GEOLOGICAL SURVEY
OF CANADA

PAPER 65-14

1. INVESTIGATION OF ESKERS FOR MINERAL EXPLORATION
2. BURIED VALLEYS NEAR KIRKLAND LAKE, ONTARIO

a

Hulbert A. Lee

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

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ROGER DUHAMEL, F.R.S.C.
Queen's Printer and Controller of Stationery
Ottawa, Canada
1965

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1. INVESTIGATION OF ESKERS FOR MINERAL EXPLORATION

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INTRODUCTION

The prime objective of the work summarized in this paper was to recognize whether or not esker sampling is worth while as a method for mineral exploration. The results with the data on hand appear geologically reasonable and encouraging but further field work is needed to surmount some of the problems of sampling. These preliminary results are published at this time as a service to the mining industry.

The present paper is part of an extensive geological attack on methods of mineral exploration in the Kirkland Lake - Larder Lake gold belt district now being carried out by the Geological Survey. Reports on various other approaches and further treatment of this project will follow as field and laboratory work progresses.

The use of eskers in mineral exploration has previously been considered barren, and the literature contains only one study on the transportation of stones in eskers that is satisfactory for use in assessing their value in terms of mineral exploration. This work, done in Finland in 1931 (Hellaakoski, 1931), shows a depositional hiatus between the position of source in bedrock and appearance of its rock fragments in the esker sediments.

The writer feels that eskers have a high potential value for mineral and geological exploration, preserving as they do in many cases, the only readily available rock fragments and minerals of the covered bedrock. Large tracts of land of northern Ontario and adjacent Quebec have no bedrock outcrops. Eskers are numerous and cut across the grain of the country theoretically providing a good sample.

Field and field-laboratory work was carried out by the author in 1964, assisted by James Langille who supervised field sampling, Douglas Grant who picked out pyrope grains, John Rowntree who counted gold grains, and Daniel Gillis, George Cargill, Richard Wilkins and Brian Lampi. Encouragement and other assistance throughout this Kirkland Lake project was given by Dr. Geoffrey Charlewood, of Heath and Sherwood Diamond Drilling Company. From discussion with the many visiting exploration geologists of Canada and other countries, the writer has benefited. Figures prepared by the author assisted by Paul Johnston.

MUNRO ESKER

In terms of mineral exploration all eskers are similar and represent uniform meltwater conditions and thus generalizations regarding one esker can be applied to others.

The large esker that passes through Kirkland Lake gold camp was chosen for this study and will be referred to in this report as the Munro esker, after the township of Munro. It is a typical representative of the family of eskers in the region and is strategically located in terms of any possible economic results which could arise from this study. This esker is essentially continuous and easily traceable on air photographs for its length of 250 miles and is readily accessible by roads and canoe. The esker crosses extensions of known gold bearing structures, the shear zone of the Upper Canada Mine, and also the Larder Lake fault and thus makes available to this study known or presumed known sources for gold abundance peaks in the esker. Excellent maps of the basement geology are available, and provide background information for petrologically distinct rock fragments present in the esker.

Samples in the Munro esker were taken along a straight-line length of 70 miles of that portion extending from Lake Abitibi, situated northeast of the mining towns of Timmins and Matheson, southward well beyond Kirkland Lake to the agricultural town of Englehart. A map of this portion of the esker showing locations of sampling points is shown in Figure 1.

A winding plateau, one to four miles wide and of great length, characterizes the surface of the Munro esker. The plateau is marred by depressions arranged generally along its axial backbone. Between the depressions there are commonly bell-shaped ridges.

Interestingly enough the zone of larger surface depressions corresponds to the subsurface zone of deepest depressions in the bedrock surface outlined by Hobson and Grant (1964) with hammer seismograph. The easily recognizable zone of surface depressions thus becomes a tool for indicating the position of hidden valleys in the bedrock surface. Thickness of sediments below these depressions is considerable, greater than 200 feet by hammer seismograph and a vertical hole into one of these did not reach the bedrock at a depth of 290 feet (Lee, 1965).

The esker sediments are dominantly sand and composed of a mixture of rock fragments and mineral grains that have undergone moderate sorting. This dominance of sand strata is clearly visible in the 50 foot exposure (locality 26, Fig. 2), and in samples from the 290 foot bore-hole (BH-3, Fig. 2). Coarser layers of gravel or boulders where present are thin.

In the zone of unmodified esker sediments sheet bedding is characteristic. Crossbedding occurs locally and is of a type suggesting deposition from a braided stream. Fore-set beds are not prominent; perhaps this is fortuitous, due to paucity of sufficiently deep exposures, but possibly it also is characteristic of the broad plateau-type esker.

Wave action by Lake Barlow - Ojibway has, in some places, washed a considerable thickness of sands onto the flanks of the esker, and in a few places has built boulder beaches. In esker sampling it becomes imperative to recognize distribution of these transported winnowed sands in order to avoid them. This is easily done by restricting samples to the crests of the bell-shaped ridges.

Large surface boulders were encountered in a few places but were avoided in taking samples.

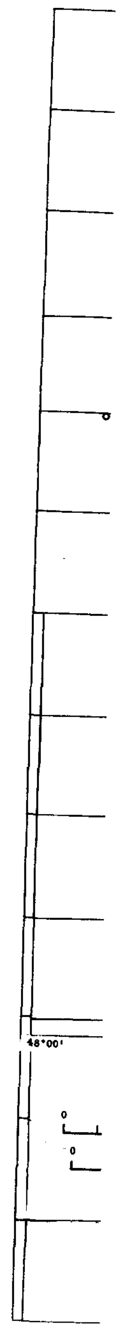

Figure 1. S

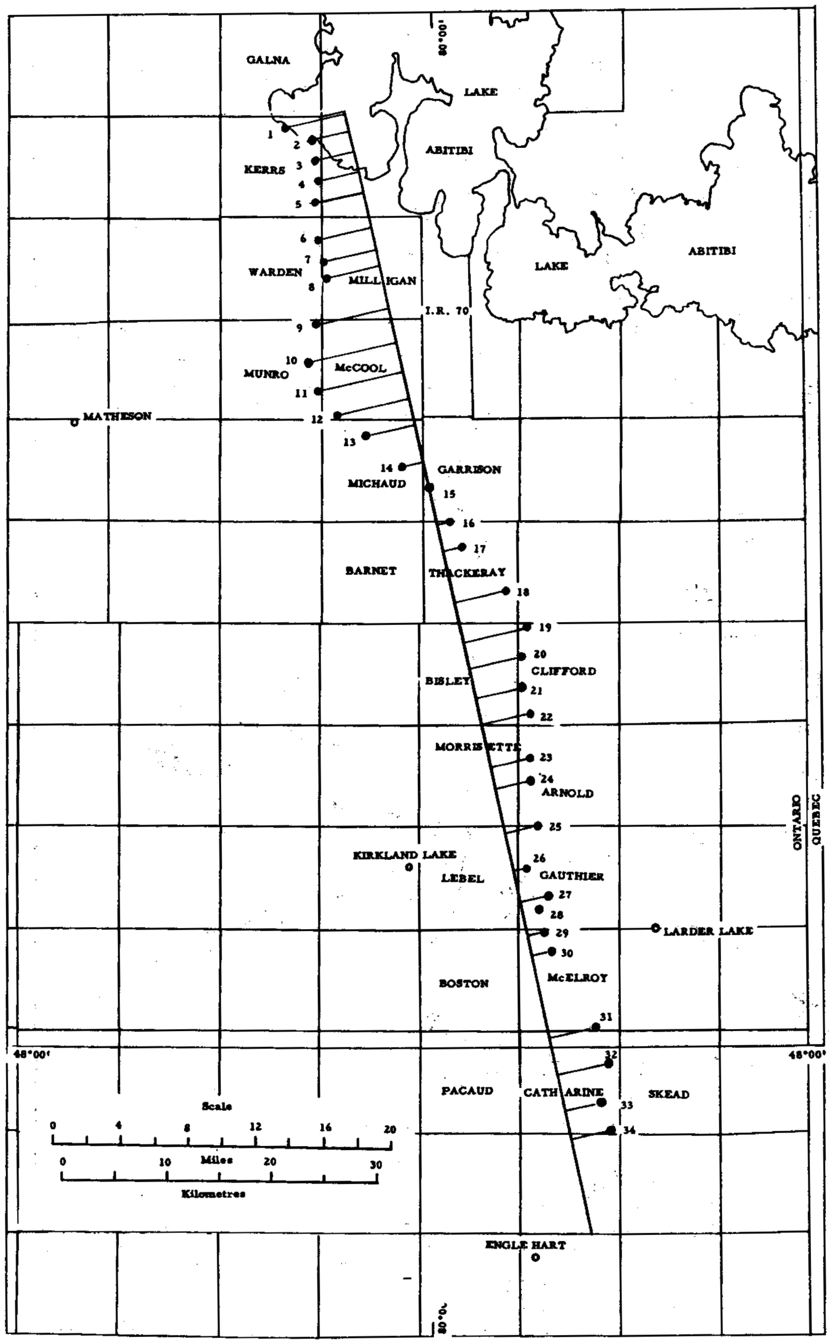

Figure 1. Sample points along Munro esker projected onto a line representing average direction of esker.

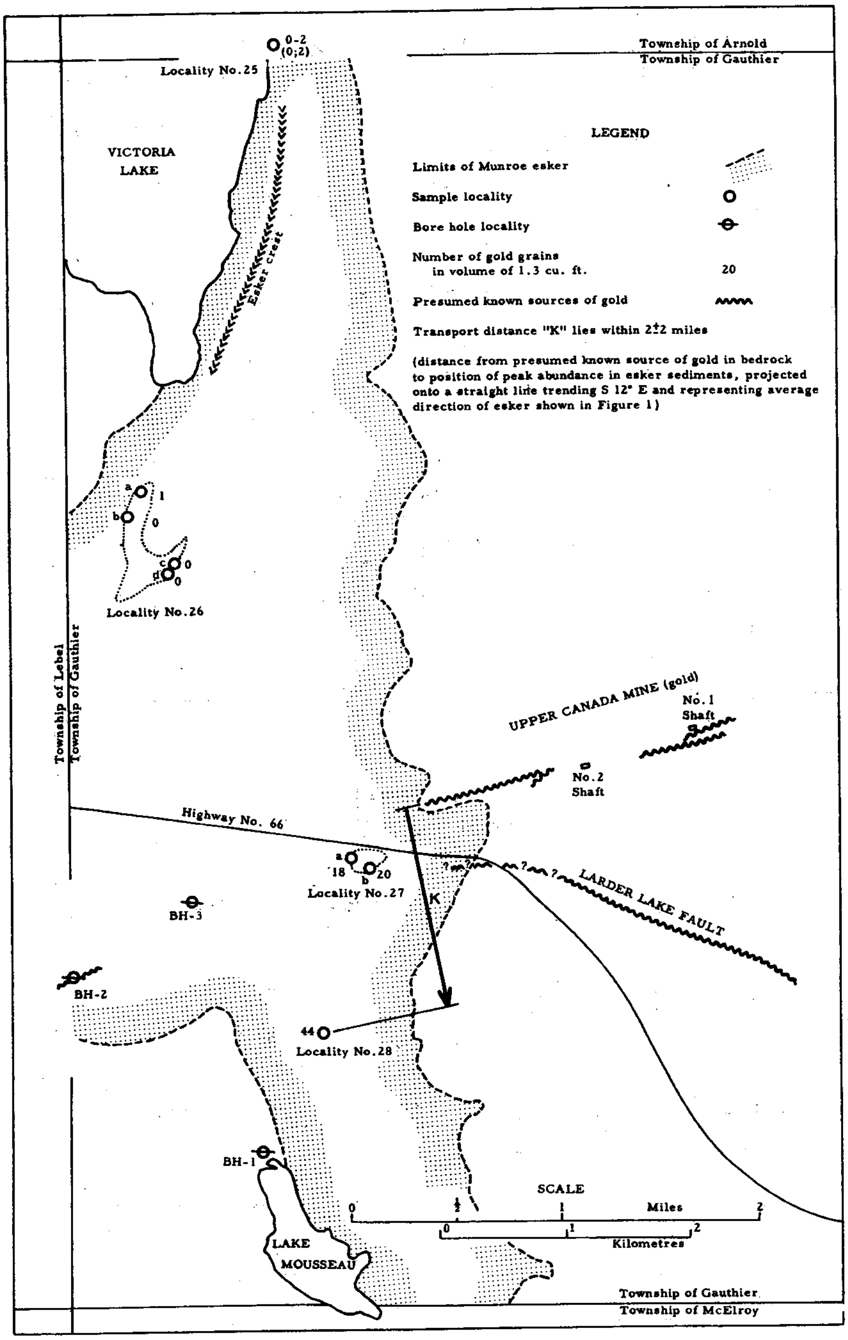

Figure 2. Gold grain sampling of Munro esker in vicinity of Upper Canada Mine, grain size larger than 10 microns. (Grain counts are uncorrected for locality variations or for patchiness.)

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ANALYSIS

Purpose of the investigation is to test distances of transport from known sources in order to establish values useful for inferring bedrock sources of economic components within an esker. Materials chosen for testing include dunite and trachyte rock fragments, free gold grains and pyrope grains. Dunite has hydrologic and transport characteristics believed comparable with iron-formation; trachyte is similarly comparable with rocks associated with gold and other heavy metal source rocks.

Dunite, composed of olivine grains set in a magnetic matrix, is readily concentrated and recognized. Small fragments can be picked out with a magnet, furthermore the olivine grains in the dunite have a characteristic weathering that reveals the distinctive ophitic texture of the rock making identification easy and positive. The indicator chosen in the Munro esker for heavy ore minerals was gold. Known or presumed known bedrock sources for dunite and gold shown on existing geological maps were investigated. Pyrope garnet was chosen to indicate the transport distance for lighter heavy minerals because it has a distinctive purple colour, is angular and lacking in crystal edges. A number of garnets selected from the Munro esker were identified as pyrope (unit cell, indices of refraction, and spectrographic composition) by R.N. Delabio of the Geological Survey. This suite was then used as a standard in the field laboratory for microscopic determinations. Trachyte was chosen as an indicator because it is a distinct rock type in the southern stretches of the esker.

Sampling Procedure

The field sample volume (1.3 cu. ft.) was a composite of material from two parallel vertical areas (3 ft. horizontal width by 5 ft. vertical) separated 6 feet horizontally. Sufficient material is needed in a wide range of sizes, ranging from 10 microns for gold to 16 mm. for trachyte, to meet minimum conditions for each subsample. A gravelly sand is preferable and was available by taking samples positioned at the crest of the bell-shaped ridges.

The field sample was washed through five screens and the fine concentrate of heavy minerals was caught in a sluice box on a specially designed rubber matting (procedure in Lee, 1963).

Each screen fraction and the riffle concentrate was treated separately to give the subsamples. This size separation was necessary because distance of transport is a function of size.

The subsample volumes were standardized in each screen fraction for counting and weighing. The 8 to 16 mm. screen fraction (trachyte) was standardized at not less than 300 pebbles and up to 500 pebbles, a number recommended by the experimental tests of Maareleveld (1956, p. 18). This size of subsample filled one-half of a 48 ounce can. It was taken by spreading the screen fraction uniformly along a 3 foot length, then cutting through it at several places until the desired amount of material was obtained. Theoretically the calculated pebble frequencies for this screen fraction are accurate to approximately one-half of 1% (1 in 300-500).

The subsample of the 3.35 to 8 mm. screen fraction (dunite and magnetic fragments) was standardized at 1,000 grams, and was cut from the material in this size class (average 4,000 - 8,000 grams) with a Jones splitter. The 1,000 gram sample contains approximately 10,000 grains and thus affords a counting accuracy of .01%.

In the screen fraction 0.5 to 1.23 mm. (pyrope grains) the total fraction was used as a subsample. It averaged 0.3 to 0.4 cu. ft. The pyrope grains were concentrated into a bullseye on screens under water by an up-and-down and rotation action. All pyrope grains were recovered and counted. The accuracy of counts on this subsample is theoretically high.

The subsample for free gold grains is the 1.3 cu. ft. field sample. All gold grains passed through the screens and were concentrated on the riffle (rubber matting) except perhaps extremely fine gold. The riffle concentrate received further treatment in a superpanner where a clean gold concentrate was made and examined under a binocular microscope. The microscope was swiveled into position as needed. Theoretically this procedure should give high accuracy for gold in the size range 10 microns and larger.

The subsample requirements of 300-500 pebbles in size range 8-16 mm. (trachyte) was met and exceeded in all field samples. The thousands of grains in the size range 3.35-8 mm. (dunite) and 0.5-1.23 mm. (pyrope) exceeded requirements in all samples. The minimum size of field sample for gold grains (chiefly 10-150 microns) has not been determined. The sample that was taken is larger than that generally used by other workers. Because of the larger sample, and the fine grain size of the gold, the sample is thought to exceed the minimum size necessary for the purposes of the study, but this has not been proven and still requires further field testing.

In general the size of the sample taken for this study is thought to meet and exceed the minimum requirements needed for purposes of mineral exploration.

Local Variations in Concentration of Components

Two or more samples were taken at each of three localities and gold counts compared as indicated in Figure 2. Locality 26 was tested for gold grain variations by taking four samples (Fig. 2, locality 26 a-d). The number of gold grains in three of these samples was zero, and in a fourth sample, one.

Locality 25 was tested for gold grain variations by taking two samples approximately 100 feet apart (Fig. 3, locality 25). The number of gold grains in these samples was 18 and 20.

Further testing of local variations was done by 40 samples from 3 bore-holes. Results are not directly comparable to those obtained by standard procedure for surface samples. At bore-hole No. 1 (Fig. 2), 12 samples were taken over consecutive vertical intervals from surface to depth of 290 feet. Eleven of these samples had zero gold grains, and one sample had a single grain.

At bore-hole No. 2 (Fig. 2), 18 samples were taken over consecutive vertical intervals from surface to depth of 230 feet. The number of gold grains counted from these samples is as follows: 9, 3, 5, 9, 5, 9, 4, 17, 10, 10, 6, 1, 3, 0, 10, 3, 1, 3. Some of the variations in the gold count could have been caused by the drilling procedure of washing out the hole prior to taking each sample.

In bore-hole No. 3 (Fig. 2), 9 samples were taken over consecutive vertical intervals from surface to depth 50 feet, then from 225 feet to 270 feet. Number of gold grains is as follows: 3, 10, 9, 19, 5, 6, 3, 5, 13.

Where gold grain values are low as in bore-hole No. 1 patchiness or local variation in vertical distribution does not appear to be important. Where gold grain values are high patchiness must be taken into consideration in future work.

Concept of Transport Distance "K"

The author's investigations in the Munro esker have confirmed Hellaakoski's observations (1931) that fragments from a particular bedrock source do not occur in maximum abundance over or immediately adjoining the source and, in fact, that the first appearance of the indicator fragments is some distance downstream along the esker from the source. The displacement distance between the bedrock source and the position of peak abundance for any component is here defined as the transport distance "K" (Fig. 3).

Short transport is expected in an esker because esker streams are thought to be short lived and overloaded with sediment. Overloading could be the cause of the braided pattern noted earlier in the Munro esker. Investigations to date, seem to indicate that "K" is uniform in any one esker for materials having similar hydrologic characteristics of size, specific gravity, and shape. In determining "K" for figures 2-9, sample points were projected onto a straight line trending S. 12°E. representing the average direction of the esker (see Fig. 1).

Values of "K" are shown as ±2 miles to allow for the wide spacing of sample localities but does not allow for uncertainties introduced by patchiness or by locality variations.

Magnetic Pebbles

In Figure 4, the distribution of magnetic pebbles in esker is compared with the magnetic susceptibility of the underlying bedrock as recorded from Geological Survey aeromagnetic maps. The pebbles include material in the size range 3.35 to 8 mm. that were attracted to a one inch horseshoe magnet.

Two broad humps separated by a prominent low show on a plot for magnetic susceptibility of the bedrock and two similar broad humps with a low between show in the esker sediments. The esker curve is displaced relative to the bedrock curve along the direction of transport. This

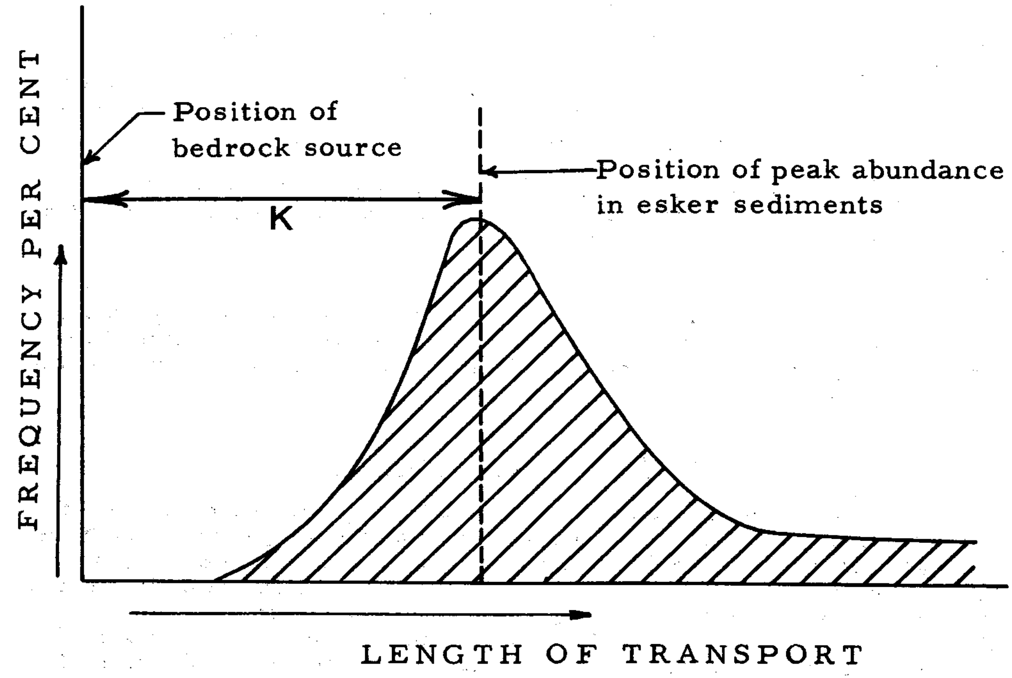


Figure 3. Hypothetical frequency distribution illustrating concept of transport distance "K".

displacement is approximately the same order of magnitude as the transport distance "K" for dunite as discussed in the following section (Figures 5 and 6). This relationship suggests a broad scale correlation between magnetic rock fragments in the esker and magnetic susceptibility of the bedrock. Further studies with magnetic fragments in the esker should test for patchiness and locality variations.

Dunite Transport Distance

The frequency of dunite fragments in the Munro esker, size range 3.35 to 8 mm., is shown in Figures 5 and 6. The presumed known sources of dunite in the bedrock are taken from Ontario Department of Mines Map 2024 and those by Satterly (1952) and (1953). The high concentration at sample points 9 and 10 are believed to relate to bedrock source A (Fig. 5) and those at 14 and 16 to source B (Fig. 6). On this basis the transport distance "K" is 8 ± 2 miles for both.

Larger size rock fragments of dunite (8 to 16 mm.), also examined although not reported in detail, have a shorter distance of transport.

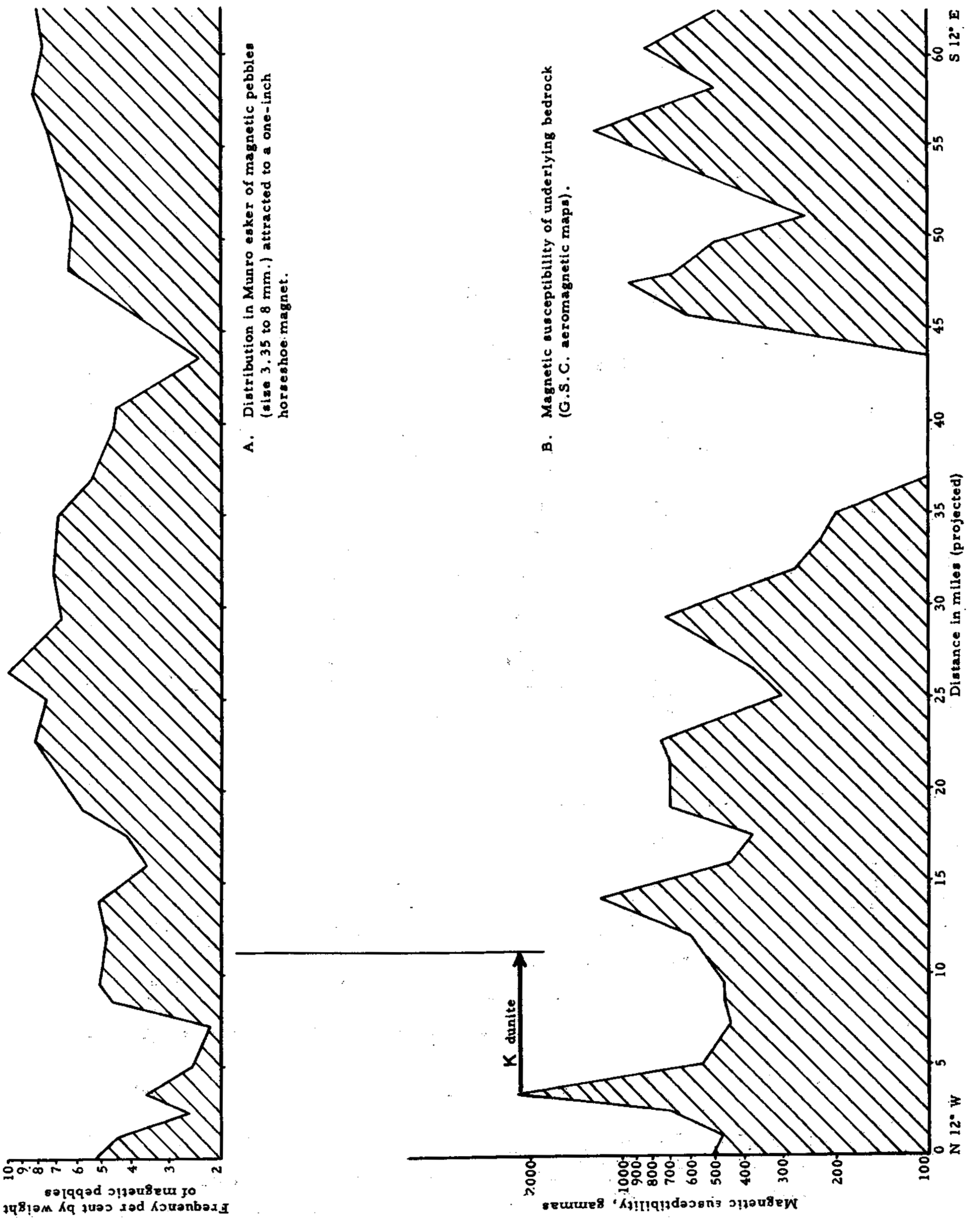
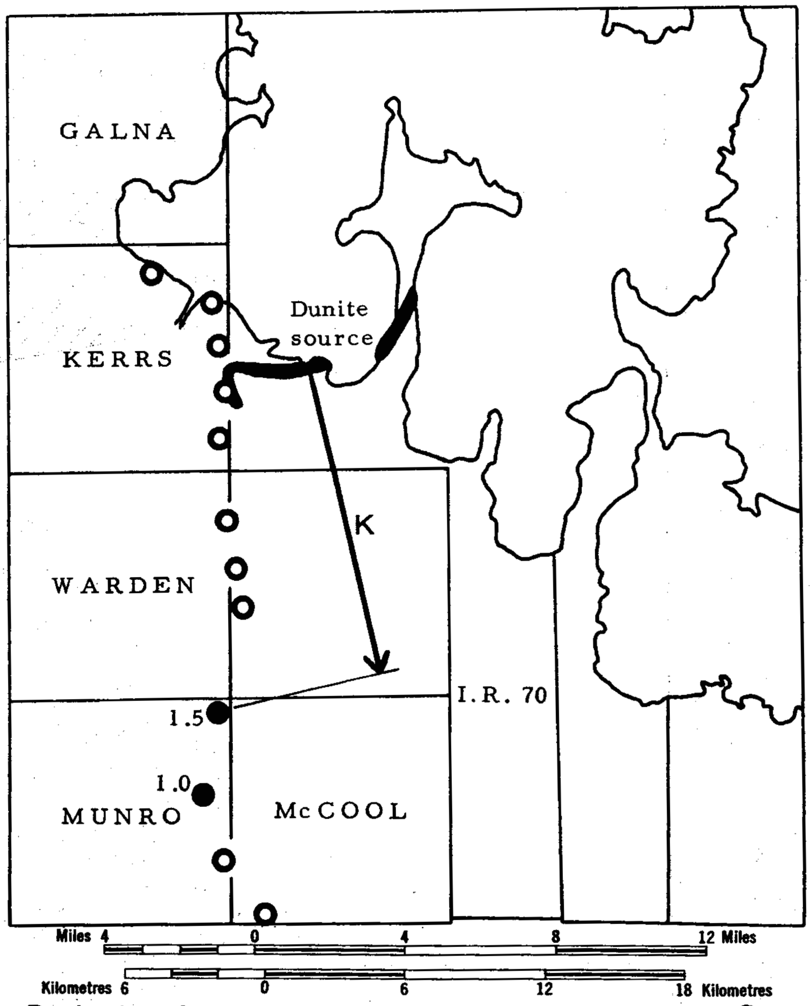


Figure 4. Relationship of magnetic fragments (size 3.35 to 8 mm.) in Munro esker to magnetic susceptibility of underlying bedrock. Rock fragment counts are uncorrected for locality variations or for patchiness. (Sample positions are projected onto a straight line trending S12°E and representing average direction of esker shown in Fig. 1.)

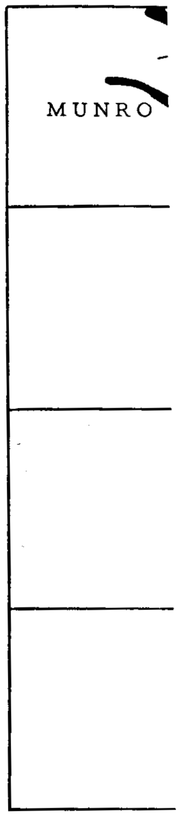


Dunite in esker: - less than 0.5%
- more than 0.5%; per cent indicated

Dunite in bedrock: known occurrences 1.5

Transport distance "K" - 8±2 miles
(distance from presumed known source in bedrock to position of peak abundance in esker, projected onto a straight line trending S 12° E and representing average direction of esker shown in Figure 1)

Figure 5. Dunite transport in Munro esker by weight per cent, size 3.35 to 8 mm. (northerly source). Counts are uncorrected for locality variations or for patchiness.



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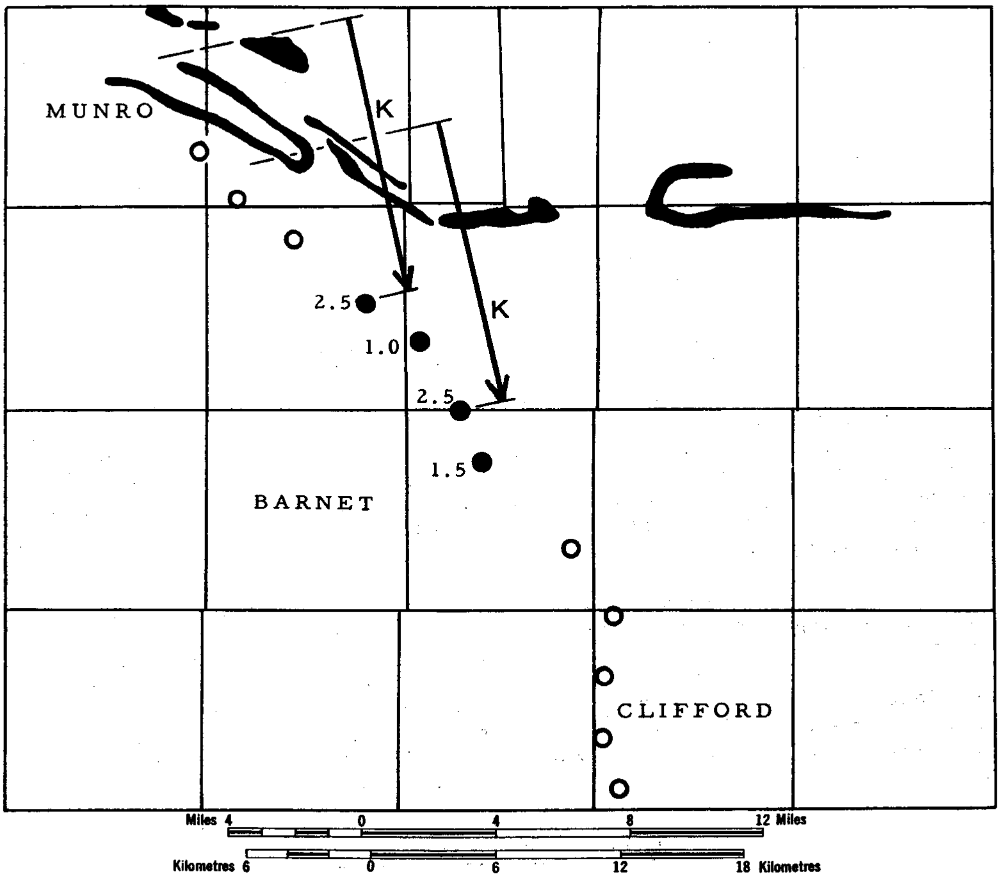


Dunite in esker: - less than 0.5%
- more than 0.5%; per cent indicated

Dunite in bedrock: known occurrences 1.5

Transport distance "K" - 8±2 miles
(distance from presumed known source in bedrock to position of peak abundance in esker, projected onto a straight line trending S 12° E and representing average direction of esker shown in Figure 1)

Figure 6. Dunite transport in Munro esker by weight per cent, size 3.35 to 8 mm. (southerly sources). Counts are uncorrected for locality variations or for patchiness.

Further work needs to take into consideration locality variations and patchiness.

Trachyte Transport Distance

Distribution of rock fragments of trachyte in the southern part of the esker is shown in Figure 7. The size range examined is 8 to 16 mm.

The presumed known bedrock source for the trachyte is taken from the Ontario Department of Mines Map 2046 and that of Gauthier township (Thomson and Griffis, 1944). The transport distance for the trachyte is 3 ± 2 miles.

As with dunite, further work needs to take into consideration locality variations and patchiness.

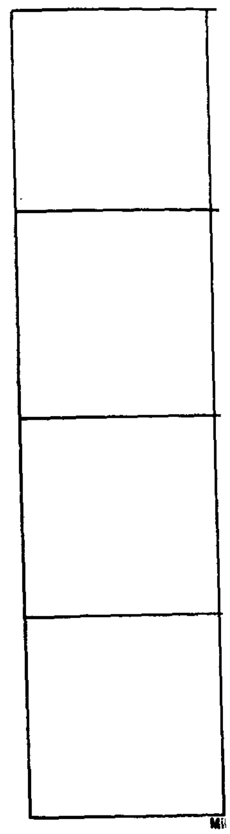
Transport Distance of Gold Grains

The frequency of gold grains size range 10 microns and larger in a portion of Munro esker is shown in Figure 2. The gold peak at localities 27 and 28 lies just south of two known gold bearing structures. Assuming that the gold represented by this peak has come from either or both of these sources the transport distance "K" lies in the range of 2 ± 2 miles. Further work needs to consider patchiness and locality variations and requires many more field samples.

The frequency of gold grains at all sample localities throughout the 70 mile length of Munro esker is shown in Figure 8. The presence of several peaks on the curve is of interest, although of course, it is not known whether they relate directly to specific bedrock sources (see Appendix for locations). The frequency as plotted is uncorrected for patchiness or locality variations. In this connection the variations in gold concentrations in bore-holes No. 2 and No. 3 cited on an earlier page should be borne in mind.

Distribution of Pyrope Grains

The frequency of pyrope grains (size 0.5 to 1.23 mm.) at all sample localities throughout the 70 miles of Munro esker is shown in Figure 9. The frequency plotted is uncorrected for patchiness or locality variations hence the data at hand does not permit definite conclusions regarding the significance of individual peaks in the curve. The broad shape of the curve however suggests a source of the pyrope somewhere in the Kirkland Lake region. From a consideration of the transport distance "K" for other components of the esker, a source is expected to lie within a ten mile radius of locality 28. No source has been reported for pyrope within such a radius.



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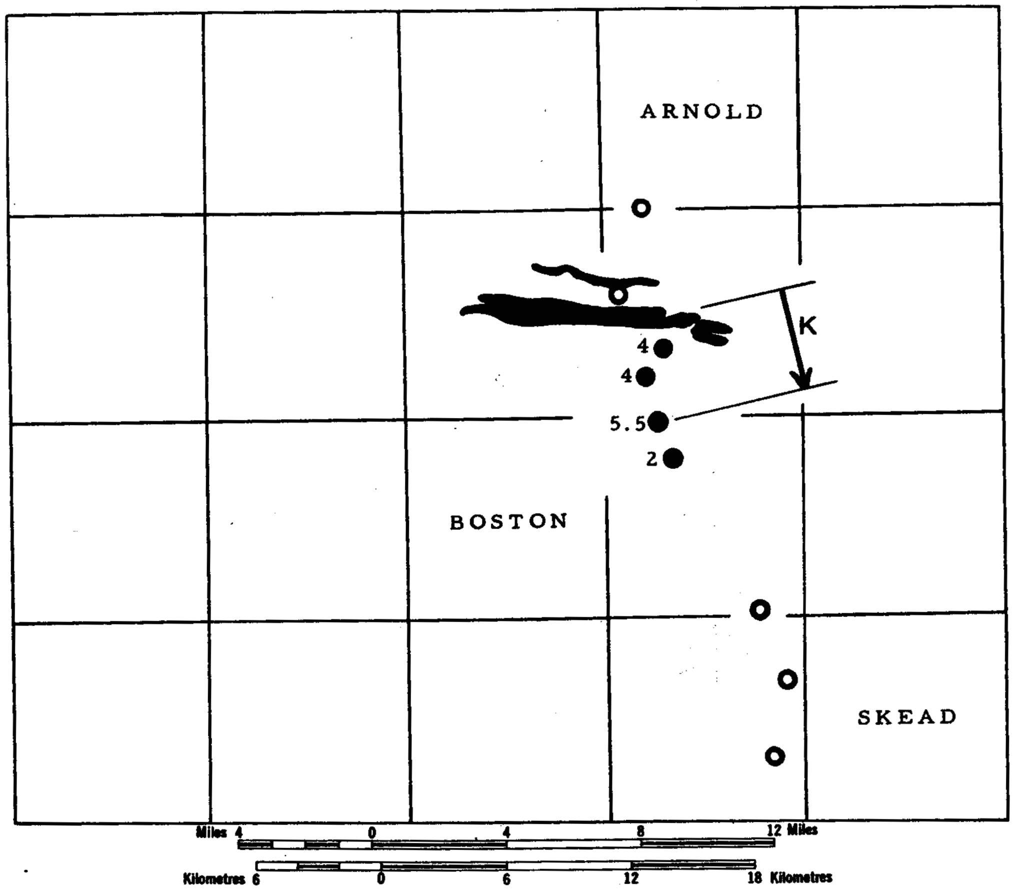

Trachyte in esker: - less than 1% ○
- more than 1%; per cent indicated ●

Trachyte in bedrock: known occurrences 1.5

Transport distance "K" - 3±2 miles
(distance from presumed known source in bedrock to position of peak abundance in esker, projected onto a straight line trending S 12° E and representing average direction of esker shown in Figure 1)

Figure 7. Trachyte transport in part of Munro esker by number per cent, size 8 to 16 mm. Counts are uncorrected for locality variations or for patchiness.

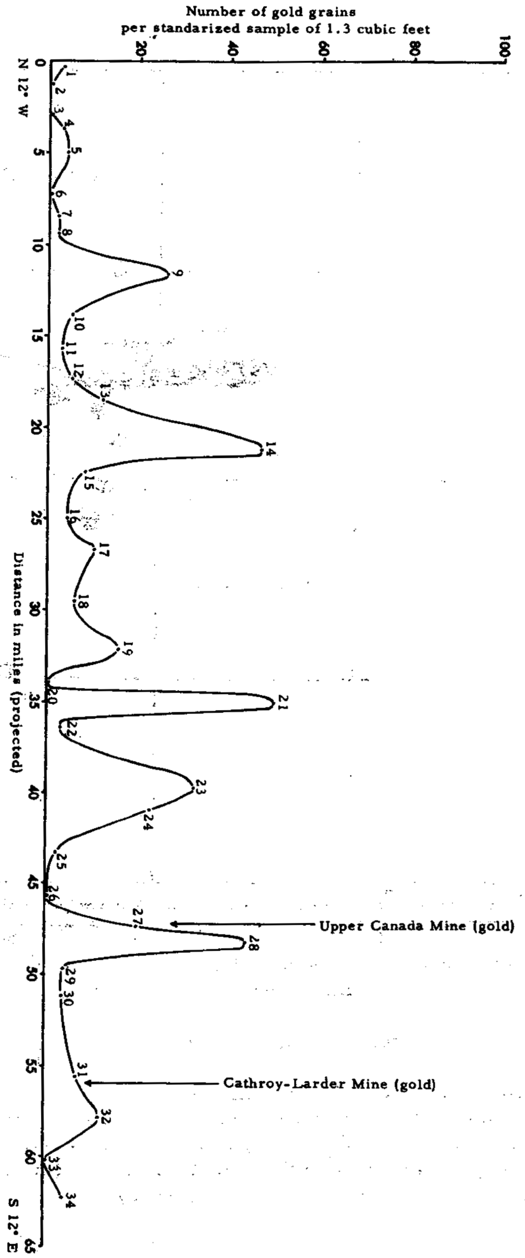

Figure 8. Gold grain counts at sample localities 1 to 34 in Munro esker, grain size larger than 10 microns. Gold grain counts are uncorrected for locality variations or for patchiness. (Sample points are projected onto a straight line trending S12°E and representing average direction of esker shown in Fig. 1.)

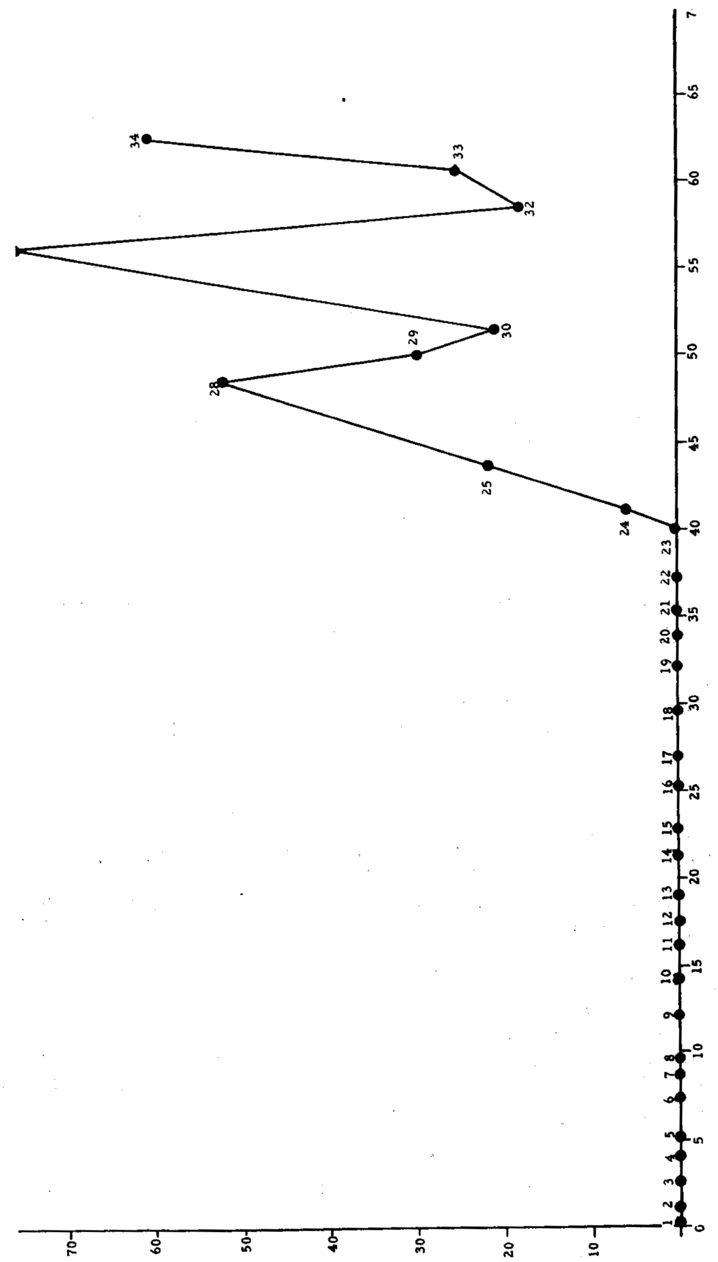

Figure 9. Pyrope grain distribution in Munro esker, size 0.5 to 1.23 mm. Counts are uncorrected for locality variations or patchiness. (Sample points are projected onto a straight line trending S12°E and representing average direction of esker shown in Fig. 1.)

Other Possibilities

The transport distance "K" determined for dunite and trachyte in conjunction with aeromagnetic maps could be used to interpret some aspects of the bedrock geology hidden under the Quaternary sediments. As an example the sample at locality 18 contains a large number of rock fragments of magnetic iron-formation, size range 3.35 to 8 mm., as well as considerable shredded asbestos, size 0.5 to 3.35 mm. If the transport distance "K" for dunite is used then the high of locality 18 coincides with a high gamma ridge as shown on the Magusi River aeromagnetic map of the Geological Survey. Other correlations of this type could be done but further work is needed to establish the magnitude of error introduced through patchiness and locality variations. The same technique can be used towards bedrock geological mapping in areas of thick overburden.

Results of other laboratory tests being done by geochemical and spectrographic analysis are not yet available.

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Sample Number	N.… Refe…
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31	32D…
32	31M…
33	31M…
34	31M…

APPENDIX

DESCRIPTION OF SAMPLE POINTS

Sample Number	N.T.S. Reference	Topographic Map 1:50,000	Township	Latitude	Longitude
1	42A/16E	Low Bush	Kerrs	48°47.3'	80°11.3'
2	42A/16E	Low Bush	Kerrs	48°46.7'	80°09.5'
3	42A/16E	Low Bush	Kerrs	48°45.4'	80°09.1'
4	42A/9E	Matheson	Kerrs	48°44.3'	80°08.6'
5	42A/9E	Matheson	Kerrs	48°43.3'	80°08.9'
6	42A/9E	Matheson	Warden	48°41.4'	80°08.7'
7	42A/9E	Matheson	Milligan	48°40.25'	80°08.5'
8	42A/9E	Matheson	Milligan	48°39.4'	80°08.1'
9	42A/9E	Matheson	Munro	48°37.1'	80°08.9'
10	42A/9E	Matheson	Munro	48°35.15'	80°09.5'
11	42A/9E	Matheson	Munro	48°33.6'	80°08.8'
12	42A/9E	Matheson	McCool	48°32.6'	80°07.3'
13	42A/9E	Matheson	Michaud	48°31.6'	80°05.2'
14	42A/8E	Ramore	Michaud	48°29.9'	80°02.6'
15	42A/8E	Ramore	Garrison	48°28.8'	80°00.3'
16	32D/5W	Magusi River	Garrison/Thackeray	48°27.0'	79°58.6'
17	32D/5W	Magusi River	Thackeray	48°25.7'	79°57.7'
18	32D/5W	Magusi River	Thackeray	48°23.7'	79°54.2'
19	32D/5W	Magusi River	Clifford	48°21.6'	79°52.6'
20	32D/5W	Magusi River	Clifford	48°20.2'	79°52.9'
21	32D/5W	Magusi River	Clifford	48°18.7'	79°53.1'
22	32D/5W	Magusi River	Clifford	48°17.3'	79°52.4'
23	32D/4W	Larder Lake	Arnold	48°14.7'	79°52.4'
24	32D/4W	Larder Lake	Arnold	48°13.7'	79°52.1'
25	32D/4W	Larder Lake	Arnold	48°11.4'	79°51.8'
26	32D/4W	Larder Lake	Gauthier	48°09.3'	79°52.5'
27	32D/4W	Larder Lake	Gauthier	48°08.0'	79°51.4'
28	32D/4W	Larder Lake	Gauthier	48°07.3'	79°51.8'
29	32D/4W	Larder Lake	McElroy	48°06.0'	79°51.2'
30	32D/4W	Larder Lake	McElroy	48°04.8'	79°50.5'
31	32D/4W	Larder Lake	McElroy	48°01.0'	79°47.7'
32	31M/13W	Englehart	Catharine	47°59.2'	79°46.4'
33	31M/13W	Englehart	Catharine	47°57.3'	79°47.1'
34	31M/13W	Englehart	Catharine	47°55.8'	79°46.1'

2. BURIED VALLEYS NEAR KIRKLAND LAKE, ONTARIO

Buried valleys are of interest to the prospector. He is primarily concerned with the rocks that underlie the valleys, their lithology, their mineralization, and their structure, any of which may control the location of the valley. From another viewpoint he is interested in the placer mineral content of a buried valley. To learn the existence of any buried valleys near Kirkland Lake and if present then to establish their significance was the object of this study.

High level airphotographs and paleo-geomorphology, that is the interpretation of the bedrock surface as reflected through hundreds of feet of Quaternary sediments, were the tools used. Kupsch (1956) has applied this approach for locating possible oil structures lying below thick glacial sediments in Saskatchewan. He terms it "submask geology". The writer searched for and found buried valleys in the Kirkland Lake region by applying principles of paleo-geomorphology. The R.C.A.F. airphotographs, scale 1 inch to 1 mile, were the highest altitude photographs available and they permitted integration of a complex of buried valleys as interpreted from scattered fragments of lineaments, unusual drainage, and other features occurring on the surface landscape. Many of these features were obscure on the ground. A pattern of buried valleys emerged on the photographs only after features due to vegetation, recent erosion, and glaciation were eliminated; this required an understanding of the Quaternary geology. Confirmation and delineation of the interpreted valleys was then made by hammer seismograph, supplemented by conventional seismograph. A map made by Grant and Hobson (1963) confirms some of the interpreted valleys and shows them to comprise a trunk system and two branches.

The next stage was to test these valleys by drilling. A drill rig was used capable of taking a six-inch diameter soil sample to provide enough material for measuring mineral content including gold. The effects of intrastratal solution in a vertical section were also investigated. That portion of the buried valleys selected for testing is located south of Highway 66 between Kirkland Lake and Larder Lake, in Gauthier township. Three bore-holes were made in order to test the origin of the valley and the contained sediments. Two of these holes were spotted in the trunk valley and a third in a branch. The first and third bore-holes were made in a deep part of the trunk valley, but owing to technical difficulties and poor sample recovery the holes had to be abandoned at depths of 297 feet and 390 feet respectively before reaching bedrock.

The second bore-hole is in the branch valley, and the drill penetrated 241 feet of Quaternary sediments before reaching bedrock. A sample of sediments taken immediately above bedrock contained rock fragments of a chlorite-talc-sericite schist, also cobbles of blue-black vein quartz and abundant sand-size grains of barite and pyrite. Grains of free gold were not found but this is not considered significant because of generally poor recoveries of gold grains in all the gravel cores below the water table. Samples taken higher in the section of sandy material are auriferous.

Bedrock was drilled for a depth of 36 feet, and the drill remained for its full length in a soft chlorite-talc-sericite schist. Mineralization of the core includes considerable pyrite, vein quartz, and calcite. Fire assays made on the core showed no detectable amounts of gold and silver. Barite was not found in the core.

The valley penetrated by the second bore-hole is a major linear feature as outlined by seismograph. Its trend and location, together with the schistose nature of the bedrock encountered in the bore-hole suggest that the valley is localized along the westerly extension of the Larder Lake fault. The lithology of the bedrock in the drill-hole is similar to that seen in the Larder Lake fault. Although no gold was present in the schistose bedrock drilled, it is present in the overlying Quaternary sediments.

The objectives of this study were realized in bore-hole number 2 in that a major shear valley was first located by paleo-geomorphology through several hundred feet of Quaternary sediments. Hammer seismograph was a necessary tool to closer confirm these interpretations. Drilling proved a major shear and positioned it accurately along the extension of the Larder Lake fault, a position previously unknown. The objectives were only partly realized in bore-holes numbers 1 and 3 in that drilling failed to reach bedrock and thus did not provide information for an answer to the origin of the major trunk valley.

The bedrock core from bore-hole 2 has been placed in storage at Ottawa with the Geological Survey of Canada. Studies on vertical distribution of minerals in the Quaternary sediments and effects of intrastratal solution are not completed.

Drilling was done by the Soils Testing Laboratories of the Department of Public Works.

Bore-hole 1

Location: Gauthier township, mining claim 40569 in north-central part, lat. 48°52.2'W, long. 79°52.2'W. Lying on north side of sand road approximately 140 feet north of Mousseau Lake and 70 feet west of inlet stream.

Elevation of ground surface at top of bore-hole 967.7 feet ASL.

0-20 feet - brownish-grey uniform sand, Aeolian.
20-95 feet - interlaminated clay and sand, Glaciolacustrine.
95-297 feet - sandy gravels, interlaminated clay sand and silt, gravelly sands, Glaciofluvial.
at 297 feet - casing broke.

An average of 12 bulk samples of core contained less than 1 grain of gold 1.3 cu. ft.

Bore-hole 2

Location: Gauthier township, mining claim 39520 in southwest corner, lat. 48°07.4'N., long. 79°53.3'W. Lying on east side of sand road that follows boundary of Lebel and Gauthier townships, approximately 4,400' south of highway No. 11, marked by iron post.

Elevation of ground surface at top of bore-hole 1115.5 feet ASL.

0-20 feet	- grey fine sand, Aeolian, contains 9 grains of gold 1.3 cu. ft.
20-225 feet	- grey fine sand, silt, Glaciolacustrine, contains 6.1 grains of gold 1.3 cu. ft.
225-241 feet	- gravelly fine sand, sandy gravel, Glaciofluvial, contains 2.7 grains of gold 1.3 cu. ft. in sand cores but no recovery in gravel cores, also abundant coarse pyrite and coarse barite in size range 1.5 to 3.35 mm., rock fragments of blue-black vein quartz present and of soft chlorite-talc-sericite schist.
241-277 feet	- Chlorite-talc-sericite schist, Bedrock, contains blue-black vein quartz, calcite veins, abundant coarse pyrite, no gold or silver was detectable in core by fire assay.

Bore-hole 3

Location: Gauthier township, mining claim 30347 in central part, lat. 48°07.8'N., long. 79°52.5'W. Lying easterly from Crystal Lake road along highway No. 66 approximately 2,925 feet, then southerly from highway No. 66 approximately 2,100 feet.

Elevation of ground surface at top of bore-hole 1,102 feet ASL.

0-10 feet	- brown fine to medium sand, Aeolian.
10-50 feet	- laminated fine to medium sand, Glaciolacustrine.
50-225 feet	- no samples attempted.
225-390 feet	- medium sand, to sandy gravel, Glaciofluvial.
at 390 feet	- hole discontinued in Glaciofluvial.

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