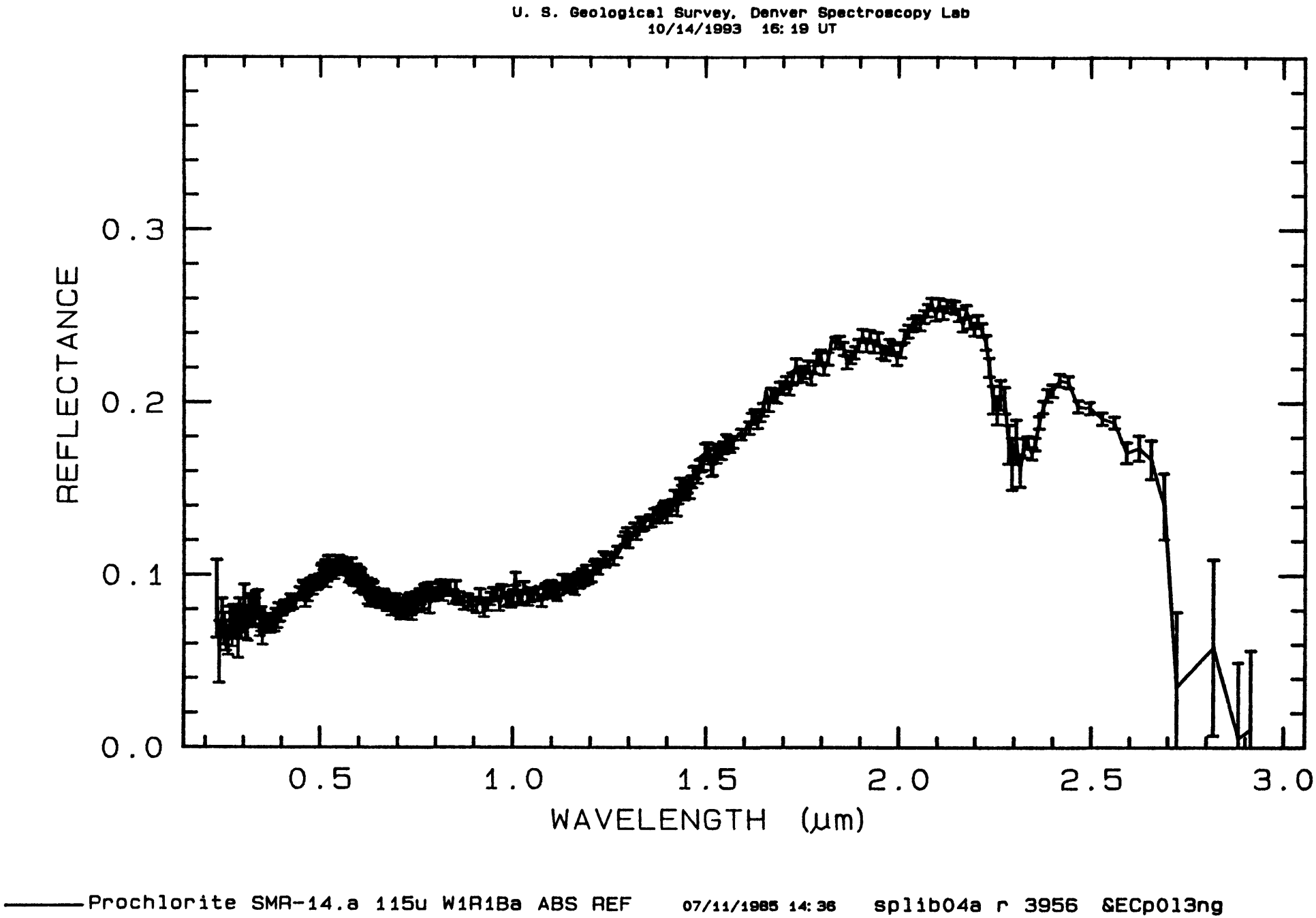
MICROSCOPIC_EXAMINATION:

Microscopically this appears to be pure prochlorite. All size fractions were examined visually and by energy dispersive methods to ensure chemical homogeneity as a function of grain size interval. (T. King)

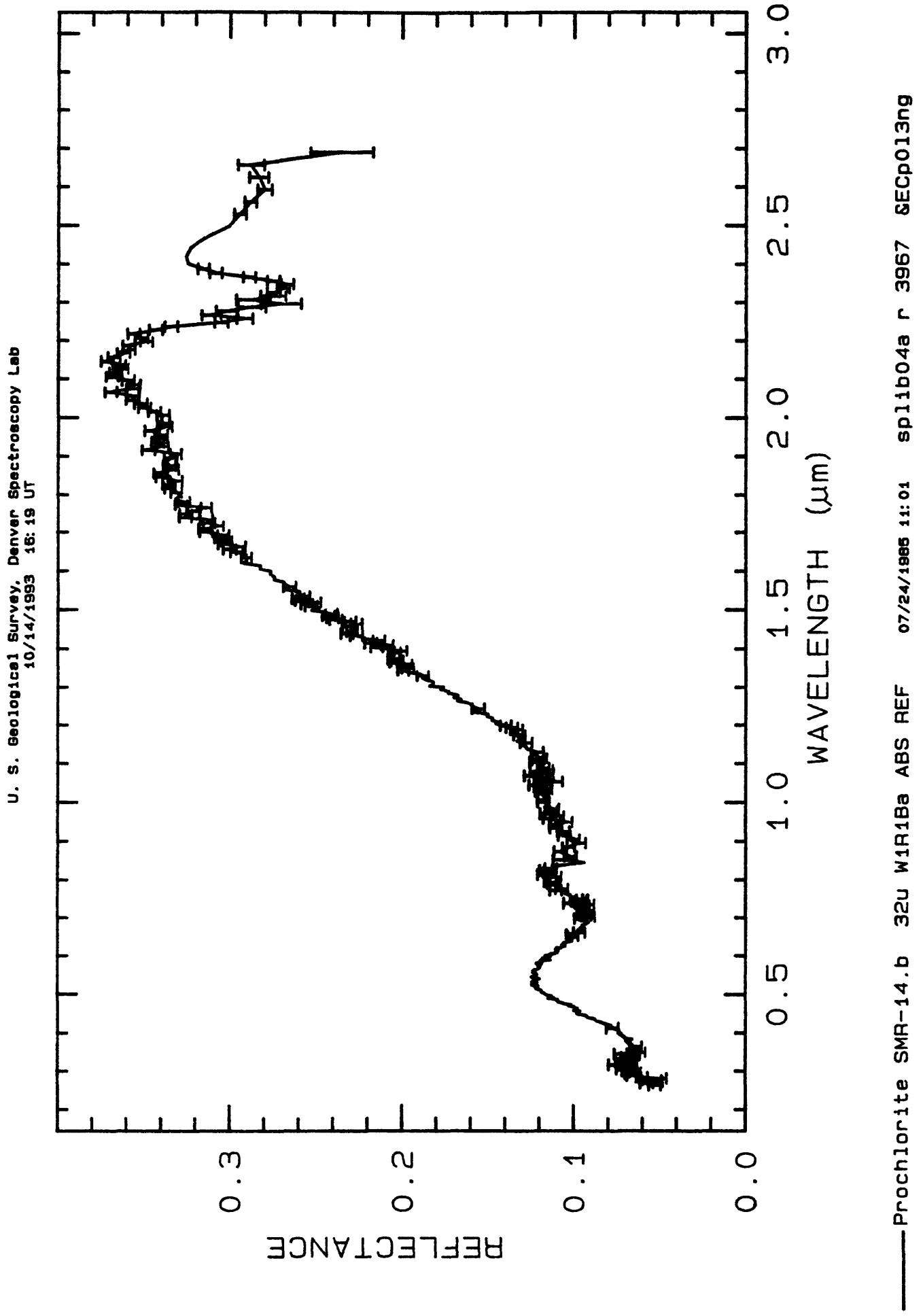
END_MICROSCOPIC_EXAMINATION.

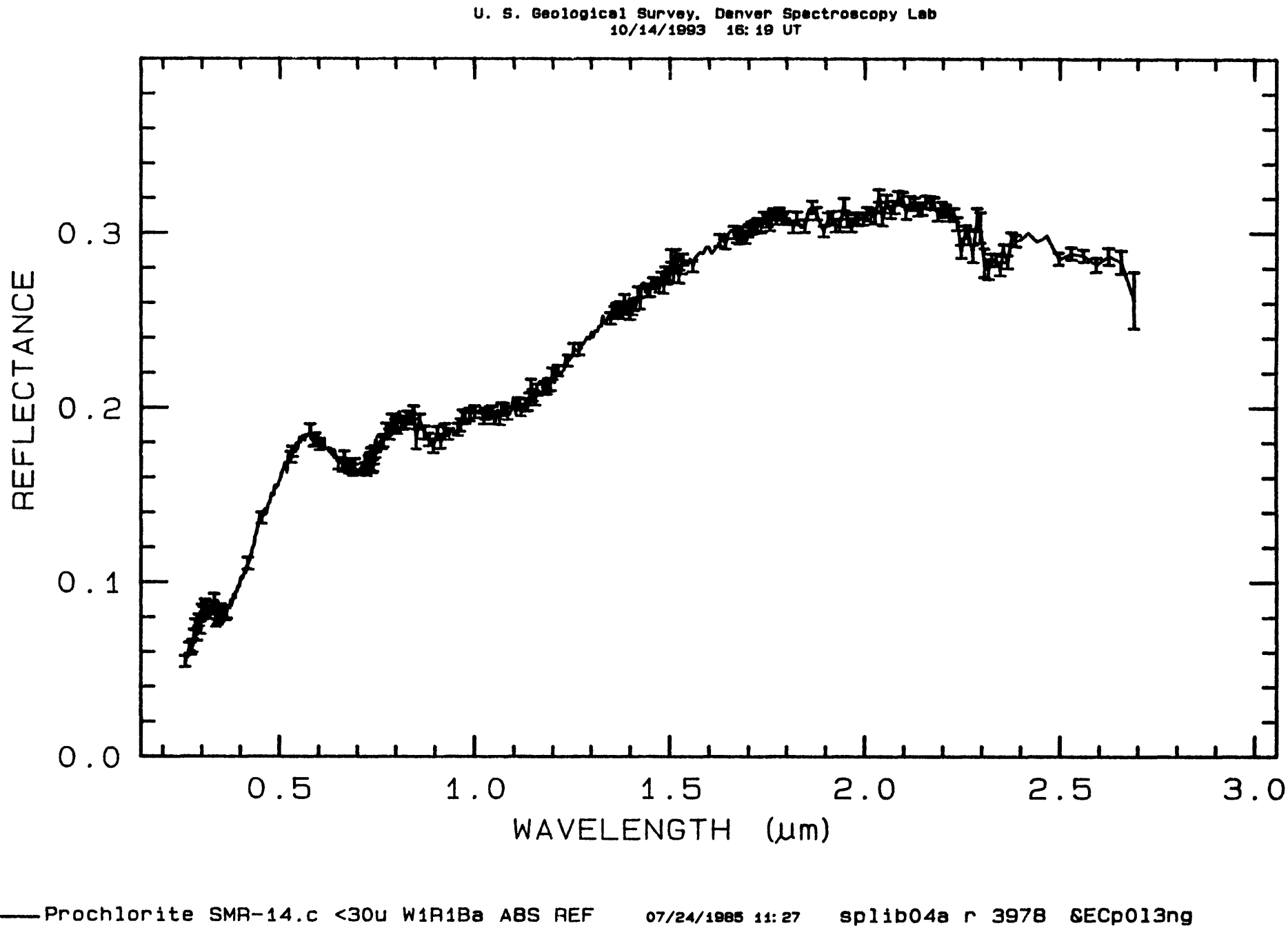
DOCUMENTED_BY: tking@speclab (Trude V.V. King)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3956	0.2-2.7μm	200	g.s.=115μm
LIB_SPECTRA:	splib04a r 3967	0.2-2.7μm	200	g.s.=32μm
LIB_SPECTRA:	splib04a r 3978	0.2-2.7μm	200	g.s.=15μm



Prochlorite SMR-14


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.0
0.1
0.2
0.3
WAVELENGTH (μm)
0.5
1.0
1.5
2.0
2.5
3.0
Prochlorite SMR-14.b 32u W1R1Ba ABS REF 07/24/1995 11:01 splib04a r 3967 &ECp013ng



Prochlorite SMR-14

TITLE: Psilomelane HS139 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS139

MINERAL_TYPE: Hydroxide (Mineral mixture)

MINERAL: Psilomelane (Romanechite)

FORMULA: BaMn+2(Mn+4)8O16(OH)4

FORMULA_NROFF: $BaMn^{+2}Mn^{+4}_{8}O_{16}(OH)_{4}$

COLLECTION_LOCALITY: Magdalena, New Mexico

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

"0-13. Psilomelane. Magdalena, N.M. (139B). "Psilomelane" is generally used as a field term for any poorly characterized massive ore of manganese. Much of the material originally cleared as psilomelane consists of mixtures of several different minerals, usually with pyrolusite (Palache et al., 1944). Psilomelane usually is of supergene origin, occurring typically as a weathering product of manganiferous carbonates or silicates. This particular sample has a black streak, and yields very little water (0.09%) when heated. Consequently, we conclude that it is composed in large part of pyrolusite. Its spectrum is opaque and spectrally featureless, due to the conduction band of MnO/d2/u extending throughout this spectral range."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: III. Oxides and hydroxides. Modern Geology, v. 2, p. 195-205.

"Many of the hard botryoidal masses formerly called psilomelane are now known to be a mixture of several manganese oxides of which romanechite is a major constituent. Some of the other minerals commonly present in the mixture are cryptomelane, KMn_{8},O_{16}; manjiroite, $(Na,K)Mn_{8}O_{16}\cdot nH_{2}O$; and todorokite (Mn,Ca,Mg) $Mn_{3}O_{7}\cdot H_{2}O$."

Klein, C. and Hurlbut, C.S., Manual of Mineralogy 20th Edition, pp 317-318, 1985.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

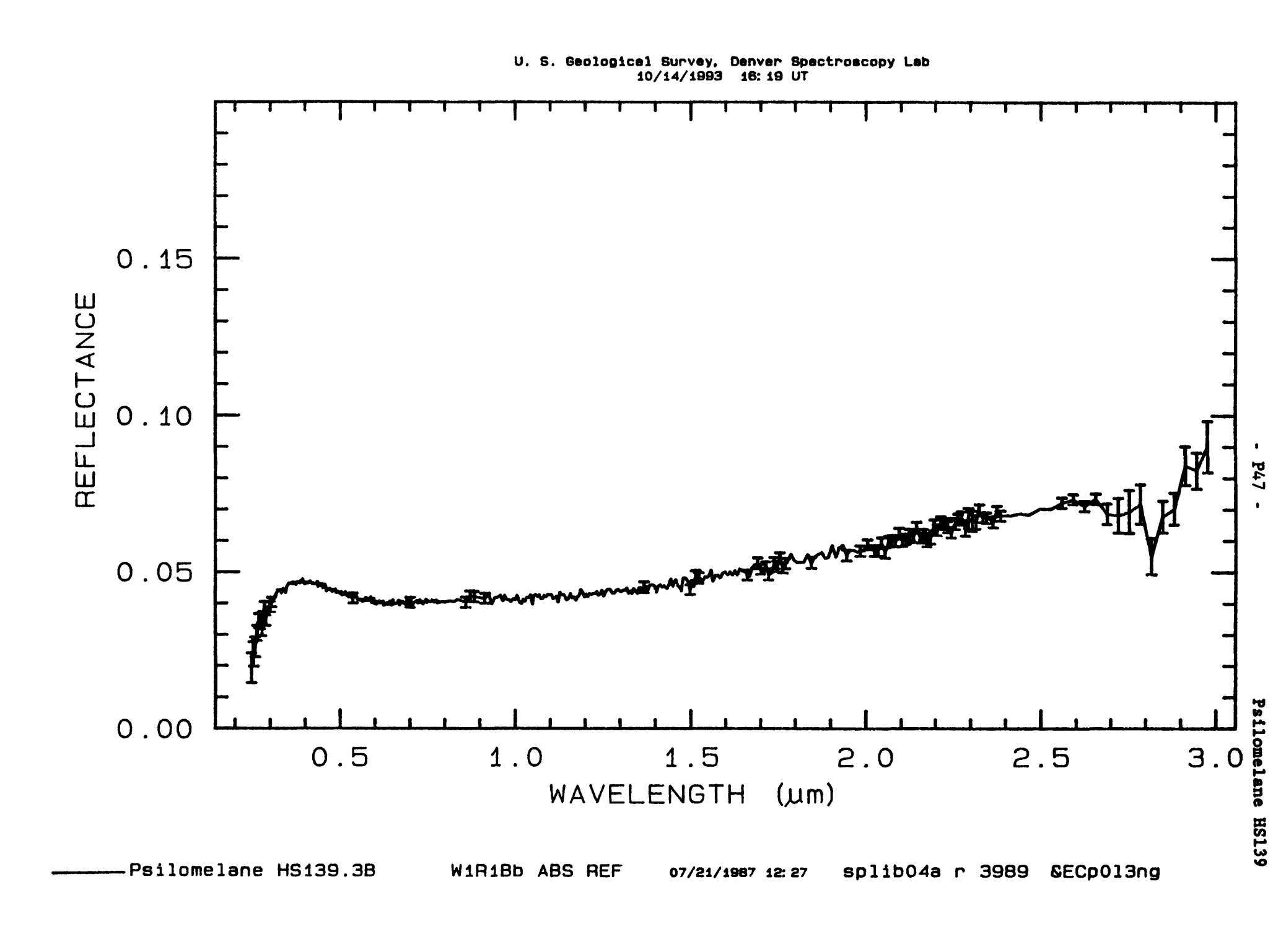
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3989	0.2-3.0μm	200	g.s.=



Psilomelane HS139

TITLE: Pyrite HS35 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: HS35

MINERAL_TYPE: Sulfide

MINERAL: Pyrite (Pyrite group)

FORMULA: FeS2

FORMULA_NROFF: FeS_2

COLLECTION_LOCALITY: Rico, Colorado

ORIGINAL_DONOR: Hunt and Salisbury Collection

CURRENT_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

ULTIMATE_SAMPLE_LOCATION: USGS Denver Spectroscopy Laboratory

SAMPLE_DESCRIPTION:

Forms series with Cattierite (CoS_2). Dimorphous with Marcasite.

"SS-19. Pyrite. Rico, Colorado (35). Pyrite, FeS_2, is the most common and widespread of sulphides. It occurs in igneous, metamorphic and sedimentary rocks, as well as in veins. In the visible, pyrite displays the reflectivity vs. particle size behavior that is peculiar to opaque minerals - ie. reflectivity decreases as particle size decreases. It is also interesting that decreased absorption in the red region of the visible results in a significant contrast in reflectivity from the red to the blue, despite the sample's overall low reflectivity. In the near-infrared, the spectral behavior of pyrite changes from that of an opaque material to that of a transparent one. This sample is contaminated with grinder steel, which is probably responsible for its low reflectivity throughout. The smallest grain size is the only one which shows a rise in reflectivity to longer wavelengths, producing what appears to be an absorption edge between 1.1 and 1.5μ. We feel, however, that this is an artifact of the contamination in this sample, and that it should display a weak ferrous ion band near 1μ like marcasite, before changing from transparent to opaque behavior."

Sieve interval 74 - 250μm.

Hunt, G.R., J.W. Salisbury, and C.J. Lenhoff, 1971, Visible and near-infrared spectra of minerals and rocks: IV. Sulphides and sulphates. Modern Geology, v. 3, p. 1-14.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: None # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:

COMPOSITION_DISCUSSION:

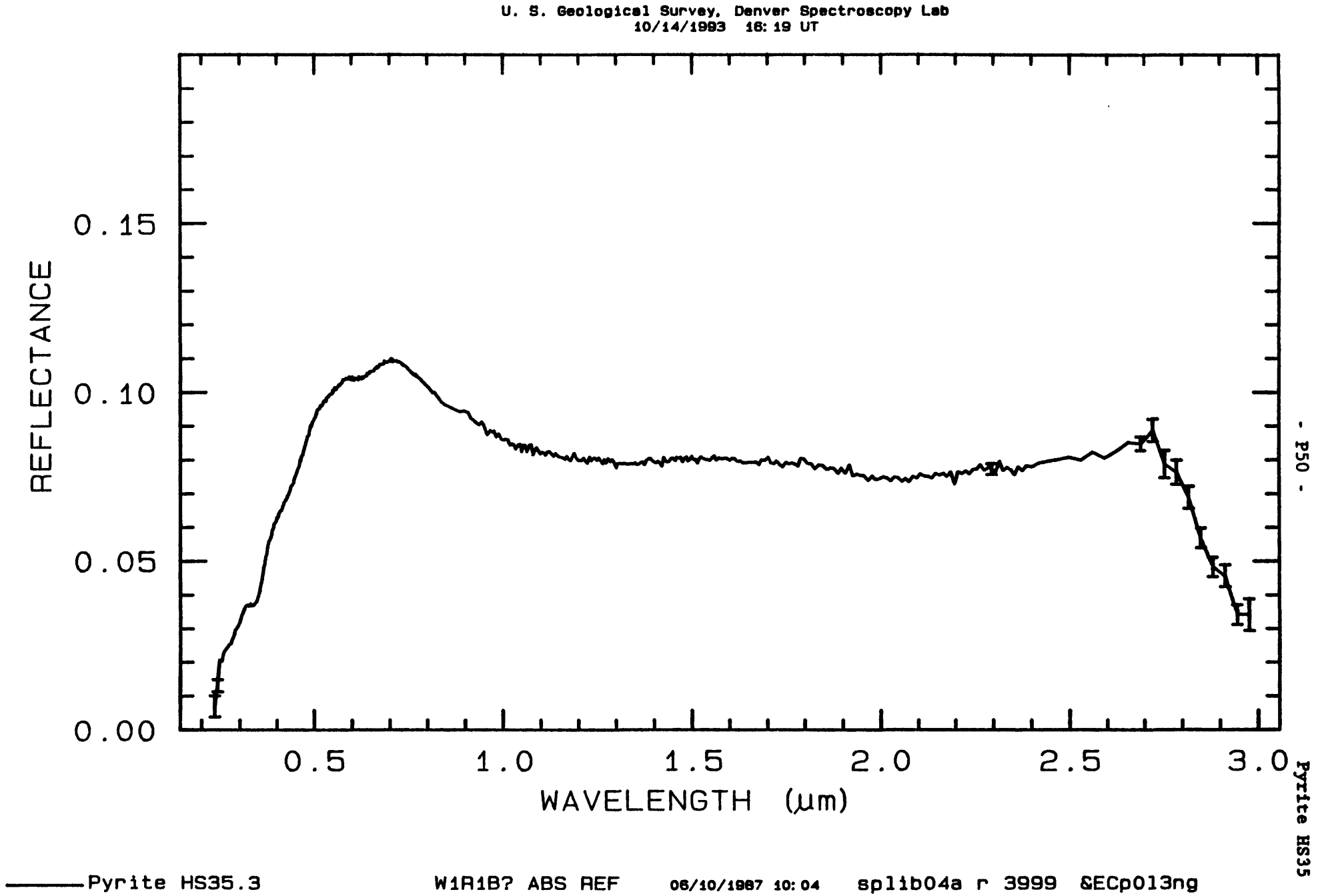
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 3999	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P50 -
Pyrite HS35
Pyrite HS35.3
W1R1B? ABS REF
06/10/1987 10:04
splib04a r 3999 &ECp013ng

TITLE: Pyrite S142-1 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S142-1

MINERAL_TYPE: Sulfide

MINERAL: Pyrite (Pyrite group)

FORMULA: FeS2

FORMULA_NROFF: FeS_2

COLLECTION_LOCALITY: Basal Shawangunk Formation, US Highway 84, Port Jervis S. Quad, NY

ORIGINAL_DONOR: Jules Friedman Field Sample

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Forms series with Cattierite (CoS_2). Dimorphous with Marcasite.

Field sample from a study done on the Shawangunk Region of New York.

For specific sample information refer to the following reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	10.0	ppm
COMPOSITION_TRACE:	As	350	ppm
COMPOSITION_TRACE:	Au	0.060	ppm
COMPOSITION_TRACE:	Cd	10	ppm
COMPOSITION_TRACE:	Cr	600	ppm
COMPOSITION_TRACE:	Cu	550	ppm
COMPOSITION_TRACE:	Hg	1.40	ppm
COMPOSITION_TRACE:	Mn	80	ppm
COMPOSITION_TRACE:	Ni	200	ppm
COMPOSITION_TRACE:	Pb	6000	ppm
COMPOSITION_TRACE:	Sb	<25	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.15	ppm
COMPOSITION_TRACE:	Tl	15	ppm
COMPOSITION_TRACE:	V	15	ppm
COMPOSITION_TRACE:	Zn	7000	ppm

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	
Sph	
Cpy	
Py	55.0
Qtz	46.0

Assay	wt%
Cu	0.07
Fe	25.60
Pb	0.59
Zn	0.64
S	27.1

For specific sample information refer to the following reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

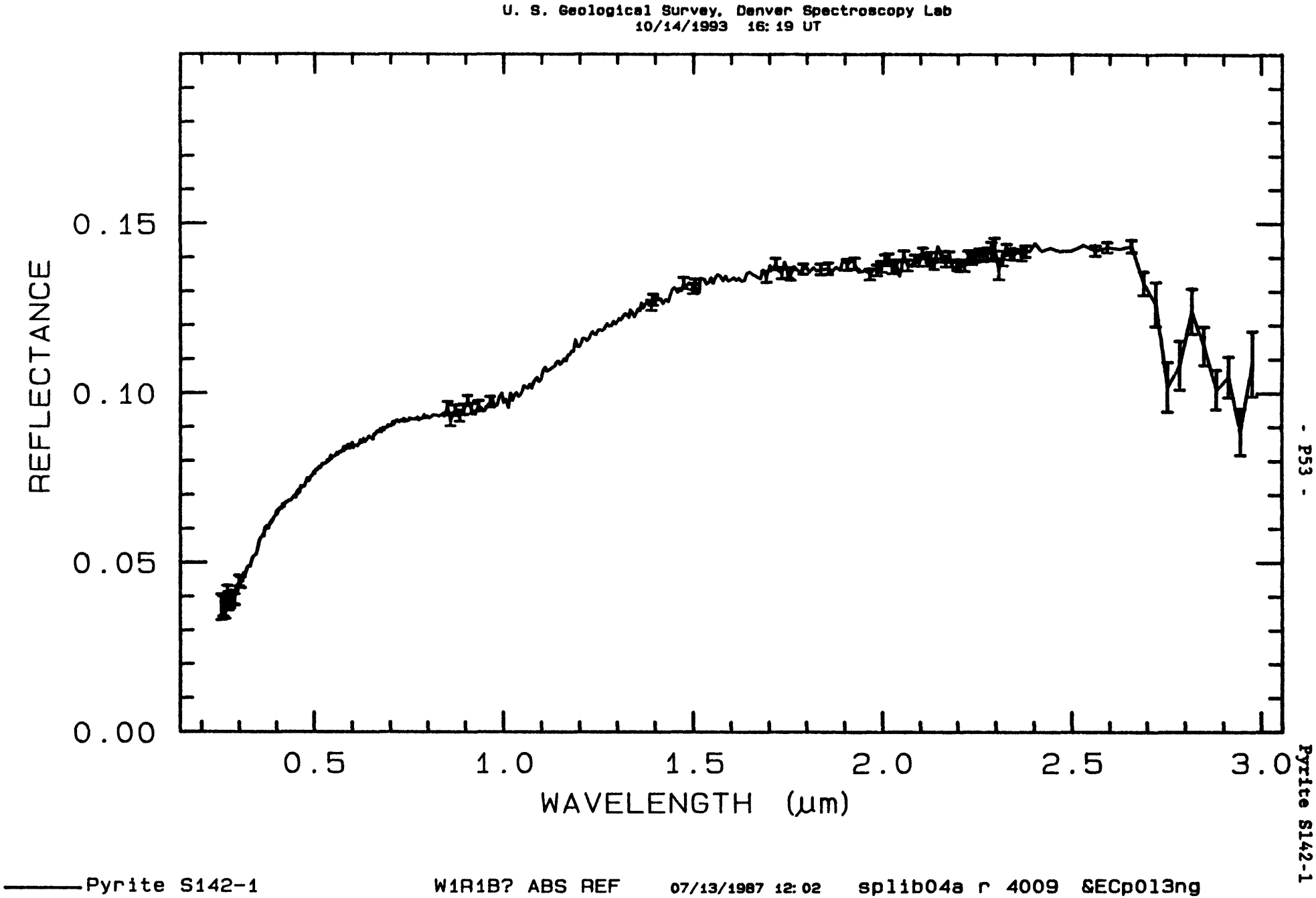
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4009	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P53 -
Pyrite S142-1
Pyrite S142-1
W1R1B? ABS REF
07/13/1987 12:02
splib04a r 4009 &ECp013ng

TITLE: Pyrite S26-8 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S26-8

MINERAL_TYPE: Sulfide

MINERAL: Pyrite (Pyrite group)

FORMULA: FeS2

FORMULA_NROFF: FeS_2

COLLECTION_LOCALITY: Ellenville (Ulster) Mine, Ellenville, Ulster County, NY

ORIGINAL_DONOR: Jules Friedman Field Sample

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Forms series with Cattierite (CoS_2). Dimorphous with Marcasite.

Field sample from a study done on the Shawangunk Region of New York.

For specific sample information refer to the following reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	<2.5	ppm
COMPOSITION_TRACE:	As	650	ppm
COMPOSITION_TRACE:	Au	0.220	ppm
COMPOSITION_TRACE:	Cd	10	ppm
COMPOSITION_TRACE:	Cr	250	ppm
COMPOSITION_TRACE:	Cu	30	ppm
COMPOSITION_TRACE:	Hg	0.035	ppm
COMPOSITION_TRACE:	Mn	35	ppm
COMPOSITION_TRACE:	Ni	50	ppm
COMPOSITION_TRACE:	Pb	40	ppm
COMPOSITION_TRACE:	Sb	<25	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.11	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	20	ppm
COMPOSITION_TRACE:	Zn	20	ppm

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	
Sph	
Cpy	
Py	95.0
Qtz	5.0

Assay	wt%
Cu	<0.01
Fe	43.43
Pb	<0.01
Zn	<0.01
S	44.8

Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

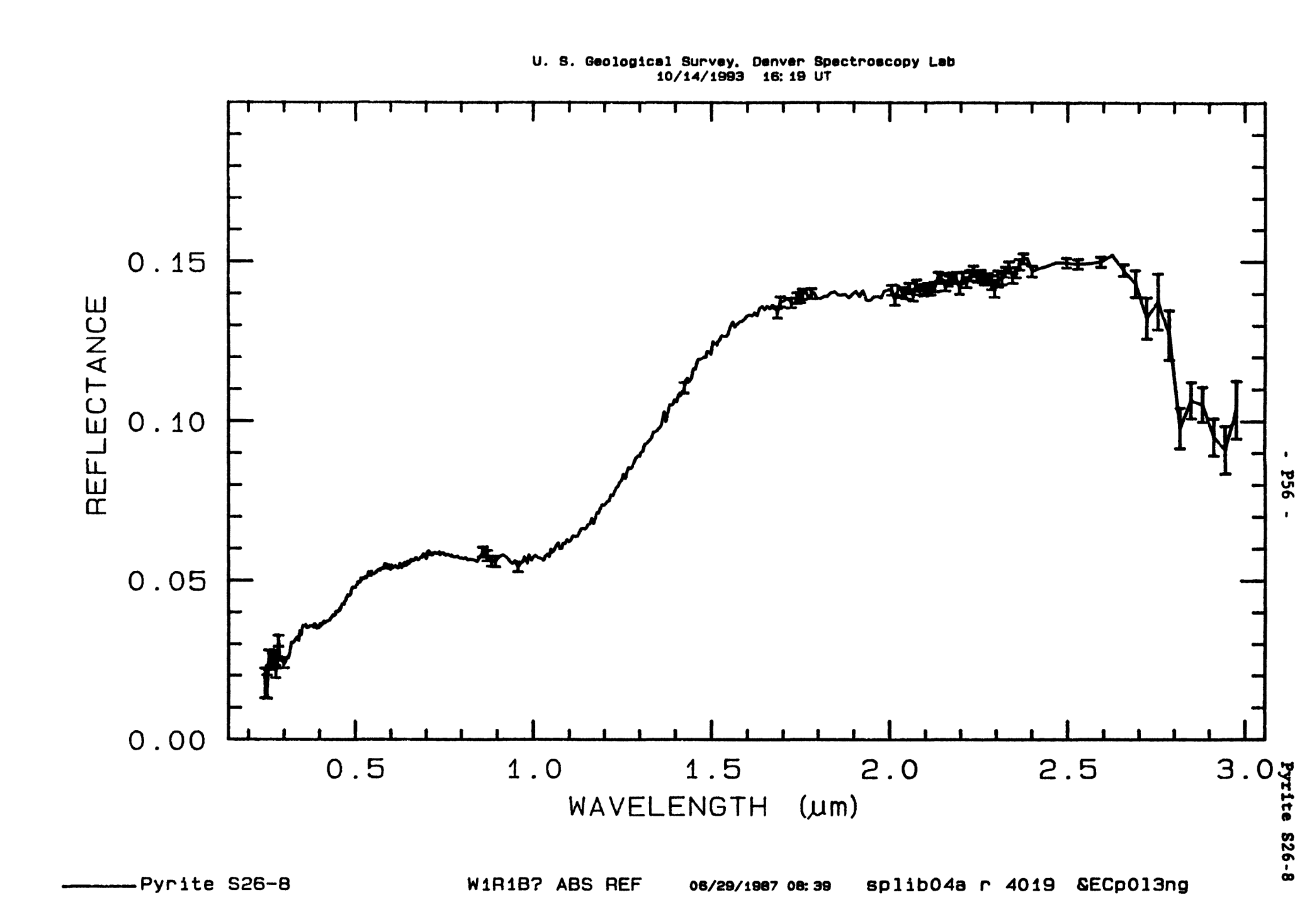
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4019	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
- P56 -
Pyrite S26-8
Pyrite S26-8
W1R1B? ABS REF
06/29/1987 08:39
splib04a r 4019 &ECp013ng

TITLE: Pyrite S29-4 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S29-4

MINERAL_TYPE: Sulfide

MINERAL: Pyrite (Pyrite group)

FORMULA: FeS2

FORMULA_NROFF: FeS_2

COLLECTION_LOCALITY: High Falls, Ulster County, NY (High Falls Shale)

ORIGINAL_DONOR: Jules Friedman Field Sample

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Forms series with Cattierite (CoS_2). Dimorphous with Marcasite.

Field sample from a study done on the Shawangunk Region of New York.

For specific sample information refer to the following reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem

COMPOSITION_TRACE:	Ag	8.0	ppm
COMPOSITION_TRACE:	As	<25	ppm
COMPOSITION_TRACE:	Au	0.010	ppm
COMPOSITION_TRACE:	Cd	<10	ppm
COMPOSITION_TRACE:	Cr	150	ppm
COMPOSITION_TRACE:	Cu	800	ppm
COMPOSITION_TRACE:	Hg	0.335	ppm
COMPOSITION_TRACE:	Mn	5	ppm
COMPOSITION_TRACE:	Ni	150	ppm
COMPOSITION_TRACE:	Pb		
COMPOSITION_TRACE:	Sb	<25	ppm
COMPOSITION_TRACE:	Se	<25	ppm
COMPOSITION_TRACE:	Te	0.12	ppm
COMPOSITION_TRACE:	Tl	<0.2	ppm
COMPOSITION_TRACE:	V	10	ppm
COMPOSITION_TRACE:	Zn	600	ppm

COMPOSITION_DISCUSSION:

Mode	wt%
Gal	6.0
Sph	
Cpy	
Py	80.0
Qtz	14.0

Assay	wt%
Cu	0.11
Fe	37.70
Pb	5.40
Zn	0.07
S	40.0

For specific sample information refer to the following reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

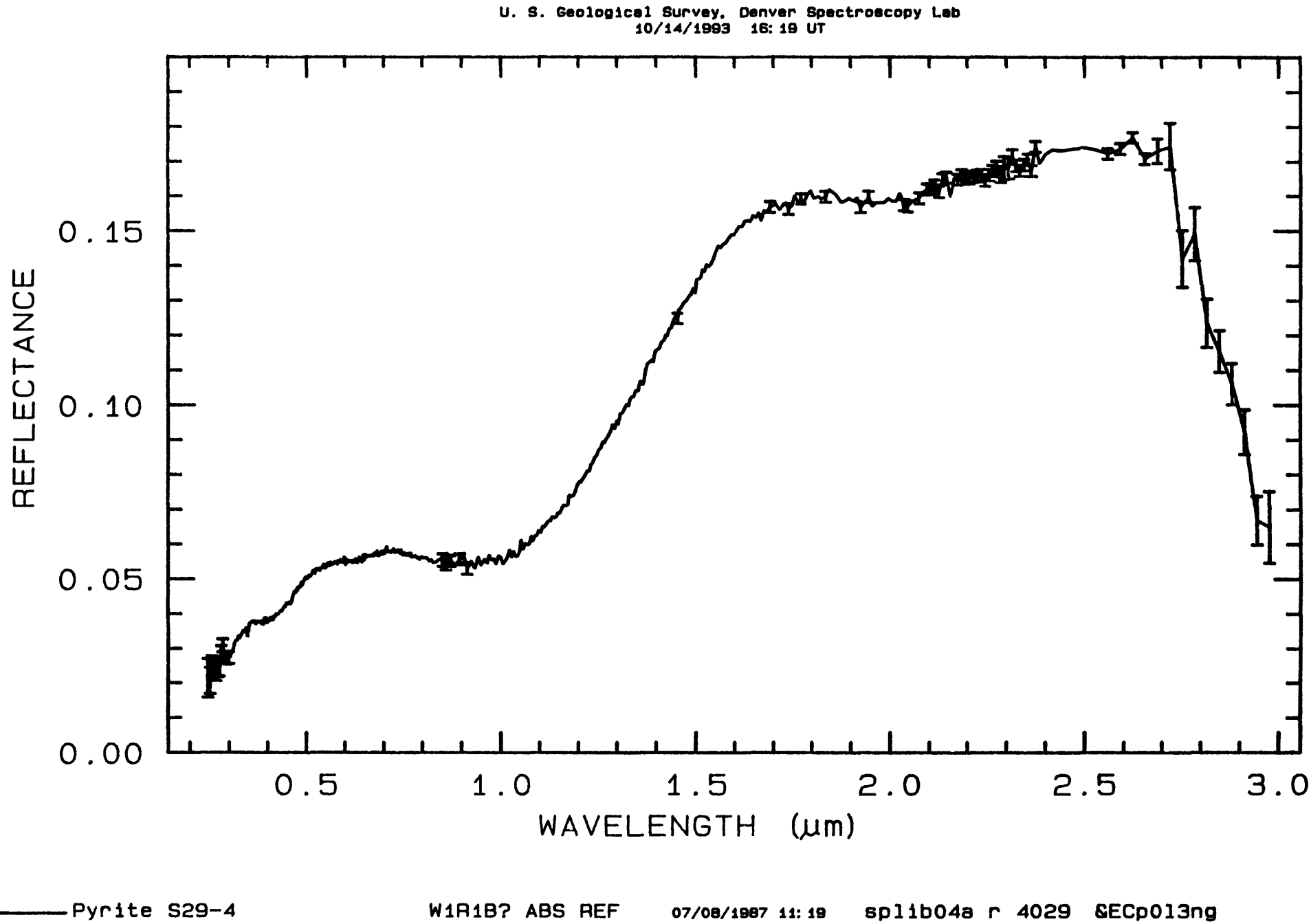
END_COMPOSITION_DISCUSSION.

MICROSCOPIC_EXAMINATION:

END_MICROSCOPIC_EXAMINATION.

DOCUMENTED_BY: bmiddleb@speclab (Barry J. Middlebrook)

LIB_SPECTRA_HED:	where	Wave Range	Av_Rs_Pwr	Comment
LIB_SPECTRA:	splib04a r 4029	0.2-3.0μm	200	g.s.=


U. S. Geological Survey, Denver Spectroscopy Lab
10/14/1993 16:19 UT
REFLECTANCE
0.15
0.10
0.05
0.00
0.5
1.0
1.5
2.0
2.5
3.0
WAVELENGTH (μm)
Pyrite S29-4
Pyrite S29-4 W1R1B? ABS REF 07/08/1987 11:19 splib04a r 4029 &ECp013ng

TITLE: Pyrite S30 DESCRIPT

DOCUMENTATION_FORMAT: MINERAL

SAMPLE_ID: S30

MINERAL_TYPE: Sulfide

MINERAL: Pyrite (Pyrite group)

FORMULA: FeS2

FORMULA_NROFF: FeS_2

COLLECTION_LOCALITY: Railroad quarry, Napanoch, Ulster County, NY

ORIGINAL_DONOR: Jules Friedman Field Sample

CURRENT_SAMPLE_LOCATION: USGS Reston, VA

ULTIMATE_SAMPLE_LOCATION: USGS Reston, VA

SAMPLE_DESCRIPTION:

Forms series with Cattierite (CoS_2). Dimorphous with Marcasite.

Field sample from a study done on the Shawangunk Region of New York.

For specific sample information refer to the following reference: Friedman, Jules D., Mutschler, Felix E., Zartman, Robert E., Briggs, Paul H., Swayze, Gregg A., Theisen, Arnold F., 1989, Shawangunk Ore District, New York: Geochemical and Spectral Data, U.S. Geological Survey Open File Report 89-193.

END_SAMPLE_DESCRIPTION.

XRD_ANALYSIS:

END_XRD_ANALYSIS.

COMPOSITIONAL_ANALYSIS_TYPE: ICP # XRF, EM(WDS), ICP(Trace), WChem