The Dispersion of Copper and Zinc in Glacial Overburden at the Louvem Deposit, Val d'Or, Quebec

R. G. GARRETT
Geological Survey of Canada, Ottawa

ABSTRACT

This paper discusses the application of overburden sampling and subsequent geochemical analysis in exploration programs — both in the testing of geophysical anomalies and geological extrapolations and in more regional studies where larger belts of potentially mineralized rocks are under investigation. A geochemical study at the Louvem deposit, Quebec, is given as an example.

INTRODUCTION

THE DISPERSION OF COPPER AND ZINC in the basal till and overlying glaciolacustrine sediments was investigated in the down-ice direction from the suboutcrop of the main copper pipe at the Louvem deposit, some 12 miles east of Val d'Or, Quebec. A total of 34 holes on 100-foot centers were sunk to an average depth of 38 feet in overburden and continued for an average of 3½ feet into bedrock. Sampling was carried out with an AX-size split spoon, which was overdriven by 50 to 100 per cent to ensure complete recovery. Samples were taken in advance of NX-size casing, which was ultimately sunk to bedrock, where AXT core drilling was commenced.

The samples were dried, and copper and zinc were determined in the minus-80-mesh fraction by a pyrosulphate fusion and colorimetric method in a field laboratory established at Val d'Or. The analytical information was thus immediately available for the direction of the drilling program.

Although the surface topography is gentle, with a slope to the northeast, the bedrock topography is rugged, and as a result the basal till thickness is variable (0-20 feet), (*Figure 1*). The till is easily distinguishable from the overlying glaciolacustrine deposits by its coarse average grain size and complete lack of sorting. The glaciolacustrine sands are well sorted and are thought to owe their origin to a large esker some 2 miles to the east.

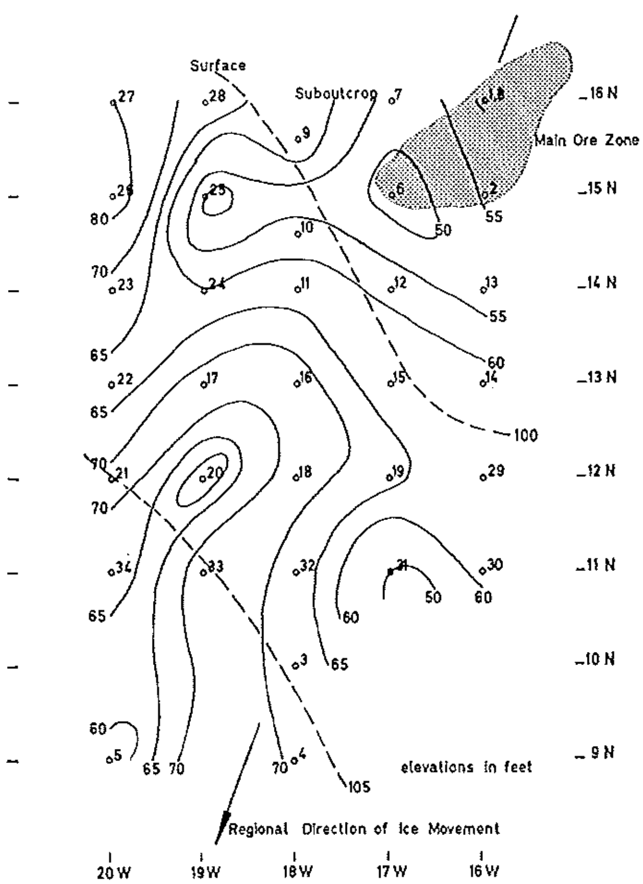

FIGURE 1 — Plan of relative elevations.

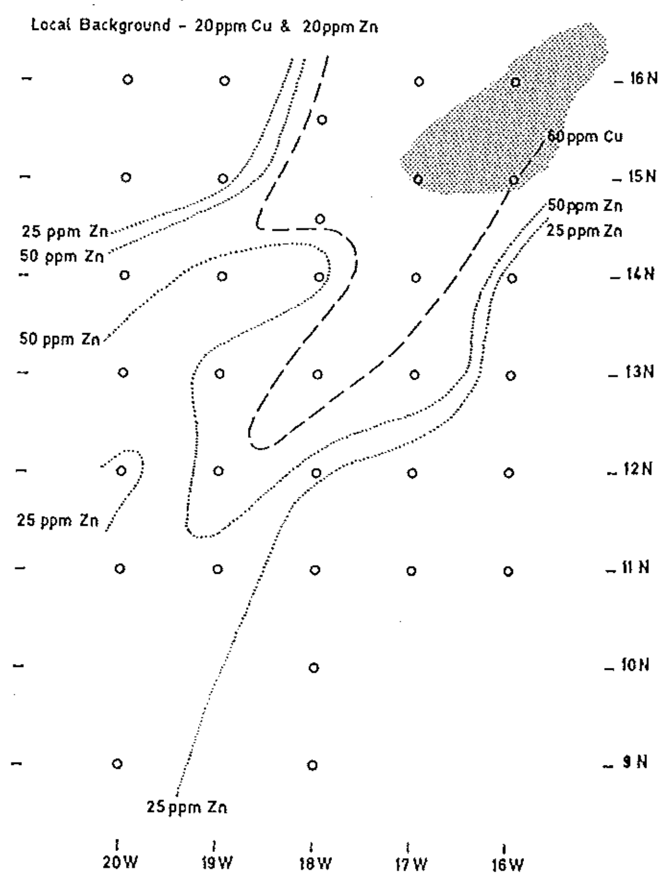

FIGURE 2 — Heavy-metal content of minus-80-mesh fraction of till.

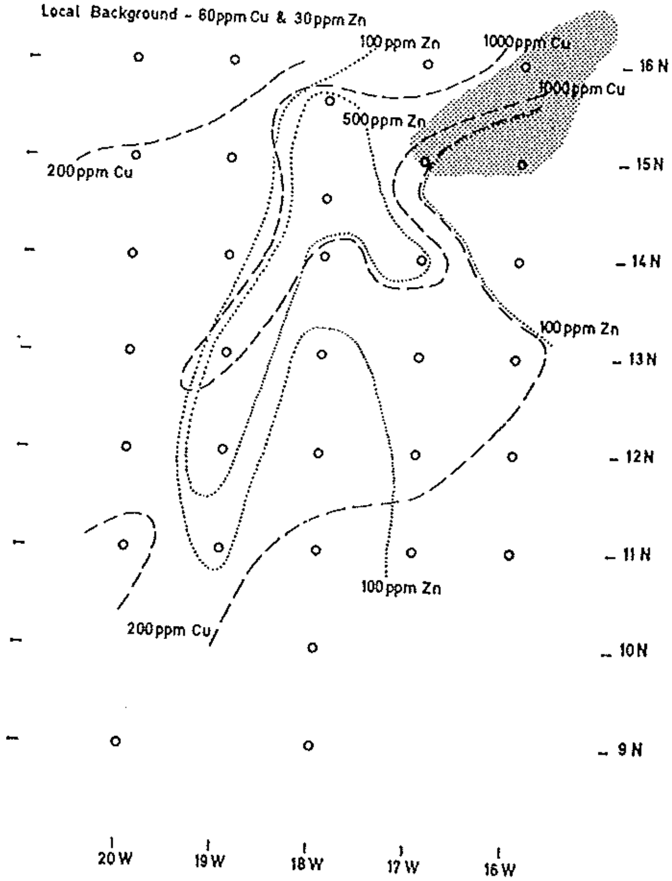

FIGURE 3 — Heavy-metal content of 80-230-mesh fraction.

RESULTS OF THE INVESTIGATION

Local background in the glaciolacustrine sediments is around 10 ppm for both copper and zinc, and there is very little variation in the data on the sediments. Local background in the basal till is 20 ppm for both copper and zinc, and there is a much greater spread in the data. Threshold values of 60 ppm Cu and 50 ppm Zn were chosen; using these, anomalous levels in the basal till were observed for some 400-500 feet in a down-ice direction from the deposit (*Figure 2*). In the case of zinc, it is possible to outline a zone of high background (> 25 ppm) which extends away from the drilled area, some 800 feet southwest.

To improve the contrast between background and anomalous levels, the 80-230-mesh fraction of all till samples was subjected to a heavy-mineral separation prior to analysis. This size fraction was chosen to increase the number of grains in a 200-mg aliquot relative to the plus-80-mesh fraction, the analytical reproducibility being a function of the number of grains analysed. Both copper and zinc were determined as in the minus-80-mesh fraction. The local backgrounds for copper and zinc were established at 60 and 30 ppm respectively, and threshold values of 200 ppm Cu and 100 ppm Zn were used to delimit an anomalous dispersion train more than 800 feet long for copper and some 700 feet long in the case of zinc (*Figure 3*).

In certain samples, there is evidence of a limited hydromorphic dispersion of zinc, because anomalous levels in the minus-80-mesh material are not reproduced in the heavy-mineral analyses, a feature which indicates that the zinc is not present in the sulphide form. There is also evidence that the anomalous zone escalades within the till (*Figure 4*). Close to the suboutcrop and outcrop of the ore, the anomalous levels of copper and zinc are found at

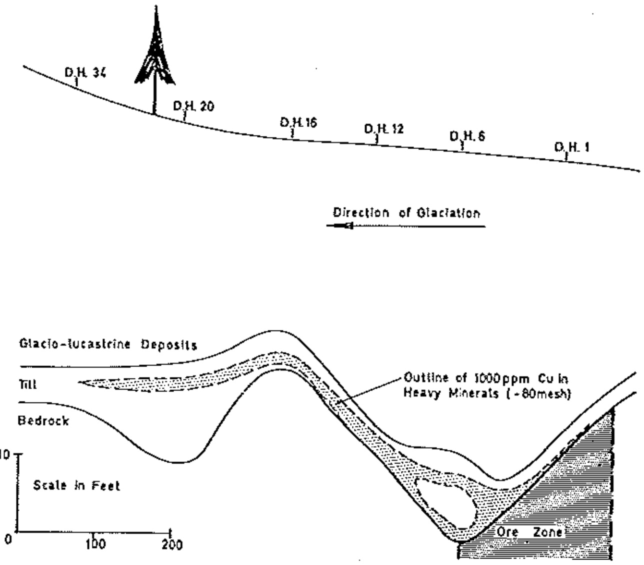

FIGURE 4 — Vertical profile of dispersion train.

the base of the till; however, as one proceeds in a down-ice direction, the anomaly appears to rise at a gradient of about 1 in 100 within the till. This feature is known as overriding and is well known in Quaternary geology.

At the Louvem deposit, clastic dispersion of copper and zinc as sulphide grains appears to be the dominant dispersion mechanism. There has, however, been some saline dispersion of zinc. The clastic dispersion train is controlled by the sum of the ice movements, but dominantly by the last readvance of the ice-sheet, and is thus relatively easy to trace to source. The saline dispersion patterns are controlled by the local hydrologic regime, which is in turn related to the bedrock topography, and more often than not there is insufficient information on these two features to allow a thorough interpretation. Due to the relative ease of interpretation of clastic dispersion patterns versus saline dispersion patterns it is preferable, in the author's opinion, to study the heavy-mineral fraction of the till.

CONCLUSIONS

It is concluded that overburden sampling and subsequent geochemical analysis has application in exploration programs at two levels. First, it offers a tool by which geophysical anomalies and geological extrapolations may be tested, assuming that part of the mineralized zone, or its envelope of disseminated mineralization, suboutcrops. In this case, it is sufficient to analyse the minus-80-mesh fraction, as the method is simply being used as a confirmatory tool before expensive diamond drilling is undertaken. Second, the method has application in more regional studies where larger belts of potentially mineralized rocks are under investigation. In this kind of work, the extra expense of heavy-mineral separations would be justified because a lower sample density could be used, and any anomalies found would be clastic and more readily traced to source.

ACKNOWLEDGMENTS

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