DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-609

INTRODUCTION

Silver, lead, and zinc deposits are known to occur in eastern New Hampshire, and one deposit, near Silver Lake, was formerly mined. A geologic and geochemical study was conducted to test the possibility that 1) similiar deposits may exist in the region under glacial cover and 2) surface exposures of veins similar to the Silver Lake deposit would produce geochemical anomalies in stream sediments.

The area examined is the Ossipee Lake quadrangle in east-central New Hampshire, near the Maine boundary. The area is one of low hills and wide valleys lying northeast of the Ossipee Mountains and south of the White Mountains. Abundant rainfall gives rise to closely spaced surface streams and numerous lakes and swamps.

GEOLOGY AND MINERAL DEPOSITS

Geology of the Ossipee Lake region has been described by Wilson (1965). Mica schists of the Littleton Formation of Late Silurian(?) and Early Devonian age underlying the central part of the quadrangle are intruded by countless small bodies of granite and pegmatite and by large plutons of the New Hampshire Plutonic Series of Devonian age. Stocks, ring dikes, and volcanic rocks of the White Mountains Plutonic Series of Late Triassic or Early Jurassic age underlie the Ossipee Mountains and other areas. The most widespread unit of this series is the Conway Granite (shown on map).

Quartz veins and silicified breccia veins shown on the map contain sporadic concentrations of argentiferous galena and sphalerite. The largest of these, the Silver Lake deposit, was mined, principally during the period 1915–18. Shafts at the Bank, Burke, and Hoyt prospects are situated near the north end of Silver Lake and another prospect shaft is located 2 miles to the east near the Madison Village Road. The veins strike north to N. 15° E. and dip nearly vertically.

Besides quartz, galena, and sphalerite, the Silver Lake vein contains abundant calcite, hematite, and chlorite and minor amounts of pyrite, fluorite, danalite(?), and sphene. Fractures in Conway Granite in the quarry near Albany contain chlorite, fluorite, and danalite(?) and in both localities, the chlorite has a distinctive vermiform habit. This similarity in mineralogy suggests that the Silver Lake deposit and other veins are younger than Conway Granite. The difference in ages may be small however, and it is probable that the metals were deposited by solutions rising from the interior of Conway Granite plutons during the final stages of crystallization (Cox, 1968).

Glacial moraine deposits are widespread in the area. Compact ground moraine covers all but the steepest slopes and a large part of the area (shown in gray) is covered by thick deposits of glacial outwash and glacial lake sediments.

SAMPLING AND ANALYTICAL METHOD

Geochemical data are based on analysis of 602 samples of fine-grained sediment collected from the active channels of streams. Collecting was done during the spring, summer, and fall of 1967 and 1968. In general streams draining areas underlain by thick glacial outwash and lake sediments were not sampled. Streams are widely spaced in these areas, and, where sampled, gave consistently low values.

Samples were dried and screened and the minus 80 mesh fraction was analyzed for cold-citrate-soluble heavy metals by methods described by Ward and others (1963, p. 27–29).

In plotting the results, many closely spaced samples with similar values have been omitted. No systematic effort was made to confirm the significance of isolated, high heavy metal values, although some sites with high values were resampled. Where resampling failed to confirm anomalous values, the lower value obtained has been plotted.

INTERPRETATION OF RESULTS

Samples collected in the two largest areas underlain by Conway Granite and in the intervening area along the west side of the quadrangle gave higher values than those from the main area of Conway terrane to the east. These two groups of samples were arbitrarily divided along the valley connecting Pequawket Pond, Silver Lake, and Ossipee Lake and plotted separately on figure 1. Samples from the west area have a mean heavy metal content of about 10 parts per million (ppm) and a median value of 9 ppm. In this high-background area, 4.5 percent of the values exceed 29 ppm and may be considered anomalous. Values from the main area to the east show a negatively skewed distribution with a mean of about 6 ppm, and a median of 5 ppm. In the eastern area 4.5 percent of the values exceed 17 ppm and may be considered anomalous.

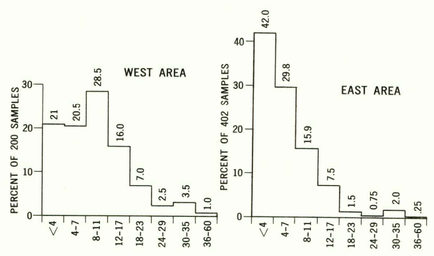


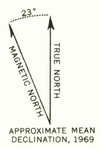
FIGURE 1. *Percent distribution of heavy-metals values in analyzed samples.*

The high heavy metal background in the areas underlain by the large Conway Granite plutons and intervening country rock indirectly supports the hypothesis that the Conway Granite is the source of the mineral deposits in this region. The metals may have been introduced during the last stages of crystallization of Conway Granite and dispersed in the country rock and in the roof zones of the larger plutons. This suggestion seems reasonable in view of the previously mentioned mineralogical similarities between the Silver Lake deposit and fracture fillings in the Conway Granite.

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1969—G69407

MAP SHOWING CITRATE-SOLUBLE HEAVY METALS IN STREAM SEDIMENTS, OSSIPEE LAKE QUADRANGLE, CARROLL COUNTY, NEW HAMPSHIRE

By
Dennis P. Cox



QUADRANGLE LOCATION

SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

1969

EXPLANATION

QUATERNARY
- Pleistocene: Thick glacial deposits (contacts modified from Wilson, 1965)

TRIASSIC OR JURASSIC
- Upper Triassic or Lower Jurassic: Quartz veins and silicified breccia veins
- Upper Triassic or Lower Jurassic: Conway Granite (includes Mount Osceola Granite in northwest part of map area) (contacts from Wilson, 1965)

SILURIAN(?) AND DEVONIAN
- Upper Silurian(?) and Lower Devonian: Schist and granitic rocks

Contact
Dashed where approximately located

LOCATION AND HEAVY METAL CONTENT OF SAMPLE OF ACTIVE-STREAM SEDIMENT

○ <8 ● 8–17 ● 18–29 ● 30–60

Cold-citrate-soluble heavy metals (Zn, Pb, Cu, Co) content, in parts per million (ppm), standardized against samples containing known amounts of zinc

● 18–29 ● 30–60

Cold-citrate-soluble heavy metals content in ppm of samples with moderate to high values but with relatively low (<1,000 ppm) manganese content

2
Groups of anomalous samples discussed in text

⚒ Mine

x Prospect shaft

INTERPRETATION OF RESULTS-CONTINUED

Noticeable concentrations of hydrous manganese-iron oxides are present as nodules and crusts on pebbles and boulders in many of the streams sampled. Colorimetric manganese determinations on 377 of the samples, yielded manganese values ranging from below the limit of detectability (50 ppm) to 9,000 ppm and revealed a positive correlation between manganese and heavy metals. A similar correlation was observed in Maine by Canney, Dennen, and Post (1964) who have shown that hydrous manganese oxides are efficient scavengers of many metals, especially zinc. The heavy metal test is most sensitive for zinc and the hydrous oxides are readily broken down during the citrate extraction. Some high heavy metals values shown on the map therefore may be the result of the scavenging action of manganese and may not indicate a nearby mineral deposit.

In an effort to identify those high values not caused by the effect of manganese, a plot of heavy metals versus manganese was constructed. Samples that contain more than 1,000 ppm manganese show a nearly continuous spread of high and low values. However, of those samples containing less than 1,000 ppm manganese only about 5 percent contained more than 17 ppm heavy metals. These samples have anomalously high heavy metal to manganese ratios and are considered to be especially significant indicators of the presence of mineral deposits. They are identified by a special symbol on the map.

Several groups or clusters of anomalous samples can be seen on the map. Of these, four groups are directly related to obvious surface expressions of mineralization.

1) The west slope of Jackman Ridge where values as high as 32 ppm occur in small streams draining an area in which a small quartz vein crops out. This vein may represent the southern extension of the fracture along which the Silver Lake deposit was introduced.
2) Near the Madison Village Road in the center of the quadrangle where moderate values (20 ppm) are related to the quartz vein shown on the map and to scattered outcrops of silicified and brecciated granitic rocks east of the vein.
3) Atkinson Mountain where values as high as 32 ppm occur downstream from vein quartz outcrops. The quartz vein is directly alined with the linear valley extending south-southwest to Danforth Ponds suggesting that the valley is fracture controlled. Thick glacial deposits in the valley made it impossible to test for the presence of mineralization along this hypothesized fracture using the method described above.
4) An area west of Manson Hill where values as high as 40 ppm occur in the vicinity of a quartz vein trending parallel to the previously described valley.

REFERENCES CITED

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.

Cox, D. P., 1968, Mineral deposits related to the White Mountain Plutonic-Volcanic Series in New Hampshire and Maine [abs.]: Geol. Soc. America Ann. Mtg., Northeast Sec., Washington, D.C., 1968, Program, p. 24.

Ward, F. N., Laken, 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.

Wilson, J. R., 1965, Bedrock geology of the Ossipee Lake area, New Hampshire: unpub. Ph. D. thesis, Dept. Geol. Sciences, Harvard Univ., Cambridge, Mass.

For sale by U.S. Geological Survey, price 50 cents