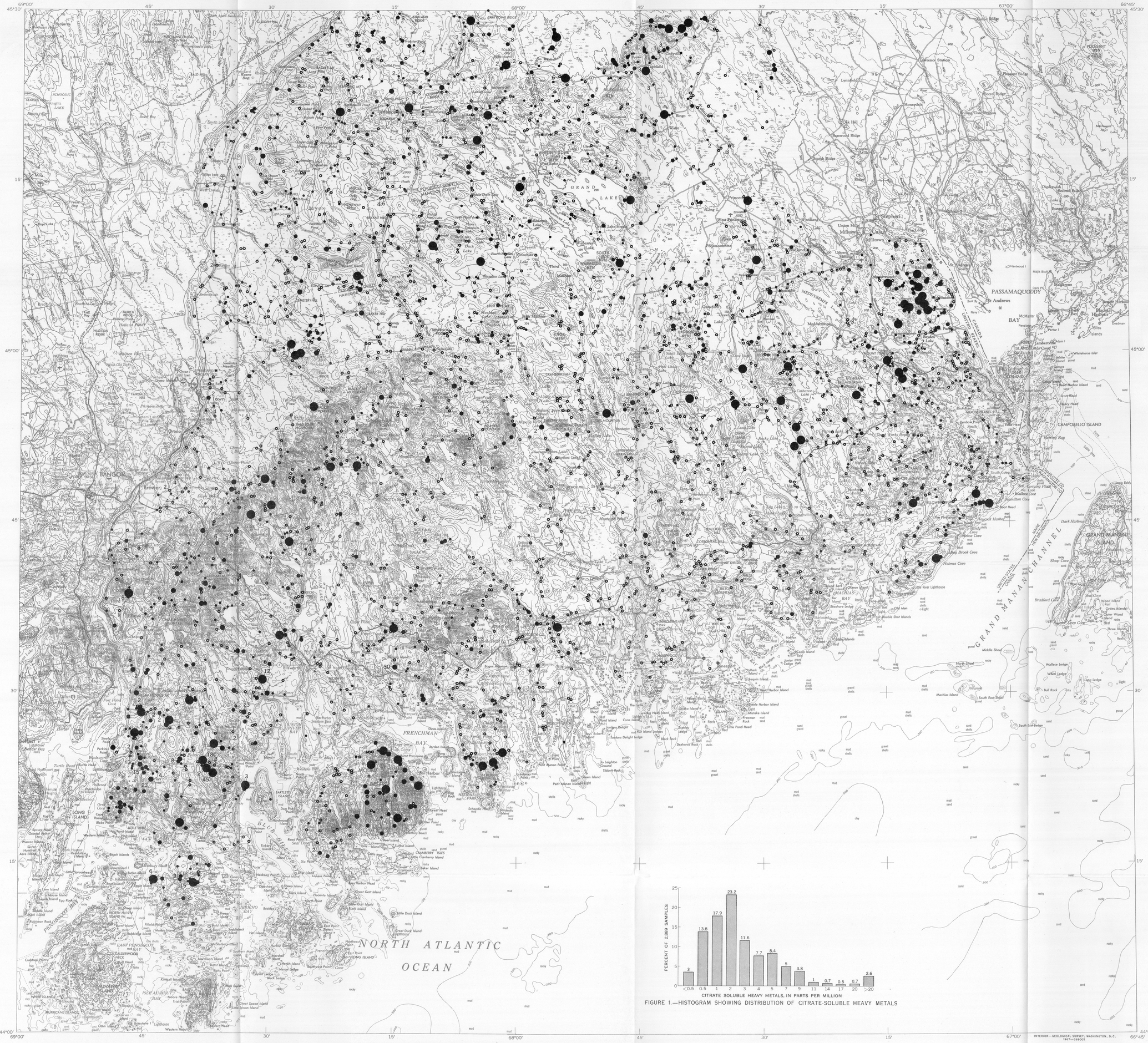
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MINERAL INVESTIGATIONS
FIELD STUDIES MAP MF-301



Base from U.S. Geological Survey
Bangor and Eastport, 1956; Millinocket, 1954; and Fredericton, 1957

SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

FIGURE 1.—HISTOGRAM SHOWING DISTRIBUTION OF CITRATE-SOLUBLE HEAVY METALS

AREA OF THIS REPORT

MAP OF SOUTHEASTERN MAINE SHOWING HEAVY METALS IN STREAM SEDIMENTS

By

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EXPLANATION

Location and heavy-metal content of sample of active stream sediment

< 3	3 to 5	6 to 10	11 to 20	>20

Type and size of dot indicates content of citrate-soluble heavy metals, in parts per million as compared with standard samples containing known amounts of zinc

2

Number shows content of cold acid-extractable copper in parts per million where more than 1.5 parts per million

DISCUSSION

This map presents the initial results of a geochemical reconnaissance of stream sediment in southeastern Maine. Its purpose is to identify metal-rich areas that might be favorable for further detailed exploration.

Geochemical work was undertaken in the northwestern part of this area in 1960 by the Maine Geological Survey (Doyle, Young, and Wing, 1961) as part of a combined geologic, geophysical, and geochemical followup of an aeromagnetic survey. Larrabee, Spencer, and Swift (1965) published analyses of 206 stream sediment samples that they collected from the northern part of this area while doing reconnaissance geologic mapping. Some of the data they reported are included on this map. Young (1962, 1965) published the results of geochemical exploration undertaken during an evaluation of many of the prospects known in the southern part of the area. The results of our first season's sampling in the southern part of this map are shown on an open-file map by Van Sickle, Dennen, and Post (1964). The present work supplements the open-file release by the addition of data on samples collected during the 1964 and 1965 field seasons.

The more comprehensive publications on the geology and mineral deposits of the area include those by Amos (1963), Bastin and Williams (1914), Chapman (1962), Gates (1961), Hussey and others (1958), Larrabee, Spencer, and Swift (1965), Rand (1957), and Young (1962, 1965). The data on this map are comparable to those for west-central Maine presented by Post and Hite (1964).

The area is underlain by metasedimentary and metavolcanic rocks generally of low metamorphic grade and principally of Ordovician and Silurian age. Some metasedimentary rocks are considered to be as old as Cambrian, others as young as Pennsylvanian. The stratified rocks are intruded by a number of dominantly felsic plutons of Devonian age. Glacial drift covers much of the area, and is particularly thick in the south-central part. The sandy outwash in this region appears to subdue the geochemical relief shown elsewhere on the map.

Most base-metal occurrences of southeastern Maine lie in the coastal area extending northeasterly from Castine to Lubec. The southwestern part of this map area includes the base-metal deposits at Castine and Blue Hill, as well as several other smaller prospects. Several small base-metal prospects also exist in the Whiting Bay-Lubec area. The recently explored Barret-Big Hill prospects northwest of West Pembroke contain gold and silver in addition to base metals. Molybdenite occurs at Catherine Mountain and Cooper Hill, but neither prospect contains base metals detectable by the citrate-soluble heavy metals or cold acid-extractable copper tests used in this investigation.

Map data are based on the analyses of 2,889 samples of fine-grained sediment collected from the active channels of streams readily accessible by roads, trails, or waterways. An attempt was made to achieve a sample density of approximately one sample per 2 square miles, but this was locally not achieved owing to variations in the drainage pattern and poor accessibility.

The samples were collected in water-resistant paper bags, oven dried in the bags at 100°C for 24 hours, and screened through a 250-micron stainless steel and aluminum sieve. The minus-250-micron portion was analyzed for citrate-soluble heavy metals (principally undifferentiated zinc, copper, lead, and cobalt) and for cold acid-extractable copper by rapid semiquantitative field methods described by Ward, Lakin, Canney, and others (1963, p. 25-29).

The statistical distribution of the citrate-soluble heavy metal values (fig. 1) reveals that 5.5 percent of the values exceed 10 parts per million and may be considered anomalous. Previous experience with the distribution of cold acid-extractable copper values indicates that values exceeding 2 parts per million are possibly anomalous and worthy of field checking.

In general, this map shows only raw data; no systematic effort was made to field check the possible significance of apparently anomalous values, although some sites with high values were resampled. Where repeat sampling has failed to confirm anomalous values, the lower value obtained has been plotted. A few highly anomalous values undoubtedly reflect contamination from mineral exploration activities. Where high values were obtained from samples collected in streams obviously contaminated by trash, the data were omitted from this map.

Many of the relatively high heavy-metal values were obtained from samples that contained appreciable concentrations of secondary black manganese-iron oxide. Such material is an efficient scavenger of many metals, especially zinc. The effect of this phenomenon on stream-sediment geochemical exploration is still imperfectly understood. Any further geochemical investigations in this area should include a study of the ratio of citrate-soluble heavy metals to manganese as a means of distinguishing high heavy-metal values that apparently are derived from a mineral deposit from values produced by the scavenging action of the manganese oxide (Canney, Dennen, and Post, 1964).

REFERENCES

Amos, D. H., 1963, Petrology and age of plutonic rocks, extreme southeastern Maine: Geol. Soc. America Bull., v. 74, p. 169-194.

Bastin, E. S., and Williams, H. S., 1914, Description of the Eastport quadrangle [Maine]: U.S. Geol. Survey Geol. Atlas, Folio 192.

Canney, F. C., Dennen, W. H., and Post, E. V., 1964, Some observations on the evaluation of stream sediment geochemical data [abs.]: Mining Eng., v. 16, no. 12, p. 92.

Chapman, C. A., 1962, Bays-of-Maine igneous complex: Geol. Soc. America Bull., v. 73, p. 885-888.

Doyle, R. G., Young, R. S., and Wing, L. A., 1961, A detailed economic investigation of aeromagnetic anomalies in eastern Penobscot County, Maine: Maine Geol. Survey Spec. Econ. Studies Ser., no. 1, 69 p.

Gates, Olcott, 1961, The geology of the Cutler and Moose River quadrangles, Washington County, Maine: Maine Geol. Survey Quad. Mapping Ser. no. 1.

Hussey, A. M., compiler, and others, 1958, Maine metal mines and prospects: Maine Geol. Survey Minerals Resources Index, no. 3, 53 p.

Larrabee, D. M., Spencer, C. W., and Swift, D. J. P., 1965, Bedrock geology of the Grand Lake area, Aroostook, Hancock, Penobscot, and Washington Counties, Maine: U.S. Geol. Survey Bull. 1201-E.

Post, E. V., and Hite, J. B., 1964, Heavy metals in stream sediment, west-central Maine: U.S. Geol. Survey Mineral Inv. Field Studies Map MF-278.

Rand, J. R., 1957, Mineral resources of Maine, Bangor sheet: Maine Geol. Survey Mineral Resources Reference Map Ser. Map MMRM-1.

Van Sickle, G. H., Dennen, W. H., and Post, E. V., 1964, Heavy metals in stream sediment, southeastern Maine: U.S. Geol. Survey open-file map.

Ward, F. N., Lakin, H. W., Canney, F. C., and others, 1963, Analytical methods used in geochemical exploration by the U.S. Geological Survey: U.S. Geol. Survey Bull. 1152, 100 p.

Young, R. S., 1962, Prospect evaluations, Hancock County, Maine: Maine Geol. Survey Spec. Econ. Studies Ser., no. 2, 113 p.

_____1963, Prospect evaluations, Washington County, Maine: Maine Geol. Survey Spec. Econ. Studies Ser., no. 3, 86 p.

Fieldwork by E. V. Post, W. L. Lehmbeck, W. H. Dennen, G. A. Nowlan, W. P. McKay, G. H. Van Sickle, J. B. Hite, D. L. Granner, N. P. Cuppels, and Maurice DeValliere, 1963, 1964, and 1965, and D. M. Larrabee, 1962. Analyses by G. A. Nowlan, W. L. Lehmbeck, G. H. Van Sickle, E. L. Mosier, and Maurice DeValliere

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