

DEPARTMENT OF THE INTERIOR
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Distributions of cadmium in samples of
nonmagnetic heavy-mineral concentrate and
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 cadmium in the minus-80-mesh (<180 μm) fraction of stream sediments and 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 each sample 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 (McDanaI 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 minerals in some stream sediments. 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 a 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 cadmium 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).

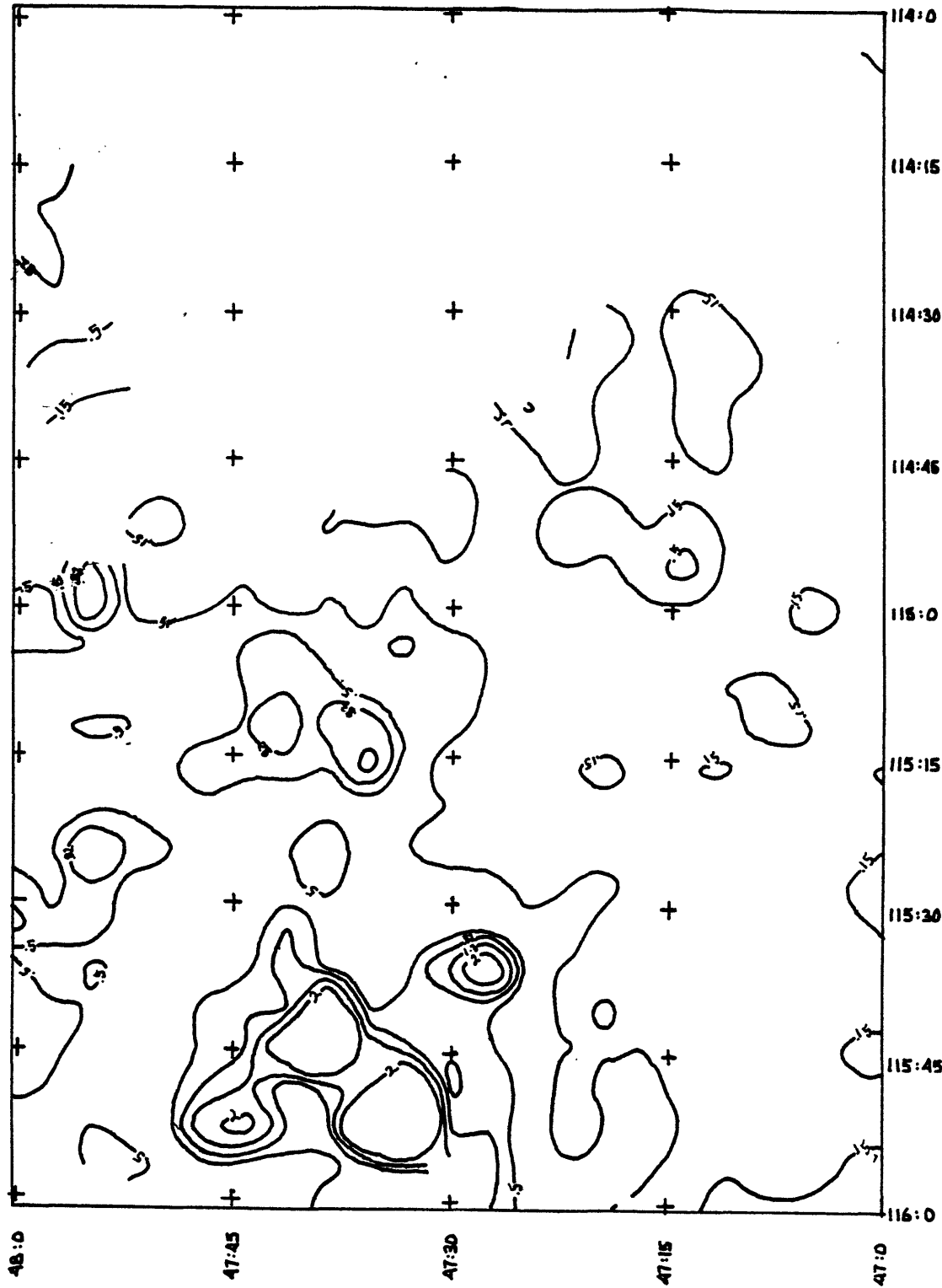
Each stream sediment was analyzed by atomic absorption spectrometry for total concentrations of cadmium. Samples of stream sediment were dissolved in a solution of hydrofluoric and nitric acids. The solubilized metals were selectively extracted into an organic phase composed of Aliquat-336 (tricaprylylmethylammonium chloride) and methyl isobutyl ketone. The concentration of cadmium is determined from the organic phase by atomic absorption spectroscopy. The lower limit for cadmium attained by this method is .05 ppm.

RESULTS

The distribution of cadmium in the stream sediments is shown in plate 1. Because the data consist of a number of populations derived from a variety of rock types, we arbitrarily chose the concentration ranges plotted to approximate the top 1, 99-95, 95-75, 75-50, 50-25, and lower 25 percentiles. Only 4 samples had concentration of cadmium at or above the detection limit of 50 ppm. The concentrations of these 4 samples are shown on plate 1. Histograms of the stream sediment data using spectrographic reporting intervals as class widths are shown on plate 1. The detection ratio, geometric mean, and geometric deviations for the cadmium concentrations in stream sediments are given in Table 1.

The cadmium distribution in stream sediments shown in figure 1 was contoured using the STPMAP computer program in the U.S. Geological Survey's STATPAC computer program (VanTrump and Miesch, 1977). This plot is useful in evaluating general regional trends in the data. This contour map was 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 km²). 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 the geometric mean of the data.

WALLACE 1° x 2° QUADRANGLE



Contour Map of Total Cadmium (Cd) in Stream Sediments

Concentrations (ppm) Plotted: 0.15 0.5 0.82 1.3 2

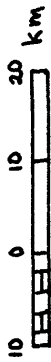
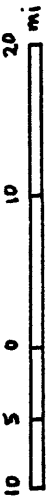


TABLE 1.

	Detection ¹ ratio	Geometric ² mean (ppm)	Geometric ² deviation (ppm)
Total cadmium in stream sediments	0.83	0.15	3.0

¹The number of uncensored data divided by total number of samples.

²Cohen's (1959) method for calculating the maximum-likelihood estimates for normal and singly censored distributions was used.

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