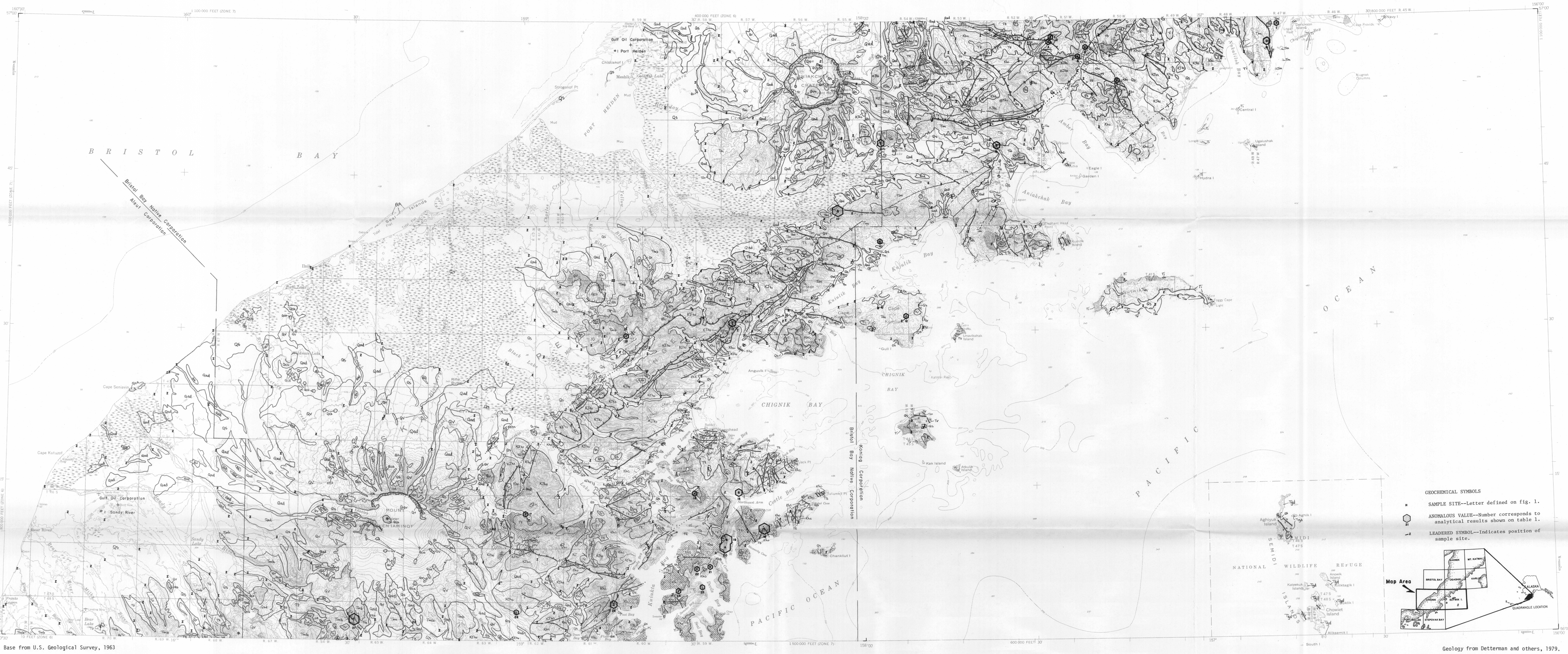
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1053F
FOLIO OF THE CHIGNIK AND SUTWIK ISLAND QUADRANGLES, ALASKA
GEOCHEMICAL MAP, Mo
SHEET 1 OF 2



Base from U.S. Geological Survey, 1963

Geology from Detterman and others, 1979.

MOLYBDENUM IN NONMAGNETIC HEAVY-MINERAL-CONCENTRATE SAMPLES

SCALE 1:250 000

5 0 5 10 15 MILES

5 0 5 10 15 KILOMETERS

DISCUSSION

Introduction

These geochemical maps show the distribution and abundance of molybdenum in the Chignik and Sutwik Island quadrangles, Alaska and are part of a folio of maps which were compiled under the auspices of the Alaska Mineral Resource Assessment Program. Background information pertaining to this folio is available in U.S. Geological Survey Circular 802 (Detterman and others, 1980.

The distribution and abundance of molybdenum in 637 minus-80-mesh stream-sediment samples and 623 nonmagnetic heavy-mineral-concentrate samples collected in 1977 and 1978 are shown on a subdued topographic and generalized geologic base. At each sample site a letter has been plotted on the map; letters represent analytical values of molybdenum expressed in ppm (parts per million) as defined on the histograms (figs. 1 and 2). Hexagons on the nonmagnetic heavy-mineral-concentrate map and squares on the stream-sediment map denote molybdenum concentrations which are considered to be anomalous; increasing symbol size represents increasing ranges of concentrations as defined on histograms (figs. 1 and 2). Anomalous concentrations of molybdenum and associated elements are tabulated by sample site in tables 1 and 2.

Sample media

The topography of the Chignik and Sutwik Island quadrangles is characteristically rugged with short, rapidly flowing mountain streams on the east and west flanks of the Aleutian Range. Where the west flank grades into tidal flats toward Bristol Bay the streams become slow and meandering. Because of earlier work, minus-80-mesh stream-sediment and nonmagnetic heavy-mineral-concentrate samples were considered to be the best sample media for the reconnaissance resource assessment of the area. In all cases the sediment samples were taken from the beds of active stream channels which were draining areas ranging from 6 to 12 km^2. The detrital material and clays composing the sediment are considered to be representative of the composition of the bedrock and colluvium within the confines of the drainage basin upstream from the sample site; analysis of this sediment may reflect the presence of mineralization. The heavy minerals were concentrated by panning the sediment to remove the dilutional effects produced by common rock-forming minerals and rock fragments, and minerals of economic importance were isolated. The concentration of heavy minerals enhances the contrast between background and anomalous values, thus making heavy-mineral-concentrate samples excellent indicators of mineral occurrences within the environment.

Sample preparation and analysis

Stream-sediment samples were air dried, sieved to minus 80 mesh, and pulverized to minus 250 mesh to produce a homogeneous sample for analysis. The heavy-mineral-concentrate samples were panned to remove a percentage of the light minerals and were then air dried. The samples were sieved to minus 20 mesh and separated using bromoform (specific gravity, 2.86) into light- and heavy-mineral fractions. The heavy-mineral fraction was passed through a Frantz Isodynamic Separator[1] to obtain a nonmagnetic fraction at a 0.6 ampere setting. The nonmagnetic fraction was then split; one fraction was used for mineralogical study and the other was pulverized with a mortar and pestle for spectrographic analysis.

Molybdenum in minus-80-mesh stream-sediment samples and nonmagnetic heavy-mineral-concentrate samples was determined by semiquantitative emission spectroscopy (Grimes and Marranzino, 1968). Detailed descriptions of sample preparation, analytical techniques, and tabulated results for the elements analyzed appear in Detra and others (1978).

Statistical data

The statistics presented on this map were compiled using U.S. Geological Survey STATPAC program (VanTrump and Miesch, 1977). The distribution of molybdenum for the entire sample set for each sample media is shown on the histograms where frequency is plotted against concentration in ppm (figs. 1 and 2). Summary statistics listed beneath each histogram were calculated using unqualified values. An unqualified value is a reported value which has not been coded with an N, L, or G, where: N indicates not detected; L indicates detected at a concentration below the lower limit of determination; G indicates detected concentration is above the upper limit of determination. Below is a listing of correlation coefficients of molybdenum to relevant associated elements. These coefficients (above diagonal) are computed from the number of unqualified pairs within the sample population (below diagonal). A coefficient of 1 indicates a perfect direct correlation and -1 an inverse relation; an asterisk indicates that the correlation coefficient was not computed. Correlation coefficients which are significant with a 5 percent or less chance of error are italized.

[1]The use of commercial trade names is for descriptive purposes only and does not constitute endorsement of those products by the U.S. Geological Survey.

Correlation coefficients of molybdenum with associated elements

Sample media	Fe	Mn	Ag	Cu	Pb	Sn	W	Zn
Mo in stream sediments	.18/21	-*.49*/21	*/2	*.65*/21	-.04/21	*/0	*/0	-.09/21
Mo in heavy-mineral concentrates	-.12/23	-.01/27	.14/6	-.10/26	.20/19	-.50/3	.07/9	.16/3

A statistical summary of background molybdenum values in the major rock units of the Chignik and Sutwik Island quadrangles has been compiled. The background summary is based on rock samples which were considered to be compositionally representative of the rock unit from which they were taken. The method of analysis was identical to that used for the minus-80-mesh stream-sediment samples. Only one major rock unit, Tertiary intrusive (Ti), contained detectable molybdenum; in this rock unit 8 of the 31 samples analyzed contained molybdenum. The range of values was from 5 to 700 ppm with an arithmetic mean of 98.7 ppm and standard deviation of 243.

Distribution and nature of geochemical anomalies

The most notable anomaly pattern of molybdenum in both minus-80-mesh stream-sediment and nonmagnetic heavy-mineral concentrate samples occurs in the Warner Bay area (T. 46 S., R. 58 W.). These anomalous concentrations are associated with plutons of varying composition shown as unit Ti on the generalized geologic map and at least one occurrence of copper and molybdenum mineralization at Warner Bay. At this occurrence molybdenum in the form of molybdenite or powellite (Tripp and Detra, 1980) occurs in veins and fracture fillings. The other high values around the Warner Bay area are probably derived from mineralized zones similar in nature to the Warner Bay occurrence.

Anomalous occurrences of molybdenum in stream sediments on Cathedral Creek (T. 43 S., R. 60 W.), Bee Creek (T. 42 S., R. 38 W.), and Cape Kumlik (T. 41 S., R. 52 W.) are probably associated with intrusive centers of diorite to quartz diorite composition. The characteristics of these occurrences and the Warner Bay occurrence suggest the possibility of porphyry-type mineralization where hydrothermal zoning has produced (1) a core enriched in copper, molybdenum, and locally, tungsten centered on the intrusive; (2) an adjacent halo of copper, lead, zinc, silver, arsenic, and (or) gold; and (3) a peripheral halo produced by tin and bismuth anomalies.

Scattered anomalous molybdenum concentrations distributed over the Sutwik Island quadrangle are probably related to small intrusive centers ranging in composition from quartz diorite, to diorite, to gabbro and have characteristics similar to the better defined anomaly patterns discussed previously. The lack of any significant molybdenum content in some of the stream-sediment samples at some sites suggests that the molybdenum sources are small and that there are strong dilutional effects from the barren source rocks.

Many of the geochemical patterns have a close spatial correlation with conspicuous aeromagnetic anomalies (U.S. Geological Survey, 1978); of special interest are correlations near Devil's Bay, Catherdral Creek area, and near Cape Kumlik.

References

Burk, C. A., 1965, Geology of the Alaska Peninsula--Island arc and Continental margin: Geological Society of America Memoir 99, 250 p.

Detra, D. E., Cooley, E. F., Hopkins, R. T., Jr., O'Leary, R. M., and Jefferis, D. R., 1978, Final results and statistical summary from analyses of stream-sediment and heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-1090, 105 p.

Detterman, R. L., Case, J. E., Cox, D. P., Detra, D. E., Miller, T. P., and Wilson, F. H., 1980, The Alaskan Mineral Resource Assessment Program: Background information to accompany folio of geologic and mineral resource maps of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Circular 802.

Detterman, R. L., Miller, T. P., Yount, M. E., and Wilson, F. H., 1979, Generalized geologic map of the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1053 A, 1 sheet, scale 1:250,000.

Galloway, W. E., 1974, Deposition and diagenetic alteration of sandstone in northeast Pacific arc-related basins: implications for graywacke genesis: Geological Society of America Bulletin, v. 85, no. 3, p. 379-390.

Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.

Tripp, R. B., and Detra, D. E., 1980, Maps showing mineralogical data of selected minerals for the nonmagnetic heavy-mineral concentrates of stream sediments in the Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1053 I, 2 sheets, scale 1:250,000.

U.S. Geological Survey, 1978, Aeromagnetic map of Chignik and Sutwik Island quadrangles, Alaska: U.S. Geological Survey Open-File Report 78-263, 11 plates, scale 1:63,360.

VanTrump, George, Jr., and Miesch, A. T., 1977, The U.S. Geological Survey RASS-STATPAC system for management and statistical reduction of geochemical data: Computers and Geosciences, v. 3, p. 475-488.

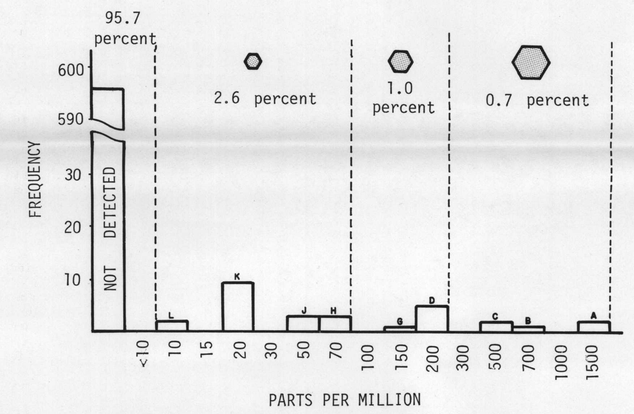


Figure 1.--Histogram for molybdenum in 623 nonmagnetic heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska, showing: symbols denoting anomalous concentrations, percentage of total number of samples represented by each range, and letters corresponding to concentrations in parts per million. Statistics are based on all unqualified values (27) within the sample population; arithmetic mean, 236.7; standard deviation, 402.1; geometric mean, 79.5; and geometric deviation, 4.5.

Table 1.--*Copper, lead, zinc, and silver associated with anomalous molybdenum values in nonmagnetic heavy-mineral-concentrate samples, Chignik and Sutwik Island quadrangles, Alaska*

[Values reported in parts per million; values shown determined by semiquantitative emission spectroscopy; N, not detected; L, detected but below value shown; G, detected at a concentration above value shown; lower limits of detection for Pb, Zn, and Ag are 20, 500, and 1 ppm, respectively; *, anomalous concentration. Map number corresponds to sample site on heavy-mineral-concentration map]

Map no.	Field no.	Mo	Cu	Pb	Zn	Ag
1	SW001	70	700*	70	7,000*	5*
2	002	200	70	N	N	N
3	048	20	300	70	N	N
4	046	20	700*	70	L(500)	2*
5	039	20	150	1,000*	N	N
6	037	20	200	50	N	N
7	023	20	3,000*	150*	N	N
8	066	200	10	N	N	N
9	144	200	500	500*	N	N
10	CG004	1,500	20	N	N	N
11	SW115	20	10	N	N	N
12	124	50	15	70	N	N
13	CG202	200	1,000*	N	N	N
14	413	20	300	70	2,000*	7*
15	144	150	300	200*	N	N
16	172	20	70	200*	N	N
17	265	70	2,000*	100	1,000*	N
18	137	500	200	200*	N	N
19	061	700	70	500*	N	N
20	062	1,500	G20,000*	70	N	15*
21	064	70	10,000*	N	N	N
22	065	20	2,000*	50	N	50*
23	066	10	70	50	N	N
24	055	50	150	20	N	N
25	036	200	5,000*	20	N	7*
26	082	10	100	N	N	N
27	099	500	200	N	N	N

DISTRIBUTION AND ABUNDANCE OF MOLYBDENUM IN MINUS-80-MESH STREAM-SEDIMENT AND NONMAGNETIC HEAVY-MINERAL-CONCENTRATE SAMPLES, CHIGNIK AND SUTWIK ISLAND QUADRANGLES, ALASKA

By
D.E. Detra and G.W. Day
1980

This map is one of a series, all bearing the number MF-1053. Background information relating to this map is published as U.S. Geological Survey Circular 802 available free from Branch of Distribution, U.S. Geological Survey, 1200 South Eads Street, Arlington, VA 22202

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