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Archer, Cathro & Associates Ltd.**YUKON**Reprinted From
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GEOCHEMICAL PROSPECTING

in the

KETZA RIVER DISTRICT

Introduction

A major silver province exists in central Yukon, centred on the Tintina Trench and extending 75 miles on either side of it. Within this northwest-trending belt, all lead-zinc deposits invariably contain appreciable amounts of silver, whether (1) vein-type, such as in the Keno Hill, Ketza River, Logjam Creek, Casino Creek, and Sixty-mile district, or (2) massive, replacement-type, such as Asarco's Quartz Lake deposit or Anvil's Faro deposit. Development of the known deposits, with the exception of the rich Keno Hill veins, has been slow because of inaccessibility.

Topography in the central Yukon is characterized by a weakly glaciated to unglaciated upland plateau dissected by deep strongly-glaciated valleys which are now obscured by deposits of glacial till. The upland plateau usually exhibits a thick cover of residual till, formed in part before the Pleistocene. This till is often permanently frozen and provides a major obstacle to conventional prospecting. The value of geochemical techniques in exploring for silver-lead vein deposits in residual-till-covered areas was conclusively proven in the Keno Hill district. Operation Keno, conducted by the Geological Survey of Canada in 1964, proved that regional silt sampling could establish general centres of silver-lead mineralization. Soil sampling at 100-foot intervals by United Keno Hill Mines Limited, using lead as the indicator metal, was effective in precisely locating mineralized veins.

The Ketza River district, located some 120 air-miles northeast of Whitehorse and 70 miles southeast of Anvil's Faro deposit, is a known silver-lead district within the Yukon silver province. The first discoveries in this district were made in 1946 by prospectors working for Hudson Bay Mining and Smelting Company, Limited. The district was further explored by Conwest Exploration Company Limited from 1954 to 1957, Ketzakey Mines Ltd. from 1960 to 1961, and Silver Key Mines Ltd. from 1964 to the present time. Prior to the geochemical survey de-

scribed in this paper, conventional prospecting, followed by hand and bulldozer trenching had located, examined and traced some 25 showings, many of them found accidentally during roadbuilding. Silver Key Mines Ltd. and Stump Mines Ltd., who control most of the known showings in the district, began a major program during the 1966 field season to collect and evaluate all the accumulated data and to find more effective and efficient methods of exploring their large holdings. The writer was engaged to advise on and to organize a geochemical test project over an area of his selection within the Silver Key Mines Ltd. and Stump Mines Ltd. property.

This paper describes the geochemical test project and the results of the follow-up work done to date. The intent of the paper is to demonstrate the effectiveness of systematic soil sampling in locating silver-lead vein deposits under conditions commonly encountered in the Yukon and to indicate how cheaply and easily such a program can be conducted if applied under the appropriate geological and geomorphological conditions.

Geological Setting

The Ketza River District is located at the head of the Ketza River in the rugged St. Cyr Range, on the southwest margin of the Tintina Trench. The St. Cyr mountains are superimposed on the Yukon Plateau and exhibit relief variations over 3,000 feet



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The author received a degree in geological engineering from the University of British Columbia in 1957. Prior to graduation he had six summers field experience in British Columbia, Yukon, and Alaska with American Smelting and Refining Company and Ventures Limited.

After graduation he worked for Wesfrob Mines Limited at the Tasu property, at Texada Mines Ltd., and at United Keno Hill Mines Limited, in both surface and underground exploration. He was chief geologist with United Keno Hill for three years prior to engaging in consulting work. He is best known for developing and organizing a modern exploration programme for United Keno Hill which included pioneering the use of a rotary percussion "overburden drill" in mineral exploration.

Mr. Archer, in partnership with R. J. Cathro, also a graduate in geological engineering from U.B.C., established a consulting firm in Whitehorse in January 1966. The firm has recently opened a second office in Vancouver.

with higher peaks exceeding 7,000 feet in elevation. Annual precipitation is higher than average for the central Yukon and probably amounts to 30 or 40 inches. Freezing temperatures and permanent snow cover can be expected in early September and the spring thaw is not complete until June. Winter temperatures fall as low as -60°F . while summers are cool with numerous rain showers.

Pleistocene glaciation consisted of broad valley glaciers in the major drainage courses with intense alpine glaciation in the higher areas. Glacial deposits are generally restricted to valley bottoms and lower slopes. At higher elevations, outcrops are less abundant than might be expected considering the steep terrain. Overburden cover is mostly residual material consisting of decomposed and frost-riven

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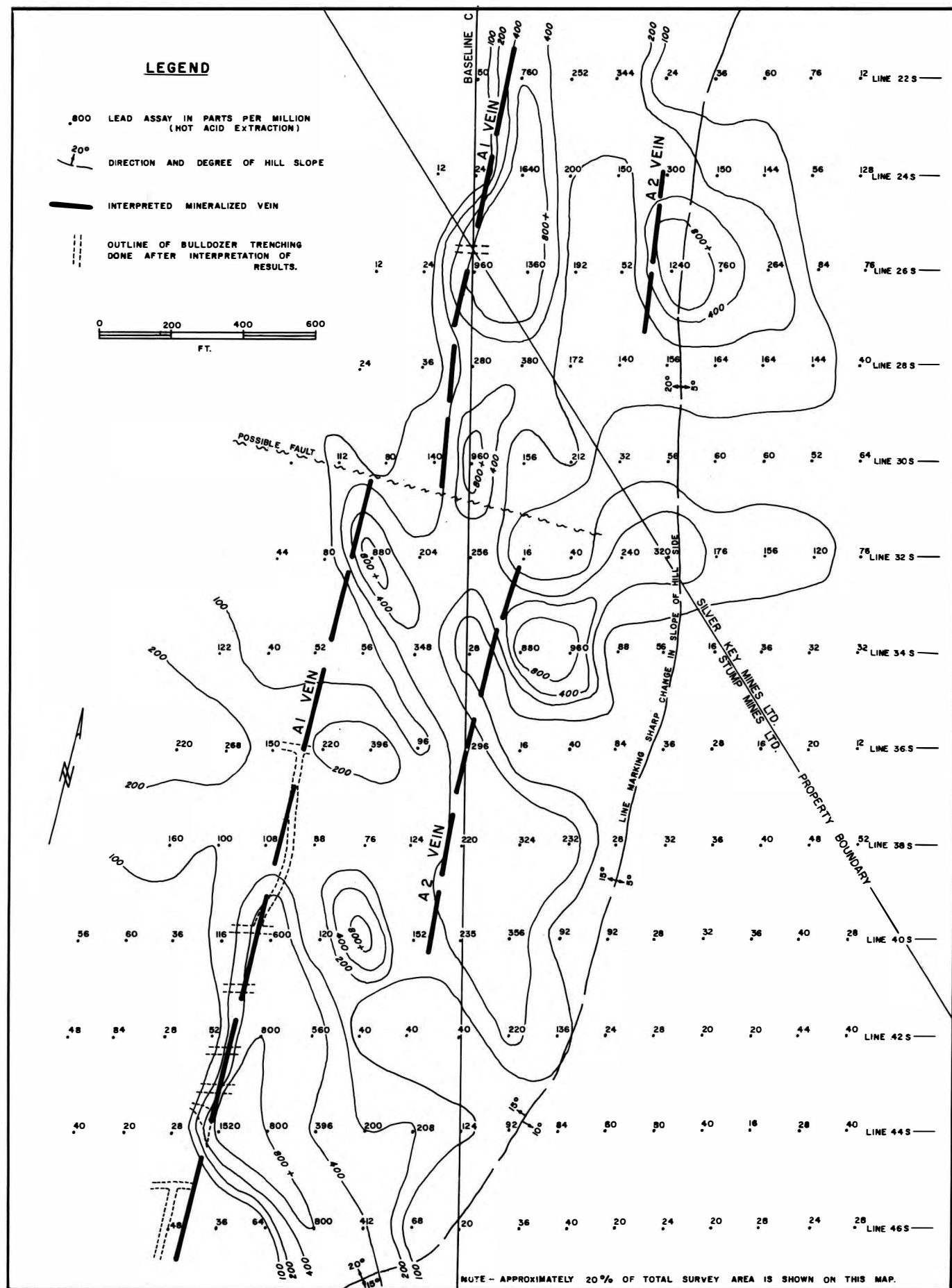


FIGURE 1 — Soil-sample survey, Ketz River Area, Yukon.

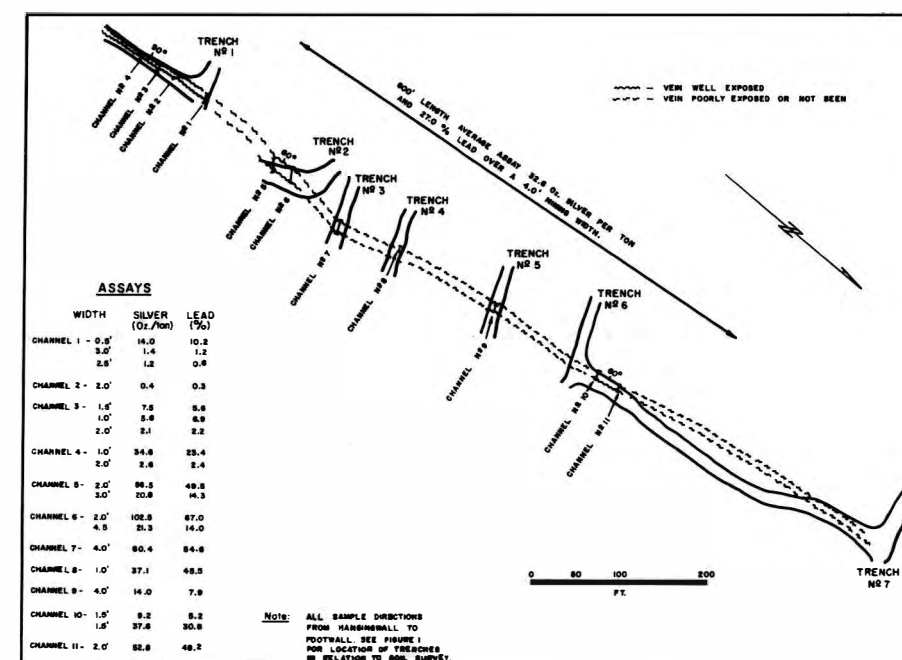


FIGURE 2 — Bulldozer trenching, soil-sample anomaly, Ketz River Area.

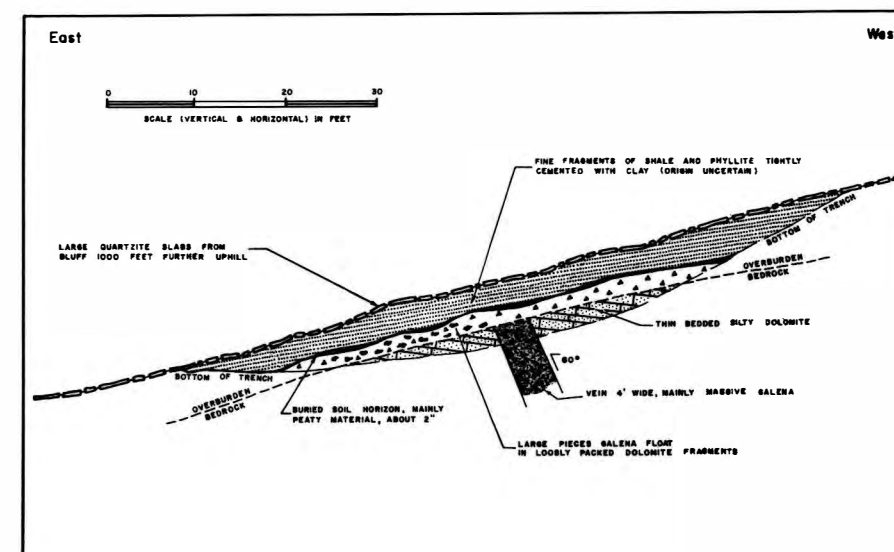


FIGURE 3 — Idealized cross-section, trench No. 3.

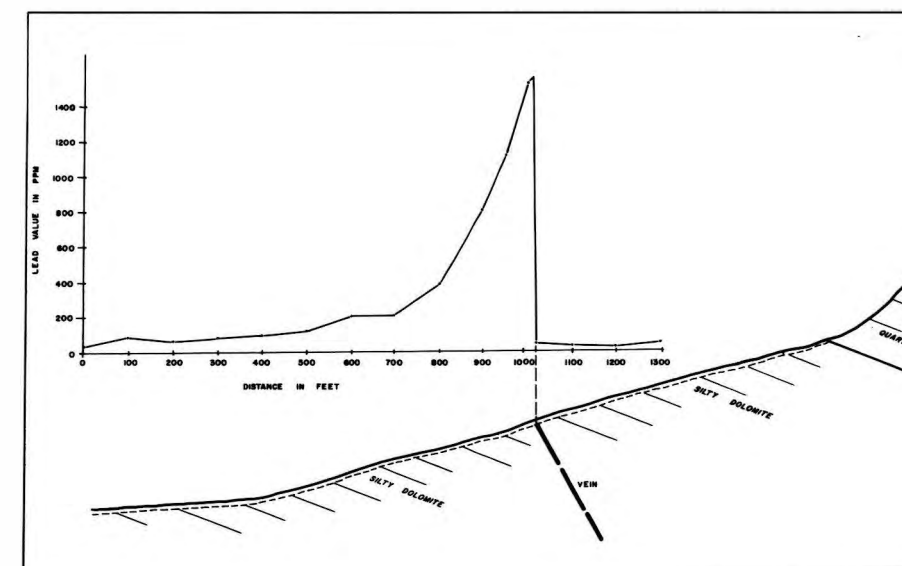


FIGURE 4 — Cross-section line 44S, looking South.

country rocks. Timbered areas are further covered by moss, peat, and muskeg-like soil up to 24 inches thick. Permafrost is prevalent and solifluction has been greatly intensified by frost action.

The geology of the district has been mapped by the Geological Survey of Canada on a scale of 1 inch to 4 miles. A wide variety of metamorphosed sedimentary and volcanic rocks, from the lower Cambrian to Mississippian, have been complexly faulted and folded. The most common rock types are bedded silty dolomite, phyllite, greenstone, and quartzite.

A number of major thrust and normal faults traverse the district in a northwest direction, parallel to and probably related to the Tintina Fault. Vein faults are weaker and usually strike north. No clear relationship has been established between the two sets of faults.

Mineralization occurs as open-space filling in the vein faults. Ore minerals are argentiferous galena, freibergite, and minor sphalerite while gangue is composed of siderite, pyrite, quartz, and fragmented country rock. Silver-lead ratios vary widely but are usually consistent within each vein. The range is from 0.2 to 4.0 and approximately half the showings have a ratio slightly greater than 1.0.

Description of Project Area

The similarity of overburden conditions, topography and mineralization between the project area and the Keno Hill district, where the dispersion pattern for lead has been well established, permitted a full scale survey without a preliminary conventional orientation survey around known showings. An area of approximately 400 acres on the south side of the headwaters of the Ketz River was chosen for the following reasons—

- (1) The area is geologically favourable for silver-lead vein deposits.
- (2) Intensive prospecting of the area had failed to locate evidence of vein structure or mineralization.
- (3) The hillside trends almost parallel to the expected direction of vein-faulting thereby providing a setting for maximum dispersion of mineralization.

The project area lies between the 4,500- and 5,000-foot elevations and consists of a gentle bench with a portion of the steeper slope above. Figure 1 shows approximately 20 percent of the total project area, which lies at the junction of the bench and steeper slope.

Vegetation on the bench consists of scattered balsam and thick clumps of buckbrush, willow, and alder on a grassy meadow. There is no outcrop

and overburden consists of moss, grass, peat, and muskeg-like material up to 18 inches thick overlying residual soils of decomposed and fragmented country rock up to 10 to 15 feet thick.

On the steeper slope above the bench, the only vegetation is a few clumps of buckbrush. Outcrops of thin-bedded silty dolomite comprise about 20 percent of the slope. Overburden is mainly a thin cover of coarse residual till, overlain in some areas by large blocks of float from a steep bluff of quartzite further uphill. Bulldozer trenching has revealed several areas underlying the coarse float where overburden is composed of fine fragments of shale and phyllite, tightly cemented with clay, that is foreign to the immediate area and probably represents a small deposit of glacial till.

Permafrost is general throughout the project area. Where the surface is insulated by moss and peat, summer thawing rarely exceeds 18 inches, whereas less insulated areas of exposed till may thaw to a depth of 5 feet or more. Solifluction has been accelerated by frost action. Frost boils, and "en masse" downslope movements of water-saturated till overlying frozen ground, have further contributed to transportation and mixing of overburden material. Quartzite blocks, moved mainly by this frost action, can be found over 800 feet downhill from their source.

Survey and Analysis Procedure

The area was first gridded by picketing parallel lines 200 feet apart at 100-foot intervals, each picket marked with its grid location. Baselines and cross-lines were established with tape and Brunton compass.

Soil samples were dug at each picket station with a mattock to obtain about 4 ounces of residual till from the B soil horizon. In some cases over 12 inches of frozen overburden had to be chopped away to obtain a suitable sample. In areas covered by coarse float, fine material could usually be found between the rocks or in the centre of a frost-boil in the vicinity of the picket. Samples were collected in individual Kraft bags, hung to dry in the field camp, and sent to a contract geochemical laboratory where they were analysed for lead by atomic absorption spectrometry of a hot aqua regia extraction. Sample preparation consisted only of removing larger rock fragments by hand from the soil. The extra accuracy and added cost of screening was not considered necessary due to the expected high contrast of anomalous values to

background.

Interpretation

Lead is not readily soluble under Yukon weathering conditions and dispersion is mainly physical, rather than chemical, in nature. Rapid solifluction produces well-defined float trains some distance downslope from mineralized veins (in the Keno Hill district such float trains are often recognizable over 1,000 feet downslope, even where the slope is gentle). Most of the lead in the float trains consists of particles of the original ore material or its oxide. Interpretation consists simply of postulating mineralized vein faults immediately uphill from a lead-rich float train indicated by soil analysis.

In this manner, a number of mineralized veins were interpreted in the project area. The most anomalous zone, where all of the follow-up work has been done to date, is shown in Figure 1. The knowledge that veins generally strike north was an important aid because several alternative interpretations could be made using other strike directions. Two parallel veins, the A1 and A2, were postulated but it is possible that the soil anomalies defining the A2 vein are actually part of the float train of the A1 vein.

Exploration of the Soil Anomalies

Figure 2 shows the results of bulldozer trenching in the southerly soil anomaly on the A1 vein. The vein was initially exposed in Trench 3 and was then followed along strike. Trenching did not start until late September and the vein could not be completely exposed because the bulldozer was unable to cut patches of permafrost so late in the season. Preliminary sampling indicates an ore shoot approximately 600 feet long assaying 32.6 ounces of silver per ton and 27 percent lead over a 4-foot width. The indicated ore shoot coincides almost exactly with the position of the soil anomaly.

Figure 3 shows an idealized cross-section of Trench 3 and Figure 4 shows a cross-section along line 44 S, which lies immediately south of this trench. The soil anomaly can be recognized at least 500 feet downhill from the vein. The highest soil value was found approximately 20 feet downhill, although the cross-section of Trench 3 indicates the vein float is capped by at least 4 feet of foreign material. The soil value in this case is probably due to an upward migration of lead in solution.

A trench was started on the soil anomaly at the north end of the postulated A1 vein (between lines 24 S

and 26 S) but failed to reach bedrock before the end of the season. However, large fragments of galena float were uncovered several feet below the surface, indicating the presence of nearby mineralization. None of the other soil anomalies shown on Figure 1 or in the remainder of the project area have been investigated as yet.

While directing bulldozing on the initial discovery trench, the writer examined in detail all anomalous areas along the postulated A1 vein but was unable to find any evidence of vein float other than several small fragments of siderite and galena in the vicinity of line 26 S.

Summary

The A1 vein is the most continuously mineralized structure found to date in the Ketzka River district. In a total strike length of 2,700 feet, an ore shoot approximately 600 feet long has been partially exposed and a further 900-foot length of good mineralization is indicated by soil sampling. It is unlikely that any techniques, other than geochemical sampling, would have located this vein efficiently and certainly no cheaper reconnaissance tool exists. In the Keno Hill District, geophysical techniques were unsuccessful in detecting similar mineralization in narrow veins.

For maximum efficiency, soil sampling of the steeper parts of the property could be done at 200-foot intervals on lines 400 feet apart without missing significant areas of mineralization. Anomalous areas so found could then be sampled at a closer interval to pin-point targets for trenching. Areas that are flatter or covered by very thick accumulations of residual till, where float trains may not be recognizable, will have to be sampled at the closer interval used in the initial survey. Soil sampling of areas covered by deep glacial till, unless extreme solifluction has occurred, is not likely to be effective. In all situations samples must be taken from the B horizon even though holes up to 24 inches deep may have to be dug in certain areas.

The total cost of a soil sample survey on a wider spacing, using the same technique outlined in this report, should not exceed \$4.00 per sample, including camp costs, for a large project. Assuming that 20 percent of the survey area required more detailed sampling, total cost would amount to about \$130.00 per claim.

Soil sampling, besides locating all significant areas of mineralization, has the added advantage in that the shape and magnitude of the anomalies allows exploration priorities to be assigned on a semi-qualitative basis.