DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-2071-B
PAMPHLET

GEOCHEMICAL MAPS SHOWING THE DISTRIBUTION AND ABUNDANCE OF SELECTED ELEMENTS IN NONMAGNETIC HEAVY-MINERAL-CONCENTRATE SAMPLES FROM STREAM SEDIMENT, SOLOMON AND BENDELEBEN 1° x 3° QUADRANGLES, SEWARD PENINSULA, ALASKA

By

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INTRODUCTION

The USGS (U.S. Geological Survey) is required by ANILCA (Alaska National Interest Lands Conservation Act, Public Law 96-487, 1980) to survey certain Federal lands in Alaska to determine their mineral resource potential. A reconnaissance geochemical survey of the Solomon and Bendeleben 1° x 3° quadrangles, an area of about 22,300 km^2 on the Seward Peninsula, west-central Alaska, was conducted from 1981 to 1983 as part of AMRAP (Alaska Mineral Resource Assessment Program). Stream-sediment samples and nonmagnetic heavy-mineral-concentrate samples derived from stream sediment were collected and analyzed for 31 elements. The mineralogy of the nonmagnetic heavy-mineral concentrates was also determined. This report presents geochemical maps and histograms showing the distribution and abundance of selected elements in the nonmagnetic heavy-mineral concentrates. Geochemical maps and histograms showing the distribution and abundance of selected elements in the stream-sediment samples and of selected minerals in the nonmagnetic heavy-mineral concentrates are given in Smith and others (1989) and in King and others (1989), respectively. A report on the interpretation of these data is in progress by S.C. Smith and H.D. King.

SAMPLE COLLECTION, PREPARATION, AND ANALYSIS

Nonmagnetic heavy-mineral-concentrate samples were collected at 1,400 sites, all of which were also stream-sediment-sample sites. The heavy-mineral-concentrate samples were derived from active alluvium collected primarily from first-order (unbranched) and second-order (below the junction of two first-order streams) streams as shown on USGS topographic maps at 1:63,360 scale. The area of the drainage basins sampled averaged about 12 km^2 and ranged from about 1 to 120 km^2. Samples were generally composited from several localities along a stretch of stream channel as long as 8 m. Stream sediments were sieved at the sample sites with a 2-mm (10-mesh) stainless-steel screen and the finer part was panned using a 14-in. gold pan.

Samples were air dried in the field; some samples were further dried in an oven at the laboratory. The panned samples were sieved with a 0.84-mm (20-mesh) screen. The finer fraction was passed through bromoform (specific gravity 2.8) to remove light-weight mineral grains not removed in the panning process. The resultant heavy-mineral sample was separated into three fractions using a large electromagnet, in this case a modified Frantz Isodynamic Separator. The magnetic separates are the same separates that would be produced by using a Frantz Isodynamic Separator set at a forward slope of 5° and a side slope of 10°, with a current of 0.1 ampere to remove the most magnetic fraction and a current of 0.7 ampere to split the remainder of the sample into an intermediately magnetic fraction and a relatively nonmagnetic fraction. The fraction containing the most magnetic material, primarily magnetite, and the intermediate fraction, consisting largely of ferromagnesian silicates and iron oxides, were not analyzed. The least magnetic fraction was split into two parts using a microsplitter. One split was used to determine the mineralogy of the nonmagnetic heavy-mineral concentrates. The other split was hand ground to less than 0.10 mm with a mortar and pestle. The ground split was used for spectrographic analysis.

The pulverized nonmagnetic heavy-mineral-concentrate samples were analyzed semiquantitatively for 31 elements using a six-step direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements and their upper and lower determination limits (based on a 5-mg sample) are given in table 1. The method was modified slightly for the concentrate samples to eliminate spectral interferences. The spectrographic results were reported as geometric midpoints, 1.0, 0.7, 0.5, 0.3, 0.2, 0.15 (or appropriate multiples of ten) having the respective boundaries 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12 (or appropriate multiples of ten). In general, the precision of the results of the method is plus or minus one reporting value of the actual value given 83 percent of the time and within two intervals 96 percent of the time (Motooka and Grimes, 1976).

The analytical data have been entered in the USGS's computerized RASS (rock analysis storage system) and are available in Arbogast and others (1985). Data reduction was done on a Data General MV/6000 computer using the USGS's STATPAC package. STATPAC programs perform numerous functions including map generation, data tabulation, data editing, and statistics (VanTrump and Miesch, 1977).

GEOCHEMICAL MAPS

Two multi-element geochemical maps, each on a geologic and a topographic base, show the spatial distribution and abundance of Ba, Co, Cu, Mo, Ni, Pb, and Zn (map A), and of Ag, As, Au, Be, Sb, Sn, Th, and W (map B).

These 15 elements were selected, other elements were excluded, and values were selected for plotting based on examination of frequency histograms and map distribution plots showing all analytical values for all of the 31 elements analyzed, on interpretation of factor analysis of the data, and on consideration of both primary and associated elements of known mineral deposits or occurrences located within the study area. In general, most of the values plotted on the maps are thought to be anomalous based on the considerations previously noted for element selection.

Groups of values were selected for plotting based on the 90th, 95th, and 99th percentiles. The data, for the most part, are not divisible at these percentiles and consequently the boundaries used for the groups of plotted values, in most cases, only roughly approximate those percentiles. The actual percentages of values plotted are given in the histograms (figs. 1 and 2).

The elements are displayed in a radial pattern on maps A and B. As many as three concentration intervals are exhibited for each element. The radial pattern and concentration intervals of each element are explained in the legend.

Histograms for each element on the maps are exhibited on figures 1 and 2. The spectrographic intervals are used as class widths. These histograms illustrate the range of the data and the general form of the distribution for each element.

REFERENCES CITED

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Table 1.--*Limits of determination for the spectrographic analysis of nonmagnetic heavy-mineral-concentrate samples*

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	0.1	50
Magnesium (Mg)	.05	20
Calcium (Ca)	.1	50
Titanium (Ti)	.005	2
	Parts per million	
Manganese (Mn)	20	10,000
Silver (Ag)	1	10,000
Arsenic (As)	500	20,000
Gold (Au)	20	1,000
Boron (B)	20	5,000
Barium (Ba)	50	10,000
Beryllium (Be)	2	2,000
Bismuth (Bi)	20	2,000
Cadmium (Cd)	50	1,000
Cobalt (Co)	10	5,000
Chromium (Cr)	20	10,000
Copper (Cu)	10	50,000
Lanthanum (La)	50	2,000
Molybdenum (Mo)	10	5,000
Niobium (Nb)	50	5,000
Nickel (Ni)	10	10,000
Lead (Pb)	20	50,000
Antimony (Sb)	200	20,000
Scandium (Sc)	10	200
Tin (Sn)	20	2,000
Strontium (Sr)	200	10,000
Vanadium (V)	10	20,000
Tungsten (W)	100	20,000
Yttrium (Y)	20	5,000
Zinc (Zn)	500	20,000
Zirconium (Zr)	20	2,000
Thorium (Th)	200	5,000

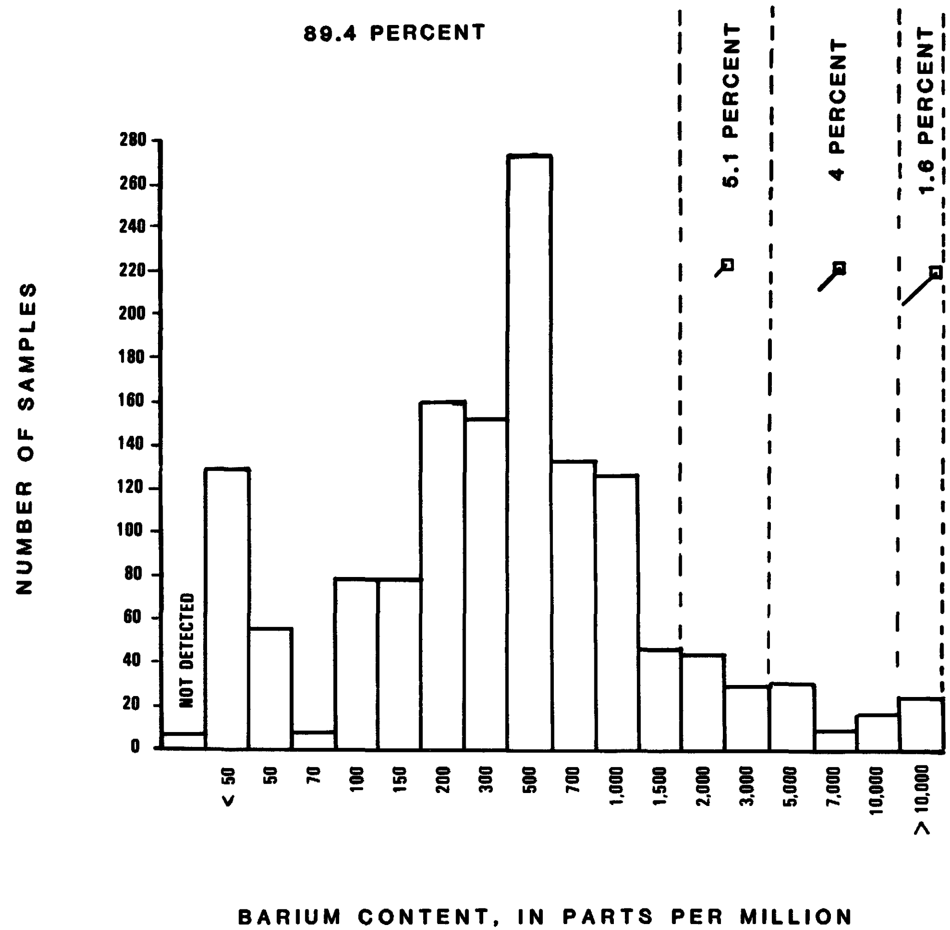
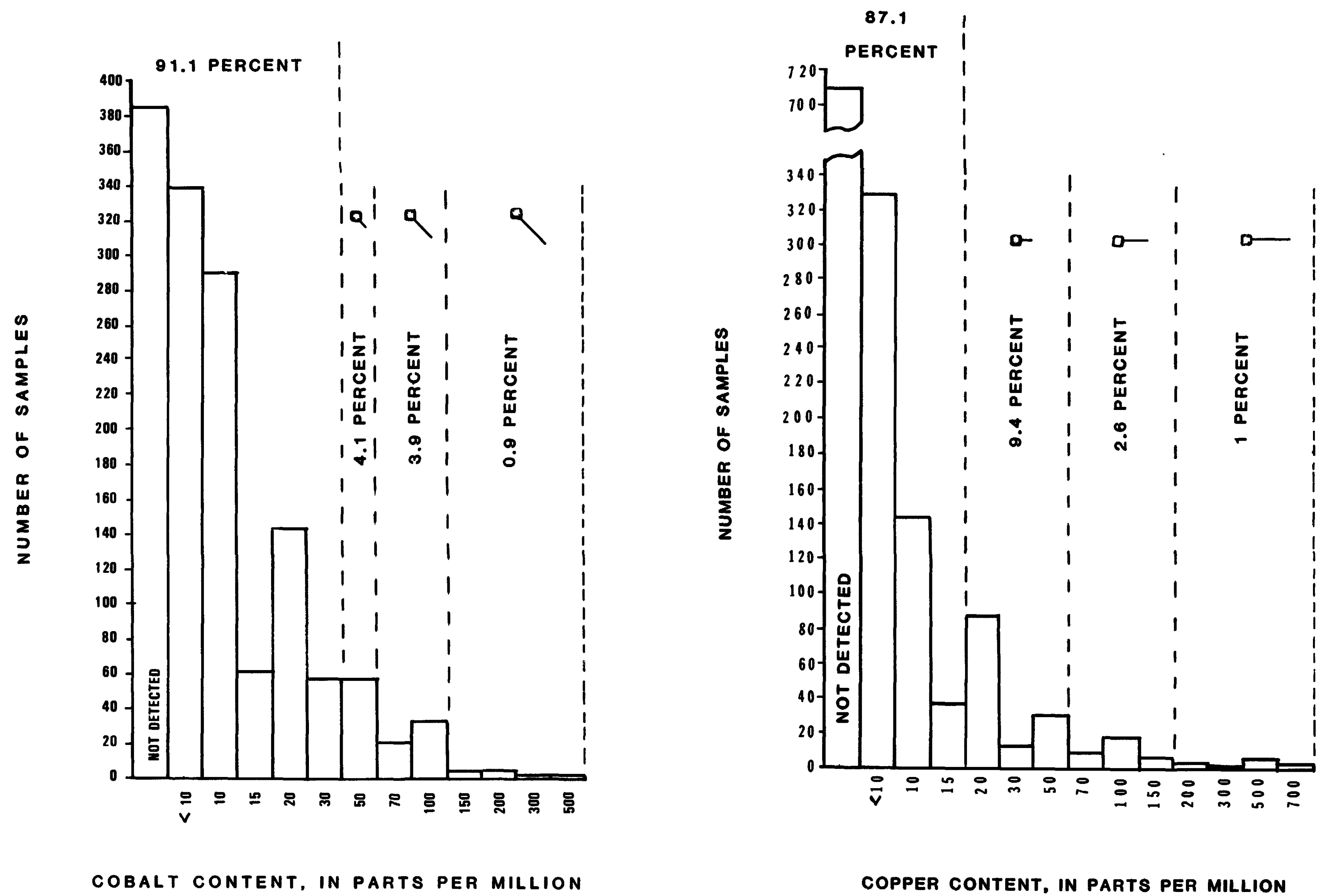


Figure 1.--Histograms showing concentrations of barium, cobalt, copper, lead, molybdenum, nickel, and zinc in nonmagnetic heavy-mineral-concentrate samples from stream sediment, Solomon and Bendeleben 1° x 3° quadrangles. Symbols (star-diagram rays), which vary in length to denote anomalous concentrations, correspond to symbols used on map A.



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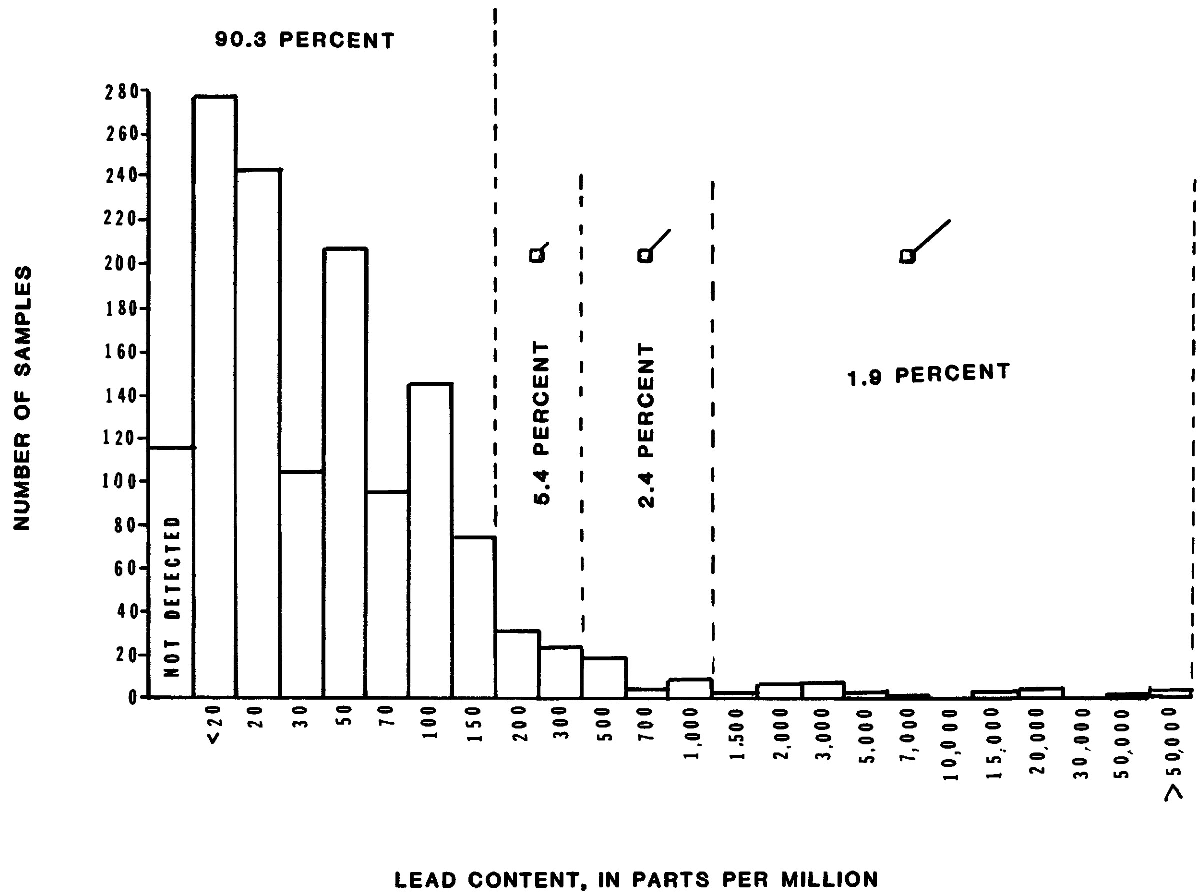

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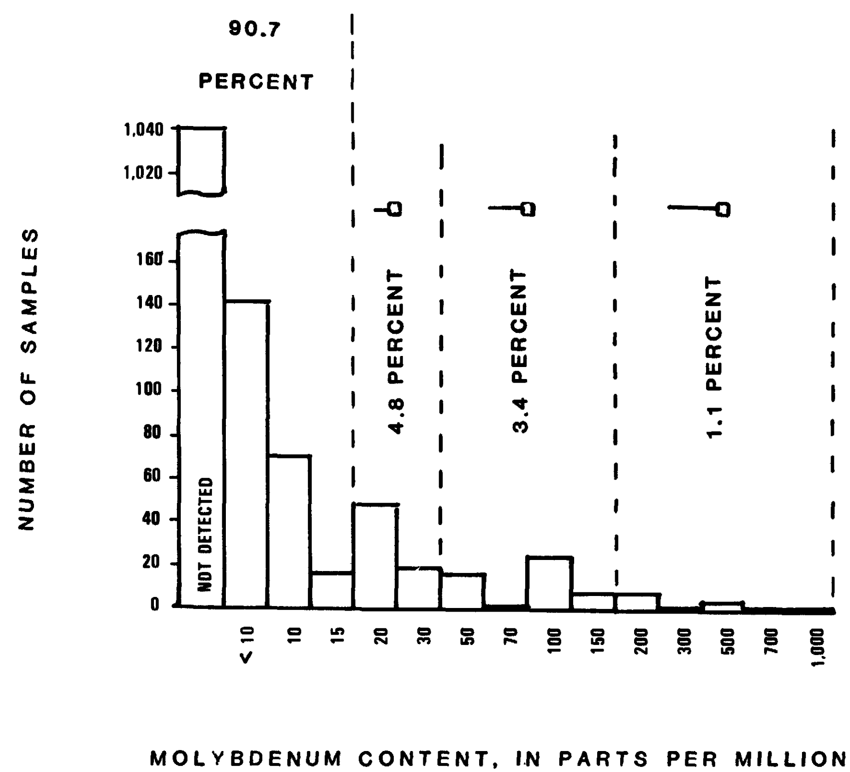

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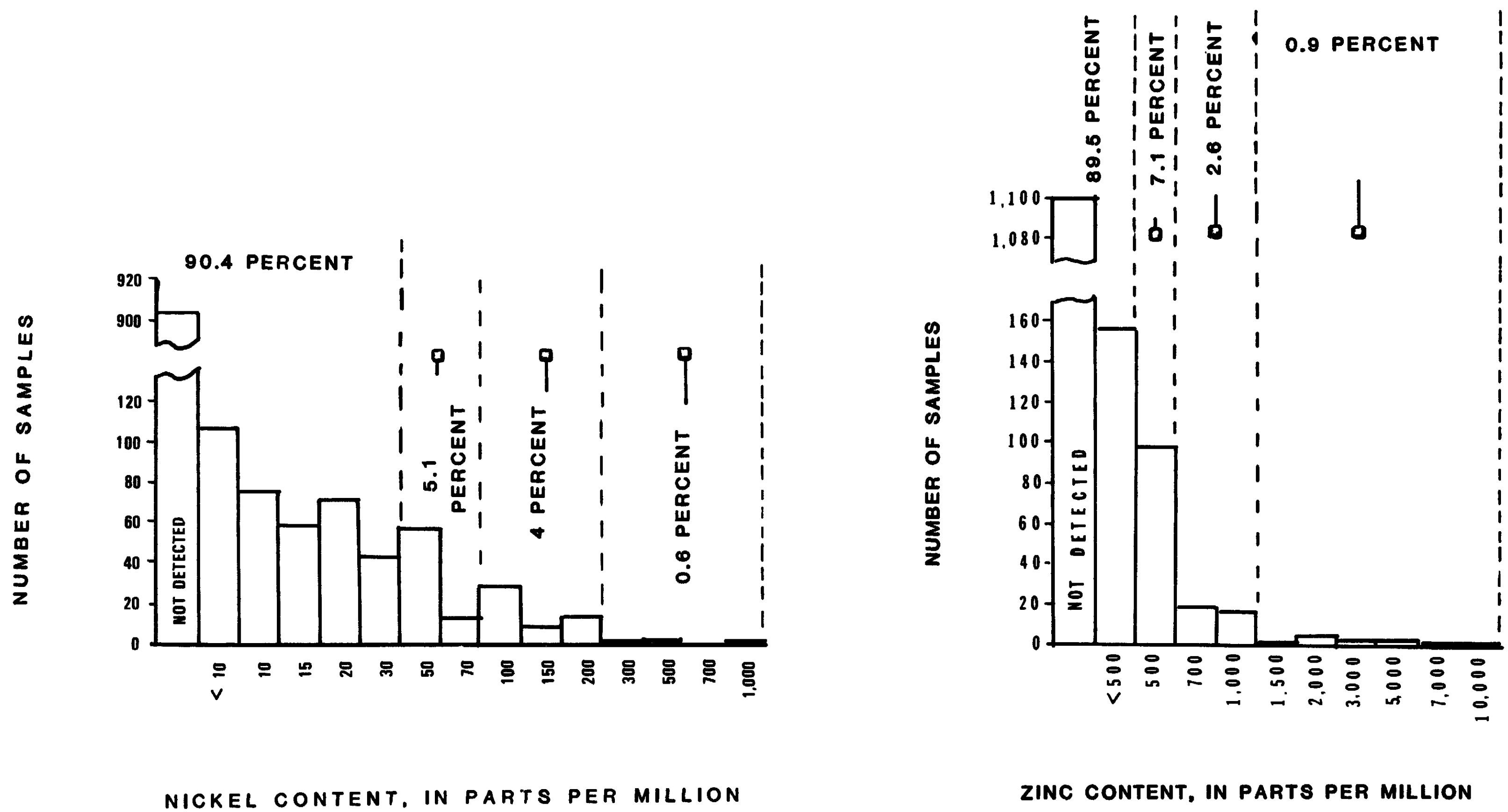

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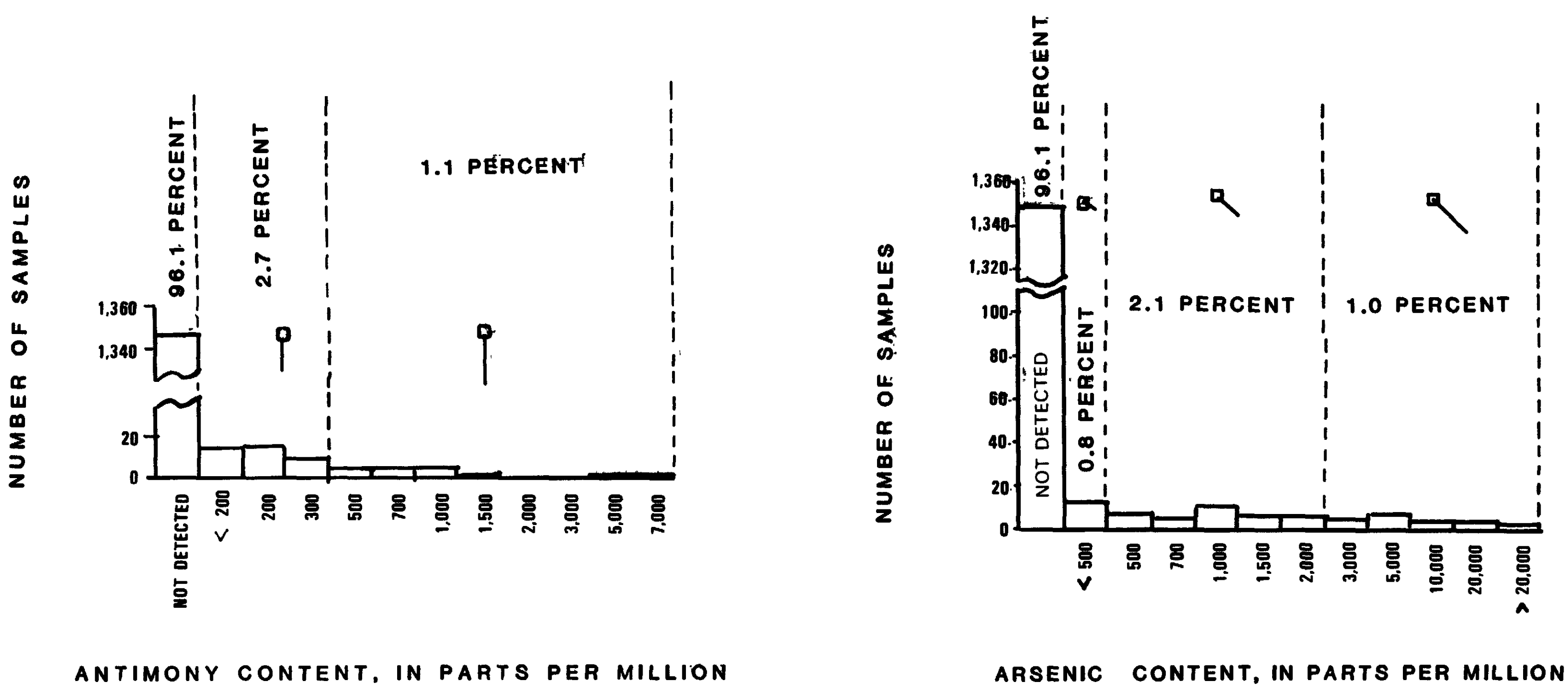
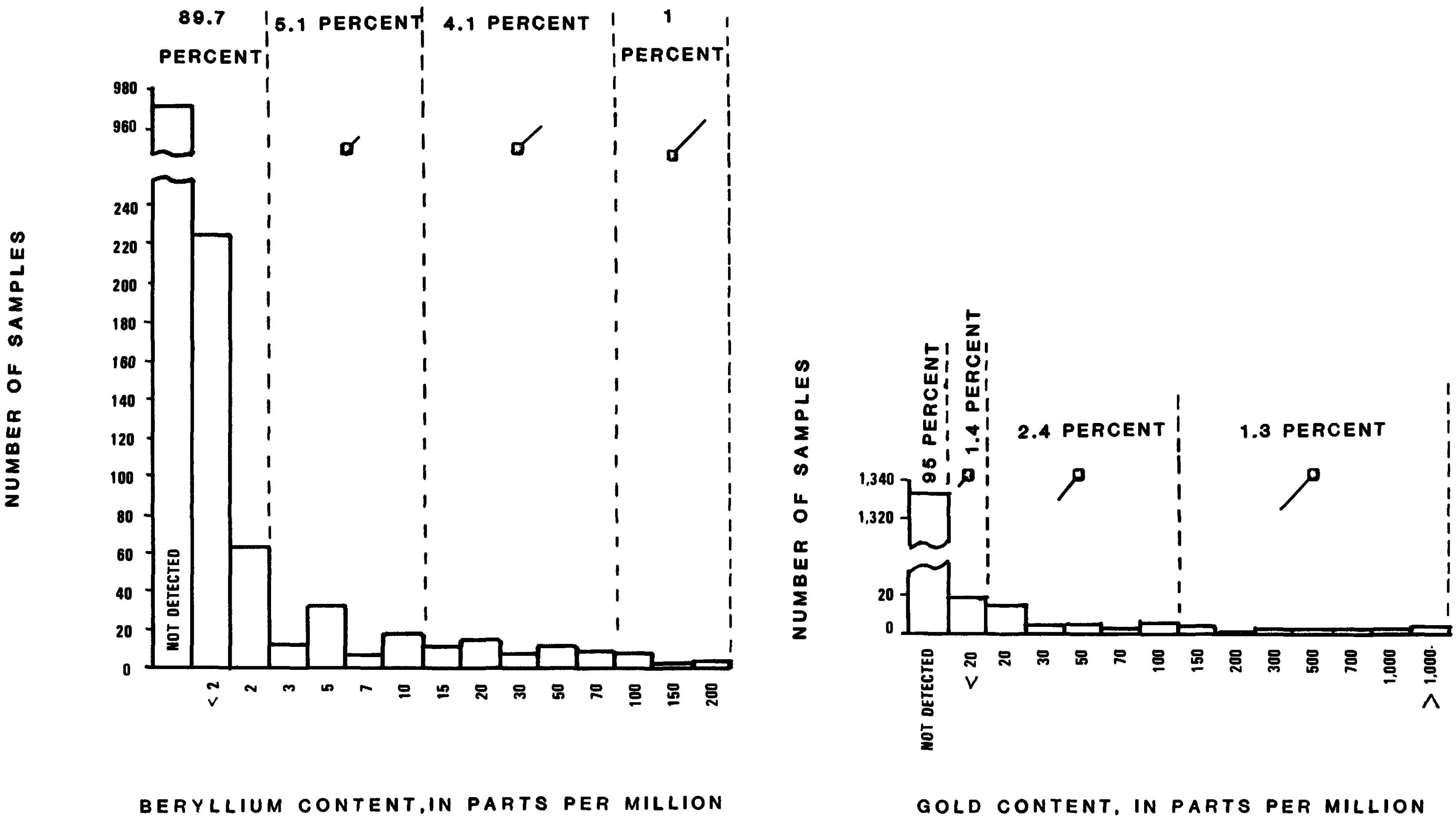


Figure 2.--Histograms showing concentrations of antimony, arsenic, beryllium, gold, silver, thorium, tin, and tungsten in nonmagnetic heavy-mineral-concentrate samples from stream sediment, Solomon and Bendeleben 1° x 3° quadrangles. Symbols (star-diagram rays), which vary in length to denote anomalous concentrations, correspond to symbols used on map B.



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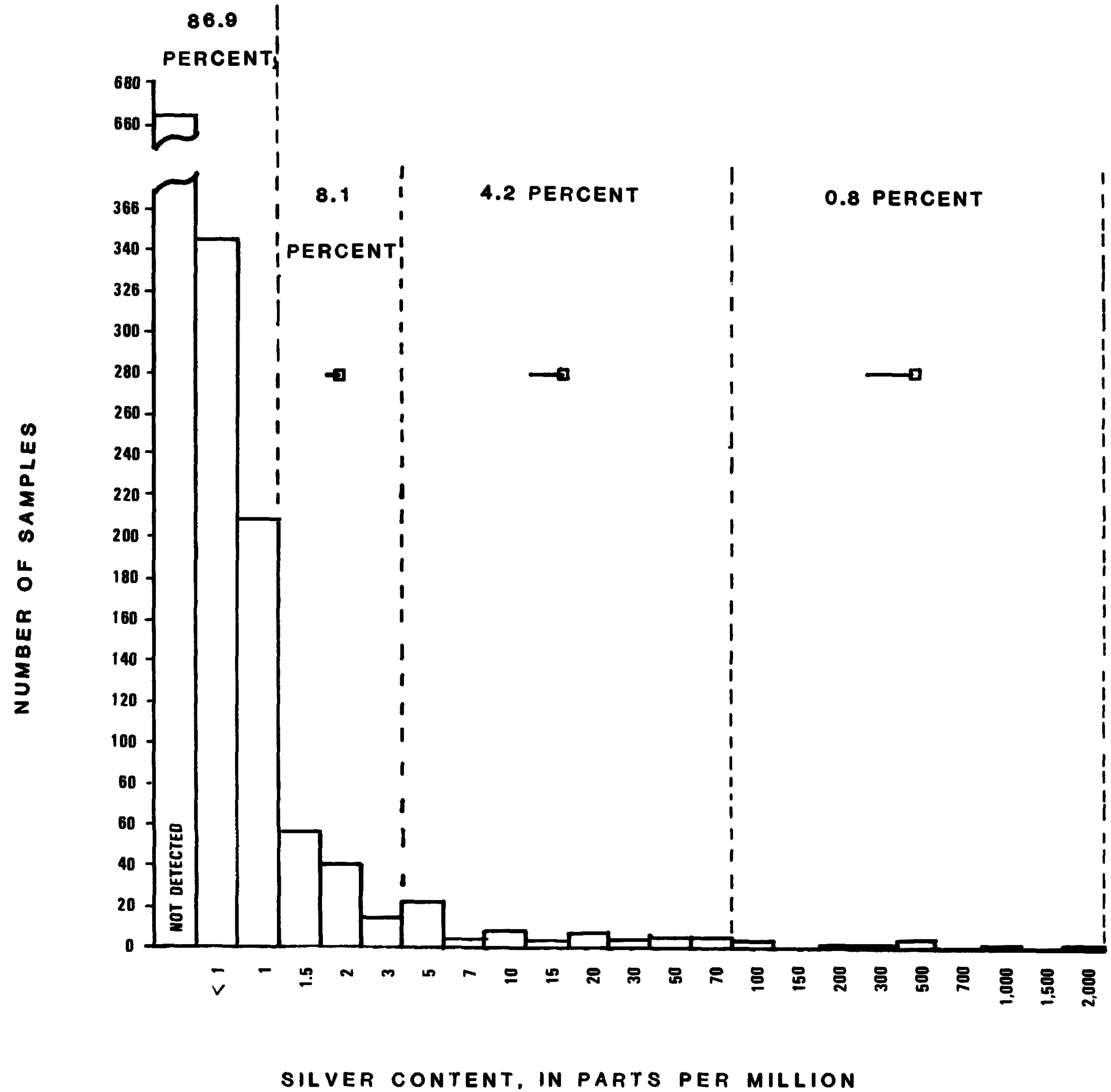

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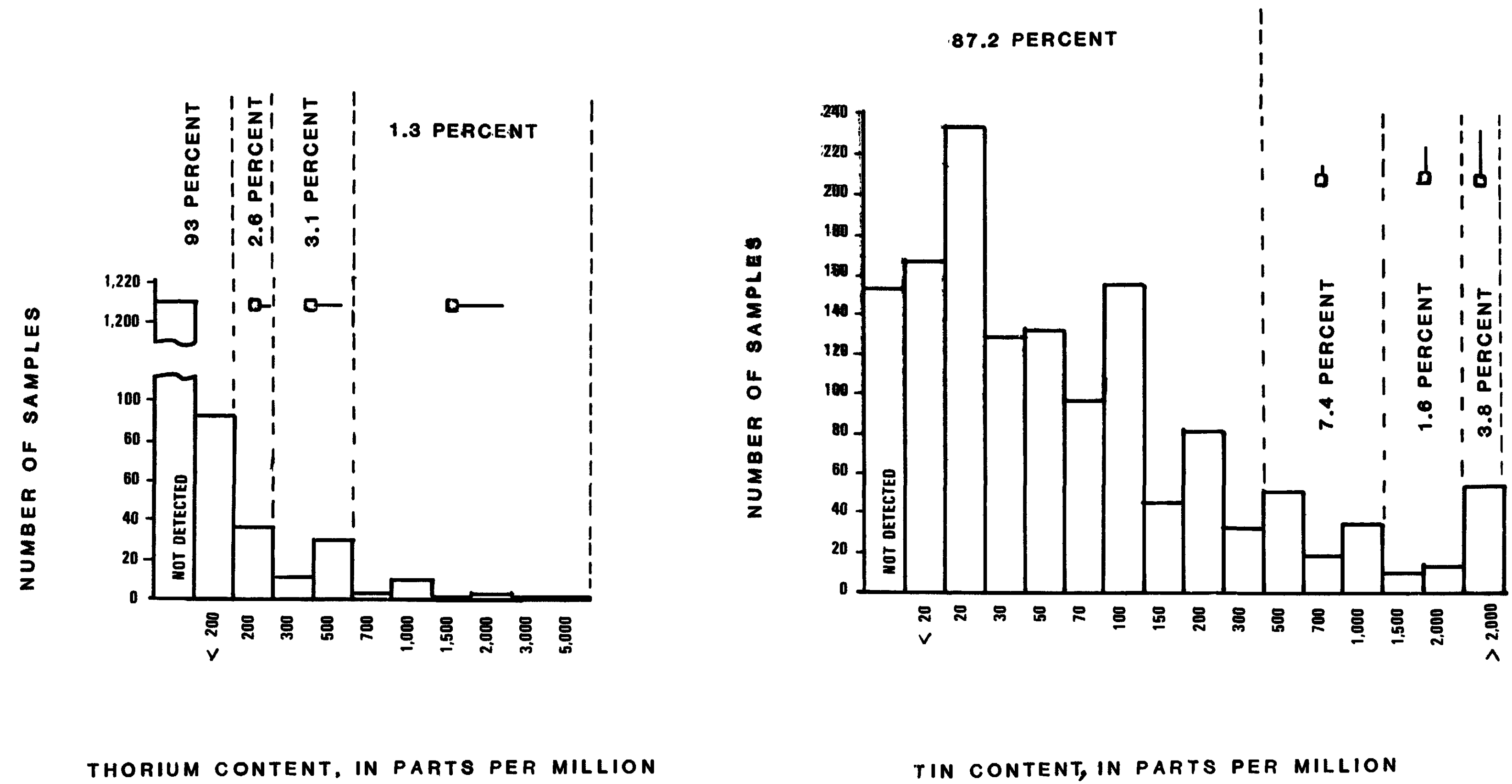

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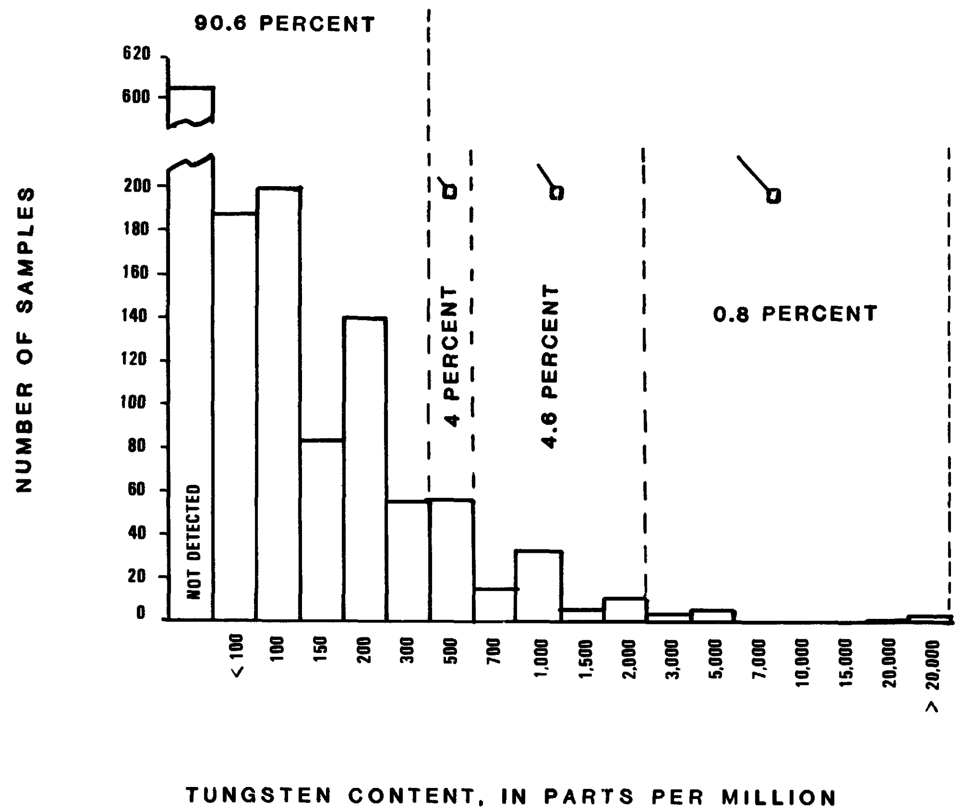

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