UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Geochemical data and sample locality maps for stream water and vegetation samples collected near five cinnabar-stibnite mineral occurrences in the Kuskokwim River region, southwestern Alaska

by

K.E. Slaughter, J.E. Gray, P.L. Hageman, J.E. Kilburn,
A.H. Love, and T.R. Peacock

Open-File Report 90-340A Paper copy
90-340B Diskette version

1990

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STUDIES RELATED TO AMRAP

The U.S. Geological Survey is required by the Alaska National Interests Lands Conservation Act (Public Law 96-487, 1980) to survey certain Federal lands to determine their mineral potential. Results of the Alaska Mineral Resource Assessment Program (AMRAP) must be made available to the public and be submitted to the President and Congress. This study presents results of a geochemical survey conducted around five cinnabar-stibnite mineral occurrences in the Kuskokwim River region, southwestern Alaska (fig. 1). Geochemical data are presented here for stream water and vegetation samples collected near these mineral occurrences. The geochemical and mineralogical data for the stream sediment and heavy-mineral-concentrate samples from this study were reported in Gray and others (1990).

INTRODUCTION

This study was conducted in the summer of 1989 as an orientation survey for future regional geochemical assessment studies in a region containing widespread cinnabar and stibnite mineral occurrences. The occurrences evaluated in this study are located in the Sleetmute, McGrath, and Taylor Mountains $1^\circ \times 3^\circ$ quadrangles. The study area covers approximately 19,200 km^2 (7410 mi^2). The purpose of this study was to evaluate several different sample media for their efficiency in geochemical prospecting for Hg-Sb lode deposits. Another objective was to identify the most reliable and most cost-effective sampling methods and analytical techniques for use in AMRAP studies currently being conducted by the U.S. Geological Survey. Results of this study will be useful in the exploration for similar mineral systems.

The terrain of the study area is dominated by low rolling hills with broad, sediment-filled lowlands as exemplified by the Kuskokwim Mountains in the central portion of the region. The most rugged topography occurs in the Kiokluk Mountains and a few other scattered mountain peaks. The maximum elevation in the area is 1248 m (4093 ft) and is located in the Kiokluk Mountains approximately 16 km (10 mi) south of the Mountain Top mine. Much of the study area is swampy, especially along portions of the Kuskokwim River basin. The minimum elevation occurs in these lowlands and is approximately 30 m (100 ft). The region is covered with vegetation that ranges from northern latitude forests to subarctic tundra.

GEOLOGY OF THE CINNABAR AND STIBNITE MINERAL OCCURRENCES

Most of the cinnabar and stibnite mineral occurrences are hosted in sedimentary rock of flysch association, but are also found in mafic dikes, carbonate rock, and hypabyssal rhyolite. Cinnabar and stibnite are the dominant ore minerals at these mineral occurrences, with lesser amounts of realgar, orpiment, and rarely native mercury. Ore minerals occur primarily in quartz-carbonate veins and stockworks that are typically found

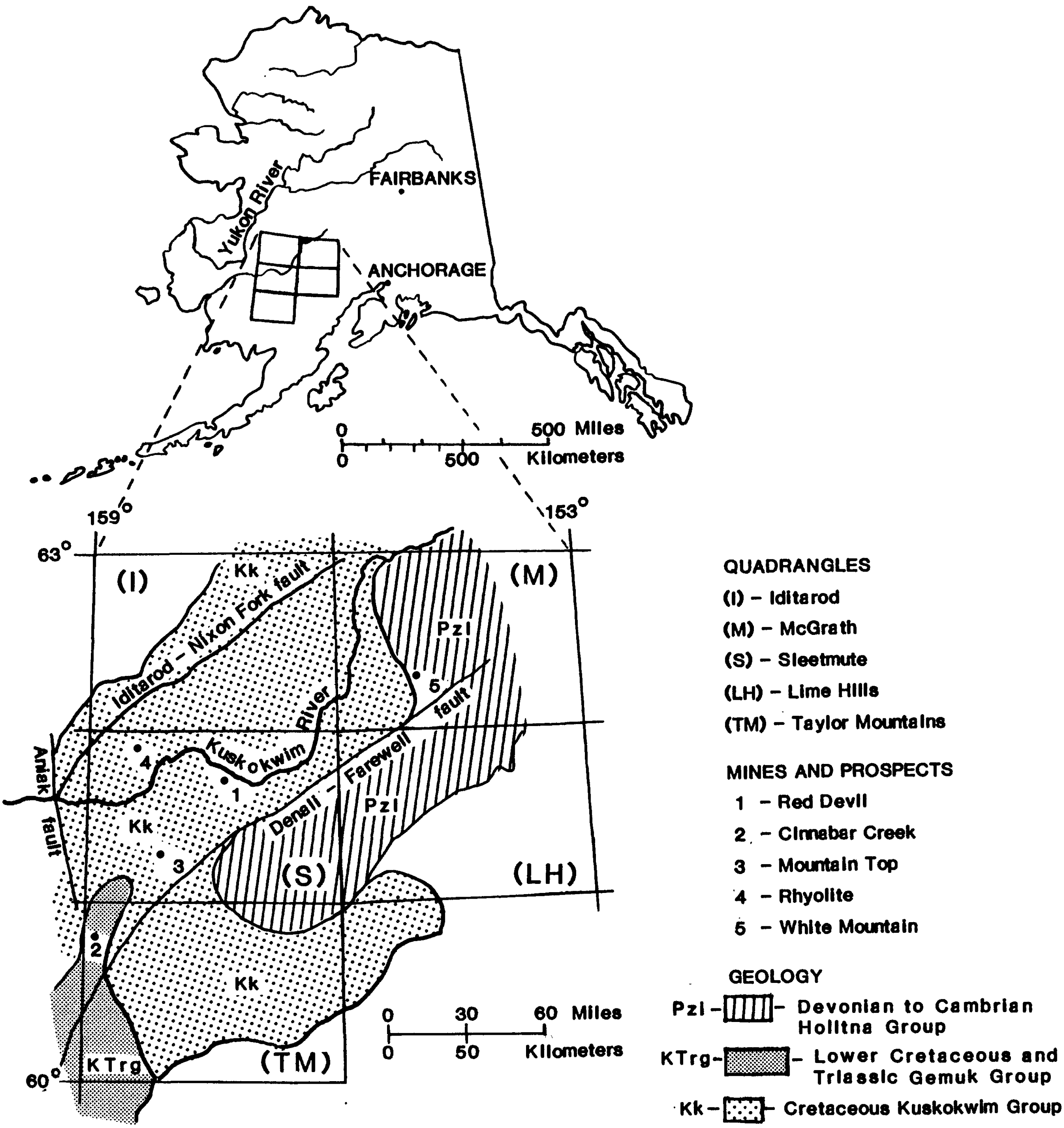

Figure 1. Location of the cinnabar-stibnite mineral occurrences studied.

along faults and fractures, or at the contacts between dikes and surrounding sedimentary rocks (Sainsbury and MacKevett, 1960).

Many of the cinnabar and stibnite mineral occurrences, including the large Red Devil deposit, are hosted by rocks of the Cretaceous Kuskokwim Group. In the Red Devil area, rocks of the Kuskokwim Group consist primarily of interbedded graywacke and shale that are intruded by numerous Cretaceous-Tertiary mafic dikes. Mineralized epithermal veins at Red Devil are found in both altered dikes and at the intersection of bedding plane faults with the dikes (Sainsbury and MacKevett, 1965). Cinnabar and stibnite are the most common ore minerals at Red Devil, but minor amounts of realgar, orpiment, pyrite, and hematite also occur (MacKevett and Berg, 1963). The cinnabar and stibnite are found primarily as open-space fillings in quartz-rich veins that also contain carbonate, limonite, and dickite gangue minerals. Individual veins are often small and less than 2.5 cm thick, but occasionally reach 1 m in width and several tens of meters in length (Sainsbury and MacKevett, 1965).

The Mountain Top mine is also located within rocks of the Kuskokwim Group. At Mountain Top, mineralized veins have only been recognized within Cretaceous-Tertiary mafic dikes that intrude the graywacke and shale of the Kuskokwim Group (Sorg and Estlund, 1972). The dikes, where mineralized, are brecciated and faulted. Cinnabar is found primarily as vug fillings in veins up to 0.3 m wide, along with quartz, dolomite, pyrite, solid and liquid hydrocarbons, and dickite. Stibnite is found only as finely-crystalline fragments in some small quartz veins or in highly weathered float (Sorg and Estlund, 1972).

The cinnabar-bearing veins at the Rhyolite prospect are found within Cretaceous-Tertiary rhyolite dikes that intrude graywacke and shale of the Kuskokwim Group. These dikes are part of the large porphyritic rhyolite stock at Juninggulra Mountain (Sainsbury and MacKevett, 1965). Cinnabar is the only sulfide recognized at this locality and is found as open-space fillings in quartz-dolomite veins, and as disseminations within the veins and the adjacent graywacke (Sainsbury and MacKevett, 1965). Gangue minerals include quartz, carbonate, kaolinite, dickite, and limonite.

The Cinnabar Creek prospects are located within the rocks of the Triassic and Cretaceous Gemuk Group. In the vicinity of these prospects, rocks consist primarily of interbedded graywacke and siltstone, with lesser lavas, tuff, chert, and limestone, all of Triassic age (Sainsbury and MacKevett, 1965). Cretaceous-Tertiary mafic dikes that exhibit silica-carbonate alteration cut these rocks near the prospects, however these altered dikes do not constitute high-grade ore (Sainsbury and MacKevett, 1965). High-grade cinnabar ore is found as massive replacements, disseminations, and vug fillings within small quartz-carbonate stockworks that occur along faults cross-cutting siltstone and graywacke of the Gemuk Group. Native mercury, and lesser stibnite and pyrite are associated with the cinnabar. Native mercury is particularly visible within sheared and brecciated sedimentary rocks and in streams in the area.

The White Mountain prospects are found within the rocks of the Cambrian to Devonian Holitna Group. Cinnabar, the only ore mineral recognized, is spatially associated with faults, most commonly where shale is faulted against limestone (Sainsbury and MacKevett, 1965). Cretaceous-Tertiary mafic dikes are also found in the White Mountain area, but have not been reported to be mineralized. Cinnabar is most commonly hosted by brecciated and silicified limestone and dolomite, occurring as disseminations and within veins up to 10 cm wide. Carbonate, limonite, dickite, and minor quartz comprise the gangue minerals (Sainsbury and MacKevett, 1965).

METHODS OF STUDY

Geochemical Sampling Techniques

Detailed geochemical sampling was conducted proximal to the five mineral occurrences described above, which were considered to be representative of cinnabar-stibnite mineralization throughout southwestern Alaska. Samples were collected on approximately one to two kilometer intervals from first- and second-order stream drainages below known mineral occurrences. In addition, samples were collected upstream from known mineralization when possible. Sample site locality maps are shown in figures 2-6 for the mineral occurrences studied.

At each site a stream water sample was taken from the active channel. Stream water samples collected at each site included: a) a 100 ml raw water sample for anion analysis, b) a 60 ml filtered water sample acidified with nitric acid for cation analysis, and c) a second filtered water sample of 30 ml was collected for Hg analysis and was acidified with hydrochloric acid, hydrogen peroxide, and nitric acid. Filtered water samples were acidified to prevent precipitation of metals and bacterial growth. Disposable 0.45 micron filters were used for the collection of filtered water samples. All stream water samples were collected in polypropylene bottles that were rinsed on site with a small amount of stream water for the raw water samples and filtered water for the filtered water samples. Water conductivities were measured with a portable conductivity meter in micromho/cm at 25°C.

Willow and alders were collected as close to the active stream channel as possible. Initially, only feltleaf willows (Salix alaxensis) were collected, however at sites where the feltleaf willow could not be found, the diamond leaf willow (Salix planifolia ssp. pulchra) or the sandbar willow (Salix interior) was collected as an alternative. At some sites willows could not be located, and there an american green alder (Alnus crispa) sample was collected. Where possible, both willow and alder samples were collected for comparison of plant chemistries. The outer four to six inches of new growth of the plant was typically collected. Approximately 10 to 25 grams of dry plant material was collected from each site. Both leaves and stems were

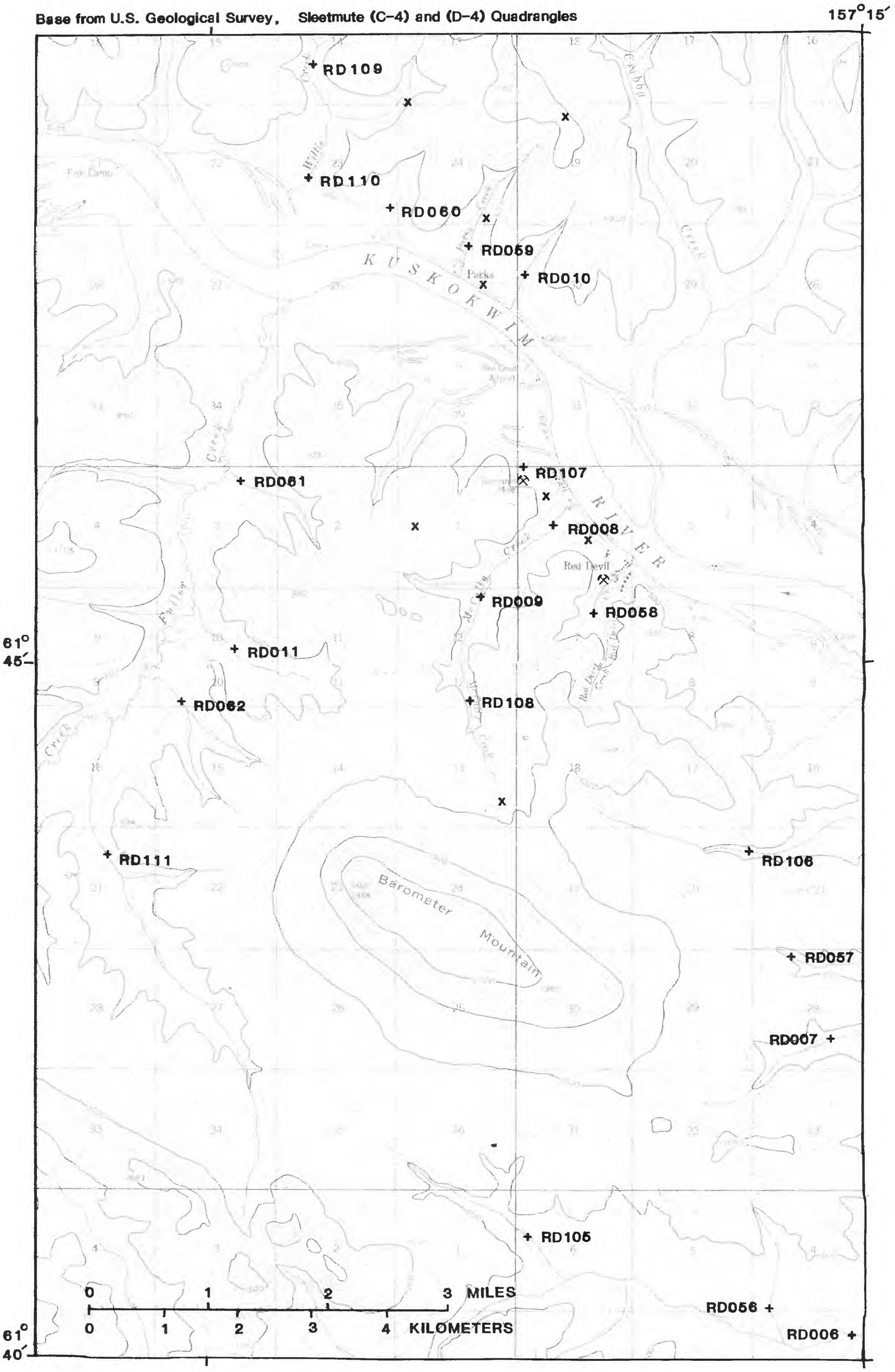

Figure 2. Localities of samples from the Red Devil area.
⚒ - Mines as labeled, x - mineral prospects.

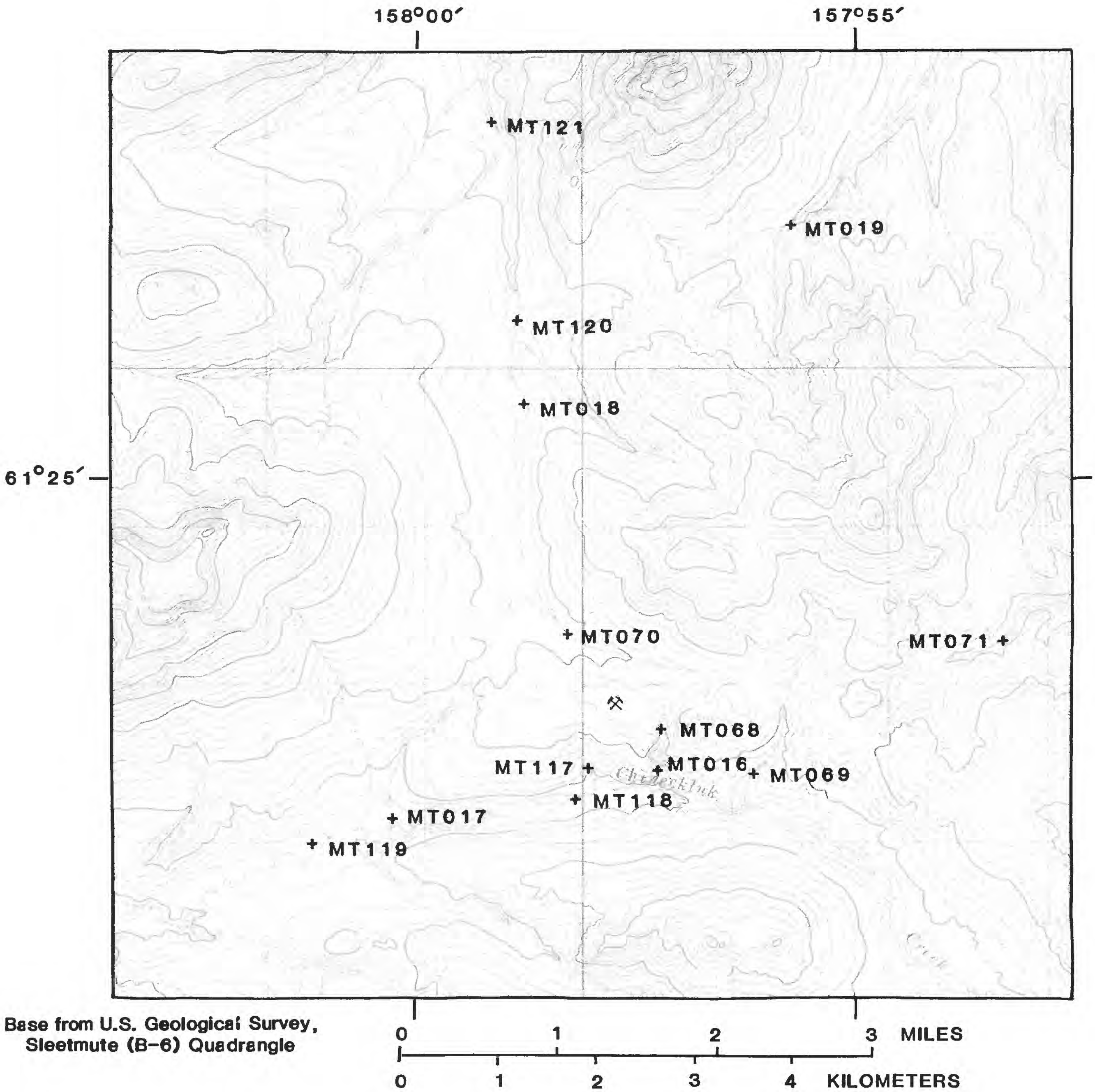

Figure 3. Localities of samples from the Mountain Top area.
⚒ - Mountain Top mine.

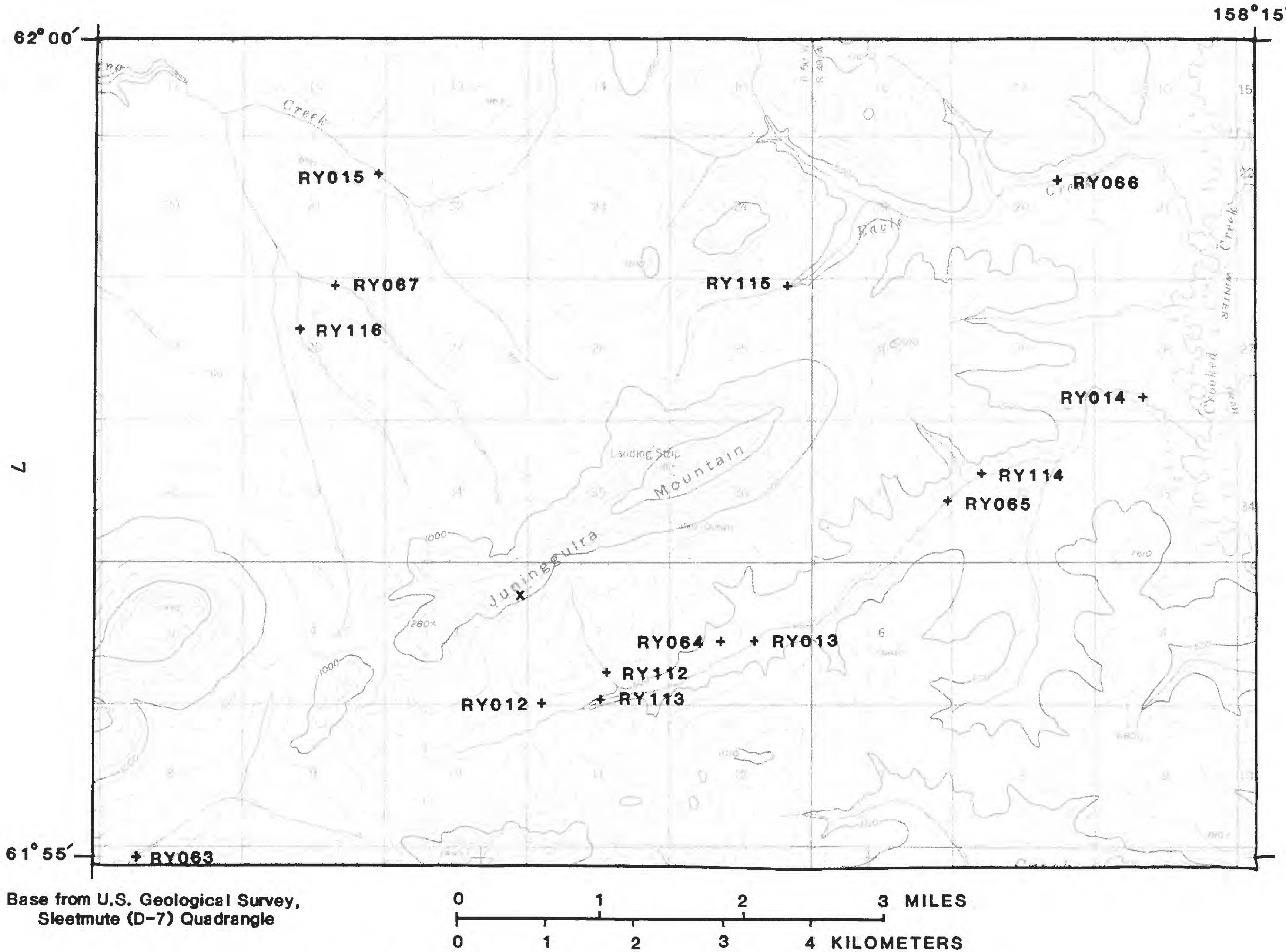

Figure 4. Localities of samples from the Rhyolite area.
x - Rhyolite prospect.

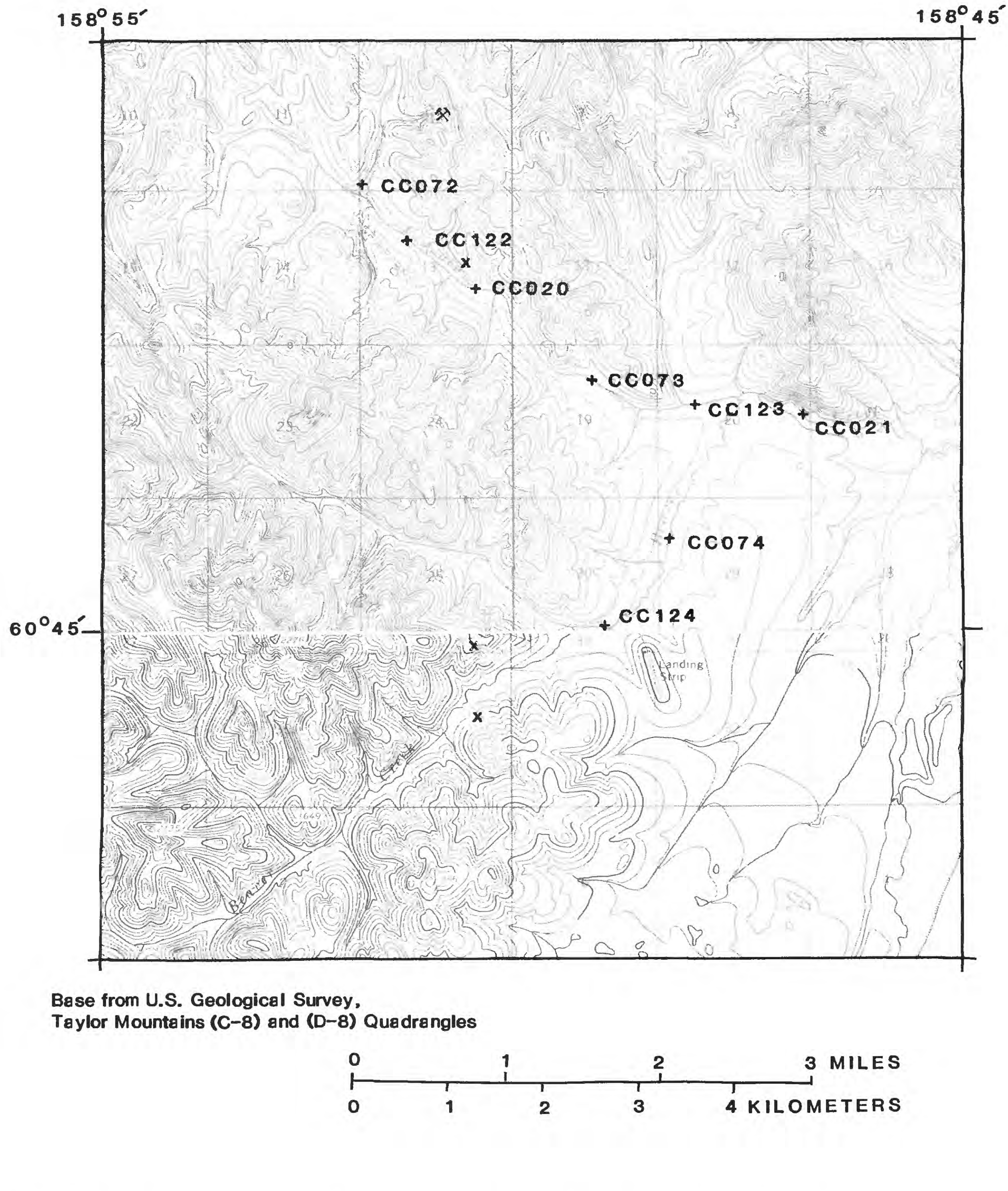

Figure 5. Localities of samples from the Cinnabar Creek area. ⚒ - Cinnabar Creek mine, x - mineral prospects.

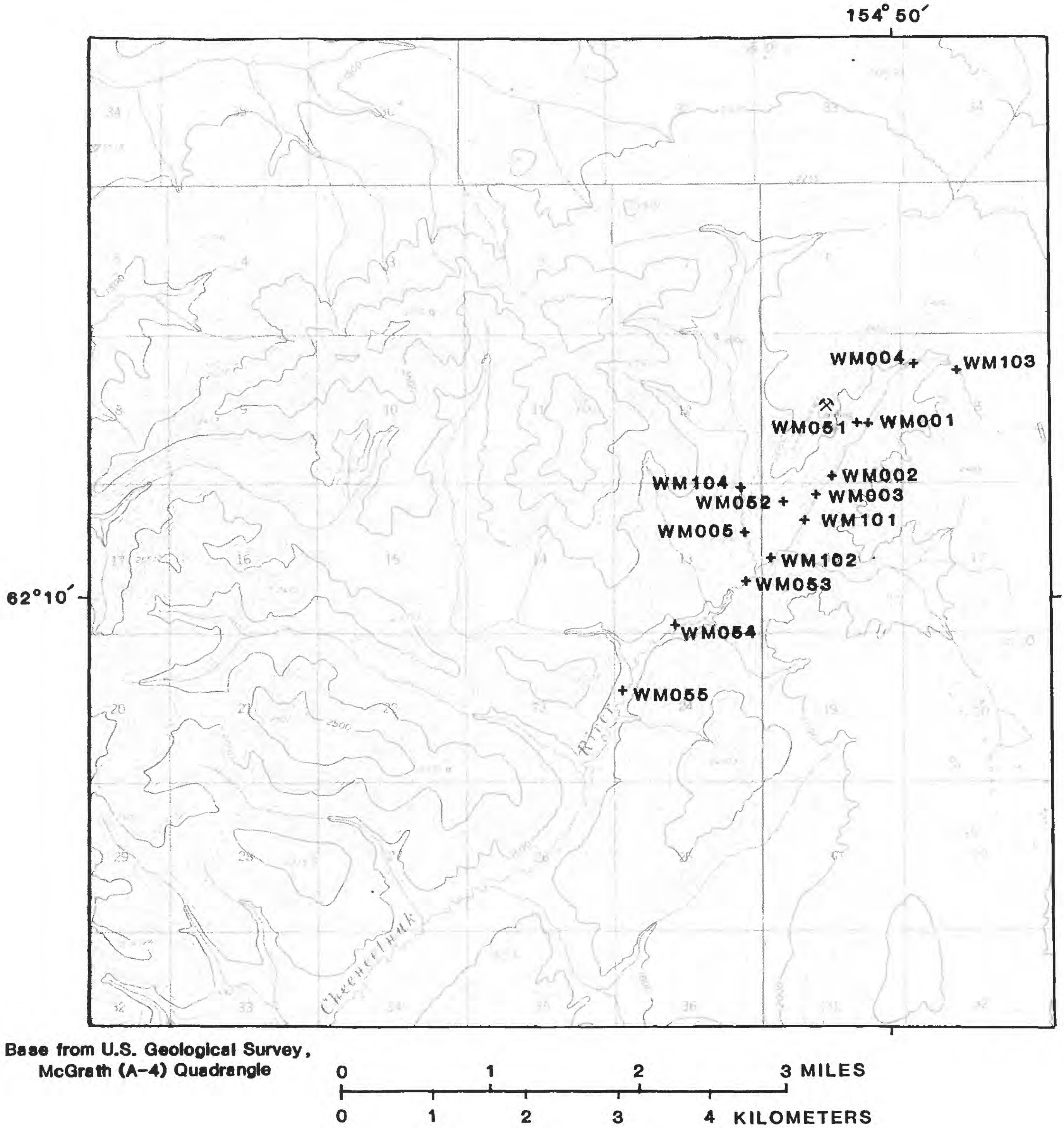

Figure 6. Localities of samples from the White Mountain area.
⚒ - White Mountain mine.

processed as one sample.

Sample Preparation

No further laboratory preparation was necessary on the stream water samples. The willow and alder samples were thoroughly washed in deionized water and air dried. No attempt was made to evaluate or correct for any wind blown detrital contamination, but eolian contamination is believed to be small because of the humid climate in the study area. These samples were then ground in a Wiley mill. The ground plant material was analyzed by instrumental neutron activation analysis (INAA).

Analytical Techniques

Ion Chromatography

The anions SO_4^{--}, NO_3^-, F^-, and Cl^- were determined simultaneously by ion chromatography on unfiltered stream water samples following the procedure developed by Fishman and Pyen (1979). The raw water samples were injected into a chromatograph where the ions of interest elute through an anion-ion exchange separator column at different rates depending on the affinity of each species for the ion-exchange resin. The sample then passes into a suppressor column and into a flow-through conductivity cell where the anions are detected and peak heights are recorded on an output chart. Unknown samples are compared with peak heights of reference standards to determine sample concentrations.

Atomic Absorption Spectroscopy

Iron, Mn, and Zn were determined by flame atomic absorption spectroscopy on acidified water samples. Antimony, Ag, As, Cd, Cu, Mo, and Pb were also determined from acidified stream water samples using a graphite furnace atomic absorption method adapted from Perkin-Elmer (1977). Mercury was determined on acidified stream water samples (collected specifically for mercury analysis as described above) by a cold vapor atomic absorption technique similar to that described by Kennedy and Crock (1987). In this method, hydroxylamine hydrochloride-sodium chloride and stannous chloride were added to the water samples in a continuous flow system to produce Hg^0. Mercury vapor was then transported to and measured in an optical absorption cell by atomic absorption spectrophotometry. The lower limits of determination for all elements analyzed in the stream water samples are shown in Table 1.

Instrumental Neutron Activation Analysis

Seven to 15 gram aliquots of ground plant material were dried, compressed into a briquette, and irradiated. Element concentrations were measured using a high purity germanium detector similar to the procedure described by Hoffman and Brooker (1982). Counting times were 500 seconds per sample. The gamma spectrum was analyzed by a computer program that determined net peak areas. Analytical values were determined by using

Table 1. Lower limits of determination for chemical methods used for stream water analysis. [Concentrations as indicated.]

Element		Lower determination limit
Ion Chromatography		
Chloride	(Cl)	0.10 ppm
Fluoride	(F)	.01 ppm
Nitrate	(NO_3)	.10 ppm
Sulfate	(SO_4)	.10 ppm
Atomic Absorption		
Iron	(Fe)	0.01 ppm
Manganese	(Mn)	.01 ppm
Zinc	(Zn)	.01 ppm
Silver	(Ag)	.02 ppb
Arsenic	(As)	.50 ppb
Cadmium	(Cd)	.1 ppb
Copper	(Cu)	2 ppb
Mercury	(Hg)	.05 ppb
Molybdenum	(Mo)	.10 ppb
Lead	(Pb)	2.0 ppb
Antimony	(Sb)	.05 ppb

a calibration developed from data of many internal standard reference materials. Other reference materials and an NBS standard were analyzed along with the willows and alders as analytical monitors. The analytical results of these materials indicate that INAA results are reliable within ± 15 percent for most elements, but are higher for element concentrations at or near the limit of determination. The elements analyzed and their lower limits of determination are shown in Table 2.

DATA STORAGE SYSTEM

The geochemical and mineralogical results were entered into the Branch of Geochemistry's data base. This data base contains both descriptive geological information and the analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1977).

The data in this report are also available on 5.25 inch, 360K magnetic diskettes that includes the text in ASCII file format, and the analytical data in database file (.dbf) format (Slaughter and others, 1990). Access to this information requires an IBM compatible computer using MS DOS, a 5.25 inch drive capable of handling 360K diskettes, and a database program able to import .dbf files.

Table 2. Lower limit of determination for Instrumental Neutron Activation Analysis of vegetation samples.

	Percent
Calcium (Ca)	0.01
Iron (Fe)	.005
Potassium (K)	.001
	Parts per million
Silver (Ag)	0.3
Arsenic (As)	.01
Barium (Ba)	5
Bromine (Br)	.01
Cerium (Ce)	.1
Cesium (Cs)	.05
Chromium (Cr)	.3
Cobalt (Co)	.1
Europium (Eu)	.05
Hafnium (Hf)	.05
Mercury (Hg)	.05
Lanthanum (La)	.01
Lutetium (Lu)	.001
Molybdenum (Mo)	.05
Sodium (Na)	.5
Neodymium (Nd)	.3
Nickel (Ni)	5
Rubidium (Rb)	1
Antimony (Sb)	.005
Scandium (Sc)	.01
Selenium (Se)	.1
Samarium (Sm)	.001
Strontium (Sr)	10
Tantalum (Ta)	.05
Terbium (Tb)	.1
Thorium (Th)	.1
Uranium (U)	.01
Tungsten (W)	.05
Ytterbium (Yb)	.005
Zinc (Zn)	2
	Parts per billion
Gold (Au)	0.1
Iridium (Ir)	.1

DESCRIPTION OF THE DATA TABLES

In Tables 3 and 4 the sample number prefixes refer to the mineral occurrence studied; CC = Cinnabar Creek, MT = Mountain Top, RD = Red Devil, RY = Rhyolite, and WM = White Mountain. The sample numbers correspond to those shown on the sample locality maps (figs. 2-6). The geochemical results for the stream water samples are listed in Table 3 and the sample suffix W designates these samples as stream waters. The geochemical data for the vegetation samples are shown in Table 4. The sample suffix T designates a willow sample, and suffix Z an alder. Vegetation identifications were made in the laboratory and are shown in Table 4. For some willows, positive identifications could not be made and a question mark (?) follows the scientific name. In Table 4, values determined for the major elements Ca, Fe, and K are given in weight percent (%); other values are given in parts per million (ppm) or parts per billion (ppb) as indicated. An "N" indicates that a given element was looked for, but not detected at the lower limit of determination shown for that element. A "--" indicates that this element was not determined for that sample. A ".0B" occurs in place of the analytical data for stream water sample WM051 because there was no water present at this site.

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Table 3. Geochemical data for stream waters collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska.
[N, not detected at the value shown; .0B, no data.]

	Sample	Latitude	Longitude	Cl ppm	F ppm	NO3 ppm	SO4 ppm	Fe ppm	Mn ppm	Zn ppm
1	CC020W	60 46 56	158 50 39	2.2	.01N	.10N	15	.08	.01	.01N
2	CC021W	60 46 14	158 46 53	4.8	.01N	.10N	8.3	.04	.01	.01N
3	CC072W	60 47 33	158 51 58	8.0	.01N	.10N	22	.03	.01	.01N
4	CC073W	60 46 26	158 49 19	2.4	.01N	.10N	12	.07	.01	.01N
5	CC074W	60 45 32	158 48 24	9.5	.01N	.10N	9.1	.05	.01N	.01N
6	CC122W	60 47 13	158 51 26	3.6	.01N	.10N	15	.06	.01	.01
7	CC123W	60 46 17	158 48 07	3.7	.01N	.10N	13	.11	.03	.01
8	CC124W	60 45 02	158 49 10	4.1	.01N	.10N	7.1	.11	.01	.01N
9	MT016W	61 23 26	157 57 16	.90	.01N	.30	6.4	.02	.01N	.01N
10	MT017W	61 23 09	158 00 17	.70	.01N	.10N	3.0	.07	.01N	.01N
11	MT018W	61 25 25	157 58 47	.70	.01N	.10N	9.0	.26	.03	.01N
12	MT019W	61 26 24	157 55 41	1.4	.40	.40	5.5	.08	.01	.02
13	MT068W	61 23 38	157 57 11	1.1	.12	1.3	5.8	.06	.01	.01N
14	MT069W	61 23 25	157 56 08	1.6	.01N	.60	4.7	.12	.01	.01
15	MT070W	61 24 10	157 58 18	1.3	.16	.10N	3.6	.19	.03	.01
16	MT071W	61 24 08	157 53 16	.60	.01N	.10N	1.0	.15	.01	.01N
17	MT117W	61 23 26	157 58 05	1.0	.07	1.7	8.1	.04	.01	.01
18	MT118W	61 23 16	157 58 11	.40	.01N	.10N	1.2	.04	.01	.01N
19	MT119W	61 23 01	158 01 12	.60	.01N	.10N	4.2	.06	.01N	.01
20	MT120W	61 25 53	157 58 52	.60	.01N	.10N	2.8	.34	.05	.01
21	MT121W	61 26 58	157 59 10	.90	.09	.10N	3.8	.16	.01	.01N
22	RD006W	61 40 11	157 15 12	1.0	.30	.10N	1.8	.41	.02	.01N
23	RD007W	61 42 19	157 15 33	.70	.01N	.10N	5.8	.05	.01N	.01N
24	RD008W	61 46 00	157 19 45	.70	.07	.10N	2.2	.10	.01	.01N
25	RD009W	61 45 28	157 20 50	.60	.01N	.10N	.10N	.04	.01	.01
26	RD010W	61 47 49	157 20 09	15	.01N	.10N	11	.11	.02	.01
27	RD011W	61 45 06	157 24 36	.70	.08	.10N	1.6	.28	.03	.01
28	RD056W	61 40 22	157 16 28	.80	.08	.10N	1.0	.53	.03	.01
29	RD057W	61 42 54	157 16 07	.60	.08	.60	1.4	.07	.01	.01
30	RD058W	61 45 22	157 19 08	.90	.01N	.10N	8.2	.03	.02	.01N
31	RD059W	61 48 00	157 21 01	.80	.07	.10N	2.8	.05	.01	.01
32	RD060W	61 48 17	157 22 12	1.0	.10	.10N	2.5	.08	.01	.01N
33	RD061W	61 46 19	157 24 31	1.1	.01N	.10N	7.7	.07	.01	.01N
34	RD062W	61 44 43	157 25 24	1.0	.07	.10N	1.3	.17	.03	.01N
35	RD105W	61 40 54	157 20 09	.90	.06	.10N	2.3	.23	.01	.01
36	RD106W	61 43 39	157 16 46	1.1	.01N	.10N	1.8	.12	.01	.01N
37	RD107W	61 46 25	157 20 11	.70	.01N	.30	3.1	.03	.01N	.01N
38	RD108W	61 44 44	157 21 01	.90	.01N	.10N	1.4	.07	.01N	.01N
39	RD109W	61 49 19	157 23 23	.90	.06	.10N	8.6	.03	.01	.01
40	RD110W	61 48 29	157 23 27	.90	.01N	.10N	9.1	.29	.04	.01N

Table 3. Geochemical data for stream waters collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska. -- continued

	Sample	Ag ppb	As ppb	Cd ppb	Cu ppb	Hg ppb	Mo ppb	Pb ppb	Sb ppb	Conductivity micromho/cm
1	CC020W	.03	4.5	.1N	2	.65	.30	2.0N	1.0	155
2	CC021W	.02	2.0	.1N	2N	.75	1.3	2.0N	.20	107
3	CC072W	.04	12	.1N	2N	.10	.30	2.0N	3.8	191
4	CC073W	.03	2.6	.1	2N	.30	.50	2.0N	.40	134
5	CC074W	.03	.90	.1N	2N	.20	.90	2.0N	.10	104
6	CC122W	.02	3.5	.1N	2N	.20	.50	2.0N	1.1	154
7	CC123W	.02	2.4	.1N	2N	.10	.50	2.0N	1.0	146
8	CC124W	.02	1.5	.2	2N	.10	.90	2.0N	.10	88
9	MT016W	.03	1.6	.1N	2N	.05N	.60	2.0N	.40	272
10	MT017W	.02	1.5	.1	2N	.05N	1.2	2.0N	.10	53
11	MT018W	.03	2.2	.1N	2N	.05	1.3	2.0N	.05N	90
12	MT019W	.02N	1.2	.1N	2N	.10	.90	2.0N	1.2	114
13	MT068W	.02	1.2	.1N	2N	.10	.70	2.0N	.20	73
14	MT069W	.02N	1.4	.1N	2N	.05	.80	2.0N	.80	158
15	MT070W	.02	1.5	.1N	2N	.05N	.50	2.0N	.60	114
16	MT071W	.02	1.6	.1N	2N	.10	.30	2.0N	.60	88
17	MT117W	.02	1.7	.1N	2N	.05N	.60	2.0N	.10	55
18	MT118W	.04	6.0	.1	2N	.10	.30	2.0N	.80	43
19	MT119W	.02N	3.0	.2	2N	.10	.70	2.0N	1.0	55
20	MT120W	.02N	1.6	.1N	2N	.25	.40	2.0N	.10	87
21	MT121W	.02N	2.2	.1	2N	.05	1.0	2.0N	.20	84
22	RD006W	.03	1.6	.1N	3	.10	.60	2.0N	.60	61
23	RD007W	.02N	1.0	.1	2N	.10	.70	2.0N	.05N	85
24	RD008W	.02	1.4	.1N	2N	3.9	.70	2.0N	.50	56
25	RD009W	.03	1.1	.1N	2N	.55	.10	2.0N	.40	74
26	RD010W	.02	1.0	.1N	2	1.8	.70	2.0N	.80	81
27	RD011W	.02	1.1	.1	2	.10	.70	2.0N	.70	52
28	RD056W	.03	1.4	.1N	4	.10	.20	2.0N	.80	53
29	RD057W	.04	1.3	.1N	2	.05	.40	2.0N	.90	155
30	RD058W	.02	1.2	.1	2N	.10	.60	2.0N	1.8	95
31	RD059W	.02	1.1	.1	2N	.10	.60	2.0N	.80	134
32	RD060W	.02	.60	.1	2N	.10	.70	2.0N	.60	158
33	RD061W	.02N	1.5	.1N	2N	.10	1.0	2.0N	1.0	72
34	RD062W	.02N	1.6	.1N	2N	.05	1.2	2.0N	.10	64
35	RD105W	.02	1.7	.3	2	.10	.90	2.0N	1.0	52
36	RD106W	.02N	2.1	.3	2N	.10	1.1	2.0N	.20	112
37	RD107W	.02N	37	.2	2	.40	.70	2.0N	55	43
38	RD108W	.02N	1.0	.2	2N	.10	.60	2.0N	.20	159
39	RD109W	.02	1.8	.1	2N	.10	.40	2.0N	.20	152
40	RD110W	.02	2.0	.1	2N	.10	.80	2.0N	.20	74

Table 3. Geochemical data for stream waters collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska. -- continued

	Sample	Latitude	Longitude	Cl ppm	F ppm	NO3 ppm	SO4 ppm	Fe ppm	Mn ppm	Zn ppm
41	RD111W	61 43 39	157 26 33	.70	.01N	.10N	2.5	.36	.02	.01N
42	RY012W	61 55 56	158 24 13	.80	.01N	.10N	2.5	.10	.01N	.01
43	RY013W	61 56 19	158 21 30	.60	.01N	.10N	1.7	.31	.02	.01N
44	RY014W	61 57 50	158 16 26	.60	.01N	.10N	2.1	.72	.04	.01N
45	RY015W	61 59 11	158 26 22	.90	.01N	.10N	2.0	.35	.01	.01N
46	RY063W	61 54 59	158 29 27	.70	.01N	.10N	.90	.71	.04	.01N
47	RY064W	61 56 20	158 21 53	.90	.09	.10N	2.5	.37	.05	.01N
48	RY065W	61 57 11	158 18 59	.60	.01N	.10N	2.3	.44	.03	.01N
49	RY066W	61 59 10	158 17 32	.70	.06	.10N	3.8	.31	.02	.01N
50	RY067W	61 58 30	158 26 53	1.0	.11	.10N	2.0	.20	.02	.01N
51	RY112W	61 56 07	158 23 22	.70	.01N	.10N	2.6	.19	.02	.01N
52	RY113W	61 55 57	158 23 29	.70	.01N	.10N	1.9	.24	.02	.01N
53	RY114W	61 57 21	158 18 31	.70	.14	.10N	1.7	.44	.02	.01N
54	RY115W	61 58 30	158 21 00	.90	.09	.10N	1.5	.11	.01	.01N
55	RY116W	61 58 14	158 27 22	.70	.01N	.10N	3.0	.30	.02	.01N
56	WM001W	62 11 01	154 50 16	.60	.01N	.10N	14	.10	.01	.01N
57	WM002W	62 10 42	154 50 43	.70	.01N	.10N	20	.12	.01	.01N
58	WM003W	62 10 35	154 50 55	.80	.06	.10N	19	.05	.01	.01N
59	WM004W	62 11 21	154 49 42	.40	.01N	.10N	.10N	.11	.02	.01N
60	WM005W	62 10 23	154 51 48	.50	.01N	.10N	19	.02	.01N	.01N
61	WM051W	62 11 03	154 50 24	.0B	.0B	.0B	.0B	.0B	.0B	.0B
62	WM052W	62 10 33	154 51 19	.60	.01N	.10N	380	.05	.01N	.01
63	WM053W	62 10 05	154 51 49	.20	.01N	.10N	23	.04	.01	.01N
64	WM054W	62 09 49	154 52 41	.60	.01N	.10N	24	.06	.01	.01N
65	WM055W	62 09 27	154 53 21	1.0	.13	.10N	33	.05	.02	.01N
66	WM101W	62 10 26	154 51 04	.60	.01N	.10N	20	.08	.01N	.01N
67	WM102W	62 10 13	154 51 29	.40	.01N	.10N	15	.07	.01	.01N
68	WM103W	62 11 19	154 49 09	.50	.01N	.10N	2.0	.15	.01N	.01
69	WM104W	62 10 39	154 51 52	.40	.07	.10N	21	.05	.01	.07

Table 3. Geochemical data for stream waters collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska. -- continued

	Sample	Ag ppb	As ppb	Cd ppb	Cu ppb	Hg ppb	Mo ppb	Pb ppb	Sb ppb	Conductivity micromho/cm
41	RD111W	.03	2.5	.1	2	.05N	.70	2.0N	.05N	152
42	RY012W	.03	1.5	.1N	2N	.05	.60	2.0N	.20	112
43	RY013W	.02	2.1	.1N	2N	.10	.90	2.0N	.10	105
44	RY014W	.02	2.7	.1N	4	.20	.30	2.0N	.30	96
45	RY015W	.02	1.8	.1	3	.05N	.70	2.0N	.05N	74
46	RY063W	.02N	1.4	.1N	2	.10	.90	2.0N	.30	55
47	RY064W	.03	3.0	.1	2N	.05	.40	2.0N	.50	182
48	RY065W	.02	1.8	.1	2N	.05N	1.0	2.0N	.30	100
49	RY066W	.02N	1.9	.1N	2	.05	1.3	2.0N	.10	102
50	RY067W	.02	1.3	.1N	2	.05N	.40	2.0N	.20	98
51	RY112W	.02N	1.7	.1N	2	.05	1.3	2.0N	.80	128
52	RY113W	.02	1.8	.2	2N	.05N	1.3	2.0N	.30	120
53	RY114W	.02	1.8	.1	2	.05	.70	2.0N	.20	107
54	RY115W	.02	1.0	.1N	2N	.10	1.0	2.0N	.10	81
55	RY116W	.03	1.7	.1	2N	.05N	.80	2.0N	.20	127
56	WM001W	.02N	4.7	.1	2N	.05N	.80	2.0N	.30	236
57	WM002W	.02	3.3	.1	3	.05N	1.3	2.0N	.20	256
58	WM003W	.02N	3.2	.1N	2N	.05N	.60	2.0N	.60	244
59	WM004W	.02N	1.2	.1N	2N	.05N	.20	2.0N	.40	167
60	WM005W	.02	.70	.1N	2N	.05N	.80	2.0N	.90	265
61	WM051W	.0B	.0B	.0B	.0B	.0B	.0B	.0B	.0B	.0B
62	WM052W	.11	1.6	.1	2N	.05N	1.8	2.0N	.20	770
63	WM053W	.02	2.3	.1N	2N	.05N	.30	2.0N	.70	254
64	WM054W	.06	7.5	.1N	2	.05N	.20	2.0N	.10	279
65	WM055W	.03	6.2	.1	2N	.10	.90	2.0N	.20	338
66	WM101W	.03	3.9	.2	2N	.05N	1.0	2.0N	.20	266
67	WM102W	.02N	2.2	.3	2N	.05N	.60	2.0N	.70	242
68	WM103W	.02N	1.4	.1	3	.05N	.50	2.0N	.80	104
69	WM104W	.03	1.3	.3	2N	.05N	.50	2.0N	.70	352

Table 4. Geochemical data for vegetation samples collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska.
[N, not detected at the limit of determination shown; --, not determined.]

	Sample	Latitude	Longitude	Ca %	Fe %	K %	Ag ppm	As ppm	Ba ppm	Br ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Eu ppm
1	CC020T	60 46 56	158 50 39	0.81	.008	1.81	.30N	0.23	18	2.0	.10N	.5	.3N	.05N	.05N
2	CC021T	60 46 14	158 46 53	1.2	.009	2.29	.30N	0.12	20	1.7	.20	.4	.3N	.06	.05N
3	CC072T	60 47 33	158 51 58	0.74	.006	1.34	.30N	0.35	18	1.1	.20	.8	.3N	.05N	.05N
4	CC073T	60 46 26	158 49 19	0.32	.005N	1.15	.30N	0.11	6.0	5.8	.10N	.5	.3N	.05N	.05N
5	CC074T	60 45 32	158 48 24	0.85	.006	1.79	.30N	0.06	8.0	.65	.10N	.3	.3N	.05N	.05N
6	CC122T	60 47 13	158 51 26	0.89	.006	1.73	.30N	0.13	10	1.8	.10N	.3	.3N	.05N	.05N
7	CC123T	60 46 17	158 48 07	0.60	.009	1.91	.30N	0.10	8.0	20	.10N	.9	1.3	.05N	.05N
8	CC124T	60 45 02	158 49 10	0.96	.005	1.68	.30N	0.04	6.0	2.6	.10N	.4	.3N	.05N	.05N
9	MT016T	61 23 26	157 57 16	0.88	.007	1.57	.30N	0.08	10	.74	.10N	.2	.3	.07	.05N
10	MT017T	61 23 09	158 00 17	0.61	.011	1.80	.30N	0.04	21	.96	.10N	.4	.3N	.05N	.05N
11	MT018T	61 25 25	157 58 47	0.95	.013	1.14	.30N	0.09	23	1.6	.10N	.3	.3N	.14	.05N
12	MT019T	61 26 24	157 55 41	0.58	.013	.936	.30N	0.14	5.0N	9.0	.10N	.8	.3	.22	.05N
13	MT068T	61 23 38	157 57 11	0.50	.007	1.35	.30N	0.07	8.0	1.1	.10N	.3	.3N	.05N	.05N
14	MT069T	61 23 25	157 56 08	0.56	.005N	1.11	.30N	0.03	12	.55	.10N	.7	.5	.12	.05N
15	MT070T	61 24 10	157 58 18	0.70	.012	.991	.30N	0.05	10	1.7	.10N	.4	.3N	.15	.05N
16	MT071T	61 24 08	157 53 16	0.70	.007	1.10	.30N	0.04	5.0N	.96	.10N	.4	.3N	.67	.05N
17	MT117T	61 23 26	157 58 05	0.58	.005N	1.24	.30N	0.03	18	.77	.10N	.4	.3N	.05N	.05N
18	MT117Z	61 23 26	157 58 05	0.68	.008	.685	.30N	0.04	26	2.6	.10N	.5	.3N	.20	.05N
19	MT118T	61 23 16	157 58 11	0.67	.006	1.79	.30N	0.05	9.0	.67	.10N	.1	.3N	.05N	.05N
20	MT118Z	61 23 16	157 58 11	0.61	.005N	.893	.30N	0.04	20	.35	.10N	.1N	.3N	.12	.05N
21	MT119T	61 23 01	158 01 12	0.73	.006	1.67	.30N	0.14	9.0	.56	.10N	.2	.3N	.05N	.05N
22	MT119Z	61 23 01	158 01 12	0.76	.012	.807	.30N	0.15	26	.46	.10N	.1	.3N	.06	.05N
23	MT120T	61 25 53	157 58 52	0.66	.006	.974	.30N	0.08	19	1.2	.10N	.4	.3N	.09	.05N
24	MT121T	61 26 58	157 59 10	0.77	.007	1.61	.30N	0.08	5.0N	1.1	.10N	.2	.3N	.05N	.05N
25	MT121Z	61 26 58	157 59 10	0.68	.006	.770	.30N	0.07	11	.61	.10N	.1N	.3N	.16	.05N
26	RD006T	61 40 11	157 15 12	0.68	.009	1.16	.30N	0.12	29	3.6	.20	.7	.3N	.05N	.05N
27	RD007T	61 42 19	157 15 33	0.61	.007	.847	.30N	0.04	6.0	2.8	.10N	.3	.3N	.08	.05N
28	RD008T	61 46 00	157 19 45	0.60	.008	1.15	.30N	0.10	10	1.5	.10N	.4	.3N	.05N	.05N
29	RD009T	61 45 28	157 20 50	0.90	.006	.705	.30N	0.05	18	.69	.10N	.1N	.3N	.08	.05N
30	RD010T	61 47 49	157 20 09	0.67	.007	.977	.30N	0.12	18	1.1	.10	.4	.3N	.05N	.05N
31	RD011T	61 45 06	157 24 36	0.53	.007	1.26	.30N	0.03	25	1.2	.10N	.4	.3N	.05N	.05N
32	RD056T	61 40 22	157 16 28	0.50	.009	.993	.30N	0.04	12	1.2	.10N	.6	.3N	.05N	.05N
33	RD057T	61 42 54	157 16 07	0.43	.005N	.800	.30N	0.03	6.0	1.9	.10N	.3	.3N	.05N	.05N
34	RD058T	61 45 22	157 19 08	0.71	.005	1.30	.30N	0.05	19	8.2	.10	.4	.3N	.05N	.05N
35	RD059T	61 48 00	157 21 01	0.54	.007	1.30	.30N	0.05	8.0	.75	.10N	.3	.3N	.06	.05N
36	RD060T	61 48 17	157 22 12	0.42	.006	.678	.30N	0.03	5.0N	.90	.10N	.4	.3N	.05N	.05N
37	RD061T	61 46 19	157 24 31	0.44	.006	1.30	.30N	0.09	5.0	1.0	.10	.6	.3N	.05N	.05N
38	RD062T	61 44 43	157 25 24	0.56	.007	1.20	.30N	0.06	25	2.3	.10N	.3	.3N	.05N	.05N
39	RD105T	61 40 54	157 20 09	0.37	.005N	.803	.30N	0.06	10	.78	.10N	.2	.3N	.05N	.05N
40	RD106T	61 43 39	157 16 46	0.35	.005N	1.00	.30N	0.05	5.0N	.84	.10N	.4	.3N	.05N	.05N

Table 4. Geochemical data for vegetation samples collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska. -- continued

	Sample	Hf ppm	Hg ppm	La ppm	Lu ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm	Sr ppm
1	CC020T	.05N	2.3	0.03	.001N	.05N	46.1	.30N	5.0N	12	.039	.01	.10	0.004	54
2	CC021T	.05N	1.6	0.07	.001N	.11	48.5	.30N	5.0N	20	.059	.01	.10	0.006	100
3	CC072T	.05N	2.7	0.03	.001N	.11	26.2	.30N	5.0N	13	.037	.01N	.20	0.004	59
4	CC073T	.05N	0.45	0.01	.001N	.13	30.5	.30N	5.0N	7.0	.021	.01N	.10	0.002	15
5	CC074T	.05N	0.40	0.02	.001N	.19	22.7	.30N	5.0N	17	.025	.01N	.10N	0.002	76
6	CC122T	.05N	0.57	0.03	.001N	.13	25.8	.30N	5.0N	14	.029	.01N	.20	0.003	52
7	CC123T	.05N	0.51	0.04	.001N	.25	25.2	.30N	5.0N	14	.320	.01N	.20	0.004	30
8	CC124T	.05N	0.31	0.03	.001N	.26	35.9	.30N	5.0N	18	.037	.01N	.10N	0.003	94
9	MT016T	.05N	0.54	0.04	.001N	.21	51.8	.30N	5.0N	13	.049	.01	.20	0.006	24
10	MT017T	.05N	0.23	0.04	.001N	.16	69.9	.30N	5.0N	13	.013	.02	.10N	0.006	49
11	MT018T	.05N	0.94	0.06	.001	.07	49.1	.30N	5.0N	52	.075	.03	.10N	0.011	62
12	MT019T	.05N	0.46	0.05	.001N	.05N	50.3	.30N	5.0N	28	.075	.02	.10N	0.009	24
13	MT068T	.05N	0.54	0.03	.001N	.12	54.0	.30N	5.0N	6.0	.070	.01	.10N	0.005	16
14	MT069T	.05N	0.33	0.04	.001N	.07	47.3	.30N	5.0N	23	.014	.01N	.10N	0.004	27
15	MT070T	.05N	0.25	0.03	.001N	.05N	39.0	.30N	5.0N	36	.029	.01	.30	0.005	30
16	MT071T	.05N	0.32	0.03	.001N	.06	42.4	.30N	5.0N	38	.039	.01N	.10N	0.005	32
17	MT117T	.05N	0.27	0.03	.001N	.06	33.1	.30N	5.0N	4.0	.036	.01N	.30	0.004	26
18	MT117Z	.05N	0.40	0.07	.001N	.18	34.2	.30N	5.0N	16	.031	.02	.10N	0.011	28
19	MT118T	.05N	0.52	0.03	.001N	.22	40.6	.30N	5.0N	24	.036	.01N	.20	0.004	38
20	MT118Z	.05N	0.23	0.03	.001N	.09	28.5	.30N	5.0N	12	.009	.01N	.10N	0.004	35
21	MT119T	.05N	0.44	0.03	.001	.14	51.4	.30N	5.0N	19	.052	.01N	.30	0.004	44
22	MT119Z	.05N	0.48	0.07	.001N	.13	40.6	.30N	5.0N	6.0	.019	.02	.10N	0.011	41
23	MT120T	.05N	0.62	0.05	.002	.05N	49.1	.30N	5.0N	37	.057	.01	.10N	0.006	40
24	MT121T	.05N	0.64	0.04	.001	.15	57.1	.30N	5.0N	26	.048	.01	.10N	0.005	40
25	MT121Z	.05N	0.29	0.03	.001N	.05N	47.5	.30N	5.0N	20	.025	.01N	.10N	0.004	36
26	RD006T	.05N	1.6	0.06	.001N	.47	45.1	.30N	5.0N	18	.007	.02	.10N	0.011	58
27	RD007T	.05N	0.43	0.03	.001N	.17	44.8	.30N	5.0N	11	.005	.01N	.10N	0.005	40
28	RD008T	.05N	0.37	0.05	.001N	.22	53.8	.30N	5.0N	8.0	.036	.02	.10N	0.010	28
29	RD009T	.05N	0.27	0.02	.001N	.35	30.4	.30N	5.0N	7.0	.007	.01N	.10	0.004	51
30	RD010T	.05N	0.27	0.03	.001N	.41	40.6	.30N	5.0N	11	.007	.01N	.10N	0.005	56
31	RD011T	.05N	0.39	0.03	.001N	.11	35.2	.30N	5.0N	7.0	.006	.01N	.10N	0.005	49
32	RD056T	.05N	0.95	0.02	.001N	.46	21.4	.30N	5.0N	8.0	.011	.01N	.10N	0.003	34
33	RD057T	.05N	0.72	0.02	.001N	.14	19.2	.30N	5.0N	7.0	.015	.01N	.10N	0.002	31
34	RD058T	.05N	0.85	0.02	.001N	.06	26.8	.30N	5.0N	20	.015	.01N	.10N	0.004	26
35	RD059T	.05N	0.30	0.02	.001N	.46	22.1	.30N	5.0N	25	.005	.01N	.10	0.002	32
36	RD060T	.05N	0.06	0.01	.001N	.27	21.0	.30N	5.0N	7.0	.005	.01N	.10N	0.002	15
37	RD061T	.05N	0.12	0.02	.001N	.11	20.2	.30N	5.0N	11	.008	.01N	.10	0.002	17
38	RD062T	.05N	0.08	0.02	.001N	.60	28.9	.30N	5.0N	6.0	.046	.01N	.10N	0.004	76
39	RD105T	.05N	0.81	0.02	.001N	.21	51.1	.30N	5.0N	10	.006	.01N	.10N	0.003	37
40	RD106T	.05N	0.26	0.02	.001N	.37	49.3	.30N	5.0N	12	.005N	.01N	.10N	0.002	19

Table 4. Geochemical data for vegetation samples collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska. -- continued

	Sample	Ta ppm	Tb ppm	Th ppm	U ppm	W ppm	Yb ppm	Zn ppm	Au ppb	Ir ppb	Scientific name (Common name)
1	CC020T	.05N	.10N	.10N	.01N	.05N	.005N	120	--	.1N	Salix alaxensis (feltleaf willow)
2	CC021T	.05N	.10N	.10N	.01N	.05N	.005N	170	--	.1N	Salix alaxensis (feltleaf willow)
3	CC072T	.05N	.10N	.10N	.01N	.05N	.005N	37	1.5	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
4	CC073T	.05N	.10N	.10N	.01N	.05N	.005N	45	0.8	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
5	CC074T	.05N	.10N	.10N	.01N	.05N	.005N	60	1.4	.1N	Salix alaxensis (feltleaf willow)
6	CC122T	.05N	.10N	.10N	.01N	.05N	.005N	130	0.8	.1N	Salix alaxensis (feltleaf willow)
7	CC123T	.05N	.10N	.10N	.01N	.05N	.005N	160	1.9	.1N	Salix alaxensis (feltleaf willow)
8	CC124T	.05N	.10N	.10N	.01N	.05N	.005N	99	1.1	.1N	Salix alaxensis (feltleaf willow)
9	MT016T	.05N	.10N	.10N	.01N	.05N	.006	72	--	.1N	Salix alaxensis (feltleaf willow)
10	MT017T	.05N	.10N	.10N	.01N	.05N	.005N	91	--	.1N	Salix ? (willow)
11	MT018T	.05N	.10N	.10N	.01N	.05N	.005N	76	--	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
12	MT019T	.05N	.10N	.10N	.01N	.05N	.005N	86	--	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
13	MT068T	.05N	.10N	.10N	.01N	.05N	.006	60	1.2	.1N	Salix ? (willow)
14	MT069T	.05N	.10N	.10N	.01N	.05N	.005N	79	1.0	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
15	MT070T	.05N	.10N	.10N	.01N	.05N	.005N	81	0.9	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
16	MT071T	.05N	.10N	.10N	.01N	.05N	.005N	50	1.7	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
17	MT117T	.05N	.10N	.10N	.01N	.05N	.005N	150	0.6	.1N	Salix alaxensis (feltleaf willow)
18	MT117Z	.05N	.10N	.10N	.01N	.05N	.008	27	1.0	.1N	Alnus crispa (American green alder)
19	MT118T	.05N	.10N	.10N	.01N	.05N	.005N	98	0.9	.1N	Salix alaxensis (feltleaf willow)
20	MT118Z	.05N	.10N	.10N	.01N	.05N	.005N	32	0.9	.1N	Alnus crispa (American green alder)
21	MT119T	.05N	.10N	.10N	.01N	.05N	.006	130	1.3	.1N	Salix alaxensis (feltleaf willow)
22	MT119Z	.05N	.10N	.10N	.01N	.05N	.005N	46	1.0	.1N	Alnus crispa (American green alder)
23	MT120T	.05N	.10N	.10N	.01N	.05N	.006	99	1.4	.1N	Salix alaxensis (feltleaf willow)
24	MT121T	.05N	.10N	.10N	.01N	.05N	.005	91	2.0	.1N	Salix alaxensis (feltleaf willow)
25	MT121Z	.05N	.10N	.10N	.01N	.05N	.005	40	1.0	.1N	Alnus crispa (American green alder)
26	RD006T	.05N	.10N	.10N	.01N	.05N	.005N	140	--	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
27	RD007T	.05N	.10N	.10N	.01N	.05N	.005N	51	--	.1N	Salix ? (willow)
28	RD008T	.05N	.10N	.10N	.01N	.05N	.005N	75	--	.1N	Salix ? (willow)
29	RD009T	.05N	.10N	.10N	.01N	.05N	.005N	39	--	.1N	Alnus crispa (American green alder)
30	RD010T	.05N	.10N	.10N	.01N	.05N	.005N	77	--	.1N	Salix ? (willow)
31	RD011T	.05N	.10N	.10N	.01N	.05N	.005N	110	--	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
32	RD056T	.05N	.10N	.10N	.01N	.05N	.005N	99	2.9	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
33	RD057T	.05N	.10N	.10N	.01N	.05N	.005N	40	2.2	.1N	Salix ? (willow)
34	RD058T	.05N	.10N	.10N	.01N	.05N	.005N	110	2.2	.1N	Salix ? (willow)
35	RD059T	.05N	.10N	.10N	.01N	.05N	.005N	58	1.9	.1N	Salix alaxensis (feltleaf willow)
36	RD060T	.05N	.10N	.10N	.01N	.05N	.005N	64	0.4	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
37	RD061T	.05N	.10N	.10N	.01N	.05N	.005N	58	0.6	.1N	Salix ? (willow)
38	RD062T	.05N	.10N	.10N	.01N	.05N	.005N	63	0.4	.1N	Salix ? (willow)
39	RD105T	.05N	.10N	.10N	.01N	.05N	.006	67	0.9	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
40	RD106T	.05N	.10N	.10N	.01N	.05N	.005N	65	0.6	.1N	Salix ? (willow)

Table 4. Geochemical data for vegetation samples collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska. -- continued

	Sample	Latitude	Longitude	Ca %	Fe %	K %	Ag ppm	As ppm	Ba ppm	Br ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Eu ppm
41	RD107T	61 46 25	157 20 11	0.92	.005	2.05	.30N	0.30	17	1.5	.20	.2	.3N	.07	.05N
42	RD108T	61 44 44	157 21 01	0.51	.005	1.11	.30N	0.08	7.0	1.0	.20	.3	.3N	.05N	.05N
43	RD109T	61 49 19	157 23 23	0.41	.005N	.695	.30N	0.08	7.0	2.0	.10N	.2	.3N	.05N	.05N
44	RD110T	61 48 29	157 23 27	0.73	.007	1.58	.30N	0.21	23	.74	.10N	.9	.3N	.07	.05N
45	RD111T	61 43 39	157 26 33	0.64	.008	1.37	.30N	0.13	35	.90	.10N	.5	.3N	.05N	.05N
46	RY012T	61 55 56	158 24 13	0.60	.017	.897	.30N	0.07	14	1.3	.20	.5	.3	.05N	.05N
47	RY013T	61 56 19	158 21 30	0.65	.041	1.33	.30N	0.22	69	.80	.50	.9	1	.05	.05N
48	RY014T	61 57 50	158 16 26	0.83	.012	2.13	.30N	0.06	43	.57	.10N	.8	.3N	.05N	.05N
49	RY015T	61 59 11	158 26 22	0.77	.008	1.19	.30N	0.09	46	4.2	.10N	.5	.3	.05N	.05N
50	RY063T	61 54 59	158 29 27	0.57	.007	.917	.30N	0.05	25	2.4	.10N	.8	.3N	.05	.05N
51	RY064T	61 56 20	158 21 53	0.41	.007	1.16	.30N	0.10	7.0	1.3	.10N	.5	.3N	.05N	.05N
52	RY065T	61 57 11	158 18 59	0.72	.008	1.32	.30N	0.02	24	.54	.10N	.3	.3N	.05N	.05N
53	RY066T	61 59 10	158 17 32	0.80	.009	1.16	.30N	0.04	35	.57	.10N	.5	.3N	.05N	.05N
54	RY067T	61 58 30	158 26 53	0.81	.007	1.02	.30N	0.03	46	.73	.10N	.3	.3N	.05N	.05N
55	RY112T	61 56 07	158 23 22	0.71	.010	.944	.30N	0.10	17	1.4	.10N	.5	.3N	.05N	.05N
56	RY113T	61 55 57	158 23 29	0.63	.009	1.27	.30N	0.07	24	1.2	.10N	.8	.3N	.05N	.05N
57	RY114T	61 57 21	158 18 31	0.81	.010	.841	.30N	0.05	38	1.0	.10N	.4	.3N	.05N	.05N
58	RY114Z	61 57 21	158 18 31	0.86	.010	.846	.30N	0.05	68	1.0	.10	.1	.3N	.05	.05N
59	RY115Z	61 58 30	158 21 00	0.66	.006	.734	.30N	0.03	30	.54	.10N	.1N	.3N	.05N	.05N
60	RY116T	61 58 14	158 27 22	0.97	.014	1.37	.30N	0.14	30	1.5	.10N	.5	.3N	.06	.05N
61	RY116Z	61 58 14	158 27 22	0.93	.010	.733	.30N	0.06	84	.73	.10N	.2	.3N	.08	.05N
62	WM001T	62 11 01	154 50 16	0.92	.011	1.42	.30N	0.40	20	.90	.10N	.4	.3N	.05N	.05N
63	WM002T	62 10 42	154 50 43	1.0	.017	1.85	.30N	0.35	19	1.7	.50	.4	.7	.05N	.05N
64	WM003T	62 10 35	154 50 55	1.2	.010	1.56	.30N	0.12	17	1.0	.10	.4	.3N	.05N	.05N
65	WM004T	62 11 21	154 49 42	0.77	.015	1.68	.30N	0.07	16	1.8	.20	.6	.3	.05N	.05N
66	WM005T	62 10 23	154 51 48	1.2	.011	1.86	.30N	0.09	7.0	1.8	.20	.4	.3N	.05N	.05N
67	WM051T	62 11 03	154 50 24	0.76	.008	1.73	.30N	0.20	5.0N	.43	.10N	.1	.3N	.05N	.05N
68	WM052T	62 10 33	154 51 19	0.84	.009	1.83	.30N	0.13	5.0N	.87	.10N	.4	.3N	.05N	.05N
69	WM053T	62 10 05	154 51 49	0.74	.006	1.53	.30N	0.10	16	.49	.20	.4	.3N	.05N	.05N
70	WM054T	62 09 49	154 52 41	0.63	.005	1.49	.30N	0.12	10	1.3	.10N	.4	.3N	.05N	.05N
71	WM055T	62 09 27	154 53 21	0.88	.007	1.52	.30N	0.12	11	.50	.10N	.3	.3N	.05N	.05N
72	WM101T	62 10 26	154 51 04	0.75	.011	1.70	.30N	0.21	11	.74	.10	.4	.3N	.05N	.05N
73	WM102T	62 10 13	154 51 29	0.67	.007	1.47	.30N	0.23	16	.68	.10N	.4	.3N	.05N	.05N
74	WM103T	62 11 19	154 49 09	0.96	.010	1.12	.30N	0.19	23	1.1	.10N	.4	.3N	.05N	.05N
75	WM104T	62 10 39	154 51 52	0.78	.006	1.27	.30N	0.13	6.0	.67	.10N	.2	.3N	.05N	.05N

Table 4. Geochemical data for vegetation samples collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska. -- continued

	Sample	Hf ppm	Hg ppm	La ppm	Lu ppm	Mo ppm	Na ppm	Nd ppm	Ni ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sm ppm	Sr ppm
41	RD107T	.05N	1.7	0.03	.001N	.11	82.6	.30N	5.0N	14	.044	.01N	.30	0.004	35
42	RD108T	.05N	1.2	0.02	.001N	.18	64.9	.30N	5.0N	8.0	.027	.01N	.10N	0.002	38
43	RD109T	.05N	0.21	0.01	.001N	.26	50.0	.30N	5.0N	5.0	.007	.01N	.20	0.003	24
44	RD110T	.05N	0.19	0.04	.001N	.35	94.3	.30N	5.0N	25	.010	.01N	.10N	0.004	45
45	RD111T	.05N	0.14	0.04	.001N	.16	110	.30N	5.0N	10	.012	.01	.10N	0.005	95
46	RY012T	.05N	1.1	0.07	.001N	.13	46.8	.30N	5.0N	4.0	.040	.03	.10N	0.012	34
47	RY013T	.07	0.38	0.32	.004	.11	149	.30N	5.0N	9.0	.054	.12	.10N	0.057	72
48	RY014T	.05N	0.24	0.05	.001N	.16	42.9	.30N	5.0N	14	.017	.01	.10N	0.007	93
49	RY015T	.05N	0.14	0.05	.001N	.31	57.5	.40	5.0N	6.0	.025	.01	.10N	0.008	130
50	RY063T	.05N	0.24	0.03	.001N	.13	28.7	.50	5.0N	28	.390	.01N	.10N	0.004	55
51	RY064T	.05N	0.09	0.03	.001N	.27	51.1	.30N	5.0N	8.0	.055	.01N	.10N	0.002	27
52	RY065T	.05N	0.11	0.03	.001N	.18	20.8	.30N	5.0N	9.0	.043	.01N	.10N	0.004	65
53	RY066T	.05N	0.20	0.04	.001N	.21	24.6	.30N	5.0N	8.0	.083	.01N	.10N	0.005	100
54	RY067T	.05N	0.07	0.02	.001N	.28	17.9	.30N	5.0N	10	.013	.01N	.10	0.003	110
55	RY112T	.05N	0.71	0.04	.001N	.05N	83.8	.30N	5.0N	4.0	.047	.01N	.10N	0.005	38
56	RY113T	.05N	0.32	0.04	.001N	.13	59.5	.30N	5.0N	7.0	.041	.01	.10N	0.007	57
57	RY114T	.05N	0.17	0.03	.001N	.15	42.8	.30N	5.0N	5.0	.018	.01N	.10N	0.004	84
58	RY114Z	.05N	0.36	0.06	.001N	.23	57.8	.30N	5.0N	8.0	.023	.01N	.10N	0.007	82
59	RY115Z	.05N	0.20	0.04	.001N	.98	30.3	.30N	5.0N	7.0	.040	.01N	.10N	0.006	80
60	RY116T	.05N	0.38	0.03	.001N	.37	56.8	.30N	5.0N	20	.037	.01N	.10N	0.005	94
61	RY116Z	.05N	0.18	0.05	.001N	.53	63.6	.30N	5.0N	9.0	.052	.01N	.10N	0.005	81
62	WM001T	.05N	0.36	0.05	.001N	.08	54.1	.30N	5.0N	12	.024	.02	.10N	0.008	35
63	WM002T	.05N	5.6	0.10	.001N	.08	88.4	.30N	5.0N	18	.057	.02	.10N	0.008	36
64	WM003T	.05N	0.23	0.04	.001N	.09	68.9	.30N	5.0N	8.0	.014	.01	.10N	0.008	67
65	WM004T	.05N	1.4	0.05	.001N	.06	43.3	.30N	5.0N	23	.011	.02	.10N	0.007	29
66	WM005T	.05N	6.8	0.05	.001N	.16	56.3	.30N	5.0N	7.0	.020	.02	.10N	0.008	37
67	WM051T	.05N	0.69	0.02	.001N	.05N	34.2	.30N	5.0N	7.0	.016	.01N	.10N	0.004	13
68	WM052T	.05N	0.66	0.03	.001N	.05N	33.7	.30N	5.0N	12	.029	.01	.10N	0.005	21
69	WM053T	.05N	1.6	0.03	.001N	.18	23.4	.30N	5.0N	8.0	.007	.01N	.10	0.004	31
70	WM054T	.05N	0.36	0.04	.001N	.05	24.5	.30N	5.0N	8.0	.011	.01N	.10N	0.005	24
71	WM055T	.05N	0.29	0.02	.001N	.23	28.3	.30N	5.0N	5.0	.011	.01N	.10	0.003	30
72	WM101T	.05N	0.36	0.06	.002	.05N	74.7	.30N	5.0N	11	.019	.02	.10N	0.009	33
73	WM102T	.05N	0.29	0.03	.001N	.05N	28.6	.30N	5.0N	9.0	.018	.01N	.10N	0.004	33
74	WM103T	.05N	2.3	0.04	.001N	.22	30.3	.30N	5.0N	12	.022	.01	.10N	0.005	36
75	WM104T	.05N	0.96	0.03	.001N	.13	22.6	.30N	5.0N	6.0	.018	.01N	.10	0.003	25

Table 4. Geochemical data for vegetation samples collected near cinnabar-stibnite occurrences in the Kuskokwim River region, Alaska. -- continued

Sample	Ta ppm	Tb ppm	Th ppm	U ppm	W ppm	Yb ppm	Zn ppm	Au ppb	Ir ppb	Scientific name (common name)
41 RD107T	.05N	.10N	.10N	.01N	.05N	.005N	83	1.3	.1N	Salix alaxensis (feltleaf willow)
42 RD108T	.05N	.10N	.10N	.01N	.05N	.005N	48	0.8	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
43 RD109T	.05N	.10N	.10N	.01N	.05N	.005N	41	2.2	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
44 RD110T	.05N	.10N	.10N	.01N	.05N	.005N	66	1.1	.1N	Salix ? (willow)
45 RD111T	.05N	.10N	.10N	.01N	.05N	.005N	97	0.9	.1N	Salix ? (willow)
46 RY012T	.05N	.10N	.10N	.01N	.05N	.007	64	--	.1N	Salix ? (willow)
47 RY013T	.05N	.10N	.10N	.03	.05N	.02	110	--	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
48 RY014T	.05N	.10N	.10N	.01N	.05N	.005N	170	--	.1N	Salix ? (willow)
49 RY015T	.05N	.10N	.10N	.01N	.05N	.005N	99	--	.1N	Salix ? (willow)
50 RY063T	.05N	.10N	.10N	.01N	.05N	.005N	98	2.4	.1N	Salix ? (willow)
51 RY064T	.05N	.10N	.10N	.01N	.05N	.005N	68	1.5	.1N	Salix alaxensis (feltleaf willow)
52 RY065T	.05N	.10N	.10N	.01N	.05N	.005N	63	0.7	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
53 RY066T	.05N	.10N	.10N	.01N	.05N	.005N	68	1.8	.1N	Salix interior (sandbar willow)
54 RY067T	.05N	.10N	.10N	.01N	.05N	.005N	93	0.6	.1N	Salix ? (willow)
55 RY112T	.05N	.10N	.10N	.01N	.05N	.005N	100	1.2	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
56 RY113T	.05N	.10N	.10N	.01N	.05N	.005N	93	0.7	.1N	Salix ? (willow)
57 RY114T	.05N	.10N	.10N	.01N	.05N	.005N	100	0.7	.1N	Salix planifolia ssp. pulchra (diamondleaf willow)
58 RY114Z	.05N	.10N	.10N	.01N	.05N	.005	35	1.1	.1N	Alnus crispa (American green alder)
59 RY115Z	.05N	.10N	.10N	.01N	.05N	.005N	31	0.6	.1N	Alnus crispa (American green alder)
60 RY116T	.05N	.10N	.10N	.01N	.05N	.005N	62	1.9	.1N	Salix alaxensis (feltleaf willow)
61 RY116Z	.05N	.10N	.10N	.01N	.05N	.005	26	1.1	.1N	Alnus crispa (American green alder)
62 WM001T	.05N	.10N	.10N	.01N	.05N	.005N	91	--	.1N	Salix alaxensis (feltleaf willow)
63 WM002T	.05N	.10N	.10N	.01N	.05N	.008	120	--	.1N	Salix alaxensis (feltleaf willow)
64 WM003T	.05N	.10N	.10N	.01N	.05N	.005N	120	--	.1N	Salix alaxensis (feltleaf willow)
65 WM004T	.05N	.10N	.10N	.01N	.05N	.005N	130	--	.1N	Salix alaxensis (feltleaf willow)
66 WM005T	.05N	.10N	.10N	.01N	.05N	.005N	81	--	.1N	Salix alaxensis (feltleaf willow)
67 WM051T	.05N	.10N	.10N	.01N	.05N	.005N	66	7.0	.1N	Salix alaxensis (feltleaf willow)
68 WM052T	.05N	.10N	.10N	.01N	.05N	.005N	96	2.8	.1N	Salix alaxensis (feltleaf willow)
69 WM053T	.05N	.10N	.10N	.01N	.05N	.005N	110	1.5	.1N	Salix alaxensis (feltleaf willow)
70 WM054T	.05N	.10N	.10N	.01N	.05N	.005N	130	1.8	.1N	Salix alaxensis (feltleaf willow)
71 WM055T	.05N	.10N	.10N	.01N	.05N	.005N	120	1.4	.1N	Salix alaxensis (feltleaf willow)
72 WM101T	.05N	.10N	.10N	.01N	.05N	.01	90	3.2	.1N	Salix alaxensis (feltleaf willow)
73 WM102T	.05N	.10N	.10N	.01N	.05N	.005N	88	1.3	.1N	Salix alaxensis (feltleaf willow)
74 WM103T	.05N	.10N	.10N	.01N	.05N	.005N	100	1.8	.1N	Salix alaxensis (feltleaf willow)
75 WM104T	.05N	.10N	.10N	.01N	.05N	.005N	120	1.6	.1N	Salix alaxensis (feltleaf willow)