Previous work on area:
2.2023 - Geological
2.1943 - Expenditure (First search)

THE SECOND BASAL TILL SEARCH

FOR GOLD WITHIN

MCGARRY TOWNSHIP, ONTARIO (32 D/4)

ON BEHALF OF

LEE - CANICO - TG JOINT VENTURE

BY:
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December, 1975

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SUMMARY

1. The second phase of exploration for gold using basal till done over 15 claims has recognized a gold train and partly defined it. This program follows a first phase basal till program, a limited biogeochemical survey for gold, and was done while some diamond drilling was in progress.

2. The survey used a grid of 800 feet and 1 cubic-foot samples of basal till were taken from subcrop, panned for gold, and superpanned to where microscopic counts could be made.

3. Tests were made to see whether, in the future, a smaller basal till sample could be used, a 0.5 cubic-foot sample. The conclusion reached is that the 0.5 cubic-foot sample could be used within target areas, but only at a sacrifice to losing weaker parts of the anomaly and weaker parts of the mineralized subcrop. The larger 1 cubic-foot sample is needed initially in searching for targets.

4. Two strongly anomalous gold trains in till are shown on the map, with their heads above the 25 gold clast contour per cubic-foot of till; or for coarse gold alone the heads exceed 10 clasts per cubic-foot. (At Kirkland Lake the ore zones are recognized in basal till by 2 to 5 gold clasts per 1.3 cubic-foot). The strong anomalies in McGarry are encouraging. They are still only partly cut-off to the north and are open to the northeast.

5. Clasts of other geo-indicators near the head of the gold trains include extensive chloritite and sericitized schist and point to a favourable major alteration structure for occurrences of gold ore in the subcrop.

6. Strongly sheared chloritite - carbonate rocks were drilled near the head of the gold fans beneath above 80 feet of clay. The rocks grade into lapilli tuff (?) also strongly sheared and with extensive sericite and hematite. A 6.3 foot drill section assays 0.010 oz/ton of gold, and next to this zone the tuff carries an estimated 10 to 20 per cent pyrite. The lapilli tuff grades further along the drill hole into pink trachyte with extensive alterations and shearing. The above sheared, chloritized, sericitized rocks intersected by drilling are a part of a much larger zone shown by the geo-indicator clasts. This partly fixes the structure which could be a favourable location for gold ore occurrence. This is encouraging.

7. Outcrops of calcarenite show some sericite alteration. Along their contacts with feldspar (Syenite or trachyte) porphyry there is extensive bleaching. Gold levels by channel sampling are variable, probably reflecting the poor sampling technique for this type of gold. One section gave a 0.08 oz/ton gold assay after previously giving nil values over a longer channel width.

Two out of three biogeochemical sites with gold anomalies match closely both in location and amounts, the gold later intersected by drilling into subcrop. These values are not economic. Another site where many elements peak in the biogeochemical sample is "on line" with a shear zone observed in outcrop, about 50 feet away and where there is 0.08 oz/ton of gold over a narrow width.

9. Recommendations are made here

1. To closer establish heads of the gold trains by additional till sampling on both an 800-foot and 200-foot grid (using a 0.5 cubic-foot sample at a total estimated cost of $15,000.

2. To carry out mechanical and hand stripping around the 0.08 oz/ton gold area of outcrop at an estimated total cost of $1,000.

3. To carry out additional biogeochemical sampling with analyses only for gold at a total estimated cost of $3,000.

4. To carry out a magnetometer survey over the contacts of gabbro with volcanic-sediment at an estimated cost of $2,000, and

5. The above best sites to be test drilled by overburden drilling so as to search for gold ore in the top 10 feet of subcrop. The estimated cost is $25,000.

INTRODUCTION

The second phase of exploration for gold using basal till was carried out in McGarry Township, Ontario, during August and September of 1975 by Lee Geo-Indicators Limited acting as manager for the Lee-Canico-TG Joint Venture. H.A. Lee was on the site from August 19th to September 8th, 1975, and S.A. Scott from August 19th to 20th, 1975, and they closely supervised all phases of the work from sampling, gold panning, superpanning to microscope counts for gold.

The purpose of the basal till exploration is to locate gold ore directly and also to delineate areas favourable for the occurrence of ore and which may then be further explored by follow-up methods.

Authority to do this work is given in the Agreement dated March 11, 1975 and signed by representatives of Lee Geo-Indicators Limited, Canadian Nickel Company Limited, and Texasgulf Canada Limited. Work was approved under the Initial Budget dated May 20, 1975.

The till sampling was done over 15 claims (L418814-17, L422246, L422251 L422254-55, L428749-52, L428775, L441501, L441504) to test the extensions of gold trains in till to the north and east of those established in the first basal till sampling phase (Lee, 1975).

PREVIOUS WORK

Outcrop geology of McGarry Township is given in a report and map at a scale of 1 inch to 1000 feet by Thompson (1941). The rocks are chiefly Temiskaming sediments occurring as conglomerate, greywacke and arkose; and Keewatin volcanics as trachyte and andesite. There is minor syenite porphyry.

A basal till reconnaissance survey showed geo-indicator boulders with low gold values and some gold clasts in till over the area (Lee, 1974). A follow-up basal till program (Lee, 1975) outlined two gold trains, then a bio-geochemical survey over possible shears at the head of the gold trains gave a number of anomalies (Scott, 1975). The biogeochemical anomalies in one of the gold trains were partly investigated by diamond drilling and an intersection of 6.3 feet of 0.010 oz./ton was attained.

SAMPLING AND ANALYTICAL METHODS

Sampling was done using an open (800 foot) grid oriented along former ice-flow with an azimuth of 165 degrees. The open grid was designed to find a gold clast train in the till at minimum cost and time. The basal till was searched out, dug for, pronounced on, and sampled. Only those sites are shown on the accompanying map where basal till was found. Two one-half cubic foot bulk samples were either carried on back-packs to a central zone for panning, or panned at the nearest pond. Volume of the sample was reduced by panning to about 5 pounds. A dispersing and wetting agent, calgon, was used to prevent loss of very fine gold during panning . Concentrates from the panning were further treated at the central field laboratory by superpanning. A long, narrow tail was obtained with one grain thickness, of chiefly magnetite and gold. Identification of the gold clasts was then made directly ver the superpanner using a binocular microscope. All gold clasts were scanned, identified and counted as either coarse clasts or fine clasts, and recorded. The heavy mineral concentrate was then stored for possible further geochemical analysis for additional elements.

REPRODUCIBILITY

The need to obtain reproducible sample results in measuring for precious metals such as gold has lead to the bulk sample in till exploration and counting gold clasts. Without this sample, results from normal fire assay and geochemical methods are totally misleading.

In gold exploration using till, Lee (1963) empirically used a 1.3 cubic foot sample, the size of sample that could be readily carried on two back-packs. Such a sample size did outline the coarse gold from the Kirkland Lake ore zones with anomalous values of gold at 2 to 5 clasts per 1.3 cubic foot of basal till. The present program reduced slightly the sample size to 1 cubic foot and introduced a refinement in measuring gold by use of a superpanner and microscopic counts of all gold sizes. Once a gold target was established and it was certain that samples would carry considerable gold, a test was introduced to see what would happen if the sample volume were reduced to one half a cubic foot, one back-pack load. As for obtaining the smaller sample, there would be no significant advantage with dug holes which are necessary anyway for adequate on site indentification of basal till, and sub-till striations. There would on the other hand be a considerable saving of time in panning operations.

In both Table 1 and Figure 1, we see the results of a series of duplicate samples from basal till, each set representing one sample site. Figure 1 is

TABLE 1 - Number of Gold Clasts in Duplicate Samples of Basal Till

Sample Site	A 0.5 cu. ft.			B 0.5 cu. ft.			Combined A + B		
	C	F	T	C	F	T	C	F	T
D599	3	5	8	4	7	11	7	12	19
D604	2	3	5	0	2	2	2	5	7
D605	0	0	0	0	0	0	0	0	0
D611	4	3	7	2	6	8	6	9	15
D613	1	1	2	0	1	1	1	2	3
D615	2	3	5	3	3	6	5	6	11
D616	4	8	12	9	8	17	13	16	29
D619a	1	4	5	0	3	3	1	7	8
D620	5	6	11	8	5	13	13	11	24
D621	1	1	2	4	1	5	5	2	7
D623	0	3	3	0	3	3	0	6	6
D624	0	7	7	2	3	5	2	10	12
D625	8	4	12	5	7	12	13	11	24
D627	3	6	9	2	7	9	5	13	18
D628	6	7	13	9	11	20	15	18	33
D629	5	6	11	3	9	12	8	15	23
D630	2	1	3	4	5	9	6	6	12
D635	4	9	13	3	11	14	7	20	27
D704	3	4	7	5	8	13	8	12	20
D705	8	9	17	6	11	17	14	20	34
D706	0	3	3	1	3	4	1	6	7

Sample Site	A 0.5 cu. ft.			B 0.5 cu. ft.			Combined A + B		
	C	F	T	C	F	T	C	F	T
D707	1	3	4	0	4	4	1	7	8
D709	0	0	0	0	1	1	0	1	1

C-- coarse gold clasts

F - microscopic gold clasts

T - total gold clasts

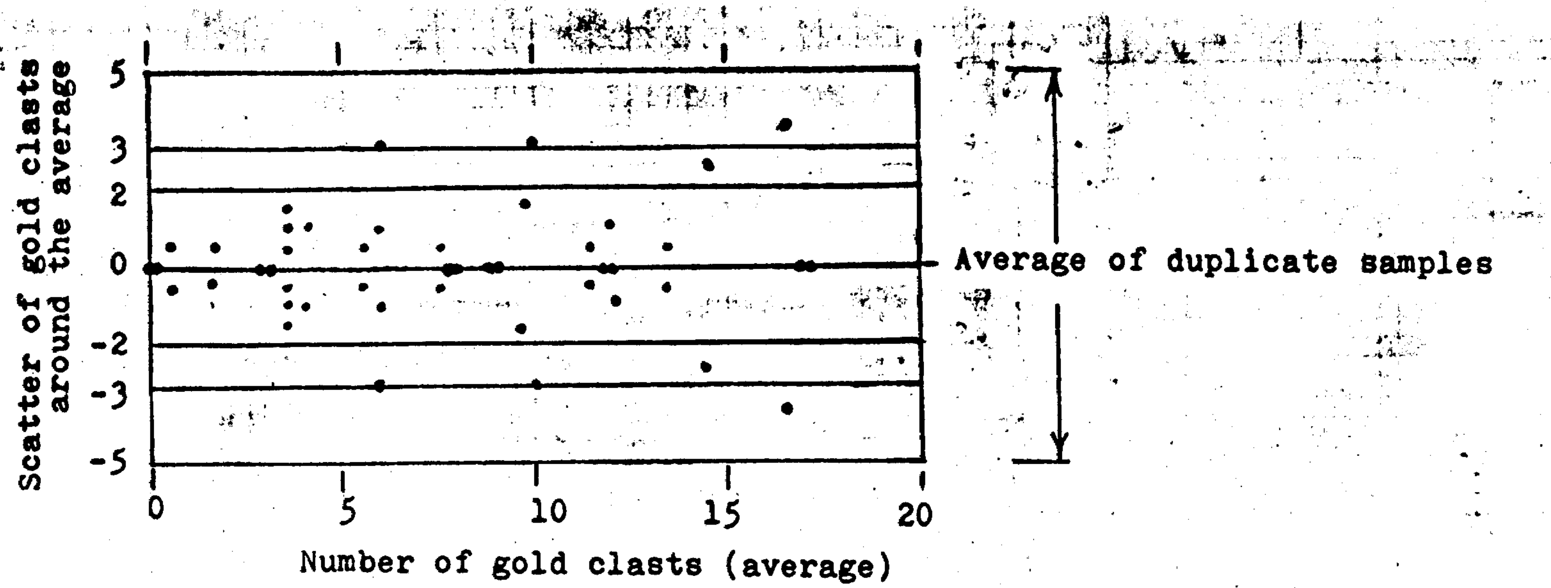

Figure 1A.- Gold clasts of all sizes

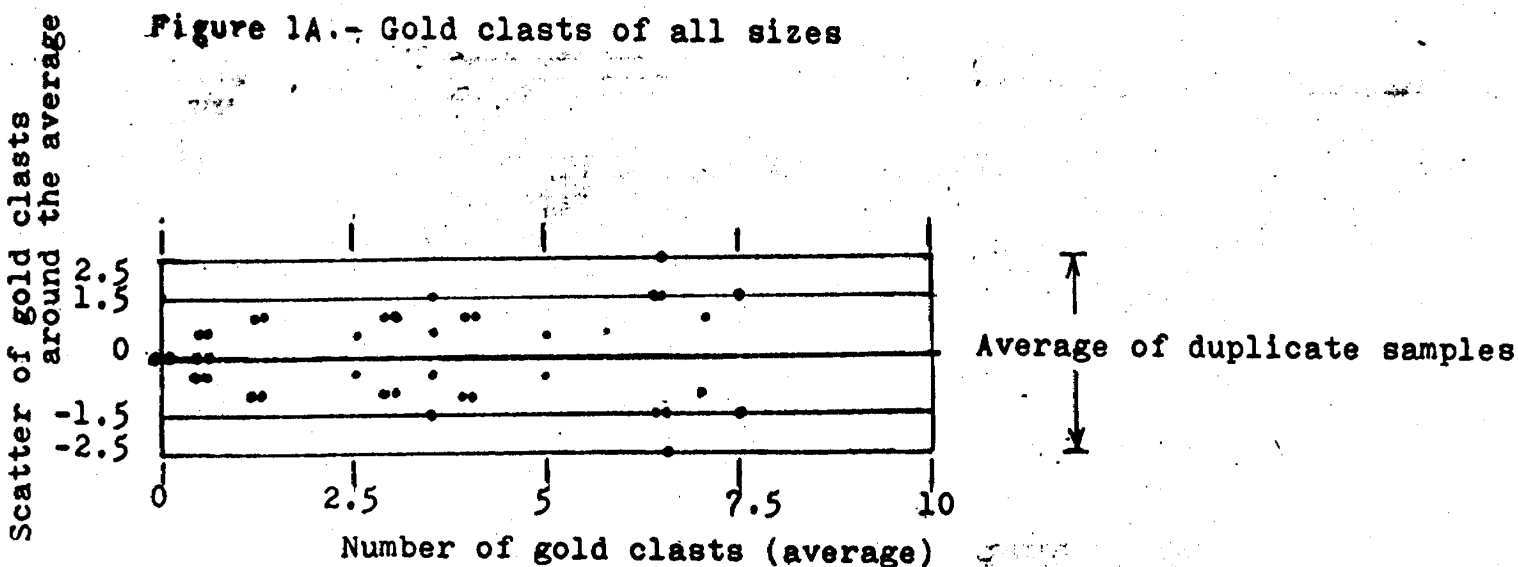

Figure 1B.- Coarse gold clasts

Figure 1.- Scatter of gold clasts in duplicate 0.5 cubic-foot samples of basal till

constructed so that the central horizontal line represents one half the number of gold clasts of all sizes that comes from the combined ore cubic-foot sample for each locality. It is equivalent to the average clast count for each pair of 0.5 cubic-foot samples. There is a vertical spread at each sample site which represents the difference between the counts of gold in individual samples and the average line.

We can see then in Figure 1A that the differences over the whole graph are between ± 2 to ± 3 gold clasts in the 0.5 cubic-foot samples. This can mean that we are in trouble in looking for an anomaly of total gold clasts under a level of 2, or by comparison with the present program, where a cubic-foot of till is used, under a level of 4. The smaller sample is seen to be adequate when it is within the gold target, but it is not satisfactory while searching for the target.

Figure 1B constructed for coarse gold alone provides a ready reference for comparison with the coarse gold orientation study at Kirkland Lake (Lee, 1963). The vertical spread in Figure 1B shows differences from the average of up to about ± 1.5. Such sampling is inadequate to outline the Kirkland Lake ore zone by basal till exploration (a 2 gold clast count for 1.3 cubic-foot sample), but it would outline portions of the ore zone.

The conclusion reached is that the 0.5 cubic-foot sample can be used within target areas but only at a sacrifice to losing weaker parts of the anomaly and weaker parts of the mineralized subcrop. In a search for target areas the large 1 cubic-foot sample is still needed to provide meaningful data.

RESULTS

Direction and Distance of Transport

The basal till method provides the intermediate step between reconnaissance exploration and test drilling of the indicated bedrock source. The basal till itself is a paleosample of the total bedrock surface. Any ore, subore, and associated pathfinder geo-indicators are dispersed into an indicator train spreading "down-ice" from the source point(s). Its transport direction in McGarry Township is given by striations on subcrop below till, and outcrop, at 150° to 180° azimuth. Movement was to the south shown by roches moutonnées.

The train of gold clasts in the till, shown on the occompanying map, cuts off at sites D605 and D709 in a region when the rock types that outcrop are gabbroic, indicating that these sites are north of the gold zone in bedrock.

The Gold Trains in Basal Till

The accompanying map shows two major gold trains emanating from an area between the north baseline and a distance about 1200 feet north, and with a dispersion south-southeastwards for a total of about 4000 feet. The western gold train has sample sites between lines 40 E and 56 E in which gold clasts are as numerous as 34 per cubic foot of basal till, or when expressed as coarse gold 14. Background is less than 4 clasts of total gold or 2 clasts of coarse gold. The 34 and 14 levels respectively are strongly anomalous as compared to 2 to 5 coarse gold clasts per 1.3 cubic-foot of till "down-ice" from the ore zones at Kirkland Lake (Lee, 1963).

The second gold train crosses the northern baseline between lines 64E and 80E with the easterly boundary still open. Here too the levels of gold clasts are exceptionally high, as many as 33 clasts of gold per cubic foot of basal till, or 15 clasts of coarse gold.

There are several shorter gold trains in addition to the above. One stretches along the north baseline from lines 40E to 16E, and another along the south baseline between lines 24E and 32E.

Geo-Indicator Clasts

A strong chloritic shear zone under the head of the gold trains approximately parallels the north baseline as shown by clasts in basal till at sites D618, D625, D635 and D705 (Table 2).

Strong sericite alteration accompanies the above shearing shown by clasts in basal till at D597, D630, and D635.

Mariposite, the chrome mica sometimes associated with gold, is in clasts of basal till at sites D619a and D630.

Table 2

Geo-Indicator Clasts in Basal Till by Sample Sites

Site No.	Blue-Black Quartz	Chlor-itite	Car-bonate	Abund-ant Sericite	Abund-ant Hematite	Abund-ant Sheared	Mari-posite	Bleached Altera-tion	Brec-ciated	Sulphide
576	+	-	+	-	-	+	+	-	-	-
577	+	-	-	-	-	-	-	-	-	-
579	+	-	-	-	-	-	-	+	-	-
580	-	-	-	-	-	-	-	-	-	-
581	-	-	-	-	-	+	-	-	+	-
582	-	+	-	-	-	+	-	-	+	-
584	-	-	-	-	-	+	-	-	-	+
585	-	-	-	-	-	-	-	-	-	-
586	-	-	-	-	-	-	-	-	-	+
590	-	+	-	-	-	-	-	-	-	-

Table 2 (Continued)

Site No.	Blue-Black Quartz	Chlor-itite	Car-bonate	Abund-ant Sericite	Abund-ant Hematite	Abund-ant Sheared	Mari-posite	Bleached Altera-tion	Brec-ciated	Sulphide
591	+	+	-	-	-	-	-	-	-	+
592	+	+	+	-	-	+	-	+	+	-
593	+	-	-	-	-	-	-	+	+	+
594	-	-	-	-	-	-	-	+	+	-
596	-	-	-	-	-	-	-	-	-	-
597	-	+	-	-	-	-	-	-	-	-
598	+	-	-	-	-	-	-	-	-	-
599	-	-	-	+	-	-	-	+	-	-
601	-	-	+	-	-	+	-	+	-	-
602	-	-	+	-	-	+	-	+	-	-
605	-	-	-	-	-	-	-	-	-	-
606	+	-	-	-	-	+	-	-	+	-
607	+	-	-	-	-	+	-	-	-	+
610	+	-	+	-	-	+	-	-	-	+
611	-	-	+	-	-	-	-	+	-	-
612	-	-	+	+	-	+	-	-	-	-
613	-	-	-	-	-	-	-	-	-	-
614	+	-	+	-	-	-	+	-	+	-
615	+	-	-	+	-	+	-	+	-	-
616	-	-	-	-	-	-	-	-	-	-
618	+	-	+	-	-	-	-	-	-	-
619	-	+	-	-	-	+	+	-	-	-
620	-	-	+	-	-	+	-	-	+	+
621	-	-	-	+	-	-	-	-	-	-

Site No.	Blue-Black Quartz	Chlor-itite	Car-bonate	Abund-ant Sericite	Abund-ant Hematite	Abund-ant Sheared	Mari-posite	Bleached Altera-tion	Brec-ciated	Sulphide
623	-	-	-	-	-	+	-	-	-	-
624	-	+	-	-	-	+	-	+	+	-
625	+	+	-	-	-	-	-	+	-	-
627	+	-	-	-	-	+	-	-	-	-
628	-	-	-	-	-	-	-	-	-	-
629	+	-	+	+	+	-	-	+	-	-
630	-	-	-	+	+	-	+	+	-	-
635	+	+	+	+	+	+	-	+	-	-
700	-	-	-	-	-	-	-	+	-	+
702	-	-	-	-	-	-	-	-	-	-
704	-	-	+	-	-	-	-	-	-	-
705	-	+	+	-	-	-	-	-	-	-
706	-	-	+	-	-	-	-	-	-	-
707	-	-	-	-	-	-	-	-	-	-
709	-	-	-	-	-	-	-	-	-	-
710	-	+	+	-	+	+	-	-	-	-

Geology Along Line 48 E

Mapping by outcrop and diamond drilling was carried out over the head of the gold indicator train along Line 48E. in an attempt to isolate the favourable structures for the occurrence of gold known from the basal till program. The accompanying map shows a plan and sections of the geology so far as it was determined. All the subcrops and outcrops, (except for the drift) are of Archean age.

The south end of the section is underlain by Temiskaming sediments including conglomerate and arenite both showing rapid facies changes. Drill hole No. 51515 is within the sediments (Perry, 1975).

The subcrop drops off steeply north of the area of above sediments and drill hole No. 51514 at a depth of 82 feet, inclination 50°, was unable to reach it. We think that this is underlain by strongly sheared chloritic rocks. At 00 + 50 north the drill hole No. 51513 reached the subcrop and proved the position for a very strong wide shear zone. The shearing is nearly vertical, at an angle of 50° on a 50° hole. The lithology is chloritite and carbonate over a drill width of 70 feet and of course the width extended southwards but not drilled is expected to be much much greater, up to 2,500 feet. Lithology and shearing showed a twin like resemblance between hand specimens of the "Larder Lake fault" outcrop at Fork Lake along Highway 66 and drill core from this hole when both were placed side by side. The drill core showed minor veinlets of blue black quartz and a rare speck of mariposite, the green mica occurring with gold at Virginiatown but also in non gold bearing rocks. The genesis of the chloritite - carbonate rock prior to shearing is difficult to say. Possibly it was a volcanic tuff or maybe a sediment. The carbonate in it readily reacts to dilute HCl.

Further along in the same drill hole the rock changes to a lapilli tuff(?). It is still sheared and there is both sericite and hematite alteration. Many of the fragments are siliceous and there are bands of 10 to 20 per cent pyrite. There is some gold in the sheared lapilli tuff with an assay length of 6.3 feet carrying 0.010 ounces of gold per ton.

Still further along in the same drill hole the lapilli-tuff passes through a sericite schist and grades into fine grained pink trachyte. The trachyte is described as dark red hematite matrix and contains pale green anhedrol feldspar phenocrysts. It is schistose and carbonated and carries a trace of pyrite. The microscopic description from thin section follows:

- Feldspar 30% as phenocrysts; highly sericitized, carbonatized
- Sericite, carbonate 43% as matrix material, fine-grained
- Quartz 5% as matrix material
- Hematite 2%, very fine-grained throughout matrix
- A few carbonate-sericite pseudomorphs after amphibole phenocrysts
- Trace pyrite
- Sericite - carbonate schist, or trachyte

This rock resembles in thin section outcrops mapped by the ODM (Our grid 0 + 20N; 72 + 30E) as trachyte (Thompson, 1941).

Further north drill hole 51512 shows the subcrops to be a yellow sericite tuff which is interbedded with subarkose; both are sheared.

The outcrops appear as small mounds and are chiefly calcarenite. The petrology of calcarenite for a number of rock specimens is given in Appendix 1 and by way of an example one is described here:

Fine to medium-grained sediment, grey-green. Calcareous, arenaceous. Trace disseminated pyrite, jasper. Carbonate (ankerite) grains weather brown.

Microscopic:

- Quartz 50%, angular; most grains show strain
- Feldspar 40%, angular, sericitized, plagioclase and potash feldspar
- Carbonate 10%, as matrix material and feldspar alteration
- Pyrite trace, jasper, carboniferous grains. Carbonate weathers brown
- Slight layering observed.

The calcarenites grade into a pink feldspar porphyry which is either a trachyte or syenite porphyry. There is considerable bleaching of the porphyry along the contact.

Other rocks exposed and sampled during staking include a chloritite - carbonate schist which outcrops on the north boundary of claim L 428754 (Appendix No. 1637), and gabbroic rocks which form hills north of the area of the geology map.

Biogeochemistry Relates to Subcrop

The biogeochemical survey along line 48E (Scott, 1975) produced several anomalies which are plotted on the accompanying geological map. The 0.002 ppm gold in vegetation is vertically over bedrock in drill hole 51515 with gold at 0.005 oz/ton. A three point gold vegetation anomaly of 0.01 to 0.03 ppm gold is over a 6.3 foot wide zone in drill hole 51513 of 0.010 oz/ton. The northern biogeochemical anomaly of 0.04 ppm gold was not intersected in drilling, possibly the drill hole passed below this target.

The biogeochemical zone "R strong" represented by a synchronous rise in many elements is approximately in-line with a shear in outcrop where 0.080 oz/ton gold was measured across 0.5 feet. An earlier wider channel sample across the same zone gave nil gold values by fire assay. The repeat sample was taken when a speck of chalcopyrite was seen in a blue-black quartz veinlet; and this repeat gave the higher value.

Discussion

A broad strong shear structure is established along line 48E in subcrop. This structure with its extensive alteration - chlorite, sericite, carbonate, hematite - shows a favourable zone for the occurrence of gold. Uneconomic values of 0.0010 oz/ton were intersected in one short hole, but considering the very erratic nature of gold in drill core (Koch and Link, 1967) this one intersection is not a sufficient test. Hence the results on subcrop and by biogeochemistry are still too sparse and do not adequately assess the subcrop for mineralization where there is an extensive altered structure underlying the heads of gold trains.

CONCLUSIONS AND RECOMMENDATIONS

Where We Are

The second phase of basal till sampling for gold on an 800 - foot grid has recognized a gold train and has partly outlined it. The level of gold clasts is strongly anomalous and encouraging. A small amount of biogeochemical sampling has been done and correlates well to subcrop. A limited amount of drilling with a Winkie drill has been done and establishes the ground position for the sheared structures and the strong chlorite, carbonate, sericite, hematite alteration zones. Low gold (0.010 oz/ton across 6.3 feet) was intersected in one hole within the generally sheared rocks. The intensely sheared rocks underlie about 80 feet of drift, whereas the less sheared rocks to the north from small low outcrops.

Where To?

Recommendation is made here to establish the heads of the gold indicator fans by additional till sampling on both an 800 - foot and 200 - foot grid using the smaller 0.5 cubic-foot sample. The cost is estimated at $15,000 inclusive of interpretative map and report. Some mechanical and hand stripping is recommended in the area of the 0.08 oz/ton outcrop at an estimated cost of $1,000 inclusive of map and report. Additional biogeochemical sampling with analysis only for gold is here recommended to search out the better sites, at a cost of $3,000. To obtain a contact between gabbroic rocks and the volcanic-sedimentary rocks a magnetometer survey is recommended, at an estimated cost of $2,000. To test the top 10 feet of subcrop for gold an overburden drilling program at estimated cost of $25,000 should be considered, and where ore or ore grade intersections are attained then bulk sampling should be done.

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2:1625
* Qualifications

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APPENDIX "A" THIN SECTION REPORT

McGarry Township

No: 1633

Location: 9 + 05 N; 48 + 15E (subcrop in till pit)

Description:

Fine - to medium - grained gray sediment, a few jasper fragments.

Calcarenite.

Finely disseminated pyrite 1%, uniform throughout.

Microscopic:

Quartz 50%, angular fragments. Slight layering produced by alignment of elongated fragments.

Feldspar 45%, plagioclase and potash feldspar, sericitized

Carbonate 4%, fine grained in matrix and as feldspar alteration

Pyrite 1%, angular, anhedral grains.

- a few jasper and black carboniferous grains. Very little fine matrix material
- Relatively fresh calcarenite - carbonate cement.

No: 1634

Location: 7 + 40N, 47 + 00E

Description:

Fine - to medium - grained greenish-grey sediment - calcarenite. A few jasper grains. Two (sedimentary?) bands 0.3 cm wide contain 10% disseminated pyrite.

Cut by 0.2 cm white carbonate veinlet, weathers brown (ankerite?)

Microscopic:

Quartz 50%, angular, shows layering

Feldspar 30%, angular, highly sericitized, carbonatized

Carbonate 19% as veinlets, matrix (cement) and feldspar alteration; very fine-grained.

Pyrite 1%, mainly in thin (sedimentary) band offset by a small fracture filled with carbonate.

- A few carboniferous fragments.
- Sedimentary layering shown by grain size distribution and grain orientation.
- Calcarenite

No: 1635

Location: 8 + 70N; 47 + 55E

Description:

Fine - to medium - grained sediment, grey-green. Calcareous, arenaceous. Trace of disseminated pyrite, jasper.

Carbonate (ankerite) grains weather brown.

Microscopic:

- Quartz 50%, angular; most grains show strain.
- Feldspar 40%, angular sericitized plagioclase and potash feldspar.
- Carbonate 10%, as matrix material and feldspar alteration.
- Pyrite trace, jasper, carboniferous grains. Carbonate weathers brown.
- Slight layering observed.

No: 1636A

Location: 7 + 00N, 47 + 00E

Description:

Medium- to fine-grained grey-green sediment. Massive. Shows yellow, wispy sericite alteration. Trace disseminated pyrite. Jasper fragments.

Microscopic:

- Quartz 40%, angular to sub-rounded, some grains showing strain.

- Feldspar 40% - plagio-clase and potash feldspar, sericitized.
- Carbonate 30% - as fine-grained matrix and feldspar alteration.
- Pyrite, jasper, biotite are accessories.
- Calcarenite.

No: 1636B

Location: 7 + 00N, 47 + 00E

Description:

As in 1636A but with visible lineation of mineral grains.

Microscopic:

As in 1636A but with pronounced lineation in matrix carbonate stringers.

No: 1637

Location: Approx. 12 + 00N, 74 + 00E

Description:

Sheared, foliated rock, medium green with limonite stain. Irregular feldspar grains up to 0.2 cm fractured, some are recrystallized, show flowage. Extensive chloritization, stringers of chlorite. Leucoxene alteration on some grains. Carbonate weathers brown. Trace pyrite.

Microscopic:

- Chlorite 50% as stringers, fine-grained matrix, alteration areas.
- Carbonate 45%, as stringers, irregular swirled areas.
- Quartz 5%, as angular, often fractured grains in lines and clumps - remnant of arenaceous sediment?
- Sericite pseudomorphys of large, lath-shaped grains of feldspar (?) - could represent phenocrysts in a porphyry.
- Large, fractured leucoxene grains in part replaced by chlorite.

Trace of pyrite

- Chlorite - carbonate schist.

No: 1682

Location: 0 + 20N, 72 + 30E

Description:

Pale green sheared rock. Larger pale (porphyritic) feldspars subhedral in fine-grained matrix. Matrix contains wavy lines of yellow sericite alteration which show shear lineation. Boundaries of feldspar grains diffuse into matrix.

Disseminated anhedral pyrite grains have limonite borders. Rock weathers with skin of red-brown carbonate and feldspar. Specks of dark green chlorite in matrix.

Microscopic:

- Ground mass 68%; very fine-grained quartz, feldspar - sericitized and carbonated.
- Plagioclase phenocrysts (andesine?) 20%
- Quartz 10% in matrix
- Biotite 2% in matrix, Pyrite 1%
- Foliation caused by shearing shows clearly. Weathered skin shows limonite grains after pyrite and ankerite(?)
- In plane light texture looks sedimentary, grain boundaries are rounded.
- With xnicols, texture looks porphyritic, with plagioclase phenocrysts in a fine-grained quartz-feldspar matrix
- Trachyte porphyry (sheared) or syenite porphyry.

Start a new page for every new hole, but fill in top portion of form only on first page for each hole.

APPENDIX "B" DRILL LOGS

FILL IN ON EVERY PAGE	HOLE NO.	PAGE NO.
	51509	1

DRILLING COMPANY	Canadian Nickel Co. Ltd
COLLAR ELEVATION	
BEARING OF HOLE FROM TRUE NORTH	345°
TOTAL FOOTAGE	150
DIP OF HOLE AT collar	-45°
LOCATION OF HOLE IN RELATION TO A FIXED POINT ON THE CLAIM	Grid Co-ordinates L 48 + 00E 17 + 70S
MAP REFERENCE NO.	32 D/4; ODM Map 50A
CLAIM NO.	
DATE HOLE STARTED	August 16, 1975
DATE COMPLETED	August 19, 1975
DATE LOGGED	Aug. 19/75
LOGGED BY	H. A. Lee
LOCATION (Tp., Lot, Con. OR Lat. and Long.)	McGarry Township
EXPLORATION CO., OWNER OR OPTIONEE	Lee Geo-Indicators Limited, In Trust
DATE SUBMITTED	
SUBMITTED BY (Signature)	
PROPERTY NAME	

FOOTAGE FROM	FOOTAGE TO	ROCK TYPE	DESCRIPTION Colour, grain size, texture, minerals, alteration, etc.	PLANAR FEATURE ANGLE °	CORE SPECIMEN FOOTAGE +	YOUR SAMPLE NUMBER	SAMPLE FOOTAGE FROM	SAMPLE FOOTAGE TO	SAMPLE LENGTH	ASSAYS +		
0	35	unconsolidated	clay									
35	50	lost core										
50	57	conglomerate	grey conglomerate; incl jasper pebbles and thin 2" wide sparsely disseminated pyrite in cubes									
57	78	conglomerate	grey conglomerate									
78	79	conglomerate	conglomerate contains 1/2" of massive pyrite									
79	81	conglomerate	grey conglomerate									
81	81.5	chlorite joint	chlorite in a 2-inch wide intersection along with quartz and pyrite									
81.5	83	grey wacke	pale green, fine grained, grey wacke(?)									
83	83.5	quartz-pyrite	grey wacke with a 1/8-inch fracture containing equal parts of pyrite and quartz									
83.5	91	grey wacke	pale green, fine grained									
91	92	chlorite schist	chlorite with favourable blue-black quartz veins									
92	93	shale	feldspar crystals in a very fine grained matrix									
93	132	shale	fine grained dark grey soft mud stone									
132	150	shale-cgl	fine grained dark grey soft mud stone with occasional pebbles									

Start a new page for every new hole, but fill in top portion of form only on first page for each hole.

FILL IN ON EVERY PAGE — HOLE NO.: 51510 — PAGE NO.: 1

DRILLING COMPANY: Canadian Nickel Company	COLLAR ELEVATION:	BEARING OF HOLE FROM TRUE NORTH: 345° Az	TOTAL FOOTAGE: 200
DATE HOLE STARTED: August 22, 1975	DATE COMPLETED: August 25, 1975	DATE LOGGED: Aug. 25/75	LOGGED BY: H. A. Lee
EXPLORATION CO., OWNER OR OPTIONEE: Lee Geo-Indicators Limited, In Trust	DATE SUBMITTED:	SUBMITTED BY (Signature):	

DIP OF HOLE AT: collar -45°; ft °; ft °; ft °; ft °

LOCATION OF HOLE IN RELATION TO A FIXED POINT ON THE CLAIM: Grid location 48 + 00E 6 + 00N

MAP REFERENCE NO.: 32 D/4; ODM Map 50A

CLAIM NO.:

LOCATION (Tp., Lot, Con. OR Lat. and Long.): McGarry Township

PROPERTY NAME:

FOOTAGE FROM	FOOTAGE TO	ROCK TYPE	DESCRIPTION Colour, grain size, texture, minerals, alteration, etc.	PLANAR FEATURE ANGLE °	CORE SPECIMEN FOOTAGE +	YOUR SAMPLE NUMBER	SAMPLE FOOTAGE FROM	SAMPLE FOOTAGE TO	SAMPLE LENGTH	ASSAYS +
0	3	unconsolidated	till							
3	8	calcarenite	fine grained grey							
8	13	trachyte porphyry	reddish-buff rock; feldspars euhedral, bleached alt.							
13	13.5	trachyte	veins 2 in. wide of quartz-ankerite							
13.5	27	trachyte	reddish-yellow zones; moderate sericite alterations; seams of fg pyrite							
27	60	trachyte	reddish unaltered trachyte or syenite							
60	75	sericite tuff	fine grained; extensive yellow and yellow green alteration with hardness of about tuff							
75	100	tuff-sediment	fg sediment with some flow structure							
93	94		flow structure as if in soft sediment							
100	108	tuff	fine grained pale yellow; a quartz vein 1/2 in. wide							
108	125	grew wacke	fg sediment with chips of yellow fg silt							
125	153	fine sediment	greenish grey fg sediment							
153	153.5		quartz vein with pink zones of trachyte(?)							
153.5	159	fine sediment	greenish grey fg sediment							
159	159.5	quartz vein	quartz vein 1 inch wide with sericite							
159.5	162	fine sediment	greenish grey fg sediment							
162	164	cherty sediment	cherty fragments							
164	175	silt stone	grey fg silt stone							
175	183	fg sediment	fg greenish sediment							
183	185		quartz-vein; extensive sericite alteration; minor graphite and ankerite							
185	200	trachyte-syenite porphyry	feldspar porphyry, minor pyrite, reddish							

Start a new page for every new hole, but fill in top portion of form only on first page for each hole.

FILL IN ON EVERY PAGE — HOLE NO. 51511 — PAGE NO. 1

DRILLING COMPANY: Canadian Nickel Company	COLLAR ELEVATION:	BEARING OF HOLE FROM TRUE NORTH: 345° az.	TOTAL FOOTAGE: 198
DATE HOLE STARTED: August 26, 1975	DATE COMPLETED: August 27, 1975	DATE LOGGED: Aug. 22/75	LOGGED BY: H. A. Lee
EXPLORATION CO., OWNER OR OPTIONEE: Lee-Geo. Industries Limited, In Trust		DATE SUBMITTED:	SUBMITTED BY (Signature):

DIP OF HOLE AT: collar -45°; ft ; ft ; ft ; ft

LOCATION OF HOLE IN RELATION TO A FIXED POINT ON THE CLAIM: Grid L 48 + 00E, 4 + 60N

MAP REFERENCE NO.: 32 D/4; ODM Map 50A

CLAIM NO.: -

LOCATION (Tp., Lot, Con. OR Lat. and Long.): McGarry Township

PROPERTY NAME:

FOOTAGE FROM	FOOTAGE TO	ROCK TYPE	DESCRIPTION (Colour, grain size, texture, minerals, alteration, etc.)	PLANAR FEATURE ANGLE *	CORE SPECIMEN FOOTAGE +	YOUR SAMPLE NUMBER	SAMPLE FOOTAGE FROM	SAMPLE FOOTAGE TO	SAMPLE LENGTH	ASSAYS +		
0	7	unconsolidated	boulders and till									
7	12	calcarenite	fg pale greenish yellow sediment, "string-sand" seams of fg pyrite									
12	21	calcarenite-tuff	fg pale yellow to buff soft mixed sediment-volcanic with fg disseminated pyrite									
21	23	silt stone-tuff	fg reddish and yellowish alterations									
23	26	carbonate	white carbonate with quartz, sericite, pyrite									
26	45	calcarenite	fg grey calcarenite, minor sericite alteration, minor disseminated fg pyrite									
45	51	calcarenite-tuff	interlayered grey calcarenite with yellow chips of silt stone or tuff to bands of yellow tuff; finely disseminated pyrite									
51	61	calcarenite	grey calcarenite, minor yellow sericite; disseminated fg pyrite									
61	67	tuff	fg yellow, strongly altered tuff-sediment; contains a one-inch lens of pyrite and a 1/8-in. layer of pyrite									
67	87	calcarenite	grey, fg pyrite disseminated									
87	92	altered syenite or trachyte	mottled green-yellow rock with chlorite chips and sericite alteration									
92	127	syenite or trachyte	pinkish colour, euhedral feldspars in fg pink matrix of feldspar(?) and pyroxene									
127	131	trachyte-sediment	pinkish colour grades to yellow colour; increased sericite alteration; disseminated pyrite 130 - 131									
131	151	sub-arkose	fg greenish-grey arenaceous; minor sericite, minor pyrite									
151	153	pebbly sub-arkose	pebbles scattered									
153	157	sub-arkose	grey arenaceous sediment, occ. small pebbles; minor yellow sericite; bands and thin layers of pyrite									
157	158	sericite	layers of vfg yellow sericite									
158	166	sub-arkose	mg arenaceous sediment with a fragment of red iron									
166	167	tuff-sediment	gradation; yellow-grey, sericite alteration, altered tuff-sediment; some fragments of mariposite green									
167	170	bedded tuff	vfg layered yellow mud, and 6" band of yellow mud; thin seam of pyrite at 170', sheared?									
170	173	sub-arkose	fg greenish-grey arenite; pyrite seam 1/8" wide at 172'									
173	178	fg sediment	fg greenish arenite with thin pyrite seam									
178	178.5		vein blue-black qtz in 1/2" vein; black walls to quartz									
			(continued)									

Start a new page for every new hole, but fill in top portion of form only on first page for each hole.

FILL IN ON EVERY PAGE

HOLE NO.	PAGE NO.
51511	2

DRILLING COMPANY	COLLAR ELEVATION	BEARING OF HOLE FROM TRUE NORTH	TOTAL FOOTAGE	DIP OF HOLE AT	LOCATION OF HOLE IN RELATION TO A FIXED POINT ON THE CLAIM	MAP REFERENCE NO.	CLAIM NO.
				collar °		32 D/4; ODM Map 50A	

DATE HOLE STARTED	DATE COMPLETED	DATE LOGGED	LOGGED BY	ft °	LOCATION (Tp., Lot, Con. OR Lat. and Long.)

EXPLORATION CO., OWNER OR OPTIONEE	DATE SUBMITTED	SUBMITTED BY (Signature)	ft ° / ft ° / ft °	PROPERTY NAME

FOOTAGE FROM	FOOTAGE TO	ROCK TYPE	DESCRIPTION Colour, grain size, texture, minerals, alteration, etc.	PLANAR FEATURE ANGLE °	CORE SPECIMEN FOOTAGE +	YOUR SAMPLE NUMBER	SAMPLE FOOTAGE FROM	SAMPLE FOOTAGE TO	SAMPLE LENGTH	ASSAYS +		
178.5	181		mg. arenaceous mottled green with minor sericite and pyrite									
181	183	silt stone	siliceous, pyrite seams									
183	186	silt stone	fg greenish-grey silt stone, minor pyrite, thinly bedded									
186	198	silt stone	fg grey arenaceous to silt stone; minor sericite, minor pyrite									

Start a new page for every new hole, but fill in top portion of form only on first page for each hole.

FILL IN ON EVERY PAGE — HOLE NO. 51512 — PAGE NO. 1

DRILLING COMPANY	COLLAR ELEVATION	BEARING OF HOLE FROM TRUE NORTH	TOTAL FOOTAGE	DIP OF HOLE AT	LOCATION OF HOLE IN RELATION TO A FIXED POINT ON THE CLAIM	MAP REFERENCE NO.	CLAIM NO.
Canadian Nickel Company		345° az.	90	collar -35	Co-ordinates L 48 + 00E 4 + 10N		

DATE HOLE STARTED	DATE COMPLETED	DATE LOGGED	LOGGED BY
August 28, 1975	August 30, 1975	August 29/75	H. A. Lee

EXPLORATION CO., OWNER OR OPTIONEE	DATE SUBMITTED	SUBMITTED BY (Signature)
Lee Geo-Indicators Limited		

LOCATION (Tp., Lot, Con. OR Lat. and Long.): McGarry Township

PROPERTY NAME:

FOOTAGE FROM	FOOTAGE TO	ROCK TYPE	DESCRIPTION Colour, grain size, texture, minerals, alteration, etc.	PLANAR FEATURE ANGLE °	CORE SPECIMEN FOOTAGE +	YOUR SAMPLE NUMBER	SAMPLE FOOTAGE FROM	SAMPLE FOOTAGE TO	SAMPLE LENGTH	ASSAYS +		
0	9	unconsolidated										
9	33	sericite-tuff	fg yellow-green; strong sericite alteration; yellow buff weathering at joints due to carbonate; fine grained pyrite disseminated; occ. qtz veins 1/4 in. wide									
16	16.5	broke into unconsolidated	in open rock fracture, unconsolidated, syenite boulders									
16.5	23	sericite tuff	yellow sericite tuff									
23	25	sericite	siliceous veins 1/4 inch wide									
25	31	sericite tuff	over 1 foot width thin streaks 2-inches wide ankerite-quartz									
33	43	sub arkose	mg grey-green sub-arkose; pyrite minor; sericite minor; at 34 feet thin strings of sulphides - at 43 feet buff carbonate vein; pyrite lens									
43	54	sericite schist	sheared yellow sericite									
54	75	sub arkose	grey, green sub-arkose, minor sericite									
75	76	sericite schist	fg sulphide bands in yellow sericite schist									
76	86	sub-arkose	mg sub-arkose with considerable fg sulphide									
86	90	sericite-carbonate	fg pale yellow sericite with thin veins (1/4 inch) of carbonate									

Additional credit available. See Assessment ...

[redacted]ES

Start a new page for every new hole, but fill in top portion of form only on first page for each hole.

FILL IN ON EVERY PAGE — HOLE NO. 51513 — PAGE NO. 1

DRILLING COMPANY	COLLAR ELEVATION	BEARING OF HOLE FROM TRUE NORTH	TOTAL FOOTAGE	DIP OF HOLE AT	LOCATION OF HOLE IN RELATION TO A FIXED POINT ON THE CLAIM	MAP REFERENCE NO.	CLAIM NO.
Canadian Nickel Co. Ltd.		345P az.	251	collar -50°	Grid Co-ordinate L 48 + 00E 0 + 50N	32 D/4; ODM Map 50A	

DATE HOLE STARTED	DATE COMPLETED	DATE LOGGED	LOGGED BY
September 1, 1975	September 4, 1975	Sept. 4/75	H. A. Lee

EXPLORATION CO., OWNER OR OPTIONEE	DATE SUBMITTED	SUBMITTED BY (Signature)	LOCATION (Tp., Lot, Con. OR Lat. and Long.)	PROPERTY NAME
Lee Geo-Industries Ltd., In Trust			McGarry Township	

FOOTAGE FROM	FOOTAGE TO	ROCK TYPE	DESCRIPTION Colour, grain size, texture, minerals, alteration, etc.	PLANAR FEATURE ANGLE *	CORE SPECIMEN FOOTAGE +	YOUR SAMPLE NUMBER	SAMPLE FOOTAGE FROM	SAMPLE FOOTAGE TO	SAMPLE LENGTH	ASSAYS +
0	88	unconsolidated	5' peat 5-88' clay							
88	89	chlorite-carbonate schist	mg weakly speckled rock of qtz-calcite-feldspar-chlorite with 5% sulphide and blue-black quartz							
89	90	chlorite-carbon-ate schist	chlorite shear with quartz-calcite veins; calcite is pink and white, slicken slides * and shear *	50°						
90	91	lost core								
91	102	chlorite-carbon-ate schist	strong chlorite shear at 91 then speckled white to dark grey rock of carbonate and chlorite; also quartz and calcite mottling; minor vfg specs of sulphides, shear *	45°						
102	102.5	chlorite-carbon-ate schist	vfg yellow specs in chlorite-carbonate-qtz; leached with HNO, 1:1 hot; but no visible gold							
102.5	104	chlorite-carbon-ate schist	calcite, pink and white abundant							
104	106	chlorite-carbon-ate-qtz schist	yellow specks, vfg; assay for gold							
106	107	chlorite schist								
107	108	core lost								
108	127	chlorite-carbon-ate schist	chlorite schist with spots of calcite 121 - 122 lost core							
127	127.5	chlorite schist	vein of porcelanic quartz with hematite in chlorite shear							
127.5	129	chlorite schist								
129	131	qtz vein	quartz vein with reddish hematite and minor chlorite and vfg yellow specks, assay for gold							
131	132	chlorite schist	minor calcite in chlorite schist							
132	133	lost core								
133	137	chlorite-carbon-ate schist								
137	137.5	chlorite-carbon-ate schist	specks of shiny yellow, assay for gold							
137.5	143	chlorite-carbon-ate schist								
143	145	vein qtz in chlor-ite	vein 4 in wide of red and white qtz with chlorite							

(continued)

Start a new page for every new hole, but fill in top portion of form only on first page for each hole.

FILL IN ON EVERY PAGE ▶ HOLE NO. 51513 PAGE NO. 2

DRILLING COMPANY	COLLAR ELEVATION	BEARING OF HOLE FROM TRUE NORTH	TOTAL FOOTAGE	DIP OF HOLE AT	LOCATION OF HOLE IN RELATION TO A FIXED POINT ON THE CLAIM	MAP REFERENCE NO.	CLAIM NO.
				collar °			

DATE HOLE STARTED	DATE COMPLETED	DATE LOGGED	LOGGED BY	ft °	LOCATION (Tp., Lot, Con. OR Lat. and Long.)

EXPLORATION CO., OWNER OR OPTIONEE	DATE SUBMITTED	SUBMITTED BY (Signature)	ft ° / ft ° / ft °	PROPERTY NAME

FOOTAGE FROM	FOOTAGE TO	ROCK TYPE	DESCRIPTION Colour, grain size, texture, minerals, alteration, etc.	PLANAR FEATURE ANGLE *	CORE SPECIMEN FOOTAGE +	YOUR SAMPLE NUMBER	SAMPLE FOOTAGE FROM	SAMPLE FOOTAGE TO	SAMPLE LENGTH	ASSAYS +			
145	147	chlorite-carbonate schist											
147	148	chlorite schist	qtz veins in chlorite										
148	156	chlorite-carbonate schist	marble effect of carbonate in chlorite schist; porcelanic quartz veins; at 151' minor yellow metallic specks with calcite										
156	157	volcanic	pink, weak sericite alteration, minor pyrite										
157	164	lapilli tuff	spotted volcanic, ghost fragments; extensive sericite, extensive pyrite; seam of specularite at 159'										
164	168	lapilli tuff	pink, similar to above but minor sericite										
168	200	lapilli tuff	pink and green spotted lapilli tuff, extensive sericite, considerable pyrite; chlorite and sericite in a siliceous rock; ghost oval clasts; brecciated quartz and feldspar, estimated 10 - 20% sulphides										
200	215	lapilli tuff	pink mottled green volcanic; sericite along fractures										
215	218	lapill- tuff	green mottled white volcanic; slicken sides*, chlorite, minor quartz	* 50°									
218	226	volcanic	pink, mottled with green										
226	227	sericite-volcanic	pink and green mottled; considerable sericite; pyrite 5 - 10%; slicken sides, shears*	50°									
227	232	trachyte-sericite	pink, considerable sericite, no pyrite										
232	245	trachyte	pink, no sericite, minor chlorite										
245	249	trachyte	only minor pyrite										
249	251	trachyte	yellow buff carbonate (Mg Fe) in pink trachyte, only minor pyrite										

+ Additional credit available. See Assessment Work Regulations

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A BASAL TILL SEARCH FOR GOLD OVER THE NORTH GRID, OTTO TOWNSHIP, ONTARIO (42A/1)

On behalf of

LEE-CANICO-TG JOINT VENTURE

By

Lee Geo-Indicators Limited
Hulbert A. Lee, Ph.D., P. Eng.
Susan A. Scott, M.Sc.

December, 1975

94 Alexander Street
Box 68
Stittsville, Ontario
KOA 3G0

Tel. (613) 836-1419

A BASAL TILL SEARCH FOR GOLD OVER

THE NORTH GRID, OTTO TOWNSHIP, ONTARIO

SUMMARY

1. The Otto stock is high in soda and potash, has many porphyry dykes and Laminar-quartz veins. Hematite specks and red colouration are common. Element zonations appear distinct, with molybdenum at high levels where there are many quartz veins; and lead at a high level within a circular depression where there are feldspathic pegmatites and lamprophyres.

2. Age of the stock is in disagreement, Huronian or Archean, likely due to what was sampled.

3. A conceptual model for geology and prospecting includes (a) a central feeder zone rich in K, Na and Pb, marked by a circular depression, with very coarse feldspathic rocks and lamprophyre, with (b) arteries leading off as dykes showing fluidal texture, and (c) at the edge of the dykes a hot piping action into the overlying Archean volcanics and sediments replacing by digestion most of them except for sodic pyroxenes and amphiboles and giving the prevalent intrusive-relic breccia. The concentrates of gold, magnetite-hematite, chalcopyrite-cyprite are, likely, near the dykes in sub-parallel fault and shear zones marked by extensive chloritite, sericite, and carbonate.

4. Extensive darkish cherty quartz with fine laminar lines continues unchanged for tens of feet, is cryptocrystalline, shows quartz lines by X-ray diffraction, and is likely derived by a slow build-up on joints and fractures. This quartz does not seem to carry gold.

5. Sampling for gold was done on a 800-foot grid using basal till. Bulk samples each of one cubic-foot were reduced in volume by panning and then gold was separated by superpanning; counts of gold clasts were made under a binocular microscope.

6. Most of the gold in basal till overlying the Otto stock is very coarse-grained and occurs in heavy mineral concentrates with abundant magnetite, some of which is coarse-grained.

7. Glacier transport for clasts in basal till was south-southeast (140° to 160° azimuth). Detailed geology outcrop mapping, subsequent to sampling, has identified bedrock source areas for the sheared clasts in the geo-indicators. The displacement from clasts to source is between 100 and 400 feet.

8. The basal till programme was successful in finding gold clasts and delineating a gold train stretching about 4,000 feet SSE along "glacier-flow" and in width between 1,000 and 1,900 feet.

9. The number of gold clasts in one cubic foot of till is as high as 19, or in terms of coarse gold, as high as 6. This is very encouraging considering that 2 or more coarse gold clasts in a 1.3 cubic-foot sample of basal till is all that outlines the Kirkland Lake ore zones.

10. A cut-off for the gold train at the "up-ice" end is suspected, but not proven, and some additional basal till sampling is recommended.

11. Favourable geological structures for gold were recognized by the detailed mapping of Scott and these are in the area over the head of the gold train. A system of EW faulting was followed by extensive quartz veining and quartz stockwork, followed by emplacement of the syenite porphyry dykes, and then a system of NS shearing.

12. Favourable traps within the fault zones are shown by fault breccia chlorite and kaolinite as clasts in till over the area of the head of the gold train.

13. An intersection of the EW quartz-vein zone with a NS shear is "up-ice" from site D779 with much gold in till. This site should be stripped and subcrop blasted and sampled.

14. Recommendation is made for additional basal till sampling at 200-foot centres over the head of the gold train. Where the most interesting gold values and structures intersect, then the subcrop should be blasted and only then sampled so as to obtain meaningful gold results. The total cost of geologist, prospector, backhoe and operator, and consultant is estimated at $15,000.

INTRODUCTION

Basal till exploration for gold was done in Otto Township, Ontario during July of 1975, by Lee Geo-Indicators Limited acting as managers for the Lee-Canico-TG Joint Venture. S.A. Scott was on the site from July 4th to August 2nd, 1975 and H.A. Lee was on the site for the periods of July 4th to 12th and July 17th to August 2nd. Together they closely supervised all phases of the work from sampling basal till, panning gold, superpanning gold, through to microscopic counts for gold and identification of likely gold host-rock geo-indicators.

Authority to do this work is given in an Agreement dated March 11, 1975 and signed by representatives of Lee Geo-Indicators Limited, Canadian Nickel Company Limited, and Texasgulf Canada Limited. Work was approved under the Initial budget dated May 20, 1975. Mineral rights on the Property are held by Lee Geo-Indicators Limited, In Trust, for the Joint Venture.

A ground grid control is given by a baseline cut on a bearing of 075 degrees azimuth from a steel survey post at the intersection of Concessions I and II with Lots 8 and 9. Picket lines were cut off the baseline at 16E, 24E, 39E, and 48E. The headline cutter was M. Dyment of Jami Minerals and Expediting Limited.

PREVIOUS EXPLORATION WORK

Lee, 1974

Selection of this area in Otto Township for gold exploration is a follow-up on results from a 200-square mile (approximately 520-square kilometer) basal till reconnaissance survey (Lee, 1974). Auriferous clasts were found at two adjacent sites about one mile apart. Lee stated that "anomalous auriferous clasts are in host rocks of mineralized 'granite' and mineralized 'andesite breccia'-----" at site 509, or D751 of the accompanying map. Again at site 510, or D769 on the accompanying map there are "anomalous auriferous clasts from a host rock of red syenite with a quartz vein, and another from a mineralized siliceous rock. ---- Such rocks are found within the Otto stock."

Wolfe, 1971

Wolfe (1971) measured high anomalous levels of the element molybdenum in bedrock over the southern grid area, up to 30 ppm Mo which is much above the normal background of less than 4 ppm for the syenite. Molybdenum is thought by the writer to be the cause of the blue-black colour in quartz that is commonly associated with gold. During subsequent staking, dark quartz veins were seen in abundance, chiefly along a high fault-line scarp.

The search area is served by excellent infrastructure of roads, rail, electricity, natural gas, gold extraction mills, and construction and mining people. The hill topography of the Otto stock would assist open pit mining.

Cochrane, 1950

The only report of detailed exploration on the Otto stock is one written by former resident geologist W.S. Savage on behalf of W.M. Cochrane (ODMNA Assessment Files, Kirkland Lake). Four showings are reported and are plotted on the accompanying maps as S1 to S4. Traces of chalcopyrite, hematite, galena (?) are reported and gold values equivalent to 0.01 to 0.04 oz./ton are mentioned.

GEOLOGY

Previous Work

The geology of the area has been treated on a regional scale by Ginn *et al* (1963), Goodwin (1966), Lovell (1970), and Ridler (1975).

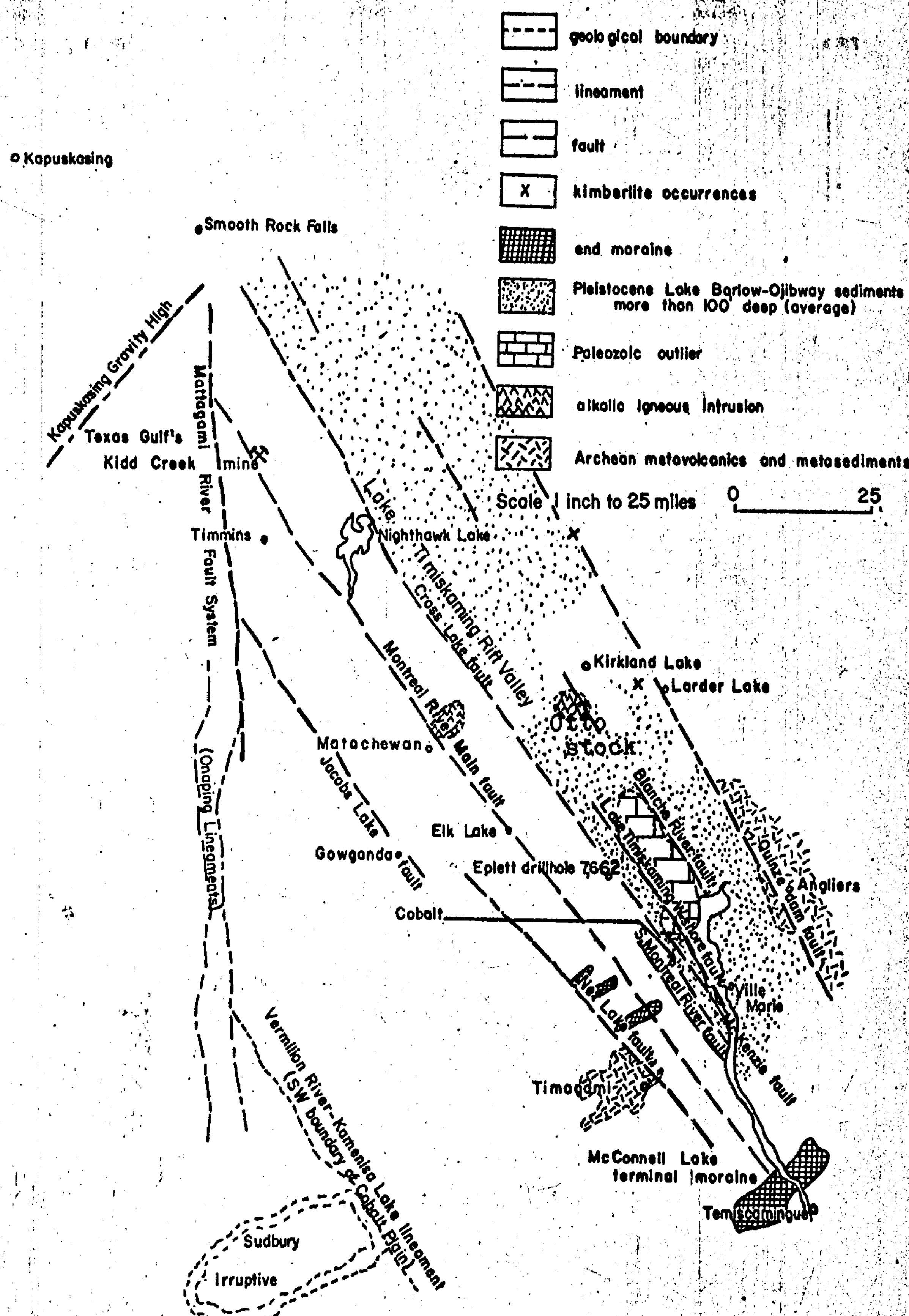

Figure I: The Lake Timiskaming Rift Valley
(after Lovell and Caine, 1970)

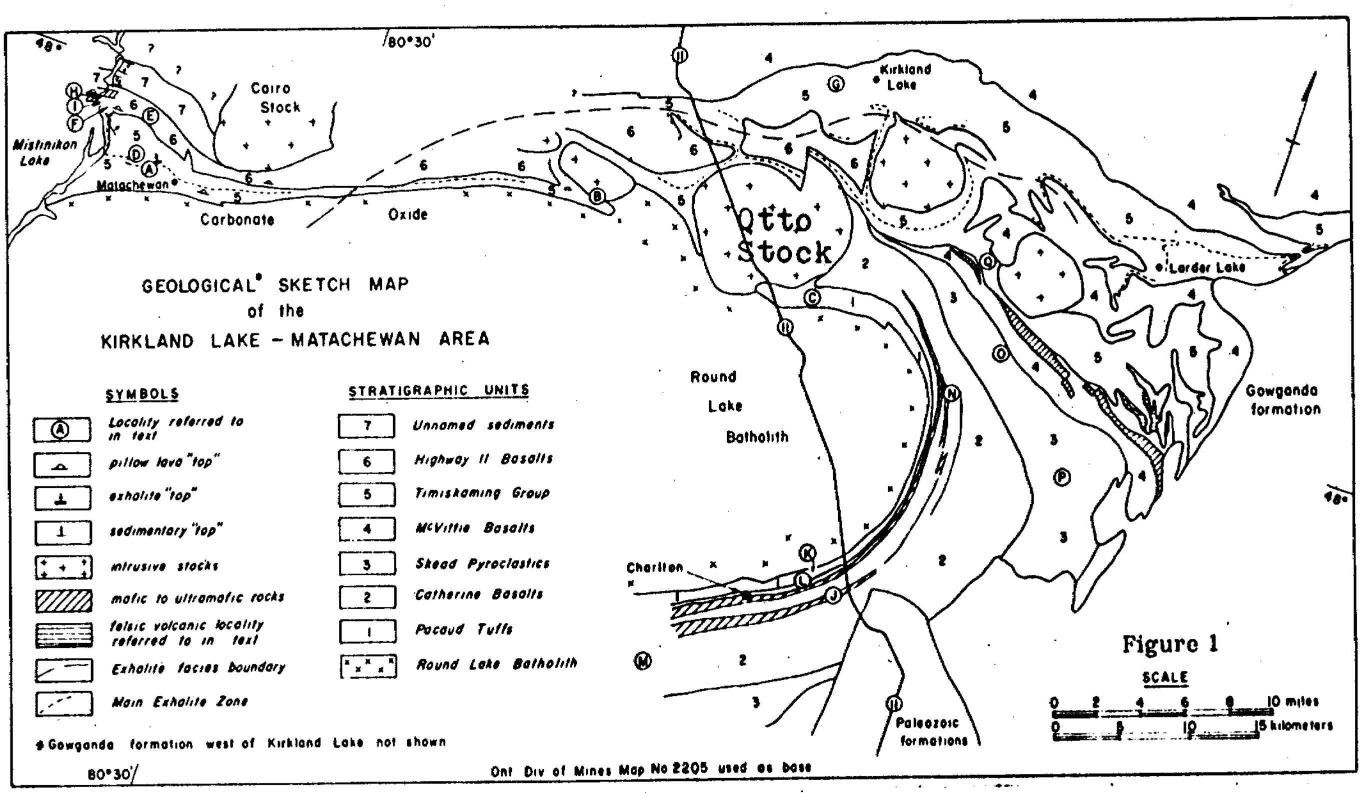

Fig. 2. Sketch map of the Kirkland Lake- Matachewan Area. (After Ridler, 1975)

Geology and geochemistry specifically on parts of the Otto stock have been made by Lawton (1954), Lovell (1969, 1972), Wolfe (1971a, b, c) and Scott and Lee (1975).

Age determinations on parts of the stock have been made by Purdy and York (1968), Bell and Blenkinsop (1975?), and Pullaiah and Irving (1975).

Geo-indicators for gold associations aregiven by Lee (1963), and Boyle (1974, 1975).

Otto Stock

Geographic

The geographic position of the Otto stock in relation to the Round Lake batholith and other surrounding plutons is shown in Figure 1.

Within Lovell's Lake Timiskaming Rift Valley (Figure 2) are the gold camp at Kirkland Lake, the silver camp at Cobalt, the Otto stock, and Jurassic Kimberlites. An internal fault parallel to the edge of the Rift Valley has displaced the west side of the Otto stock southwards. Approximately in line to the south is the Blanche River fault which marks the èastern boundary of the downfaulted Silurian and Ordovician limestones. The Rift has had a long and complicated history.

Composite Lithologies

The Otto stock is high in potash (extensive microcline and perthitic feldspars). It contains considerable syenite, syenite porphyry, quartz syenite, and lamprophyre. In addition, it contains many black and green partial digestions of Archean volcanic and sedimentary rocks. It is cut by many porphyry dykes, quartz veins, and there is considerable intrusive-relic breccia, a relic breccia of the sediments and volcanics fused with syenitic material. Hematite is a common colouration both where the rocks are sheared and within porphyry.

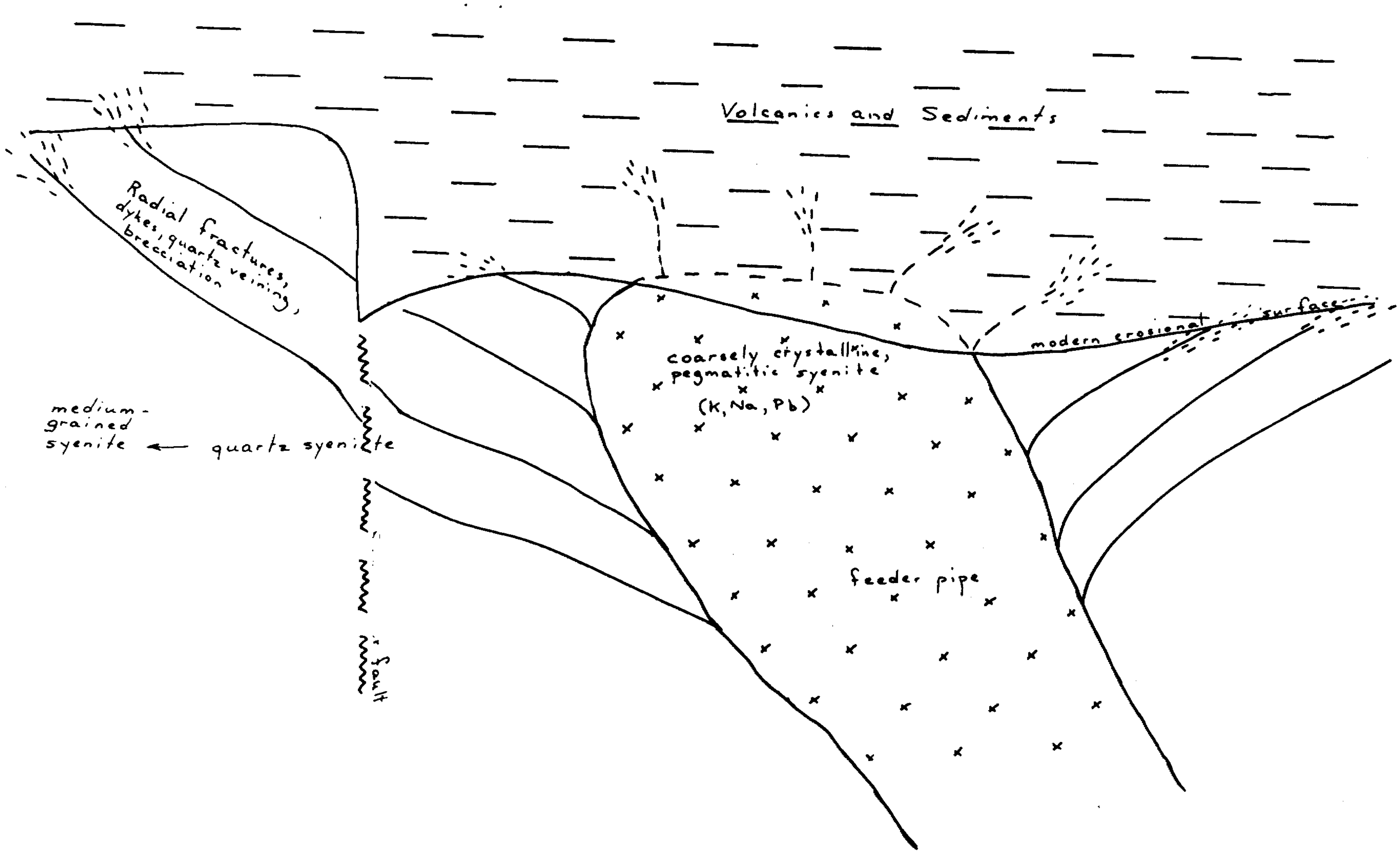

Figure 3 : Genetic model of the Otto stock – section looking north (After Scott and Lee, 1975)

Element Zonations

The element molybdenum is in greatest abundance where there is also extensive quartz veining, even though the sampling was done to avoid the veins. The element lead is in greatest abundance near Highway 112 where there is a circular depressed area and the rocks include many feldspar pegmatites and lamprophyre dykes.

Age Disagreements

The absolute age determinations for the Otto stock are wide apart, reflecting what material was sampled. The Rb-Sr whole rock isochrons are 1730 ± 50 m.y. and 2160 ± 80 m.y. chiefly on the mafic rocks and lamprophyres. It compares in age to the Nippising diabase of Huronian age (2160 ± 60 m.y. of Fairbairn). The older date is Archean.

Thermal Overprint

The pink syenite in the stock is magnetically unstable. The lamprophyre and basic parts (Pullaiah and Irving, 1975) give a single very stable magnetization (N), a reversed magnetization (R) and a small unstable magnetization (S). The latter is shown by low blocking temperatures probably acquired during some subsequent mild reheating event called a thermal overprint.

Conceptual Model for Geology and Prospecting

The foregoing data here assembled into a conceptual geology-prospecting model is shown in Figure 3. A feeder zone is shown to underlie (a) the circular depression, (b) the area of abundant lamprophyre dykes, (c) the coarse feldspar porphyry and pegmatites, and (d) the high element lead concentrations in the bedrock. The arteries for the feeder zone show now as porphyry and mafic dykes with an orientation (detailed mapping of

1 inch to 100 feet) towards the circular depression. The earlier area-mapping has lumped younger dykes and syenite together, but even in that mapping a pattern can be extracted by joining up areas of either porphyry or lamprophyre. The picture is of a series of dykes radiating outward from a circular depression. A fluidal texture is observed in many of the dykes from detailed mapping and these indicate some artery flow.

An "intrusive-relic breccia" shows up well in the detailed mapping however only large units, such as the one along Highly 11, has been mapped where it is called mafic syenite, syenite contaminated by country rocks, and syenite with numerous xenoliths and autoliths. The potash feldspar from the younger intrusives and possibly some of the older syenite have penetrated the Archean sediments and volcanics and has replaced by digestion much of the older rock leaving as relicts a few of the resistant sodic minerals of amphibole and pyroxene. Such a composite origin for the Otto stock can account for the age differences already mentioned and the late thermal overprint.

Blockfaulting within the stock has been extensive as evidence by topographic levels separated by scarps dropping down to the north. Long linear joints are slickensided and show smears of hematitite and fibrous, bluish, sodic amphibole. Many of the joints are filled with darkish cherty looking quartz which is in very fine laminae parallel to the joint edges. In some places, this laminar quartz can be seen to follow horizontal as well as vertical joints.

The gold (known from basal till sampling) and copper (chalcopyrite, cuprite) are depicted in the model as concentrates resulting from hot piping action into volcanics and sediments, and these heavier minerals came to rest at the hanging wall next to the artery-porphyry dykes.

In prospecting, we are looking for economic gold concentrations. The position of intrusive-relict breccia next to porphyry dykes determines the hanging wall of the volcanic-sediments, and parallel or sub-parallel shears, faults adjacent to dykes could provide traps for the concentrates. Such trap conditions would be further indicated by extensive fillings of chloritite, sericite, and carbonate.

Although not part of the conceptual model, the geochemical solubility indicators for gold from epigene solutions should be kept in mind. These are arsenides, tellurides, selenides, and antimonides.

SAMPLING AND ANALYTICAL METHODS

Sampling was done using an 800-foot grid oriented approximately along former ice flow with an azimuth of 165 degrees. The basal till was searched out by making use of topography (stoss-side of low outcrops), and by finding and using glacially shaped bedrock ramps (where the former ice impinged perpendicular to the outcrop ridge) and there looking for a matching drift ramp. Places were avoided when the surface showed a low depression between outcrop and drift (easily eroded sand); also where the drift surface is hummocky (talus, colluvium); and where the drift surface is a smooth flat plain where it meets the bedrock outcrop (silt, clay).

An uprooted tree on a till ramp may have caught in the root a telltale glacially shaped (soled, striated) clast. Even the slightly protruding, subrounded, glacially shaped clasts may be felt under one's feet and give the needed clue through the few inches of covering moss.

Sites chosen for test pitting were those which had the best factors that optimized the chances of finding basal till nearest to interesections of the 800-foot grid.

Pits were dug with a shovel (approximately 6 feet long x 3 feet wide by 2 to 6 feet deep) until basal till could be definitely identified. Characteristics looked for were high compaction; pebbles break clean from matrix and leave a cast; fissility due to unloading; a range of grain sizes due to the several mechanics of breaking and crushing. In most of the cases, this till accounted for a layer about 6 inches thick (15 cm.) directly overlying glacially striated, polished subcrop surface of the bedrock.

The accompanying map shows only sites where basal till was identified by a competent practical Pleistocene geologist and samples taken. Many other test pits were dug, but those which did not have basal till in them are <u>not</u> shown on the accompanying map.

The one cubic-foot bulk sample of till was carried out on two back-packs to a central zone for panning. Volume of the sample was reduced there to about 5 pounds using a regular large gold pan. A dispersing and wetting agent, calgon, was used to prevent loss by flotation of very fine gold.

Concentrates from the panning were then further treated at the central field laboratories by superpanning. A long narrow tail was obtained of chiefly magnetite and gold. Identification of the gold clasts was then made directly over the superpanner using a binocular microscope. All gold clasts were scanned under low (x 8) and medium (x 25) power, identified and counted as either coarse clasts or fine clasts, and recorded.

Most of the gold in basal till overlying the Otto stock is very coarse-grained and identification is easy and positive. However, without strong sunlight and even with a microscope lamp, the very fine-grained gold and bronzite pyroxene present in some samples could occasionally be confused. Where samples were suspected of carrying bronzite, a HNO_3 leach was used prior to gold counts. The corrected values after the leach are shown on the accompanying maps.

The technique for a person to pan very fine-grained gold requires one to four weeks of training. The graduate prospector on this job, Bryan McKenzie, had one week of solid continuous training at Haileybury School of Mines and a month at a project in McGarry Township before proceeding with the samples from the present area. Production ranged from 2 to 4 samples (each a cubic foot) per day, depending on the amount of cementation in the samples. Mr. McKenzie picked out the geo-indicators for gold and set them aside for further examination by a geologist. A suite of the rock types from each sample site was set aside for examination if needed when an anomaly showed up.

Special geology experience, which takes several years to attain, is needed to feel basal till under one's feet, where pits will then be dug and pronouncements made on the material when encountered. Basal till in Otto Township stratigraphically underlies (1) a cover of organic roots, and (2) gravel-sand and reworked till of glacial wave action. An experienced geologist with a practical knowledge of till and glacier mechanics can, with the help of an assistant obtain as many as four bulk samples per day, whereas a geologist inexperienced with till, along with an assistant, averages less than one sample per day.

Gold assays are given in this regard to three decimal places (e.g. 0.005 oz./ton gold) when assay was done by fire assay, and to four decimal places when assay was done by atomic absorption on the fire assay bead.

RESULTS, NORTH GRID

Direction and Distance of Transport for Clasts in Basal Till

Transport of clasts by glaciation was south-southeast, 140° to 160° azimuth, shown by striations both on outcrop and at the interface of till and subcrop. Direction of motion is shown by roches moutonnées and miniature crag-and-tail features.

The detailed outcrop geology mapping has revealed sources for the sheared rocks at site D~~760~~774. The displacement is 100 ~~and 300~~ to 400 feet ~~respectively~~ between source and clasts position in basal till.

Size of Gold Clasts

Many of the gold clasts over the south grid are very coarse and this caused a mild gold fever in the camp where the superpanning was being done. Another feature of the superpan concentrates from Otto township is the marked abundance of magnetite some of which is coarse-grained.

As mentioned previously, both coarse and total (coarse + fine) gold clasts are recorded and are shown on the accompanying maps. But only total gold is contoured on the maps. If the coarse gold were contoured, results would be essentially the same as those for total gold.

The Gold Train in Basal Till

As mentioned earlier, this basal till programme was done to search out gold clasts, if any existed, in basal till over the area shown by earlier reconnaissance to have auriferous cobbles (Lee, 1974). The gold clast search was highly successful and a strong train of gold clasts was found and delineated as illustrated on the accompanying maps.

The number of gold clasts in one cubic foot of basal till is as high as 19, or in terms of coarse gold as high as 6. This is encouraging and is better than results from the orientation study at Kirkland Lake where the ore zones are outlined by 2 to just over 5 grains of coarse gold in 1.3 cubic feet of basal till.

The gold train in basal till is outlined on the accompanying maps by a level of 4 gold clasts per cubic feet. So defined, it stretches south-southeast along "ice-flow" for about 4,000 feet, with a width of 1,000 to 1,900 feet. The "up-ice" end of the gold train is not yet proved, and some additional till sampling is needed.

Geo-Indicator Clasts

Chloritite

Two areas of chloritite are recognized from clasts in the basal till and are shown on the accompanying map. The significance of chloritite, as mentioned previously, lies in its common association with faults and shear zones as pathways and traps for gold.

In the southern of the two chloritite areas, some clasts in till are composed of kaolinized material, noted for sites D783 and 787. Hairline veins of chlorite are within the kaolinite. The chloritic material at site D787 is on microscopic examination seen to be alteration of fibrous sodic amphibole, hence of only minor importance.

In the more important northern area of chloritite shown on the accompanying map, the pertinent clasts (site D779) have chlorite as fillings around whitish kaolinized veinlets; and also within brecciated material where it is accompanied by carbonate (leached casts). Clasts with chloritized-siliceous stockworks and some pyrite are in till samples from sites D773 and 778. Chloritite occurs in the northern area as boulders in float.

Sheared Rocks

Clasts in basal till at site D774 include sheared material and, as mentioned previously, this site is immediately "down-ice" from later-mapped sheared zones.

Sheared clasts in basal till at site D777 relate, likely, to an as yet unmapped shear zone immediately "up-ice".

Other Clasts

Dark, commonly laminated, cherty vein quartz is included as clasts in most of the basal till samples, and being so pervasive it is not included with geo-indicators on the accompanying map.

Mylonite clasts are in a till sample from site D779 and are likely a product of a thrust sheet.

Favourable Outcrop Geology

The detailed geology outcrop mapping by Scott (1975) shows significant structures over the head area for the basal till gold train, and these are included on the accompanying map. The dominant trend for most of the structures is east-west and could be radial to the circular depression noted earlier by Lovell (1972) to the east.

Early east-west faulting produced three main structural masses, each of which is marked by strong scarps which dip off sharply towards the north. The shearing along these faults shows considerable hematite, smeared fibrous amphibole, and thin fillings of dark laminar quartz.

Major quartz veining followed, and the main vein as shown in small outcrop patches is a quartz stockwork 1 to 5 feet wide. The quartz stockworks are in line, and joined up have a length of about 1,600 feet.

A later emplacement of dykes follows, to a large extent, E-W patterns. Scott recognizes 4 types of dykes, many of which are composed of favoured syenite porphyry. The chief differences between the dykes are the relative abundance of feldspar phenocrysts, and the amounts of mafic constituents. Most of the dykes carry considerable magnetite, from 1 to 5 per cent, and can be the source of excessive magnetite in the superpan concentrates.

The fourth and latest structural event is marked by north-south cross-faulting which seems to have off-set the main sets of dykes. The highest gold levels in basal till are in the area of these north-south shears and this could be an indication of the time of mineralization.

CONCLUSIONS AND RECOMMENDATIONS

The programme was rewarded by the finding of gold clasts in basal till from which a gold train was delineated. The counts of gold in a cubic foot of till are considerably higher than those overlying and "down-ice" from the gold ore zones at Kirkland Lake also in basal till. Most of the clasts in the basal till show short transport; sheared clasts in till have later been matched to bedrock shears about 100 to 400 feet "up-ice". In the 800-foot sampling grid, a cut-off for the gold train is not proved and some additional till sampling is needed.

Favourable geological structures for gold were recognized by the most recent detailed mapping of Scott, and these are in the area over the head of the gold train in basal till. A system of EW faults was followed by extensive quartz veining and quartz stockwork, followed by favourable porphyry dykes, and then a system of NS shears. Favourable traps within the fault zones are also shown by fault-brecciated chloritite and kaolinite as clasts in till over the head of the gold train. When the presence of gold can be established in a structure, then the structure becomes a target for further exploration.

Intersection of the E-W quartz vein zone with a N-S shear "up-ice" from site D779 is of interest as a possible bedrock source area for the abundant gold clasts in basal till at that site.

Recommendation is here made for additional basal till sampling for gold clasts to be done on a 200-foot grid over the area at the head of the gold train, and this to be followed by mechanical or hand trenching to expose subcrop. Where the presence of favourable structures corresponds with a bedrock source indicated by high gold values in the till, then the subcrop should be blasted and only then sampled so as to obtain meaningful gold results.

The total estimated cost for geologist, prospector, backhoe, and consultant is $15,000.

LEE GEO-INDICATORS LIMITED

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December, 1975

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A BASAL TILL SEARCH FOR GOLD OVER THE SOUTH GRID, OTTO TOWNSHIP, ONTARIO (42A/1)

On behalf of

LEE-CANICO-TG JOINT VENTURE

By

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A BASAL TILL SEARCH FOR GOLD OVER

THE SOUTH GRID, OTTO TOWNSHIP, ONTARIO

SUMMARY

1. The Otto stock is high in soda and potash, has many porphyry dykes and laminar-quartz veins. Hematite specks and red colouration are common. Element zonations appear distinct, with molybdenum at high levels where there are many quartz veins; and lead at a high level within a circular depression where there are feldspathic pegmatites and lamprophyres.

2. Age of the stock is in disagreement, Huronian or Archean, likely due to what was sampled.

3. A conceptual model for geology and prospecting includes:

   (a) a central feeder zone rich in K, Na, and Pb, marked by a circular depression with very coarse feldspathic rocks and lamprophyre with

   (b) arteries leading off as dykes showing fluidal texture, and

   (c) at the edge of the dykes and syenite a hot piping action into the overlying Archean volcanics and sediments replacing by digestion most of them except for sodic pyroxenes and amphiboles and giving the prevalent intrusive-relic breccia.

   The concentrates of gold, magnetite-hematite, chalcopyrite-cuprite-ore, likely, near the dykes in sub-parallel fault and shear zones marked by extensive chloritite, sericite, and carbonate.

4. Extensive darkish cherty quartz with fine laminar lines continues unchanged for tens of feet, is cryptocrystalline, shows quartz lines by X-ray diffraction, and is likely derived by a slow build-up on joints and fractures. This quartz does not seem to carry gold.

5. Sampling for gold was done on a 800-foot grid using basal till. Bulk samples each of one cubic-foot were reduced in volume by panning, and then gold was separated by superpanning; counts of gold clasts were made under a binocular microscope.

6. Most of the gold in basal till overlying the Otto stock is very coarse-grained and occurs in heavy mineral concentrates with abundant magnetite, some of which is coarse-grained.

7. Glacier transport for clasts in basal till was south-southeast (140^{o} to 160^{o} azimuth). Detailed geology outcrop mapping, subsequent to sampling, has identified bedrock source areas for the sheared clasts in the geo-indicators. The displacement from clasts to source is 100 feet and 300 feet respectively.

8. Zone A shown on the accompanying maps has two concentrations of gold shown by the 800-foot grid sampling. The number of clasts in a cubic foot of till is up to 45 and for the coarse clasts alone is up to 10. This is very encouraging considering that 2 or more coarse clasts in a cubic foot of till is all that outlines the Kirkland Lake ore zones.

9. Zone A has some favourable chloritite and carbonate shown by clasts in the till.

10. Zone A has a syenite porphyry dyke Z in outcrop which contains some chalcopyrite. In one pit near it, there is quartz carbonate stockwork with chalcopyrite, and in another pit a 4-foot wide zone of glassy white quartz is reported to carry 0.04 oz./ton gold and specks of galena. Projections of both this quartz vein and dyke would meet in subcrop about 200 feet up-ice from the gold site at D759. It is recommended that this intersection be uncovered by stripping with a backhoe, and the subcrop exposed, be blasted and sampled for gold.

11. Zone A in outcrop has intrusive relic breccia, several shear zones, and a major fault-line scarp all near to and sub-parallel to dyke Z. These are possible localities for gold traps.

12. Recommendation is made to close the sampling grid within the area of Zone A from 800-foot to 200-foot.

13. Zone B shown on the accompanying maps is given by 3 sample sites in an 800-foot grid. Gold clasts in the basal till are up to 18 clasts per cubic foot, or 7 clasts of coarse gold per cubic foot. This is encouraging and well above the 2 or more goarse gold clasts in a 1.3 cubic-foot sample of basal till in the Kirkland Lake orientation study over the ore zones.

14. Zone B has numerous clasts of fault breccia (site D757), which include (a) talc-kaolinite-serpentinite stockwork of fracture fillings in a dense greenish-black matrix; (b) quartz-iron carbonate-chlorite in layers and fragmental pieces; and (c) brecciated silicified iron carbonate veining. An old fault zone passes, likely, nearby in subcrop and as such could be a favourable host zone for gold. Other indications of a fault zone in subcrop are at site D755 where clasts in basal till include chlorite-quartz-sericite pyrite, and boulder float of quartz-carbonate vein and disseminated pyrite, minor chalcopyrite and gold. A third sample site D756 has (a) clasts of sheared siliceous material with minor graphite, pyrrhotite and pyrite and (b) siliceous material with iron carbonate in a fault breccia.

An outcrop exposure of chlorite-carbonate is at the sheared north face of a syenite hill. The material likely continues into subcrop as part of the fault breccia seen in clasts at site D757.

15. Zone B has a porphyry dyke X in outcrop carrying low gold values and considerable magnetite. The dyke X is sub-parallel to two mapped shear zones and not far from the chlorite-carbonate breccia zone. The magnetite in dykes such as dyke X can explain the high magnetite content in the superpanner concentrates.

16. Zone B has in outcrop quartz zones which when projected would meet dyke X in subcrop about 500 feet up-ice from the site which contains so much gold in basal till. Intrusive-relic breccia is also mapped within this zone.

17. Recommendation is made to close the basal till sampling grid over Zone B from 800-foot to 200-foot centres, and in promising areas to backhoe to subcrop, blast, and sample for gold.

18. The cost of additional till sampling for 30 sites in Zone A and 24 sites in Zone B, the backhoe trenching, blasting, sampling, and consultant is estimated at $15,000.

INTRODUCTION

Basal till exploration for gold was done in Otto Township, Ontario during July of 1975, by Lee Geo-Indicators Limited acting as managers for the Lee-Canico-TG Joint Venture. S.A. Scott was on the site from July 4th to August 2nd, 1975 and H.A. Lee was on the site for the periods of July 4th to 12th and July 17th to August 2nd. Together they closely supervised all phases of the work from sampling basal till, panning gold, superpanning gold, through to microscopic counts for gold and identification of likely gold host-rock geo-indicators.

Authority to do this work is given in an Agreement dated March 11, 1975 and signed by representatives of Lee Geo-Indicators Limited, Canadian Nickel Company Limited, and Texasgulf Canada Limited. Work was approved under the Initial budget dated May 20, 1975. Mineral rights on the Property are held by Lee Geo-Indicators Limited, In Trust, for the Joint Venture.

A ground grid control is given by a baseline cut on a bearing of 075 degrees azimuth from a steel survey post at the intersection of Concessions I and II with Lots 8 and 9. Picket lines were cut off the baseline at 16E, 24E, 39E, and 48E. The headline cutter was M. Dyment of Jami Minerals and Expediting Limited.

PREVIOUS EXPLORATION WORK

Lee, 1974

Selection of this area in Otto Township for gold exploration is a follow-up on results from a 200-square mile (approximately 520-square kilometer) basal till reconnaissance survey (Lee, 1974). Auriferous clasts were found at two adjacent sites about one mile apart. Lee stated that "anomalous auriferous clasts are in host rocks of mineralized 'granite' and mineralized 'andesite breccia'-----" at site 509, or D751 of the accompanying map. Again at site 510, or D769 on the accompanying map there are "anomalous auriferous clasts from a host rock of red syenite with a quartz vein, and another from a mineralized siliceous rock. ---- Such rocks are found within the Otto stock."

Wolfe, 1971

Wolfe (1971) measured high anomalous levels of the element molybdenum in bedrock over the southern grid area, up to 30 ppm Mo which is much above the normal background of less than 4 ppm for the syenite. Molybdenum is thought by the writer to be the cause of the blue-black colour in quartz that is commonly associated with gold. During subsequent staking, dark quartz veins were seen in abundance, chiefly along a high fault-line scarp.

The search area is served by excellent infrastructure of roads, rail, electricity, natural gas, gold extraction mills, and construction and mining people. The hill topography of the Otto stock would assist open pit mining.

Cochrane, 1950

The only report of detailed exploration on the Otto stock is one written by former resident geologist W.S. Savage on behalf of W.M. Cochrane (ODMNA Assessment Files, Kirkland Lake). Four showings are reported and are plotted on the accompanying maps as S1 to S4. Traces of chalcopyrite, hematite, galena (?) are reported and gold values equivalent to 0.01 to 0.04 oz./ton are mentioned.

GEOLOGY

Previous Work

The geology of the area has been treated on a regional scale by Ginn *et al* (1963), Goodwin (1966), Lovell (1970), and Ridler (1975).

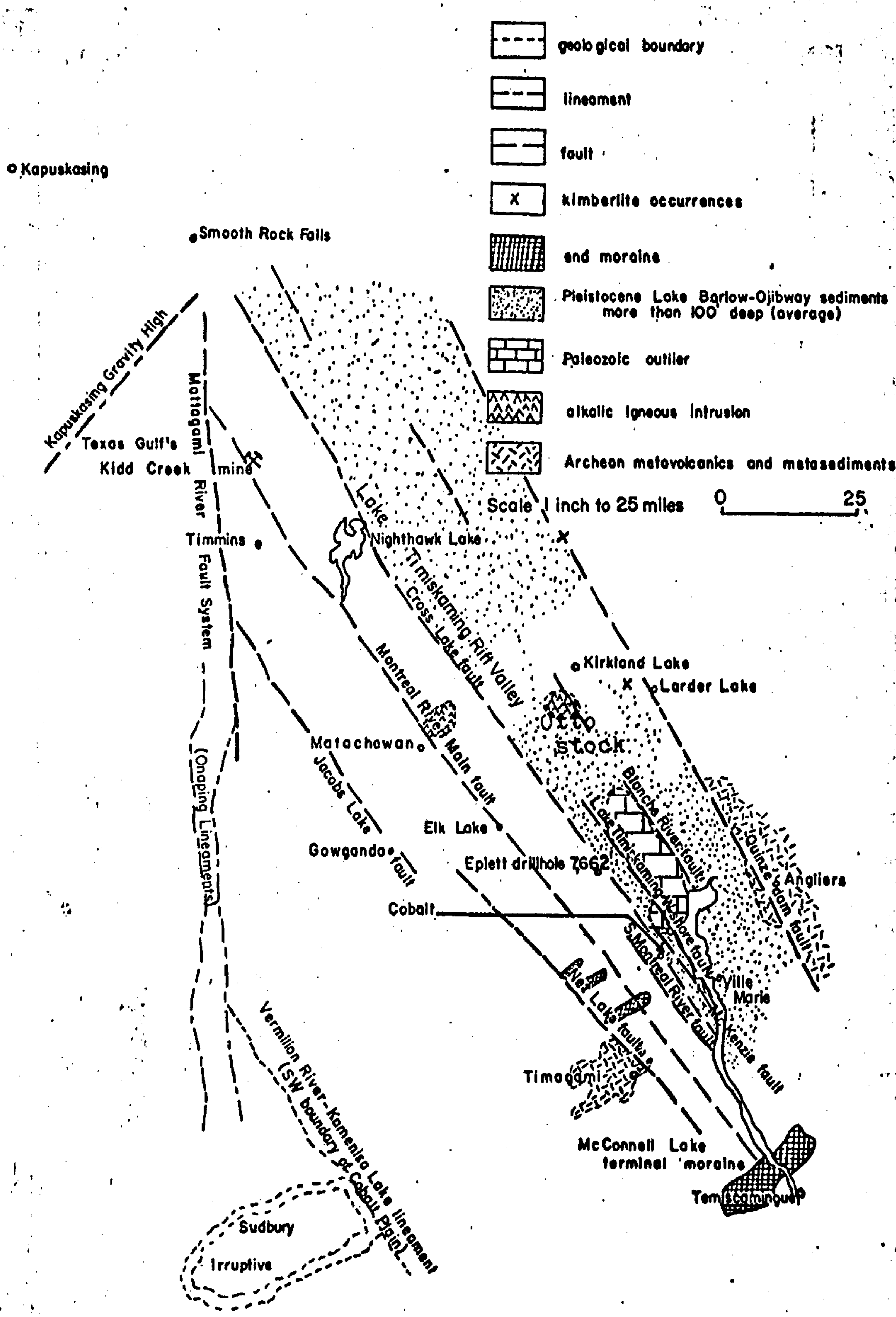

Figure I: The Lake Timiskaming Rift Valley
(after Lovell and Caine, 1970)

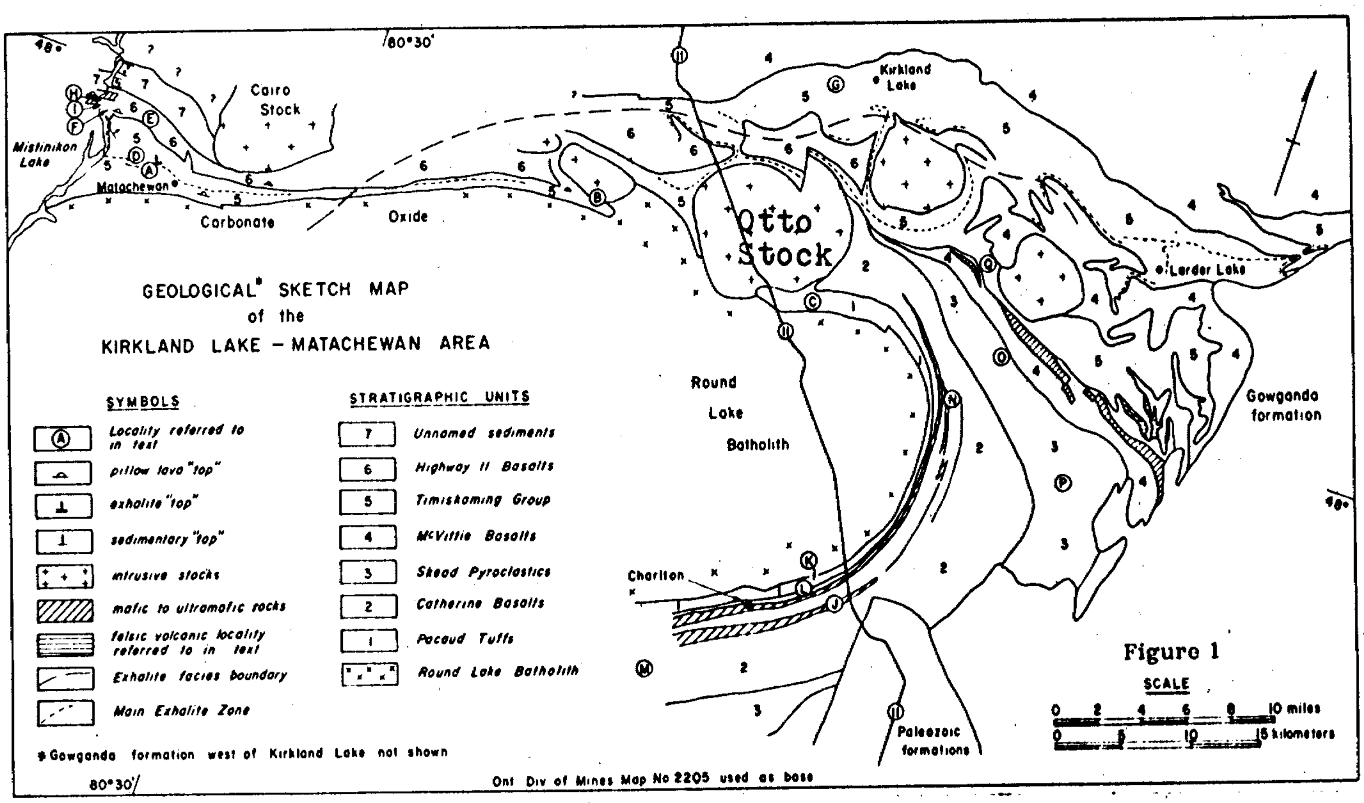

Fig. 2. Sketch map of the Kirkland Lake- Matachewan Area. (After Ridler, 1975)

Geology and geochemistry specifically on parts of the Otto stock have been made by Lawton (1954), Lovell (1969, 1972), Wolfe (1971a, b, c) and Scott and Lee (1975).

Age determinations on parts of the stock have been made by Purdy and York (1968), Bell and Blenkinsop (1975?), and Pullaiah and Irving (1975).

Geo-indicators for gold associations aregiven by Lee (1963), and Boyle (1974, 1975).

Otto Stock

Geographic

The geographic position of the Otto stock in relation to the Round Lake batholith and other surrounding plutons is shown in Figure 1.

Within Lovell's Lake Timiskaming Rift Valley (Figure 2) are the gold camp at Kirkland Lake, the silver camp at Cobalt, the Otto stock, and Jurassic Kimberlites. An internal fault parallel to the edge of the Rift Valley has displaced the west side of the Otto stock southwards. Approximately in line to the south is the Blanche River fault which marks the èastern boundary of the downfaulted Silurian and Ordovician limestones. The Rift has had a long and complicated history.

Composite Lithologies

The Otto stock is high in potash (extensive microcline and perthitic feldspars). It contains considerable syenite, syenite porphyry, quartz syenite, and lamprophyre. In addition, it contains many black and green partial digestions of Archean volcanic and sedimentary rocks. It is cut by many porphyry dykes, quartz veins, and there is considerable intrusive-relic breccia, a relic breccia of the sediments and volcanics fused with syenitic material. Hematite is a common colouration both where the rocks are sheared and within porphyry.

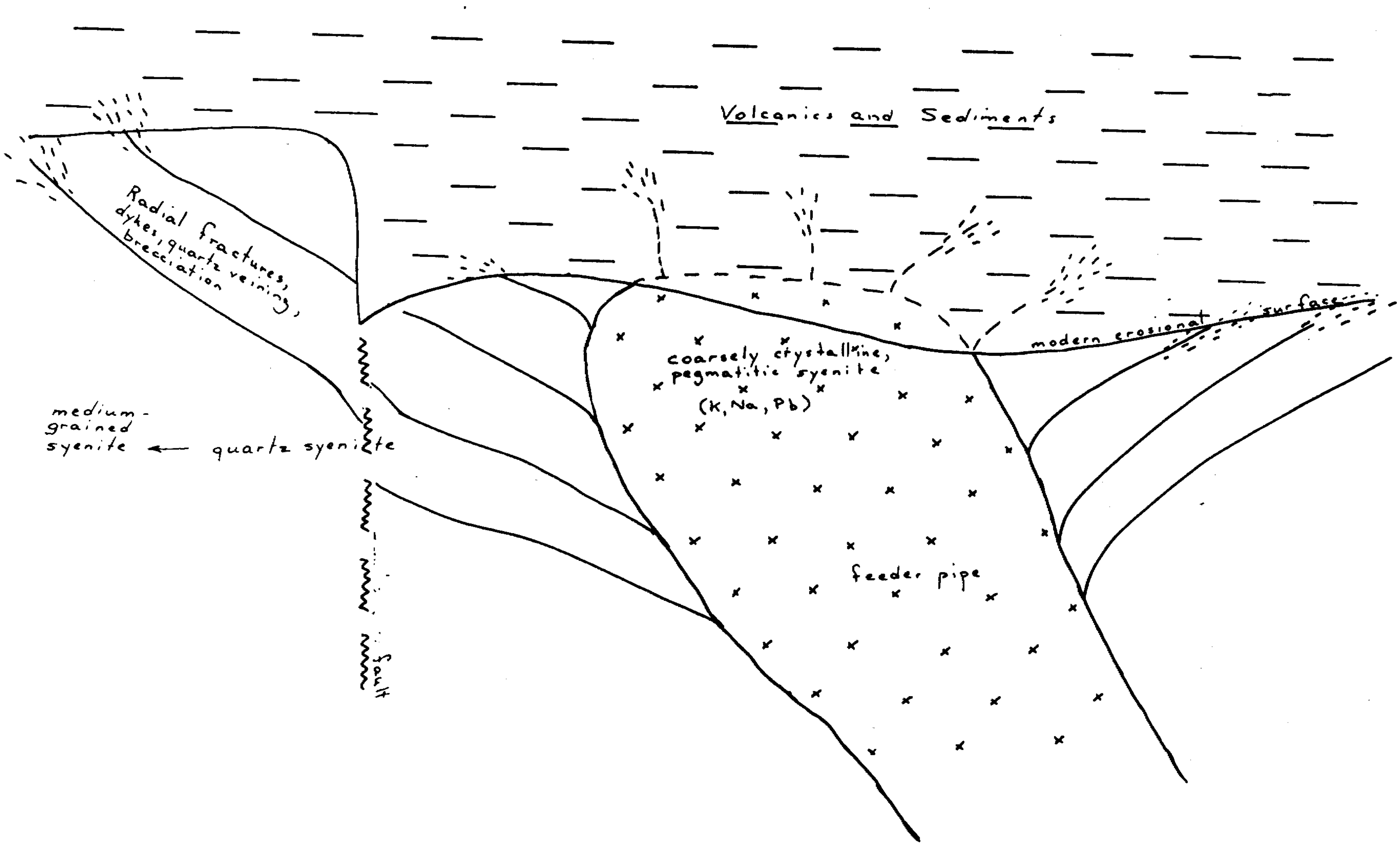

Figure 3 : Genetic model of the Otto stock - section looking north (After Scott and Lee, 1975)

Element Zonations

The element molybdenum is in greatest abundance where there is also extensive quartz veining, even though the sampling was done to avoid the veins. The element lead is in greatest abundance near Highway 112 where there is a circular depressed area and the rocks include many feldspar pegmatites and lamprophyre dykes.

Age Disagreements

The absolute age determinations for the Otto stock are wide apart, reflecting what material was sampled. The Rb-Sr whole rock isochrons are 1730 $\pm$ 50 m.y. and 2160 $\pm$ 80 m.y. chiefly on the mafic rocks and lamprophyres. It compares in age to the Nippising diabase of Huronian age (2160 $\pm$ 60 m.y. of Fairbairn). The older date is Archean.

Thermal Overprint

The pink syenite in the stock is magnetically unstable. The lamprophyre and basic parts (Pullaiah and Irving, 1975) give a single very stable magnetization (N), a reversed magnetization (R) and a small unstable magnetization (S). The latter is shown by low blocking temperatures probably acquired during some subsequent mild reheating event called a thermal overprint.

Conceptual Model for Geology and Prospecting

The foregoing data here assembled into a conceptual geology-prospecting model is shown in Figure 3. A feeder zone is shown to underlie (a) the circular depression, (b) the area of abundant lamprophyre dykes, (c) the coarse feldspar porphyry and pegmatites, and (d) the high element lead concentrations in the bedrock. The arteries for the feeder zone show now as porphyry and mafic dykes with an orientation (detailed mapping of

1 inch to 100 feet) towards the circular depression. The earlier area-mapping has lumped younger dykes and syenite together, but even in that mapping a pattern can be extracted by joining up areas of either porphyry or lamprophyre. The picture is of a series of dykes radiating outward from a circular depression. A fluidal texture is observed in many of the dykes from detailed mapping and these indicate some artery flow.

An "intrusive-relic breccia" shows up well in the detailed mapping however only large units, such as the one along Highly 11, has been mapped where it is called mafic syenite, syenite contaminated by country rocks, and syenite with numerous xenoliths and autoliths. The potash feldspar from the younger intrusives and possibly some of the older syenite have penetrated the Archean sediments and volcanics and has replaced by digestion much of the older rock leaving as relicts a few of the resistant sodic minerals of amphibole and pyroxene. Such a composite origin for the Otto stock can account for the age differences already mentioned and the late thermal overprint.

Blockfaulting within the stock has been extensive as evidence by topographic levels separated by scarps dropping down to the north. Long linear joints are slickensided and show smears of hematitite and fibrous, bluish, sodic amphibole. Many of the joints are filled with darkish cherty looking quartz which is in very fine laminae parallel to the joint edges. In some places, this laminar quartz can be seen to follow horizontal as well as vertical joints.

The gold (known from basal till sampling) and copper (chalcopyrite, cuprite) are depicted in the model as concentrates resulting from hot piping action into volcanics and sediments, and these heavier minerals came to rest at the hanging wall next to the artery-porphyry dykes.

In prospecting, we are looking for economic gold concentrations. The position of intrusive-relict breccia next to porphyry dykes determines the hanging wall of the volcanic-sediments, and parallel or sub-parallel shears, faults adjacent to dykes could provide traps for the concentrates. Such trap conditions would be further indicated by extensive fillings of chloritite, sericite, and carbonate.

Although not part of the conceptual model, the geochemical solubility indicators for gold from epigene solutions should be kept in mind. These are arsenides, tellurides, selenides, and antimonides.

SAMPLING AND ANALYTICAL METHODS

Sampling was done using an 800-foot grid oriented approximately along former ice flow with an azimuth of 165 degrees. The basal till was searched out by making use of topography (stoss-side of low outcrops), and by finding and using glacially shaped bedrock ramps (where the former ice impinged perpendicular to the outcrop ridge) and there looking for a matching drift ramp. Places were avoided when the surface showed a low depression between outcrop and drift (easily eroded sand); also where the drift surface is hummocky (talus, colluvium); and where the drift surface is a smooth flat plain where it meets the bedrock outcrop (silt, clay).

An uprooted tree on a till ramp may have caught in the root a telltale glacially shaped (soled, striated) clast. Even the slightly protruding, subrounded, glacially shaped clasts may be felt under one's feet and give the needed clue through the few inches of covering moss.

Sites chosen for test pitting were those which had the best factors that optimized the chances of finding basal till nearest to interesections of the 800-foot grid.

Pits were dug with a shovel (approximately 6 feet long x 3 feet wide by 2 to 6 feet deep) until basal till could be definitely identified. Characteristics looked for were high compaction; pebbles break clean from matrix and leave a cast; fissility due to unloading; a range of grain sizes due to the several mechanics of breaking and crushing. In most of the cases, this till accounted for a layer about 6 inches thick (15 cm.) directly overlying glacially striated, polished subcrop surface of the bedrock.

The accompanying map shows only sites where basal till was identified by a competent practical Pleistocene geologist and samples taken. Many other test pits were dug, but those which did not have basal till in them are not shown on the accompanying map.

The one cubic-foot bulk sample of till was carried out on two back-packs to a central zone for panning. Volume of the sample was reduced there to about 5 pounds using a regular large gold pan. A dispersing and wetting agent, calgon, was used to prevent loss by flotation of very fine gold.

Concentrates from the panning were then further treated at the central field laboratories by superpanning. A long narrow tail was obtained of chiefly magnetite and gold. Identification of the gold clasts was then made directly over the superpanner using a binocular microscope. All gold clasts were scanned under low (x 8) and medium (x 25) power, identified and counted as either coarse clasts or fine clasts, and recorded.

Most of the gold in basal till overlying the Otto stock is very coarse-grained and identification is easy and positive. However, without strong sunlight and even with a microscope lamp, the very fine-grained gold and bronzite pyroxene present in some samples could occasionally be confused. Where samples were suspected of carrying bronzite, a HNO_3 leach was used prior to gold counts. The corrected values after the leach are shown on the accompanying maps.

The technique for a person to pan very fine-grained gold requires one to four weeks of training. The graduate prospector on this job, Bryan McKenzie, had one week of solid continuous training at Haileybury School of Mines and a month at a project in McGarry Township before proceeding with the samples from the present area. Production ranged from 2 to 4 samples (each a cubic foot) per day, depending on the amount of cementation in the samples. Mr. McKenzie picked out the geo-indicators for gold and set them aside for further examination by a geologist. A suite of the rock types from each sample site was set aside for examination if needed when an anomaly showed up.

Special geology experience, which takes several years to attain, is needed to feel basal till under one's feet, where pits will then be dug and pronouncements made on the material when encountered. Basal till in Otto Township stratigraphically underlies (1) a cover of organic roots, and (2) gravel-sand and reworked till of glacial wave action. An experienced geologist with a practical knowledge of till and glacier mechanics can, with the help of an assistant obtain as many as four bulk samples per day, whereas a geologist inexperienced with till, along with an assistant, averages less than one sample per day.

Gold assays are given in this regard to three decimal places (e.g. 0.005 oz./ton gold) when assay was done by fire assay, and to four decimal places when assay was done by atomic absorption on the fire assay bead.

TABLE 1: GEO-INDICATOR CLASTS IN BASAL TILL OVER ZONES "A" AND "B".

ZONE A Sample Point	Gold Clasts/ cu.ft. till Total	Coarse	Chlorite	Carbonate	Breccia	Hematite	Graphite	Sheared	Qtz BB	Qtz Other	Mineral-ization
D751	4	0	-	+	-	-	-	+	-	+	cup.
D752	1	0	-	-	-	+	-	-	+	+	-
D753	3	0	-	-	+	-	-	-	+	-	-
D754	2	1	-	-	-	-	-	-	-	+	-
D759	45	10	-	+	-	-	+	+	+	+	-
D760	4	4	-	-	-	-	-	+	+	+	-
D768	18	3	-	-	-	-	-	-	+	-	-
ZONE B											
D755	8	2	+	-	+	-	-	-	+	+	py
D756	18	7	-	-	-	-	+	-	+	+	py,po
D757	7	2	-	+	-	-	-	-	-	+	-
D758	3	1	-	-	-	-	+	-	-	+	-
D761	0	0	-	-	+	-	-	-	-	+	-

py-- pyrite; po-- pyrrhotite; cup-- cuprite; Qtz BB-- blue-black quartz

RESULTS, SOUTH GRID

Direction and Distance of Transport for Clasts in Basal Till

Transport of clasts by glaciation was south-southeast, 140° to 160° azimuth, shown by striations both on outcrop and at the interface of till and subcrop. Direction of motion is shown by roches moutonnées and miniature crag-and-tail features.

The detailed outcrop geology mapping has revealed sources for the sheared rocks at site D760. The displacement is 100 and 300 feet respectively between source and clasts position in basal till.

Size of Gold Clasts

Many of the gold clasts over the south grid are very coarse and this caused a mild gold fever in the camp where the superpanning was being done. Another feature of the superpan concentrates from Otto township is the marked abundance of magnetite some of which is coarse-grained.

As mentioned previously, both coarse and total (coarse + fine) gold clasts are recorded and are shown on the accompanying maps. But only total gold is contoured on the maps. If the coarse gold were contoured, results would be essentially the same as those for total gold.

Zone A

Gold Clasts in Basal Till

Sampling on a 800-foot grid shows two concentrations of gold tentatively grouped together as Zone A on the accompanying map (sites D759, 760, 765, 768). The number of clasts in a cubic foot of till is as high as 45 and the coarse gold alone is as high as 10 clasts. This is very encouraging considering that 2 or more coarse gold clasts in a cubic foot of till is what outlines the Kirkland Lake ore zones.

Sampling is now required on a 200-foot grid within Zone A, and any promising targets should be uncovered by backhoe, holes made with a plugger into subcrop and blasted, in order to obtain adequate samples for testing gold.

Geo-indicator Clasts in Basal Till

Chloritite and Carbonate

Sheared chloritite clasts are in the basal till at site D767. Carbonate clasts are at sites D759 and 768. The source of these clasts has not been identified in outcrop exposures, and they may only occur in subcrop.

Sheared Rocks

The coarser-grained rocks such as the Otto syenites, when sheared give plates a centimeter or more wide. This wider spacing makes identification of sheared clasts a little more difficult. Slickensides at the edge of plates with a little smeared bluish fibrous hornblende, hematite, or chloritite may be the major clues.

The sheared clasts at site D760 have sources, as already mentioned, 100 to 300 feet "up-ice" as shown by later mapping. Sheared clasts at site D751 could give a southwest continuity of the exposed shear zone.

Other Clasts

A type of dark laminar quartz occurs as till clasts at most sites over the south grid. This quartz has multiple known sources in outcrop with likely many more in subcrop. The quartz is cryptocrystalline having the luster nearly of wax, but its X-ray pattern is of quartz. It shows very, very fine laminae or layering which in outcrop is seen to be parallel to the plate edges of shears and joints and is continuous for up to tens of feet. Inclusions of undetermined black specks, and red ferruginous oxides give dark colours to the quartz.

In early prospecting, this dark quartz was mistaken for the favourable blue-black quartz associated with gold. However, considerable sampling and analysis did not yield gold values and the laminar lines now make it suspect as a variety of silica with each layer added successively, and then later recrystallized. A thermal study would be necessary to determine this type of quartz. Because of its presence in most samples and multiple sources, it is not shown with the geo-indicator clasts on the accompanying maps.

Cuprite

A heavy substance in superpan concentrates from site D751 is banana-shaped with lines along its length. The outer coating is reddish and the interior a chrome-green. X-ray diffraction identified the mineral as cuprite, Cu_2O. Some additional testing of the basal till near site D751 is advisable.

Favourable Outcrop Geology

Dyke Z

Duke Z as shown on the accompanying map is a syenite porphyry 4 to 6 feet wide.

At showing S, Cochrane and Savage describe the dyke as "...4 feet wide, N5^{o}E, vertical, coarse grey porphyry. A few small specks of chalcopyrite and occasional small greenstone inclusions occur in the porphyry... The porphyry is cut by a few, narrow vuggy gash stringers of quartz."

At S5, one of the present writers observed a pit in syenite bedrock. Exposed in the pit is a quartz-carbonate stockwork Zone 18 inches across in which there are blebs of pyrite, chalcopyrite, and malachite.

At S3, Cochrane and Savage report a coarse-grained outcrop that contains numerous rounded inclusions of micaceous greenstone. Some of these are said to contain traces of chalcopyrite and 0.01 oz./ton of gold.

At S2, Cochrane and Savage report occasional narrow quartz stringers, northeasterly trend and steep dip to west cut the coarse rock. Traces of specular hematite and rare specks of pyrite and chalcopyrite occur in these stringers. Grab samples assayed for gold ran 0.01 oz./ton.

Quartz Veins

At S4, on the southwest side of a syenite hill, an irregular vein of glassy white quartz about 4 feet wide cuts the syenite. The vein strikes N45°E and dips vertical. There are inclusions in the vein and specks of galena were reported earlier by Cochrane, but not seen. One grab sample is said to have assayed 0.04 oz. of gold/ton.

An intersection, arrived at by projections of the vein and dyke Z, would meet in subcr-p about 200 feet "up-ice" from the strongly anomalous gold site at D759. It is recommended that this intersection be uncovered by stripping with a backhoe and the subcrop exposed, blasted and sampled.

Intrusive-Relic Breccia

Three small outcrop exposures of "intrusive-relic breccia" shown by the detailed mapping is indicative of considerable subcrop exposure on the northwest side of dyke Z; thus defining the hanging wall side.

Shears and Faults

Two shear zones outcrop, sub-parallel to dyke Z, as does a major fault-line scarp with an escarpment about 100 feet high.

The above geological conditions contains a number of favourable elements for the piping model, and together with abundant gold clasts per cubic foot of till, and the geo-indicator clasts in till, makes the zone worthy of further till testing and promising areas to be exposed by backhoe, blasted and sampled for gold.

Zone B

Gold Clasts in Basal Till

Sampling on the 800-foot grid shows a concentration of gold on the accompanying map (D755, 756, 757). The number of clasts in a cubic foot of till is as high as 18 and the coarse gold alone is as high as 7 clasts. This is encouraging considering that 2 or more coarse gold clasts per cubic foot of till is all that outlines the Kirkland Lake ore zone. Sampling is now needed on a 200-foot grid within Zone B.

Geo-indicator Clasts in Basal Till

Chloritite and Carbonate

Clasts from D758 show strong alteration and fragmentation and are, likely, a fault breccia. Some clasts have a talc-kaolinite-serpentinite stockwork of fracture fillings in a dense-greenish black matrix; others are of quartz-iron, carbonate-chlorite bands and triangular pieces in a dark green much brecciated rock; whereas other clasts in the same dark green rock have siliceous-iron carbonate veins. An intense fault-zone passes likely, nearby in subcrop and as such it would be a favourable host zone for the gold.

A small outcrop exposure of carbonate-chloritite is exposed a short distance "down ice" and will be discussed later in the report. It is, likely, part of the same breccia zone.

Clasts in basal till from D755 include chlorite-quartz-sericite-pyrite. Boulder float 400 feet to the east of site D755 is composed of quartz-carbonate vein material with disseminated pyrite, minor chalcopyrite, and gold (0.0025 oz./ton).

Clasts in basal till from D756 contain (a) sheared siliceous material with minor graphite, pyrrhotite, and pyrite; (b) siliceous material-iron carbonate-glassy ovoid quartz in a fault breccia. This is the site where, as already mentioned, there is much gold in the basal till.

Other Clasts

Some clasts in basal till from D755 and 761 show spinifex texture and are magnetic. Source material for the ultramafic flow is likely a short distance "up-ice" in subcrop, and this is, likely related to the serpentinite showing up in the fault breccia-clast at site D757.

Favourable Outcrop Geology for Conceptual Piping Model

Chloritite and Carbonate

An exposure on the north face of a syenite outcrop is described by Scott and Lee (1975) as follows:

> "---chlorite-carbonate sheared material. Dark green with blebs and stringers of red-pink carbonate throughout. A little hematite stain; slightly magnetic".

> "Microscopic: total feldspar 30%; chlorite-carbonate groundmass 69%; magnetite 1%. Remnant large feldspar phenocrysts are plagioclase and microcline, highly fractured, sericitized and carbonatized, appears as diffuse masses, fine-grained groundmass is chlorite-carbonate, carrying anhedral magnetite, shows schistosity around phenocrysts. A few carbonate veinlets, a little hematite in fractures".

As mentioned earlier in this report, this type of material, but more brecciated, continues into subcrop to the north as shown by the clasts in basal till at site D757.

Dyke X

Dyke X with a width of about 6 feet is described by Scott and Lee as:

> "...porphyry dyke material, d-ifferent from all other porphyry dykes mapped. Massive, blocky fracture. Abundant fresh euhedral (calcic?) feldspar phenocrysts ~ 5 mm. in diameter (40%). Matrix more mafic, containing hematite, magnetite, pyroxene, feldspar, trace pyrite. Strongly magnetic. Grab samples give low gold (0.0010 oz./ton)".

> "Microscope: Total feldspar 70%, biotite 20%, pyroxene 5%, magnetite 5%. Phenocrysts of plagioclase and microperthite, commonly composite, zoned. Common plagioclase twinning observed. Also unusual cross type twinning. Most feldspar phenocrysts show some sericitization. Plagioclase is of andesine composition, potash feldspar most likely microcline. A few large grains of biotite, amphibole and pyroxene, the former two in part alteration products of the latter. High colour of pyroxene indicates aegerine-augite and corresponding sodic amphibole. Magnetite occurs as very small euhedral grains in matrix. A few larger subhedral pyrite grains. Accessories apatite, hematite. Matrix composed of fine-grained potash feldspar, biotite, magnetite, apatite. Flow texture, common in many dykes, is not apparent".

The dyke X is sub-parallel to the two mapped shear zones. Its relationship to the chloritite-carbonate is not established but it is of interest. The low gold content of the dyke is of interest.

Quartz Veins

Several zones with quartz veins (3, 4 and 6 feet wide zones), each contains a series of veins of white quartz about 4 inches wide. When projected, These quartz vein zones would meet dyke X in subcrop about 500 feet "up-ice" from site D756 which contains much gold in basal till.

Intrusive-Relic Breccia

An areas of "intrusive-relic breccia" is mapped between dyke X and the high gold site. The breccia is characterized by mottled pink-green rock with 2-foot inclusions and 6-inch wide mafic breccia dykes.

Zone B shows considerable promise both as a piping model and also as an altered fault breccia zone. These, together with high gold in basal till, low gold in dyke X and geo-indicator clasts makes the zone worthy of further till testing. Promising areas need then to be exposed by backhoe, stripping, blasted and sampled for gold.

CONCLUSIONS AND RECOMMENDATIONS

Zone A and B is each worthy of further exploration. The complete piping-artery model is present in both zones from intrusive-relic breccia, to dykes with fluidal texture, and quartz veins. There are structural traps available for concentrating gold.

In Zone A, four prospect pits show low levels of copper (chalcopyrite) and gold (0.01 to 0.04 oz./ton). These pits are near to and within a strong, syenite porphyry dyke Z. Structural traps are available in subcrop indicated by chloritite clasts (D767) and carbonate clasts (D759, 768). Shearing in outcrop is mapped, and about 400 feet north of the high gold values in till. There is a major fault-line escarpment sub-parallel to Zone A and with a down drop of about 100 feet.

Compared to the orientation study at Kirkland Lake for gold where two coarse clasts of gold per cubic foot is anomalous, the levels in Zone A are strongly anomalous with 3, 4, and 10 clasts respectively at different sites. The gold in subcrop is either at the edge of dykes, concentrated in pockets in structural traps, or continuous within a structural zone. The till samples in the present survey are too far apart to distinguish local pockets from a continuous zone. Additional till sampling of 30 sites is needed to determine concentrations of gold and to show where the stripping by backhoe, followed by plugger holes, dynamited pits and subcrop sampling should be done.

The estimated cost of backhoe with operator, geologist, prospector, and consultant is $15,000. It is recommended that funds be provided.

LEE GEO-INDICATORS LIMITED

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Susan A. Scott

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December, 1975

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CERTIFICATE

I, HULBERT A. LEE, of the regional municipality of Ottawa-Carleton, Province of Ontario, do hereby certify that:

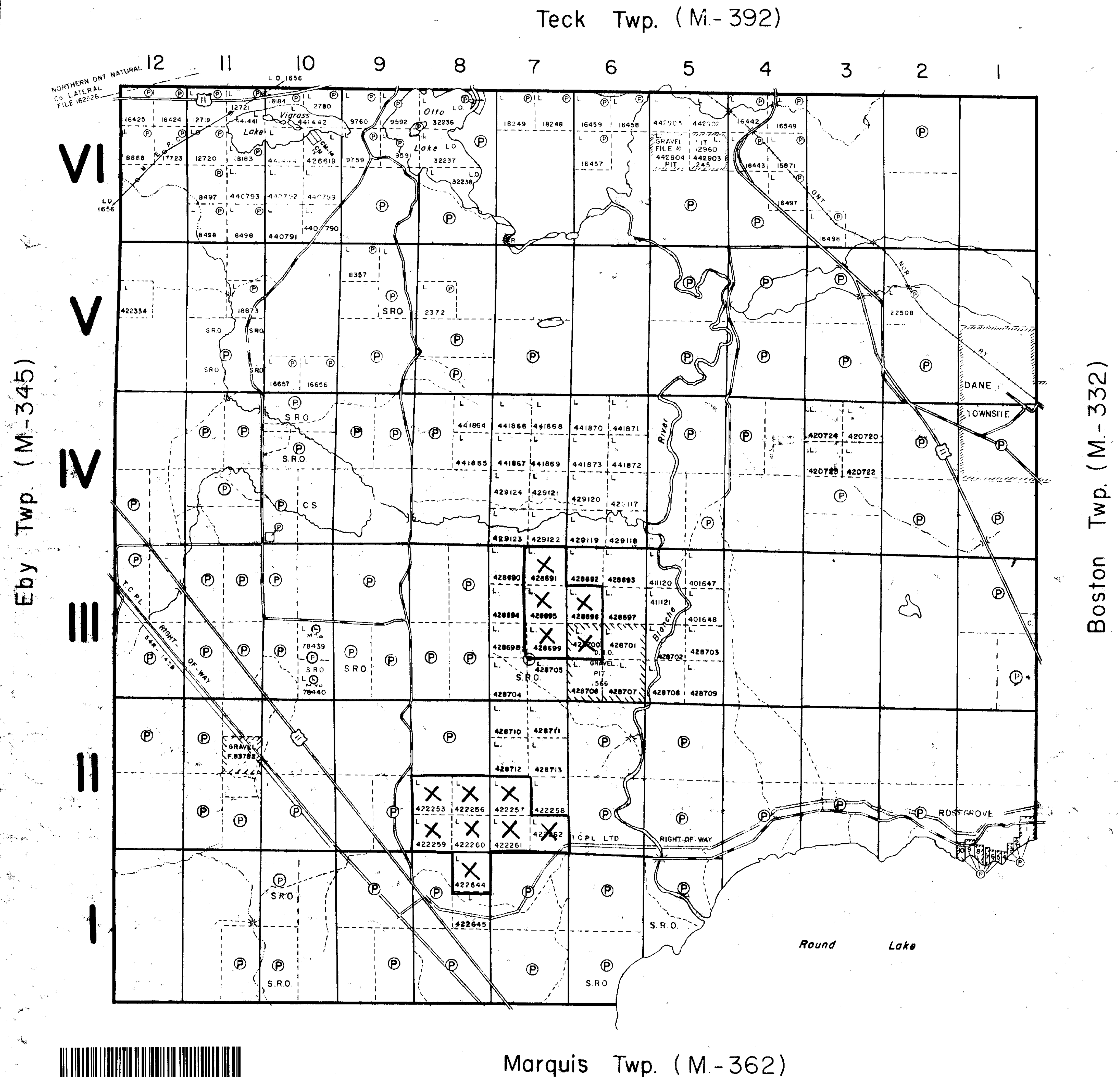
1. I am a geologist, residing at 94 Alexander Mtreet, Stittsville, Ontario, KOA 3G0.
2. I am a graduate of Queen's University, with a B.Sc. degree in geology and mineralogy (1949) and a graduate of the University of Chicago with a Ph.D. in geology (1953).
3. I am a member of the Professional Engineers of Ontario, the Canadian Institute of Mining and Metallurgy, the Society of Exploration Geochemists, and a fellow of the Geological Society of America. I have been practicing my profession continuously since graduation with a B.Sc.
4. The statements made in this report are based on deep-pitting, bulk sampling, geological, and heavy mineral data obtained by the authors and Mr. Bryan McKenzie unless otherwise noted by reference.

Hulbert A. Lee, P.Eng.

REGISTERED PROFESSIONAL ENGINEER
H. A. LEE
PROVINCE OF ONTARIO

Stittsville, Ontario

December 10, 1975



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THE TOWNSHIP
OF
OTTO

2.2024

DISTRICT OF
TIMISKAMING

LARDER LAKE
MINING DIVISION

SCALE: 1-INCH=40 CHAINS

LEGEND

PATENTED LAND	Ⓟ
CROWN LAND SALE	C.S.
LEASES	Ⓛ
LOCATED LAND	Loc.
LICENSE OF OCCUPATION	L.O.
MINING RIGHTS ONLY	M.R.O.
SURFACE RIGHTS ONLY	S.R.O.
ROADS	
IMPROVED ROADS	
KING'S HIGHWAYS	
RAILWAYS	
POWER LINES	
MARSH OR MUSKEG	
MINES	
CANCELLED	C.

NOTES

400' Surface Rights Reservation around all Lakes and Rivers

Dane Townsite shown thus

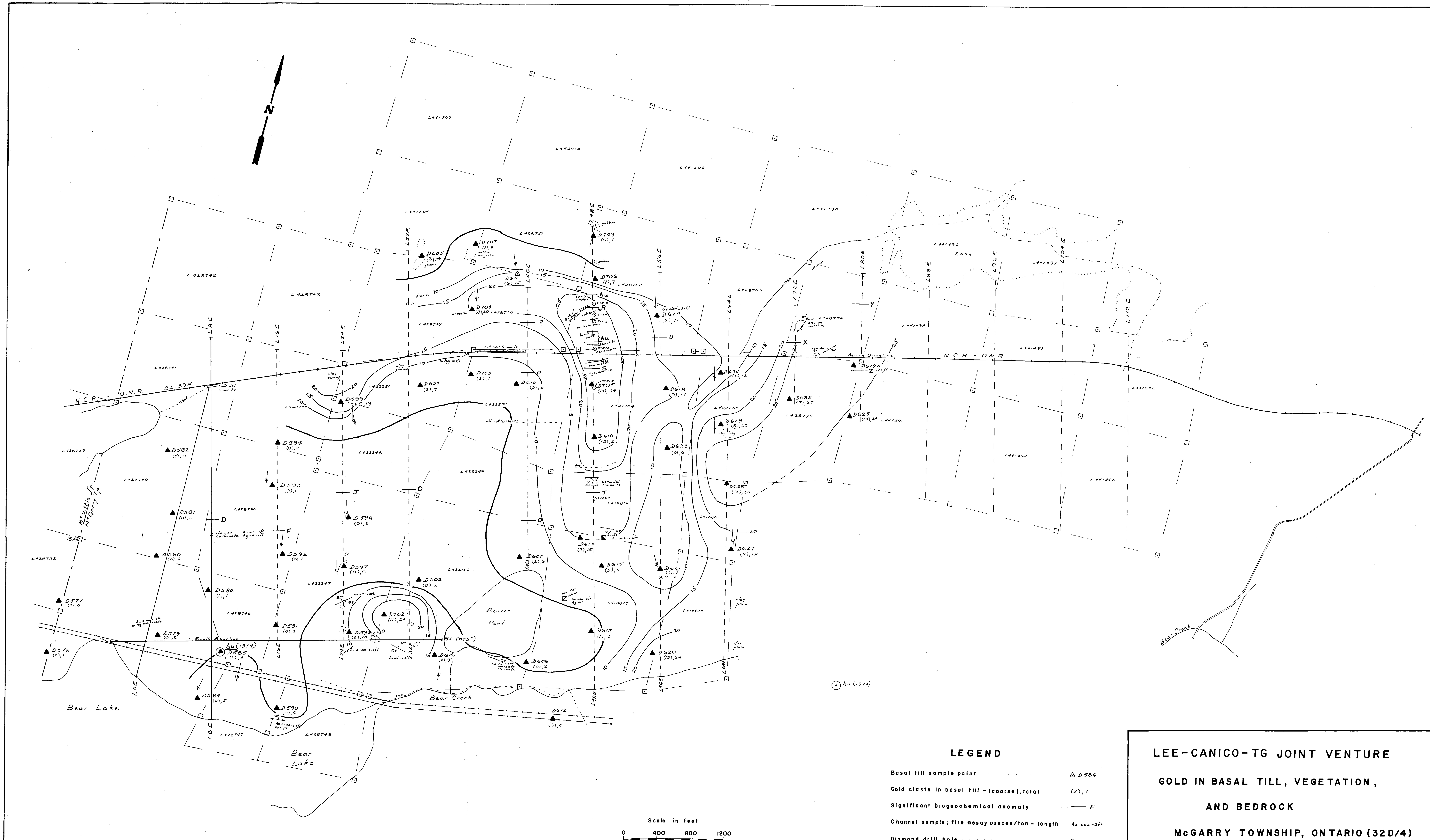
NOT OPEN for STAKING

O.C. Jan 10, 1911.

DATE OF ISSUE
JAN 2? 1976
SURVEYS AND MAPPING BRANCH

PLAN NO.- M-379

ONTARIO
MINISTRY OF NATURAL RESOURCES
SURVEYS AND MAPPING BRANCH



LEGEND

Basal till sample point	△ D586
Gold clasts in basal till - (coarse), total	(2),7
Significant biogeochemical anomaly	—— F
Channel sample; fire assay ounces/ton - length	Au .002 - 3ft
Diamond drill hole	⊙
Gold train in basal till	
Striation	
Shearing; vertical, inclined	
Strike and dip of quartz vein	

LEE-CANICO-TG JOINT VENTURE

GOLD IN BASAL TILL, VEGETATION, AND BEDROCK

McGARRY TOWNSHIP, ONTARIO (32D/4)

by

Lee Geo-Indicators Limited

Scale: 1 inch = 400 feet

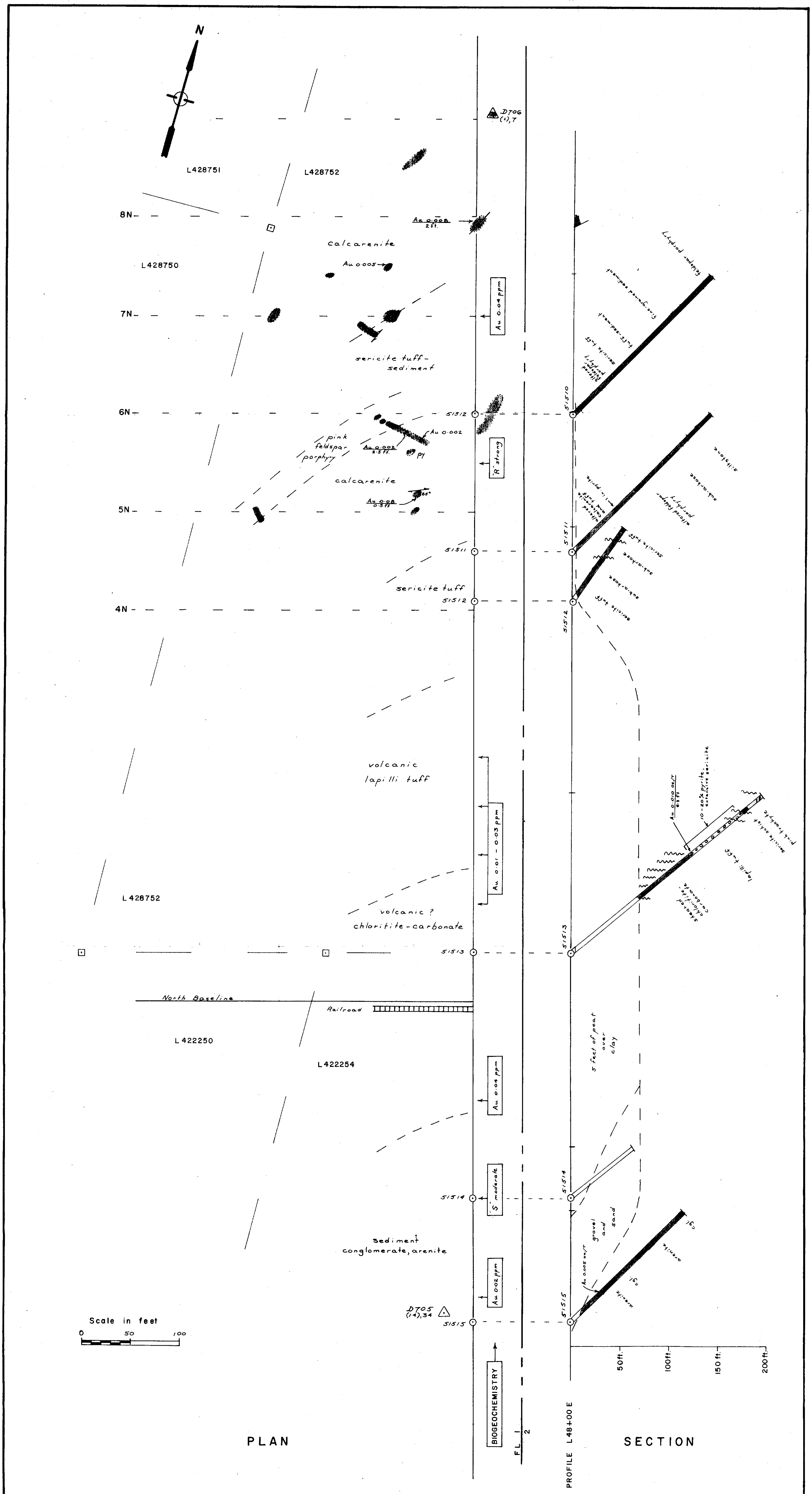
Hulbert A. Lee
Hulbert A. Lee

December, 1975

2.2024

210

210



LEGEND

- Chloritite - carbonate
- Lapilli tuff
- Sericite tuff
- Trachyte
- Feldspar porphyry, syenite or trachyte
- Conglomerate
- Arenite
- Sub - arkose
- Calcarenite
- Siltstone
- Tuffite
- Shear; strike and dip, general
- 51514 Diamond drill hole
- DT05 (14),34 Basal till site; (coarse gold clasts), total

LEE-CANICO-TG JOINT VENTURE

GEOLOGY ALONG LINE 48+00E

McGARRY TOWNSHIP, ONTARIO (32D/4)

by

Lee Geo-Indicators Limited

Scale: 1 inch = 50 feet

Hulbert A. Lee

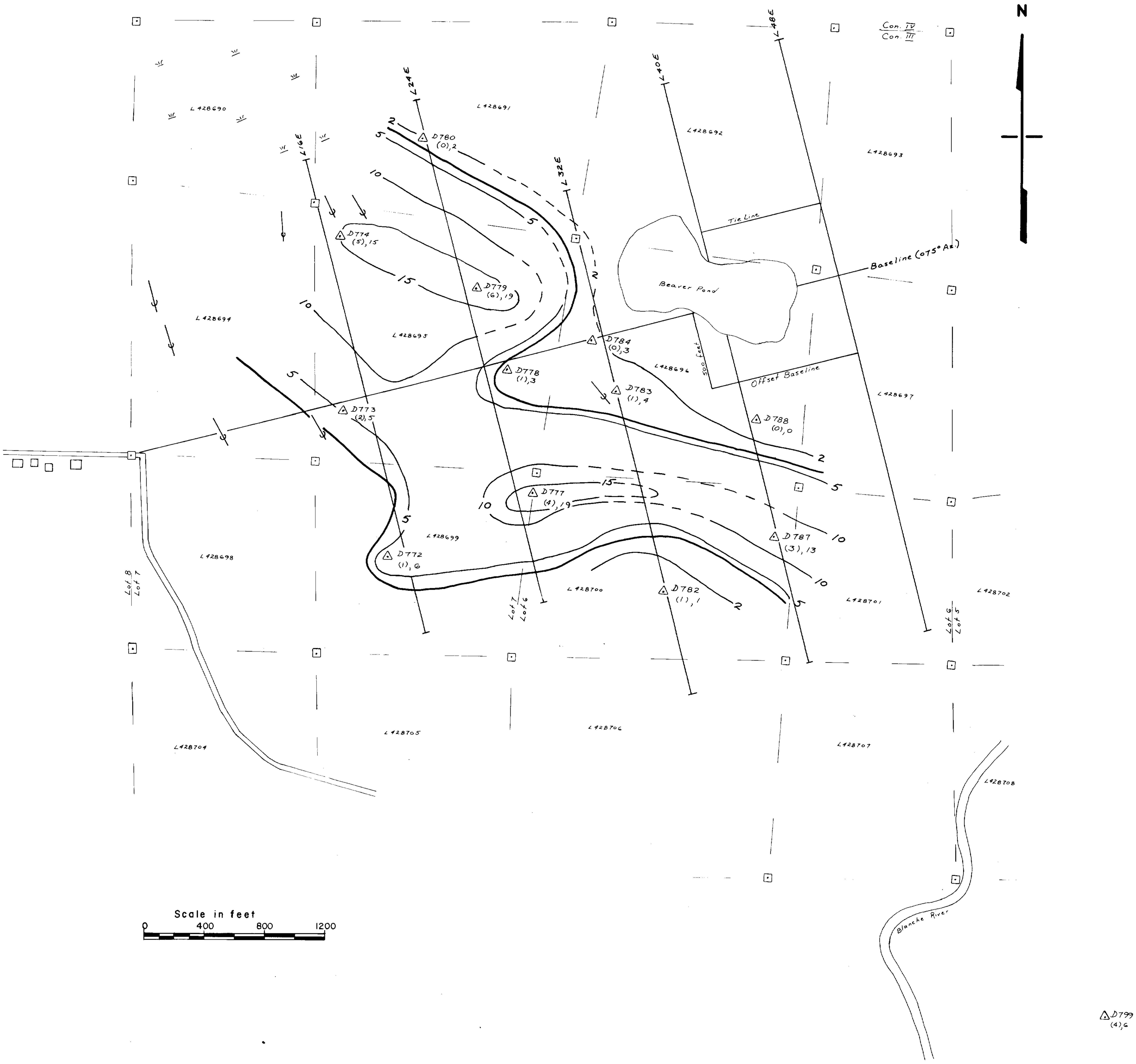
Hulbert A. Lee

December, 1975

2.2024

220

220



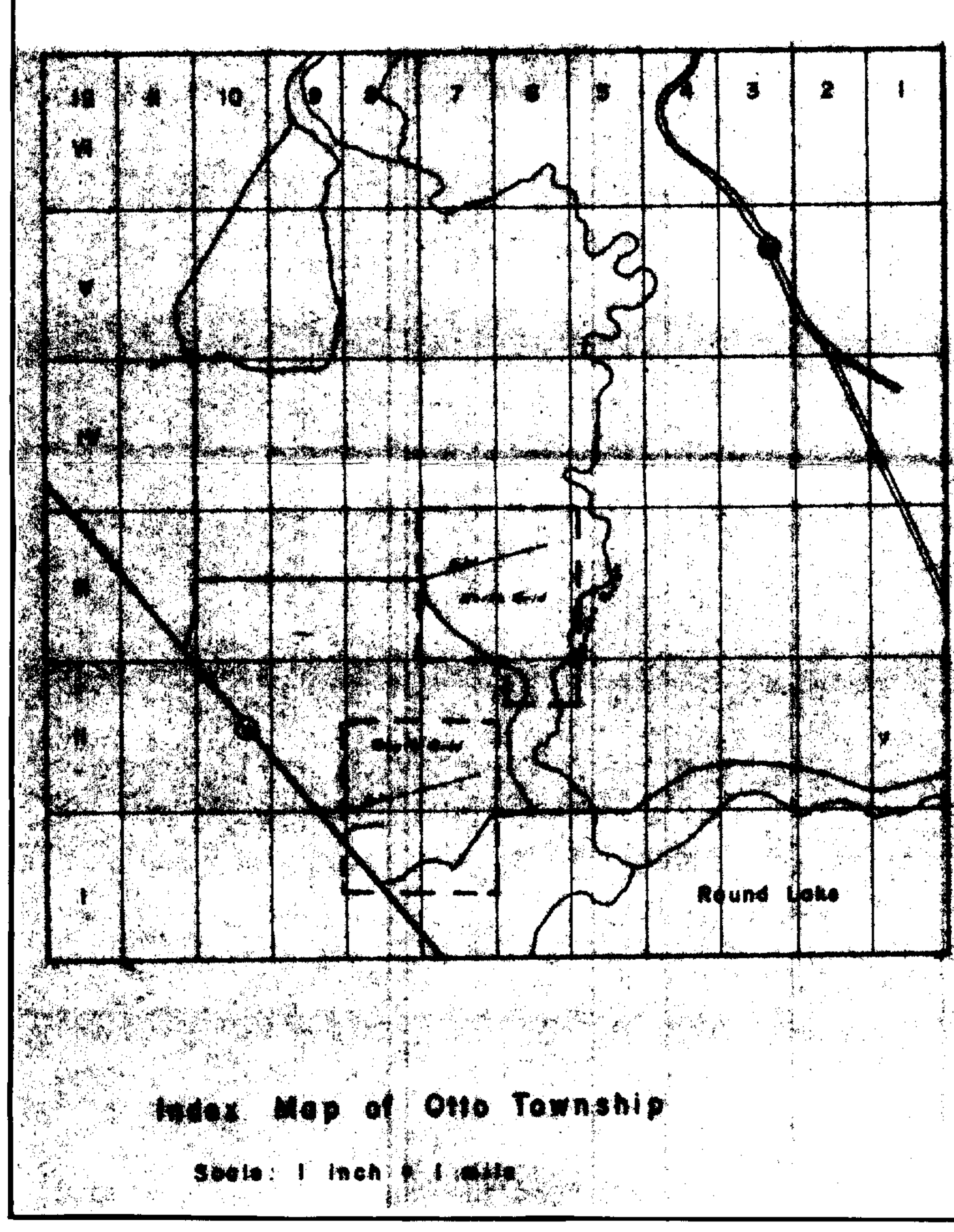
LEGEND

Sample point - - - - - - - - - - - - - - △D779

Gold clasts in 1 cubic foot of basal till
-(coarse), total - - - - (2),4

Striation - - - - - - - - - - - - - -

Gold train in basal till - - - - - - - - -



LEE-CANICO-TG JOINT VENTURE

GOLD CLASTS IN BASAL TILL
OVER NORTH GRID
OTTO TOWNSHIP, ONTARIO (42 A/1)

by

Lee Geo-Indicators Limited

Scale: 1 inch = 400 feet

Hulbert A. Lee *Hulbert A. Lee*
Susan A. Scott *Susan A. Scott*

December, 1975

2.2024

230

LEGEND

Sample point — — — — — — — — — — — — — △ D778

Gold clasts in 1 cubic foot of basal till - (coarse), total — — (2),4

Chloritite clasts in basal till — — — — — — —

Pyrite (py) and pyrrhotite (po) clasts in basal till — — Py·Po

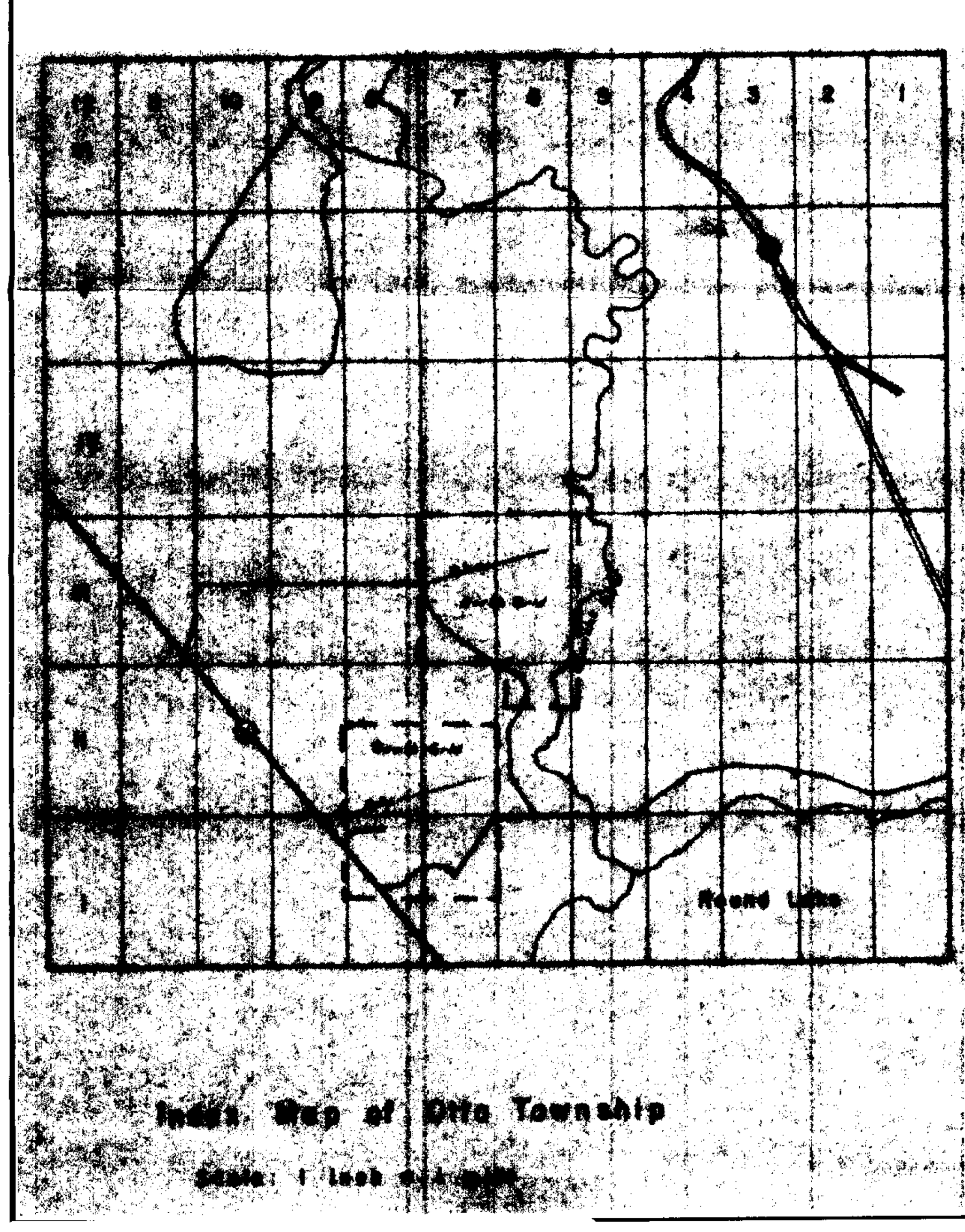
Float (chloritite Fc, sulphide Fs, carbonate Fca) — — Fc, Fs, Fca

Gold train in basal till — — — — — — — —

Dyke, mainly syenite porphyry and syenite — — — —

Quartz veining and stockwork — — — — — — — x—·—x

Fault and shear zones — — — — — — — — —



LEE-CANICO-TG JOINT VENTURE

GOLD AND CHLORITITE CLASTS IN BASAL TILL, AND STRUCTURES IN BEDROCK OVER NORTH GRID OTTO TOWNSHIP, ONTARIO (42A/1)

by

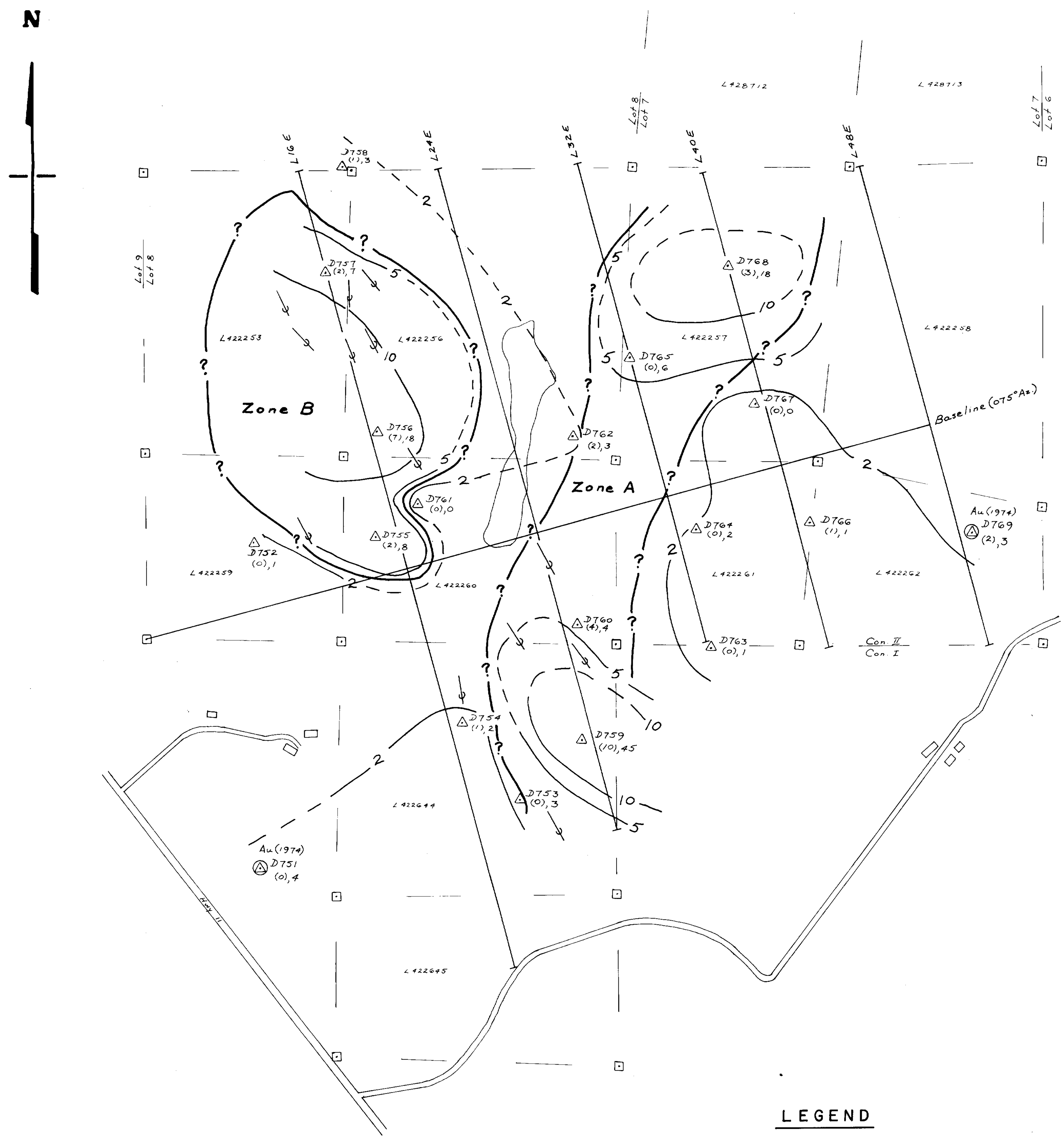
Lee Geo-Indicators Limited

Scale: 1 inch = 400 feet

Hulbert A. Lee *Hulbert A. Lee*
Susan A. Scott *Susan A. Scott*

December, 1975

2.2024



LEGEND

Sample point — — — — — — — — — — — — △D757

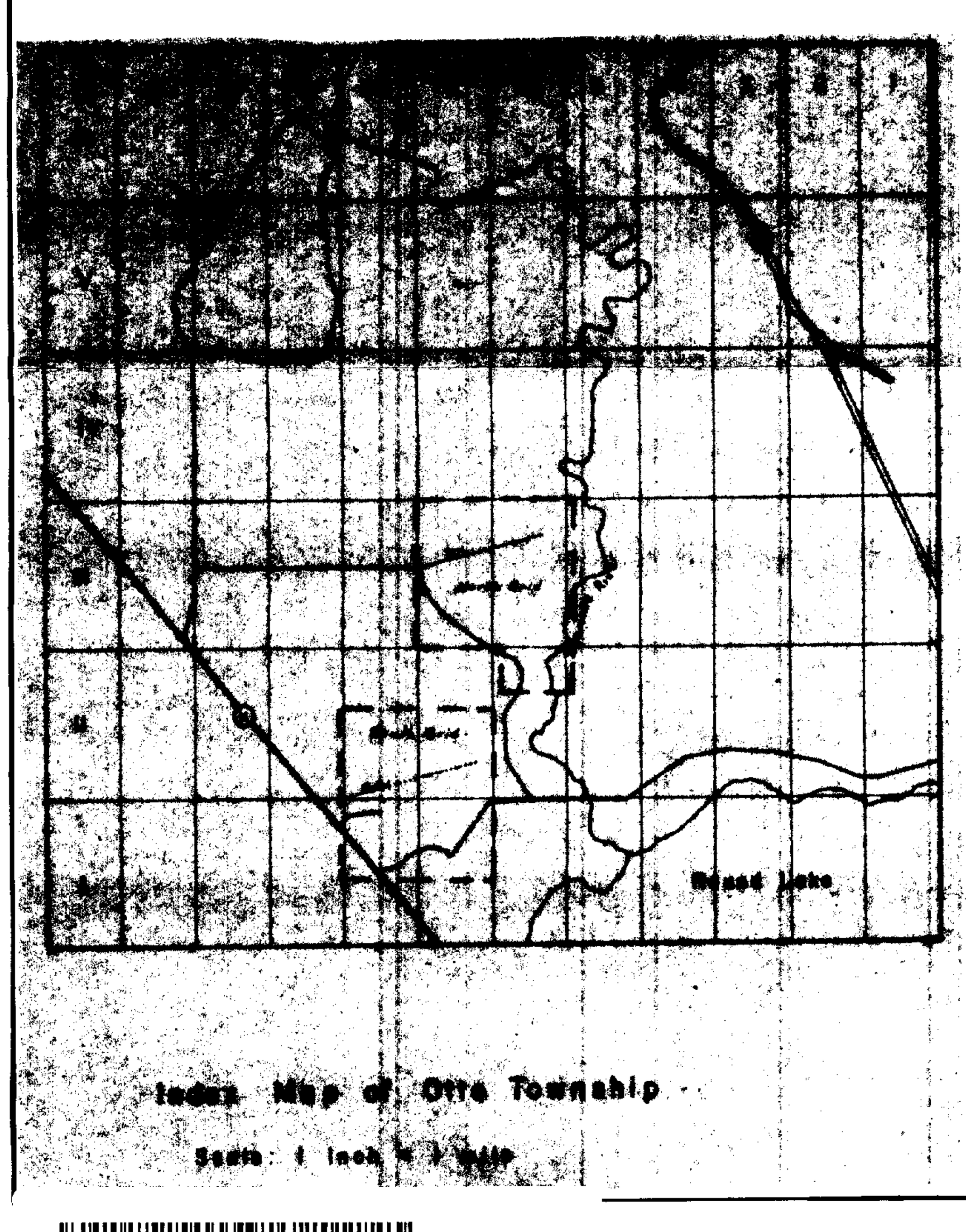
Gold clasts in 1 cubic foot of basal till-(coarse), total - (10),45

Striation — — — — — — — — — — — — —

Indicated gold source zones — — — — — — — —

Scale in feet

0 400 800 1200



LEE-CANICO-TG JOINT VENTURE

GOLD CLASTS IN BASAL TILL OVER SOUTH GRID OTTO TOWNSHIP, ONTARIO (42 A/1)

by

Lee Geo-Indicators Limited

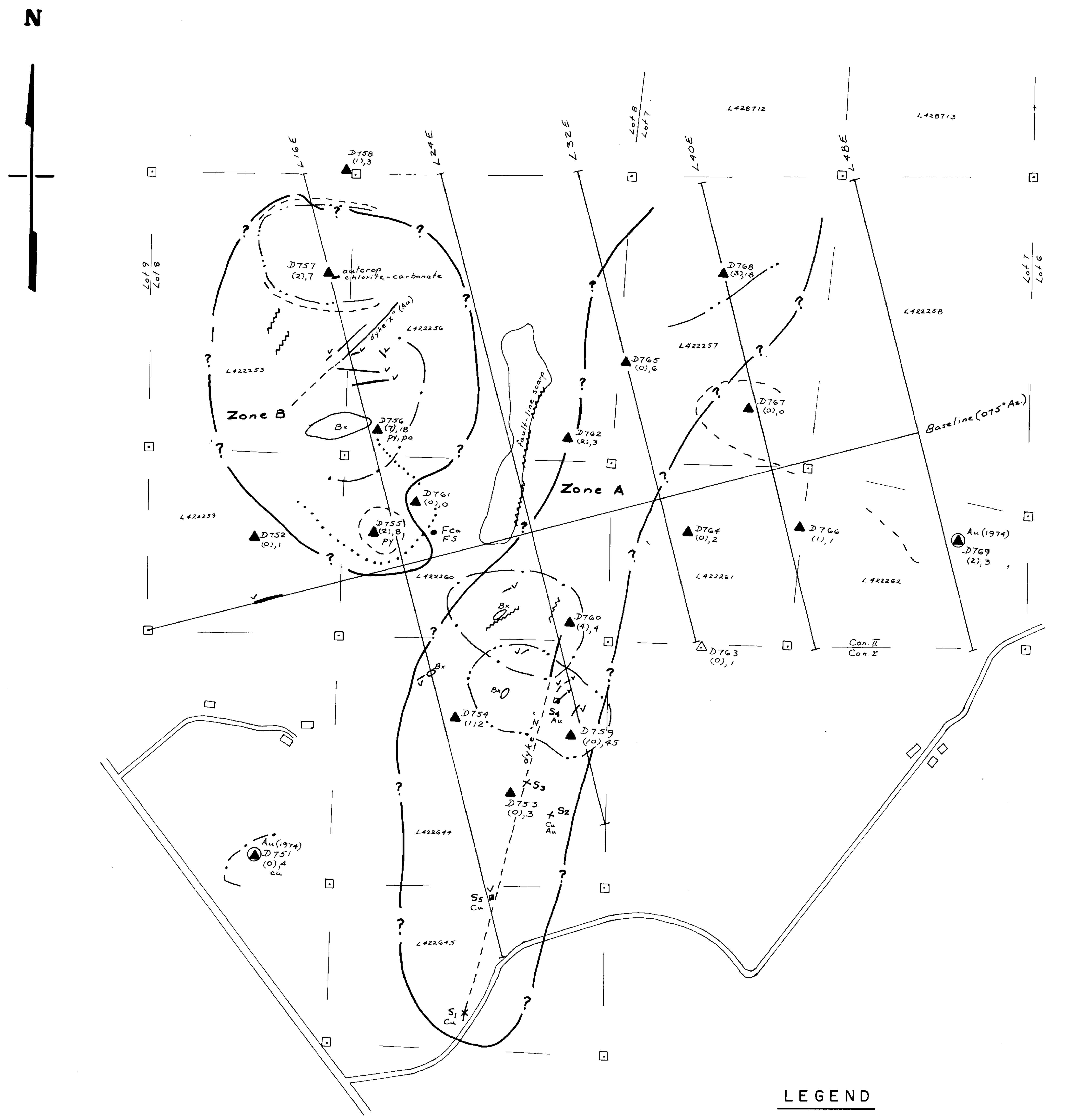
Scale: 1 inch = 400 feet

Hulbert A. Lee *Hulbert A. Lee*
Susan A. Scott *Susan A. Scott*

December, 1975

2.2024

250



Scale in feet

0 400 800 1200

LEGEND

Sample point — — — — — — — — — — — △D757

Gold clasts in 1 cubic foot of basal till - (coarse), total — (10), 45

Chloritite clasts in basal till — — — — — —

Quartz - carbonate clasts in basal till — — — —

Abundant sheared clasts in basal till — — — —

Ultramafic, spinifex clasts in basal till — — — —

Pyrite (py), pyrrhotite (po), cuprite (cu) clasts in basal till — — — Py, po, cu

Float (carbonate FCa, sulphide FS) — — — — FCa, FS

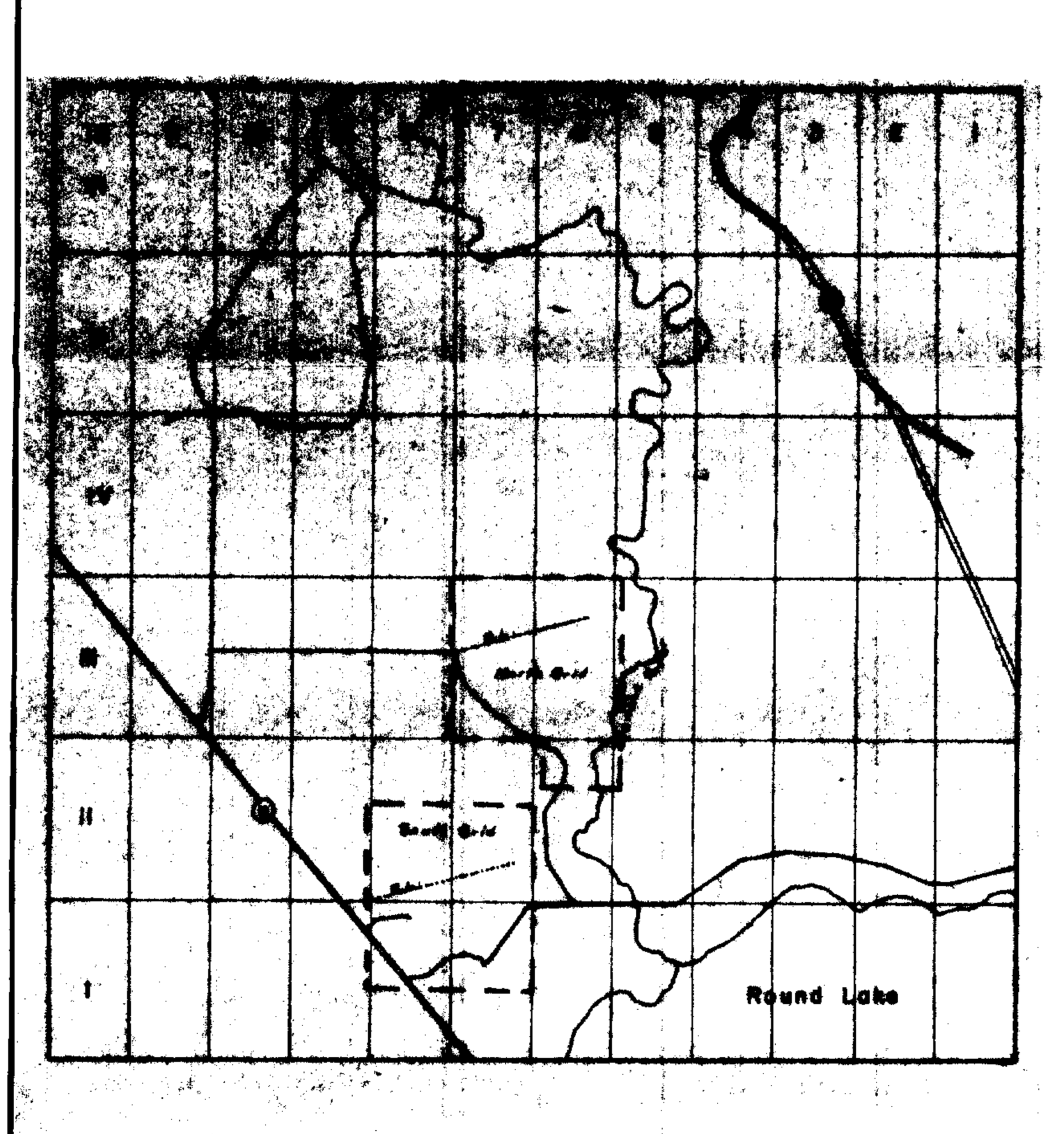
Dyke, mainly syenite porphyry — — — — —

Vein quartz — — — — — — — — — —

Mafic inclusions, "intrusive relic breccia" — — — Bx

Fault and shear zones — — — — — —

Indicated gold source zones — — — — — ?



Index Map of Otto Township

Scale: 1 inch = 1 mile

LEE-CANICO-TG JOINT VENTURE

GOLD AND OTHER INDICATOR CLASTS IN BASAL TILL, AND STRUCTURES IN BEDROCK OVER SOUTH GRID

OTTO TOWNSHIP, ONTARIO (42 A/1)

by

Lee Geo-Indicators Limited

Scale: 1 inch = 400 feet

Hulbert A. Lee Susan A. Scott	[signatures]	December, 1975

32D04NE0478 2.2024 MCGARRY

2.2024