GEOCHEMISTRY

28. BIOGEOCHEMICAL PROSPECTING RESEARCH

Eldon H. Hornbrook

During the summer pilot project investigations of one copper and one molybdenum property in British Columbia were planned and completed, the object being to determine the scope and effectiveness of biogeochemical prospecting for copper and molybdenum.

All operational phases of the projects were carried out simultaneously. They included: (1) operation, by a three-man crew, of the analytical facilities housed in two mobile-trailer laboratories at a fixed base (Smithers, B.C.), (2) collection by a three-man crew of soil and vegetation samples and (3) shallow seismic investigations by a two-man crew. The shallow seismic investigation was carried out under the direction of G.D. Hobson to determine the depth of surficial material.

Approximately 1,500 samples of soil and vegetation were collected from 246 stations, established at both properties. The prepared samples were analyzed by colorimetric and spectrographic methods. The colorimetric analyses were made in Ottawa under the direction of J.J. Lynch. Throughout the summer the analytical results were forwarded to the computer centre in Ottawa for processing so that by early fall more than 24,000 single element determinations could be plotted for evaluation and interpretation.

Examination of the results indicates that biogeochemical prospecting methods are effective for copper and molybdenum. At the Lucky Ship property of Amax Exploration Inc., the molybdenum mineralization generally occurs in a concentric zone about the periphery of a granite plug. Contoured results for molybdenum in twigs or needles accurately define the concentric distribution of the mineralization. Similarly, on the Huckleberry property of Kennco Explorations (Western) Ltd. the results for copper in twigs or needles indicate the extent of previously known copper mineralization.

29. GEOCHEMISTRY OF LEAD-ZINC DEPOSITS IN CARBONATE ROCKS (33N, 34C, 52S (East Half))

D.F. Sangster

Lead-zinc deposits occuring in Proterozoic rocks of the Port Arthur, Ontario and Manitounuk Sound, Quebec areas were examined.

Port Arthur area

Several sphalerite-galena-barite vein deposits in dolomitic shales of the Sibley Group were examined and samples taken for geochemical purposes. The deposits are consistent in mineralogy, character (veins), and strike direction; although some extend downwards into granitic 'basement' rocks, none appear to extend upwards into an overlying carbonate zone within the Sibley. One vein contained muscovite as a gangue mineral with the sphalerite and galena; a sample of this muscovite was submitted for radiometric dating.

Manitounuk Sound area

Small pyrite-sphalerite-galena deposits are exposed in a stromatolite-bearing dolomite. Although roughly conformable in general outline with the enclosing host rock, the deposits, in detail, show cross-cutting and replacement features.

30. GEOCHEMICAL PROSPECTING METHOD DEVELOPMENT, BANCROFT, ONTARIO (31, C, D, E, F)

A.Y. Smith, W. Dyck, J.J. Lynch, D. Church and S. Withers

Geochemical prospecting methods for uranium were carried out in the Bancroft area of Ontario between June and September, 1967. Reconnaissance methods tested included stream sediment geochemistry, swamp geochemistry and hydrogeochemistry employing radon in surface waters. Detailed methods tested included soil geochemistry and the radon content of soil gas. Analyses for uranium were performed in the field mobile laboratory by employing a fluorometric method after nitric acid digestion.

Stream and swamp sediments were collected over an area of approximately 290 square miles and analyzed for uranium. Where possible two samples were collected from each site; a sample of the fine sand and silt

fraction of normal active stream sediment; a sample of organic-rich sediment from the stream or of organic bottom muck from swamp sites in the drainage system. Tentative background values for uranium in these materials were: active stream sediment, less than 1 ppm U; organic sediment and swamp muck, 1 - 2 ppm U. Contrast between background and anomaly was considerably greater in the case of the organic-rich samples. However, both types of sample served to indicate anomalous areas.

Detailed soil sampling was carried out over radioactive zones on both Faraday Uranium Mines properties. Soils in both areas are of the Podzol Great Soil Group developed on thin sandy glacial overburden. Locally, in areas of impeded drainage gleysolic soils are developed. Contrary to expectation, uranium is not strongly concentrated in the humus-rich Ao horizon of most of the soils of the area. Anomalous patterns are commonly weak and poorly developed in this horizon. An exception is the case of the humus horizon of the gleysolic soils where strong concentration of uranium may occur if a nearby source of uranium exists. On the other hand, strong anomalies in uranium are developed in the iron-rich B horizon and serve to focus attention on the radioactive zones. Tentatively it may be said that uranium enters the profile in solution; there is no evidence for the transfer of uranium minerals into the soil profile from underlying bedrock sources. As a consequence the anomalies show down-slope migration and other features characteristic of solution transport. The mode of transport and fixation of uranium is presently under investigation.

Preliminary tests were carried out to determine the feasibility of using the radon content of soil-gas and of surface waters as an indication of the presence of uranium. Determination of the radon content of surface waters was carried out by degassing the water with air and collecting and counting the evolved radon in an alpha counting chamber. At the same time uranium was determined on the same water samples by a fluorometric method.

A total of 59 samples of surface waters (as distinct from groundwaters) were collected and analyzed for radon and uranium content. Radon content of these waters ranged from less than 1 pc/l. (pico curie per litre) to greater than 1000 pc/l., while uranium values ranged from less than 1 ppb (parts per billion) to 50 ppb. While detailed study of the data is still underway, several tentative conclusions may be stated. There is a general correspondence between uranium and radon levels. Streams and creeks have a higher radon content than do lakes and swamps, probably reflecting their closer proximity to groundwater sources. Considerable contrast exists between 'background' values and anomalous value in radon. The technique is simple and inexpensive and holds promise as a regional reconnaissance method for detecting uraniferous districts. However many aspects of the distribution and dispersion of radon in surface waters remain to be studied.

Radon in soil-gas was studied in the vicinity of the Bicroft Uranium mine. Soil-gas was collected from previously dug holes by means of evacuated vessels, and counted for radon content in an alpha chamber. Radon content of 30 samples of soil-gas ranged from 30 to 4600 pc/l. and showed correlation with both soil uranium content and scintillometer measurements. The method offers promise in detailed geochemical prospecting for buried uranium deposits, but future work should take advantage of recent advances in both sampling and analytical technique.

Comparative studies were made in conjunction with the Exploration Geophysics Division in several places in the Bancroft area between three detailed prospecting techniques for uranium. Coverage was obtained over the same ground employing a Gamma-ray Spectrometer, a light-weight field scintillometer and soil geochemistry. A comparison will be made between the three methods with respect to effectiveness, efficiency and costs.

31. GEOBOTANY; ONTARIO AND BRITISH COLUMBIA

Lily Usik

Circular Terrain Features in northern Ontario

From examination of aerial photographs it was suggested that certain circular terrain features noted in northern Ontario were caused by differences in the vegetation cover, and that these differences might be related to geochemical factors, in the environment[1]. A one-day ground reconnaissance of one of these 'circles' north of Timmins, Ontario confirmed the first observation. It was found that the area of the annulus of the circle was conspicuous because of the presence of more larch (Larix larcinia) than spruce (Picea sp.) in this zone as compared to the areas within and outside of it. Furthermore, the area within the circle had a dense cover of shrub-height cedar (Thuja occidentale) whereas the area outside had only individual sporadic occurrences.

It was also noted from observation of surface water conditions that the circular area associated with the dense cedar growth was much wetter than the surrounding terrain which suggested a circular depression. However, the movement of surface water was seen to be outwards from the centre of the circle into the annulus.

Samples of foliage of the tree species occurring in the different zones of the circular feature were collected for chemical analysis.

Geobotanical Investigation in British Columbia

The field investigation in British Columbia was an introductory examination of the scope, and feasibility of possible systematic methods of geobotany applied to exploration for mineral deposits. Geobotanical investigations were made for three undisturbed (or relatively undisturbed) areas where different and known mineralization occurred.

The Lornex copper deposit is situated in the Highland Valley near Ashcroft whereas the Huckleberry Mountain copper deposit and the Lucky Ship molybdenum deposit are situated southeast of Smithers in central British Columbia. Over a hundred plant species were identified in the field for the three areas, and their presence, distribution and associations were investigated and mapped in relation to mineralized and non-mineralized zones for each of the areas. During field investigation no correlation between plant species (indicator plants) or plant communities and the zone of mineralization was apparent. A study of tree ratios was made in one of the areas in order to establish relationships between mineralization and tree growth. In the same area an investigation was also made of the occurrence of conspicuous trunk deformity in one of the tree species in relation to mineralization. In another area material was collected from the dominant tree and associated herb species for chemical analysis.

More detailed analyses of field and laboratory botanical data as well as examination of aerial photographs in relation to the available geological and geochemical data, are being carried out to establish conclusive results.

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[1]Usik, Lily: A report on circular features in organic terrain; Report of Activities, Geol. Surv. Can., Paper 66-2, pp. 55-56 (1966).