DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-2071-A
PAMPHLET

GEOCHEMICAL MAPS SHOWING THE DISTRIBUTION AND ABUNDANCE OF SELECTED ELEMENTS IN STREAM-SEDIMENT SAMPLES, 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 stream-sediment samples. Geochemical maps and histograms showing the distribution and abundance of selected elements and selected minerals in the nonmagnetic heavy-mineral concentrates are given in King and others (1989a) and King and others (1989b), 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

Stream-sediment samples were collected at 1,590 sites. These samples consist of 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 part of the fine fraction was collected for the stream-sediment sample.

Samples were air dried in the field; some samples were further dried in an oven at the laboratory. After drying, the stream-sediment samples were sieved with a 0.18-mm (80-mesh) stainless-steel screen and the finer fraction was pulverized to less than 0.10 mm in a vertical grinder using ceramic grinding plates.

The pulverized stream-sediment samples were analyzed semiquantitatively for 31 elements using a six-step direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their upper and lower determination limits (based on a 10-mg sample) are given in table 1. 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). Spectrographic analyses were done by B.F. Arbogast, S.J. Sutley, and G.W. Day.

Stream-sediment samples were also analyzed for As, Bi, Cd, Sb, and Zn using a flame atomic absorption method (modified from Viets, 1978). Some of the stream-sediment samples (618 samples) were analyzed for gold by atomic absorption (Thompson and others, 1968). The lower limits of determination for elements analyzed by atomic absorption are as follows (in parts per million): As, 5 or 10; Au, 0.05; Bi, 1; Cd, 0.1; Sb, 2; and Zn, 5. Atomic absorption analyses were done by J.D. Hoffman, R.M. O'Leary, D.M. Hopkins, Anna Mantei, A.L. Gruzenski, and W.C. Martin.

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, Cd, Co, Cu, Mo, Ni, Pb, and Zn (map A), and of Ag, As, Be, Sb, Sn, Th, and W (map B). The concentrations plotted for As, Cd, Sb, and Zn are those that were determined by atomic absorption analysis; concentrations plotted for all of the other elements are those that were determined by semiquantitative spectrographic analysis.

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 on figures 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.

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Table 1.–*Limits of determination for the spectrographic analysis of stream-sediment samples*

Elements	Lower determination limit	Upper determination limit
	Percent	
Iron (Fe)	0.05	20
Magnesium (Mg)	.02	10
Calcium (Ca)	.05	20
Titanium (Ti)	.002	1
	Parts per million	
Manganese (Mn)	10	5,000
Silver (Ag)	0.5	5,000
Arsenic (As)	200	10,000
Gold (Au)	10	500
Boron (B)	10	2,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	5	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Lanthanum (La)	20	1,000
Molybdenum (Mo)	5	2,000
Niobium (Nb)	20	2,000
Nickel (Ni)	5	5,000
Lead (Pb)	10	20,000
Antimony (Sb)	100	10,000
Scandium (Sc)	5	100
Tin (Sn)	10	1,000
Strontium (Sr)	100	5,000
Vanadium (V)	10	10,000
Tungsten (W)	50	10,000
Yttrium (Y)	10	2,000
Zinc (Zn)	200	10,000
Zirconium (Zr)	10	1,000
Thorium (Th)	100	2,000

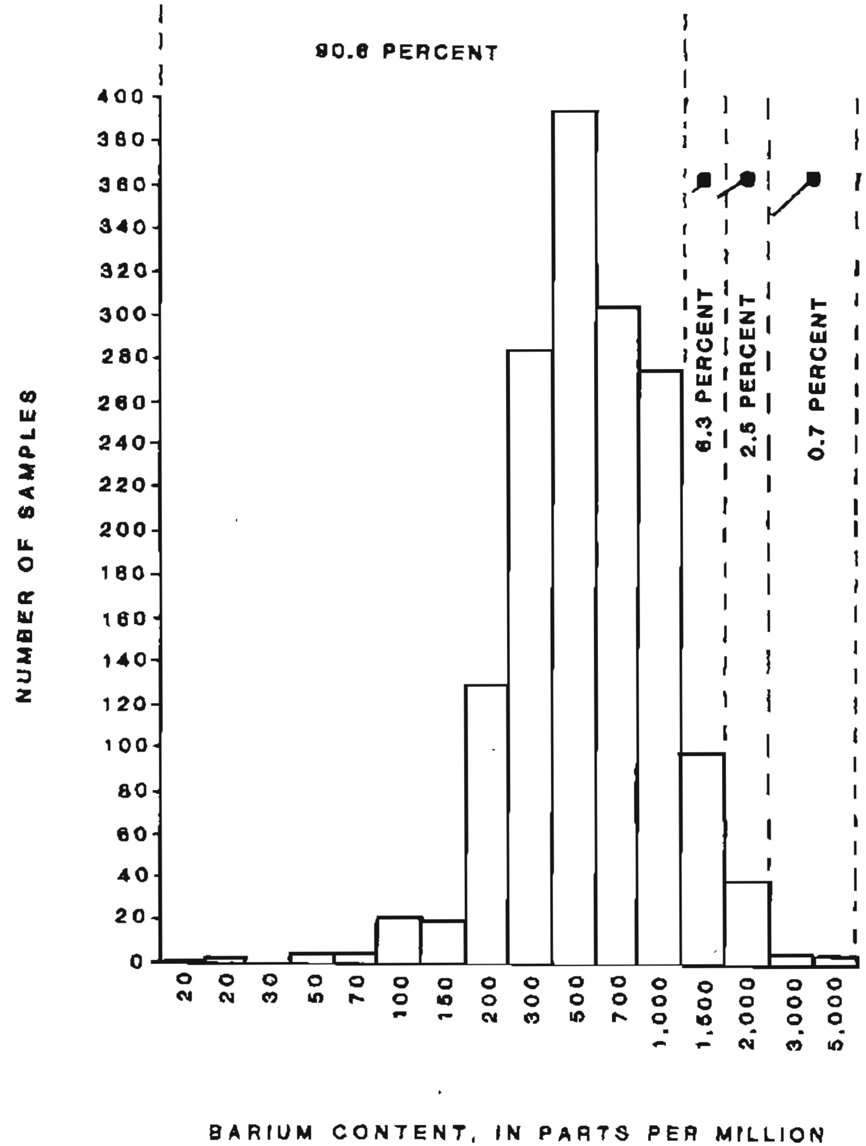


Figure 1.--Histograms showing concentrations of barium, cadmium, cobalt, copper, lead, molybdenum, nickel, and zinc in stream-sediment samples, Solomon and Bendeleben 1° x 3° quadrangles. Symbols (star-diagram rays), which vary in length to denote anomalous concentrations, correspond to symbols used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

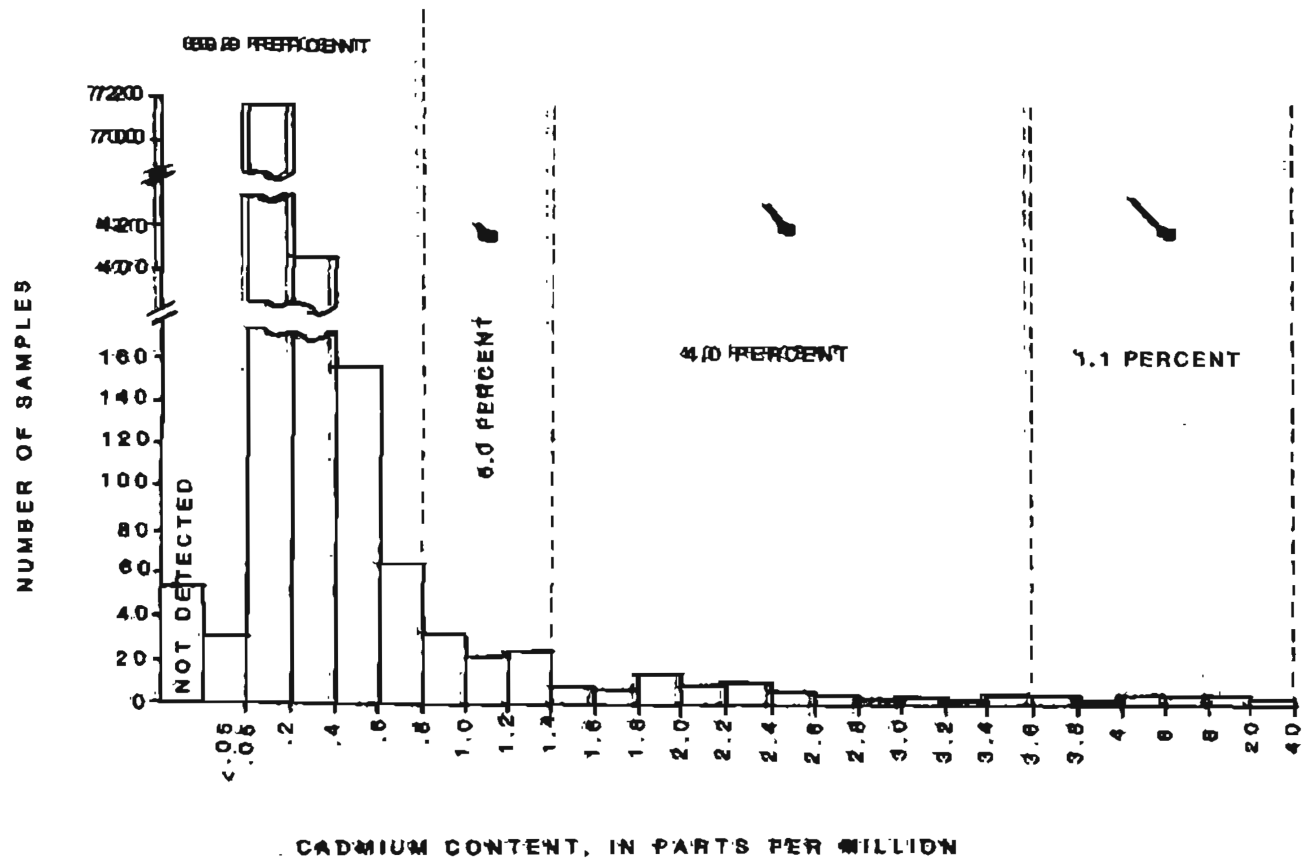
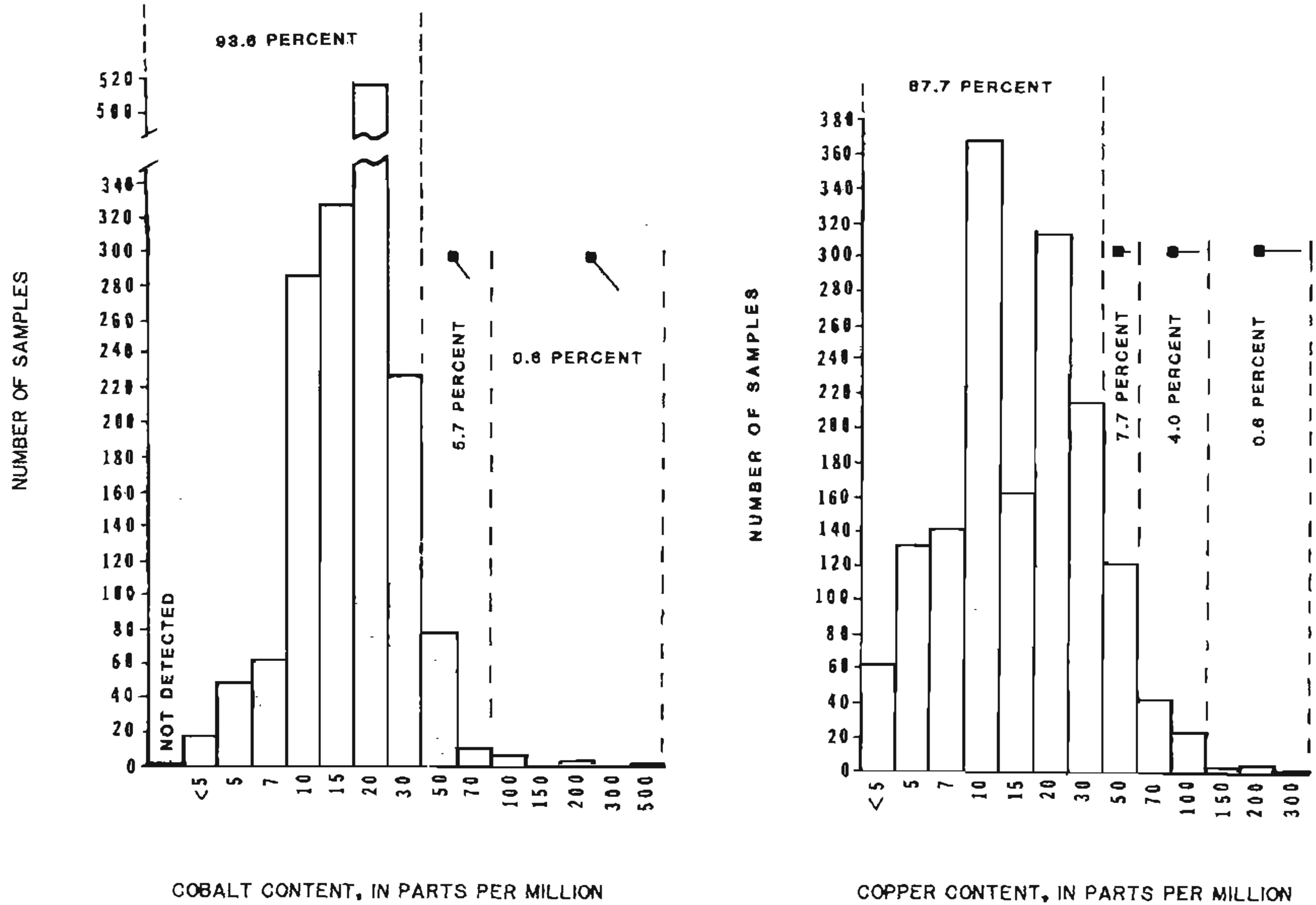


Figure 1.--Histograms showing concentrations of barium, cadmium, cobalt, copper, lead, molybdenum, nickel, and zinc in stream-sediment samples, Solomon and Bendeleben 1° x 3° quadrangles.--Continued



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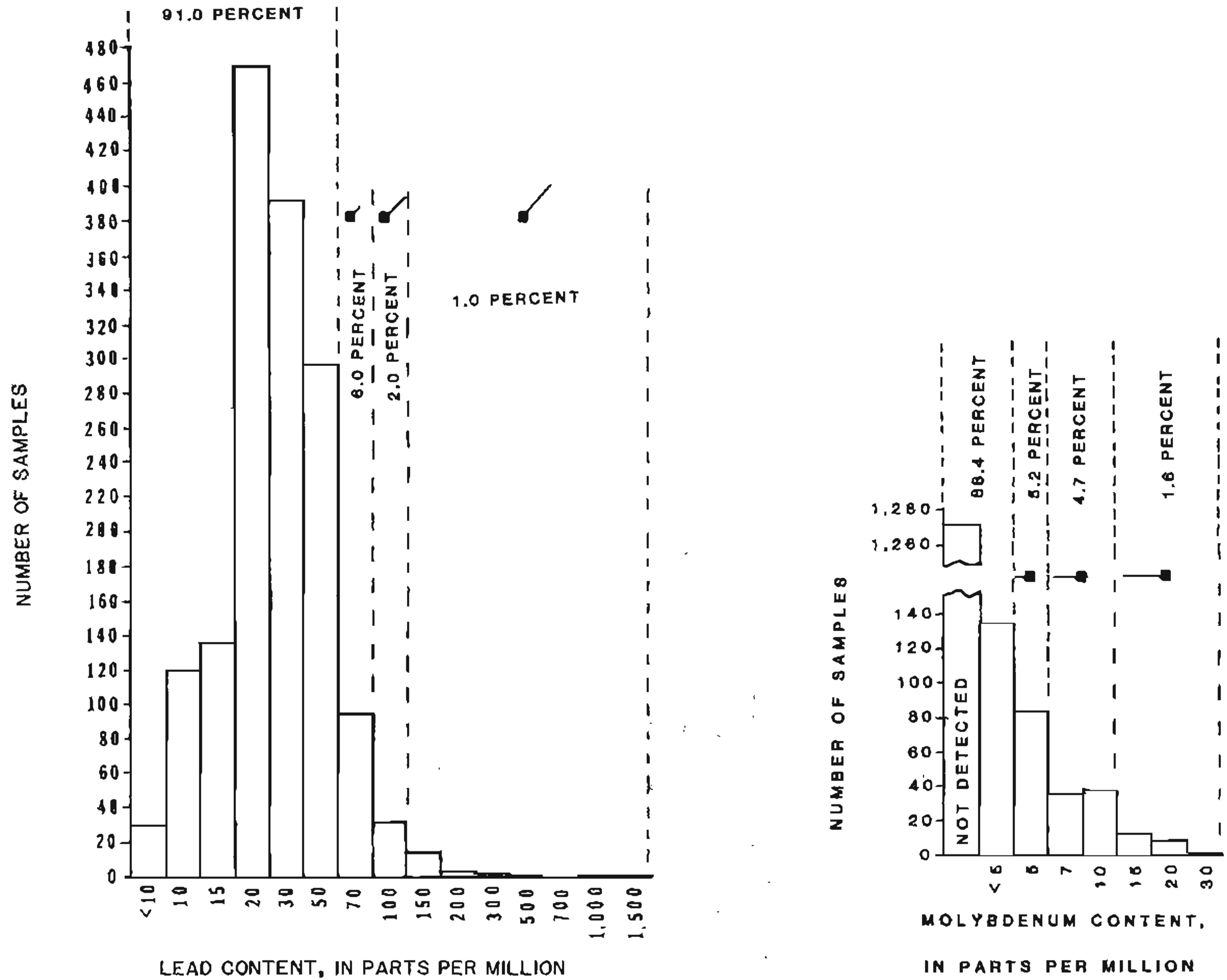

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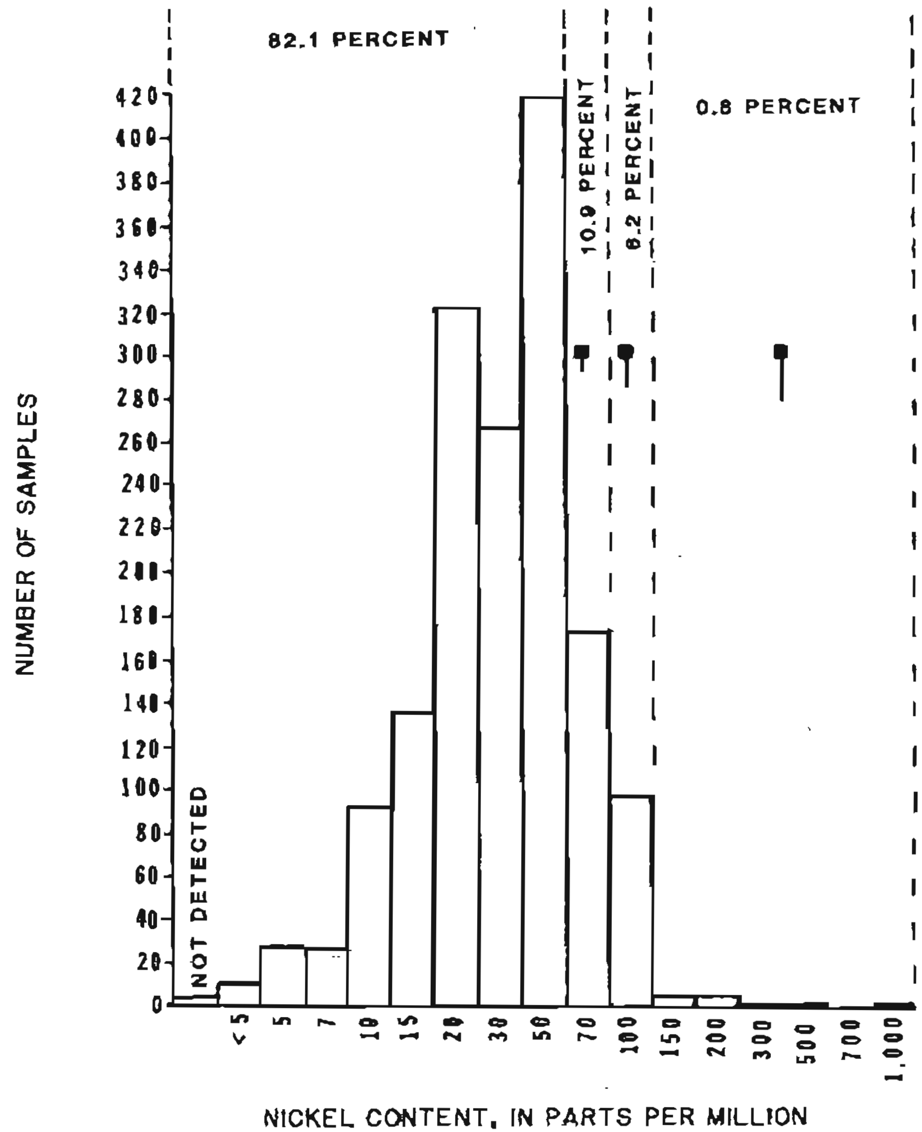

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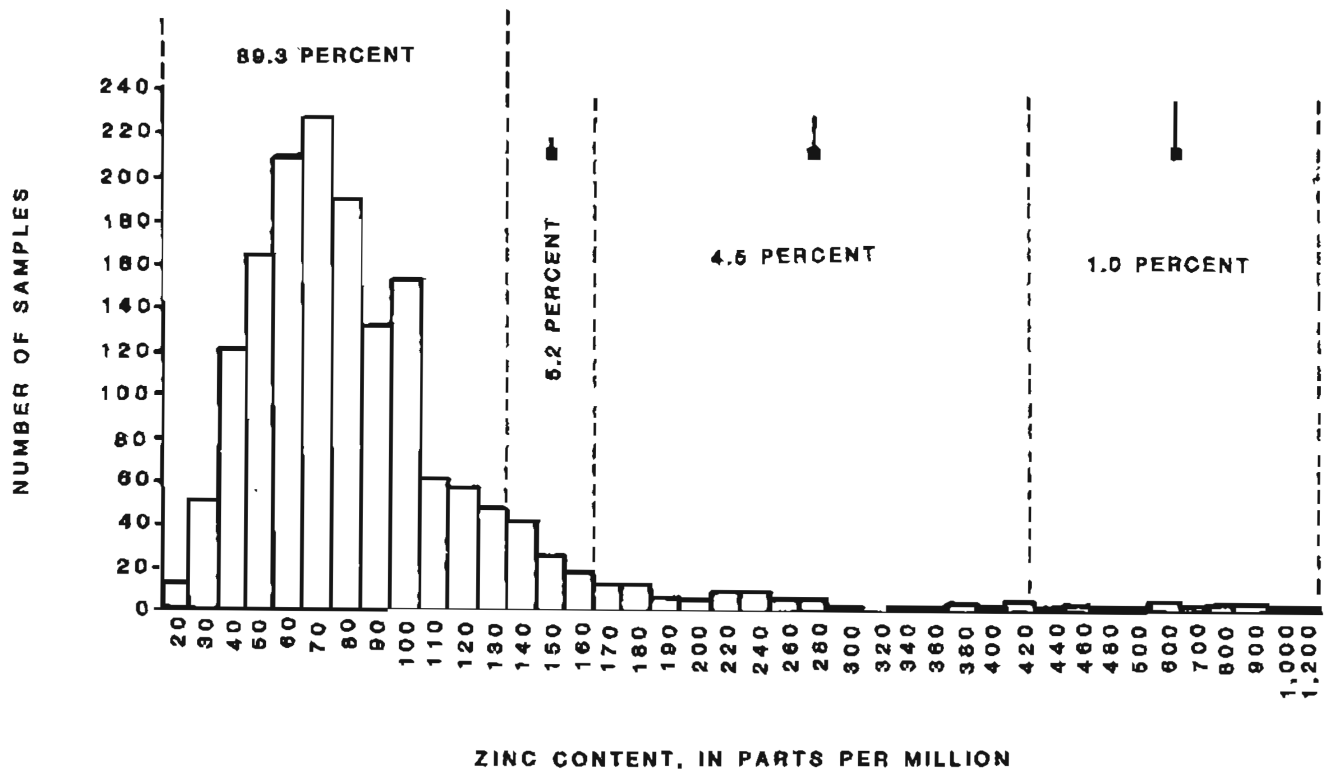

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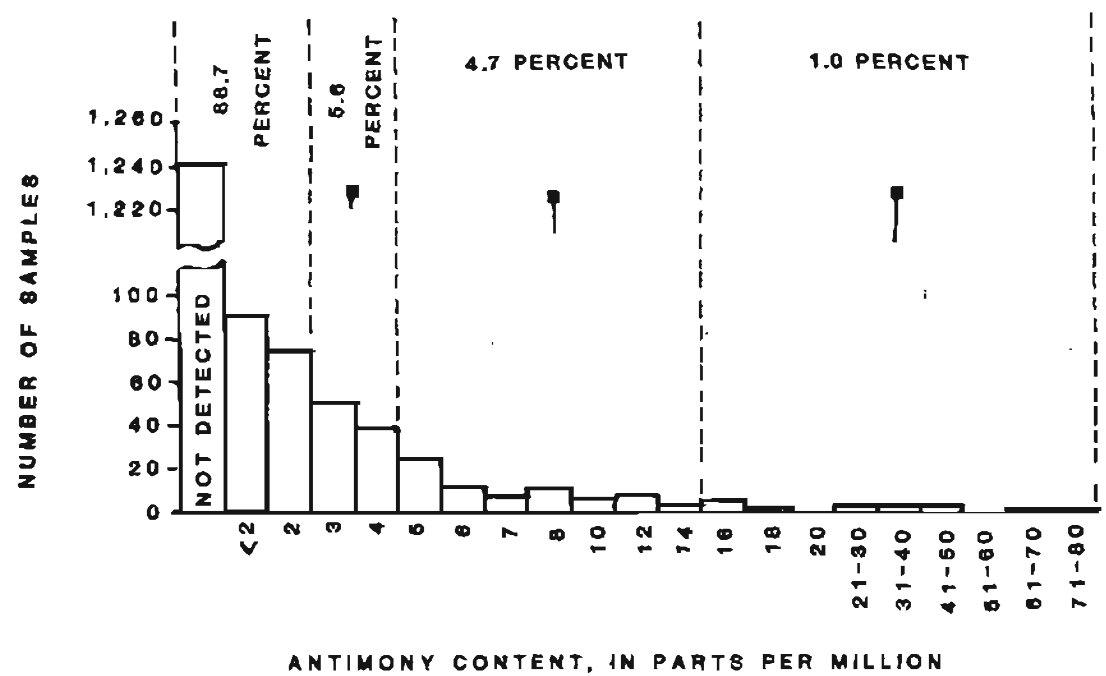
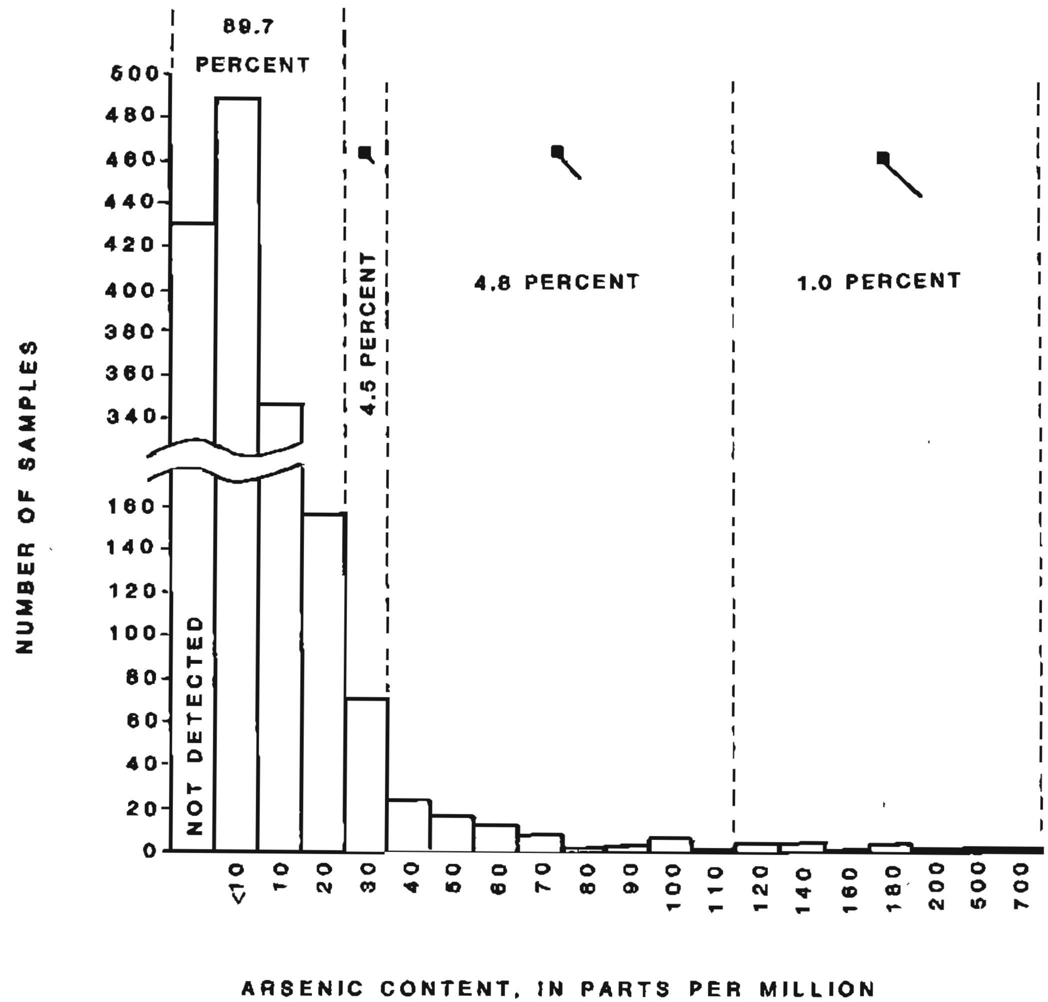


Figure 2.--Histograms showing concentrations of antimony, arsenic, beryllium, silver, thorium, tin, and tungsten in stream-sediment samples, Solomon and Bendeleben 1° x 3° quadrangles. Symbols (star-diagram rays), which vary in length to denote anomalous concentrations, correspond to symbols used on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



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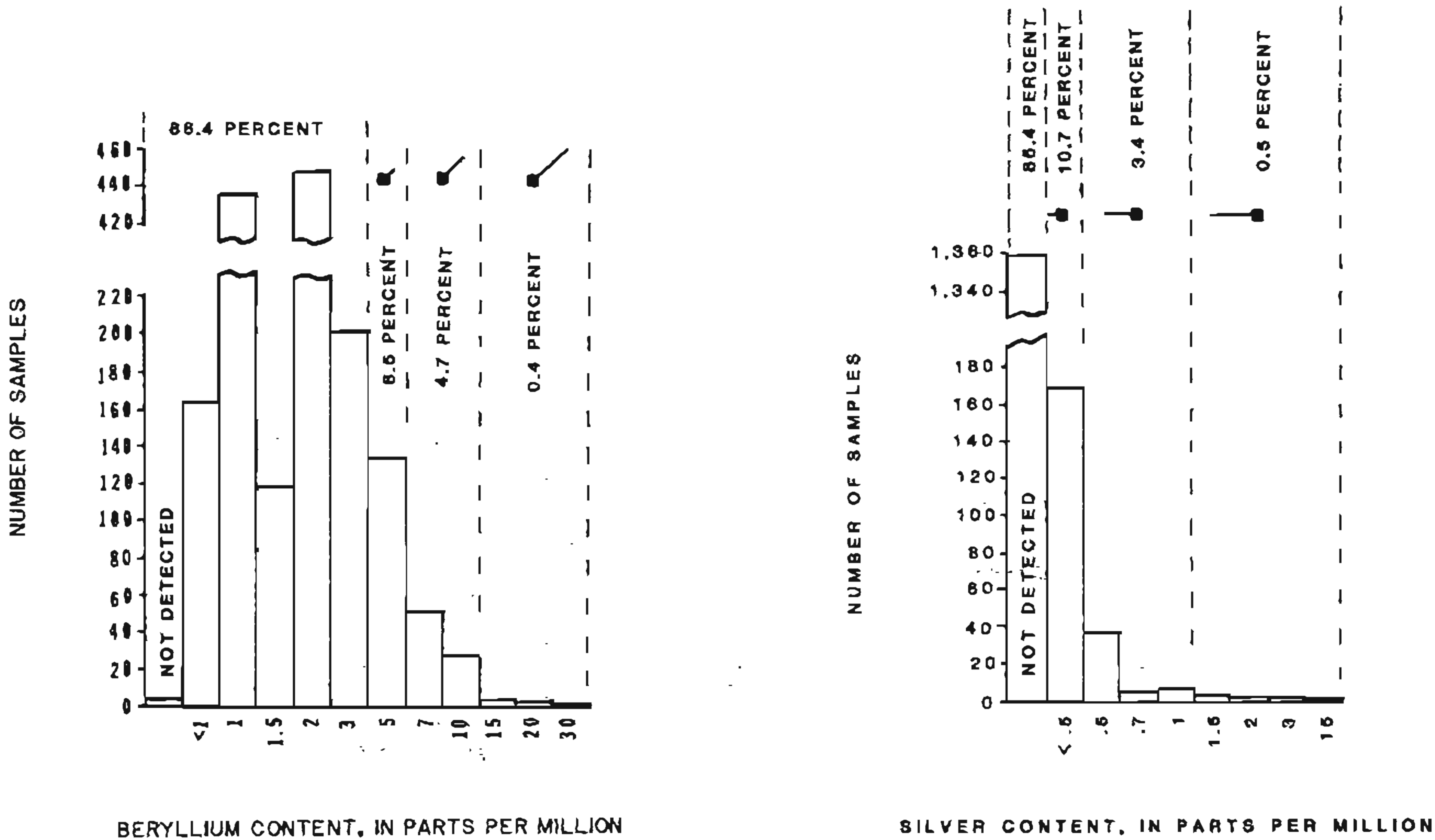

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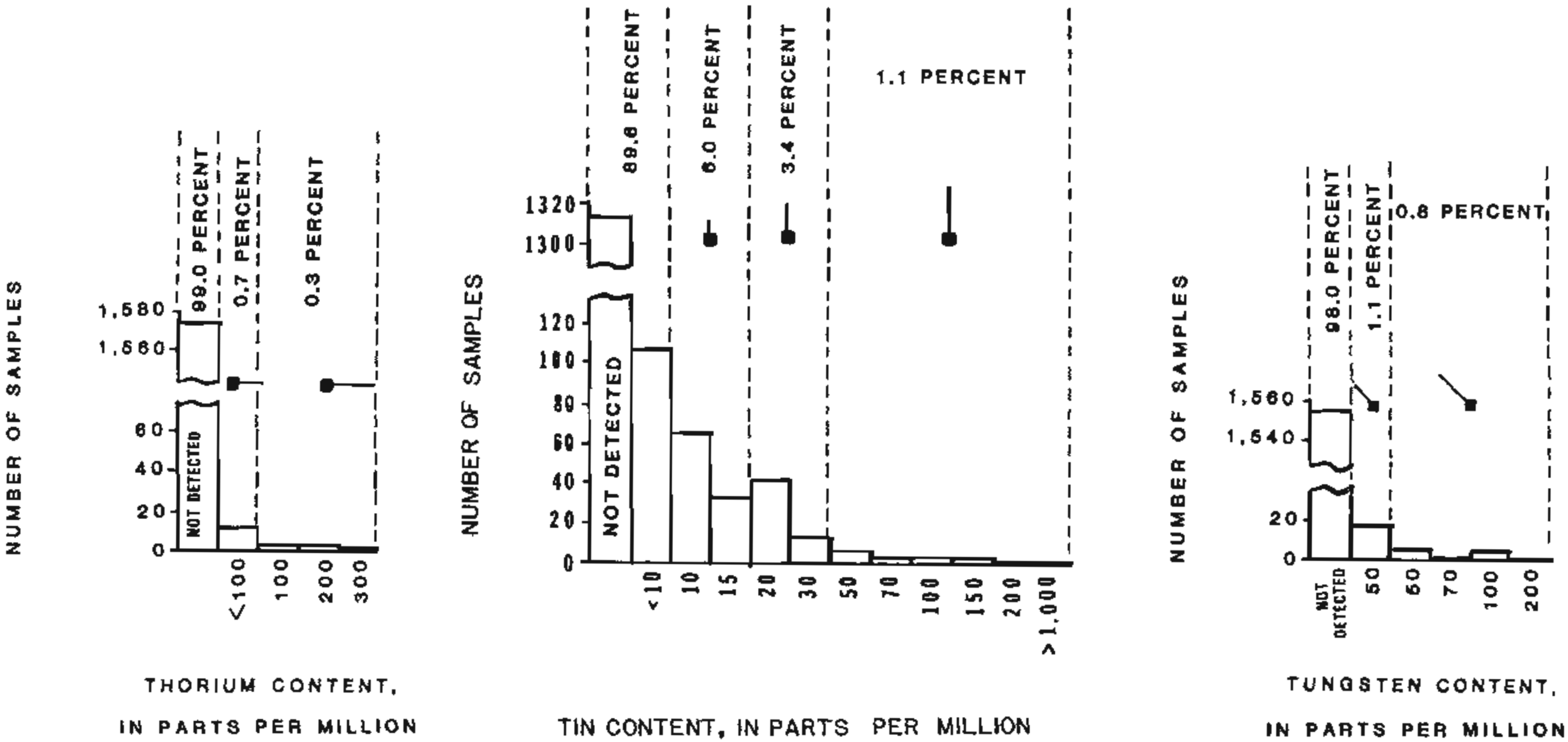

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