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A CATALOG OF STUDY MATERIAL OF RADIOACTIVE MINERALS

by

T. W. Stern

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Trace Elements Investigations Report 129

CONTENTS

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Introduction

This catalog is a list of specimens of radioactive minerals for which the Geological Survey has been collecting optical, X-ray diffraction, and other data. The specimens are in the study collections of the U. S. National Museum, the Mineralogical Museum of Harvard University (including some specimens on loan at Harvard from the American Museum of Natural History), and the Geological Survey. The listing does not include all specimens in these institutions, but it does include those specimens for which X-ray patterns can be made available as well as representative specimens from significant localities. In addition, references are given to material on deposit, at the U. S. National Museum, that has been described in the literature.

Because of the rarity of much of the material here listed, requests for study material must be considered individually. Regardless of the quantity of material, any request granted by the U. S. National Museum will have to be accepted on the terms laid down by that organization to conserve limited or rare minerals.

Those minerals that show external crystal form but do not give X-ray powder diffraction patterns are listed with the word "ignited" after the X-ray powder diffraction photograph number. The ignition was done in air to red heat except where noted.

In the course of work at Harvard on radioactive minerals many mineral species have been designated as "phases". Many of these phases have been identified as valid species already known; some new species have been established. Many phases remain unidentified and these present some problems. Some may be mixtures and others may not be uranium minerals. Phase numbers assigned by Professor Frondel of Harvard University are given in the list for some species.

The grouping of the minerals in this list follows that in "A glossary of uranium- and thorium-bearing minerals," by Judith Weiss Frondel and Michael Fleischer (U. S. Geological Survey Circular 74). Optical properties are given for most of the minerals except the silicates, and such data are taken largely from volumes 1 and 2 of the 7th Edition of Dana's System of Mineralogy.

The following entry, partly fictitious for illustration's sake, shows the form used in the list:

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Vanoxite 1/ USNM 95059	Bill Bryan claim, Wild Steer Canyon, Montrose County, Colo.	TE 474	USGS-XS USNM-150 g HMM-3x3,M

1/ Hess, F. L., U. S. Geol. Survey Bull. 750-D, 63 (1925).

The first column gives the mineral name and the institutional number of the specimen; the second column, the locality; the third, the reference number of any X-ray diffraction powder patterns that have been made; and the fourth, the quantity of material available. In the example given above the Geological Survey has enough material for X-ray

and spectrographic analysis; the U. S. National Museum has about 150 grams of this mineral; and the Harvard Mineralogical Museum has a moderately incrusted specimen measuring about 3 by 3 centimeters.

The kindness of Dr. George Switzer of the U. S. National Museum and Professor Clifford Frondel of Harvard University for their many helpful suggestions is gratefully acknowledged. Joseph Berman, Theodore Botinelly, J. H. Eric, Judith Weiss Frondel, K. J. Murata, John C. Rabbitt, and Jane Titcomb of the Geological Survey also have aided in the work.

The following abbreviations are used:

AMNH	American Museum of Natural History.
C	Enough material for one chemical analysis.
H	Heavily incrusted specimen with area of specimen given in centimeters.
Har.	Harvard X-ray powder pattern.
HMM	Harvard Mineralogical Museum.
Inv.	Investigations Section, Geochemistry and Petrology Branch, U. S. Geological Survey.
L	Lightly incrusted specimen with area given in centimeters.
M	Moderately incrusted specimen with area given in centimeters.
S	Enough material for one spectrographic analysis.
TE	Trace Elements Section, Geochemistry and Petrology Branch, U. S. Geological Survey.
USGS	U. S. Geological Survey.
USNM	U. S. National Museum.
USNM C	U. S. National Museum Canfield Collection.
USNM R	U. S. National Museum Roebling Collection.
X	Enough material for one X-ray powder pattern.

GROUP A. URANIUM AND THORIUM MINERALS

AMPANGABEITE $(Y,Er,U,Ca,Th)_2(Cb,Ta,Fe,Ti)_7O_{18}$?

Optics 1/

In transmitted light, red brown in color and isotropic (metamict). n = 2.13 ± 0.03 (Ampangabé).

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Ampangabeite USNM C4020	Samiresy, Betafo, Madagascar	---	USGS-XS USNM-100 g
Ampangabeite HMM 88874	Ambatofosikely, Madagascar	Har. 11299 Not ignited, no pattern	---
Ampangabeite HMM 88874	Ambatofosikely, Madagascar	Har. 11302 Ignited, faint pattern	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 39 (1921).

ANDERSONITE $Na_2Ca(UO_2)(CO_3)_3 \cdot 6H_2O$

Optics 1/

	n	Dichroism	
O	1.520	Colorless	
E	1.540	Pale yellow	Uniaxial positive (+)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Andersonite 1/ USNM	Hillside mine, Yavapai County, Ariz.	Inv. 2791	USNM-2 mg

1/ Milton, Charles, U. S. Geol. Survey, personal communication.

AUTUNITE $Ca(UO_2)_2(PO_4)_2 \cdot 10\text{-}12H_2O$

Optics

Orientation	n(Autun)1/	n(Maryland)2/	n 3/	Dichroism
(E) X	1.553	1.555	1.58-1.59	Colorless to pale yellow
Y	1.575	1.575		Yellow to dark yellow
(O) Z	1.577	1.578	1.59-1.60	Yellow to dark yellow

Some anomalous biaxial negative autunite is uniaxial. The biaxiality is dependent on the water content of the crystals and 2V decreases with decreasing water content. In the biaxial material, 2V ranges from 0° to about 53° and usually is 10° to 30° with r > v, strong; Z = c and Y is parallel to one of the diagonals of the square tablets. The tetragonal dehydration product, meta-autunite I, also shows a sectoral, biaxial character with 2V decreasing to 0° with decreasing water content; Z = c and Y is perpendicular to the edges of the tablets. The indices of refraction in both hydrates increase with decreasing water content. Some of the reported descriptions of autunites probably refer to meta-autunite I

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Autunite HMM Phase 14	Gross Green, Ruggles mine, N. H.	Har. 1640	---
Autunite HMM Phase 14	Argentina	Har. 5546	---
Autunite USNM 87239	Mount Painter, Victoria, Australia	---	USGS-XS USNM-3x3,M
Autunite USNM R5672	Mount Painter, Victoria, Australia	---	USGS-XS USNM-3x6,M
Autunite? HMM(CC-4) Phase 17	Cornwall, England	Har. 3936	HMM-6x6,M
Autunite USNM C4384	Autun, France	---	USGS-XS USNM-20 g
Autunite USNM 79981	Autun, France	TE 3122	USNM-20 g

Autunite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Autunite USNM R5676	Lurissa, Italy	---	USGS-XS USNM-12x8,M
Autunite? TE	Mina de Urgeiriça, Portugal	---	USGS-XS
Autunite USNM R5675	Lauter, Saxony	---	USGS-XS USNM-3x3,M

1/ Michel-Levy, A., and Lacroix, Alfred, Les minéraux des roches, 157 (1888).
2/ Shannon, E. V., Am. Mineralogist 11, 35 (1926).
3/ Meixner, Heinz, Chemie der Erde 12, 433 (1940).

BASSETITE $Fe(UO_2)_2(PO_4)_2 \cdot 8H_2O$

Optics

Orientation	n(Na)	Pleochroism	
X b	(~1.56)	Pale yellow	Biaxial
Y	1.574	Deep yellow	negative (-)
Z∧c-4°	1.580	Deep yellow	2V~62°

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Bassetite USNM R7906 Phase 15	Cornwall, England	TE 3126	USNM-3x3,L
Bassetite USNM C4386	Cornwall, England	---	USGS-XS USNM-6x6,L
Bassetite AMNH 19786	Wheal Basset mine Cornwall, England	---	HMM-3x3,L

BAYLEYITE $Mg_2(UO_2)(CO_3)_3 \cdot 18H_2O$

Optics 1/

Orientation	n	Pleochroism	
X	1.455	Pinkish?	
Y	1.490	Pale yellow	Biaxial negative (-)
Z	1.500	Pale yellow	$2V = 30^\circ$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Bayleyite	Hillside mine, Yavapai County, Ariz.	Inv. 2777	None, now meta-bayleyite

Meta-bayleyite $Mg_2(UO_2)(CO_3)_3 \cdot ?H_2O$

Optics

	n
X	1.502
Z	1.551

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Meta-bayleyite USNM ?	Hillside mine Yavapai County, Ariz.	Inv. 4004	USNM-small quantities can be separated from 500 g of ro

1/ Milton, Charles, U. S. Geol. Survey, personal communication.

BECQUERELITE $2UO_3 \cdot 3H_2O$?

Optics

Yellow in transmitted light. With increasing temperature 2V decreases, and the mineral is uniaxial at about 100°C.1/

Becquerelite---Optics (Cont.)

Orientation		n 2/	Pleochroism	
X	c	1.735	Colorless	Biaxial negative (-)
Y	b	1.820	Light yellow	2V = 31° (Na)
Z	a	1.830	Dark yellow	r > v, marked.2/

Specimen Data

Mineral and identifying number	Location	Ref. no of X-ray patterns	Quantity
Becquerelite USNM 104784	Chinkolobwe, Belgian Congo	---	USGS-XS USNM-6x6,M
Becquerelite USNM R5896	Chinkolobwe, Belgian Congo	---	USGS-XS USNM-300 g
Becquerelite USNM R6701	Chinkolobwe, Belgian Congo	---	USGS-XS USNM-6x6,M
Becquerelite HMM 87086 Phase 78	Katanga, Belgian Congo	Har. 1193	HMM-1 g
Becquerelite USNM R8391	Kalongwe, Belgian Congo	---	USGS-XS

1/ Schoep, Alfred, Soc. géol. Belgique Bull. 33, 197 (1923).
2/ Berman, Harry, in Palache, Charles, and Berman, Harry, Am. Mineralogist 18, 20 (1933). Billiet, V., Soc. franç. minéralogie Bull. 49, 136 (1926), gives nX = 1.750, nY = 1.87, nZ = 1.88.

BETAFITE $(U,Ca)(Cb,Ta,Ti)_3O_9 \cdot nH_2O$?

Optics 1/

In transmitted light nearly colorless and isotropic. n = 1.915 ± 0.02 (Antaifasy), 1.925 ± 0.01 (Betafo), 1.92 - 1.96 (samiresite).

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Betafite USNM 96864	Madagascar	---	USGS-XS USNM-500 g

Betafite---Specimen Data (Cont.)

Blomstrandite--Synonym of betafite

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Blomstrandite USNM 92976	Betafo, Madagascar	TE 649	USGS-XS USNM-75 g
Blomstrandite HMM 87873	Tongafeno, Madagascar	Har. 2020 Ignited	---

Samiresite--Synonym of betafite

Samiresite USNM C3958	Samiresy, Madagascar	---	USGS-XS USNM-75 g
Samiresite HMM 87813	Samiresy, Madagascar	Har. 344 Not ignited, no pattern	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 46, 130 (1921).

BRANNERITE $(U,Ca,Fe,Y,Th)_3Ti_5O_{16}$?

Optics

In transmitted light, yellowish green. Metamict. Isotropic. Indices:1/ n_{Li} 2.26 ± 0.02, n_{Na} 2.30 ± 0.02.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Brannerite USNM 96023	Poncia placer, Boise County, Idaho	TE 698 Ignited	USGS-XS USNM-75 g
Brannerite TE 1761-B	---	TE 221	---
Brannerite	Kelly Gulch, Custer County, Idaho	Inv. 2785 Ignited	---
Brannerite 1/ USNM 105793 USNM 94286	Kelly Gulch, Custer County, Idaho	---	---

Brannerite (Cont.)

1/ Hess, F. L., and Wells, R. C., Franklin Inst. Jour., 189, 225 (1920).

CALCIOSAMARSKITE
$(Ca,Y,etc.,U,Th)_3(Cb,Ta,Fe,Ti,Sn)_5O_{15}$
and
$(Ca,Y,etc.,U,Th,Zr)_3(Cb,Ta,Fe,Ti)_5O_{16}$

Optics

Brownish and isotropic (metamict) in transmitted light. n = 2.015 1/ (Hybla), 2.095 (Parry Sound).

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Calciosamarskite USNM 103439	Hillside, W. Australia	TE 757 Ignited	USGS-XS USNM-25 g
Calciosamarskite HMM 90523	Hybla, Hastings County, Ontario	Har. 2015 Ignited	HMM-10 g
"Calciosamarskite" HMM 90522	Parry Sound, Ontario	Har. 2014 Ignited	---

1/ Larsen, E. S., and Berman, Harry, U. S. Geol. Survey Bull. 848, 61 (1934).

CARNOTITE $K_2(UO_2)_2(VO_4)_2 \cdot 3H_2O$

Optics

Orientation		n(Long Park, Colo.) 1/	n 2/	Pleochroism	
X	c	1.750		Nearly colorless	Biaxial
Y	b	1.925	2.06	Canary yellow	negative (-)
Z	a	1.950	2.08	Canary yellow	2V~40° (whit ~50° (Na)

Carnotite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Carnotite HMM 24675 Phase 82	McIntyre Canyon, San Miguel County, Colo.	Har. 4224	HMM-50 g
Carnotite USNM 90449	Mesa County, Colo.	---	USNM-100 g
Carnotite USNM 92010	Gateway, Colo.	---	USGS-XS USNM-25 g
Carnotite USNM 97070	Long Park, Montrose County, Colo.	---	USGS-XS USNM-300 g
Carnotite 3/ USNM 84531	Copper Prince mine Roc Creek, Montrose County, Colo.	---	USNM-50 g
Carnotite 4/ USNM 85710-712	Copper Prince claim, Roc Creek, Montrose County, Colo.	---	USNM-200 g
Carnotite 5/ TE-LRS/13/48	Jo Dandy mine, Paradox Valley, Montrose County, Colo.	TE 40	USGS-XSC
Carnotite 5/ TE-LRS/20/48	Radium No. 6 mine, Radium group, San Miguel County, Colo.	TE 42	USGS-XSC
Carnotite 5/ TE-LRS/25/48	Calamity No. 13 mine, Calamity Mesa, Mesa County, Colo.	TE 43	USGS-XSC
Carnotite 5/ TE-LRS/28/48	Calamity No. 13 mine, Calamity Mesa, Mesa County, Colo.	TE 44	USGS-XSC
Carnotite 5/ TE-LRS/61/48	Club mine, Uravan area, Montrose County, Colo.	TE 45	USGS-XSC
Carnotite 5/ TE-LRS/62/48	Club mine, Uravan area, Montrose County, Colo.	TE 46	USGS-XSC

Carnotite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Carnotite 5/ TE-LRS/63/48	Club mine, Uravan area, Montrose County, Colo.	TE 47	USGS-XSC
Carnotite USNM 91286	South side San Miguel River, 16 mi. west of Naturita, Colo.	Inv. 4169	USNM-300 g
Carnotite ore TE	Bald Eagle No. 2 mine, San Miguel County, Colo.	---	USGS-1½ bbl.
Carnotite ore TE	Garbut group, San Juan County, Colo.	---	USGS-1 bbl.
Carnotite ore TE	Ownbey group, San Miguel County, Colo.	---	USGS-½ bbl.
Carnotite ore TE	Rico mine, San Juan County, Colo.	---	USGS-1 bbl.
Carnotite ore TE	Yellow Bird group, Montrose County, Colo.	---	USGS-3/4 bbl
Carnotite ore TE	Gypsum Valley, Colo.	---	USGS-3/4 bbl
Carnotite ore TE	Fall Creek, Colo.	---	USGS-1 bbl.
Carnotite HMM(TC-C) Phase 58	Mauch Chunk, Pa.	Har. 3943	HMM-9x12,L
Carnotite 5/ TE-LRS/1/48	Parco mine, Yellow Cat group, Thompson area, Grand County, Utah	TE 38	USGS-XSC
Carnotite 2/ USNM 95332 USNM R5696	Cane Springs Pass, 16 mi. SE Moab, Utah	Inv. 4165 of USNM 95332	USNM-21x9,H
Carnotite ore TF	Mexican Hat area, San Juan County, Utah	---	USGS-3/4 bbl

Carnotite--Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Carnotite ore TE	Henry Mountains, Utah	---	USGS-1 bbl.
Carnotite USNM 87282	Olary, South Australia	---	USGS-X USNM-9x5,M
Carnotite HMM(TC-2)	Olary, South Australia	TE 3069 and Har. 3941	HMM-6x6,L

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 273 (1921).
2/ Hess, F. L., and Foshag, W. F., U. S. Nat. Museum Proc. 72, art. 12 (1927).
3/ Hillebrand, W. F., and Ransome, F. L., Am. Jour. Sci, 4th ser., 10, 120-144 (1900).
4/ Hillebrand, W. F., and Ransome, F. L., U. S. Geol. Survey Bull. 262, 9 (1905).
5/ Stieff, L. R., Girhard, M. N., and Stern, T. W., U. S. Geol. Survey TEI Rept. 108.

CLARKEITE $UO_3 \cdot nH_2O$?

Optics

Orange in transmitted light.

	n	
X	1.997	Biaxial negative (-)
Y	2.098	2V 30°-50°
Z	2.108	r < v, weak

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Clarkeite USNM 96482 Phase 27	Fannie Gouge mine, Spruce Pine, N. C.	TE 3145	USNM 200 g
Clarkeite HMM(SL1A) Phase 27	near Spruce Pine, N.C.	Har. 3856	HMM-3x3,M

Clarkeite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Clarkeite USNM 103189	Fannie Gouge mine, Spruce Pine, N. C.	---	USGS-XS USNM-150 g
Clarkeite USNM C5415	Spruce Pine, N. C.	---	USGS-XS USNM-100 g
Clarkeite 1/ USNM 96510	Spruce Pine, N. C.	---	USNM-5 g
Clarkeite 2/ USNM R6607	Deer Park mine, Spruce Pine, N. C.	---	USNM-5 g

1/ Henderson, E. P., Am. Mineralogist 16, 214 (1931).
2/ Ross, C. S., Henderson, E. P., and Posnjak,E., Am. Mineralogist 16, 213 (1931).

CUPROSKLODOWSKITE $Cu(UO_2)_2Si_2O_7 \cdot 6H_2O$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Cuprosklodowskite USNM R8383	Kalongive,Katanga, Belgian Congo	TE 297	USGS-XS USNM-9x9,M
Cuprosklodowskite USNM R8384	Kambowe, Katanga, Belgian Congo	---	USGS-XS USNM-30 g
Cuprosklodowskite USNM R8391	Kalongive,Katanga, Belgian Congo	---	USGS-XS USNM-6x9,M
Cuprosklodowskite HMM 96587 Phase 11	Joachimsthal, Bohemia	Har. 3835	HMM-3x9,L

Uranochalcite--A hydrous, copper, uranium, and calcium sulfate, of questionable validity.

Uranochalcite? HMM 807 Phase 67	Joachimsthal, Bohemia	Har. 1630	HMM-3x6,L

Uranochalcite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uranochalcite? HMM 807 Phase 73	Joachimsthal, Bohemia	Har. 1631	HMM-3x6,L
Uranochalcite? AMNH 19156	Joachimsthal, Bohemia	---	HMM-3x6,L

Voglianite--A hydrous calcium and uranium sulfate, of questionable validity. The type material of Vogl for uranochalcite and voglianite has not been found. Present museum specimens bearing these names have proved to be cuprosklodowskii

Voglianite? AMNH 16824	Joachimsthal, Bohemia	---	HMM-6x6,L

CURITE $Pb_2U_5O_{17}\cdot 4H_2O$?

Optics

In transmitted light, yellow to reddish orange.

Orientation		n 1/	n 2/	Pleochroism	
X	b	2.06		Pale yellow	Biaxial negative (-)
Y	a	2.11	2.07	Light red orange	2V large
Z	c	2.15	2.12	Dark red orange	r > v, strong

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Curite USNM C4512 Phase 49	Chinkolobwe mine, Kasola, Katanga, Belgian Congo	TE 3142	USNM-100 g
Curite USNM C4513	Chinkolobwe mine, Kasola, Katanga, Belgian Congo	---	USGS-XS USNM-100 g
Curite USNM 94711	Kasola mine, Belgian Congo	---	USGS-XS USNM-100 g
Curite USNM 94713	Kasola mine, Belgian Congo	---	USGS-XS

Curite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Curite USNM 95601	Chinkolobwe mine, Belgian Congo	---	USGS-XS USNM-200 g
Curite USNM 95603	Katanga, Belgian Congo	---	USGS-XS USNM-200 g
Curite? USNM 104784	Chinkolobwe, Belgian Congo	---	USGS-XS USNM-75 g
Curite USNM R5896	Chinkolobwe mine, Kasola, Katanga, Belgian Congo	---	USGS-XS USNM-100 g
Curite USNM R5901	Chinkolobwe mine, Kasola, Katanga, Belgian Congo	---	USGS-XS USNM-100 g
Curite HMM Phase 49	Katanga, Belgian Congo	Har. 1129	---
Curite HMM 91181 Phase 50	Wälsendorf, Bavaria	Har. 3921	USGS-3x9,L

1/ Larsen, E. S., and Berman, Harry, U. S. Geol. Survey Bull. 848, 209 (1934).
2/ Billiet, V., Soc. franç. minéralogie Bull. 49, 136 (1925).

DELORENZITE $(Y,U,Fe^{2})(Ti,Sn)_3O_8$?

Optics

In transmitted light, chestnut brown. Metamict and isotropic.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Delorenzite HMM 89594	Val Vigesso Italy	Har.11350 Ignited Har.11307 Ignited, faint patterns	---

DEWINDTITE $Pb_3(UO_2)_5(PO_4)_4(OH)_4 \cdot 10H_2O$

Optics 1/

Not pleochroic.

Orientation		n	
X	b	1.762	Biaxial positive (+)
Y	c	1.763	r < v
Z	a		2E large

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Dewindtite USNM 95605	Chinkolobwe, Katanga, Belgian Congo	TE 3137	USGS-XS USNM-25 g
Dewindtite USNM C4513	Chinkolobwe, Katanga, Belgian Congo	---	USGS-XS USNM-100 g
Dewindtite USNM C4516	Chinkolobwe, Katanga, Belgian Congo	---	USGS-XS USNM-50 g
Dewindtite USNM R5901	Chinkolobwe, Katanga, Belgian Congo	---	USGS-XS USNM-100 g
Dewindtite HMM W-1 Phase 46	Wälsendorf, Bavaria	---	---

1/ Schoep, Alfred, Soc. franç. minéralogie Bull. 48, 77 (1925).

DJALMAITE $(U,Ca,Pb)(Ta,Cb,Ti)_3O_9 \cdot nH_2O$

Optics

Transparent in thin splinters, with a yellowish-brown color n = 1.97

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Djalmaite USNM 105973	Volta Grande deposit, Nazareno district, São João del Rei, Minas Geraes, Brazil	TE 599	USGS-XS USNM-10 g

DUMONTITE $Pb_2(UO_2)_3(PO_4)_2(OH)_4 \cdot 3H_2O$

Optics

Orientation		n	Pleochroism	
X	a	1.88	Pale yellow	Biaxial psoitive (+)
Y	c			r < v
Z	b	1.89	Deep yellow	2V large

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Dumontite USNM 95884	Chinkolobwe, Katanga, Belgian Congo	TE 3169	---
Dumontite USNM 97140	Chinkolobwe, Katanga, Belgian Congo	---	USGS-XS USNM-6x6,M
Dumontite USNM R6701	Chinkolobwe, Katanga, Belgian Congo	---	USGS-XS USNM-10x12,I

EPIIANTHINITE $yUO_3 \cdot xH_2O$?

Optics 1/

Orientation		n	Pleochroism	
X	c	1.70	Pale yellow	Biaxial negative (-)
Y	b	1.79	Yellow	2V small
Z	a	1.793	Deep yellow	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Epiianthinite? USNM R8378	Katanga, Belgian Congo	---	USGS-X USNM-9x12,L
Epiianthinite? USNM R8368	Katanga, Belgian Congo	---	USGS-XS USNM-15x21,I

1/ Schoep, Alfred, and Stradiot, Sadi, Am. Mineralogist 32, 344-350 (1947).

ESCHYNITE $(Ce,Ca,Fe?,Th)(Ti,Cb)_2O_6$

Optics

Isotropic (metamict) and transmits light in only the thinnest splinters. Reddish brown to light brown. Becomes anisotropic on ignition, and the refractive index increases somewhat.1/ n = 2.26 ± 0.01,2/ increasing to 2.285 on ignition.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Eschynite HMM 87857	Statoust, Urals	Har. 2016 Ignited	---
Eschynite HMM 87859	Miask, Urals	Har. 1872 Ignited	---
Eschynite HMM 58082	Hitterö, Norway	Har. 1912 Ignited	---
Eschynite USNM 94581	Hitterö Norway	TE 24 Ignited	USGS-XS USNM-30 g
Eschynite HMM 84641	Saetersdalen, Norway	Har. 1853 Ignited	---

1/ Larsen, E. S., and Berman, Harry, U. S. Geol. Survey Bull. 848, 65 (1934).
2/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 72 (1921).

EUXENITE $(Y,Ca,Ce,U,Th)(Cb,Ta,Ti)_2O_6$

Optics 1/

In transmitted light, brown, yellow brown, or reddish brown. Isotropic (metamict). The refractive index increases after ignition.

n	
2.24 ± 0.02	(Hitterö, Norway)
2.195	(no locality; 2.23 after ignition)
2.06	(no locality; 2.22 after ignition)

Euxenite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Euxenite TE	---	TE 26	---
Euxenite HMM	Colorado from A. C. Lane	Har. 2275 Ignited	---
Euxenite USNM 97694	Castello Branco, Fazenda de Sta. Clara, 11 kms. from Tocantens Pomba, Minas Geraes, Brazil	---	USGS-XS USNM-150 g
Euxenite HMM	Brazil	Har. 9545 Ignited Har. 9555 Ignited	---
Euxenite HMM 90791	South Sherbrooke Township, Lanark County, Ontario	Har. 1710 Ignited 3 hrs. to red heat	---
Euxenite USNM 103025	Lot 12, Con. 5, South Sherbrooke Township, Ontario	---	USGS-XS USNM-300 g
Euxenite HMM 84648	Tangen Quarry, near Kragerö, Norway	Har. 2029 Ignited	HMM-100 g
	Lyndochite--Variety of euxenite		
Lyndochite HMM 90520	Lyndoch Township, Ontario	Har. 1926 Ignited	HMM-5 g
Lyndochite USNM 102745	Lyndoch Township, Ontario	TE 748 Ignited	USGS-XS USNM-20 g
	Tanteuxenite--Variety of euxenite		
Tanteuxenite USNM 96284	Wleys, West Australia	TE 653	USGS-XS USNM-10 g
Tanteuxenite HMM 90701	Pilbara Goldfield, West Australia	Har. 2026	---

Euxenite---Specimen Data (Cont.)

Toddite--Possibly a mixture of columbite and euxenite

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Toddite HMM 90526	Dill Township, Ontario	Har. 334	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 73 (1921); and Larsen, E. S., and Berman, Harry, U. S. Geol. Survey Bull. 848, 62, 63, 64 (1934).

FERGUSONITE $(Y,Er,Ce,Fe)(Cb,Ta,Ti)O_4$

Optics

In transmitted light, light brown to dark brown, and some specimens cloudy. The metamict material is isotropic. On ignition it becomes anisotropic but in such fine grain as to permit measurement only of the mean index of refraction.1/ Large ignited grains, however, may exhibit birefringence possibly due to strain. 1/ Refractive indices:

	Metamict	Ignited (mean index)
Baringer Hill, Texas 2/	2.19 ± 0.02	
Boksput, Africa 3/	2.05	
Risör, Norway 4/	2.08	2.07
No locality 4/	2.115	2.070
No locality	2.175	2.142
Risör, Norway	2.08	2.08
Virginia	2.06	2.06

Anisotropic crystals with an isotropic (metamict) shell have been found at Hundholmen, Norway.5/ Uniaxial, negative (-), with strong birefringence and weak pleochroism, O > E.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Fergusonite HMM 81181	Petaca, N. Mex.	Har. 2031 Ignited Har. 2030 Ignited	---

Fergusonite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Fergusonite USNM 80705	Spruce Pine, Mitchell County, N.C.	TE 745 Ignited	USGS-XS USNM-30 g
Fergusonite USNM R5878	Llano County, Texas	---	USGS-XS USNM-50 g
Fergusonite USNM C4510	Llano County, Texas	TE 727 Ignited	USGS-XS USNM-100 g
Fergusonite HMM 87817	Rulandsdalens, near Risör, Norway	Har. 1838	---
Fergusonite HMM 58254	Ytterby, Sweden	Har. 1910 Ignited	---
	Adelpholite--Synonym of fergusonite? A poorly defined substance, possibly an altered mossite.		
Adelpholite USNM R5058	Tammela, Finland	---	USGS-XS USNM-150 g
	Arrhenite--An altered fergusonite		
Arrhenite USNM R5135	Ytterby, Sweden	---	USGS-XS USNM-25 g
	Bragite--Synonym of fergusonite		
Bragite USNM R5051	Arendal, Norway	---	USGS-XS USNM-10 g
	Risörite--Synonym of ergusonite		
Risörite USNM 93038	Risör, Norway	---	USGS-XS USNM-50 g
	Rutherfordite--An altered fergusonite		
Rutherfordite USNM R5054	Rutherford County, N. C.	---	USGS-XS USNM-2 g

Fergusonite---Specimen Data (Cont.)

Sipylite--Synonym of fergusonite

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Sipylite USNM R5057	Little Friar Mountain Amherst County, Va.	---	USGS-XS USNM-20 g

Tyrite--Synonym of fergusonite

Tyrite USNM R7138	Helle, Naskilen, Arendal, Norway	---	USGS-XS USNM-500 g

1/ Barth, T. F. W., Norsk geol. tidsskr. 9, 23 (1926).
2/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 74 (1921).
3/ Mountain, Rec. Albany Museum, Grahamstown, 4, 122 (1931).
4/ Barth, T. F. W., and Berman, Harry, Chemie der Erde 5, 37 (1930).
5/ Vogt, J. H. L., Centralbl. Mineralogie, 373 (1911).

FORMANITE $(U,Th,Ca)(Ta,Cb,Ti)O_4$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Formanite HMM 8614A	---	Har. 2850 Ignited	---
Formanite HMM 8614B	---	Har. unnumbered Ignited	---

FOURMARIERITE $PbU_4O_{13}\cdot 5H_2O$?

Optics 1/

In transmitted light, yellow or reddish yellow. Pleochroic in shades of yellow and orange.

Orientation		n	Pleochroism	
X	c	1.85	Colorless	Biaxial negative (-)
Y	b	1.92	Pale yellow	2V large
Z	a	1.94	Yellow	r> v, strong

Fourmarierite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Fourmarierite USNM R5899	Chinkolobwe mine, Belgian Congo	TE 601	USGS-XS USNM-15 g

1/ Larsen, E. S., and Berman, Harry, U. S. Geol. Survey Bull. 848, 205 (1934), and Billiet, V., Soc. franç. minéralogie Bull. 49, 136 (1926).

FRITZSCHEITE $Mn(UO_2)_2[(P,V)O_4]_2 \cdot 8H_2O$?

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Fritzscheite USNM R5685	Johanngeorgenstadt, Saxony	---	USGS-X USNM-6x6,L

GUMMITE $UO_3 \cdot nH_2O$

Optics

In transmitted light, orange or yellow. Anisotropic; some is very finely divided and seemingly isotropic. The indices vary widely: n = 1.575 1/ (Easton, Pa.), 1.96 2/ (Kambowe, Katanga). Gummite from Spruce Pine, N.C., 3/ is biaxial negative (-) with 2V = 60° and nX = 1.742, nY = 1.762, nZ = 1.776, and not pleochroic.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-Ray patterns	Quantity
Gummite USNM 102618	Ruggles mine, Grafton, N.H.	---	USGS-XS USNM-100 g
Gummite HMM H-1, Phase 26	Ruggles mine, Grafton, N.H.	Har. 3843	---

Gummite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Gummite USNM 96482	Spruce Pine, N.C.	TE 3146	USNM-200 g
Gummite USNM 103189	Fannie Gouge mine, Spruce Pine, N.C.	---	USGS-XS USNM-200 g
Gummite USNM C5415	Spruce Pine, N.C.	---	USGS-XS USNM-100 g
Gummite 3/ USNM 86120	Wiseman mica mine, Mitchell County, N.C.	---	USNM-10 g
Gummite? USNM 104784	Chinkolobwe, Katanga, Belgian Congo	---	USGS-XS USNM-500 g
Gummite USNM R8384	Kambowe, Katanga, Belgian Congo	---	USGS-XS USNM-50 g
Gummite USNM R8397	Luiswishi, Katanga Belgian Congo	---	USGS-XS USNM-50 g
Gummite USNM 91225	Brejaúba, Minas Geraes, Brazil	---	USGS-XS
Gummite HMM Phase 31	Gordonia, South Africa	Har. 3967	HMM-10 g
Gummite (red zone) AMNH Phase 24	Rajputana, India	Har. 4089	---
Gummite (brown zone) AMNH Phase 29	Rajputana, India	Har. 4087	---
Gummite HMM Phase 28	---	Har. 4125	---
	Eliasite--Synonym of gummite		
Eliasite USNM R5888	Joachimsthal, Bohemia	---	USGS-XS USNM-50 g
Eliasite USNM C2257	Joachimsthal, Bohemia	---	USGS-XS USNM-10 g

Gummite---Specimen Data (Cont.)

Pittinite--Synonym of gummite

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Pittinite USNM R5887	Joachimsthal, Bohemia	---	USGS-XS USNM-75 g

Yttrogummite--Synonym of gummite

Yttrogummite USNM R6562	North Karelia, Russia	---	USGS-XS USNM-25 g

1/ Wells, R. C., Fairchild, J. G., and Ross, C. S., Am. Jour. Sci., 5th ser., 26, 45 (1933).
2/ Schoep, Alfred, and de Leenheer, L., Soc. belge géologie Bull. 46, 309 (1937).
3/ Ross, C. S., Henderson, E. P., and Posnjak, E., Am. Mineralogist 16, 213 (1931).

IANTHINITE $2UO_2 \cdot 7H_2O$?

Optics

In transmitted light, dark violet.

Orientation		n 1/	Pleochroism	
X	c	1.674 ± 0.003	Colorless	
Y	b	1.90 ± 0.02	Violet	Biaxial negative (-)
Z	a	1.92 ± 0.02	Dark violet	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Ianthinite HMM 87090 Phase 6	Katanga, Belgian Congo	Har. 4214	HMM-3x3,L
Ianthinite USNM 95990	Katanga, Belgian Congo	---	USNM-1x1,L

1/ Billiet, V., Soc. franç. minéralogie Bull. 49, 136 (1926).

ISHIKAWAITE (U,Fe,Y,etc.)(Cb,Ta)O_4

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Ishikawaite? USNM 105862	Ishikawa, Fukushima, Japan	---	USGS-X USNM-3 g

JOHANNITE $Cu(UO_2)_2(SO_4)_2(OH)_2 \cdot 6H_2O$

Optics

Strongly pleochroic, with X colorless, Y pale yellow, Z greenish yellow or canary yellow. Biaxial.

	n Joachimsthal 1/	n Colorado
X	1.572	1.577
Y	1.595	1.597
Z	1.614	1.616
2V (Na)	~90°	~90°
Sign	(-)	(-)
Dispersion	r > v, strong	r < v, strong

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Johannite USNM R6329	Wood mine, Gilpin County, Colo.	---	USGS-XS USNM-3x3,L
Johannite USNM C4763	Joachimsthal, Bohemia	TE 298	USGS-XS USNM-6x6,L
Johannite HMM 89613 Phase 3	Joachimsthal, Bohemia	Har. 1433	---
Johannite HMM 68991	Joachimsthal, Bohemia	---	HMM-6x9,M
	Gilpinite = johannite		
Gilpinite USNM C4766	Montrose County, Colo.	---	USGS-XS USNM-9x9,L

Gilpinite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Gilpinite 2/ USNM 49090	Central City, Colo.	---	---

1/ Larsen, E. S. and Berman, Harry, Am. Mineralogist 11, 1 (1926).
2/ Larsen, E. S., and Brown, G. V., Am. Mineralogist 2, 75 (1917).

KASOLITE $Pb(UO_2)SiO_4 \cdot H_2O$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Kasolite USNM 95610	Belgian Congo	TE 634	USGS-XS USNM-20 g
Kasolite USNM C4517	Chinkolobwe, Katanga, Belgian Congo	---	USGS-XS USNM-20 g
Kasolite HMM 86781 Phase 79	Katanga, Belgian Congo	Har. unnumbered	---

LIEBIGITE $Ca_2U(CO_3)_4 \cdot 10H_2O$

Optics 1/

Orientation	n	Pleochroism	
X a	1.497	Nearly colorless	Biaxial positive (+)
Y	1.502	Pale yellowish green	$2V = 40^\circ$
Z	1.539	Pale yellowish green	$r > v$, moderate

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Liebigite HMM Phase 18	Joachimsthal, Bohemia	Har. 1767	---

Liebigite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Liebigite USNM R6753	Joachimsthal, Bohemia	TE 594	USGS-XS USNM-9x12,L
Liebigite AMNH 8976	Joachimsthal, Bohemia	---	HMM-9x9,L
	Uranothallite--Synonym of liebigite		
Uranothallite HMM 93993	Joachimsthal, Bohemia	---	HMM-3x3,L
Uranothallite USNM R2761	Joachimsthal, Bohemia	---	USGS-XS USNM-3x9,L
Uranothallite TE(CFM-1)	---	TE 3160	---

1/ Frondel, Clifford, Harvard University, personal communication.

MACKINTOSHITE $(Th,U)SiO_4 \cdot H_2O$?

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Mackintoshite USNM R5890	Barringer Hill, Llano County, Texas	TE 714 Ignited	USGS-XS USNM-1 g
	Hydrothorite--$ThSiO_4 \cdot 4H_2O$		
Hydrothorite USNM 95956	Tantalite mine, Wodgina, West Australia	---	USGS-XS USNM-200 g
	Pilbarite--$UO_3 \cdot PbO \cdot ThO_2 \cdot 2SiO_2 \cdot 4H_2O$ Alteration product of mackintoshite		
Pilbarite USNM R4841	Pilbara, West Australia	---	USGS-XS USNM-5 g

MAITLANDITE $(U,Th,Pb)SiO_4 \cdot 3H_2O$?

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Maitlandite USNM 95958	Wodgina, West Australia	TE 586 TE 722 Ignited	USGS-XS USNM-1 g

Nicolayite--Close to maitlandite

Nicolayite USNM 95959	Wodgina, West Australia	---	USGS-X USNM-5 g

MEDJIDITE--Sulfate of uranium and calcium

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Medjidite USNM R6331	Joachimsthal, Bohemia	---	USGS-XS USNM-20 g
Medjidite AMNH 16836	Joachimsthal, Bohemia	---	HMM-3x9,L

METATORBERNITE $Cu(UO_2)_2(PO_4)_2 \cdot 8H_2O$

Optics

Optically uniaxial; some is biaxial due to strain, 2V small. Pleochroic. O = sky blue, E = green.

	640 mμ	515 mμ	440 mμ	white light
nO	1.618	1.633	1.649	1.610 - 1.628
nE	1.622		1.646	
Sign	(+)	isotropic	(-)	(+)

Metatorbernite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Metatorbernite USNM R5682	Old Gunnis Lake mine, Calstock, Cornwall, England	---	USGS-XS USNM-10 g
Metatorbernite TE	Mina de Urgeiriça, Portugal	TE 435	USGS-XSC

METAZEUNERITE $Cu(UO_2)_2(AsO_4)_2 \cdot 8H_2O$

Optics

In transmitted light, green. Weakly dichroic.

	n(Schneeberg)1/	n(Tintic)2/	n(Schneeberg)1/	Dichroism
O	1.643	1.647	1.651	Grass green
E	1.623	1.630	1.635	Pale green

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Metazeunerite USNM C4385	---	TE 112	6x6,M

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 151, 158 (1921).
2/ Weiss-Frondel, Judith, U. S. Geol. Survey, personal communication.

MONAZITE $(Ce,La,Y,Th)PO_4$

Optics

In transmitted light, yellowish brown or yellow to colorless.

Orientation	n(Na) Brazil 1/	n(Na) Madagascar 2/	n Bolivia 3/
X b	1.7902	1.8004	1.785
Y	1.7912	1.8008	1.787
Z ∧ c = 2°to6°	1.8441	1.8494	1.840
2V	15°33'	11°00'	

r<v, in some r>v; horizontal dispersion weak. Pleochroism faint or not perceptible.

Monazite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Monazite USNM R4339	Spruce Pine, N.C.	---	USGS-XS USNM-100 g
Monazite 4/ USNM 102846	Mars Hill, N.C.	---	USNM-25 g
Monazite 5/ USNM 100282-86	Morefield mine, Amelia, Va.	---	USNM-75 g
Monazite TE(517-7-B)	---	TE 248	---
Monazite USNM 105008	Luwangashi, Belgian Congo	---	USGS-XS
Monazite 6/ USNM 96870	Divino de Ubá, Minas Geraes, Brazil	---	USNM-200 g
Monazite HMM	Arendal, Sweden	Har. 5079	---
	Mengite--Synonym of monazite		
Mengite USNM R5099	Ilmen Mountains, Urals, Russia	---	USGS-XS USNM-10 g
	Turnerite--Synonym of monazite		
Turnerite USNM C4033	Binnenthal, Switzerland	---	USGS-X USNM-20 g
	Urdite--Synonym of monazite		
Urdite USNM R5168	Hitterö, Norway	---	USGS-XS USNM-50 g

1/ Busz, **Neues Jahrb., Beilage-Band** 39, 492 (1914).
2/ Sabot, R. C., Inaug. Diss. Ghent (1914); Neues Jahrb. 138 (1920).
3/ Gordon, S. G., Acad. Nat. Sci. Philadelphia, Not. nat. 2 (1939).
4/ Marble, J. P., Am. Mineralogist 21, 456-57 (1936).
5/ Glass, J. J., Am. Mineralogist 20, 741-68 (1935).
6/ Fenner, C. N., Am. Jour. Sci., 5th ser., 16, 382-91 (1928).

PARASCHOEPITE $UO_3 \cdot 2H_2O$?

Optics 1/

Orientation		n	Pleochroism	
X	c	1.705	Colorless or nearly so	Biaxial negative (-)
Y	b	1.760	Yellow	2V ~40°
Z	a	1.770	Yellow	r < v

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Paraschoepite HMM(K-1)	Katanga, Belgian Congo	TE 66	HMM-1/5 g
Paraschoepite HMM Phase 99 Type specimen	Katanga, Belgian Congo	Har. unnumbered	HMM-1/5 g

1/ Schoep, Alfred, and Stradiot, Sadi, Am. Mineralogist 32, 344-350 (1947).

PARSONSITE $Pb_2(UO_2)(PO_4)_2 \cdot 2H_2O$

Optics

In transmitted light, pale yellow. Not pleochroic. Biaxial negative (-

Orientation	n(Kasola)1/	n(Ruggles)	n(Wölsendorf)
X	1.85	~1.870	~ 1.795
Y b			
Z	1.862	~1.890	~1.815
Z ∧ c (usually)	12°	6°-23°	2°-36°

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Parsonsite USNM 97139	Katanga, Belgian Congo	TE 3141	USNM-20 g
Parsonsite USNM 95605	Chinkolobwe, Belgian Congo	---	USGS-XS USNM-10 g

1/ Billiet, V., Soc. franç. minéralogie Bull. 49, 136 (1926).

PHOSPHURANYLITE--A lead, calcium, uranium phosphate

Optics

Some is uniaxial negative (-), but ordinarily it is biaxial negative (-). 2V variable and ranges up to about 35° but usually is 5° to 20°.

Orientation	n(Flat Rock mine, N.C.)	n(Ruggles mine, N.H.)	n(Rosmaneira, Portugal)	Pleochroism
X or E	1.690	1.668	1.660	Colorless to pale yellow
Y	1.718	1.710	1.700	Golden yellow
Z or O	1.718	1.710	1.701	Golden yellow

In biaxial material $r > v$, strong.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Phosphuranylite USNM 104824	Rio Grande do Norte, Brazil	TE 3127	USGS-XS USNM-100 g
Phosphuranylite HMM	Rosmaneira, Portugal	---	HMM-5 g

POLYCRASE $(Y,Ca,Ce,U,Th)(Ti,Cb,Ta)_2O_6$

Optics

In transmitted light, brown, yellow brown, or reddish brown. Isotropic (metamict). The refractive index increases after ignition.

	n	
Polycrase	2.248	Sta. Clara, Brazil 1/

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Polycrase TE	Overlook, N.Y.	TE 478 Ignited	USGS-XSC
Polycrase USNM 97642	San Jose de Bujauba, Minas Geraes, Brazil	TE 749 Ignited	USGS-XS USNM-100 g

Polycrase---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Polycrase HMM 87869	Hitterö, Norway	Har. 1712 Ignited 3 hrs. to red heat	---

1/ Hess, F. L., and Henderson, E. P., Franklin Inst. Jour. 200, 235 (1925).

POLYMIGNYTE $A(Cb,Ti,Ta)O_4$
$A = Ca,Fe^2,Y,etc.,Zr,Th$

Optics

In transmitted light, reddish brown and isotropic (metamict). $n = 2.22 \pm 0.01$ 1/ (Fredricksvärn).

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Polymignyte HMM 58171	Fredricksvärn, Norway	Har. 1905	---
Polymignyte USNM 94098	Fredricksvärn, Norway	TE 612	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 122 (1921).

PRIORITE $(Y,Er,Ca,Fe^2,Th)(Ti,Cb)_2O_6$

Optics

Isotropic (metamict) and transmits light in only the thinnest splinters Reddish brown to light brown. Becomes anisotropic on ignition, and the refractive index increases somewhat.1/ Priorite $n = 2.142 \pm 0.01$, after ignition $n = 2.24$.

Priorite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Priorite HMM 85140	Ahi-Tromby, Madagascar	Har. 1837 Ignited	HMM-75 g
Priorite HMM 80039	Iveland, Satersdalen, Norway	Har. 1880 Ignited	---
Priorite HMM	---	Har. 1837	---

Blomstrandine--Synonym of priorite

Blomstrandine USNM C4019	Iveland, Satersdalen, Norway	TE 756 Ignited	USGS-XS USNM-100 g
Blomstrandine HMM 84647	Morefjaer, Arendal, Norway	Har. 1871 Ignited	HMM-100 g
Blomstrandine HMM 87873	Tongafeno, Madagascar	Har. 2028 Inv. 2784	HMM-50 g

1/ Larsen, E. S., and Berman, Harry, U. S. Geol. Survey Bull. 848, 65 (1934).

RAUVITE $CaU_2V_{12}O_{36}\cdot 20H_2O$

Optics

Mean index of refraction 1.88.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Rauvite USNM 96159	Yellow Cat district, Grand County, Utah	---	USGS-XS USNM-100 g
Rauvite USNM 96054	Yellow Cat Wash, Grand County, Utah	---	USGS-XS USNM-300 g

Rauvite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Rauvite USNM C4417	Temple Mountain (San Rafael Swell) Emery County, Utah	TE 3135	USGS-XS USNM-5 g
Rauvite 1/ USNM 95060	Temple Mountain (San Rafael Swell) Emery County, Utah	TE 3167 Har. 422	USNM-100 g HMM-1 g

1/ Hess, F. L., U. S. Geol. Survey Bull. 750-D, 68 (1925).

RENARDITE $Pb(UO_2)_4(PO_4)_2(OH)_4 \cdot 7H_2O$

Optics

Orientation		n	Pleochroism	
X	a	1.715 ± 0.003	Yellow	Biaxial negative (-)
Y	c	1.736 ± 0.003	Yellow	2V = 41° 01' (calc.)
Z	b	1.739 ± 0.003	Colorless	r > v

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Renardite USNM R8395	Chinkolobwe, Katanga, Belgian Congo	TE 593	USGS-XS USNM-3x6,L

RUTHERFORDINE UO_2CO_3?

Optics 1/

In transmitted light, yellow. Optically biaxial with: nX 1.72 ± 0.01
nZ 1.80 ± 0.01

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 129 (1921).

SALÉEITE $Mg(UO_2)_2(PO_4)_2 \cdot 10H_2O$

Optics

Orientation	n(Schneeberg)1/	n(Katanga)2/
E (or X)	1.559 ± 0.002 Colorless	1.559
Y		1.570
O (or Z)	1.574 ± 0.002 Pale greenish yellow	1.574
2V		62°
		r > v, strong

Uniaxial negative (-), some is anomalously biaxial.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Saléeite USNM R8385	Chinkolobwe, Katanga, Belgian Congo	TE 655	USGS-XS USNM-4x9,L
Saléeite HMM	Chinkolobwe, Katanga, Belgian Congo	---	HMM-3x9,L

1/ Mrose, M. E., Am. Mineralogist 35, 525-530 (1950).
2/ Schoep, Alfred., Med. Kl. Wetens. Kon. Vlaam. Acad., 65 (1939).

SAMARSKITE $(Y,Er,U,Ca,Fe,Th)(Cb,Ta)_2O_6$

Optics

In transmitted light, light brown to dark brown. Ordinarily metamict and isotropic. Anisotropic samarskite has been reported but without verification.1/ Refractive index variable, with n = 2.20 ± 0.05 reported on unanalyzed material.2/

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Samarskite 3/ USNM 49088	Devil's Head Mountain near Pikes Peak, Colo.	---	USNM-40 g
Samarskite HMM 92576	Spinelli quarry, Glastonbury, Conn.	Har. 1879 Ignited	---

Samarskite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Samarskite HMM 81133	Wiseman's mine, Mitchell County, N.C.	Har. 1900 Ignited	---
Samarskite HMM 58012	Mitchell County N.C.	Har. 1916 Ignited	---
Samarskite HMM 58011	Yancey County N.C.	Har. 1891 Ignited	---
Samarskite HMM 92510	Topsham, Maine	Har. 1889 Ignited	HMM-10 g
Samarskite 4/ USNM 96115	Petaca, N. Mex.	---	USGS-XS USNM-175 g
Samarskite	Mitchell County, N.C.	Inv. 4469 Ignited	---
Samarskite 5/	Mitchell County, N.C.	Inv. 4474 Ignited	---
Samarskite USNM 96872	Divino de Ubá, Minas Geraes, Brazil	---	USGS-XS USNM-200 g
Samarskite TE(404 ATO-2)	---	TE 169 Ignited	---
Samarskite	---	---	USGS-XSC

Annerödite--Mixture of samarskite and parallel growths of columbite

Annerödite USNM R7142	Anneröd, Moss, Norway	---	USGS-XS USNM-75 g

Vietinghofite--Synonym of samarskite

Vietinghofite USNM R5118	Baikal Lake, Siberia	---	USGS-XS USNM-20 g

1/ Van Aubel, René, Soc. géol. Belgique Annales 58, Pub. vel. Congo belge, Fasc. 38 (1935) --- Neues Jahrb. Mineralogie 1 (1945), on material from Kivu, Belgian Congo.
2/ Larsen, E. S., U. S. Geol. Survey Bull. 679 129, 158 (1921).
3/ Hillebrand, W. F., U. S. Geol. Survey Bull. 55, (1889).
4/ Hess, F. L.,and Wells, R. C., Am. Jour. Sci., 5th ser., 19, 17-26 (1930).
5/ Davidson, Norman, U. S. Geol. Survey, Analysis D-1763.

SCHOEPITE $4UO_3 \cdot 9H_2O$?

Optics

Yellow in transmitted light.

Orientation		n 1/	Pleochroism	
X	c	1.690 ± 0.003	Colorless	Biaxial negative (-)
Y	b	1.714 ± 0.003	Lemon yellow	2V 89°
Z	a	1.735 ± 0.003	Lemon yellow	r > v

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Schoepite USNM 94712	Katanga, Belgian Congo	TE 615	USGS-X USNM-30 g
Schoepite USNM C4517	Chinkolobwe mine, Katanga, Belgian Congo	---	USGS-XS USNM-20 g
Schoepite HMM 87090 Phase 80	Katanga, Belgian Congo	Har. 1571	HMM-3x3,L
Schoepite HMM 96613 Phase 59	Great Bear Lake, Canada	Har. 3902	HMM-6x6,L

1/ Walker, T. L., Am. Mineralogist 8, 67 (1923).

SCHROECKINGERITE $Ca_3NaUO_2(CO_3)_3(SO_4)F \cdot 10H_2O$

Optics

Usually biaxial with small and variable 2V, 0° - 25°.

	n(Wyoming) 1/	n(Joachimsthal) 2/	Uniaxial ?
O	1.542	1.539 - 1.545	negative (-)
E	1.489	1.496	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Schroeckingerite	Yavapai County, Ariz.	Inv. 2765	---

Schroeckingerite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Schroeckingerite	Near Wamsutter, Wyo.	---	USGS-XSC
Schroeckingerite HMM 92877	Near Wamsutter, Wyo.	---	HMM-20 g
Schroeckingerite HMM Phase 5	---	Har. 1591	---
Schroeckingerite AMNH 8979	Joachimsthal, Bohemia	---	HMM-3x6,L

Dakeite--Synonym of schroeckingerite

Dakeite 3/ USNM 103010	Near Wamsutter, Wyo.	TE 609	USGS-XS USNM-20 g

1/ Larsen, E. S., and Gonyer, F. A., Am. Mineralogist 22, 561 (1937).
2/ Nováček, R., Am. Mineralogist 24, 317 (1939).
3/ Jaffe, H. W., Sherwood, A. M., and Peterson, M. J., Am. Mineralogist 33, 152-157 (1948).

SKLODOWSKITE $Mg(UO_2)_2Si_2O_7 \cdot 7H_2O$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Sklodowskite USNM 105130	Katanga, Belgian Congo	TE 627	USGS-X USNM-20 g
Sklodowskite USNM R6700	Katanga, Belgian Congo	---	USGS-XS USNM-3x3,L
Sklodowskite HMM 86773 Phase 81	Katanga, Belgian Congo	Har. 1691	---

SODDYITE $5UO_3 \cdot 2SiO_2 \cdot 6H_2O$?

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Soddyite USNM 95601	Chinkolobwe mine, Katanga, Belgian Congo	---	USGS-XS USNM-100 g
Soddyite USNM C4513	Chinkolobwe mine, Katanga, Belgian Congo	---	USGS-X USNM-50 g
Soddyite USNM R5896	Chinkolobwe mine, Katanga, Belgian Congo	---	USGS-XS USNM-50 g
Soddyite HMM 86774	Chinkolobwe mine, Katanga, Belgian Congo	TE 3162 Har. 1194	USGS-XS
Soddyite HMM 86775	Chinkolobwe mine, Katanga, Belgian Congo	TE 3168	USGS-S

SWARTZITE $CaMgUO_2(CO_3)_3 \cdot 12H_2O$

Optics 1/

Orientation	n	Pleochroism	
X	1.465	Colorless	Biaxial negative (-)
Y	1.51	Yellow	$2V = 40^\circ$
Z	1.540	Yellow	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Swartzite USNM ?	Hillside mine, Yavapai County, Ariz.	---	USNM-30 mg

1/ Milton, Charles, U. S. Geol. Survey, personal communication.

THORIANITE $(Th,U)O_2$

Optics

Transparent in very thin splinters. Isotropic; n variable, averages $2.20 \pm .1$/

Thorianite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Thorianite TE	Buckland-Siwalik area, Seward Peninsula, Alaska	TE 286	---
Thorianite USNM 93295	Bambaraluma Valley, Ceylon	TE 579	USGS-XS USNM-30 g
Thorianite USNM 96863	Ceylon	---	USGS-XS USNM-200 g
Uranothorianite--Uranium-rich member of series			
Uranothorianite USNM R3679	Landbo, Norway	TE 263 Ignited	USNM-15 g

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 143 (1921).

THORITE $ThSiO_4$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Thorite USNM R7901	Stove Mountain, El Paso County, Colo.	---	USGS-XS USNM-30 g
Thorite USNM R7040	Lindvikkollen, Kragero, Norway	---	USGS-XS USNM-50 g
Thorite HMM 85827	Arendal, Norway	Har. 11321 Not ignited, no pattern	---
Auerlite--Phosphatian variety of thorite			
Auerlite USNM R3684	Henderson County, N.C.	---	USGS-XS USNM-10 g

Thorite---Specimen Data (Cont.)

Calciothorite--Variety of thorite

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Calciothorite USNM R3681	Arö, Langesund Fiord, Norway	TE 720 Ignited	USGS-XS USNM-10 g
	Enalite--Uranoan thorite		
Enalite USNM 105392	Fukuoke-mura, Enagun, Gita Prefectu, Japan	TE 578	USGS-X USNM-5 g
	Eucrasite--Variety of thorite		
Eucrasite USNM R3682	Brevig, Norway	TE 719 Ignited	USGS-XS USNM-10 g
	Ferrothorite--A ferrian thorite		
Ferrothorite USNM 97278	Befaritra, Madagascar	---	USNM-25 g
	Freyalite--Variety of thorite		
Freyalite USNM R3683	Langesund Fiord, Norway	---	USGS-XS USNM-10 g
	Orangite--Synonym of thorite		
Orangite USNM R3678	Brevig, Norway	Inv. 2573 Ignited	USNM-5 g
Orangite USNM R7043	Laaven, Langesund, Brevig, Norway	---	USGS-XS USNM-50 g
Orangite	Brevig, Norway	Inv. 2590 Ignited	---
	Uranothorite--Uranoan thorite		
Uranothorite USNM R3680	Arö, Norway	TE 724 Ignited	USNM-10 g

THOROGUMMITE $(Th,U)SiO_4 \cdot 6H_2O$?

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Thorogummite USNM C4510	Llano County, Texas	---	USGS-XS USNM-50 g
Thorogummite USNM 104045	Iisaka, Fukushima, Japan	---	USGS-XS USNM-10 g
Thorogummite USNM 95959	Wodgina, West Australia	TE 705 Ignited TE 706 Modified ignition	USGS-XS

THOROTUNGSTITE - Essentially a basic tungstate (or oxide) with (Al,Fe):(Th,Ca,Ce,Zr):W ~1:1:3

Optics

Optically negative (-) with indices over 1.74 and strong birefringence.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Thorotungstite USNM 95659	Pulai, Kinta, Federated Malay States	TE 565	USGS-XS USNM-300 g
Thorotungstite 1/ USNM 96854	Pulai, Kinta, Federated Malay States	---	USNM-300 g

1/ Scrivenor, J. B., Am. Jour. Sci., 5th ser., 13, 487-490 (1927).

TORBERNITE $Cu(UO_2)_2(PO_4)_2 \cdot 8\text{-}12H_2O$

Optics

	n Cornwall	Dichroism	
O	1.592	Sky blue	Uniaxial negative (-)
E	1.582	Green	

Torbernite---Optics (Cont.)

The indices of refraction and the specific gravity doubtless vary with water content in the range from 8 to 12 H_2O but correlated data are lacking. Most of the published optical data on so-called torbernite are of uncertain affiliation and may belong to metatorbernite.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Torbernite TE	Robineau claim, near Lawson, Colo.	---	USGS-XS
Torbernite TE	Majuba Hill, Nev.	---	USGS-XSC
Torbernite USNM 97445	Spruce Pine, N.C.	---	USGS-XS USNM-9x15,M
Torbernite HMM 62582	Mount Painter, Australia	---	HMM-75 g
Torbernite USNM 87239	Mount Painter, Australia	---	USGS-XS USNM-20 g
Torbernite USNM R5670	Joachimsthal, Bohemia	---	USGS-XS USNM-9x15,M
Torbernite USNM R8385	Chinkolobwe, Katanga Belgian Congo	---	USGS-XS USNM-5 g
Torbernite USNM 94782	Belgian Congo	---	USGS-X USNM-50 g
Torbernite USNM 105126	Katanga, Belgian Congo	---	USGS-XS USNM-10 g
Torbernite USNM C4517	Chinkolobwe, Katanga, Belgian Congo	---	USGS-X USNM-10 g
Torbernite USNM 101995	Buhowo, Bulgaria	---	USGS-XS USNM-5 g
Torbernite USNM C4382 Phase 13	Cornwall, England	TE 3109	USNM-3x6,M

Torbernite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Torbernite USNM C4383	Redruth, Cornwall, England	---	USGS-XS USNM-5 g
Torbernite HMM 7112 Phase 13	Old Gunnis Lake, Calstock, Cornwall, England	Har. 3926	HMM-6x6,L

TRÖGERITE $(UO_2)_3(AsO_4)_2 \cdot 12H_2O$

Optics

Uniaxial or biaxial (-). In transmitted light pale lemon yellow. Not pleochroic.

Orientation 1/	n 2/	
X c	1.585 ± 0.005	1.580
Y	1.630 ± 0.005	
Z∧a = 12°-14°	1.630 ± 0.005	1.624
2V	Very small	0°

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Trögerite USNM C4394	Schneeberg, Saxony	---	USGS-X USNM-3x2,L
Trögerite USNM R5683	Weisser-Hirch mine, Schneeberg, Saxony	---	USGS-X USNM-6x9,L
Trögerite USNM R7927	Schneeberg, Saxony	TE 3131	USGS-6x6,L

1/ Goldschmidt, V., Zeitschr. Kristallographie, 31, 468 (1899).
2/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 145 (1921).

TYUYAMUNITE $Ca(UO_2)_2(VO_4)_2 \cdot nH_2O$

(n = 9-10, but may be down to 4)

Optics

In transmitted light, colorless to pale yellow. Faintly pleochroic, X nearly colorless, Y pale canary yellow, Z canary yellow.1/

	n(Red Creek, Utah)2/	n(Henry Mts., Utah)3/	n(Paradox Valley)4/	n(Paradox Valley)4/
X = c	1.670	1.72 ± 0.01	1.75-1.80 (calc.)	1.78 (calc.)
Y = b	1.870	1.860	1.927-1.932	1.895
Z = a	1.895	1.953	1.965-1.968	1.92
2V	36°	48°	~48°	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Tyuyamunite HMM 80815	Long Park, Montrose County, Colo.	TE 3063	---
Tyuyamunite USNM 97070	Long Park, Montrose County, Colo.	Inv. 4166	USNM-300 g
Tyuyamunite HMM TCC	Mauch Chunk, Pa.	TE 3102	---
Tyuyamunite USNM 96159	Yellow Cat district, Grand County, Utah	---	USNM 300 g
Tyuyamunite USNM 96054	Yellow Cat Wash, Grand County, Utah	---	USGS-X USNM-300 g
Tyuyamunite USNM 95387	Fergana, Russian Turkestan	---	USGS-XS USNM-5 g
Tyuyamunite USNM R5697	Fergana, Russian Turkestan	Inv. 4172	---
Tyuyamunite HMM 89539	Fergana, Russian Turkestan	Har. 4196	HMM-½ g

1/ Khlopin, V. G., Acad. Russie, 73 (1925) and Dolivo-Dobrovolsky, V. V., Soc. russe minéralogie Mém. 2, 54, 359 (1925).

2/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 148 (1921).

3/ Ross, C. S., in Hess, F. L., U. S. Geol. Survey Bull. 750-D, 73 (1925).

4/ Merwin, H. E., in Hillebrand, W. F., Am. Jour. Sci, 5th ser., 8, 201 (1924).

URACONITE - Hydrous sulfate of U and Cu.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uraconite USNM C4769	Telegraph mine, Gilpin County, Colo.	TE 300	USGS-X USNM-3x6,L
Uraconite HMM 69071 Phase 65	Joachimsthal, Bohemia	Har. 1431	HMM-3x3,L
Uraconite USNM 93341	St. Just, Cornwall, England	---	USGS-X USNM-3x9,L
Uraconite USNM R6767	Daniel mine, Schneeberg, Saxony	---	USGS-XS USNM-9x15,L

URANINITE UO_2(between UO_2 and U_3O_8, with U^{4} predominant)

Optics

In transmitted light, greenish, yellowish, or deep brown. Usually opaque.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uraninite TE	Eldorado mine, Colo.	---	USGS-XSC
Uraninite HMM 90884	Newry, Maine	Har. 3865	---
Uraninite USNM 102618	Ruggles mine, Grafton, N.H.	---	USGS-XS USNM-500 g
Uraninite USNM C5838	Ruggles mine, Grafton, N.H.	---	USGS-XS USNM-1200 g
Uraninite TE	Katanga, Belgian Congo	---	USGS-XSC
Uraninite USNM R8383	Kalongwe, Belgian Congo	---	USGS-XS USNM-100 g

Uraninite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uraninite USNM R8391	Kalongwe, Katanga, Belgian Congo	---	USGS-X USNM-50 g
Uraninite USNM R8401	Chinkolobwe, Katanga Belgian Congo	---	USGS-XS USNM-1000 g
Uraninite USNM C2257	Joachimsthal, Bohemia	---	USGS-XS USNM-5 g
Uraninite USNM 91225	Brejaúba, Minas Geraes, Brazil	---	USGS-X USNM-300 g
Uraninite 1/ USNM 83570	Huggeneskilen, Moss, Norway	TE3098	USNM-10 g
Uraninite USNM 103596	Gordonia, West Cape Colony, South Africa	---	USGS-XS USNM-4000 g
	Bröggerite--Thorian uraninite $(U,Th)O_2$		
Broggerite USNM C4497	Raade, Norway	---	USGS-XS USNM-25 g
	Cleveite--Uraninite with rare earths		
Cleveite USNM 95469	Rosland, near Tvedestrand, Norway	---	USGS-XS USNM-75 g
	Nivenite--Uraninite with rare earths		
Nivenite USNM C4510	Llano County, Texas	---	USGS-XS USNM-75 g
Nivenite USNM R5878	Llano County, Texas	---	USGS-XS USNM-50 g
Nivenite USNM R5888	Joachimsthal, Bohemia	---	USGS-XS USNM-20 g
	Pitchblende--Colloform and massive uraninite		
Pitchblende TE	Central City area, Colo.	---	USGS-XS

Pitchblende---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Pitchblende TE	Caribou mine, Colo.	---	USGS-XSC
Pitchblende TE	Prairie Divide, Colo.	---	USGS-XS
Pitchblende USNM 101917	Deer Park no. 5 mine, Penland, N.C.	TE 566	USGS-XS USNM-15 g
Pitchblende USNM R4339	Spruce Pine, N.C.	TE 560	USGS-XS USNM-100 g
Pitchblende USNM 104784	Chinkolobwe, Katanga, Belgian Congo	TE 572	USGS-XS USNM-200 g
Pitchblende USNM 104838	Columbia, South America	TE 709 Ignited TE 710, TE 712 Modified ignition	USGS-XS USNM-500 g

Uranopissite--Synonym of uraninite

Uranopissite USNM R5881	Przibram, Bohemia	TE 558	USGS-XS USNM-300 g

1/ Hillebrand, W. F., in Clarke, F. W., U. S. Geol. Survey Bull. 78, 48 (1891).

URANOCIRCITE $Ba(UO_2)_2(PO_4)_2 \cdot 8H_2O$

Optics

Orientation	n(Falkenstein)1/	n(Synthetic)2/	Pleochroism
X a	1.610 ± 0.003	1.604	Nearly colorless
Y	1.622 ± 0.003		Pale canary yellow
Z	1.623 ± 0.003	1.613	Pale canary yellow
2V	Small	0°	Biaxial (-)

Uranocircite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uranocircite AMNH 15779	Falkenstein, Saxony	---	HMM-10 g
Uranocircite USNM R5687	Bergen, near Falkenberg, Saxony	---	USGS-XS USNM-2 g
Uranocircite HMM 96586 Phase 96	Falkenstein, Saxony	Har. 9826	HMM-3x3,L

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 149 (1921).
2/ Fairchild, J. G., Am. Mineralogist 14, 265 (1929).

URANOPHANE $Ca(UO_2)_2Si_2O_7 \cdot 6H_2O$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uranophane USNM 102618	Ruggles mine, Grafton, N.H.	---	USGS-X USNM-9x12,M
Uranophane USNM 96481	Fannie Gouge mine, Spruce Pine, N.C.	---	USGS-XS USNM-6x9,L
Uranophane USNM C5415	Spruce Pine, N.C.	---	USGS-XS USNM-6x9,L
Uranophane USNM 103189	Spruce Pine, N.C.	TE 600	USGS-X USNM-6x9,L
Uranophane TE	Lusk, Wyo.	---	USGS-XS
Uranophane USNM R4838	Mount Painter, Victoria, Australia	Inv. 5086	USGS-S USNM-9x9,L
Uranophane HMM 89756	Wölsenberg, Bavaria	---	HMM-9x12,L
Uranophane HMM 87092	Katanga, Belgian Congo	---	HMM-25 g

Uranophane---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uranophane USNM 91225	Brejaúba, Minas Geraes, Brazil	---	USGS-X USNM-5x8,L

Beta-uranophane--Polymorph of uranophane

Optics 1/

Orientation	n(Na)	n(Na)	Pleochroism	
X	1.665	1.662	Nearly colorless	Biaxial
Y	1.686	1.686	Deep yellow	2V large
Z	1.696	1.694	Deep yellow	r > v, crossed, strong

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Beta-uranophane HMM 90891 Phase 44	Newry, Maine	Har.	HMM 6x6,L
Beta-uranophane USNM R2765	Frankfort, Philadelphia, Pa.	Inv. 2845	USNM-9x9,L
Beta-uranophane HMM 87644 Phase 7	Joachimsthal, Bohemia	Har. 4172	---

Lambertite--Synonym of uranophane

Lambertite USNM R5903	Lusk, Wyo.	---	USGS-XS USNM-9x6,L

Uranotil--Synonym of uranophane

Uranotil	Luiswishi, Katanga, Belgian Congo	---	USGS-XS
Uranotil HMM 87646	Kuffersberg, Silesia	Har. 3892	HMM-2 g

1/ Nováček, R., Ceske Spol. Nauk. Věstnik Article VII, 1-36 (1935).

URANOPILITE $(UO_2)_6(SO_4)(OH)_{10}\cdot 12H_2O$

Optics

Biaxial (+), 2V rather large (Na), 0° for some wave lengths. In transmitted light, colorless to pale yellow. Not perceptibly pleochroic.

Orientation	n(Joachimsthal)1/	n(Na)2/	
X ~ b	1.621	1.623	r<v, extreme;
Y ∧ c +18°	1.623	1.625	also r>v.
Z	1.631	1.634	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uranopilite HMM 6074	Montrose County, Colo.	---	---
Uranopilite USNM R7876	Huel Edwards, Cornwall, England	TE 604	USGS-X USNM-3x3,L
Uranopilite USNM R7929	Joachimsthal, Germany	---	USGS-X USNM-3x3,L
Uranopilite HMM 88035 Phase 76	Johanngeorgenstadt, Saxony	Har.	HMM-3x9,L

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 150 (1921).
2/ Nováček, R., Soc. royale sci. Bohème, Cl. sci., Mém. 7 (1935) average of numerous measurements.

URANOSPHAERITE $Bi_2U_2O_9\cdot 3H_2O$

Optics 1/

Orientation		n	
X	a	1.955 ± 0.01	Biaxial positive (+)
Y	b	1.985 ± 0.01	2V large
Z	c	2.05 ± 0.01	Dispersion r<v, strong

Uranosphaerite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uranosphaerite USNM R5892	Schneeberg, Saxony	TE 639	USGS-X USNM-4x6,L
Uranosphaerite HMM 713 Phase 77	Schneeberg, Saxony	Har. 1198	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 150 (1921).

URANOSPINITE $Ca(UO_2)_2(AsO_4)_2 \cdot 8H_2O$?

Optics 1/

Biaxial negative (-) in some specimens uniaxial negative (-).

Orientation	n(Schneeberg)	n(Schneeberg)	n(Schneeberg)	Pleochroism
X or E	1.560	1.56	1.55	Nearly colorless
Y	1.582		1.567	Pale yellow
Z or O	1.587	1.586	1.572	Pale yellow
2V	46°	0°	62°	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uranospinite USNM 94665 Phase 115	Spanish Fork, Utah	Har. 9785	---
Uranospinite AMNH 15777	Schneeberg, Saxony	TE 3164	---
Uranospinite USNM R6767	Daniel mine, Schneeberg, Saxony	---	USGS-X USNM-9x15,L
Uranospinite USNM C4394	Schneeberg, Saxony	---	USGS-X USNM-1x2,L

Uranospinite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uranospinite HMM	---	Har. 8336	---
Uranospinite HMM Phase 55	Neustädtle, Saxony	Har. 1594	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 151 (1921). Goldschmidt, V., Zeitschr. Kristallographie 31, 468 (1899).

UVANITE $U_2V_6O_{21}\cdot 15H_2O$

Optics

Orientation	n	Pleochroism	
X	1.817	Light brown	Biaxial positive (+)
Y	1.879	Dark brown	$2V = 52^\circ$
Z	2.057	Greenish yellow	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Uvanite 1/ USNM R5708	Temple Rock, Emery County, Utah	TE 3132 Har. 1689	USGS-XS USNM-300 g
Uvanite HMM 62753 Phase 2	Temple Rock, Emery County, Utah	Har. 1597	HMM-5 g

1/ Hess, F. L., and Schaller, W. T., Washington Acad. Sci. Jour. 4, 576 (1914).

VANDENBRANDEITE $CuUO_4\cdot 2H_2O$

Optics

Green in transmitted light. Biaxial, apparently negative (-).1/ Absorption from green to colorless.

Vandenbrandeite---Optics (Cont.)

	n(Kalongwe)2/	n(Chinkolobwe)1/	
X	1.77 ± 0.02	1.76 ±	Dispersion strong.
Y	1.78 ± 0.02		2V large. An optic
Z	1.80 ± 0.02	1.80 ±	axis is nearly ⊥{001}.
			Z∧ elong. = 40° ± .1/

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Vandenbrandeite USNM R8383	Kalongwe, Katanga Belgian Congo	---	USGS-XS USNM-9x9,L
Vandenbrandeite USNM R8389	Kalongwe, Katanga, Belgian Congo	---	USGS-XS USNM-20 g
Vandenbrandeite USNM R8384	Kambowe, Katanga, Belgian Congo	---	USGS-XS USNM-3x6,M
Vandenbrandeite USNM R8391	Kalongwe, Katanga, Belgian Congo	---	USGS-XS USNM-3x9,L
Vandenbrandeite USNM 97250	Katanga, Belgian Congo	TE 3144	---
Vandenbrandeite USNM 97142 Phase 4	Katanga, Belgian Congo	Har. 3772	USNM-30 g
Vandenbrandeite USNM 105125	Katanga, Belgian Congo	---	USNM-3x3,L

1/ Thoreau, J., Soc. géol. Belgique, Annales, 55 C3 (1933).
2/ Schoep, Alfred, Mus. Congo belge annales 1, 25 (1932).

VOGLITE $Ca_2CuU(CO_3)\cdot 6H_2O$

Optics

Orientation	n	Pleochroism	
X	1.541	Deep bluish green	Biaxial psitive (+)
Y	1.547	Deep bluish green	2V = 60° (Na)
Z	1.564	Pale yellowish	r < v very strong

Voglite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Voglite USNM C2257	Joachimsthal, Bohemia	TE 301	USGS-XS USNM-5 g

WALPURGITE $Bi_4(UO_2)(AsO_4)_2O_4 \cdot 3H_2O$?

Optics 1/

Colorless to pale yellow in transmitted light, not pleochroic. Biaxial negative (-).

	n(Joachimsthal)	n(Schneeberg)
X	1.90 ± 0.03	1.871 ± 0.005
Y	2.00 ± 0.03	1.975 ± 0.005
Z	2.05 ± 0.03	2.005 ± 0.005
2V	Medium large	52° (calc.)

Dispersion slight

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Walpurgite USNM C4394	Schneeberg, Saxony	---	USGS-XS USNM-3x2,L
Walpurgite HMM	Schneeberg, Saxony	---	HMM-50 g
Walpurgite USNM C4397	Weisser-Hirsch, Schneeberg, Saxony	---	USGS-XS USNM-3x3,L
Walpurgite HMM 62752	Schneeberg, Saxony	Har. 9880	HMM-3x3,L
Walpurgite USNM R5688	Schneeberg, Saxony	TE 3133	USNM-3x3,L
Walpurgite USNM 4819 Phase 56	Schneeberg, Saxony	Har. 3964	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 155 (1921).

ZEUNERITE $Cu(UO_2)_2(AsO_4)_4 \cdot 10\text{-}16H_2O$

Optics 1/

All specimens of natural so-called zeunerite that have been examined by X-ray means have proved to be the meta-I hydrate with 5 to 8 H_2O and to be isostructural with meta-autunite and metatorbernite. Fully hydrated material with 10 to 16 H_2O and isostructural with autunite and torbernite has not yet been shown to occur in nature. In order to maintain parallelism of nomenclature, the name metazeunerite is given here to the species and the name zeunerite proper is held in reserve status for natural occurrence of the 10 to 16 H_2O hydrate that later may be demonstrated.

Artificial $Cu(UO_2)_2(AsO_4)_4 \cdot 10\text{-}16H_2O$ is tetragonal. Optically uniaxial negative with nO 1.602 to 1.610. The water content varies zeolitically within the range of stability of the phase and the indices of refraction vary therewith. Heated to 65°C. in air, this phase breaks down to metazeunerite with a water content varying zeolitically between 5 and 8 H_2O.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Zeunerite HMM 89129	Tintic mine, Eureka, Utah	Har. 9793	HMM-½ g
Zeunerite USNM R4385	Schneeberg, Saxony	---	USGS-XS USNM-6x6,M
Zeunerite USNM R5683	Weisser-Hirsch, Schneeberg, Saxony	---	USGS-XS USNM-6x6,M
Zeunerite USNM R6761	Schneeberg, Saxony	TE 3123	USNM-6x6,L

1/ Weiss-Frondel, Judith, U. S. Geol. Survey, personal communication.

ZIPPEITE $(UO_2)_2(SO_4)O \cdot nH_2O$

Optics

Biaxial negative (-), X nearly colorless, Y pale yellow to orange yellow, Z deep yellow to orange yellow.

Zippeite---Optics (Cont.)

	nX	nY	nZ	Z ∧ c	2V
Joachimsthal 1/	1.575	1.615	1.646		
Joachimsthal 1/	1.616	1.677	1.700		
Joachimsthal 2/	1.620	1.680	1.720	~32°	large
Joachimsthal 2/	1.630	1.70	1.720		rather large
Fruita, Utah 2/	1.630	1.689	1.739	41°	large
Joachimsthal 1/	1.636	1.694	1.732		
Gilpin County, Colo. 2/	1.660	1.710	1.760	~40°	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Zippeite USNM R7929	Joachimsthal, Bohemia	---	USGS-X USNM-9x6,L
Zippeite USNM C4767	Joachimsthal, Bohemia	TE 251	USGS-S USNM-3x6,L
Zippeite HMM 89612 Phase 64 Mixture?	Joachimsthal, Bohemia	Har. 1430	---

1/ Nováček, R., Soc. royale sci. Bohème, Cl. sci., Mém. 7 (1935).
2/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 159 (1921).

GROUP B. MINERALS WITH MINOR AMOUNTS OF URANIUM AND THORIUM

ALLANITE $(Ca,Ce,Th)_2(Al,Fe,Mg)_3Si_3O_{12}(OH)$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Allanite USNM 103023	Canyon City, Colo.	---	USGS-XS USNM-100 g
Allanite 1/ USNM 48413	Devil's Head Mountain, Douglas County, Colo.	---	---
Allanite HMM	Blueberry Mountain, E. Woburn, Mass.	Har. 4251	---
Allanite HMM	Rubideaux Mountain granite, Elsinore quad., Calif.	Har. 4253	---
Allanite 2/ USNM 104353	Whiteface Mountain, Essex County, N.Y.	---	USNM-75 g
Allanite 2/ USNM 104354	Cook Shaft, Mineville, Essex County, N.Y.	---	---
Allanite 3/ USNM 103601	Barringer Hill, Llano County, Texas	---	USNM-200 g
Allanite 4/ USNM 44456	Amherst County, Va.	---	USNM-10 g
Allanite 5/ USNM 10355	Huddersfield Township, Quebec	---	USNM-100 g
Allanite USNM R3834	Ytterby, Sweden	---	USGS-XC USNM-75 g
Allanite USGS-WTS	---	Inv. 2867	---
Allanite USGS-WTS	---	Inv. 4026	---
Allanite TE	---	TE 3220	---
Allanite TE(435-W-RS-1)	---	TE 528	---

Allanite---Specimen Data (Cont.)

Yttro-orthite--Synonym of allanite

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Yttrium orthite USNM 96847	North Karelia, Russia	---	USGS-XS USNM-150 g

1/ Eakins, L. G., Proc. Colo. Sci. Soc. 2, 32 (1886).
2/ Marble, J. P., Am. Jour. Sci., 5th ser., 241, 32-42 (1943).
3/ Marble, J. P., Am. Mineralogist, 25, 168-173 (1940).
4/ Marble, J. P., Am. Jour. Sci., 5th ser., 30, 349-352 (1935).
5/ Marble, J. P., Nat. Research Council Rept. Comm. Measurement Geol. Time, 1942.

BASTNAESITE $(Ce,La)(CO_3)F$

Optics 1/

In transmitted light, colorless to pale yellow. Faintly pleochroic with absorption E > O.

	n(Bastnaes)	n(Pikes Peak)	Uniaxial positive (+)
O	1.722	1.717	
E	1.823	1.818	

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Bastnaesite TE	Birthday prospect, San Bernardino County, Calif.	TE 255	USGS-XSC
Bastnaesite USNM R7792	Stove Mountain, near Pikes Peak, Colo.	---	USGS-XS USNM-25 g
Bastnaesite HMM	Stove Mountain, St. Peter's dome, Colo.	Har. 9706	---
Bastnaesite 2/ USNM 48415	St. Peter's dome, Pikes Peak region, Colo.	---	USNM-15 g
Bastnaesite 2/ USNM 81857	Cheyenne Mountain, Pikes Peak region, Colo.	---	---
Bastnaesite 1/ USNM 105628-631	Red Cloud mine, Gallinas Mountains, Lincoln County, N. Mex.	---	USNM-200 g

Bastnaesite---Specimen Data (Cont.)

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Bastnaesite 1/ USNM R2617	Madagascar	Inv. 1512	USNM-25 g

1/ Glass, J. J., and Smalley, R. G., Am. Mineralogist 30, 601-615 (1945).
2/ Hillebrand, W. F., Am. Jour. Sci., 4th ser., 7, 51 (1899).

CAPPELENITE $(Ba,Y)_2SiBO_6$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Cappelenite HMM 85281	Langesund Fiord, Norway	Har. 11319 Not ignited Very faint pattern	---
Cappelenite HMM 85281	Langesund Fiord, Norway	Har. 11351 Ignited Same pattern as un-ignited but stronger	---

CERITE Ce_2SiO_5

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Cerite TE	Jamestown district, Colo.	---	USGS-XSC
Cerite USNM 45326	Bastnaes, Sweden	---	USGS-XS USNM-100 g
Cerite USNM R7073	Bastnaes, Sweden	TE 635	USGS-XS USNM-500 g
Cerite HMM	Bastnaes, Sweden	Har. 7957	HMM-500 g

CORVUSITE $V_2O_4 \cdot 6V_2O_5 \cdot xH_2O$?

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Corvusite USNM 102627	Gateway, Colo.	---	USGS-XS USNM-75 g
Corvusite TE	Small Spot mine, Mesa County, Colo.	TE 503	USGS-XS
Corvusite TE-LRS/58/48	Club mine, Montrose County, Colo.	TE 464	---
Corvusite 1/ USNM 96806	Tomlinson and Hart basin claims, 9 mi. W. of Gateway, Colo.	TE 472	USNM-100 g
Corvusite 1/ USNM 96807	Ponto No. 3 claim, N. wall Gypsum Valley, San Miguel County, Colo.	---	USNM-4000 g

1/ Henderson, E. P., and Hess, F. L., Am. Mineralogist 18, 195-205 (1933).

DAVIDITE - Contains Ti,Fe, rare earths,U,V, and Cr.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Davidite USNM 87282	Olary, South Australia	TE 605	USGS-XS USNM-150 g

HIELMITE AB_2O_6 or $A_2B_3O_{10}$

A = Y,Fe^2,U^4,Mn,Ca; B = Cb,Ta,Sn,W

Optics 1/

In transmitted light, dark yellowish brown to opaque. Anisotropic, but some has been altered externally or along fractures to an isotropic material. Optically positive (+), and nearly or quite uniaxial.

Hielmite---Optics (Cont.)

	n_{Li}	Pleochroism
X	2.30 ± 0.02	Yellowish brown
Z	2.40 ± 0.04	Nearly opaque

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Hielmite HMM 57842	Kårarfvet, near Fahlun, Sweden	Har. 1913 Ignited	---
Hielmite USNM C4006	Kårarfvet, Sweden	TE 633	---
Hielmite HMM 85106	Striposem, Sweden	Har. 1906 Ignited - same as fergusonite, Petaca, N. Mex.	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 85 (1921).

HOKUTOLITE - Variety of barite

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Hokutolite USNM R5965	Kuroshibu Hot Springs, Ugo (Akitaken), Japan	TE 596	USGS-XS USNM-200 g

JOHNSTRUPITE - A complex silicate of Na,Ca,Th,Ce, and Ti

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Johnstrupite USNM R5016	Brevig, Norway	---	USGS-X USNM-5 g

KOLM - Rock with hydrocarbon and uranium

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Kolm USNM 87266	Stromsberg, near Launa, Province Narke, Sweden	---	USGS-XS USNM-30 g

MELANOCERITE - Chiefly a boro-silicate of Ce and Y

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Melanocerite USNM R6990	Brevig, Norway	---	USGS-X USNM-10 g
Melanocerite HMM 85282	Langesund Fiord, Norway	Har. 11315 not ignited, no pattern Har. 11345 ignited good pattern	---

Caryocerite--Near melanocerite

Caryocerite USNM C2625	Langesund Fiord, Norway	---	USGS-XS USNM-25 g
Caryocerite HMM 85283	Langesund Fiord, Norway	Har. 11322 Not ignited no pattern	---
Caryocerite HMM 85283	Langesund Fiord, Norway	Har. 11348 Ignited definite pattern	---

MICROLITE $(Na,Ca)_2(Ta,Cb)_2O_6(O,OH,F)$

Optics

Isotropic, but may show weak anomalous birefringence in the non-metamict material. Colorless, or pale yellow, brown, etc., in material with a deep body color; sometimes cloudy. May show a zonal structure

Microlite---Optics (Cont.)

in shades of brown or yellow. n apparently decreases with increasing alteration by hydration. On ignition n increases to 2.0 - 2.2.1/

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Microlite USNM 104745	Brown Derby mine, Montrose County, Colo.	---	USGS-XS USNM-20 g
Microlite HMM	Topsham, Maine	Har. 453	---
Microlite 2/ USNM 100282	Moorefield mine, Amelia, Va.	---	USNM-10 g
Microlite 2/ USNM 100282	Rutherford mine, Amelia, Va.	---	USNM-10 g
Microlite USNM 93594	Amelia, Va.	---	USGS-XS USNM-10 g
Microlite HMM	---	Inv. 2825	---

Calciotantalite--Possibly a mixture of microlite and tantalite

Calciotantalite USNM R6520	Pilbara Gold district, Western Australia	---	USGS-XS USNM-30 g

Neotantalite--An altered microlite with composition close to tantalite

Neotantalite USNM R5095	Department Allier, France	TE 746 Ignited	USGS-X USNM-200 g
Neotantalite	Department Allier, France	Har. 231	---

1/ Larsen, E. S., and Berman, Harry, U. S. Geol. Survey Bull. 848, 60, 61 (1934).
2/ Glass, J. J., Am. Mineralogist 20, 741-768 (1935).

MOSANDRITE - Complex silicate of Na,Ca,Ce, and Ti

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Mosandrite USNM R7136	Brevig, Norway	---	USGS-XS USNM-10 g

PISEKITE - Essentially a columbate-tantalate-titanate of U and rare earths, with Th and Sn.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Pisekite? USNM R7434	Pisek, Bohemia	---	USGS-X USNM-2 g

PYROCHLORE $(Na,Ca)_2(Cb,Ta)_2O_6F$

Optics

Isotropic, but may show weak anomalous birefringence in the non-metamict material. Colorless, or pale yellow, brown, etc., in material with a deep body color; some may be cloudy. May show a zonal structure in shades of brown or yellow. n apparently decreases with increasing alteration by hydration. On ignition n increases to 2.0 - 2.2.1/ Pyrrhite has n = 2.16 2/ and koppite has n = 2.12 to 2.18.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Pyrochlore USNM R5033	Fredricksvärn, Norway	TE 737 Ignited	USGS-XS USNM-30 g
Pyrochlore HMM 87780	Miask, Urals	Har. 2039 Ignited	USGS-XS HMM-20 g

Pyrochlore---Specimen Data (Cont.)

Chalcolamprite--Synonym of pyrochlore

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Chalcolamprite HMM 87784	Narasuk, Greenland	Har. 434	HMM-5 g
Ellsworthite--Composition is close to pyrochlore, but analyses show it is relatively high in U and H_2O and low in alkalies			
Ellsworthite USNM 94804	Ontario	---	USGS-XS USNM-20 g
Ellsworthite	Hastings County, Ontario	Inv. 2997 Ignited	---
Ellsworthite HMM 81175	Hybla, Ontario	Har. 2035 Ignited	---
Ellsworthite HMM 90525	Haliburton County, Ontario	Har. 333 Ignited	---
Ellsworthite HMM 89636	Haliburton County, Ontario	Har. 433 Ignited	---
Ellsworthite HMM 89636	Haliburton County, Ontario	Har. 469 No pattern	---
Endeiolite--Similar in composition to chalcolamprite			
Endeiolite USNM C4018	Narsarsuk, Greenland	---	USGS-XS USNM-5 g
Hatchettolite--Uranian pyrochlore			
Hatchettolite HMM 87786	Mitchell County, N.C.	Har. 2036 Ignited	---
Hatchettolite HMM 91477	Hybla, Ontario	Har. 2038 Ignited	HMM-100 g
Hatchettolite USNM 97640	San José de Bujaube Minas Geraes, Brazil	TE 638	---

Pyrochlore---Specimen Data (Cont.)

Koppite--Synonym of pyrochlore

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Koppite	Near Schelingen, Kaiserstuhl, Germany	---	USGS-XS

Marignacite--Synonym of pyrochlore

Marignacite USNM R5037	Wausau, Wis.	TE 656	USGS-X USNM-½ g
Marignacite HMM 87782	Wausau, Wis.	Har. 230 Ignited Har. 1191-not ignited, poor pattern	---

Pyrrhite--Synonym of pyrochlore

Pyrrhite? USNM C3963	Azores	---	USGS-X USNM-1 g

1/ Larsen, E. S., and Berman, Harry, U. S. Geol. Survey Bull. 848, 60, 61 (1934).

2/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 124, 180 (1921).
Glass, J. J., Am. Mineralogist 20, 752 (1935).
Kreutz, Stefan, Akad. Wiss., Krakau, 54, 227 (1915).
Kreutz, Stefan, Jahrb. Min. 134 (1918).

ROWLANDITE - An yttrium silicate

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Rowlandite USNM R3784	Llano County, Texas	---	USGS-X

STEENSTRUPINE - Complex silicate of rare earths, Th,Na,K,Fe,Mn,Mg,P,Be,Al, and Ta with (OH) and F.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Steenstrupine USNM R3317	Kangerdluarsuk, Greenland	---	USGS-XS USNM-30 g

TENGERITE a) Close to $CaY_3(OH)_3(CO_3)_4 \cdot 3H_2O$
b) Supposedly an yttrium carbonate

Optics

Material from Ytterby, supposedly tengerite, was optically positive (+) with 2V large, nX = 1.555, nY = 1.585, and nX parallel to the elongation.1/ Alteration product at Iisaka, Japan, also classed with tengerite, occurred as a white powder or as globular concretions with a minute scaly structure and pearly luster. nX = 1.622, nY = 1.642.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Tengerite USNM 104044	Iisaka, Fukushima, Japan	---	USGS-XS USNM-10 g

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 142 (1921).

THALENITE $Y_4Si_4O_{13}(OH)_2$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Thalenite USNM R3782	Osterby, Dalecarlia, Sweden	---	USGS-XS USNM-30 g
Thalenite HMM 85996	Torsekebacken, Sweden	Har. 7962 not ignited; pattern only one line — metamict?	---

THUCOLITE - A hydrocarbon

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Thucolite USNM 103138	Besner mine, Henvey Township, Parry Sound, Ontario	---	USGS-XS

TRITOMITE - A boro-silicate of cerium, yttrium, calcium, and thorium, also containing fluorine. Exact formula uncertain.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Tritomite USNM R3319	Brevig, Norway	---	USGS-X USNM-5 g
Tritomite HMM 85290	Langesund Fiord, Norway	Har. 11320 Not ignited, no pattern Har. 11349 Ignited, good pattern	---

TSCHEFFKINITE - Complex silicate of rare earths, Fe,Mn,Mg,Ca,Al,Ti,Th, and U

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Tscheffkinite HMM 85151	Fiadanana, Madagascar	Har. 11318 not ignited, no pattern Har. 11347 ignited, good pattern	---
Tscheffkinite HMM 96869	Ilmen Mountains, Urals	Har. 11317 not ignited, no pattern Har. 11344 ignited, good pattern but not same as HMM 85151	---

Tscheffkinite---Specimen Data (Cont.)

Chevkinite = tscheffkinite

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Chevkinite 1/ USNM 105344	Aquarious Mountains, Mohave County, Ariz.	---	USNM-75 g

1/ Kauffman, A. J., and Jaffe, H. W., Am. Mineralogist, 31, 582-588 (1946).

VANOXITE - A hydrated vanadium oxide, perhaps $2V_2O_4 \cdot V_2O_5 \cdot 8H_2O$, reported to contain up to 0.5% U.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Vanoxite 1/ USNM 95059	Bill Bryan claim, Wild Steer canyon, Montrose County, Colo.	TE 474- gave no picture	USGS-S

1/ Hess, F. L., U. S. Geol. Survey Bull. 750-D, 63 (1925).

VOLBORTHITE $Cu_2(VO_4)(OH) \cdot H_2O(?)$

Optics

In transmitted light, green to greenish yellow. Faintly pleochroic. Biaxial.

Orientation	n Uzbekite 1/	n Utah 2/
X	2.01	2.01
Y	2.04	2.05
Z	2.07	2.10 (calc.)
2V	large	68° (Li) 83° (Na)
Sign	(-)	(+) red, (-) violet
Disp.	r < v	r > v (inclined)

Volborthite (Cont.)

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Volborthite USGS(WTS 49-45CSX) Type specimen	Russia	Inv. 4463	---

Calciovolborthite - $Cu,Ca(VO_4)(OH)(?)$

Calciovolborthite 2/ USNM 93298	Richardson, Grand River, Utah	---	USNM-4x10,M

1/ Barth, T. F. W., and Berman, Harry, Chemie der Erde, 5, 30 (1930).
2/ Hillebrand, W. F., and Merwin, H. E., Am. Jour. Sci., 4th ser., 35, 441 (1913) on material termed calciovolborthite (?).

WIIKITE - Ill-defined mixture and alteration product of minerals high in Cb,Ta,Ti,Si, and Y.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Wiikite USNM R5119	Lokansuari, Impilahti, Finland	---	USGS-XS USNM-100 g
Wiikite HMM 58172	Nuolainniemi, Finland	Har. 11325 not ignited, no pattern Har. 11316 not ignited, faint pattern Har. 11330 ignited, good pattern but not same pattern as un-ignited material	---

XENOTIME $Y(PO_4)$

Optics 1/

In transmitted light, colorless to very pale yellowish green, yellow or yellowish brown.

Xenotime---Optics (Cont.)

	n Na	n Na (New Zealand)	
O	1.721	1.720	Uniaxial positive (+)
E	1.816	1.827	

Xenotime may be weakly dichroic with O pink, yellow, or yellowish brown; and E brownish yellow, grayish brown, or greenish.

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Xenotime USNM 105008	Luwangashi	---	USGS-XS USNM-25 g
Xenotime	Washington Heights, New York, N.Y.	Inv. 2708	---
Xenotime HMM	Washington Heights, New York, N.Y.	Har. 5838	---
Xenotime 2/ USNM 82391	Pikes Peak, El Paso County, Colo.	---	---

1/ Hutton, C. O., Am. Mineralogist 32, 141 (1947).
Kraus, M, and Reitinger, Zeitschr. Kristallographie, 34, 268 (1901)
2/ Penfield, S. L., Am. Jour. Sci., 3rd ser., 45, 398-399 (1893).

YTTRIALITE - Silicate of Th and Y metals chiefly

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Yttrialite USNM C3094	Llano County, Texas	TE 738 Ignited	USGS-XS USNM-20 g
Yttrialite USNM R5878	Llano County, Texas	---	USGS-XS USNM-20 g
Yttrialite 1/ USNM 85070?	Barringer Hill, Llano County, Texas	---	USNM-30 g

1/ Hillebrand, W. F., Am. Jour. Sci. 4th ser., 13, 145 (1902).

YTTROCRASITE $(Y,Th,U,Ca)_2(Ti)_4O_{11}$?

Optics

In transmitted light, rich amber to light yellow. In part metamict and isotropic; in part weakly anisotropic. n ranges from 2.12 to 2.15.1/

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Yttrocrasite USNM R5031	3 mi. E. Barringer Hill, Burnet County, Texas	---	USGS-XS USNM-10 g

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 158 (1921).

YTTROTANTALITE $(Fe,Y,U)(Cb,Ta)O_4$

Optics

Transmits light in thin splinters. Isotropic (metamict), becomes crystalline on heating. In section red brown and isotropic n = 2.15 ± 0.02.1/

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Yttrotantalite USNM R7141	Ytterby, Sweden	---	USGS-XS USNM-150 g
Yttrotantalite HMM 87851	Ytterby, Sweden	Har. 1887 Har. 1907 Ignited	---

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 158 (1921).

ZIRCON $ZrSiO_4$

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Zircon HMM 91500	Renfrew County, Ontario	Har. 7979	---

Zircon---Specimen Data (Cont.)

Alvite--Variety of zircon, near cyrtolite

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Alvite USNM R7033	Alve, Helle Brudd, Arendal, Norway	TE 667 Ignited	USGS-XS USNM-100 g
Alvite	Helle, Norway	Inv. 2551	---

Cyrtolite--Altered zircon, containing U,Th,Y and other rare earths

Cyrtolite USNM 80183	Mitchell County, N.C.	TE 665 Ignited	USGS-XS
Cyrtolite	Near Bluffton, Llano County, Texas	Inv. 2554	---

Hagatalite--Synonym of zircon

Hagatalite USNM 105393	Hagata-mura, Ochi-gun, Ehime Prefecture, Japan	TE 692 Ignited TE 693 Modified ignition	USGS-XS USNM-10 g

Naegite--Synonym of zircon

Naegite USNM 105465	Naegi, near Takayuma Gitu Prefecture, Honshu, Japan	---	USGS-XS USNM-15 g

ZIRKELITE $(Ca,Fe,Th,U)_2(Ti,Zr)_2O_5$?

Optics

Transparent in very thin splinters, with a dark-brown or reddish-brown color. n = 2.19 ± 0.01.1/

Specimen Data

Mineral and identifying number	Location	Ref. no. of X-ray patterns	Quantity
Zirkelite USNM R5026	Jacuipiranga, São Paulo, Brazil	---	USGS-X USNM-1 g

1/ Larsen, E. S., U. S. Geol. Survey Bull. 679, 160 (1921).

GROUP C. SYNTHETIC URANIUM COMPOUNDS PREPARED BY THE U. S. GEOLOGICAL SURVE

URANYL ARSENATES

Compound	Method of synthesis	Ref. no. of X-ray patterns
Ca uranyl arsenate Preparation 20	Precipitation from solution	TE 97
Cu uranyl arsenate	Precipitation from solution	

URANYL CARBONATES

Na,Ca uranyl carbonate	Precipitation from solution	Inv. 2869
Ca,Mg uranyl carbonate	Precipitation from solution	Inv. 4266
Mg uranyl carbonate	Precipitation from solution	Inv. 2868

URANYL PHOSPHATES 1/

Ca uranyl phosphate Preparation 13	Precipitation from solution	TE 58
Na uranyl phosphate	Base exchange from Ca compound	
Ba uranyl phosphate	Base exchange from Na compound	
Mn uranyl phosphate	Base exchange from Na compound	
Cu uranyl phosphate	Base exchange from Na compound	
Ni uranyl phosphate	Base exchange from Na compound	
Pb uranyl phosphate	Base exchange from Na compound	
Mg uranyl phosphate	Base exchange from Na compound	

URANYL VANADATES 2/

Compound	Method of synthesis	Ref. no. of X-ray patterns
Na uranyl vanadate Preparation 16	Precipitation from solution	TE 68
K uranyl vanadate Preparation 15	Precipitation from solution	TE 57
Ca uranyl vanadate Preparation 6	Precipitation from solution	TE 19
(NH_4) uranyl vanadate Preparation 9	Precipitation from solution	TE 22
Cu uranyl vanadate Preparation 18	Base exchange from Ca compound	TE 67
Zn uranyl vanadate Preparation 34	Base exchange from Ca compound	TE 227
Sr uranyl vanadate Preparation 12	Precipitation from solution	TE 37
Ba uranyl vanadate Preparation 8	Precipitation from solution	TE 21
Tl uranyl vanadate Preparation 35	Base exchange from Ca compound	TE 229

1/ Fairchild, J. G., Am. Mineralogist 14, 265-275 (1929).
2/ Murata, K. J., et al., U. S. Geol. Survey TEI Rept. 107 (1950).