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Distributions of total antimony in samples of nonmagnetic heavy-mineral concentrate and of total and partially extractable antimony in samples of stream sediment from the Wallace 1° x 2° quadrangle, Montana and Idaho

By

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INTRODUCTION

This map is part of a folio of maps of the Wallace 1° x 2° quadrangle, Montana and Idaho, prepared under the Conterminous United States Mineral Assessment Program (CUSMAP). This report presents the distributions of total and partially extractable antimony in the minus-80-mesh (<180 µm) fraction of stream sediments and antimony in nonmagnetic heavy-mineral concentrates from stream sediments collected in the Wallace 1° x 2° quadrangle, Montana and Idaho. The Flathead Indian Reservation, in the eastern part of the quadrangle, was not included in this study. No data interpretations are presented in the report. The purpose of this report is to present the data at the map scale (1:250,000) used for displaying other Wallace CUSMAP information to aid users of the data in making their own interpretations. A complete tabulation of the data for all samples collected in the Wallace quadrangle has been provided by Leach and others (1982); this report also presents a detailed discussion of the sampling and analytical methods, and includes statistical summaries of the data. A tabulation of the data is also available on computer tape from the National Technical Information Service (McDanal and others, 1982). The distribution of other selected elements for the Wallace quadrangle are available as 1:250,000 maps (Leach and others, 1983a,b,c,d,e).

METHODS

Samples were collected from 1229 sites on small-order stream drainages at a minimum density of one site per cell where the cell is an area of 4 square miles (10.4 km^2). Some cells may not contain a sample site because of various factors including lack of a small-order stream drainage or inaccessibility. Some cells contain more than one sample site because of resampling for various reasons. Samples were not collected from the most active part of the Coeur d'Alene mining district because of probable contamination.

A sampling site consists of a 10-m stretch of the active stream channel. At least five grab samples of stream sediment were collected at each site using a polyethylene or aluminum scoop. The grab samples were composited and air dried. The composited sample was sieved using a stainless steel, 80-mesh (180 µm opening) screen. The material which passed through the 80-mesh screen was analyzed.

A heavy-mineral-concentrate sample was collected at most sites using a generic gold pan. Heavy-mineral concentrates were not collected from some sites because of the paucity of heavy mineral grains in the stream sediments at the sites. Commonly, 3 to 4 kg of composited sediment would yield the desired 30 to 60 gm of concentrate. At the laboratory, the sample was air dried, and the highly magnetic material was removed by a magnet. Any light-weight material remaining in the concentrate was separated by allowing the heavier fraction to settle through bromoform (specific gravity, 2.82). The resulting heavy-mineral fraction was separated into nonmagnetic and magnetic fraction using a Frantz Isodynamic Separator at a setting of 0.6 ampere, with 15° forward and 15° side settings. The nonmagnetic fraction was pulverized in an agate mortar before analysis.

Each nonmagnetic heavy-mineral-concentrate sample was analyzed semiquantitatively for antimony and 30 other elements using an optical emission spectrograph according to the method outlined by Grimes and Marranzino (1968). The semiquantitative spectrographic values are reported as the approximate geometric midpoints: 1.0, 0.7, 0.5, 0.3, 0.2, 0.15 (or appropriate powers of ten) of ranges whose respective boundaries are: 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12 (or appropriate multiples). Only 28 samples had concentrations of antimony at or above the lower determination limit of 200 ppm. The samples we identified on Plate 1 where the concentration is ppm are written next to the appropriate sample.

Each sample of stream sediment was analyzed by atomic absorption spectrometry for total and partially-extractable concentrations of antimony. The partially extractable method used a 3.6N hydrochloric-acid solution containing 20 percent ascorbic acid and 10 percent potassium iodide in contact with the sample for 30 minutes at room temperature. The partial solubilized metals are selectively extracted into an organic phase composed of Aliquat-336 (tricaprylylmethylammonium chloride) and methyl isobutyl ketone. The concentration of antimony is determined from the organic phase by atomic absorption spectroscopy. This partial extraction technique is similar to the method described by Viets and others (1979) and dissolves the loosely-bound metals associated with clays and with surface coatings of Fe-Mn oxides, possibly associated with oxidized sulfide occurrences. The extraction also dissolves the majority of the secondary minerals, such as sulfates, carbonates, and oxides, that are stable under oxidizing conditions. The extraction does not dissolve significant amounts of most sulfide minerals. Total metal concentrations are determined by digestion of the sample in a solution of hydrofluoric and nitric acids, extraction into the Aliquat-336/methyl isobutyl ketone phase, and analysis by atomic absorption spectrometry. The lower limit of determination for antimony attained by the partially extractable and total metal methods is 1 ppm.

RESULTS

The distributions of total and partially extractable antimony in stream sediments are shown in plates 1 and 2, respectively. Concentrations of antimony at or above the lower determination limit in samples of nonmagnetic heavy-mineral concentrates are shown on plate 1. Because the data consist of a number of population derived from a variety of rock types, we arbitrarily chose the concentration ranges for antimony in stream sediments plotted on plates 1 and 2. Histograms of the stream sediment data using spectrographic reporting intervals as class widths are shown on the plates.

The partially extractable and total antimony concentrations in stream sediments were contoured using the STPMAP program in the U.S. Geological Survey's STATPAC computer program (VanTrump and Miesch, 1977). These plots shown on figures 1 and 2, are useful in evaluating general regional trends in the data. The contour maps were generated by contouring weighted average concentrations computed at the corners of a square grid. This grid consisted of 660 squares, where each square is an area of 10.4 square miles (26.4 km^2). Therefore, each square will average 2.6 of the sample cells. The computed concentrations at the corners of the squares are averages of concentration occurring within a given radius from the corner point and weighted according to the distance from the corner point. The lowest contour value shown is at the geometric mean of the data.

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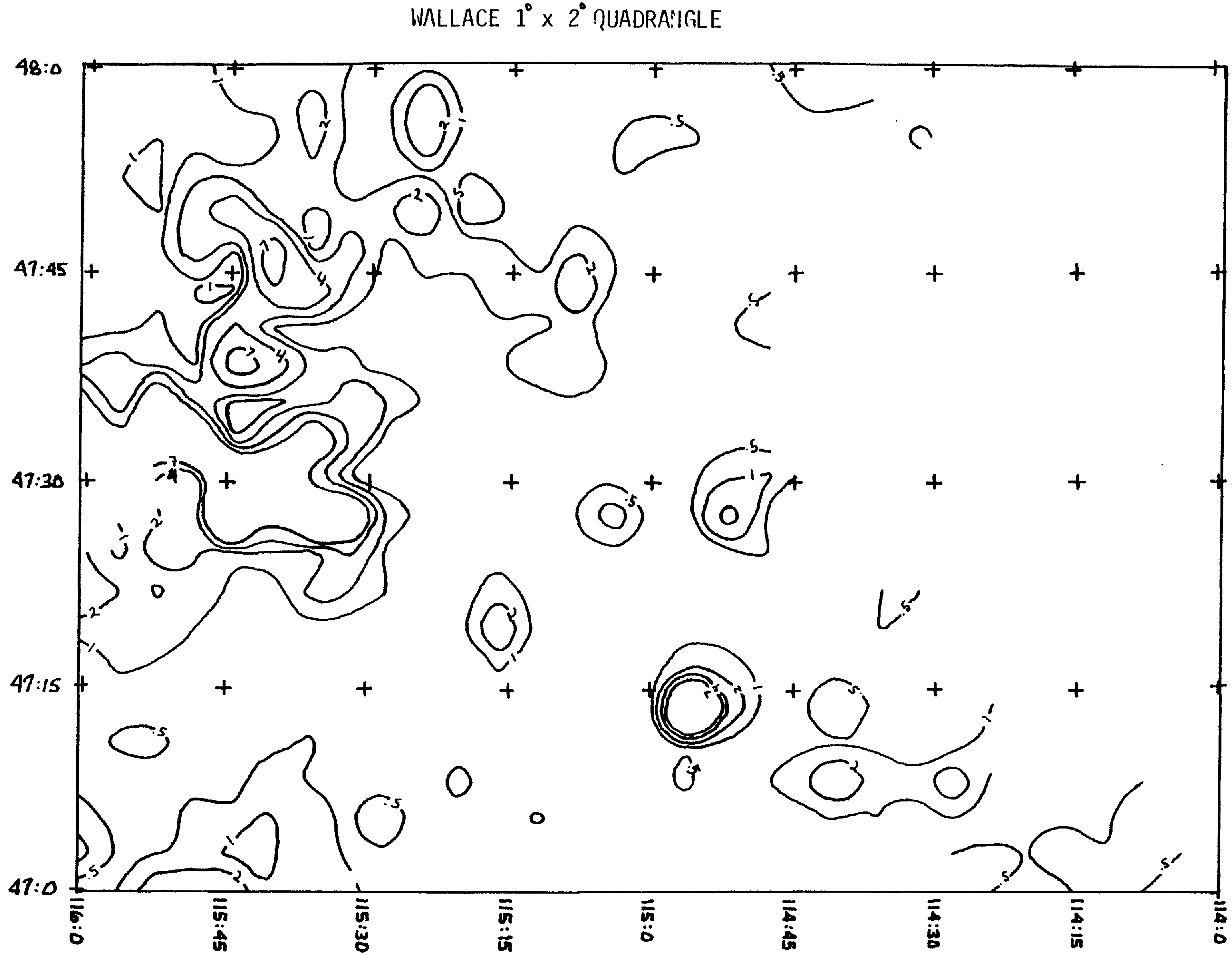
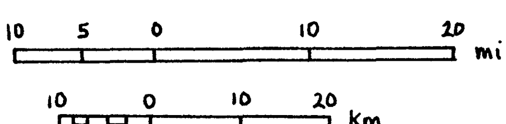


Figure 1.--Contour Map of Total Antimony (Sb) in Stream Sediments
Concentrations (ppm) Plotted: 0.5, 1, 2, 4, 7
[Concentrations plotted are weighted averages; see text]



WALLACE 1° x 2° QUADRANGLE

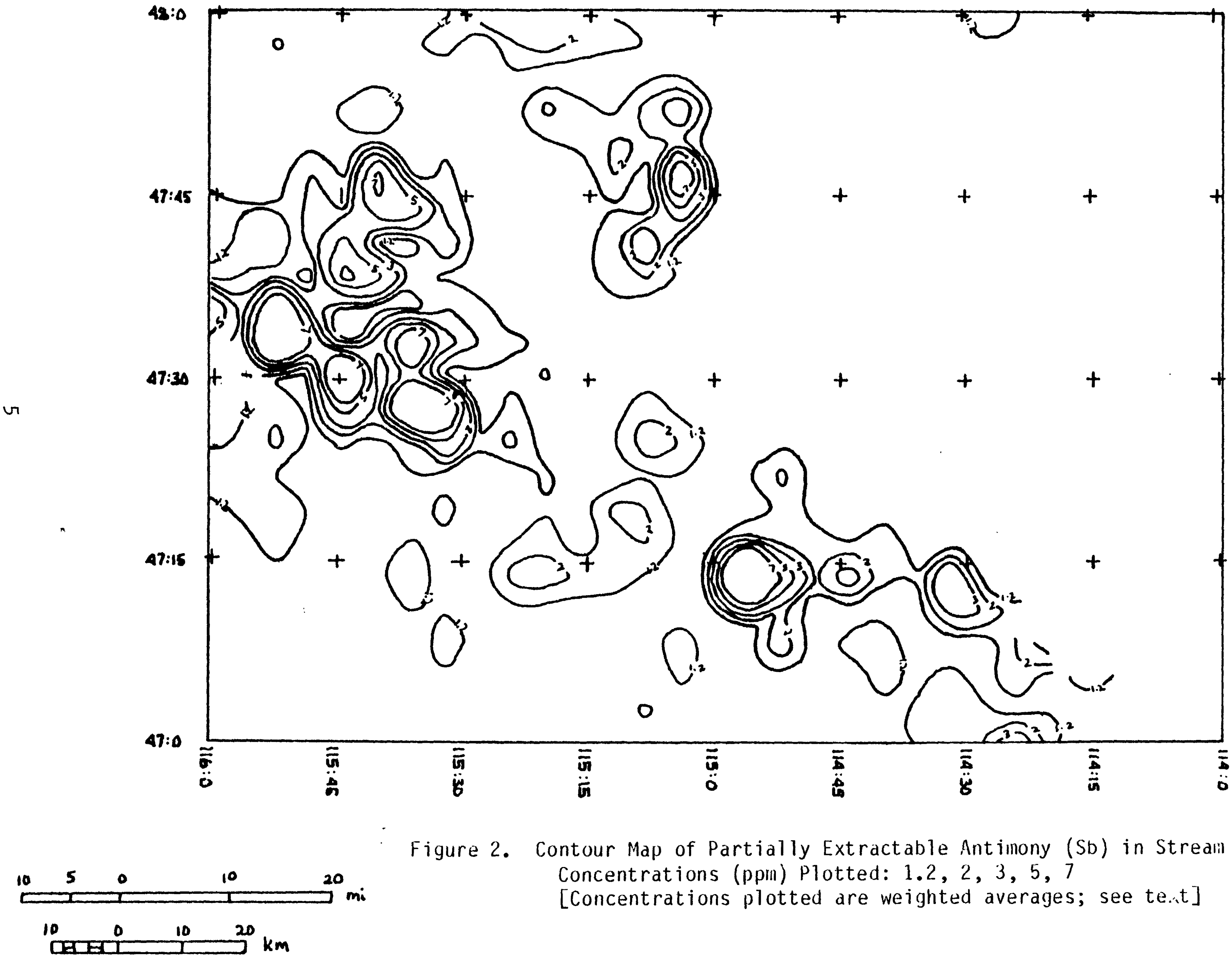


Figure 2. Contour Map of Partially Extractable Antimony (Sb) in Stream Sediments
Concentrations (ppm) Plotted: 1.2, 2, 3, 5, 7
[Concentrations plotted are weighted averages; see text]