Ministry of Natural Resources
Ontario

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ONTARIO GEOLOGICAL SURVEY

Open File Report 5518

Geology of the Lateral Lake Area

District of Kenora

by

R.O. Page

1984

THIS PROJECT WAS FUNDED BY THE ONTARIO MINISTRY OF NORTHERN AFFAIRS THROUGH THE NORTHERN ONTARIO GEOLOGICAL SURVEY (NOGS) PROGRAM.

Parts of this publication may be quoted if credit is given. It is recommended that reference to this report be made in the following form:

Page, R.O.

1984: Geology of the Lateral Lake Area, District of Kenora, Ontario Geological Survey Open File Report 5518, 175p., 8 tables, 12 photos, 13 figures and 4 maps in back pocket.

Ontario Geological Survey

OPEN FILE REPORT

FOREWORD

The Lateral Lake area was mapped at a detailed scale under the Northern Ontario Geological Survey (NOGS) Program funded by the Ontario Ministry of Northern Affairs. The area lies southwest of Sioux Lookout within the Wabigoon and English River subprovinces and includes the Goldlund Mine, a porphyry dike hosted gold deposit currently in production, molybdenum and base metal showings.

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ABSTRACT

Early Precambrian (Archean) mafic, intermediate, and felsic metavolcanics underlie about sixty percent of the Lateral Lake map area, and include an older sequence in the central and northern portions of the area, and a younger sequence in southeast Echo Township. Mafic metavolcanics throughout the area are mainly massive and pillowed flows, although coarse fragmental units are not uncommon in the younger sequence. Metagabbro and metapyroxenite bodies are found in several locations within the older sequence of mafic lavas and are probably syn-volcanic intrusions. Intermediate and related felsic metavolcanics form the upper half of the older metavolcanic sequence and consist mainly of coarse pyroclastic rocks (tuff-breccia, breccia, and lapilli tuff). A major complex of dacitic and rhyolitic flows (or domes) occurs near the base of this unit and may represent a near-vent environment. Felsic and intermediate metavolcanics in the younger sequence are more uniform in composition (mainly rhyolitic), and are apparently overlain by a sulphide-quartz ironstone unit which may represent fumarolic (exhalative) activity at the end of volcanism.

Interbedded with, and overlying the metavolcanics are three major units of clastic metasedimentary rocks. The oldest metasedimentary unit equivalent to the Patara formation locally lies unconformably over the older mafic metavolcanic unit, but also includes beds within and possibly overlying the older intermediate to felsic metavolcanics. The Patara formation includes

volcanic clast conglomerates, quartzose wackes, and pebbly or graphitic slates. Unconformably overlying both the Patara metasediments and the older metavolcanic sequence is a distinctive unit of sandstone, siltstone, and polymict conglomerate, interpreted as a fluviatile sequence correlated with the Ament Bay formation. This sequence is older than the Ghost Lake Road metavolcanic unit and younger than the older metavolcanics. The remaining metasediments in the map area consist of fine, medium, and coarse-grained lithic wackes, slate, and higher grade metamorphic equivalents equivalent to the Little Vermilion formation and the Minnitaki group. These units are above the older and younger volcanic units respectively.

Pre- to syn-tectonic granodioritic to quartz monzonitic intrusive masses were subsequently emplaced into the meta-volcanic-metasedimentary succession.

The map area is at the boundary of the Wabigoon and English River Subprovinces. From north to south major structures are:

1) the northern belt, a south-facing homocline extending south to Redhat Lake;
2) a central syncline;
3) the Lateral - Tot Lakes anticline;
4) the Kathlyn Creek fault and fold belt;
5) the Echo Township south facing homocline;

The area includes the Echo Township molybdenum prospect, and occurrences of Cs, Li, Ta, base metals and the currently producing Goldlund Mine, a gold property.

GEOLOGY OF THE

LATERAL LAKE AREA

by

R.O. Page[1]

1981

INTRODUCTION

Lateral Lake map area (Figure 1) covers a rectangular area of about 400 km^2 (155 square miles), primarily in the Wabigoon Volcanic Belt. The centre of the area lies about 295 km air distance northwest of Thunder Bay, while the nearby towns of Dryden and Hudson are located about 30 km to the southwest and northeast, respectively. Only one or two families reside year-round in the map area, but considerable use is made of the area's recreational (fish and wildlife) and timber resources.

The present survey represents a joint program by the Ontario Geological Survey and Ministry of Northern Affairs to update the geological and mineral potential data base in northwestern Ontario to aid the economic development of the region.

PRESENT GEOLOGICAL SURVEY

Geological mapping for this report was conducted during the 1979 field season (May-September). Pace and compass traversing at 0.4-0.5 km intervals was carried out over much of the meta-volcanic-metasedimentary terrain, augmented by reconnaissance-scale (0.8-1.0 km spacing) traversing in areas of major

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Manuscript approved for publication by P.C. Thurston, Acting Chief Geologist, August, 1984.
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intrusive bodies and low outcrop density. In addition, detailed mapping done by Armstrong (1951), and more recently by Johnston (1972) and McCarter (Colvine and McCarter, 1977), was checked for consistency with the present mapping and incorporated with the present survey's data.

Field location and daily mapping was plotted on 1:15,840 (1 inch = 1/4 mile) scale vertical air photographs provided by the Air Photo Library (Ministry of Natural Resources), and all information was subsequently compiled on Forest Resource Inventory base maps of the same scale. Considerable changes (mainly logging) in the general appearance of the western third of the area have taken place since the 1965 and 1968 air photos were taken and some adjustments were accordingly made on the base maps. Elsewhere in the area, 1975 air photos generally provided excellent location, except where there had been recent road construction; supplemental air photo coverage, obtained from the District Office of the Ministry of Natural Resources in Sioux Lookout, adequately covered most roads.

Uncoloured preliminary maps, P.2371, P.2372, of the Lateral Lake area were issued by the Ontario Geological Survey in July 1980.

ACCESS

Highway 72 provides all-weather paved road access into the southeast corner of the map area, at a distance of about 30 km from the Trans Canada Highway (No. 17). Additional access into the area for most of the year can be made from Hudson, Dryden, and Highway 72 via a system of major gravel roads which crisscross the map area (Dryden-Hudson road, Ghost Lake road, Kathlyn Lake road). Access to more isolated portions of the area is facilitated by numerous logging roads of variable condition. As a general rule, logging roads which reach shorelines, or are built on sand and gravel areas, tend to be kept passable through general usage.

Many of the lakes in the map area may be reached by roads within the area, including: Franciscan, Maskinonge, Kathlyn, Crossecho, Centrefire, Watch, Gilbert, Gullwing, and Needle. Canoe travel between lakes is quite restricted by swampy, shallow creeks, or by boulder-strewn rapids in some of the deeper creeks. Access to Vermilion Lake is possible via one of several gravel roads which branch off the Dryden-Hudson road. Many of the lakes are accessible by float plane which may be chartered in Sioux Lookout or Dryden.

PREVIOUS GEOLOGICAL WORK

The first recorded geological investigation within the map area was made by Parks (1897) who traversed the eastern margin of the area, noting arkose, quartzose wacke and slate, and greenschists occurring in the Maskinonge-Vermilion Lake area. Earlier surveys of Bell (1873) and Coleman (1895) skirted the area to the northeast and southeast, following the major canoe routes only. McInnes (1901) examined the eastern portion of Vermilion Lake (outside the map-area), noting the pyrite deposits located there. Collins (1907) also examined the east end of Vermilion Lake, and later (Collins, 1909) produced the first geological reconnaissance map encompassing the current map area.

Hurst's (1932) mapping included the eastern portion of the Lateral Lake area (Echo and Lomond Townships), Armstrong (1951) provided detailed mapping (1 inch = 1000 feet) of Echo Township, and the mapping of Harding (1951) completed reconnaissance of the rest of the Lateral Lake area. More recently, Johnston (1972) conducted detailed mapping over ground which includes the northeast corner of the present survey area. Breaks et al. (1976) provided a more up to date reconnaissance survey of the whole Lateral Lake area, as a portion of a larger mapping project.

Geological investigations of areas immediately adjoining the present survey area include: a) Satterly (1941), Laval and Brownridge Townships to the south; b) Johnston (1969), Pickerel Township to the east; c) Palonen and Speed (1974), 1975, 1977), McAree Township to the south; and d) Trowell (1977, 1978), reconnaissance and compilation in the Vermilion Lake area and to the east. Additional information on these adjoining areas is contained in the reports (and mapping) of Hurst (1932), Johnston (1972) and Breaks et al. (1976).

More detailed investigations of certain mineral deposits within the map area include those by Webb (1948) and Chisholm (1951) on the Echo Township gold deposits, and those by Satterly (1960), Vokes (1963), and Colvine and McCarter (1977) on the molybdenum deposits in and around the Lateral Lake stock. Detailed sedimentological studies have also been conducted in the Lateral lake area, although most of the mapping by Pettijohn (1934, 1935), Walker and Pettijohn (1971), and Turner and Walker

(1973) were done east of the present survey, on along-strike equivalents of units within the map area. Reid (1978) investigated intermediate variolitic lavas in central Pickerel Township, units which are essentially the same as those occurring in southeastern Echo Township.

HISTORY OF MINERAL EXPLORATION

Exploration within the Lateral Lake area was of a very limited nature prior to the 1941 gold discoveries in Echo Township. Early work discussed by Hurst (1932), Armstrong (1951), and Harding (1951) is restricted to pits and trenches in molybdenite-bearing granitic intrusives, in quartz veins (with and without sulphide mineralization), and in sulphide-rich zones within metavolcanic and metasedimentary units.

Gold mineralization discovered in southeastern Echo Township stimulated a major period of exploration in the area between 1946 and 1952, although no significant production resulted. Surface prospecting, trenching, ground geophysical surveys, and diamond drilling were initially used to explore a number of deposits, two of which were subsequently explored from underground workings (Windward and Newlund prospects, now held by Windfall Oil and Mines Limited and Goldlund Mines Limited, respectively). The Newlund prospect was extensively explored underground (4570 m of drifts and crosscuts, 6220 m of diamond drilling), through five levels via a 255 m (835 feet) deep shaft. The first level (200 foot) of these workings extends for over 1.4 km, connecting with the 68 m (222 feet) shaft of the Windward prospect, crossing the entire Windfall claim block, and reaching about 80 m into the adjoining Conecho prospect (now held by Rio Algom Mines Limited).

Virtually no work was carried out on the Echo Township gold deposits between 1952 and 1973. Since the later date, however, Goldlund Mines Limited has rehabilitated most of their surface facilities and conducted a re-sampling of portions of the 1st and 2nd levels, through an option agreement in 1973-74 with Rayrock Mines Limited. Rayrock's evaluation suggested a grade of 0.089 ounces gold per ton for about 1.1 million tons of indicated ore, considerably below the grade suggested for a similar tonnage by the 1948-52 exploration (Botsford, 1974). Test stoping of "enriched zones" (Broadhurst, 1978) on the first level (west) of the no. 1 zone, conducted by Goldlund Mines Limited in 1978, yielded 3,000 tons of muck which graded 0.180 (cut) ounces gold per ton (Kuryliw, 1979). During the 1979 field season Goldlund Mines Limited was running diamond drills underground (1st and 2nd levels) and on surface. In 1980 and 1981 geophysical surveys and diamond drilling further delineated the orebody. In 1982, production began with the completion of a 200 ton per day concentrating mill. Field mapping, trenching, and diamond drilling have continued, in due course, to better delineate the ore body. By December 1, 1983 7,338 oz. of gold were produced, in concentrate form from 50,412 tons of ore, while the mine recorded a $3.4 million loss. Campbell Resources took over operation of the mine and their reserves of 600,000 tons of 0.20 oz. per/ton (Northern Miner 01.12.83).

Exploration for molybdenum in the map area was stimulated by the 1946 Ontario Department of Mines discovery of pegmatitic to stockwork molybdenite deposits in the east end of the Lateral Lake stock (Armstrong, 1951). In 1954, Detta Minerals Limited optioned ground from G.L. Pidgeon, drilled several short holes, and drove a test adit 35 m into the "main showing". Muck samples from the adit (255 tons) graded 0.24% MoS_2 (over 23.4 feet adit length) and 0.57% MoS_2 (over 25.8 feet) (Satterly, 1960; Vokes, 1963). Pidgeon Molybdenum Mines Limited and DeCoursey Brewis Minerals Limited conducted major drilling tests (612 m and 2364 m) of their respective deposits in 1957-1958. In 1963, Denison Mines Limited evaluated adjoining ground with 1255 m of diamond drilling in twelve holes.

Rio Algom Mines Limited, working through their controlling interest in Pidgeon Molybdenum Mines Limited, diamond drilled an additional 3475 m in 1965-66 to fill in and extend knowledge of their main zone of mineralization. Prior to the 1965-66 drilling, the deposits on Pidgeon Molybdenum Mines Limited property were reported to contain an estimated 275,000 tons of material grading 0.60% MoS_2 (Vokes, 1963). At the end of the 1979 field season, Rio Algom Mines Limited and Dickenson Mines Limited initiated a joint venture to further explore the molybdenum potential of the Pidgeon property, along with the eastern third of the Lateral Lake stock, while also testing the country rocks around the stock for other base metals (Cu, Zn). As of January, 1980 ground geophysical surveys and about 2700 m of diamond drilling were nearing completion.

Exploration for other base metals (Cu, Ni, Zn) in the map area was not initiated to any extent prior to the mid-1960s.

Phelps Dodge Corporation of Canada Limited optioned ground in east-central McIlraith Township in 1968, conducted ground magnetometer surveys, and diamond drilled ten holes totalling 980 m to evaluate copper mineralization in mafic amphibolites; minor nickel and gold values were also recorded (Assessment Files Research Office, O.G.S., Toronto). Between 1970 and 1972, Canadian Nickel Exploration Company Limited diamond drilled 18 holes totalling about 1670 m to test conductive zones scattered in numerous claim groups in Echo, Webb, McIlraith, and Lomond Townships (Assessment Files Research Office, O.G.S., Toronto). During 1976-77, Selco Mining Corporation Limited conducted ground geophysical surveys over a large claim group in southeastern Echo Township, and diamond drilled a single hole (125 m) to test a conductive zone (Assessment Files Research Office, O.G.S., Toronto).

More recently (1978-79), Rio Tinto Canadian Exploration Limited and Selco Mining Corporation Limited have conducted separate base metal exploration programs over most of the map area. Both companies flew airborne geophysical surveys in the area following release of reconnaissance mapping by the Ontario Geological Survey (Breaks et al. 1976). These exploration programs have concentrated on the Vermilion-Redhat-Bluett Lakes unit of intermediate to felsic metavolcanics, but have also tested mafic metavolcanics to the north and south. Rio Tinto has thus far diamond drilled twenty holes (2032 m total), while Selco has put down fifteen diamond drill holes (1420 m) (Assessment Files Research Office, O.G.S., Toronto).

Exploration for uranium in the map area is limited to airborne radiometric surveys flown in 1969 for C. Morton, covering a block of ground north of the east end of Gullwing Lake, and the 1968 sampling and diamond drilling (three short holes) an optioned claims in Drope Township by Conwest Exploration Company Limited (Assessment Files Research Office, O.G.S., Toronto).

In 1964, Carol Metal Mines Limited investigated the lithium-cesium potential of a complex pegmatite dike located in central Webb Township by trenching and four diamond drill holes totalling 223 m (Assessment Files Research Office, O.G.S., Toronto). Tantalum Mining Corporation Limited re-staked this ground in 1978, and have since diamond drilled three additional holes (156 m total); a pegmatite section in one hole assayed minor amounts of Ta_2O_5 (Assessment Files Research Office, O.G.S., Toronto).

TOPOGRAPHY

Topography within the Lateral Lake area is quite variable for Superior Province shield terrain, and includes bedrock areas of high local relief to gently rolling hills, large hills of Pleistocene sand and gravel, gently sloping sand plains, and low, flat areas underlain by sand and clay. Maximum local relief of 65 to 70 m is developed between bedrock ridges and creeks or lakes east of Redhat Lake, and north and south of Gullwing Lake, although relief of 45 m is found between Kathlyn Lake and the large moraine hill to the east. Average elevation in the area is about 400-405 m above mean sea level (1310-1330 feet), with maximum elevations of 450 to 460 m occurring in several locations. The "central lowlands" in Echo and Webb Townships lie at 380 to 390 m.

Drainage pattern in the general area encompassing the map area is strongly influenced by interacting effects of east to northeast trending bedrock ridges and valleys and a northwest trending moraine which acts as a drainage barrier. Water in Echo Township and the eastern half of Webb Township drains south through Crossecho Lake and east through Maskinonge Lake to enter the Minnitaki Lake system; Drope Township and the western half of Webb Township drain southwest through Gullwing Lake to join the Wabigoon River; Breithaupt and part of McIlraith Townships drain southwest and then north into Route Lake; Lomond Township and the rest of McIlraith Township drains east into Vermilion Lake. Within Echo and Webb Townships, Armstrong (1950, p.4) approximately describes the circuitous course of Kathlyn Creek:

"The water of Cathfran lake, just 3,000 feet north of Crossecho lake, flows into Kathlyn lake, then through Lateral lake, Moly lake, and Kathlyn creek into the north shore of Philcot lake, and finally into Crossecho lake. The latter drains southward through Tablerock lake into Sandybeach lake in McAree township, which in turn empties into Pickerel arm of Lake Minnitaki".

ACKNOWLEDGEMENTS

The author was assisted in the field by B. Cristie, D. Hamilton, M. Kane, and C. Tenody. Mr. Cristie served as senior assistant, independently mapping about 40 percent of the area, concentrating on ground surrounding Bluett lake, the area from Centrefire to Watch Lakes, and the area south of Philcott Lake. Mr. Hamilton, Miss Kane, and Miss Tenody performed a variety of duties as junior assistants, and each served as the geologist on a number of traverses during the latter part of the field season. Mr. Hamilton led six short traverses scattered around the map area, while Miss Kane conducted detailed mapping between Redhat Lake and the Kathlyn Lake road as a portion of her honours bachelors thesis program at St. Francis Xavier University. The spirit of cooperation and enthusiasm maintained by the assistants throughout the summer aided the project to a very large degree.

Because of the high level of exploration activity, the author was fortunate to have discussions with a number of company representatives concerning geological and economic aspects of the area, as well as access to confidential company reports, maps, and drill logs. Particular appreciation in this regard is extended to P.S. Broadhurst, C.J. Kuryliw, and the office staff of Goldlund Mines Limited, to W. Benham, T. Botrill, and U. Paltser of Rio Tinto Canadian Exploration Limited, and to A.P. Pryslak of Selco Mining Corporation Limited. Gratitude is also extended to the employees and management of Goldlund Mines Limited for allowing the crew access to their underground workings, and for providing one evening's "emergency accommodation" early in the season when a number of bears moved into the survey's base camp.

The author also acknowledges special assistance provided to the survey and personnel by a number of area residents and merchants, including Mr. DeRose and his employees in Sioux Lookout, Mr. and Mrs. R. Edwards of Pickerel Arm Camps, and Mr. and Mrs. W. Smith, owners of the Gullwing Lodge. Finally, but certainly not least, the author extends his thanks to various Ontario government employees whose services proved invaluable during field work and subsequent investigatons: the staffs of the Mining Recorder's Office and Resident Geologist's Office in Sioux Lookout, and the co-managers of the firebase warehouse at the Sioux Lookout District office of the Ministry of Natural Resources.

EARLY PRECAMBRIAN

METAVOLCANICS

MAFIC METAVOLCANICS

Two major units of mafic metavolcanics occur in the Lateral Lake area. The older mafic unit extends across the northern portion of the map area, forming the western termination of the Northern Volcanic belt of Turner and Walker (1973). Equivalent mafic rocks are repeated to the south in the Lateral Lake anticline, forming the country rocks surrounding the Lateral Lake stock. A younger mafic metavolcanic unit is exposed in southern Echo Township and southeastern Webb Township. The younger mafic rocks are strike equivalents of the "Central Volcanics" to the east (Page and Clifford, 1977) and the Brownridge volcanics to the southwest (Satterly, 1941). A discontinuous unit of mafic metavolcanics occurs in southwestern Webb and southeastern Drope Townships as a variant of the predominantly intermediate volcanics exposed there, and will be described in that context.

The older mafic metavolcanic succession consists of at least 3050 m of massive and pillowed lavas with minor intercalations of mafic fragmental beds and plagioclase-phyric to megacrystic lavas. The majority of mafic rock in this unit occur as brownish to greenish black amphibolites, although epidote amphibolite and greenschist grade rock are the norm in the Vermilion Lake area. Gabbro and ultramafic intrusive bodies cut the succession locally at 900-1200 m below the upper contact of the unit, and appear to be associated with thin units of intermediate to felsic metavolcanics in the same stratigraphic position. Thin units (< 1 m) of graphitic and/or sulphidic slate are present locally, as are disseminated to massive sulphide units (generally pyrrhotite-pyrite), although most occurrences of these are interpreted from diamond drill logs. Garnet amphibolites, while not common in the whole succession, are commonly associated with the disseminated to massive sulphide occurrences.

The older mafic metavolcanic unit is repeated to some extent in the Vermilion Lake area, and is truncated by a major granitic intrusive body and major fault in the Bluett-Centrefire Lakes area. Although facing criteria are absent in the central portion of this unit, both regional criteria (Johnston, 1972; Trowell, 1977, 1978) and facing of rock units further to the south indicate a generally south-facing succession. Foliation data suggests the unit is overturned to vertical throughout most of its extent.

Major repetition of the older mafic unit is interpreted on the basis of repetition of younger rock units by the syncline in the centre of the map area and by the appearance of mafic metavolcanics bordering the core intrusive body (Lateral Lake stock) of the Lateral-Tot Lakes anticline. This interpretation is supported by the presence of pyroxenite and gabbro intrusive rocks in the Gullwing Lake area, and sporadic occurrences of felsic schists (probably tuffs) within the mafic metavolcanics. The dominant lithology within the mafic metavolcanics is a layered amphibolite which, on closer examination, is seen to have been produced by relatively intense deformation of mafic pillow lavas and associated mafic fragmental rocks. Particularly good exposures of such rocks are found in the ridges inland from the southeast shore of Gullwing Lake, and in the outcrop area near the road intersections about 2.4 km northeast of Gullwing Lake. Somewhat less deformed, originally massive mafic lavas, are found along with the layered amphibolite in the outcrop area near where the Kathlyn Lake road crosses the anticline.

In thin section, amphibolites of the older mafic unit are seen to generally consist of 60-70 percent common hornblende, 20-30 percent quartz, and 5-10 percent plagioclase (albite, oligoclase, andesine). Minor constituents include zoisite, sphene, actinolite, less commonly cummingtonite-grunerite, and opaque minerals (magnetite, pyrrhotite, pyrite). Garnet amphibolites typically also contain several percent biotite, and mafic rocks surrounding the Lateral Lake stock often contain retrograde chlorite as a trace to minor constituent. No systematic collection of mafic rocks was obtained for chemistry during this survey, but representative analyses of Northern Volcanic belt mafic lavas are given in Table 2. The majority of lavas in the older mafic succession may be classed as magnesian tholeiitic basalts (N. Trowell, personal communication).

The younger mafic metavolcanic succession, exposed in southern Echo and Webb Townships, totals about 3,000 m thickness. Facing criteria in pillow lavas in Echo Township indicate a south-facing succession. Mafic rocks there form the major portion of an alternating sequence of mafic lavas and pyroclastic rocks and intermediate variolitic lavas. Minor components in the succession include andesitic pyroclastic rocks and thin beds of intermediate to felsic tuffs. The mafic metavolcanics include massive and pillowed lavas, a discontinuous unit of plagioclase-phyric lava ("basalt porphyry" of Armstrong, 1951), and scattered occurrences of pyroclastic rocks and pillow-related breccias and tuffs. The mafic pyroclastic units typically contain vesicular, amygdaloidal to highly scoriaceous fragments. Massive and pillowed flow units are in a few cases amygdaloidal, but never to the extent of the fragmental units. In thin section, the mafic lavas exhibit a typical greenschist metamorphic grade assemblage of chlorite, tremolite-actinolite, quartz, sodic plagioclase, and epidote, with minor amounts of calcite, sphene, and opaques. Amygdules are generally filled with calcite with or without epidote. In contrast with the older mafic metavolcanics, the younger mafic rocks are generally high-iron tholeiitic basalts (N. Trowell, personal communication).

INTERMEDIATE METAVOLCANICS

Two major units of intermediate metavolcanics occur in the Lateral Lake area, one extending across the entire map area (from Vermilion Lake to Bluett Lake), the other being restricted to southern Webb and Drope Townships. Both of these units were described by Harding (1951) as assemblages of "conglomerate and greywacke", but were re-defined (in part) as intermediate to felsic metavolcanics during the reconnaissance mapping of Breaks and Bond (1977). As no formal nomenclature exists for these units, they will be informally termed the Redhat Lake metavolcanics (for the northern unit), and the Ghost Lake Road metavolcanics (for the southern unit). The Redhat Lake metavolcanics correspond to the "younger Keewatin volcanics" of Pettijohn (1935). Less extensive units of intermediate metavolcanics occur in other locations within the map area, including: scattered occurrences of dacitic tuffs and flows in the older mafic metavolcanics; intermediate tuffs of the Daredevil Formation of Pettijohn (1935) in northeastern Echo Township; variolitic lavas within the younger mafic metavolcanics; and isolated occurrences of coarse, intermediate pyroclastics within the southeast Echo Township felsic metavolcanics.

Redhat Lake metavolcanics consist of up to 2300 m of primarily coarse, dacitic pyroclastics, a major dacite-rhyolite flow-dome complex, and minor units of lithic and crystal tuff. The unit appears to conformably overlie the older mafic metavolcanics within the map area, but further east is apparently separated from the mafic unit by conglomerates or wackes of the Patara metasediments. Redhat Lake metavolcanics are overlain, probably unconformably to the south by pebble conglomerates and sandstones of the Ament Bay Formation, while to the west, intermediate metavolcanics are apparently overlain by felsic metavolcanics in the Needle Lake area. In the Vermilion Lake area (within the map area and further east), Redhat Lake metavolcanics are apparently both overlain and underlain by a variety of clastic rocks of the Patara metasediments. Further east, at Slate Island in Vermilion Lake (about 4 km east of the northeast corner of the map area), Redhat Lake metavolcanics are entirely displaced by Patara metasediments, indicating an apparent facies change in time-equivalent rock units.

The most characteristic lithology within the Redhat Lake metavolcanic unit is a dacitic tuff-breccia to lapilli tuff composed of sub-angular porphyritic dacite clasts set in a fine-grained, lithic or crystal-lithic tuff matrix. These rocks are typically moderately foliated, medium grey to dark grey in colour, and most easily recognized as clastic on weathered surfaces. The porphyritic dacite clasts are distinctive in the map area by their content (2-15%) of very small (1-2 mm), equant, plagioclase phenocrysts. More rarely, dacitic breccias were noted which are composed entirely of aphanitic dacite clasts (Photo 1). Similarly, one occasionally finds agglomerate units interbedded with the more common tuff-breccias (Photo 2). Although the Redhat Lake metavolcanics are poorly stratified, better exposures along shorelines commonly contain bedded units of tuff-breccia, lapilli tuff, and lithic or crystal tuffs (Photo 3).

A notable feature of the Redhat lake metavolcanics is a lack of distinct clast-size variation along the length (or thickness) of the unit. An alternative parameter, presence of siliceous flows, may possibly be used to discriminate near-vent from distal-vent environments within the unit. A major flow or dome complex is exposed within the basal portion of the Redhat Lake metavolcanics, between the Kathlyn Lake road on the west and Vermilion Lake on the east. The flow complex is continuously exposed for a strike length of about 4 km, reaching a maximum thickness of about 1050 m. Isolated exposures of similar or related massive lithologies at the same stratigraphic level bring the total strike length of the complex to about 8 km, while other flow rocks are exposed intermittently to near the eastern limits of the Redhat Lake unit (east of the current map area). Lithologies exposed in the central portion of the complex include aphanitic to holocrystalline dacite, dacite porphyry, amygdaloidal dacite, and aphanitic rhyolite. The western extension of the flow strata is marked by a quartz-feldspar porphyry (rhyolite porphyry), while the eastern extension consists only of aphanitic rhyolite or felsite.

Petrography of the Redhat Lake metavolcanics is somewhat complex due to the change in metamorphic grade from east to west and variable amounts of carbonate alteration. In general, lower metamorphic grade (greenschist) assemblages in the Vermilion Lake area consist of fine-grained mosaics or felted masses of quartz +

plagioclase + chlorite + sericite + carbonate. Higher metamorphic grade (upper greenschist to amphibolite) intermediate metavolcanics consist of quartz + plagioclase + biotite $\pm$ hornblende $\pm$ epidote $\pm$ muscovite $\pm$ carbonate. Thus, Redhat Lake metavolcanics may be characterized by an excess of biotite over both hornblende and muscovite, and the prominance of carbonate (as a minor to major constituent). Accessory minerals noted include tremolite-actinolite, microcline, apatite, sphene, opaque minerals (pyrite and/or magnetite), and tourmaline. the occurrence of tourmaline in these intermediate metavolcanics may be significant as a possible indicator of hydrothermal alteration. Although noted in only one sample in the field, fully half of the thin sections (6 of 12) of Redhat Lake metavolcanics contained trace to minor amounts of tourmaline.

Chemical analyses of Redhat Lake intermediate metavolcanics are presented in Table 3, spanning a range in composition from andesite through dacite. Several of these rocks (nos. 18, 19, 20) contain significant CO_2 (7 to over 15 percent), and a precise classification is unwarranted. These same samples appear to contain increased amounts of Ca, Mg, and Fe, so the included carbonate is probably ankeritic in composition.

The second major unit of intermediate metavolcanics, here termed the Ghost Lake Road metavolcanics, consists of predominantly andesitic fragmental rocks, with several intercalated metasedimentary beds and a discontinuous unit of mafic fragmental rocks. In detail, the entire section of metavolcanics and metasediments bounded by Gullwing Lake, the

Kathlyn Creek fault, and the Ghost Lake Road consists of (in descending order):

a) Ghost Lake Road metavolcanics, 1650 m;

b) garnet-biotite-quartz schists, 120-180 m;

c) Ament Bay Formation sandstones, 240-300 m; and

d) Redhat Lake metavolcanics, ca. 300 m.

Facing determinations in both Ament Bay and Ghost Lake Road units are consistently south to southeast and there is little evidence for major faulting. Because of their position overlying the Ament Bay Formation, and their intercalation with wackes and slates, the Ghost Lake Road metavolcanics are believed to be equivalent to the Daredevil Formation of Turner and Walker (1973). Other exposures of Daredevil Formation metavolcanics are found in northeastern Echo Township.

Ghost Lake Road metavolcanics are similar in many respects to the western portion of the Redhat Lake metavolcanics, consisting almost entirely of intermediate breccia, tuff-breccia, and lapilli tuff. In contrast, however, the Ghost Lake Road unit is somewhat more mafic (hornblende-rich) in composition, and is distinctly better stratified than the generally chaotic Redhat Lake unit. Mineralogy of the Ghost Lake Road metavolcanics is qualitatively the same as the higher metamorphic grade assemblage of the Redhat Lake unit, consisting of quartz, intermediate plagioclase, common hornblende, epidote, biotite, and various accessory minerals (apatite, sphene, ores). Hornblende contents almost always exceed biotite, however, and the rocks are best described as intermediate amphibolites, corresponding roughly to andesite in chemical composition. More siliceous beds (approximately dacitic in composition) are rare, and restricted to 1-4 m thick units of lithic tuff. More mafic (basaltic) units are amphibolites and epidote amphibolites, and are relatively common as thin units in the succession, and form a discontinuous, mappable unit near the middle of the section.

Bedding organization is particularly noticeable in the Ghost Lake Road metavolcanics. Tuff-breccia, breccia, and less common agglomerate units attain thicknesses of 20 to 30 m, while lapilli tuff and groups of laminated lithic tuff beds (Photo 4) are only tens of centimeters to several meters in thickness. Distinctive, epidote-rich tuff units are occasionally traceable along strike for several hundred meters. Flat lamination and, more rarely, graded bedding, are the only sedimentary structures observed in the sequence. The environmental interpretation suggested by these features is below wave base, subaqueous deposition by vertical sedimentation and, possibly, turbidity current mechanisms. The graded beds, of course, could be produced by simple vertical sedimentation of material produced in single, explosive eruptions, and the complete absence of small-scale cross-bedding (Bouma C divisions) is perhaps supportive of such a mechanism. If turbidity currents were operative as a depositional mechanism, they could be of either subaqueous pyroclastic flow variety or simply the re-sedimentation of unconsolidated pyroclastic material. In any event, material at the site of deposition does not appear to have been subjected to any sort of current re-working.

Intermediate metavolcanics of the Daredevil Formation (Pettijohn, 1935; Turner and Walker, 1973) are exposed in northeastern Echo Township within a sequence composed predominantly of lithic wacke and slates. Lithologies present in the three isolated outcrop areas include crystal-lithic tuff, lithic tuff, and lapilli tuff to coarse-lithic tuff. The easternmost exposures of these tuffs (located about 600-620 m south of Blackfox Lake) are very similar to the lower tuff unit of the formation, described by Pettijohn (1935, p.1901) as a "...dense hackly rock of fine grain, possibly a rhyolite or possibly a more altered facies of the acid tuff marked by fewer crystals of large size". No exposures of the upper (mafic) tuff unit of the Daredevil Formation were encountered in Echo Township, but the inferred fold complications between Blackfox and Hooch Lakes would appear to place such a unit in extensively overburden-covered ground.

Interpretation of the intermediate to felsic tuffs of the Daredevil Formation as being subaerial ash flow deposits (Turner and Walker, 1973; p.838) must be questioned, because about 450 m of quartzose and lithic wacke, siltstone, and slate probably indicative of a resedimented association, deep basinal environment, are present between the underlying continental association, fluvial-alluvial environment sediments of the Ament Bay Formation and the tuffs. The lower contact of the tuffs at Little Vermilion Lake, as described by Turner and Walker (1973, p.830), is poorly exposed and marked by a zone of shearing; this may represent an extension of the Kathlyn Creek fault. The stratigraphic significance of this shear zone or fault does not alter Turner and Walker's (1973) basic observation that a marked change in depositional environment took place between Ament Bay and Daredevil time. However, it is possible that rapid subsidence is not essential to such a change in environment. Further field study of the rocks south of Blackfox Lake may reveal new information on the transition from non-marine to marine environments.

Intermediate metavolcanics occurring elsewhere in the Lateral Lake area include dacitic pyroclastics (and flows) within the older mafic metavolcanic unit, andesitic pyroclastics and variolitic lavas within the younger mafic metavolcanic unit, and isolated beds of intermediate pyroclastics within the Franciscan Lake felsic metavolcanic unit. Dacitic pyroclastics within the older mafic metavolcanic unit are similar in most respects to rocks in the Redhat Lake metavolcanics, except that coarse fragmental rocks are rare. Instead, the most common rocks exposed consist of lithic and crystal-lithic tuffs. A single exposure of sheared, dacitic to rhyolitic flow rock is located about 610 m east of the Kathlyn Lake road in western Lomond Township. Several other occurrences of intermediate to felsic fragmental rocks are noted in diamond drill logs and plotted on the map face (Maps P.2371 and 2372). Most of the intermediate to felsic pyroclastics within the older mafic unit occur at or near the same stratigraphic position as gabbroic to ultramafic intrusive rocks, perhaps suggesting that the pyroclastics are related to a hiatus in effusive mafic volcanism which may have been accompanied by mafic intrusive activity.

Intermediate metavolcanics are interbedded with the younger mafic metavolcanics of southern Echo Township and include andesitic pyroclastics and variolitic lavas. The andesitic lithologies are plagioclase-phyric tuff-breccias and lapilli tuff exposed on and near the south shore of Crossecho Lake and, locally, in the bedrock ridge located 600-650 meters north to northwest of the shaft at the Goldlund Mines Limited property. These pyroclastics are similar in many respects to metavolcanics exposed further east, and possibly correlate with "unit 3" of Page and Clifford (1977) in the northeast bay area of Minnitaki Lake (about 40 km east of the present map area). Variolitic lavas as mapped by Armstrong (1951) form two, well-defined marker horizons in central-southern Echo Township, and are also found as thin units in the poorly exposed ground south of Maskinonge Lake and near the north shore of Franciscan Lake. The lavas consist of felsic varioles ranging in size from 0.5 to 2.0 cm set in an intermediate to mafic matrix of chlorite, tremolite-actinolite, quartz, and albite. Similar variolitic lavas have been described elsewhere as the product of quenched immiscible liquids (Gelinas et al. 1976), but Reid (1978) has suggested that along-strike equivalents of the Echo Township variolitic rocks, about 16 km to the east, are the result of spherulitic crystallization.

Two small exposures of intermediate pyroclastics are present within the Franciscan Lake felsic metavolcanic unit in southeastern Echo Township. Both exposures consist of angular to sub-angular felsic fragments (blocks and lapilli) set in a matrix of hornblende, quartz, feldspar, and minor garnet. One of these exposures, in a road outcrop on the north side of Highway 72 (about 500 m north of the township boundary) clearly indicates that these intermediate metavolcanics are simply a more mafic phase of the felsic metavolcanics within which they are found.

FELSIC METAVOLCANICS

Felsic metavolcanics in the Lateral Lake area are represented by one major unit overlying part of the Redhat Lake intermediate metavolcanics, numerous minor units within the Redhat Lake metavolcanics, a second major unit in the Franciscan Lake area, and a number of minor, isolated units within the older mafic metavolcanics. In the field, felsic metavolcanics were generally characterized by the presence of quartz as a phenocryst phase (in clasts or flows) or crystal component (in tuffs). Other lithologies, lacking such quartz "eyes", were classified as felsic by their very low colour index (less than 20 percent mafic minerals, but usually less than about 10 percent). As with the intermediate metavolcanics, mineralogy of the felsic extrusives changes from east to west with increasing metamorphic grade. Felsic metavolcanics in the Vermilion Lake and Franciscon Lake areas exhibit a lower to middle greenschist facies mineral assemblage of quartz + plagioclase + sericite + carbonate with minor constituents including chlorite and biotite. To the west, higher metamorphic grade conditions have produced more coarsely re-crystallized rocks composed of quartz + plagioclase + muscovite + biotite with minor to trace amounts of chlorite, carbonate, apatite, and opaque minerals. Garnet, epidote, and sphene were noted in several thin sections, while tourmaline was found in two samples from the Vermilion Lake area. Major and trace element chemistry for selected felsic metavolcanics is given in Table 4.

Felsic metavolcanics form an integral part of the Redhat Lake metavolcanic unit, occurring as thin (generally less than 60 m thick) units within the predominantly intermediate succession. Lithologies include tuff-breccias, lapilli and lithic-crystal tuffs, massive rhyolite, and rhyolite porphyry, all of which are gradational in composition and appearance with the interbedded intermediate metavolcanics. Felsic lavas within the Redhat Lake unit form a minor component of a dacite-rhyolite flow-dome complex which is inferred to be relatively close to its source vent or vents. A single pyroclastic unit (rhyolite tuff-breccia) is found within the flow-complex about 210 m west of the Kathlyn Lake road, and consists of angular fragments of pale yellow rhyolite set in a tuffaceous matrix; the rhyolite clasts are indistinguishable from the massive (cherty) rhyolite phase of the flow complex. Massive, porphyritic (quartz-feldspar) rhyolite occurs in an outcrop area about 0.4 km north of Castor Lake (eastern McIlraith Township) at about the same stratigraphic level as the flow-dome complex in Lomond Township. The rhyolite is similar to dacite porphyry exposed some 2.4 km to the east, containing abundant, equant (1-2 mm) plagioclase phenocrysts set in a fine-grained, granular matrix of quartz, feldspar, and minor biotite; the rhyolite is distinguished, however, by the presence of 1-2 percent quartz phenocrysts overaging about 4-6 mm in size.

Felsic metavolcanics form a major unit in the map area, extending some 5 km northeast and east from the north end of Needle Lake (northwestern Webb Township). The Needle Lake area felsic metavolcanics apparently overlie the Redhat Lake intermediate metavolcanics and reach an estimated thickness of 300-450 m. Unfortunately, lack of outcrop and their position in the axial portion of an inferred syncline precludes accurate determinations of thickness and stratigraphic position. Lithologies exposed within the unit include rhyolite breccia, tuff-breccia, lapilli tuff, and a variety of lithic tuffs. Most of these felsic metavolcanics differ from the underlying intermediate metavolcanics merely by a decrease in content of mafic minerals. Breccias exposed in a long ridge about 0.9 km northeast of Needle Lake locally include large (up to 65 cm by 40 cm) clasts of flow-banded rhyolite, although the majority of clasts are aphanitic to plagioclase-phyric rhyolite to dacite. Felsic tuffs generally consist of a granular mosaic of quartz, muscovite, and plagioclase, with minor to trace amounts of biotite, and garnet. Lithic fragments in these tuffs blend imperceptively into the matrix when viewed in thin section, but are readily apparent in the clean, weathered outcrops.

Felsic metavolcanics form a second major unit in southeastern Echo Township, which consists of a relatively homogeneous assemblage of breccias and lapilli tuffs. Much of this unit was previously mapped (Armstrong, 1951) as metasediments, but bedrock examined south and west of Franciscan Creek is readily correlated with felsic lithologies noted on Franciscan Lake shorelines and between Highway 72 and the Goldlund Mines Limited access road. Total thickness of the felsic metavolcanics exposed in the Franciscan Lake unit is estimated as a minimum of 750 m, but the distribution of associated metasediments suggests significant fold repetition may be present. The unit consists of an assemblage of monolithic breccia, tuff-breccia, and lapilli tuff, with bedded lithic tuffs observed at only a single outcrop. Crude bedding was also noted in several exposures along Highway 72. Considerable carbonate and sericite is present in the felsic metavolcanics exposed on Franciscan Lake, but elsewhere the metamorphic grade is higher and the rocks are a more re-crystallized and foliated mosaic of quartz, plagioclase, muscovite, biotite, and carbonate.

Felsic schists are present in several locations as thin lenses within the mafic metavolcanics surrounding the western half of the Lateral Lake stock. These units are strongly foliated quartz-plagioclase-muscovite schists with variable minor quantities of quartz "eyes" and biotite. The best exposures of these rocks are located about 1 km north of the west end of Tot Lake (Webb Township), where their variability suggests a volcanic origin. However, similar rocks are exposed about 3.2 km due south, on the opposing limb of the Lateral - Tot Lakes anticline, where they cross-cut foliation in the surrounding mafic rocks at a low angle and are interpreted as early dikes genetically related to the Lateral Lake stock.

METASEDIMENTS

Metasediments form about 25 percent of the bedrock in the

Lateral Lake map area, include a considerable spectrum of lithologies, and are readily divisable into two, major, rock-stratigraphic units and several smaller units. The two larger metasedimentary units extend west and southwest, respectively, from the eastern boundary of the area, while smaller units of metasediments occur in the Vermilion Lake, Gullwing Lake, and Franciscan Creek areas. Previous mapping and sedimentological studies of rock units which extend into the map area date from the mid-1930s to 1978 and have established a reasonably comprehensive stratigraphic framework which was utilized during the current survey. A brief summary of the results and nomenclature of the previous work is presented below, followed by descriptions of the various metasediments within the map area.

Metasediments conformably to unconformably overlying the northern older mafic metavolcanic units in the map area were first studied in detail at Vermilion and Abram Lakes by Pettijohn (1935) who named the unit the Patara sediments. Descriptions of this unit were refined and expanded by Trowell (1977, 1978) who suggested the name Patara Group as being more appropriate to its diversity. Lithologies present in the Patara metasedimentary unit include volcanic boulder and cobble conglomerates, lithic wackes, siltstones, slates, and a variable component of intermediate to felsic metavolcanic rocks which increases in the west-central portion of Vermilion Lake and overwhelms the metasedimentary component west of Vermilion Lake.

Metasediments occurring in southern Vermilion and Lomond

Townships, and on Little Vermilion and Abram Lakes were first studied in detail by Pettijohn (1934, 1935) who termed the unit the Abram series. Turner (1972) and Turner and Walker (1973) redefined the unit as the Abram Group which includes three smaller units (in decreasing age): Ament Bay Formation, Daredevil Formation, and Little Vermilion Formation. In Turner and Walker's study area (east of the present map area), the Ament Bay Formation consits of massive, polymict conglomerate, pebbly arkose, and massive and bedded arkose. The Ament Bay Formation unconformably overlies a massive quartz porphyry which in turn is either younger than or time-equivalent to the Redhat Lake metavolcanic unit within the map area. Turner and Walker (1973) interpreted the Ament Bay Formation as an alluvial fan deposit. The overlying Daredevil and Little Vermilion Formations consist of 'greywacke' (lithic wacke, wacke), although the Daredevil Formation was defined as predominantly felsic and mafic tuffs where studied by Turner and Walker (1973). All of the greywacke beds in these two units were ascribed to deep water (below storm wave base) turbidite deposition (Turner and Walker, 1973).

Metasediments exposed mainly south and east of the present map area, but represented by the small unit in southeastern Echo Township, were first studied in detail by Pettijohn (1936) who included them in his Abram series. These rocks were subsequently redefined as the Minnitaki Group by Walker and Pettijohn (1971) following detailed study of a portion of the unit about 32 km east of the present map area. The entire Minnitaki Group has been interpreted as turbidite deposits (Walker and Pettijohn, 1971).

Metasediments extending southwest from Webb Township, apparently equivalent to the Abram Group, were termed the "Brownridge sediments" by Satterly (1943), while those south of the area were named the "Thunder Lake sediments" (Satterly, 1943). The latter group was originally included in the "Abram series" by Pettijohn (1939), but more recent mapping (Palonen and Speed, 1974, 1975, 1976, 1977) utilized the nomenclature of Walker and Pettijohn (1971) and included these rocks in the Minnitaki Group. Detailed mapping by Johnston (1969, 1972) of the areas east of the present study covered the type areas for all three major metasedimentary units (Patara, Abram, and Minnitaki) and utilized the accepted nomenclature at the time of publication, namely the Patara metasediments and Abram metasediments ("series") of Pettijohn (1934, 1935, 1936).

CONGLOMERATES

Conglomerates are present in both the Patara metasediments and Ament Bay Formation. Within the Patara metasediments, oligomictic mafic-clast conglomerate forms a discontinuous basal unit, overlying lavas of the older mafic metavolcanic unit. A single outcrop of such mafic-clast conglomerate is present in the map area, on the northwestern shore of Vermilion Lake, where it consists of closely-packed, fine-, medium-, and coarse-grained mafic lava boulders and cobbles set in a pebbly, mafic wacke matrix (Photo 5). A few pebbles of vein quartz and intermediate metavolcanics are scattered among the mafic clasts, but no trace of bedding or finer-grained interbeds was observed. A chemical analysis of this conglomerate (Table 2, analysis no. 20) indicates its general similarity to the underlying basaltic lavas (Table 2, analyses NVG 14, 29, and 51).

Polymictic volcanic-clast conglomerate is also present within the Patara metasediments, occurring on an island in central Vermilion Lake (just east of the area boundary) and in several exposures along the south shoreline of Vermilion Lake. The polymict conglomerates consist of sub-angular to sub-rounded clasts of mafic, intermediate, and felsic metavolcanics set in pebbly to mafic wacke matrix. They were initially mistaken in the field for intermediate breccias of the Redhat Lake metavolcanic unit, primarily because of the abundance of intermediate to felsic clasts, but were later discriminated by two criteria: 1) matrix composition of the polymict conglomerates is quite mafic (chlorite and biotite-rich) compared to the sericitic matrix of the volcanic breccias; 2) brown-weathering carbonate is a very minor to trace constituent of the polymict conglomerates, but is ubiquitous in the volcanic breccias as both a matrix and vein-filling component. Unlike the mafic-clast conglomerate, polymict volcanic clast conglomerates appear to be concentrated in the upper portion of the Patara metasediments.

Conglomerates form a major component of the Ament Bay Formation within the map area, and occur as massive boulder conglomerate with rare sand beds, isolated boulder beds within massive sandstones, and as thin, pebble and cobble conglomerates within bedded sandstone - siltstone units. Virtually all conglomerates within the Ament Bay Formation are polymict, containing conspicuous sub-rounded to rounded clasts of phaneritic intermediate to felsic intrusive rocks in addition to clasts of mafic metavolcanics; intermediate to felsic metavolcanics, quartz porphyry, and vein quartz (Photo 6). The packing of clasts ranges from closely packed in a lithic wacke matrix to isolated within an arkosic to subarkosic (sandstone) matrix.

Massive conglomerate with rare sandstone interbeds occurs only in a series of isolated outcrops in northern Webb Township. The enclosed sandstone beds range from about 10 cm to 40 cm and give the only definitive bedding in the unit which has an estimated thickness of about 600 m. In rare instances, rows of larger boulders give a suggestion of bedding within the massive conglomerate, but the outcrops are characterized by fabric (foliation, stretched-pebble elongation) dislocation due to kink folding.

One occurrence of an isolated boulder bed was noted in the Ament Bay Formation, located east of Blackfox Creek, about 730 m north of Blackfox Lake. The bed consists of a single row of rounded cobbles and boulders of phaneritic intermediate intrusive rock completely enclosed in massive, structureless subarkosic wacke. The occurrence is atypical of the Ament Bay Formation studied in the map area because of the massive nature of the enclosing sandstone, but appears to be relatively more common to the east (Turner and Walker, 1973). More commonly, pebble and cobble units within the Ament Bay Formation are interbedded with thin- to medium-bedded sandstones and siltstones.

Thin beds of pebble and cobble conglomerate have been noted in numerous exposures of the Ament Bay Formation west of Cloudlet Lake, and in the outcrop area west of Hooch Lake and south of Cloudlet Lake. Several other exposures were noted in the unit of Ament Bay Formation located south of Gullwing Lake in western Webb Township. These units range up to several meters in thickness, but are more commonly less than one meter and frequently only 10-20 cm in thickness. The thicker conglomerate beds are generally found in the lower 150 m of the Ament Bay Formation and as the basal unit along the Kathlyn Lake road, suggesting they are lateral equivalents of the massive conglomerate unit located further west. The thinner conglomerate units are intimately interbedded with the sandstone-siltstone assemblage which typifies the Ament Bay Formation in the map area. Several occurrences of pebble beds marking trough cross-strata within abundantly cross-stratified sandstones were noted in the main outcrop area west of Cloudlet Lake. Clasts within these pebble and cobble units are essentially as described for the massive conglomerates of the Ament Bay Formation, although they appear to have a greater percentage of phaneritic intermediate intrusive-clasts, probably a reflection of greater durability of those types. A single occurrence of siltstone-pebble conglomerate associated with such trough cross-stratified sandstones was noted along the logging road which cuts through the main outcrop area in southwestern Lomond Township (see: Photo 7).

SANDSTONES AND MUDSTONES

Sandstones and mudstones, or their derived schists form a dominant component of the metasedimentary units within the map area, and are readily subdivided into two major assemblages on the basis of composition and sedimentary structures. Ament Bay Formation sandstones are typically arkosic to subarkosic wackes. Thin section study shows them to contain sub-equal proportions of quartz and sodic plagioclase (30 to 60% of the whole rock) set in a fine matrix (40-70%) of quartz, feldspar, sericite (or muscovite), and chlorite (or biotite). The matrix appears to be simply a finely ground equivalent of the sand fraction. The associated mudstones are unique in the map area, being pale yellowish brown, yellowish grey, or light olive grey siltstones as opposed to dark grey to black siltstones and slates which are typical of the assemblages other than the Ament Bay. These Ament Bay Formation siltstones appear to be approximately the same composition as the matrix material of the associated sandstones.

A variety of sedimentary structures are present in the Ament Bay sandstone-siltstone assemblage, the most prominant of which includes trough cross-stratification (Photo 7) and parallel lamination. Large - and small-scale (up to about 20 cm) trough cross-stratification is present in most exposures of Ament Bay sandstones, except in the areas between Blackfox and Vermilion Lakes and the poor exposures south of Cloudlet Lake and west of Hooch Lake. Multiple sets of cross-stratified beds reach 4-5 m in thickness, but more typically 1 to 3 sets totalling 50-100 cm are interbedded with thin, massive sandstones, parallel laminated sandstones, and parallel laminated siltstones.

Parallel laminated sandstones are also common in the Ament Bay Formation, but do not occur as frequently as the cross-stratified beds. These sandstones are typified by abundant, very thin (up to several millimeters), dark laminations on a millimeter to centimeter spacing (Photo 8). The units reach up to about 1 m in thickness, but are more commonly in the range of 20-40 cm. The dark laminae are apparently thin mud partings within the sandstones and are similar to laminae which generally define inclined bedding in the cross-stratified sandstones. Parallel laminated and cross-stratified beds commonly occur in contact with each other, but a roughly equal number of occurrences of one type passing up into the other was observed, so no sequence of structures was apparent.

Other sedimentary structures observed in Ament Bay Formation sandstones commonly include small-scale scours (Photos 7 and 8), and several occurrences of large- and small-scale soft-sediment deformation. Small-scale deformation structures include convolute bedding and mushroom-shaped features which may be fluid-escape structures. The large-scale structures are rare, and consist of up to 1 m of parallel laminated and massive sand beds thrown into rounded, open, overturned folds, sandwiched within undisturbed sandstones and siltstones. Such folded units are interpreted as the result of local slumping immediately following deposition.

Siltstones occur commonly in the Ament Bay Formation, apparently being absent only in the massive sandstone environment north of Blackfox Lake and in the massive conglomerate area of northern Webb Township. Although common, siltstones probably account for only 5-10 percent of Ament Bay strata in the main outcrop area of southwestern Lomond Township. The siltstones occur as single beds up to several centimeters thick, but more typically are found in thinly bedded and thinly laminated intervals of fine sandstone and siltstone-argillite (Photo 9). These units are generally 50-100 cm in thickness, ranging up to about 2 m, while the siltstone beds within stay in the range of one to several centimeters. The associated sandstones are generally of fine sand grade, parallel laminated or massive, and are several centimeters up to 10-20 cm in thickness. Flat lamination is the only prominent sedimentary structure observed in the Ament Bay mudstones, although several occurrences of load structures were noted. A unique siltstone-sandstone sequence seen along the south side of the new logging road in southwestern Lomond Township contained several units of ripple-drift cross-lamination in addition to flat laminated and thin bedded units.

A second lithologic assemblage of sandstones and mudstones present in the map area consists of repetitious sequences of lithic wacke and slate, siltstone-slate, or monotonous siltstone. Metasediments of this assemblage are stratigraphically unrestricted and are included in the Patara metasediments, the Daredevil and Little Vermilion Formations (Abram Group), and the Minnitaki Group. The assemblage is distinguished from the Ament Bay lithologies by the ubiquitous presence of dark grey to black mudstones (generally slates, but in one area only siltstones), and the virtual absence of sedimentary structures other than flat lamination and graded bedding.

Sandstones within this assemblage are generally lithic subarkosic wackes, with the sand grade consisting of 5-20 percent lithic fragments, 10-25 percent plagioclase, and 65-85 percent quartz set in an abundant matrix (50-75 percent) of biotite, chlorite, quartz, and feldspar. In most areas, the sandtones occur as 5-40 cm thick massive beds, but were observed to reach thicknesses up to about 1 m. Thinner sandstone beds are commonly normally graded, and associated with sub-equal thicknesses of slate (Photo 10). With a decrease in grain size, these wackes grade into siltstones which are distinguished from the slate mudstones only by the presence of a small percentage of tiny quartz chips and a somewhat granular texture. Such siltstones are prominent in the Franciscan Creek area (southeastern Echo Township), and the two outcrop areas northwest of Kathlyn and Philcott Lakes, respectively.

DERIVED METASEDIMENTARY SCHISTS

Metamorphic grade increases to the west within the map area, a feature which is defined to a large extent by changes in mineralogy of metasedimentary units. In general, the occurrence of dark red garnet porphyroblasts within metasediments serves to separate a lower metamorphic grade terrain from a higher grade terrain, and occurs roughly along a line joining Vermilion Lake, Redhat Lake, Tot Lake, and Philcott Lake. The different varieties of metasediments have each responded differently to the increase in metamorphism, and will be described in turn.

Polymictic conglomerates are found near the Webb-McIlraith Townships boundary and in a single outcrop south of Gullwing Lake, within the higher metamorphic grade area. Garnet occurs in the matrix of these conglomerates, and in some of the clasts, but their distinctive polymictic character left little doubt as to their correlation with the Ament Bay Formation and the map codes were retained for the high and low metamorphic rank varieties. Ament Bay Formation sandstones also occur in the higher metamorphic grade area, restricted to two areas south of Gullwing Lake. Porphyroblastic garnet (up to about 2 mm in size) is also found in these sandstones, but is almost wholly restricted to the thin, dark laminae which defines the bedding and cross-stratification. The sandy portions of the exposures are simply more coarsely crystalline (re-crystallized) equivalents of the quartz and feldspar sand and silt of the lower metamorphic grade terrain (with minor biotite), while the dark laminae are composed of larger biotite flakes, hornblende prisms, and euhedral garnets. Perhaps the most remarkable feature of the Ament Bay Formation sandstones in the higher grade area is the fact that they are so little changed in appearance from their lower grade counterparts, retaining the characteristic bedding, colouration, and (for the most part) mineralogy.

Sandstones and mudstones of the second metasedimentary assemblage are significantly transformed in the higher metamorphic grade terrain, primarily because of their abundant mafic mud component. Sandstones, formerly lithic wackes ("greywacke"), have been converted to biotite-feldspar-quartz schists which often also contain a small percentage of garnets. The slates (dark mudstones) are mainly converted to garnet-biotite schists, although these rocks must represent a considerable range of compositions as local varieties are rich in andalusite, muscovite, or biotite porphyroblasts, with or without a major garnet component. The garnet-rich metamorphosed mudstones grade into lean oxide ironstone described in the following section.

IRONSTONES

Iron-rich metasediments in the map area are associated with the lithic wacke-slate clastic metasedimentary assemblage, locally with the older mafic metavolcanic unit, and can be subdivided into magnetite and sulphide-bearing varieties. Magnetite (quartz-biotite-garnet) ironstone[2] occurs within the higher metamorphic grade metasediments about 1 to 3 km north of the western portion of Gullwing Lake. The most prominent lithology in this area is a well-layered rock containing up to about 50 percent dark red garnets (up to 0.5 mm) in the biotite-rich layers. Magnetic attraction of a compass needle is locally pronounced on and near the exposures, and the magnetite occurs either as euhedral crystals (0.1 - 1.0 mm) or as thin laminae up to several millimeters. The abundance of garnet in these rocks suggests the ironstone represents a metamorphosed iron-and magnesium-rich mud. A similar, garnet-rich lithology is found in

2 Ironstone is defined as a chemical sedimentary rock that contains 33 percent or more, of the common iron minerals by volume. Excluded are other chemically precipitated sediments, such as chert, and clastic sedimentary material, that are commonly interlayered with ironstone. Also excluded are ferruginous rocks, and skarn deposits.

contact with felsic breccias and tuffs about 1.1 km northeast of Needle Lake, but there contains only a small percentage of magnetite.

Sulphide-bearing ironstones, containing variable amounts of pyrrhotite, pyrite, and locally magnetite, occur sporadically within the older mafic metavolcanic unit (near Watch Lake), within clastic metasediments along the north shore of Maskinonge Lake, and as a transitional unit between the Franciscan Lake felsic metavolcanics and the Franciscan Creek (Minnitaki Group) metasediments. Weak magnetic attraction was noted at two locations, respectively 425 m and 610 m south of Watch Lake, with rusty, weathered, layered rock and mafic amphibolite being poorly exposed at the northerly occurrence. It is possible that these occurrences are merely sulphide-rich zones within the enclosing lavas, but it seems more likely that they correlate with isolated occurrences of sulphidic ironstone noted at a similar stratigraphic level northeast of the map area, and there termed iron formation (Johnston, 1972; p.5 and pp.35-38). A thin unit of pyritic, graphitic slate, occurring at a higher stratigraphic level within the older mafic metavolcanics, is exposed on the west shore of Vermilion Lake. While not strictly an ironstone, the latter unit is probably the strike equivalent of similar lithologies intersected in drilling under Vermilion Lake about 760 m to the southeast (see: Description of Properties, Selco Mining Corporation Limited); "graphitic argillite" from this core contained an estimated 20 to 50 percent pyrite. A zone of nodular pyrite occurring in tectonized mudstones along the north shore of Maskinonge Lake is a similar type of occurrence, although the latter is enclosed in a lithic wacke-mudstone succession rather than mafic lavas.

The most continuous unit of sulphidic ironstone in the map area occurs in the southeastern corner of Echo Township, marking a transition between felsic metavolcanics and clastic metasediments. Regional stratigraphic relationships suggest that this ironstone overlies the Franciscan Lake felsic metavolcanics, and the transitional nature of these two units is clearly exposed in a large outcrop along Highway 72, about 850 m southwest of Franciscan Creek. There, several meters of felsic breccia and lapillistone are apparently overlain by a minimum of 2-3 m of bedded quartz-pyrite ironstone, separated by a 3-4 m interval of felsic pyroclastics and fine-grained siliceous material, both containing disseminated pyrite. The bedded ironstone contains units of finely crystalline quartz with minor muscovite and scattered pyrite alternating with beds of nearly massive pyrite with minor magnetite and quartz. Drill log descriptions, local magnetic attraction, and exposures elsewhere in southern Echo Township suggest that the unit contains local concentrations of either magnetite or pyrrhotite, or both. Individual beds of ironstone reach about 10 cm in thickness, but both the siliceous and sulphidic varieties tend to be in the range of 1-3 cm. This thin-bedded character is particularly well-exposed in outcrop along Franciscan Creek, about 210 m southeast of the Highway 72 - Goldlund Mines road intersection. Total thickness of the ironstone may be estimated at 9-12 m from drill hole data, but a local thickness of at least 50 m was intersected by the Canadian Nickel Company Limited drill hole in the southern part of Lot 1, Concession II of Echo Township.

METAMORPHOSED MAFIC INTRUSIVE ROCKS

Mafic intrusive rocks within the Lateral Lake map area are restricted to several small bodies of metamorphosed gabbro and pyroxenite within the older mafic metavolcanic unit. The pyroxenites occur both as coarse-grained intrusive material (with pyroxene pseudomorphs), and as wholly metamorphosed, foliated to equigranular actinolite rock. Major and trace element chemistry of selected gabbro and pyroxenite is given in Table 2 (analyses 3 and 4).

Gabbro occurs as an isolated, elongate body, possibly a sill, about 3 km east of Centrefire Lake, and as a portion of a composite gabbro-pyroxenite mass north of Gullwing Lake in eastern Drope Township. The body east of Centrefire Lake consists of massive, medium-grained, diabasic rock composed of 60 percent pale amphibole (uralite), 35 percent epidote minerals replacing plagioclase, and minor amounts of sphene, quartz, magnetite, and chlorite. While the relationships between this body are obscured by overburden, a small exposure of similar diabasic gabbro, located about 2 km to the east, is more or less gradational in texture with the surrounding mafic lavas. If the larger mass is similarly gradational with the enclosing lavas, it may simply be an unusually thick flow which cooled slowly allowing larger crystal growth. Gabbro occurring in eastern Drope Township is similar in texture to that in Lomond-McIlraith

Townships, but at least in part reflects the higher metamorphic grade of the western area. The portion of the gabbro exposed on Gullwing Lake is composed of about 50 percent hornblende, about 30 percent intermediate plagioclase (An_{50}) and associated epidote, 20 percent quartz, and a trace of opaque minerals.

Pyroxenite and derived actinolite rock forms the larger portion of the composite pluton north of Gullwing Lake, a small lensoid body just west of Centrefire Lake, and a thin unit south of Gullwing Lake. The major body north of Gullwing Lake consists of both pyroxenite with relict intrusive texture, and massive, monomineralic actinolite rock. All exposures of the metamorphosed pyroxenite are characterized by a rough knobby surface, narrow veins (0.3-8 cm wide) of fibrous actinolite, and a moderate reddish brown weathering rind about 0.5-1.0 cm thick passing into fresh rock. In thin section, the metamorphosed pyroxenite is seen to consist of 75-80 percent actinolite, occurring as large (1-10 mm), ragged pseudomorphs after pyroxene and as bladed to acicular fine matrix crystals. The remainder of the rock is composed of felted chlorite (15-20 percent), and up to 10 percent magnetite. The massive actinolite rock is composed of about 95 percent actinolite as large, interlocking, ragged blades, about 4 percent magnetite, and a small amount of carbonate. Foliated actinolite rocks, occurring in the amphibolite ridges about 450 m south of Gullwing Lake and immediately west of Centrefire Lake are similar in mineralogy to the massive actinolite rock, but are distinctive for their strongly oriented sheaves and whorls of actinolite.

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Felsic to intermediate intrusive rocks in the map area range in composition from trondhjemite, granodiorite, quartz monzonite to granite, and occur as plugs, stocks, and portions of batholiths. Fine-grained dikes, porphyry dikes, and pegmatitic dikes are common in portions of the area, and span a compositional range similar to the larger intrusive masses. All of the intermediate to felsic intrusive rock may be crudely subdivided into three suites based on feldspar composition, including:

a) sodic suite, consisting of trondhjemite and porphyry dikes and stocks;

b) transitional suite, consisting of granodiorite to quartz monzonite bodies and some pegmatitic dikes; and

c) potassic suite, consisting of irregular granite masses and most pegmatitic dikes.

Intrusive rocks of the sodic suite include felsite, quartz porphyry, feldspar porphyry, quartz-feldspar porphyry dikes and plugs, irregular bodies and dikes of albite trondhjemite, and a stock (oligoclase) trondhjemite. With only a few exceptions, sodic suite intrusive rocks are restricted to the southern portion of Echo Township. The sodic nature of all the intrusive rocks in southern Echo Township, in turn, suggests a co-magmatic origin.

Felsite is documented in only one location, as a dike in southwestern Echo Township where Kathlyn Creek exists from Crossecho Lake. The dike is a fine-grained, light-coloured, weakly foliated, siliceous rock in contact with intermediate variolitic lava. Similar fine-grained to aphanitic siliceous rocks, occurring in several locations along the south shore of Vermilion Lake in Lomond Township were mapped as massive rhyolite, but may be intrusive material related to the quartz-feldspar porphyry body found in the same area.

Quartz porphyry is essentially a felsite with the addition of 1 to 5 percent quartz phenocrysts, and occurs as a small stock west of Franciscan Lake and as a few dikes in the same area. The main rock is a pale yellow coloured, white to buff weathering rock, and locally exhibits felsitic phases such as in the small outcrop in a gravel pit in Lot 4, Concession I of Echo Township.

Feldspar porphyry occurs as narrow dikes in southern Echo Township, and is also found as a larger dike about 550 m east of Hooch Lake in the northern portion of the township. The dike exposed on a small peninsula in Crossecho Lake is one of the better exposures of feldspar porphyry and consists of at least 50 percent creamy-white plagioclase phenocrysts (up to 5 mm) set in a turgid, pale greenish-grey aphanitic matrix of quartz, feldspar, carbonate, and sericite.

Quartz-feldspar porphyry is the most common dike rock in the southern Echo Township area, and also forms the western end of a small stock which extends east of the map-area, from the mouth of Blackfox Creek where it empties into Vermilion Lake. Both the numerous dikes in Echo Township and the stock in Lomond (and Vermilion) Township consist of abundant phenocrysts of feldspar and a smaller percentage of quartz phenocrysts set in a fine-grained to felsitic matrix. About the only noticeable differences in the quartz-feldspar porphyries of the two areas are occasional large (1.0-1.5 cm) quartz phenocrysts in the Vermilion Lake body, and the common occurrence of quartz-filled tension fractures in the Echo Township dikes.

The Crossecho Lake stock in southernmost Echo and Webb Townships is composed of fine-grained trondhjemite, trondhjemite porphyry, and locally, quartz-feldspar porphyry. All of these rocks are included in the "sodic suite" intrusives of the map area and their spatial association within the stock strongly suggest a co-magmatic source. In turn, it is reasonable to suggest the stock as a source for the numerous sodic dikes east of Crossecho Lake. The fine-grained trondhjemite consists of closely-packed, euhedral to subhedral plagioclase crystals up to several millimeters with an interstitial granular mosaic of quartz, feldspar, and minor biotite. With an increase in size and decrease in number of plagioclase crystals, the matrix becomes fine-grained and the rock grades into trondhjemite porphyry with 50-70 percent phenocrysts. Field relations suggest that quartz-feldspar porphyry forms a local, marginal phase of the stock, and would thus be a likely dike phase in surrounding country rock. The distribution and variety of dikes around the Crossecho Lake stock, and perhaps the stock itself, must be given some economic consideration as a variety of trondhjemite carries virtually all the known, significant gold mineralization in the southern Echo Township deposits.

Albite trondhjemite forms several irregular masses, a large, composite dike, and at least one small dike in Lots 5 through 9, Concessions I and II of Echo Township. Other occurrences of similar intrusive rock are reported as granodiorite in diamond drilling and trenching along an east-northeast strike in southeastern Echo Township and western and central Pickeral Township (Armstrong, 1951; Chisholm, 1951). The albite trondhjemite differs from trondhjemite and trondhjemite porphyry by its very fine grain size (approaching aplite in some places), lack of porphyritic texture of any kind, and its apparently pervasive albitization and silicification. In thin section, albite trondhjemite from the no. 1 zone workings of Goldlund Mines Limited consists of about 70 percent albite, 20 percent quartz, 5-6 percent chlorite, 3-4 percent magnetite plus pyrite, and minor carbonate and sericite. A similar intrusive from the no. 3 zone differed only in containing about 10 percent biotite (instead of chlorite), slightly increased amounts of carbonate, sericite, and opaques, minor epidote, and a somewhat lower percentage of plagioclase. Bleached albite trondhjemite adjoining auriferous quartz veins in the no. 1 zone is similar to unbleached rock which it grades into, but does contain several percent carbonate and a larger quantity of pyrite. All of these samples share the common characteristics of grain size (1-2 mm, equigranular) and abundance of albite + quartz (85-90 percent of the rock).

The transitional intrusive suite includes megacrystic to porphyritic biotite quartz monzonite, homogeneous quartz monzonite to granodiorite, and foliated to cataclastic granodiorite to quartz monzonite. These lithologies form the majority of felsic to intermediate intrusive masses in the map area, including the Gilbert-Islay Lakes pluton, the Bluett Lake stock, and the Lateral Lake stock. Certain pegmatites and aplites appear to be associated with the Lateral Lake stock, although the majority of such rocks are included in the generally later potassic suite.

Megacrystic to porphyritic biotite quartz monzonite forms a broad marginal zone of the Gilbert-Islay Lakes pluton in the northwestern portion of the area. The rock is typically composed of about 40 percent microcline, occurring as sporadic to abundant megacrysts (1.0-1.5 cm) and phenocrysts, and as a groundmass constituent. The remainder of the rock is an anhedral to subhedral granitic mosaic of 30 percent oligoclase, 25 percent quartz, 6 to 7 percent biotite, and trace to minor amounts of muscovite, sphene, apatite, opaque minerals, and chlorite replacing biotite. Most of the megacrystic quartz monzonite occurs within 1.6 km of the contact of the pluton with the country rocks, but scattered patches of this phase can be found almost to the northwest corner of the area. Local zones of intense foliation give rise to a rock approaching augen texture.

Homogeneous biotite quartz monzonite to granodiorite forms the interior phase of the Gilbert-Islay Lakes pluton, the Bluett Lake stock, and as a major constituent of the small, irregular bodies north of Gullwing Lake. This lithology is always fine- to medium-grained and hypidiomorphic-granular in texture, containing 30-50 percent oligoclase, 10-20 percent microcline, 15-25 percent quartz, 5-10 percent biotite, with minor quantities of muscovite, epidote, sphene, apatite, and opaques. A few locations contain up to several percent hornblende in addition to biotite. Two occurrences of granodioritic gneiss, located about 2.4 km north of Gullwing Lake and on several islands in western Gullwing Lake, are included with the homogeneous granodiorite to quartz monzonite. While compositionally almost identical, the granodioritic gneiss is recognized by the presence of well-defined, centimeter-scale mineralogical layering, with a leucocratic (quartz + plagioclase rich) phase alternating with more mafic phases (biotite or biotite + hornblende rich).

Foliated to cataclastic granodiorite to quartz monzonite forms the large majority of the Lateral Lake stock. Local occurrences of granitic and muscovite granite pegmatite, and microcline aplite, form the remainder of the stock. This lithology differs very little in composition from the megacrystic quartz monzonite to the northwest, but its texture is unique in the map area. The rock is typically foliated to strongly foliated, with the quartz drawn out into lenses or ribbons. Biotite is uniformly aligned, and the larger feldspar crystals are commonly partially granulated. Development of this fabric appears to increase in the western portion of the Lateral Lake stock, and is especially pronounced on the small islands at the northern end of Gullwing Lake where the texture is cataclastic. Well-foliated rocks are also present locally at the east end of the stock, however, as in the outcrop area of the "southwest zone" of the Pidgeon Molybdenum Mines Limited property in Echo Township.

Colvine and McCarter (1977) have suggested that the foliated character of the Lateral Lake stock is likely the result of deformation during intrusion. While this may be true in part, the results of this survey indicate that the fabric is primarily tectonic in origin. The western end of the stock, in particular, appears to be more intensely foliated, and a similar tectonic fabric extends at least 4 km south and southwest into the metavolcanic-metasedimentary country rocks.

Potassic suite intrusive rocks of the map area include inhomogeneous biotite granite and a diverse suite of simple to complex pegmatites. The inhomogeneous granites are found in the same general area as the homogeneous quartz monzonite-granodiorite, that is, in the far western and, rarely, northwestern portions of the area. Field relationships suggest that the inhomogeneous granites represent a hybridization of the homogeneous quartz monzonite-granodiorite and the very inhomogeneous simple pegmatites. Pegmatitic rocks have a similar areal distribution to the inhomogeneous granites, most often occurring as dikes, but also forming a few larger, irregular bodies north and south of Gullwing Lake.

The inhomogeneous granites do not differ substantially from the homogeneous quartz monzonite-granodiorite intrusives, except in feldspar content and texture. Mapping of the area north of Gullwing Lake disclosed several localities of biotite-bearing granitic intrusive material with a highly variable to patchy grain size distribution. Subsequent staining of rock slabs revealed these variable grain size rocks to contain considerably more potash feldspar than the associated homogeneous phases. The homogeneous, inhomogeneous, and simple pegmatitic phases occur as relatively isolated portions of an intrusive mass about 1.5 km north of the western portion of Gullwing Lake.

Pegmatites occur almost entirely in the western third of the map area. They were subdivided into four, wholly gradational varieties on the basis of accessory mineralogy, as opposed to feldspar composition. Subsequent staining of selected varieties indicated that most have potash feldspar greater than or equal in amount to plagioclase, yielding a quartz monzonite to granite classification. In general, it appears that the simple pegmatites tend to be consistently potassic, while the more complex pegmatites tend to be more variable in feldspar composition.

In addition to quartz, plagioclase, and potash feldspar, simple pegmatites contain only biotite as an easily recognizable constituent. Many of the simple pegmatites contain only scattered traces of biotite. The simple pegmatites are concentrated into several large bodies around the western portion of Gullwing Lake, and occur as scattered dikes in the eastern Gullwing Lake area, within the Lateral Lake stock, and at numerous locations within the Bluett Lake stock and Gilbert-Islay Lakes pluton. These pegmatites are typically pink coloured rocks with a highly variable (patchy) grain size. Local aplitic phases alternate randomly within the dominant medium- to coarse-grained phase which in turn, contains patches and lenses of very coarse crystals (up to several centimeters). The smaller dikes tend to be more uniform in grain size, while the larger bodies are variable in the extreme.

Complex pegmatites were defined in the field by the appearance of pale greenish-yellow muscovite and tiny (less than 0.5 mm) red garnets in the otherwise usual pegmatite mineralogy. The assemblage muscovite-garnet is very common in these pegmatites, while the assemblage biotite-muscovite was found only infrequently; the assemblage biotite-garnet (or biotite-garnet-muscovite) was noted in only a few locations. The complex pegmatites occur as several small, isolated masses north and south of the western portion of Gullwing Lake and immediately east of Gilbert Lake, as a swarm of roughly north-south trending dikes south of the east end of Gullwing Lake, and as an intimate mixture with simple pegmatites in a larger mass south of Gullwing Lake. Complex pegmatites are typically white to pale yellowish in colour, and like the simple pegmatites, are highly variable in grain size. The white colour of these pegmatites is deceptive however, as they generally contain a large percentage of potash feldspar. It has been suggested that the lack of pink colour in the potash feldspars is due to high Fe^{+3}/Fe^{+2} ratios in the complex pegmatites (F. Breaks, O.G.S., personal communication).

Two types of complex pegmatites in the map area are associated with mineral deposits and deserve special attention. The first type is known from only a single dike occurrence in Webb Township, about 1 km south of Tot Lake, and contains Li-Cs-Ta mineralization (see: Description of Properties, Tantalum Mining Corporation Limited). The dike is composed of huge crystals of potash feldspar and spodumene, with quartz, plagioclase, garnet, muscovite, pollucite, and tourmaline as accessories. An associated aplitic phase is essentially a sodic plagioclase and quartz rock, with minor apatite, muscovite, and garnet. The second type of mineralized pegmatite occurs along the eastern margin of the Lateral Lake stock, and at two locations near the southwestern margin of the stock, and has pyrite and molybdenite associated with it and an accompanying aplitic phase. These pegmatites would be considered simple and potassic using the field subdivisions described above, except that greenish-yellow muscovite is prominent in its association here with the molybdenite. All gradations between quartz veins and quartz-potash feldspar-muscovite pegmatites are present at the east end of the stock, and these are closely associated with a pink, microcline aplite. The molybdenite is disseminated in both pegmatitic and aplitic phases (see: Description of Properties, Pidgeon Molybdenum Mines Limited and Rio Tinto Canadian Exploration Limited).

METAMORPHIC RELATIONSHIPS

A general increase in metamorphic grade from east to west in the map area has been discussed in previous sections. Areas around Maskinonge, Hooch, Blackfox, and southern Vermilion Lake represent the lowest metamorphic grade conditions in the area, apparently about middle greenschist grade. A progressive increase in metamorphic grade westward is indicated by the appearance of garnet or biotite porphyroblasts in rocks of appropriate composition, but no attempt was made to document this change more rigorously. The area between Bluett Lake and western Gullwing Lake is believed to represent the highest pressure-temperature conditions attained in the area, based on a substantial increase in grain sizes in metasedimentary and intermediate metavolcanic rocks.

CENOZOIC

PLEISTOCENE & RECENT

Pleistocene geology of the map area is quite diversified and is well exposed because of the numerous roads, gravel and sand pits, and extensively logged areas. Three major Pleistocene units were observed: a) varved clay, resting on bedrock, and probably of significant thickness in major lake basins; b) bedded sand and silt with rare clay beds; and c) boulder till forming the Trout-Basket (Zoltai, 1961) moraine (in part stratified till) and associated gravel and sand outwash. A generalized distribution of the major lithologic types is shown in Figure 4.

Varved clay is generally exposed only in the lower elevation terrain bordering creeks and lakes. In some places, such as in southwestern Lomond Township, the clay unit is absent on the higher bedrock ridges. Whenever the survey observed vertical faces in the clay, varves were present, with alterations of light grey silt or clay and dark grey, sticky clay in thin units of 1-5 cm.

The sand-silt unit overlying the clay was observed in several locations in the area, but its bedded nature is particularly well exposed in a large, flat-bottomed pit in southeastern Echo Township (Photo 11). The sedimentary structures in the sands at this locality are suggestive of outwash environments described elsewhere in Ontario (Walker, 1972). The interbedded clay units are similar to the underlying varves, and may be the result of deposition in isolated ponds or swales on outwash plain.

The Trout-Basket moraine (Zoltai, 1961) complex dominates the topography of much of the map area, extending from the northwest to the southeast corner of the area. It is also relatively easy to investigate as most of the major and minor unpaved roads in the area are built on it. Zoltai (1961) traced the moraine from Trout Lake, near the town of Red Lake, to Basket Lake, near the town of Ignace, a distance of about 250 km. Both the terraced sides of the moraine and the frequently stratified character of its constituent till (Photo 12) attest to modification by lake action. Zoltai (1961) has suggested that the stratified till indicates that the moraine was deposited directly into an ice-front lake.

Glacial striae are also shown in Figure 4, and generally trend about 030-040°. A small number of striae trend 055-060°, and Harding (1951) suggested that this may be due to two ages of striae in the map-area. It is also possible that the variation in striae is the result of local deflections in ice movement caused by the larger bedrock ridges near Redhat, Gilbert, and Gullwing Lakes.

Low-lying areas within the Lateral Lake map-area contain substantial thicknesses of Recent organic deposits. Major streams in the area contain small deposits of re-worked Pleistocene gravel, sand, silt, and clay.

STRUCTURAL GEOLOGY

GENERAL STRUCTURE

The Lateral Lake map area lies at the boundary of the Wabigoon sub-province belt and the English River subprovince. Structure within the map area is dominated by generally steeply-dipping, folded, and faulted metavolcanics and metasediments and minor related intrusive bodies. The contact of this supracrustal assemblage with the English River plutonic-gneiss terrain is apparently intrusive in the northwestern portion of the area, from Islay to Gilbert Lakes, but is more properly described as a metamorphic grade transition zone (with associated intrusives) in the far western portion of the area.

Exclusive of the English River intrusive terrain, the area may be broadly subdivided into five major structural zones, including (from north to south):

a) the northern, south-facing, homocline, extending from the northern area boundary to about Redhat Lake;

b) the central syncline, extending from about Cloudlet lake to the Needle-Bluett Lakes area;

c) the Lateral-Tot Lakes anticline, cored by the Lateral Lake stock;

d) the Kathlyn Creek fault and fold belt, extending westward from Maskinonge Lake to the Coates Bay area of Gullwing Lake, and;

e) the southeastern, south-facing Echo Township homocline.

The northern homocline is dominated by a relatively simple, succession of mafic, intermediate, and felsic metavolcanics with vertical to steeply north-dipping bedding and foliation. This sub-area passes eastward into a complex fold and fault terrain in the vicinity of Vermilion Lake and appears to be locally disrupted by strike faulting in the older mafic metavolcanics, such as in the Centrefire and Bluett Lakes area.

The central syncline is a well-defined structure in the Cloudlet-Redhat Lakes area, but is only inferred further west on the basis of irregularities in bedding strike and the repetition of major lithologic units. The fold is gently overturned to the south, and appears to plunge gently to the east, in the Cloudlet-Redhat Lakes area, but must be considerably overturned in the Needle-Bluett Lakes area where all strata dip only moderately to the northwest.

The Lateral-Tot Lakes anticline forms a southward continuation of the rather gently disturbed central portion of the map area. Flanks of the anticline dip only moderately (40-60°), while the crestal zone is doubly-plunging (5-20° in the east, 25-30° in the east, 25-30° in the west). The fold is probably the combined result of gentle doming associated with the emplacement of the Lateral Lake stock, later modified (tightened) by penetrative regional deformation. This later deformation produced local cataclasis within the stock, and probably also resulted in the formation of the Kathlyn Creek fault.

The Kathlyn Creek fault and fold terrain is bounded on the north by the Kathlyn Creek fault and on the south by the inferred extension of the Little Vermilion fault (Johnston, 1969, 1972) and the Crossecho Lake stock. Exposure within this sub-area is minimal except north of Maskinonge Lake and west of the centre of Webb Township. Outcrop is sufficient, however, to define at least three large-scale folds and infer at least one major fault in addition to the boundary faults.

The southeastern Echo Township area is apparently homoclinal, with a south-facing mafic and felsic metavolcanic sequence only moderately disturbed by intrusive sills, dikes, and irregular plugs. A minor number of strike faults of small displacement are apparently present where very detailed mapping has been conducted in underground workings (Kuryliw, 1979). The homocline appears to pass into a complex fold terrain in the extreme southeastern corner of the area.

FOLDS

Most folds defined in the map area are large (Kilometre-scale) structures which can be inferred or defined over strike lengths of 1-8 km. The only fold of this type which is not defined by top determinations is the short anticline shown on the map in the western part of Vermilion Lake. A possible syncline of this magnitude, not shown on the map, may exist in the Kathlyn Creek fault and fold terrain, extending from the southern part of Hooch Lake eastward to a point about 230 m south of the northeast corner of Echo Township; such a fold would be inferred primarily on the basis of significant changes in bedding strike in the area between Blackfox and Maskinonge Lakes.

Minor folds (10-100 cm scale) are rare in the map area and were only observed in exposures on Kathlyn and Maskinonge Lakes. The metasediments at these locations displayed tight to isoclinal folds with both Z and S styles. The minor folds on Kathlyn Lake are perhaps suggestive of additional large-scale folding within the fault and fold sub-area.

FAULTS

As with fold structures, only large-scale faults were defined in the map area with confidence. In many cases, no direct evidence of faulting could b located on the ground, so lineaments are shown on the map face; most lineaments possibly represent faults because noticeable (10-15^{o} or more) deflections of rock fabric measurements are associated with them, such as the lineament following the north shore of Bluett Lake, and the northeast-trending lineaments extending from the north side of the Lateral Lake stock.

The most prominent fault in the map area is the previously undefined Kathlyn Creek fault. This fault extends roughly east-west across at least 80 percent of the map area, is downthrown on the south, and truncates all strata older than the Little Vermilion Formation. The eastern end of the fault is defined by an abrupt change in both strike and dip of bedding (from southeast to east-west on the north side of the fault; from north dip to vertical or south dip on the south side of the fault) and in lithology (Ament Bay Formation on Hooch Lake; Daredevil and Little Vermilion Formations southeast of Hooch Lake). The western portion of the fault is marked by the juxtaposition of four distinct metavolcanic and metasedimentary units on the south side of the fault against the older mafic metavolcanics on the north side of the fault which are structurally elevated near the core of the Lateral-Tot Lakes anticline. The central portion of the Kathlyn Creek fault is inferred, but is placed on Kathlyn Creek which is the eastern portion of a highly linear swamp which extends from Gullwing Lake. Inferred splays off this major fault must at least be present west of Philcott Lake (near Beartrack Creek) where truncation of strata and folds is reasonably well defined, and near the eastern end of Lateral Lake where significant foliation changes are present and the Lateral Lake stock margin becomes quite irregular.

FOLIATIONS AND LINEATIONS

Rock fabrics throughout most of the map area are sub-vertical. Within the northern and central portions of the area, however, consistent deviations are present. In the northern portion of the area, steep to rarely moderate northerly dips occur. Within the central portion of the map area, in the Lateral-Tot Lakes anticline, rock fabrics both within the Lateral Lake stock and in the supracrustal rocks in general are parallel to the contact of the stock, dipping moderately away from it in all directions. The country rocks near the eastern end of the stock locally exhibit very shallow dips away from the stock, in the range 5 to 20 degrees.

Linear rock fabrics, marked by pronounced mineral orientation and rodding, are present only in the area south and west of the west end of the Lateral Lake stock. The country rocks surrounding the stock, all supracrustal rocks south of the south of the Kathlyn Creek fault (extending to the southern boundary of the area), and locally the intrusive rocks of the stock itself all exhibit a gentle to moderate (25-40°), southwesterly plunging tectonic fabric. Upward, or possibly rotational movement of the north side of the Kathlyn Creek fault, combined with regional stresses, probably produced this area of linear deformation.

ECONOMIC GEOLOGY

A diverse suite of mineral deposits are present in the Lateral Lake area, including cesium-lithium-tantalum, gold, iron, copper-nickel, copper-zinc, zinc, molybdenum, uranium, sand and gravel, and clay. Exploration activity in the map area during 1978-79 attained a very high level, including two separate regional investigations for copper-zinc, a major re-investigation of the most extensive known molybdenum prospect, a greatly expanded exploration and development program at the principal gold prospect, a new testing of the cesium-lithium-tantalum deposit, and miscellaneous activity by prospectors.

Over 600 claims (patented and unpatented) were staked or held during 1978-79. A compilation of exploration data pertaining to the area (mostly work filed for assessment credits) is given in Table 7. This exploration may be compared with the location map for properties current to 31 September 1979 (Figure 5).

In the following section, summary descriptions of the various types of deposits in the map area are presented. Relationships and hypotheses concerning the origin of certain deposit types are also given, followed by detailed descriptions of the properties and deposits proper.

CESIUM-LITHIUM-TANTALUM PEGMATITE DEPOSIT

Pollucite (Cs), spodumene-lepidolite (Li), and tantalite (Ta) occur in a single, known, complex pegmatite-aplite dike which cuts mafic amphibolites. The dike is a very late intrusion, and appears to be genetically related to similarly late, less complex pegmatites which occur in abundance in the Gullwing Lake area, west of the complex dike.

GOLD DEPOSITS

Gold occurs in essentially two different types of deposits in the map area. Trace to minor quantities of gold (and silver) are found in disseminated and massive sulphide deposits (copper-nickel, copper-zinc) within metavolcanics. Major gold values are associated with quartz vein and stockwork deposits which in turn are primarily found in albite trondhjemite dikes, but also occur in porphyry dikes and metavolcanics.

SULPHIDE-RELATED OCCURRENCES

Small amounts of gold have been detected in disseminated copper (nickel) mineralization found in mafic metavolcanics in the north-central portion of the map area. Minor gold (and/or silver) values are similarly found within disseminated to massive sulphide (copper-zinc) zones within felsic to intermediate metavolcanics extending across the northern portion of the area. Still other silver values have been noted in sulphide zones within the northern mafic metavolcanic unit.

QUARTZ VEIN AND STOCKWORK DEPOSITS

Gold occurs locally in substantial amounts associated with transverse, quartz-filled tension fractures which are preferentially developed in portions of albite trondhjemite dikes. The dikes are apparently confined to southeast Echo Township (within the map area), intrude a mafic to intermediate metavolcanic succession, and are locally concordant with the volcanic strata. They are, further, substantially albitized and locally silicified.

The quartz veins occur singly, or in vein clusters, and are commonly associated with coarse cubes of pyrite. Extensive drifting and cross-cutting in underground workings on three properties have established that gold values attain maximum values where vein clusters are re-fractured, resulting in a stockwork-like type of deposit. Little is known at time of writing about the vertical distribution or continuity of the veins and vein clusters.

ORIGIN OF VEIN-TYPE GOLD DEPOSITS

The available information concerning the vein-type gold deposits appears to suggest three features critical to their origin:

1) albitized and locally silicified host rocks, commonly composite, trondhjemitic dikes but also including porphyry dikes and intermediate, variolitic lavas;

2) tensional fracturing and the formation of quartz and quartz-carbonate veins, together with additional host rock alteration and introduction of pyrite and gold;

3) additional fracturing of early-formed vein constituents and host rocks, with remobilization of early gold, and deposition of tellurides and gold.

The first feature appears to be a hydrothermal event of considerable regional extent, associated with most common host rock (trondhjemite). The latter features suggest an on-going hydrothermal event, associated with recurrent regional tectonic movements which selectively fractured (and re-fractured) the more competent rock masses in the area.

IRON DEPOSITS

Iron deposits in the map area consist of iron oxide- and/or iron sulphide-rich metasedimentary units. Magnetite-bearing biotite-garnet schist occurs in the area north of the west end of Gullwing Lake and is associated with minor occurrences of thin (0.5-1.0 cm) magnetite ironstone beds. The mineralogy of these units, combined with their occurrence in a thick unit of biotite-quartzofeldspathic schist, suggests that they represent highly metamorphosed units of iron and magnesium-rich muds.

Nodular and disseminated pyrite occurs with biotite schist and mafic pillow lavas on the north shore of Maskinonge Lake. Although no diamond drilling has tested this deposit for copper-zinc mineralization, the available information suggests the occurrence consists entirely of iron sulphides.

Bedded to locally massive quartz sulphide ironstone occurs as an intermittantly traceable unit at or near the contact between the Franciscan Lake felsic metavolcanics and Minnitaki Group clastic metasediments. Pyrrhotite and pyrite are generally the predominant iron minerals in the unit, but magnetite content locally exceeds that of the combined sulphides. Several drill holes, and a short exploration shaft (just east of the map area in Pickeral Township), have tested the unit for gold and copper-zinc potential with negligible results.

SULPHIDE DEPOSITS

Copper (nickel), copper-zinc, molybdenum, and zinc sulphide deposits are present in the map area. The copper-bearing deposits appear to be volcanogenic-type mineralization within mafic to felsic metavolcanics. The latter two deposit types are intrusive margin or contact-related occurrences. A large percentage of recent exploration activity in the map area has been aimed at potential copper-zinc deposits and at a re-evaluation of molybdenum deposits.

DISSEMINATED COPPER (NICKEL) DEPOSIT

A major drilling program in the north-central portion of the map area in 1968 disclosed the presence of disseminated pyrrhotite-pyrite-chalcopyrite mineralization within massive and pillowed mafic amphibolites. One drill hole intersected minor nickel values in addition to copper. Several drill holes yielded trace to minor gold values accompanying the sulphides.

DISSEMINATED TO MASSIVE COPPER-ZINC DEPOSITS

Numerous, sulphide-bearing, conductive zones in the map area have been tested by diamond drilling in the last ten years, but especially between 1978-1979. Most of these geophysical conductors occur in the Vermilion-Redhat-Bluett Lakes intermediate to felsic metavolcanic unit, the older mafic metavolcanics to the north, and in mafic metavolcanics surrounding the Lateral Lake stock. The deposits consist of varying amounts of pyrrhotite and pyrite, with trace to minor quantities of arsenopyrite, chalcopyrite, and/or sphalerite.

Pyrrhotite seems to be the most abundant iron sulphide where the deposits are enclosed in mafic metavolcanics (or are sulphidic-graphitic argillite), while pyrite tends to predominate in felsic to intermediate metavolcanic related occurrences.

The deposits show a complete spectrum of sulphide abundances, ranging from massive sulphide beds up to 3 m, to disseminated and/or stringer sulphide zones which vary between 1 and 10 m in thickness. More rarely, clasts of bedded sulphide (pyrite) occur in pyroclastic units. Minor to substantial values for silver and gold have been recorded for a number of drill hole intersections.

ORIGIN OF DISSEMINATED AND MASSIVE COPPER (NICKEL) AND COPPER-ZINC DEPOSITS

The majority of sulphide deposits present in mafic, intermediate, and felsic metavolcanics in the map area appear to conform to a volcanogenic-exhalative (Sangster, 1972) mode of formation. This model is particularly supported by: a) occurrences of bedded sulphides, both as clasts and as massive units; b) sulphide occurrences within fine-grained tuffaceous units and/or metasediments, suggestive of a non-eruptive phase in the volcanic activity; and c) the apparent along strike continuation of several sulphide-rich zones as given by successive drill-hole intersections. Certain of the drill holes provide relatively precise correlation of sulphide-bearing units and their enclosing metavolcanics, further supporting a stratigraphic control of the sulphide deposits.

Within the framework described above, disseminated and stringer type sulphide mineralization in the area is seen as either metal-poor lateral equivalents of the massive sulphide units, or as mineralized zones associated with the sulphur- and metal-rich fumaroles which produced the massive sulphide units. Such a "vent-proximal" origin may be particularly applicable to the copper (nickel) deposits in the north-central portion of the area as these disseminated deposits occur over a considerable stratigraphic interval, within both massive and pillowed mafic lavas.

QUARTZ STOCKWORK-APLITE-PEGMATITE ASSOCIATED MOLYBDENUM DEPOSITS

Molybdenite-pyrite mineralization occurs in the marginal portion of the east end of the Lateral Lake stock, and at several locations near the south margin of the stock near Gullwing Lake. Deposits at the east end of the stock are associated with quartz veining and stockworks, simple pegmatites, and pink aplite dikes. Diamond drilling programs dating from the late 1950s have progressively increased the known extent of mineralization and outlined several lenses of potentially economic material.

Deposits near the southwest contact of the stock have been known since the early 1900s, and also occur with pegmatite, aplite, and quartz veining. To date, only surface prospecting has been used to evaluate these deposits.

ORIGIN OF MOLYBDENUM DEPOSITS

Colvine ad McCarter (1977) have proposed a model for the Lateral Lake stock which relates the molybdenum mineralization to the formation of a late hydrous phase in the cooling history of the stock. This hydrous, molybdenum-enriched phase is believed to have produced the molybdenum deposits and associated quartz veins and intrusive lithologies. The concentration of known mineralization at the east end of the stock is inferred (Colvine and McCarter, 1977) to be the result of a higher level of emplacement for that portion of the stock, based on the abundance of hydrous phases, and abundance of country rock xenoliths there, and progressive potash-enrichment to the east in pegmatites in and near the stock. As a result of the present survey, it is evident that: a) large mafic enclaves or roof pendents occur at the west end of the stock as well as at the east end; b) the apparent lack of pegmatites, aplites, and quartz veins along the western stock margins could simply be the result of poor exposure of these marginal zones; c) pegmatitic rocks cutting both the stock and country rocks in the vicinity of Gullwing Lake (and locally carrying molybdenite) are demonstrably post-tectonic while the stock is clearly pre- to syn-tectonic. The above relationships suggest a possible alternative model for molybdenum mineralization within the Lateral Lake stock which is related to a more widespread pegmatite intrusive event and localization of molybdenite in structurally induced, tensional environments, in proximity to the Kathlyn Creek fault.

INTRUSIVE ASSOCIATED ZINC DEPOSIT

Exploratory diamond drilling in 1976, 1977 and 1979, about 1250 m northeast of the shaft of Goldlund Mines Limited, has intersected massive to disseminated sphalerite-pyrrhotite mineralization at a depth of about 75 m. The mineralization occurs at or near the hanging wall contact of a south-dipping albite trondhjemite dike with its enclosing mafic metavolcanics.

The dike is host to gold mineralization in the No. 1 zone of Goldlund Mines Limited, but the zinc deposit has not been reported to carry gold values.

URANIUM DEPOSITS

Uranium mineralization is associated with several pegmatite dikes located west of the west end of Bluett Lake. The mineralization is apparently confined to the intrusive rocks and immediately adjacent metasedimentary schists. Although pegmatites are widespread in the western portion of the map area, these are the only ones known to carry uranium.

CLAY, SAND, AND GRAVEL DEPOSITS

The Lateral Lake area contains extensive deposits of Pleistocene clay, sand, and gravel.

Sand and gravel deposits generally occur together in the map area, and are especially concentrated in and near a moraine-outwash complex extending from southeast Echo Township to the northwestern corner of the area. Stratigraphy within this complex is locally quite complicated, but existing pits appear to have taken advantage of the margins of the complex where glacial lake shoreline reworking has resulted in sorting of gravels.

CONSIDERATIONS FOR FUTURE EXPLORATION

The Lateral Lake area holds considerable potential for a number of metallic deposits, especially copper, zinc, molybdenum, and gold. Lesser, but not insignificant potential is also present for nickel and tantalum. Although the intensified exploration of 1978-79 has tested the most prominant mineralization or anomalous zones, this work also provides an extensive data base and an initial screening for future exploration programs. This data base is used in the following sections to suggest areas of high potential for future exploration, and possible procedures.

CESIUM-LITHIUM-TANTALUM

Currently sub-economic cesium, lithium, and tantalum mineralization is present in a complex pegmatite dike located about 1 km south of Tot Lake. Diamond drilling in 1964 and 1979 has effectively defined the strike and dip extent of the dike.

The dike is of the same relative age and structural style as numerous, less complex, pegmatites which cut identical country rocks (mafic amphibolites) about 4.2 to 6.8 km to the west. It is reasonable to expect that additional pegmatite dikes (simple and/or complex) occur in 4 km of drift-covered amphibolites west of the complex dike. Several kilometers of drift-covered ground are present east of the dike. High-precision ground magnetometer surveys in these covered areas could be utilized to detect vertical dikes which, in this area, generally strike north-south, at nearly right angles to foliations in the more magnetic amphibolites.

COPPER-NICKEL AND COPPER-ZINC

Exploration for copper-nickel and copper-zinc in the map area is considered together in this section because of the author's belief that both types belong to a single class of volcanogenic-exhalative mineralization. A considerable amount of diamond drilling (more than 5100 m in over 50 drill holes) has located widespread massive and disseminated mineralization to date, with notable values for Cu, Zn, Ag, and Au found in a few holes. The mineralization is found at intervals throughout a thick (ca. 5000 m) succession of mafic and intermediate to felsic metavolcanics extending from Bluett and Gullwing Lakes in the west, to Vermilion Lake in the east, and in metavolcanic rocks surrounding the Lateral Lake Stock.

It is suggested that future exploration for sulphide mineralization in this extensive group of rocks proceed along two lines. First, that portion of the Vermilion-Redhat-Bluett Lakes metavolcanic unit in the Vermilion Lake area and eastward (out of the map area) is not known to have been investigated on either a reconnaissance or detailed scale. This is in spite of a number of sulphide occurrences, the general equivalence with intermediate to felsic metavolcanics within the map area, and the presence of probable, sub-volcanic, felsic intrusive bodies (felsite and quartz-feldspar porphyry). Further east, the metavolcanic unit appears to undergo a facies transition into metasediments of the Patara Metasediments, but still contains a number of sulphide occurrences (Johnston, 1972; Trowell, 1977, 1978). This whole group of rocks warrants immediate investigation.

Second, sulphide mineralization is present in three different environments: a) at several stratigraphic levels in close proximity to the Centrefire Creek flow-dome complex; b) as discreet, apparently continuous horizons in the Centrefire Lake-Bluett Lake area; and c) as disseminated and massive zones in mafic metavolcanics in the Gullwing Lake area. The clustering of mineralized zones in and around the flow-dome complex suggests a near-vent environment for fumarolic activity and sulphide deposition. The apparent lack of mineralization east of this complex may reflect a primary change in depositional environment, or possibly a lack of detailed exploration.

The apparently continuous mineralized zones in the Centre-fire-Bluett Lakes area suggest a more distal character for these deposits. In such an environment, local changes in paleogeography, in the order of 10-30 m, could lead to increased thickness of sulphides.

The volcanogenic characteristics of the Gullwing Lake sulphide deposits are not clear but the area has several structural aspects which may effect exploration. The mafic metavolcanics here define the western nose of the gently-plunging Lateral-Tot Lakes anticline, and are characterized by a penetrative linear fabric. Potential sulphide bodies in this structural regime might occur as southwest-plunging rods, with an approximate 30° plunge and relatively small horizontal dimensions (compared to down-plunge length). Such sulphide bodies would be difficult to detect with widely spaced geophysical grids.

One final aspect of the previous base-metal exploration deserves mention. With the exception of two drill holes (in the Phelps Dodge prospect), no deep drilling (below 130 m) has tested sulphide zones in the map area. In zones where Cu-Zn-Ag-Au values are highest, such deeper drilling may prove beneficial. This may be especially suggested for the Phelps Dodge prospect where the best intersections (drill hole 70-3; see: Mehagan, R., property No. 13) are untested at greater depth.

GOLD

Previous exploration for gold deposits in southeast Echo Township appear to have reasonably defined the location of the major albite trondhjemite dike (and several smaller dikes) in which the gold is concentrated. Future exploration in this area should concentrate on outlining the location of abundant quartz-filled fractures, and determination of background gold content of the dikes. The latter point being significant in assessing the possibility of large tonnage, low grade, open pit mining. Additional exploration should be directed toward locating potentially similar dikes (or other fractured lithologies) which may exist parallel to the main dike.

MOLYBDENUM

Major molybdenum exploration programs to date in the map area have been concentrated on and close by the known deposits of Pidgeon Molybdenum Mines Limited. The model of intrusion and mineralization for the Lateral Lake stock put forward by Colvine and McCarter (1977) suggests that molybdenum will be present in significant quantities only at the eastern end of the stock. In this report, the author has proposed an alternative model, however, which includes the western end and north and south margins of the stock as potentially favourable ground.

The latter model is based on regional tectonic and intrusive relationships, but is somewhat incomplete due to a minimal amount of outcrop. Perhaps more significantly, the latter model has virtually no exploration data to draw on; there is no known ground geophysical or diamond drilling investigation of the western third of the stock. Future exploration for molybdenum mineralization associated with the Lateral Lake stock should concentrate on the area of known, major deposits (east end) and along the stock margin for the western third of the body. Initial exploration of the western portion should be close to the known occurrences near the south margin.

ZINC

Little is known as of this writing about the distribution or significance of pyrrhotite-sphalerite mineralization detected by diamond drilling along the contact of the "main dike" (gold-bearing) on the property of Goldlund Mines Limited. Further exploration (additional drilling) of this occurrence is probably warranted before a larger-scale search for potential similar deposits on adjoining ground is initiated.

DESCRIPTION OF PROPERTIES, MINERAL DEPOSITS, AND AREAS OF EXPLORATION

Information on older properties and mineral deposits within the Lateral Lake area is contained in reports by Hurst (1932), Webb (1948), Armstrong (1950), Harding (1950), and Chisholm (1951). Additional information on some of these deposits, and all information on more recent exploration, has been extracted from field notes taken during the present survey, from published reports by Satterly (1960), Vokes (1963), Johnston (1968, 1969, 1972), and Colvine and McCarter (1977), from the Assessment Files Research Office and Source Mineral Deposit Record (O.G.S., Toronto), from Resident Geologist's Files (O.G.S., Sioux

Lookout), from private files of exploration companies and prospectors, and from files at the library of Northern Miner Press Limited (Toronto). Only current and defunct properties for which geological or related information is available are discussed here and located on the map face (back pocket).

Properties are titled in this report according to ownership as of 31 September, 1979. Names in parentheses, following titles, refer to previous owners or names by which the property is otherwise known, e.g., Goldlund Mines Limited (Newlund Mine). Reference is also made in this report to some of those companies and individuals who did not hold ground in 1979, but who have done work on currently held properties and have made this information available through the sources listed above, and which is recorded in Table 7.

Mineral deposits located on ground open to staking as of 31 September, 1979, are titled as prospects or occurrences, depending on the amount of work carried out in exploration and development. A prospect is a deposit on which underground development or more than 500 m (1640 feet) of diamond drilling has been conducted, and an occurrence is a deposit on which less than 500 m of diamond drilling has been carried out, e.g., Phelps Dodge prospect, Woodney occurrence.

Areas of exploration are titled according to the last company or individual who performed work on ground open to staking. Dates in square brackets, following titles, indicate the date of last major work on parcels of land where no mineral deposits have been discovered as of 31 December, 1979, e.g., Morton, C.

[1969]. Numbers in parentheses following titles of properties, mineral deposits, and areas of exploration correspond to those on the map face (back pocket).

ALBERT'S OCCURRENCE (1)

In 1973, V. Alberts investigated sulphide mineralization in the southwestern portion of Webb Township, located approximately 1100 m south of Gullwing Lake and about 410 m east of the Webb-Drope Townships boundary. A single drill hole (32.5 m) was put down into "tan schists with some white quartzite and some sulphides" (drill log descriptions; AFRO, Toronto), several meters north of a number of shallow trenches.

Neither the drill hole collar or trenches were encountered in the field during the present survey, but minor pyrite mineralization was noted in a several meter thick unit of intermediate tuff located about 880 m west (on strike) of the drill hole-trenching location. A grab sample of this material, collected by the author, yielded 450 ppm Cu and 98 ppm Zn (assayed by Geoscience Laboratories, O.G.S., Toronto). As of 31 September, 1979, this ground was open to staking.

AVONDA, F.P. (2)

Acquired in 1972, this property consists of two patented claims, KRL 22836 and KRL 22837, located in Lot 1, Concession III, Echo Township. The property was formerly a portion of ground held and explored by Mosher Long Lac Gold Mines Limited and Lun-Echo Gold Mines Limited, who conducted geological mapping, a ground magnetometer survey, and an unknown amount of diamond drilling (on the old, larger claim group). Exposed bedrock is not known to occur on the Avonda property, and the reader is referred to descriptions of adjoining properties (4, 9, 11) for additional information.

CANADIAN NICKEL OCCURRENCES (3)

Following airborne geophysical surveys, Canadian Nickel Exploration Company Limited conducted diamond drilling tests of anomalous zones during 1970, 1971, and 1972, in fourteen separate locations scattered around Echo, Webb, Lomond, and McIlraith Townships (Figure 5). A total of 1621 m was drilled in 17 holes.

All but two or perhaps three of these drill holes were directed at conductive zones within mafic amphibolites of the northern metavolcanic unit and correlative rocks surrounding the Lateral Lake stock. Similarly, all but two holes encountered sulphide-rich horizons in which pyrrhotite was the predominant sulphide (drill log descriptions, AFRO, O.G.S., Toronto). It is here suggested that the company was selectively drilling conductors with a high magnetic correlation, especially since subsequent exploration (see: Rio Tinto Canadian Exploration, No.19, and Selco Mining Corporation Limited, No. 20) has disclosed numerous other drill targets within the same area of investigation.

CHOI, W.P.H. AND CHOI, E.K.S. (4)

Acquired in 1970, this property consists of three patented claims, numbered KRL 22839, KRL 22840, and KRL 23060, located in Lot 1, Concession III, Echo Township. The three claims were previously a portion of the ground held and explored by Mosher Long Lac Gold Mines Limited and Lun-Echo Gold Mines Limited, who conducted geological mapping, a ground geophysical survey, and an unknown amount of diamond drilling (on the old, larger claim group).

Bedrock in the Choi property, examined by the author during the present survey, consists of mafic metavolcanics, isolated occurrences of variolitic intermediate lava, and a narrow, sheared dike of material similar to the trondhjemite host rock for gold mineralization at Goldlund Mines Limited, some 4 km to the southwest. Chisholm's (1951) index map of the Echo-Pickeral Townships area indicates that such a dike passes into the Choi property from the adjoining Villbona prospect (to the west, now held by Goldlund Mines Limited, No. 9). Mr. W. Choi has indicated to the author that no work has been conducted, or is planned, for the three-claim property, pending developments on adjacent properties.

COATES OCCURRENCE (5)

Molybdenite mineralization occurring at the margin of the Lateral Lake stock was first discovered by C.D. Coates at this location around 1906, and has been mentioned in several regional economic compilations in addition to local-scale mapping surveys (Walker, 1911; Parsons, 1917; Eardley-Wilmont, 1925; Harding, 1950). The deposit, located about 800 m southeast of the eastern portion of Gullwing Lake, consists of clustered and scattered molybdenite rosettes occurring with pyrite and muscovite within a quartz-feldspar pegmatite dike. The host dike is one to two meters wide, traceable for 14-15 m, and cuts foliated mafic amphibolites at a very shallow angle to their fabric. Other, similar but smaller, pegmatite dikes and veinlets also occur in the main exposure, but are more sharply cross-cutting the country rocks and carry little mineralization. The most abundant molybdenite is found in three shallow pits cut in the pegmatite along the crest of the small outcrop ridge.

Other molybdenite occurrences are found near the main Coates deposit. One, located about 790 m due west, consists only of rare, isolated rosettes occurring in a muscovite-biotite-quartz-feldspar pegmatite; the pegmatite, in turn, is traceable for about 400 m to the north where it is at least 20 m wide, very coarse-grained, and carries no molybdenite.

The second occurrence, located about 550 m northeast of the Coates deposit, consists of simple pegmatite and aplite dikes cutting both foliated quartz monzonite (Lateral Lake stock) and layered amphibolite at roughly right angles to the stock/country rock contact. Shallow trenching on the south side of the outcrop discloses scattered clusters and isolated rosettes of molybdenite within the pegmatite and aplite. This latter occurrence is significant in that the host pegmatite and aplite is clearly late intrusive material, oriented in the same direction as the numerous dikes exposed in country rock amphibolites to the southwest, and was emplaced after formation of foliation in both the Lateral Lake stock and country rocks. Collectively, the molybdenite deposits around and including the main Coates occurrence, suggest an environment similar to that found at the Pidgeon Molybdenum Mines Limited property at the east end of the Lateral Lake stock. No detailed exploration, or diamond drilling, is known to have tested this ground. As of 31 September, 1979, all ground covering the margin of the stock within one mile of the Coates occurrence was open to staking.

EAST LUN GOLD MINES LIMITED (6)

The property adjoins that of Goldlund Mines Limited to the north, in central Echo Township, and consists of nine patented claims numbered KRL 23248 through KRL 23256. An additional claim group of at least 13 claims, located north of the current property, was held and explored by East Lun Gold Mines Limited around 1950, but has since been allowed to lapse; some of this latter area is now included in the Echo Township Wilderness Area and is withdrawn from staking.

Exploration on the current property consists of a ground magnetometer survey conducted in 1946, and two diamond drill holes totalling 221 m. The magnetometer survey outlined two strong linear magnetic highs trending E-NE through the claim group. Dillman (1946) related the southern linear to an inferred dike, while the northern linear was related to either multiple dikes or to the metavolcanic-metasedimentary contact. No outcrops occur on the East Lun property and Dillman (1946) further stated his interpretations as "conjectural". Armstrong (1950, pp.35-36) summarized the diamond drilling as follows:

"Both holes indicated considerable depth of overburden, and the second intersected four porphyry dikes. Mineralization is sparse in both holes".

Exploration of the northern claim group (now lapsed) consisted of a ground magnetometer survey of 13 claims, and five diamond drill holes, totalling 236 m. The magnetometer survey outlined lensoid (discontinuous) magnetic highs which were interpreted as indications of formational boundaries and local faults (Salt and Keevil, 1950). Subsequent diamond drilling failed to reach bedrock.

GLEN ECHO MINES LIMITED [1951] (7)

During the winter of 1951, Glen Echo Mines Limited conducted diamond drilling in the Crossecho Lake area, on ground in part currently held by Thompson (property 23), and in part now open to staking. The Glen Echo claim group was apparently formed from properties held in 1950 by D. MacIntosh and R. McCombe (see: Hurst, 1951). A total of fourteen holes were drilled for Glen Echo by Mining Corporation of Canada Limited, but the total length is not known as drill logs for only the first three holes (785 m) are available in records; a December 1950 Northern Miner article indicates a drilling contract for about 1980 m. This diamond drilling appears to have been cross-sectional reconnaissance, and the lithologies encountered are coded on the geological map (back pocket). No economic mineralization or gold assays are reported.

GODDAN, O.N., KENDALL, A.M., AND YOUNG, J.W. (8)

This jointly held property consists of a single patented claim, number K.2563, located on the south shore of Vermilion Lake, easternmost Lomond Township. Two, sequentially numbered, patented claims adjoining the current property to the north and west have recently reverted to the crown. Bedrock within the single claim is a complex juxtaposition of felsic metavolcanics (massive felsite and fragmental units), intermediate metavolcanics, quartz-feldspar porphyry, and arenites of the Ament Bay Formation.

While there is no record of exploration on the property about 120 m west of the claim, an old trench in similarly complex lithologies exposes quartz-carbonate-pyrite veining sub-parallel to the foliation. Two selected grab samples of rubble from the trench assayed.

GOLDLUND MINES LIMITED (9, 9a, 9b)

The property of Goldlund Mines Limited is located in Lots 2 through 7, Concessions I, II, and III, southern Echo Township, consisting of fourty-five patented claims and twenty-three unpatented claims. The patented ground represents the original ground held by predecessors of the company, and covers the initial Echo Township gold discoveries as well as the most extensive underground development and surface exploration (Newlund Mine). Seven unpatented claims, adjoining the patented ground to the northeast, were staked in the mid-1970s and cover the majority of ground explored by Villbona Gold Mines Limited in the early 1950s (9b, Villbona Prospect). Sixteen other unpatented claims, adjoining the patented ground to the southeast, were also staked in the mid-1970s and cover much of the ground which received exploration programs conducted by North Denison Mines Limited (1950) and Selco Mining Corporation Limited (1976-77) (9a, North Denison Prospect).

In the following description, extensive use was made of unpublished data from the files of Goldlund Mines Limited.

NEWLUND MINE (9)

HISTORY AND EXPLORATION

This portion of the Goldlund Mines Limited property consists of forty-five patented claims, including KRL 18719 through KRL 18727, KRL 18767 through KRL 18775, KRL 18808 through KRL 18816, KRL 18830 through KRL 18838, and KRL 18900 through 18908. Gold mineralization was discovered in this ground by A. Ward and R. Lundmark (two prospectors associated with the Mosher group) in the northern portion of Lot 6, Concession I of Echo Township during the summer of 1941. With initial financing provided by Mosher Long Lac Mines Limited, Lunward Gold Mines Limited was formed to explore the deposit(s), and during 1941-42, the no. 1 and no. 2 zones were extensively trenched and tested to shallow depths with 32 diamond drill holes totalling 8314'. Virtually all activity was suspended during 1943-44 because of World War II.

Operations resumed late in 1945 with the discovery of zone no. 3, which was immediately tested with shallow diamond drilling. Deeper drilling of the no. 2 zone, along with shallow, fill-in drilling, proceeded during 1946, but late in that year, work was again directed toward the no. 1 zone to better define its dimensions. Diamond drilling continued throughout 1947 in zones 1, 2, and 3. Little work was done in 1948, pending additional funding, but late in 1949, Prospectors Airways Limited made an agreement with the operators and Newlund Mines Limited was incorporated to take over the Lunward holdings.

An exploration shaft was begun in October 1949, sunk to 226 feet by year-end, and the 200 foot level crosscut started out early in 1950. Drifting and crosscutting proceeded rapidly through the first half of 1950, and early in the fall, shaft deepening was begun, coinciding with the start of shaft-sinking on the adjoining Windward prospect (both funded at the time from the same source). By the end of 1950, the Newlund shaft was down to 442 feet, with a second level started at 350 feet. The Windward shaft reached its final depth of 226 feet by spring of 1951, while the Newlund shaft was again deepened (to 525 feet) and a level begun at 500 feet. All during this shaft-sinking, drifting and cross-cutting was proceding in the upper levels of the Newlund workings, along with similar work on the one level of the Windward; by May 1951, connection had been made between the 200 feet level of Newlund and the main east drift of the Windward.

All three levels (200, 350, 500 feet) of the Newlund were explored with drifts, crosscuts, and diamond drilling during the rest of 1951, and in February 1952, the shaft was again deepened, reaching its present depth of 835 feet in about June of that year. This was followed by exploration of the fifth level (800 feet) and minor additional work in the upper levels until the fall of 1952. Exploration on all of the three lower levels was apparently not as encouraging as the earlier work on the 200 foot level, and following recommendations of Prospectors Airways Limited, all operations at the Newlund property were suspended in November of 1952. The underground workings were kept dry for a short time, but ultimately finances dictated abandonment of even care and maintenance; the property remained idle between 1952 and 1973.

As of suspension in 1952, total exploration of gold mineralization on the property amounted to:

surface drilling

(1941-42)	8,314' in 32 holes
zone no.1 (1945-47)	15,955' in 38 "
" no.2 "	9,169' in 27 "
" no.3 "	20,595' in 86 "
	54,033' in 183 holes

surface trenching ca. 9,000'

underground, from shaft (835')

200' level	5957'	drifts +	crosscuts,	10,137'	ddh
350' "	3042'	"	" ,	2,298'	"
500' "	3512'	"	" ,	4,195'	"
650'	(station only)				
800' "	2516'	"	" ,	3,789'	"
totals	15,027'	"	"	20,419'	"

Although all of this underground development was clearly exploratory in nature, government statistics for 1948 list production from "Lunward" (Gold Mines Limited) at 0.920 ounces for a value of $32.00 (Arnold, 1948).

A feasibility study was commissioned by Newlund Mines Limited in 1971, in response to increases in the price of gold, but no significant work was accomplished until March 1973 when Rayrock Mines Limited and Newlund Mines Limited made an agreement for a new investigation of the property. By July 1973, Goldlund Mines

Limited had replaced Newlund, and dewatering of the shaft was in progress. Rayrock's financing of the venture initially provided for purchase and installation of a new headframe and hoist, construction of an on-site assay office, dewatering to the second level, bulk sampling, and diamond drill hole sampling. A total of about 2,000 samples were obtained by Rayrock from the following sources in the no. 1 zone only:

a) 3871 tons of muck obtained by taking down backs in selected crosscuts and drifts, and from several short test raises;

b) 288 tons of muck obtained from new advances in two crosscuts;

c) 1,880 linear feet of chip sampling; and

d) 4932 feet of drill core from 41 horizontal holes (Botsford, 1974).

Rayrock's assessment of the property, announced early in 1974 (Botsford, 1974), was stated as uneconomic at then current gold prices (about CAN $140 per ounce). Rayrock declined further work and their agreement with Goldlund expired late in 1975.

Goldlund Mines Limited continued exploration of various portions of the property in 1976 and 1977, including ground magnetic and electromagnetic surveys, and 15 diamond drill holes. The diamond drilling verified the presence of the "main dike" 6500 feet (1980 m) east of the shaft, and intersected both gold and pyrrhotite-sphalerite mineralized sections about 1260 m east of the shaft (Broadhurst, 1978).

Late in 1978, Goldlund dewatered the underground workings to the first level and conducted test stoping of 3,000 tons of material from known, higher grade shoots to check grade based on a new theory of vein distribution. Favourable results from this test stoping, combined with fast rising gold prices, led the company to initiate a major diamond drilling program (from surface and underground) which got underway by mid-1979. This program called for re-drilling of the entire extent of the nos. 1, 2, and 3 zones to a depth of 350 to 500 feet, using precision surveyed holes to accurately define the distribution of quartz-vein clusters which represent higher-grade shoots. In addition, such drilling provided a more accurate sample of lower-grade material between the shoots, to enable a reliable calculation of bulk, low-grade and low-volume, high-grade mining options.

GOLDLUND

In April of 1981, after Hollinger Argus cancelled the option agreement of December 1980 (Northern Miner 80.12.25; 81.4.30), Goldlund began preparations to carry out the development of the property single-handedly. By April 1982, a 200 ton per day mill had been erected and open pit and underground reserves were estimated at 50,000 tons at .26 oz. per ton (Northern Miner 82.4.17). By July of 1982 (Northern Miner 82.7.29) 150 to 250 tons per day were being processed with an average head grade of .28 to .37 oz. per ton. Recovery was 96%. Concentrate which ranges from 2.4 to 4.0 oz. per ton is shipped to Timmins for refining. The cost of producing an ounce of gold as of July 1982, was $250 (Northern Miner 82.7.15).

The reserve estimates in early 1983 were 900,000 tons calculated on the cut off grade of .14 oz. per/ton. The ore proved to be more difficult to mill, hence recovery dropped to 86% and costs rose to $300 per/ton. As of April 1983, 25,200 tons of ore at .17 oz. per ton, from underground sources and .20 oz. per/ton from the pit had been processed.

In October of 1983 Campbell Resources negotiated a takeover of Goldlund Mines and released reserve estimates of 600,000 tons to the 800 foot level at .20 oz. per ton. Campbell plans to boost production to 350 tons per day and accept up to 100 tons per day custom milling (Northern Miner 83.01.12).

GEOLOGY

General geology of rock units in southeast Echo Township was described in previous sections and will not be repeated here. The following account presents details of geologic features particularly related to gold mineralization, based on the author's observations in the area and on earlier, published and unpublished descriptions with updating in 1984 by John Easton geological assistant O.G.S. Toronto. Particular reference will be made to Figure 6 which represents the only published compilation of surface geology and exploration (surface and underground) of the Goldlund deposits.

Extrusive lithologies occurring on the Newlund Mine portion of Goldlund Mines limited property include mafic and intermediate flows and pyroclastic rocks. Mafic metavolcanics include massive, aphyric to porphyritic lavas, pillow lavas, and amygdaloidal units which appear to grade from pillowed lavas into coarse fragmental units. Intermediate metavolcanics include isolated occurrences of andesitic fragmental units and two major variolitic lava horizons. These extrusive rocks form the exposed portion of a steeply south-dipping, homoclinal, south-facing succession estimated to be 2400 to 2700 m in thickness.

A variety of intrusive rocks cut the volcanic succession in and around the Newlund Mine and include:

(youngest) quartz-feldspar porphyry;
quartz porphyry/late albite trondhjemite;
feldspar porphyry;
early albite trondhjemite;
(oldest) diorite (after: Frohberg, 1952, p.1)

The majority of gold mineralization in the Goldlund property (and adjoining properties) is contained within early albite trondhjemite dikes and sill-like bodies which invade, but are locally concordant with, the metavolcanic succession. As discussed earlier, virtually all previous workers in the area referred to the albite trondhjemite masses as granodiorite. While these rocks may have originally been granodiorite, their mineralogy now clearly reflects pervasive albitization along with local silicification and/or carbonate alteration, and are classified accordingly.

Frohberg (1952) states, that a hornblende-rich dioritic intrusive is found in several portions of the underground working, pinching in and out of the no.1 zone footwall contact of the albite trondhjemite. Frohberg (1952) further states that similar mafic intrusive rocks occur in outcrop north and south of the no. 1 zone. However, diorite was not observed in the Newlund Mine area during the present survey.

Early albite trondhjemite forms the host for gold mineralization throughout the no. 1 zone, as well as in the no. 2, 3, and 5 zones. The no. 1 zone essentially coincides with the largest albite trondhjemite body in the map area and has been previously termed the "main dike", the "Newlund (or Goldlund) granodiorite", and the "Goldlund sill". Although most recently termed a sill (Kuryliw, 1979), Frohberg (1952, p.3) states:

"The principal granodiorite intrusion which forms the hostrock of the Newlund No. 1 Ore Zone, has been referred to ... . as a sill. Strictly speaking, it is more correct to call it a dike as in many sections it is not conformable to the volcanic series but cuts across the latter at acute angles".

Additional definitive evidence for this body being a dike can be seen in Figure 6, where the eastern exposed portion cuts mafic metavolcanics at approximately right angles to their strike.

The no. 1 zone albite trondhjemite has been traced for about 2500 m (8200 feet) along strike in the Newlund mine portion of Goldlund Mines Limited property, through underground workings, outcrop, and drill holes west of the Goldlund property, other underground workings and drill holes extend the known length of the main dike an additional 700 m (2300 feet). The width varies from about 9 m to at least 90 m. Albite trondhjemite dikes which host the number 2 and 3 zones appear to be portions of a second dike, that are traceable (in drill holes plus outcrop) for a total of about 2,000 m, average about 15 m in thickness, and reach a maximum width of about 55 m at the eastern end of the no. 2 zone. Similar dike rock in the no. 5 zone is traceable for about 120 m along strike and varies from about 15 to 23 m in width.

The no. 1 zone albite trondhjemite is a fine-grained, locally foliated, light grey to medium dark grey rock which weathers to various shades of light brown, greyish orange pink, or brownish to greenish grey. Considerable variation in texture, colour, and mineralogy are related to both intensity of mineralization and alteration, and the apparent composite nature of the dike. Kuryliw (1979) has stated that the body consists of multiple intrusions, with the mineralized, hanging wall body exhibiting chilled border zones on both sides varying between 1.2 and 3.0 m in thickness. Frohberg (1952, p.4) states:

"Underground the granodiorite main dike has been found to vary considerably both as regards texture and composition. The footwall portion commonly consists of a rather fine-grained, dark type relatively high in ferro-magnesian minerals such as biotite, hornblende and chlorite, whereas a lighter coloured variety with medium to coarse textures prevails in the centre and near the hanging wall. Owing to a parallel orientation of the ferro-magnesian constituents, the granodiorite generally has a more or less pronounced gneissic texture. Some coarse phases have the appearance of augen-gneiss with conspicuous cataclastic features.

The relationship between the coarse, lighter-coloured granodiorite and the fine-grained, biotite-rich variety is not entirely clear. In places one type appears to grade into the other. In some instances, however, dikes of dark, massive granodiorite have been found cutting the coarse, geissic variety, thus suggesting that the granodiorite intrusive was emplaced by more than one magmatic event.

Additional variations in the albite trondhjemite dikes are apparently the result of wallrock-dike interactions, especially noticeable in the no. 3 zone trenches; trondhjemite observed there by the author is very fine-grained, dark grey, pyrite impregnated, and distinguished with difficulty from the enclosing volcanics. Following detailed underground mapping in the no. 1 zone, Frohberg (1952, p.5) stated:

"Underground, some portions of the granodiorite dike have been found to have poorly defined boundaries and tend to give the impression that the granodiorite is grading into the adjacent wallrock. This local lack of sharp contacts is due partly to a hybridization of the older rocks by the granodiorite, and partly to a contamination of the latter with wallrock matter."

A variety of porphyritic intrusive rocks, mainly dikes, occur in southeast Echo Township, and are particularly abundant in the Newlund mine area. The most detailed descriptions of these various dikes is provided by Frohberg (1952, p.8) who states:

"The oldest group forms irregular dikes rarely exceeding 3 feet in width. If perfectly fresh, the rock consists of a dark-grey groundmass with plagioclase phenocrysts up to one half inch in length. In many places, the feldspar crystals have been completely replaced by secondary products such as carbonate or sericite, and the groundmass has been bleached to a light-grey colour.

Dikes of pale-yellow to light olive-green quartz porphyry are distinctly later than the early feldspar porphyry but locally tend to follow the course of the latter. Some dikes are quite narrow, others attain widths up to 60 feet and are known to continue for more than one half mile. Some of the dikes observed underground cut the granodiorite at an acute angle and are of interest as they appear to have a structural influence upon the development of the vein patterns."

A larger quartz porphyry body referred to here as the Franciscan Lake stock is located about 1220 m east of the Goldlund shaft. No definitive relationship can be made between this body and the dikes found in the mine area, although their general similarity of appearance suggests a single intrusive event.

Another porphyry lithology was described by Frohberg (1952, pp.9-10) as follows:

"Grey quartz-feldspar porphyry with phenocrysts up to one half inch in length forms somewhat irregular dikes up to 30 feet wide. It is generally quite fresh and locally has been referred to as 'tombstone' porphyry because of its striking appearance. It cuts all other porphyry dikes and may be related to a small stock of late granodiorite located some eight hundred feet northwest of the Newlund plant. The west portion and minor off-shoots of this intrusion are grading into a porphyritic phase resembling the quartz-feldspar porphyry dikes."

According to all available accounts, one of the more problematical aspects of the Goldlund deposits is the distribution of quartz veins with which gold values are associated. Tensional veins of quartz (with carbonate and pyrite) were observed by the author in the no. 3 zone on surface, and in the no. 1 zone (surface, 1st level east and west, 2nd level west). The veins are generally quite straight, strike consistently N-S to N20E, dip 40° to 60° to the west, and usually have an associated band of bleached rock in the immediately adjacent trondhjemite. Frohberg's (1952) descriptions of this veining are the most detailed available consistent with the author's observations. Frohberg states (p.14):

"Individual veins vary in width from fractions of an inch to about one foot. They have the appearance of fracture fillings and are commonly accompanied by more or less pronounced zones of altered wallrock. Their length rarely exceeds forty feet; many die out at shorter distances without any trace of shearing or fracturing continuing beyond the end of the quartz. Owing to the lack of exploration work between levels, very little is known about the continuity of the fractures in a vertical direction.

A characteristic feature of the transverse veins is their arrangement in short clusters or in patterns continuing for hundreds of feet. The spacing of the stringers in such systems varies from a few inches to more than ten feet. While their attitude is roughly parallel, the great majority of the fractures are not uniform in length and in places have a tendency to overlap one another. Locally, single veins are observed 'sticking out' far beyond the general outline of a vein zone.

In sections of high quartz frequency, irregular diagonal branches are often forming minor networks between the transverse stringers. Stockwork-like patterns have been encountered where transverse and longitudinal veins are equally well-developed, as for instance on the first level east between survey stations 1-18E and 1-21E."

He continues (p.15):

"In a horizontal plane, the fractured or shattered areas within the main granodiorite are roughly elliptical or cigar-shaped in outline. Some patterns extend only a few score feet. Others, like the West Ore Zone on the first level, are continuous for as much as 1,000 feet. Most vein zones have a rather highly fractured core and grade toward both ends into paterns of decreasing quartz frequency."

He further continues (p.16):

"There is sufficient evidence to suggest that the tensional fracture patterns of the No. 1 Vein Zone, developed in those sections of the main granodiorite dike which transect the older formations at acute angle, while conformable sections remained essentially unaffected."

And (p.16-17):

"Observations underground suggest that the following features have locally influenced the development of the vein patterns:

a) Variations in the thickness of the basic diorite dike following the footwall contact of the granodiorite.
b) Changes in the local thickness of the granodiorite.

c) Minor bulges in the granodiorite footwall contact.

d) Pre-ore faults and slips.

e) Pre-ore dikes cutting the granodiorite at acute angle."

ALTERATION AND MINERALIZATION

As mentioned above, veins in the no. 1 zone are generally marked by the occurrence of bleached wallrock trondhjemite. Frohberg (1952, p.22) states:

"Under the microscope, the altered wallrock is seen to consist of newly introduced albite, carbonate, magnetite, ilmenite, and varying amounts of finely crystallized pyrite. It is noteworthy, however, that the alteration bands are practically free of sericite. Albite and ankeritic carbonate were formed largely at the expense of the original orthoclase and ferro-magnesian minerals. Very likely the latter also supplied much of the iron contained in the newly formed pyrite. The final alteration product consists of more than 50% albite, with carbonate, quartz, magnetite, ilmenite and pyrite making up the balance."

He continues (p.23):

"As a rule, the degree of wallrock alteration is no safe criterion in judging the gold content of a vein. . . Many vein sections with intensely altered granodiorite have been found to be quite poor while elsewhere quartz stringers with little or no wallrock alteration carried considerable visible gold."

Major constituents of the veins proper are quartz, ankeritic carbonate, and pyrite. Minerals occurring in minor to trace amounts include actinolite, biotite, tourmaline, and scheelite, with metallic constituents including sphalerite, chalcopyrite, galena, pyrrhotite, altaite (PbTe), petzite ($(Ag, Au)_2Te$), ilmenite, and native gold (Frohberg, 1952). Pyrite occurs both as coarse, cubic crystals up to 2-3 cm, and as disseminated grains and aggregates in both the veins and altered wall rock. Minor fractures cutting the coarse pyrite cubes are filled with carbonate and massive pyrite, suggesting at least two generations of pyrite deposition (Frohberg, 1952). Both gold and tellurides were apparently deposited late in the sequence, and are commonly found together (Frohberg, 1952). However, higher than average gold values are also found in association with the coarse pyrite cubes, and with galena and sphalerite. Virtually all investigations of the Newlund mine deposits suggest that the only definitive indicator of higher grade gold values is the existence of late fracturing of the early vein materials.

The Goldlund Mines deposit is described by Fyfe and Kerrich (Northern Miner 80.3.6) as a seafloor hydrothermal system. The driving force for their convective system is considered to be an igneous intrusion at depth. Cooling fractures in the offshoots, i.e. the Goldlund trondhjemite dikes, created a highly permeable aquifer for rising heated brime. The oxygen isotope fractionation data of Fyfe & Kerrich show gold deposition from water at 350°C and oxygen isotope compositions indicating derivation from rocks at a high temperature. The volume of leached source rock, assuming 50% of the 2 ppb total gold in mafic volcanics (OGS MP 97, pg. 165) is 143 km^3 and a carrier fluid volume of 15 km^3. This results in a water-rock ratio of

10:1, however a major caution is that the Fyfe and Kerrich model does not state that all of the 4 x 10^8 grams of gold leached is found on the Goldlund property or in economic grades.

TONNAGE AND GRADE

NORTH DENISON PROSPECT (9a)

This portion of the Goldlund Mines Limited property consists of sixteen mining claims located in Lots 2 through 5, Concessions I and II of Echo Township, adjoining the Newlund mine ground to the southeast. Claim numbers included in this block are Pa.358040 through Pa.358048, Pa.358050 through Pa.358054, Pa.358056, and Pa.358057.

The claim block covers much of the Franciscan Lake quartz porphyry stock, as well as the major contacts between the stock and enclosing metavolcanics, between mafic and felsic metavolcanic units, and between felsic metavolcanics and metasediments of the Minnitaki Group. A major unit of quartz-magnetite-sulphide ironstone occurs in the uppermost portion of the felsic metavolcanics (or as a transitional unit between the felsic metavolcanics and metasediments) and has been the subject of exploration by North Denison Mines Limited, Goldlund Mines Limited, and Selco Mining Corporation Limited.

In June-July of 1950, North Denison Mines Limited drilled four cross-sectional holes in the Franciscan Lake-Franciscan Creek area for a total of 1097 m. Lithologies encountered in this drilling included felsic metavolcanics, sulphidic ironstone, wacke and slate metasediments, and several small intrusive bodies, probably dikes. The drilling was apparently stimulated by gold exploration on the adjoining Newlund ground; only gold assays were run on selected core, returning nil to trace amounts of gold.

In 1973, Goldlund Mines Limited drilled three shallow holes (totalling 110 m) about 100 m west of North Denisons' holes 1 and 2. One hole encountered minor pyrite in quartz-carbonate stringers. In 1976, Goldlund Mines Limited drilled two holes for a total of about 173 m to test a weak electromagnetic conductor about midway between Franciscan and Not Much Lake. Felsic metavolcanics, minor quartz porphyry, and quartz veining was recorded in these two holes, along with local disseminated pyrite; a one-foot section of drill hole 76-11 disclosed sheared quartz porphyry with an estimated 30% sulphide content (mostly pyrrhotite with minor pyrite and sphalerite).

During 1976, Selco Mining Corporation conducted ground magnetic and electromagnetic surveys over a 37-claim block of ground extending from northeast of Franciscan Lake to Lot 7, Concession VI of McAree Township, including all of the North Denison prospect claim block currently held by Goldlund Mines Limited, five patented claims held by Goldlund Mines Limited, and portions of the claim groups now held by Kuryliw and Broadhurst (property No. 10) and Wilkinson (property no. 24). This work was conducted as part of an option agreement between Selco Mining Corporation Limited and Goldlund Mines Limited, and the two holes drilled by the latter between Franciscan and Not Much Lake in 1976, as discussed above, were directed at a conductor that had not been recommended for drilling in a report for Selco (Reed, 1976). Selco Mining Corporation drilled a single hole of 125 m, collared about 760 m west of Not Much Lake, to test the conductor considered to be the most favourable located by these surveys (Reed, 1976). Felsic and intermediate metavolcanics were cut throughout the length of the hole, with several, thin, sulphide-bearing zones; the most prominent sulphide-bearing zone (1.4 m) was estimated to contain 10-15% sulphides, being mainly pyrrhotite with minor pyrite and trace sphalerite. Early in 1977, Selco Mining Corporation Limited conducted additional magnetometer and electromagnetic surveys over a single claim (Pa.358053), south of Franciscan Lake, without locating favourable conductive zones.

VILLBONA PROSPECT (9b)

This portion of Goldlund Mines Limited property consists of seven mining claims in Lots 2 and 3, Concessions II and III, Echo Township, and adjoins the patented ground of Goldlund's to the northeast. Claim numbers in this block include Pa.376473 through Pa.376478, and Pa.436909.

Very little bedrock information is available for this claim block, due to extensive sand and gravel overburden and sketchy records of exploration. The ground was first staked by Villbona Gold Mines Limited in the early 1950s. The limited information suggests that the bedrock consists mainly of mafic metavolcanics with minor units of intermediate variolitic lavas. Chisholm (1951) reports that a "granodiorite dike" traced in 20 drill holes for a strike length of 610 m across the central portion of the claim group. This dike is reported to average about 30 m in thickness, striking northeast and dipping steeply south, and exhibiting several features typical of the Goldlund no. 1 zone trondhjemite, including transverse quartz-filled tension fractures, albitization, and coarse pyrite cubes (Chisholm, 1951). Ferguson et al. (1971) report "low concentrations" for gold obtained in about 5700 m of diamond drilling conducted by Villbona Gold Mines Limited during 1950 and 1951.

The original Villbona Gold Mines Limited claims were allowed to lapse and there is no record of further work until 1972, when ground magnetometer and geologic mapping surveys were conducted (Kuryliw, 1972). In addition to mafic metavolcanics, granodioritic and quartz porphyry dikes were noted in isolated exposures (Kuryliw, 1972). Four linear magnetic lows were tentatively related to similar dike rocks in covered areas.

The ground again became available, and the current claims were staked over the period 1977-1979. Late in 1977, Goldlund Mines Limited conducted a ground magnetic survey over six of the current claims. This latter survey also reports locating granodioritic and quartz porphyry dikes trending northeast across the claim block, and a NNW-trending fault (or bedrock valley), beneath overburden (Kuryliw, 1977).

KURYLIW, C.J. AND BROADHURST, P.S. (10)

During 1979, C.J. Kuryliw and P.A. Broadhurst staked a total of 16 claims in two groups in the Crossecho Lake and Not Much Lake areas of southern Echo Township (Concession I, Lots 4 through 7 and 9 through 11). The east group (Not Much Lake) contains seven claims, including Pa.436893 through Pa.436897, Pa.436901, and Pa.437013, and is underlain almost entirely by felsic metavolcanics of the Franciscan Lake unit. Selco Mining Corporation of Canada Limited conducted ground geophysical surveys over most of the east group in 1976, and drilled a single hole of 125 m which intersected a narrow pyrrhotite-pyrite conductive zone.

The west group (Crossecho Lake) contains nine claims, Pa.436907, Pa.436910, Pa.436911, and Pa.437007 through 437012. Bedrock exposed in the west group consists of mafic and intermediate metavolcanics, and isolated occurrences of feldspar and quartz-feldspar porphyry dikes. A possibly major fault trends north-south through the western portion of the claim group. There is no recorded exploration on the property.

LEWIS, M.I. (11)

The Lewis property consists of three patented claims, KRL 22832, KRL 22833 and KRL 22835, which are located in Lots 1 and 2, Concession II of Echo Township, just north of Franciscan Lake. The only exposures known in this claim group occur in the westernmost claim and consist of mafic metavolcanics with several thin porphyry dikes.

These claims form a portion of the ground previously held and explored by Mosher Long Lac Gold Mines Limited and Lun-Echo Gold Mines Limited. Mosher Long Lac conducted ground magnetometer and geological mapping surveys (McGregor, 1947; Brant, 1947). Chisholm (1951) reports that the "granodiorite" dike detected on the adjoining Villbona prospect (now held by Goldlund Mines Limited, no. 9b) was traced by nine drill holes in the Lun-Echo ground for a strike length of 427 m. A Northern Miner article of 5 April 1951 states that 13 diamond drill holes were completed for a total of 2540 m. On the basis of Chisholm's (1951) map, the diamond drilling appears to have been conducted on claims north of the Lewis property (see: properties 2 and 4).

MCGREGOR, J.G. (1954) (12)

Records on file at the Assessment Files Research Office (O.G.S., Toronto) indicate that J.G. McGregor drilled several holes in the western Vermilion Lake area, probably during 1954. Drill logs are available for only one hole (152 m), which cut carbonatized mafic metavolcanics with short intersections containing pyrite and minor arsenopyrite. No additional work is recorded in this area and as of 31 September, 1979, the ground was open to staking.

MEHAGAN, R. [estate] (13)

In May, 1979, R. Mehagan staked four claims (Pa.518310 through Pa.518313) in east-central McIlraith Township. These claims cover the area of greatest known copper mineralization detected by the 1968 diamond drilling program of Phelps Dodge Corporation of Canada Limited (see also: Phelps Dodge Prospect, No. 16). Mr. Mehagan passed away in August, 1979, and the claims were held in his estate as of 31 September, 1979.

Bedrock exposures are present only in the northern portion of this property, along a ridge and a power line which follows the ridge crest. All rock there consists of mafic amphibolite, representing both massive and pillowed mafic lavas. Minor sulphide mineralization was noted in these rocks during the present survey and grab samples taken by the field party yielded 117 ppm Cu, 340 ppm Ni, and 240 ppm Zn (assays by Mineral Resources Laboratory, O.G.S., Toronto).

Previous exploration on the Mehagan property included a total of about 729 m of diamond drilling in five holes (Fig. 7) all by Phelps Dodge Corporation of Canada Limited. Four diamond drill holes intersected significant pyrrhotite-chalcopyrite mineralization in the form of 1-10 cm thick massive sulphide bands associated with quartz-carbonate bands and stringers within silicified and carbonatized mafic lavas (drill log descriptions; AFRO, O.G.S., Toronto). Sulphide concentrations were noted as occurring as interpillow material in several of the drill holes. The best intersection obtained by Phelps Dodge (d.h. #3, 127 to 177 feet) gave an average of 0.39% copper over 50 feet of core. No drilling has been conducted either along strike from this intersection or at greater depth.

MORTON, C. [1969] (14)

In 1968, C. Morton contracted for airborne radiometric surveys to be flown over several claim blocks in northwestern Ontario. This exploration was apparently initiated in response to work then in progress on uranium occurrences near Bluett Lake (Sweany, D., property no. 21). One claim group investigated (now lapsed) is located north of the northeast end of Gullwing Lake, and was surveyed with an airplane-mounted, continuous-recording, gamma-ray spectrometer adjusted to record uranium and thorium only (Oja, 1969).

Little bedrock is exposed in the area surveyed for C. Morton, but the claim group covered the inferred contacts between the Lateral Lake stock, mafic metavolcanics, and intermediate metavolcanics. Background readings in the Sioux Lookout-Dryden area were established at 3 to 5 counts per second and several points within the northeast Gullwing Lake block exceeded 6 counts per second, about two times background levels (Oja, 1969). The most obvious cluster of these "high" values (6-7 counts per second) coincide with a steep slope on the margin of gravel and boulder moraine material located between Bluett Creek and a small, unnamed kettle lake to the east, just south of the Gullwing Lake Road. Although recommendations were made for ground checks of these anomalies, there is no record of follow-up work.

PENARROYA CANADA LIMITED [1965] (15)

In 1965, a combined airborne electromagnetic and magnetic survey was conducted over the south-central portion of Webb Township (Beartrack Creek area) for B. Breakey of Penarroya Canada Limited. Most of the survey covered portions of Laval Township, south of the present map area, but about 55 of the total 308 line miles were located in Webb Township.

Within the surveyed area of Webb Township, only a single area was recommended for follow-up work, this being the northern end ofa long, multiple, discontinuously conductive zone which had a coincident, 80 gamma magnetic anomaly (Stemp, 1965). This anomalous zone is located 1070 to 1370 m southwest of Philcott Lake, in an area of extensive sand cover, but nearly coinciding with an inferred metasedimentary-mafic metavolcanic contact.

Claims, that have now lapsed, were staked over this zone, but there is no record of follow-up work.

PHELPS DODGE PROSPECT (16)

In 1968, Phelps Dodge Corporation of Canada Limited optioned a block of twenty-two claims in east-central McIlraith Township from E. Ranta. A ground magnetometer survey was conducted over the whole claim block and was followed by ten diamond drill holes totalling 980 m (Figure 8).

Pyrrhotite-chalcopyrite mineralization (with erratic nickel and trace gold values) was intersected in four of the drill holes while the remainder cut pyrrhotite-pyrite disseminations with trace chalcopyrite. The most significant mineralization (drill hole no. 3) is not reported to have been tested either at depth or along strike to the east or west. A group of four claims covering drill holes 1, 2, 3, and 8 was held in good standing by the estate of R. Mehegan as of 31 September, 1979, but the adjoining ground was open to staking.

PIDGEON MOLYBDENUM MINES LIMITED (17)

The property described here consists of three patented and eighteen leased claims located in Lots 6 through 9, Concession V of Echo Township. The claim group covers the extreme eastern end of the Lateral Lake stock plus the surrounding amphibolite country rock. A test adit, nearly 6,000 m of diamond drilling, and ground geophysical surveys have previously been used to investigate stockwork and pegmatitic mineralization, and renewed exploration (geophysical surveys and diamond drilling) was under way as of this writing.

Considerable information concerning the property is available in published reports by Satterly (1960), Vokes (1963), and Colvine and McCarter (1977), but other information was made available from Rio Tinto Canadian Exploration Limited.

HISTORY AND EXPLORATION

Molybdenite-pyrite mineralization was discovered in 1946 in Lot 8, Concession V, Echo Township, within the southeast margin of the Lateral Lake stock, by members of an Ontario Department of Mines mapping crew. The ground on which these showings occur was staked in the early 1950s by G.L. Pidgeon and subsequently optioned to Detta Minerals Limited (1954) who drilled two, sub-horizontal test holes and drove a 114 foot (35 m) adit for the purpose of bulk sampling. Ground adjoining the Pidgeon property was held by A.O. Lantz in 1956 and was explored with two short drill holes totalling about 80 m.

Pidgeon Molybdenum Mines Limited was incorporated in 1957 to take over the holdings of Pidgeon, Lantz, and Mid-North Engineering Services Limited. The resulting 21-claim block was then optioned to Rio Tinto Canadian Exploration Limited and during 1957-58, twenty-one diamond drill holes were put down (Figure 9) for a total of 2364 m.

The property remained idle between 1958 and 1964, but in 1965-66 were re-investigated by Rio Tinto Canadian Exploration Limited. A ground magnetometer survey was conducted over the seven eastern claims in the group, and an additional twenty-eight holes were drilled, totalling 3475 m (Fig. 9), to fill in the 1957-58 drill results. The claims held by Pidgeon Molybdenum

Mines Limited were apparently then brought to lease and patent, and presently include patented claims Pa.14051, Pa.14071, Pa.14081, and leased claims Pa.14192 through Pa.14195, Pa.15232 through Pa.15236, Pa.15242 through Pa.15244, Pa.15254, Pa.33572, Pa.33573, and Pa.33758 through Pa.33760.

The property was again idle from 1966 to 1978, then late in 1979, Rio Tinto Canadian Exploration Limited and Dickenson Mines Limited initiated a joint venture exploration program with Pidgeon Molybdenum Mines Limited. Ground geophysical surveys have since been conducted over the Pidgeon property and the surrounding claim block (see: Rio Tinto Canadian Exploration Limited, property no. 19), and approximately 2740 m of diamond drilling was nearing completion as of mid-December 1979.

GEOLOGY AND MINERALIZATION

Bedrock within the claim group consists primarily of foliated granodiorite to quartz monzonite (Lateral Lake stock), and foliated to schistose mafic amphibolites surrounding the stock. The country rock amphibolites represent substantial deformed and metamorphosed mafic volcanics, primarily massive and pillowed lavas. Isolated occurrences of fine-grained, biotite-rich metasediments are occasionally found within the metavolcanics, as are irregularly layered amphibolite which probably represents highly deformed mafic pyroclastic lithologies. Several quartz porphyry and quartz-feldspar porphyry dikes cut the metavolcanics 1200 to 1500 m east of the main Pidgeon showings. Quartz veins, while not abundant outside of the stock, appear to be localized close the inferred contact between the metavolcanics and metasedimentary rocks which are not exposed in the claim group.

On a regional scale, the Pidgeon claims cover the eastern exposed end of the Lateral-Tot Lakes anticline. Foliation strikes within metavolcanics in the claim block change progressively from northwest (in the north), to north-south, to east-northeast (in the south), with dips all away from the Lateral Lake stock rarely exceeding 45-50°. In the crestal zone of the fold, dip values lessen to as gentle as 5-10°.

Intrusive lithologies within the Lateral Lake stock carry virtually all known molybdenum mineralization found in the claim group and are exposed primarily in two, northeast-trending ridges in the western portion of the block. Lithologies present in the southwest and main zones are essentially the same, consisting of foliated, medium-to coarse-grained granodiorite to quartz monzonite, pink aplite, and a spectrum of coarse-grained to pegmatitic lithologies ranging from muscovite-quartz-feldspar (pegmatite), through feldspar-quartz pegmatite, to quartz veins with scattered feldspar. Aplite cuts the granodiorite of the stock, but at the southwest zone, occurs as interfolial stringers and veins described as "lit-par-lit" and "banded gneiss" by previous workers (Satterly, 1960; Vokes, 1963). Quartz veins cut all other lithologies in the southwest zone and clearly are filled tension fractures, generally striking 150° to 175° in addition to locally following the host rock foliation (at about 050/50°SE). At the main zone, quartz-rich pegmatites, veins, and pods locally take on the appearance of breccia, containing inclusions of earlier quartz-feldspar pegmatite and aplite.

Aplitic dikes and veinlets at the main zone are commonly buckled, some also occurring as boudins.

The north zone was not visited by the present survey crew, but is described by Vokes (1963, p.76) as follows:

"About 1,000 feet northeast of the adit, a stripped and blasted outcrop shows the grey granitic gneiss striking N40°E and dipping at 50°SE. The gneiss shows the usual thin aplitic bands. It is 'overlain' higher up the escarpment by what appears to be a great thickness of pink aplitic granite cut by wide pegmatitic quartz veins. Molybdenite is irregularly scattered through the aplite in well-formed flakes up to 5 mm across. It is accompanied by pyrite.

There are at least three major quartz-pegmatite veins in this outcrop, varying in thickness between 2 and 5 feet. They can be traced for several tens of feet in a general N35°E direction, but their courses are somewhat sinuous in detail. The pegmatites are zoned, with feldspar occurring predominantly along both walls, whereas the cores of the veins are pure quartz. The feldspars are pink, well-formed crystals, up to an inch or two in length, arranged in irregular groups in the quartz. Mica, where present, occurs along the wall zones with the feldspar. Molybdenite also is concentrated preferentially along the pegmatite walls and for an inch or so into the surrounding aplite. Strings of well-formed flakes of molybdenite are also evident in the aplite along cracks or fractures leading from the walls of the pegmatite. Other molybdenite occurs at random in the aplite without any apparent localizing structures. This last type of occurrence is very characteristic, consisting of euhedral crystals from 3 to 5 mm in diameter set individually or in small groups randomly oriented within the aplite."

Mineralization in the main and southwest zone exposures, visited by the survey crew, consists primarily of molybdenite and lesser pyrite, both of which are preferentially associated with late, feldspar and muscovite-rich intrusive phases. The description of mineral occurrence at the main zone by Satterly (1960, p.30) is confirmed as being particularly accurate:

"Molybdenite mineralization is present as scattered to abundant flakes in the aplite, as fracture-filling seams in the aplite, and as scattered flakes in the muscovite granite pegmatite and quartz. Muscovite, and to a lesser extent pyrite, is associated with the molybdenite mineralization. Pyrite occurs in cubes, from 1/4 inch to as much as 1 inch across, in aplite, or in coarse aggregates often intimately associated with molybdenite and muscovite. Bismuthinite is a rare accessory in muscovite granite pegmatite, occuring as minute prismatic crystals 1/16 inch across and up to 1 inch in length. Magnetite is present in minute, round grains and occasionally larger masses up to 1 inch across in aplite stringers. Tourmaline was noted in one place as an aggregate of minute black needles and radiating clusters filling a fracture."

Grade and tonnage estimates for all deposits in the Pidgeon Molybdenum Mines Limited property are in need of revision. Average grades for muck + channel samples taken from the adit in 1954 were 0.31% MoS_2 (0-23.1 feet into the adit) and 0.55% MoS_2

(25.8 feet, 42.0-67.8 feet into the adit) (Satterly, 1960; Vokes, 1963). Tonnage and grade of three parallel zones, based on the 1957-58 drilling only, was estimated at a total of 275,000 tons containing 0.6% MoS_2 including 10% dilution (Vokes, 1963). Subsequent drilling (1965-66 and 1979) is believed to indicate a substantially increased tonnage of somewhat lower grade material.

RIO ALGOM LIMITED (CONECHO PROSPECT) (18)

This twenty-one claim property, located in Lots 7 through 10, Concessions I and II of Echo Township, was acquired in 1962 by Rio Algom Mines Limited (now Rio Algom Limited). The property was previously held and explored by Frederick Mining and Development Limited and later by Conecho Mines Limited. Claim numbers in the group include KRL 23106 through KRL 23123, KRL 22735, KRL 22736, and a single adjoining claim in northern McAree Township, KRL 22737.

Bedrock in the property consists of isolated exposures of mafic metavolcanics, mostly pillow lavas, and a single outcrop of quartz porphyry. Albite trondhjemite dikes, similar to that in the no. 1 zone of Goldlund Mines Limited but carrying lower gold values, are known to occur in claim KRL 23114 where drill holes and limited underground exploration have traced them for a strike length of about 300 m. Most of the property is overlain by Pleistocene deposits and extensive swamps.

Exploration on the claim group includes ground magnetometer surveys covering the whole property, and twenty surface drill holes totalling 4313 m (Young, 1950; Chisholm, 1951). Limited underground exploration of the "main zone" trondhjemite included

78.2 m (256.5 feet) of drifting, 142.6 m (467.8 feet) of cross cutting, 810 m (2659 feet) of diamond drilling in 28 holes, and 20.4 tonnes (20.5 tons) of bulk sample in seven lots (Young, 1953).

The ground magnetometer survey run in 1946 covered only the southernmost three claims of the property and related a central area of low magnetic intensity to an inferred intrusive dike (Dillman, 1946b). The 1950 magnetometer survey covered all but the southern two claims of the property and detected two parallel belts of complex, high magnetic intensity in the northern half of the group, and a distinct change in the orientation of magnetic trend lines (from northeast to north) in the area of claims KRL 23114 and KRL 22735. The complexity of the northern magnetic belts was interpreted as being due to the presence of magnetic ironstones or magnetic mineralization (either magnetite or pyrrhotite) (Koulomzine and Geoffroy, 1950), but the author would tentatively relate them to variably magnetic units of mafic metavolcanics interbedded with intermediate variolitic lavas. The marked change in strike of magnetic trend lines was suggested as an area of favourable exploration in the belief that the bend might be a zone of cross fracturing and quartz vein deposition (Koulomzine and Geoffroy, 1950).

The surface diamond drilling which followed the 1950 geophysical survey is poorly recorded; drill logs and locations are available for only seven of the twenty holes, all of which are plotted on the geological map (back pocket), 5 of which have shown in Figure 10 with all available assay information where this could be accurately placed. It is apparent that the structural and lithologic control of gold mineralization in the Conecho prospect is essentially the same as that found in the no. 1 zone of Goldlund Mines Limited: sporadic high assays within a background of trace to minor gold values. Chisholm (1951) states that core from DH no. 17 (within the "main zone") contained visible gold in a quartz-filled fracture which was surrounded by bleached and albitized alteration band, while the gold was associated with altaite and coarse cubes of pyrite.

No tonnage or grade estimates can be made for this property at this time. However, Young (1953) gives assay results of the underground sampling as follows:

area sampled	length sampled feet	oz Au/ton
main drift	28	0.19
main drift	45	0.03
main drift	51	0.06
1-xcut-S	38	0.01
1-xcut-N	17	0.06
2-xcut-S	21	0.02
2-xcut-N	10	0.04

If the sampling is representative, that portion of the drift yielding 0.19 ounces gold per ton would likely represent a "higher-grade vein cluster" as defined by the operators at Goldlund Mines Limited. Thus, the Rio Algom Limited "Conecho Prospect" clearly warrants re-newed exploration activity.

RIO TINTO CANADIAN EXPLORATION LIMITED (19, 19a, 19b)

During 1978-79, Rio Tinto Canadian Exploration Limited conducted two major exploration programs within the Lateral Lake map area. One of these dealt with molybdenum mineralization associated with the Lateral Lake stock and is represented by a large (118 claims) property extending from Hooch Lake in northern Echo Township to Tot Lake in northeastern Webb Township (Figure 5). This claim group completely surrounds the property of Pidgeon Molybdenum Mines Limited and includes two previous exploration sites (De Coursey Brewis prospect, 19a; Denison prospect, 19b).

The second program was directed at the testing of sulphide mineralization present primarily in mafic to felsic metavolcanics extending from Vermilion Lake, through Redhat Lake, to Bluett and Gullwing Lakes. Properties held for this program as of 31 September 1979 included a block of 76 claims in the Centrefire-Redhat Lakes area, 99 claims in a number of blocks in the Bluett-Needle-Gullwing Lakes area, and 21 claims in two groups in central Webb Township (Figure 5). Drill logs for twenty holes totalling 2032 m have been filed as of this writing for assessment work credits on these properties. The molybdenum and sulphide exploration program will be discussed separately in the following sections.

Two drill holes (208.5 m total) were put down by Rio Tinto Canadian Exploration Limited in April of 1979 along the northern margin of the Lateral Lake stock, between Lateral and Tot Lakes. The western drill hole (G12) cut through the country rock amphibolite and into the Lateral Lake stock granodiorite, encountering only minor pyrite with trace chalcopyrite and pyrrhotite mineralization in a 33 m thick metavolcanic screen within the intrusive rock. The eastern drill hole (G14) did not reach the intrusive mass proper, but disclosed disseminated pyrite and magnetite, plus trace molybdenite in a 10 m thick granodiorite dike; a 10 cm thick, conductive zone of pyrrhotite-pyrite was also intersected within the mafic amphibolites.

HOOCH LAKE-TOT LAKE CLAIM GROUP (19)

This claim block is the largest single property held in the Lateral Lake area, and together with the property of Pidgeon Molybdenum Mines Limited, covers the eastern third of the Lateral Lake stock, along with a substantial area of mafic amphibolite surrounding the stock. Claim numbers in the property include Pa.436811, Pa.511789 through Pa.511827, Pa.511832, Pa.512191 through Pa.512204, Pa.531994 through Pa.532023, Pa.532032 through Pa.532057, and Pa.532059 through Pa.532064. The Rio Tinto property, as well as the Pidgeon property, are currently being investigated through a joint venture by Rio Tinto Canadian Exploration Limited, Dickenson Mines Limited, and Pidgeon Molybdenum Mines Limited for both molybdenum and base-metal potential. It has been stated to the author that detailed geophysical surveys and about 2740 m of diamond drilling are nearing completion, but the exact areas of exploration have not been disclosed (T. Bottrill, Rio geologist, personal communication 1979-80). Likely areas for molybdenum exploration in this property include three zones along the margin of the Lateral Lake stock previously drilled by De Coursey Brewis Minerals Limited and Denison Mines Limited.

DE COURSEY BREWIS PROSPECT (19a)

Early in 1958, De Coursey Brewis Minerals Limited conducted diamond drilling (five holes, 612 m total) along the southern contact of the Lateral Lake stock, just north of Moly Lake. All five holes cut intrusive lithologies apparently similar to those exposed at the "main zone" of the Pidgeon Molybdenum Mines Limited property to the east: "granite" (granodiorite), aplite, and pegmatite-quartz vein. Although two of the five holes bottomed in "non-intrusive" rocks (probably mafic amphibolite), it may be suggested that these holes were stopped in screens of country rock which were caught up in the marginal zone of the stock. Molybdenite-pyrite (plus minor chalcopyrite) mineralization was encountered in four of the holes, generally associated with pegmatite, quartz vein, or aplite (Figure 11). The western-most drill hole encountered only pyrite and trace chalcopyrite.

DENISON PROSPECT (19b)

In 1963, Denison Mines Limited held at least twelve claims covering ground north and south of the east end of Lateral Lake, adjoining property held by Pidgeon Molybdenum Mines Limited to the east. Twelve diamond drill holes were put down in these claims by Denison in 1963, for a total of 1255 m. All of this drilling was in and near the margin of the Lateral Lake stock, and all holes encountered molybdenite mineralization, with pyrite, chalcopyrite, and pyrrhotite also noted in several (Figure 12).

CENTRAL WEBB TOWNSHIP AREA (19)

Rio Tinto Canadian Exploration Limited held two blocks of claims in central Webb Township as of 31 September 1979. No exploration is reported for the northern block of six claims (Pa.511897 through Pa.511902), but it adjoins a small group of claims which has seen considerable exploration (see: Tantalum Mining Corporation Limited, no. 22). Bedrock within the northern block consists of strongly foliated granodiorite of the Lateral Lake stock (to the north), and mafic amphibolites with deformed granitic dikes (to the south).

The southern claim group consists of fifteen claims (Pa.511949 through Pa.511963) extending west from the north-western portion of Philcott Lake. A single drill hole (G15) of 102.7 m was put down in April of 1979 to test a conductive zone, intersecting a 4.5 m thick unit of graphitic argillite containing thin zones with pyrite-pyrrhotite mineralization concentrated in and near quartz veinlets (drill log descriptions; AFRO, OGS, Toronto). The remainder of the hole cut quartz-biotite schists.

BLUETT-GULLWING LAKES AREA (19)

Two large groups and several smaller blocks of claims were held by Rio tinto Canadian Exploration Limited in the Bluett-Gullwing Lakes area as of 31 September, 1979. The Gullwing Lake group consists of 23 claims (Pa.436581 through Pa.436603), and was tested by three holes (G1A, G4, G6; 322.2 m total) drilled from lake ice. Hole G1 intersected quartz-biotite schists containing a 0.9 m interval with pyrrhotite and pyrite occurring as lenses and fracture fillings; the bottom third of the hole was in mafic metavolcanics. Hole G4 cut similar lithologies, but mineralized zones included 7.8 m of disseminated pyrite within metasediments (or intermediate to felsic tuff), and 0.8 m of pyrite-pyrrhotite (plus trace chalcopyrite) within intermediate tuffs. Hole G6 was entirely within mafic to intermediate metavolcanics and intersected a 4.2 m thick zone with multiple, thin units of semi-massive pyrrhotite-pyrite with minor chalcopyrite.

Eighteen claims in several small blocks were held in the area between Bluett and Needle Lakes and south of Bluett Lake. Claim numbers included Pa.511942 through Pa.511945, Pa.511948, Pa.512187, Pa.512189, Pa.512190, and Pa.512176 through Pa.512185. A single drill hole (G11, 90.2 m) was collared south of Bluett Lake, intersecting a 4.3 m thick, silicified sulphide-bearing unit (pyrrhotite-pyrite-trace chalcopyrite) occurring between quartz-biotite schists and intermediate to felsic metavolcanics.

A major group of 58 claims was held by Rio Tinto Canadian Exploration Limited as of 31 September, 1979, extending northeast from the southwest portion of Bluett Lake to east of Swanson Lake. Claim numbers in this group include Pa.511925 through Pa.511929, Pa.511934, Pa.512166 through Pa.512175, Pa.512188, Pa.512205 through Pa.512231, Pa.512234, Pa.512235, Pa.512238 through Pa.512245, Pa.512299 through Pa.512301, and Pa.512310. Two drill holes (G10, G10B; 159.1 m total) were started from a single location to test a conductive zone about 1 km northeast of Bluett Lake. Hole G10 apparently missed the conductor as only iron stain and trace pyrite are recorded in the drill logs. Hole G10B intersected numerous, thin (10-100 cm), sulphide-rich zones within two units measuring about 9 m and 21 m respectively; pyrrhotite, pyrite, and minor chalcopyrite are noted as the mineralization within these units, while the host rocks include felsic pyroclastics and mafic metavolcanics.

CENTREFIRE-REDHAT LAKES CLAIM GROUP (19)

A large, irregular block of 76 claims, extending from Centrefire Lake in the west, past Redhat Lake, and reaching about 0.8 km from Vermilion Lake in the east (Figure 5), was held by Rio Tinto Canadian Exploration Limited as of 31 September 1979, and included claims Pa.436576 through Pa.436580, Pa.511834 through Pa.511896, and Pa.512302 through Pa.512309. This area was the most intensively investigated by Rio Tinto's sulphide exploration program in the map area, with eleven drill holes totalling about 1150 m used to test conductive zones in mafic and intermediate to felsic metavolcanics.

Six Rio Tinto drill holes (from west to east: G9, G8, G19A, G17, G18, and G2) were collared in mafic metavolcanics, although two of these (G17 and G2) appear to have cut either a single contact or a transitional unit between the northern mafic metavolcanics and the Bluett-Redhat-Vermilion Lakes intermediate to felsic metavolcanic unit. All six of these holes have pyrrhotite in common as the dominant sulphide, occurring with lesser amounts of pyrite, and with or without minor quantities of chalcopyrite. The sulphide-bearing zones range in thickness from about 0.3 to 4 m, although holes G8 and G2 contain thick sections (30 m and more) with disseminated sulphides. Black, grey, or green argillite, with or without graphite, was noted in association with the sulphides in four of the holes, while a black, cherty argillite was reported with the sulphides in hole G9.

Five of the eleven Rio Tinto drill holes in this area (G5, G7, G13, G16, and G3) intersected mainly intermediate to felsic metavolcanics. Again, sulphide-bearing zones were generally thin (0.3-0.4 m) and associated with graphitic argillite. Drill hole G3 cut a 0.4 m massive pyrite-pyrrhotite zone, adjoining a 0.4 m zone with pyrrhotite in fractures; no metasediments accompanied this mineralization. Hole G13 was also free of metasedimentary beds, but does appear to have cut a conductive zone; hole G16 was moved 100 m north of G13 and drilled back to intersect several thin zones of pyrite-bearing graphitic argillite. Drill hole G7 was somewhat anomalous in containing a 0.3 m section with abundant pyrite and arsenopyrite (logged by the author) in addition to a separate, pyrrhotite-graphite, conductive zone.

SELCO MINING CORPORATION LIMITED (20)

In 1976-77, Selco Mining Corporation Limited conducted ground geophysical surveys over an extensive claim block in southeastern Echo Township. This ground is now in part held by Goldlund Mines Limited (property no.9), C.J. Kuryliw and P.S. Broadhurst (property no. 10), and D. Wilkinson (property no. 24); portions of the ground surveyed are also open to staking. Following completion of the geophysical surveys, a single drill hole (125 m) was used to test a conductive zone, intersecting a thin zone of pyrrhotite-pyrite mineralization in ground currently held by Goldlund Mines Limited (see: Goldlund Mines Limited, North Denison prospect, no. 9a).

More recently (1978-79), Selco Mining Corporation Limited has conducted an intensive sulphide exploration program in the northern portion of the Lateral Lake map area. To date, a total of 15 drill holes (1420 m total) have been used to test the conductive zone in primarily intermediate to felsic metavolcanics; two additional holes are reported but no logs have been filed as of this writing. As of 31 September 1979, Selco Mining Corporation Limited held a total of 155 claims in numerous isolated groups extending from north of Gullwing Lake through the Bluett-Needle Lakes area, and scattered across the area south of Centrefire Lake, through Castor and Redhat Lakes, and into the western end of Vermilion Lake (Figure 5). Claim numbers applying to these properties include (from west to east): Pa.436373 through Pa.436376, Pa.436535 through Pa.436540, Pa.498206 through Pa.498216, Pa.498231 through Pa.498233, Pa.498186 through Pa.498191, and Pa.498217 through Pa.498230. The extensive block of ground extending from Bluett Lake to the area west and south of Centrefire Lake is composed of 69 claims, including: Pa.436234 through Pa.436239, Pa.436202 through Pa.436207, Pa.436210 through Pa.436212, Pa.436214 through Pa.436216, Pa.436218, Pa.436219, Pa.436221, Pa.436222, Pa.436224, Pa.436225, Pa.436227 through Pa.436232, Pa.435986 through Pa.435992, Pa.435994 through Pa.435999, Pa.436658 through Pa.436665, Pa.436541 through Pa.436546, Pa.498139, Pa.498142 through Pa.498144, and Pa.436700 through Pa.436707. The claim block in the Castor-Redhat Lake area consists of claims Pa.498127 through Pa.498138. Five isolated claim groups in southwestern Lomond Township include claims numbered Pa.498113 through Pa.498120, Pa.498121 through Pa.498126, Pa.436556 through Pa.436561, Pa.498102, Pa.498103, and Pa.436377 through Pa.436384.

BLUET LAKE AREA (20)

Selco Mining Corporation Limited has put down nine drill holes to test conductive zones in ground northeast, east, and south of Bluett Lake. Drill logs were not available for two of these holes (9B-1, 9B-2), both of which are located southeast of Bluett Lake. Hole 7B-2 is the only hole in this area drilled into rocks of the northern mafic metavolcanic group; it intersected two, 5-6 feet thick zones of disseminated pyrrhotite mineralization (with trace chalcopyrite) within mafic to intermediate tuffs which may represent screens in gabbroic intrusive rock.

Three drill holes, 7A-1, 7B-1, and 7C-2 are characterized by 1 to 6 foot thick sulphide-rich (pyrrhotite + pyrite) to massive sulphide zones within intermediate to felsic pyroclastics. One to five mineralized zones are present in each of the three holes, but hole 7B-1 is notable in containing a 6 foot thick massive sulphide bed with trace zinc and silver (0.08% Zn, 0.6 oz. Ag), and a 5 foot thick massive sulphide grading into 4.5 feet of stockwork sulphide mineralization. Drill hole 7C-1 is somewhat anomalous as it intersected a 24 foot thick zone of disseminated pyrite-pyrrhotite mineralization with very thin zones of more abundant sulphides.

Holes 12A-1 and 8-1, apparently testing a conductive zone along strike of Canadian Nickel's drill hole #42782, both intersected thin (2 to 5 feet thick), massive, pyrrhotite-pyrite units. The massive sulphide beds in hole 12A-1 occur within a 114 feet (35 m) thick disseminated (stringer) sulphide zone, and sulphide clasts were noted over a 20 foot thick interval. Drill hole 8-1 is perhaps more significant as reported zinc assays range from 0.08% to 0.79% in the massive sulphide beds; a 31 foot thick unit of pyrrhotite-rich graphitic argillite was also cut in hole 8-1.

CASTOR-REDHAT LAKES AREA (20)

Seven drill holes have been put down by Selco Mining Corporation Limited in this area to date, all cutting primarily felsic to intermediate metavolcanics. Drill holes 4-1 and 5-3 intersected varying types of sulphide mineralization, but are both notable for silver-gold content. Hole 4-1 cut three massive sulphide beds (3.1 to 6.8 feet thick; all are pyrite-pyrrhotite), the thickest of which yielded 0.10 to 0.15 ounces silver and trace to 0.01 ounces gold per ton; a 29 foot (8.7 m) thick zone of disseminated and stringer pyrrhotite-pyrite mineralization was also intersected. Drill hole 5-3 cut only a 5 foot thick unit of bedded pyrite-sericite tuff, but the reported assays give 0.04 ounces silver and 0.07 ounces gold per ton.

Drill holes 5-2 and 6-1 may be tentatively correlated by the presence of relatively thick units in each hole containing sparse to numerous clasts of bedded pyrite (27 m in hole 5-2, 7 m in hole 6-1). Drill hole 6-1 also intersected two, thin (5.5 and 2.7 feet), massive sulphide beds of pyrrhotite-pyrite.

Drill holes 5-1 and 5-4 both intersected thin, massive, pyrite-pyrrhotite units, with additional disseminated iron sulphide zones. Drill hole 3-1 is the "odd" one in this area, having cut a 26 foot thick, pyrite-bearing, graphitic argillite within felsic metavolcanics. Similar pyritiferous graphitic argillite units of 12 and 4 feet were intersected in drill hole 15-1 (put down from ice in Vermilion Lake), but the host rocks are mafic metavolcanics rather than felsic rocks. Assays returned from hole 15-1, however, were among the best reported in the area by Selco: 0.28% to 0.75% zinc, 0.07% to 0.10% copper, and 0.02 to 0.09 ounces silver per ton.

SWEANY, D.(21)

As of 31 September 1979, D. Sweany of Dryden held a block of ten claims at the west end of Bluett Lake, these laying almost entirely within Drope Township. Claim numbers in the group include Pa.488759 through Pa.488768. The claim group covers the "main showings" within ground explored for uranium mineralization by Conwest Exploration Company Limited in 1968.

The 1968 investigation was begun with blasting of several small pits and trenches. Four short drill holes (110 m total) were put down later in 1968, in the vicinity of the northeastern group of trenches. Assays from samples apparently taken from the trenches are reported to have generally yielded 0.01-0.04% U_3O_8, although two samples gave 0.14 and 0.27% U_3O_8, respectively (Pope, 1968). Assays taken on core samples gave "discouraging results" (Pope, 1968).

During the present survey, the northeast showing (diamond drill hole and trench site) was examined, revealing a reddish biotite pegmatite (13 to 14 m wide) which cuts biotite-poor quartzofeldspathic schists, the latter probably intermediate to felsic tuffs. Two very small pits and a larger pit (approximately 2 m x 2 m x 0.6 m deep) were cut into the pegmatite which was locally coated with yellow (uranium) oxidation stain. A second trenched area, denoted in Pope's (1968) report as the "main gossan" and shown as being about 825 m southwest of the northeast showing, was not located on two separate attempts by the present survey crew.

TANTALUM MINING CORPORATION LIMITED (22)

Tantalum Mining Corporation Limited held a group of four claims (Pa.436646 through Pa.436649) in central Webb Township, south of the west end of Tot Lake. The Tanco claims cover ground optioned by Carol Metal Mines Limited in 1964 from A. Koxowy and A. Leduchowske. The Carol Metal investigation of this ground consisted of trenching, bulk sampling, and a limited amount of diamond drilling (four holes, 223 m) (Fig. 13), all apparently directed at the lithium potential of a spodumene-bearing complex pegmatite. No grade or tonnage figures are available for this earlier work.

During December 1978 and January 1979, Tantalum Mining Corporation drilled three holes (156 m total) to define the downdip and northwest strike configuration of the pegmatite (Figure 13). At a depth of 43 m, the dike measured only one foot in core from drill hole GW-2, while only thin (5-10 cm) stringers of albite aplite were intersected in hole GW-3, located some 76 m northwest of the single outcrop. About 4.4 m of the complex pegmatite were intersected at a depth of 21 m in drill hole GW-1. Four assays of core totalling 4.1 m of this intersection yielded an average grade of 0.036% Ta_2O_5 and trace amounts of tin. As cut-off grade is in the range 0.08% Ta_2O_5 at the Bernic Lake mine of Tantalum Mining Corporation Limited (Crouse et al. 1979), the Tot Lake deposit appears to be well below economic limits at this time. The pegmatite investigated by the above programs is exposed on the eastern side of a single outcrop where it is traceable for a strike length of about 25 m. The dike cuts across the foliation in deformed country rock amphibolites, striking about 135° with an 80° easterly dip. Foliations in the amphibolites are unaffected by the intrusive except within about 2 to 3 m of the dike. The dike is apparently quite uniform in thickness, reaching a maximum of about 4 m. Two small trenches have been blasted into the northern end of the exposure, while a major cross-trench and 20 m by 20 m excavation (water-filled) are located near the southern end of the outcrop.

The complex pegmatite is composed of two major phases: a very coarse-grained to pegmatitic assemblage of quartz, potash feldspar, plagioclase, greenish-yellow muscovite, and spodumene, and a fine-grained (aplitic), white phase composed of albite and quartz. Accessory minerals include coarse prisms of black tourmaline (associated with the pegmatitic phase), moderate orange pink, euhedral crystals of almandite-spessartite garnet (r.i. = 1.78, found locally in the contact zone between the two major phases), and disseminated tiny crystals of blue apatite and an unidentified opaque mineral, possibly tantalite (both found in the aplitic phase).

THOMPSON, W. (23)

As of 31 September 1979, W. Thompson of Sioux Lookout held a group of nine claims, Pa.436857, Pa.436858, and Pa.436860 through Pa.436866, in Lots 9 and 10, Concession II of Echo Township. The claim group is located along the northwest shore of Crossecho Lake, around the mouth of Kathlyn Creek. Very limited outcrop at and close to the lakeshore consists entirely of massive and pillowed mafic lavas.

Previous exploration on this ground is apparently limited to eight diamond drill holes (length unknown) put down in 1951 by Glen Echo Mines Limited. All of this drilling appears to be cross-sectional (reconnaissance) in nature, although the northernmost hole is reported to have cut a fault zone between mafic metavolcanics to the south, and metasedimentary rocks to the north. There is no report of current investigations.

WILKINSON, D. (24)

D. Wilkinson of Dryden held a group of ten claims in Lots 1 through 5, Concession I of Echo Township, as of 31 September 1979. Claim numbers in the group included Pa.437114 through Pa.437116 and Pa.498263 through Pa.498269. Bedrock within the Wilkinson claim block is almost entirely felsic metavolcanics, with only small amounts of felsic to intermediate intrusive rock and metasedimentary units. One metasedimentary unit, consisting of quartz-pyrite-pyrrhotite ironstone, is apparently gradational with sulphide-bearing felsic metavolcanics, and cuts in and out of the northern portion of the claim group.

Previous exploration of the property is restricted to ground geophysical surveys over the three western claims, conducted in 1976 by Selco Mining Corporation Limited. There is no report of current investigations.

WINDFALL OILS AND MINES LIMITED
(WINDWARD PROSPECT) (25)

Windfall Oils and Mines Limited currently holds thirteen patented claims in Lots 7, 8 and 9, Concession I of Echo Township, plus another six, adjacent, patented claims in northern McAree Township. The Echo Township portion of the property adjoins to the southwest the property of Goldlund Mines Limited, and includes claims numbered KRL 21447 through KRL 21456, and KRL 22678 through KRL 22680 (Figure 10). The claim group was previously held by Windward Gold Mines Limited which conducted extensive exploration for gold in the late 1940s and early 1950s, in association with similar exploration then in progress at the adjoining Newlund Mines Limited prospect (now Goldlund Mines Limited).

The early exploration history (1947-52) of the Windward prospect can be briefly summarized as follows:

a) surface diamond drilling, 11 holes totalling 5,111 feet;
v) shaft to 222 feet with one level at 165 feet;
c) drifting for 2,735 feet, crosscutting for 244 feet;
d) underground drilling, 17 holes totalling 8,183 feet.
(Ferguson et al. 1971).

In 1971, Windfall Oils and Mines Limited conducted a ground electromagnetic survey over the whole claim group, locating a number of conductive zones suggesting a "series of fault or sheer structures broken by cross faults..." (Szetu, 1971, p.6). Although a few of the conductive zones outlined in Szetu (1971) were recommended as drill targets, there is no report of follow-up work.

Geology of the Windfall Oils and Mines property is essentially a continuation of that found in the southwestern portion of the Goldlund property (no.9) as reported by C.J. Kuryliw (1980) in geophysical and diamond drilling reports (AFRO). The area consists of massive and pillowed mafic lavas interlayered with, intermediate variolitic lavas, andesitic tuffs, lapilli tuffs and fragmental units. The trondhjemite dike is 100'-300' thick at the Windfall Shaft and splits to form three subparallel dikes which are separated by increasingly wide interdike layers of tuffs and andesitic flows. Two widely spaced faults cross the Windfall property dividing it into three major exploration targets.

Two holes totalling 2,448 feet were drilled to test the extension of the Goldlund West Zone onto the Windward Property. One of the holes intersects a 21 foot gold-bearing trondhjemite zone while the other missed the target.

In area two, 10,600 feet of drilling revealed the presence of three fractured, gold bearing trondhjemites. These dikes are 35-55 feet wide, with an average aggregate total of 120 feet and separated by 2 to 10 feet of andesitic tuff. Gold is concentrated at the contact of quartz veins, which trend N15E and plunge 30-40^{o}W, and the trondhjemite. Area 2 was tested with 26 drill holes, 20 of which revealed mineralization.

In area three, the dikes curve from N80E to N45E, and flatten to dip 60° south at the western limit of the claim block. The trondhjemite dikes tend to widen to the west. Here the north and central dikes are 40 to 60 feet wide and separated by 10 feet of tuff. The southerly dike is separated by 30-40 feet of andesitic pillow lava and is relatively unfractured and unmineralized. Most of the 17 drill holes were drilled on the northerly dike and reveal significant gold mineralization.

C.J. Kuryliw (1980a) describes the ore association as follows:

The tension fractures in the granodiorite are commonly filled with quartz to form a veinlet from a fraction of an inch up to a foot wide. Visible gold is commonly associated with later grey or white quartz introduced into the refractured veins and adjacent wallrock. The concentration of visible gold occurs along the vein wallrock contact. The total amount of visible gold does not differ recognizably with the thickness of the veinlet, since it is the contacts that contain the visible gold concentrations.

Minerals associated with gold enrichment are most commonly altaite (a lead telluride) and occasionally sphalerite. Pyrite is ubiquitous to all periods of mineralization. One type of pyrite mineralization that occurs as massive veinlets 1" to 4" thick invariably has visible gold mineralization.

Probable reserves of 150,120 tons of .30 oz. per ton were indicated by this survey (Kuryliw, 1980a). Further underground exploration and development were recommended by Kuryliw, however further details are not presently available.

Previously unreported pyrite mineralization was encountered on the property during the present survey, in a small shoreline exposure on the east side of Kathlyn Creek where it exists from Crossecho Lake. The western half of the outcrop consists of intermediate variolitic lava, while the eastern half is composed of dense, grey felsite with minor disseminated pyrite. Overall, the exposure somewhat resembles portions of the no. 3 zone of Goldlund Mines Limited, except that transverse quartz veining is not in evidence.

WOITOWICZ OCCURRENCES (26)

In 1973, M. Woitowicz conducted diamond drilling to investigate pyrrhotite-chalcopyrite mineralization in mafic amphibolites, located about 400 m southwest of Gullwing Lake. Four holes totalling 134 m were put down in the immediate vicinity of several test pits and trenches, recording only "sulphides" or "weak sulphides".

The test pits and trenches (and drill site) are easily accessible by a good bush road, a short distance north off of the Ghost Lake Road. The outcrop, major trenches, and several small pits at the drill site expose strongly foliated amphibolite and garnet amphibolite with thin (less than 1 m) lenses or units carrying 5-10% disseminated pyrrhotite and minor chalcopyrite. Rarely, 1-5 cm lenses of massive sulphide can be found in the trench rubble.

Another test pit, blasted into medium-grained, black, foliated amphibolite, is located about 600 m west of the drill site, at the south side of the bush road. Mineralization at this pit is restricted to 1-2% disseminated pyrrhotite with trace chalcopyrite.

Along strike to the west of the Woitowicz occurrences, two diamond drill holes have tested conductive zones within the mafic amphibolites (see also: Canadian Nickel Exploration Company Limited, no. 3, and Rio Tinto Exploration Limited, no. 19). While the Rio Tinto claims are currently held in good standing, all ground in the area of the Woitowicz occurrences, and the Canadian Nickel drill hole, is open to staking as of 31 September 1979.

WOODNEY OCCURRENCES (27)

Pyrite nodules (spherulitic concretions) and lenses occur in association with tourmalinized biotite schist and mafic pillow lavas on the north shore of Maskinonge Lake, in Lot 3, Concession V of Echo Township. Armstrong (1951) reports that these pyritic metasediments are found for a length of about 520 m along the shoreline, with mineralization consisting of pyrite and pyrrhotite. Hurst (1932) gives a similar description for the occurrence, but adds that minor galena is also present. Samples of pyrite nodules obtained during the present survey and analyzed by the Mineral Resources Branch, O.G.S., Toronto, yielded 380 ppm Cu, 380 ppm Ni, and 230 ppm Zn.

A second occurrence on Maskinonge Lake, not visible during the present survey, was described by Armstrong (1951, p.38):

"On the south shore of Maskinonge lake, in lot 1, concession

IV, pyritic basic volcanics have been exposed in four trenches dug during the summer of 1946, showing a total length of 160 feet. The width is not fully exposed but it is probably less than 12 feet. The pyrite occurs, with a little chalcopyrite, as pods or lenses, as nodules, and as streaks in the associated rocks."

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Table 1: Table of Lithologic Units, Lateral Lake Map-Area.

PHANEROZOIC

CENOZOIC

QUATERNARY

RECENT

Lake, stream, and bog deposits

PLEISTOCENE

Varved clay, sand, and gravel deposits

UNCONFORMITY

PRECAMBRIAN

EARLY PRECAMBRIAN (ARCHEAN)

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Felsite, quartz, feldspar, and quartz-feldspar porphyries, albite trondhjemite, trondhjemite granodiorite, quartz monzonite, granite, aplite, pegmatite, and granodioritic gneiss.

INTRUSIVE CONTACT

METAMORPHOSED MAFIC TO ULTRAMAFIC INTRUSIVE ROCKS

Gabbro, pyroxenite, and monomineralic actinolite rock.

INTRUSIVE CONTACT

METASEDIMENTS

Quartzose wacke, siltstone, slate, biotite-feldspar-quartz and garnet-biotite schists, quartz-magnetite-biotite-garnet schist, and magnetite-pyrite-pyrrhotite-quartz ironstone.

METASEDIMENTS (AMENT BAY FORMATION)

Polymict conglomerate, feldspathic arenite, feldspathic wacke, siltstone, argillite.

UNCONFORMITY

METASEDIMENTS (PATARA METASEDIMENTS)

Volcanic clast conglomerate, lithic wacke, feldspathic lithic wacke, argillite, pebbly mudstone, quartzose wacke, slate.

UNCONFORMITY

METAVOLCANICS

FELSIC METAVOLANICS

Aphanitic and porphyritic lavas, breccia, tuff-breccia, agglomerate, lapillistone, lapilli tuff, crystal-lithic and lithic tuff, garnet-biotite-muscovite-plagioclase-quartz schist.

INTERMEDIATE METAVOLCANICS

Aphanitic and porphyritic lavas, breccia, tuff-breccia, agglomerate, lapillistone, lapilli tuff, lapilli-crystal tuff, crystal-lithic and lithic tuff, schistose and lineated intermediate metavolcanics, muscovite-biotite-plagioclase-quartz schist, variolitic lava.

MAFIC METAVOLCANICS

Massive, porphyritic, ophitic, and pillowed lavas, coarse fragmental rocks, lithic and crystal-lithic tuffs, schistose and lineated mafic metavolcanics, fine-to coarse-grained amphibolites, garnet amphibolite, layered amphibolite.

TABLE 2: Chemistry of Mafic Metavolcanics and Related Rocks. Chemical Analyses by Geoscience Laboratory, Ontario Geological Survey.

		NVG-14	NVG-29	NVG-51	81	3	4	20
%	SIO_2	47.40	47.50	47.00	49.60	47.60	40.20	49.80
	TIO_2	0.86	0.99	0.79	0.39	0.31	0.32	1.26
	AL203	14.00	16.33	15.20	7.89	18.70	5.80	14.80
	FE_2O_3*	3.30	1.80	3.04	10.90	8.00	15.10	14.30
	FEO	9.58	11.8	8.45	-	-	-	-
	MNO	0.21	0.19	0.19	0.19	0.13	0.22	0.22
	MGO	9.47	8.71	6.90	14.30	9.34	25.60	5.41
	CAO	10.10	6.83	12.20	13.30	13.00	4.82	9.27
	NA_2O	1.55	1.75	2.55	0.61	1.87	0.26	2.05
	K_2O	0.08	0.05	0.14	0.36	0.09	0.01	0.12
	P_2O_5	0.06	0.07	0.06	0.05	0.03	0.03	0.11
	CO_2	1.22	0.02	0.08	0.01	0.02	0.04	0.10
	S	0.06	0.02	0.08	0.01	0.02	0.04	0.10
	TOTAL	101.00	100.30	99.20	99.60	99.23	92.60	100.30
	LOI							
	SP.GR.	3.03	2.88	3.00	3.02	2.97	2.94	3.00
ppm	Ba	50	40	70	90	60	40	50
	Co	55	50	50	55	40	115	46
	Cr	430	315	370	1500	420	2280	242
	Cu	210	65	135	95	54	168	148
	Li	10	15	9	10	54	n.d.	16
	Ni	225	125	135	250	150	600	108
	Pb	n.d.	n.d.	n.d.	65	44	108	6
	Zn	105	110	85	120	50	122	105
	Zn/Cu	0.50	1.69	0.63	1.26	0.93	0.73	0.71

n.d. = below detection limits;
- = not analyzed for
Fe_2O_3* - total iron as Fe_2O_3
NVG-14 - Grey-green, fine-grained amygdaloidal basalt flow.
NVG-29 - Grey-green, fine-grained, plagioclase-phyric basalt flow.
NVG-51 - Green, fine-grained, pillowed basalt.
81 - Schistose basaltic komatiite; west shore, Centrefire Lake.
3 - Equigranular gabbro; north shore, Gullwing Lake.
4 - Equigranular metapyroxenite; north shore, Gullwing Lake.
20 - Mafic clast conglomerate; west shore, Vermilion Lake.
Note: NVG samples and No. 81 collected by N. Trowell, NVG samples from Botham Bay area, Vermilion Lake.

TABLE 3: Chemistry of Intermediate Metavolcanics. Chemical Analyses by Geoscience Laboratory, Ontario Geological Survey.

	2	8	11	14	16	18	19	22	23
SIO_2	55.70	65.10	61.30	57.40	67.30	58.40	55.90	38.70	68.20
TIO_2	0.82	0.71	0.75	0.59	0.27	0.68	0.64	0.48	0.48
AL203	16.50	15.90	16.00	18.20	15.40	13.80	14.40	10.20	15.20
FE_2O_3*	8.64	4.62	6.31	6.43	2.44	5.19	5.03	12.20	1.55
MNO	0.19	0.08	0.10	0.16	0.04	0.10	0.08	0.20	0.02
MGO	3.00	1.77	2.51	2.89	0.83	3.12	3.57	6.20	1.36
CAO	8.69	4.09	3.16	6.33	2.16	5.19	7.56	12.10	2.95
NA_2O	3.70	3.46	5.52	3.11	3.91	3.62	2.71	0.95	2.13
K_2O	1.47	1.92	0.61	1.98	3.79	1.87	1.46	0.74	3.17
P_2O_5	0.32	0.22	0.26	0.26	0.10	0.22	0.27	0.15	0.15
CO_2	0.53	0.56	0.23	1.43	1.90	7.23	7.16	15.90	3.76
S	0.15	0.06	2.20	0.47	0.03	0.01	0.01	0.01	0.01
TOTAL	99.71	99.40	98.80	99.25	98.17	100.60	100.80	99.70	100.30
LOI	0.80	1.50	2.30	2.10	2.60	8.40	9.20	17.80	5.10
SP.GR.	2.89			2.76	2.71				
		98.49	98.95						
Ba	940	380	230	820	960	670	460	340	720
Co	23	11	24	28	6	14	13	43	n.d.
Cr	84	80	73	236	51	109	151	110	56
Cu	26	32	14	68	18	8	19	102	14
Li	18	10	12	28	14	8	34	60	4
Ni	22	30	61	51	10	55	46	127	8
Pb	43	16	14	56	32	20	22	14	14
Zn	123	74	186	58	72	62	63	138	20
Zn/Cu	4.7	2.3	13.3	0.85	4.0	7.8	3.3	1.35	1.4

n.d. below detection limits;

Fe_2O_3* = total iron as Fe_2O_3

2 Andesitic lapilli tuff (intermediate amphibolite); southeast shore, Gullwing Lake.

8 Dacitic lapilli tuff; southeast bay, Bluett Lake.

11 Dacitic lapilli tuff; drill hole site, 1.83 km NNE of Needle Lake.

14 Dacitic lapilli tuff; one kilometer southwest of Redhat Lake, McIlraith Township.

16 Dacite flow-dome; Centrefire Creek area, Lomond Township.

18 Felsic to intermediate breccia (carbonatized); west end, Vermilion Lake.

19 Intermediate tuff-breccia (carbonatized); island at west end of Vermilion Lake.

22 Intermediate tuffs (thin-bedded carbonate & silicate); island near south shore of Vermilion Lake, Lomond Township.

23 Felsic to intermediate lapilli tuff; island in central Vermilion Lake, northeast map-area corner.

TABLE 4: Chemistry of Felsic Metavolcanics. Chemical Analyses by Geoscience Laboratory, Ontario Geological Survey.

	1	7	9	10	13	15	17	21
SIO_2	70.60	66.20	71.20	73.60	70.40	70.20	75.00	70.20
TIO_2	0.33	0.73	0.56	0.64	0.26	0.22	0.09	0.25
AL203	16.90	16.40	16.60	15.40	16.80	14.40	13.80	15.30
FE_2O_3*	1.79	4.04	1.44	0.69	1.62	2.30	0.30	1.02
MNO	0.05	0.05	0.04	0.02	0.02	0.05	0.03	0.01
MGO	1.01	1.74	0.48	0.38	0.67	0.72	0.27	0.60
CAO	2.52	3.39	1.86	2.20	2.51	1.70	0.61	1.92
NA_2O	3.64	4.15	3.20	5.30	3.75	4.11	0.43	6.09
K_2O	2.42	1.81	2.25	1.07	3.28	2.02	9.07	1.27
P_2O_5	0.10	0.16	0.08	0.10	0.06	0.06	0.02	0.10
CO_2	0.15	0.22	0.33	0.33	0.15	0.85	0.86	2.55
S	0.09	0.06	0.07	0.01	0.03	0.64	0.02	0.05
TOTAL	99.60	100.10	98.11	99.74	99.55	97.27	100.50	99.70
LOI	1.00	1.50	1.60	0.60	0.80	1.90	1.00	3.00
SP.GR.	2.68		2.69	2.67	2.63	2.68	2.61	
Ba	630	390	600	390	920	440	1500	570
Co	7	9	n.d.	10	n.d.	12	n.d.	n.d.
Cr	22	71	73	25	11	28	n.d.	5
Cu	22	9	6	11	91	29	n.d.	n.d.
Li	32	14	99	8	18	9	8	6
Ni	11	15	n.d.	7	n.d.	12	n.d.	n.d.
Pb	45	14	49	67	53	51	73	13
Zn	84	54	26	42	48	52	12	50
Zn/Cu	3.8	6.0	4.3	3.8	0.53	1.79	-	-

n.d. below detection limits;

Fe_2O_3* = total iron as Fe_2O_3

- = not determined

1 Rhyolitic lithic tuff (muscovite-quartz schist); southeast shore, Gullwing Lake.

7 Felsic lithic tuff; southeast shore, Bluett Lake.

9 Muscovite-quartz schist; one km east of Needle lake, Webb Township.

10 Rhyolite breccia; one km northeast of Needle Lake, Webb Township.

13 Felsic crystal-lithic tuff; 1.5 km north of Tot Lake, Webb Township.

15 Felsic tuff-breccia; Centrefire Creek area, Lomond-McIlraith Township line.

17 Rhyolite flow-dome; Centrefire Creek area, Lomond Township.

21 Massive rhyolite (felsite); peninsula from south shore of Vermilion Lake.

Table 5: Assay Results for Selected Mafic Metavolcanics.

Map #	26	27	28	29	48	50	51	52	33
Lab *	5716	5715	3323	3324	3320	5726	5725	3326	3322
Cu	0.72%	260	127	650	62	330	190	117	12
Ni	-	-	126	74	-	-	-	340	620
Pb	2460	18	-	-	29	21	n.d.	-	-
Zn	1.05%	180	380	0.21%	230	420	880	240	240
Ag	0.92	tr.	-	-	tr.	0.22	0.10	-	-
Au	tr.	tr.	-	-	tr.	tr.	tr.	-	-
Sn	10	n.d.	-	-	n.d.	3	7	-	-
Zn/Cu	1.46	0.69	2.99	3.23	3.71	1.27	4.63	2.05	20.0

- = not analyzed for

n.d. below detection limits

tr. = trace

Cu in ppm except sample 5716 in wt. %.

Table 6: Assay Results for Selected Intermediate to Felsic Metavolcanics.

Map #	1	3	17	23	30	42	45	46	53	54	55	57	63
Lab #	5719	3312	5717	3314	3319	5722	5724	5723	3311	3316	5721	3317	3315
Cu	11	15	46	n.d.	34	34	22	44	6	44	220	27	48
Pb	39	19	n.d.	15	25	21	18	19	23	18	110	18	27
Zn	92	69	60	34	80	46	160	40	37	390	400	37	74
Ag	0.10	tr.	tr.	tr.	tr.	0.10	0.12	tr.	tr.	tr.	0.18	tr.	tr.
Au	tr.	tr.	tr.	tr.	0.01	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.
Sn	n.d.	n.d.	3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	3	n.d.	n.d.
Zn/Cu	8.36	4.60	1.3	-	2.35	1.35	7.27	0.91	6.17	8.86	1.82	1.37	1.54

tr. = trace

n.d. = below detection limits

Table 7: Exploration data available for the Lateral Lake area.

File name and date	property number	type of work	mineral-ization	Reference
Alberts, V. (1973)	1	dd(1; 32 m)	sulphide	1
Lun-Echo (?)	2,4,11	ddr	Au	2, 3
Mosher Long Lac (1947)	2,4,11	g.m.r., mag	Au	1
Canadian Nickel Exploration Co. Ltd. (1970-72)	3	dd(17; 1621 m)	po, py, Cu, Zn	1
East Lun Gold Mines Limited (1946, 1950)	6	dd (5; 236 m), mag, ddr	-	1
Glen Echo Mines Limited (1951)	7, 10, 23	dd (3; 785 m), ddr	-	1, 4
Selco Mining Corp. Ltd. (1976-77)	9, 9a, 10, 24	mag, em, dd (1, 125 m)	po, py -?	1
Lunword Gold Mines Limited (1945)	9	ddr	Au	1

North Denison Mines Limited (1950)	9a	dd (4; 1097 m)	po, py, mag	1
Goldlund Mines Limited (1973)	9a	dd (2; 110 m)	po, py, -?	1
Goldlund Mines Limited (1976)	9a	dd (2; 173 m)	po, py, -?	1
Kuryliw, C.J. (1972)	9b	mag, g.m.r.	-	1
Goldlund Mines Limited (1977)	9b	mag	-	1
McGregor, J.G. (1954)	12	dd (1; 152 m)	sulphide	1
Phelps Dodge Corp. of Can. Ltd. (1968)	13, 16	mag, dd (10; 980 m)	po, py, Cu, Ni, Au	1
Morton, C. (1969)	14	ARAD	-	1
Penorroya Canada Limited (1965)	15	AMAG, AEM	-	1
Lantz, A.O. (1956)	17	dd (2; 80 m)	?	1
Pidgeon Molybdenum Mines Ltd. (1957-58)	17	dd (21; 2212 m)	py, mo	2
Pidgeon Molybdenum Mines Ltd. (1965)	17	mag	-	1

Pidgeon Molybdenum Mines Ltd. (1966)	17	dd (1; 402 m)	-	1
Frederick Mining and Development Ltd. (1950)	18	mag	-	1
Conecho Mines Limited (1950)	18	dd (7; 1515 m)	- py, Au	1
Rio Tinto Canadian Exploration Ltd. (1979)	19	dd (20; 2032 m)	py, po, cp, sp	1
DeCoursey Brewis Minerals Ltd. (1958)	19a	dd (5; 612 m)	py, mo, cp	1
Denison Mines Limited (1963)	19b	dd (8; 858 m)	py, mo	1
Selco Mining Corporation Ltd. (1979)	20	dd (15; 1420 m)	py, po, Cu, Zn, Ag, Au	1
Conwest Exploration Co. Ltd. (1968)	21	dd (3; 94 m), samp.	U	1

Canol Metals Limited (1968)	22	dd (4; 223 m)	Cs, Li	1
Tantalum Mining Corp. Ltd. (1979)	22	dd (3; 156 m)	Ta	1
Windfall Oils and Minerals Ltd. (1971)	25	em	-	1
Woitowicz, M. (1973)	26	dd (4; 134 m)	po, py, cp	1

Abbreviations for type of Work

dd = diamond drilling
ddr = reported diamond drilling
gmr = geological mapping and report
mag = ground magnetic survey
em = ground electromagnetic survey
samp = sampling with assays
ARAD = airborne radiometric survey
AMAG = airborne magnetic survey
AEM = airborne electromagnetic survey

References

1 = Assessment Files Research Office, O.G.S., Toronto.
2 = Source Mineral Deposit Record, O.G.S., Toronto.
3 = Chisholm (1951).
4 = Resident Geologist's Office, O.G.S., Sioux Lookout.

Table 8: TONNAGE & GRADE

No. 1 zone	No. 2 zone	No. 3 zone
'1.36 m.t. @0.160 (I) '1.75 m.t. @0.128 (II) (1)'1.70 m.t. @0.137 (II-a) '2.14 m.t. @0.117 (III)	(no estimate)	'8 trenches at '40' intervals 'over a 280' 'zone length 'gave 44.5 + (2)'which graded '(averages) '0.149 x 15.4' ' wide; '0.123 x 20.5' ' wide;
<-----(3)------>		
surface 0.328 dd 0.358 to 488' depth	surface 0.311 dd 0.40 to 500'	combined 2 + 3
0.82 m.t. @0.24 (4.) #1 zone, west block (only)	no estimate	no estimate
average cut grade to 350' level 0.089 oz/t. for 1.0 m.t.	(5)->#1 zone, west block	

logarithmic mean of Newlund
sampling = 0.163 oz/t. for 1.0 m.t. (6)

1) Stewart et al. (1947b); high assays cut to 1 oz.
2) " " (1947a);
3) Hurst (1951) ...not considered reliable!!
4) Author's calculations on tonnage and grade figures in Frohberg (1952);
5) Botsford (1974) = Rayrock assessment
6) Broadhurst (1978)

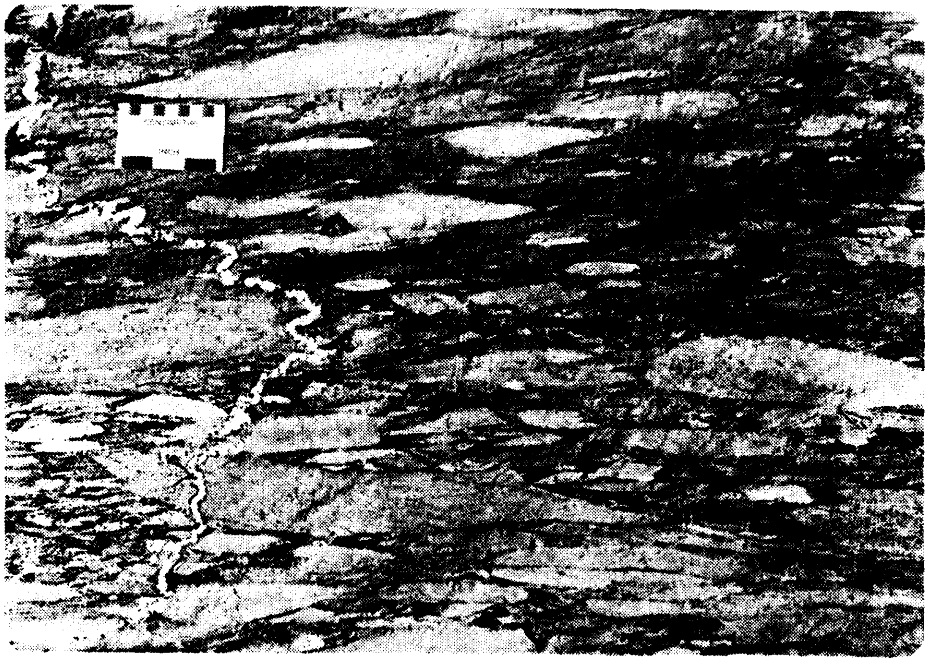


Photo 1.
Dacitic breccia,
Vermilion Lake.

Photo 2. Stratified dacitic
agglomerate and tuff-breccia,
Vermilion Lake.

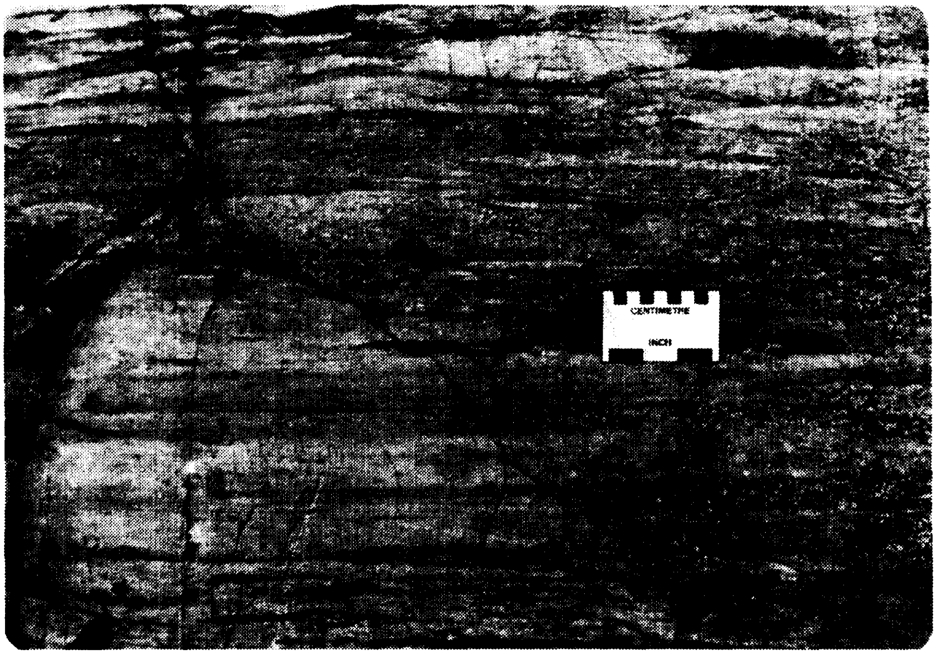


Photo 3. Bedded dacitic tuff-breccia and lithic tuff, Bluett Lake.

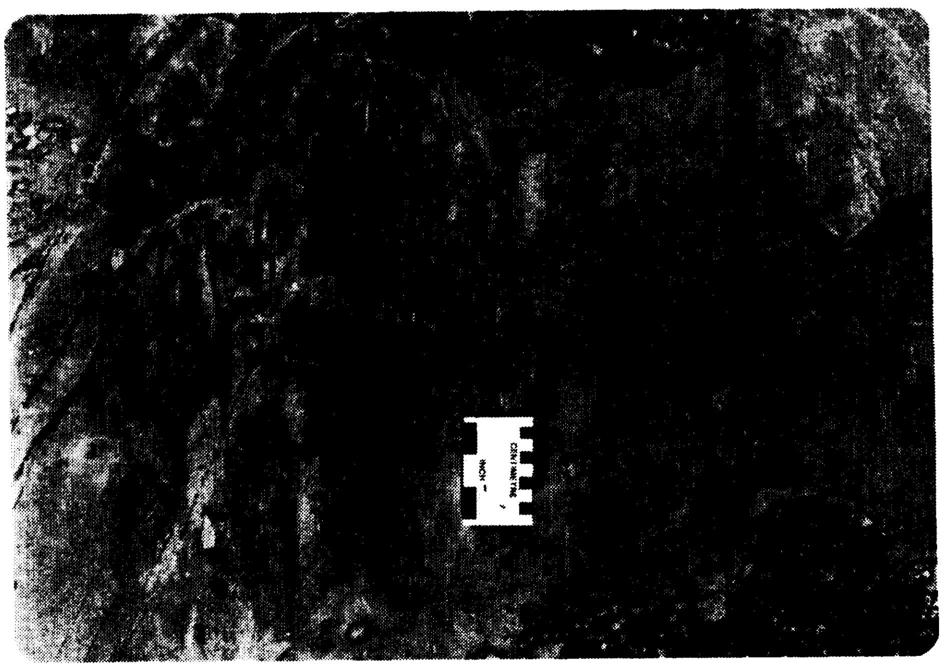


Photo 4. Andesitic lapilli and lithic (ash) tuff, Ghost Lake road, Drope Township.

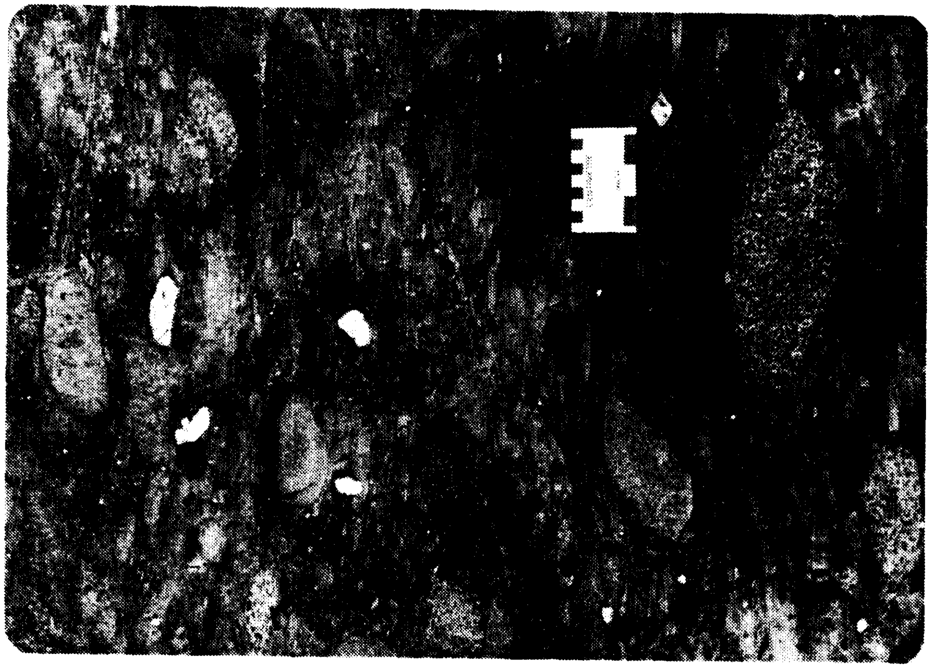


Photo 5. Mafic volcanic clast conglomerate, Vermilion Lake.

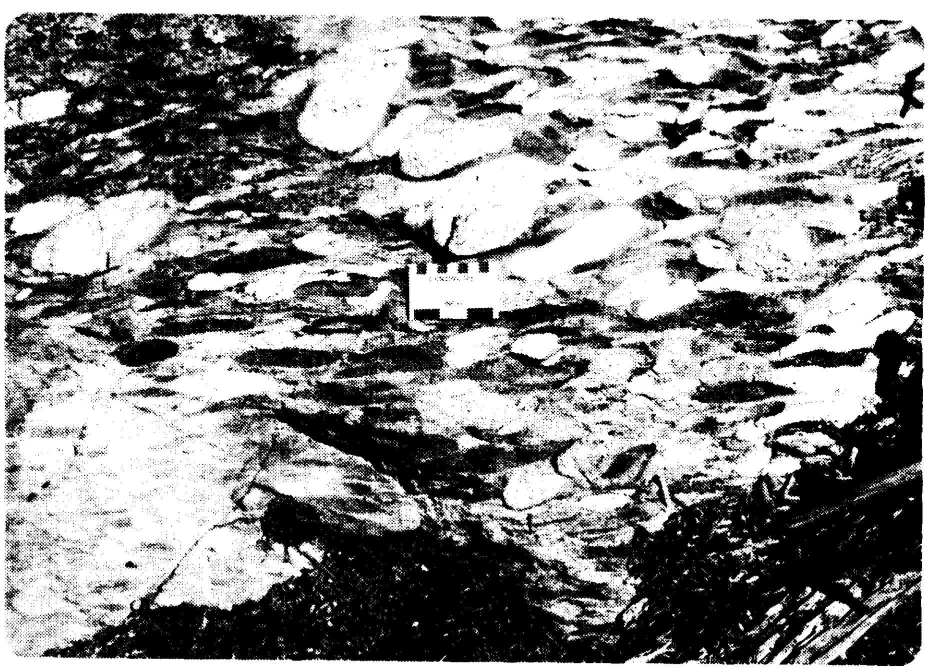


Photo 6. Polymict boulder conglomerate, Ament Bay Formation, Webb Township.

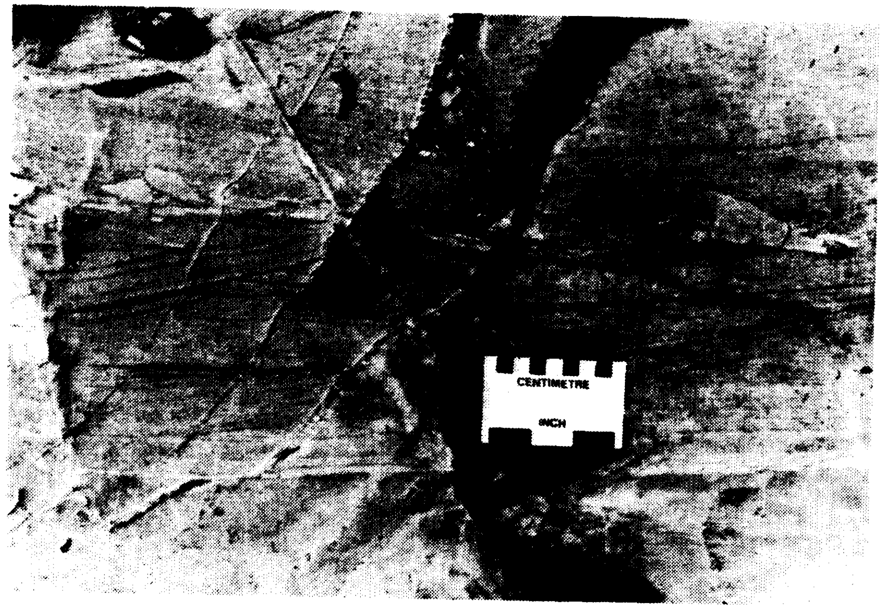


Photo 7. Cross-stratified arkosic wackes, Ament Bay Formation, Lomond Township.

Photo 8. Parallel laminated and massive arkosic wackes, Ament Bay Formation, Lomond Township.

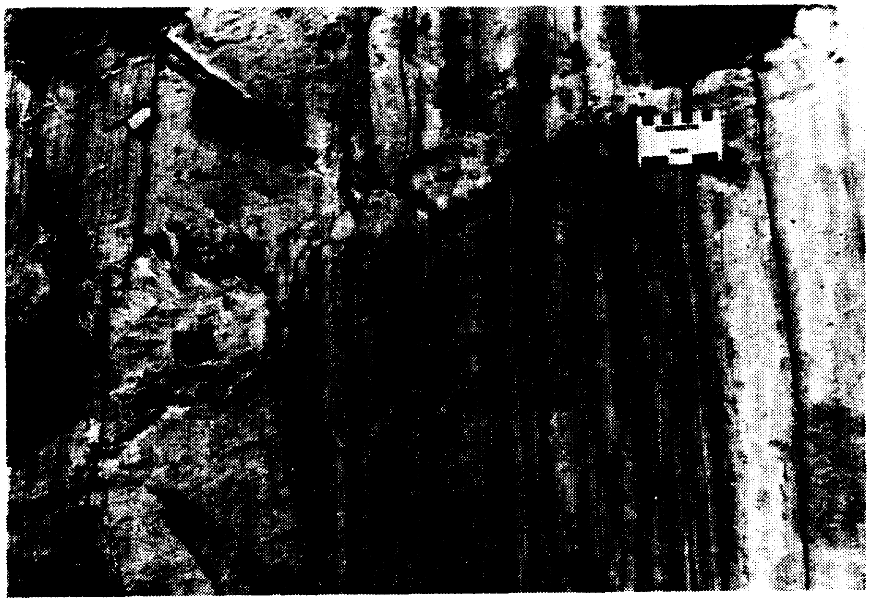


Photo 9. Thin-bedded to laminated siltstones, Ament Bay Formation, Lomond Township.

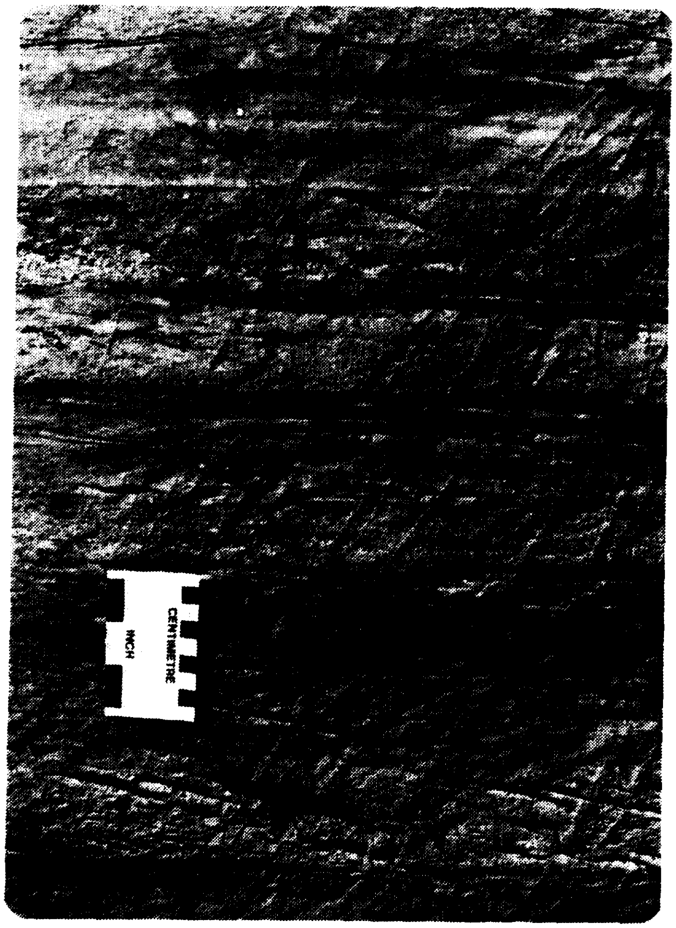


Photo 10. Graded lithic wacke and slate, Little Vermilion Formation(?), Kathlyn Lake.

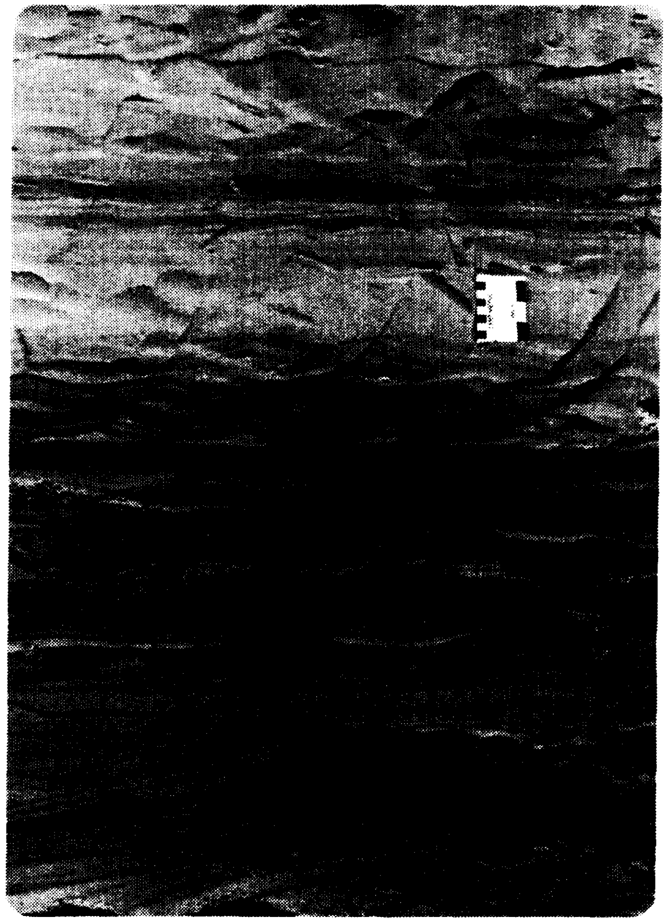


Photo 11. Thin-bedded Pleistocene sand, silt, and clay, Echo Township.

Photo 12. Stratified Pleistocene till, Trout-Basket moraine, McIlraith Township.

LEGEND[a]

CENOZOIC[b]

RECENT

Lake, stream, and bog deposits.

PLEISTOCENE

Sand and gravel deposits (terminal moraine and outwash), clay and varved clay (lake bottom deposits).

UNCONFORMITY

PRECAMBRIAN[c]

EARLY PRECAMBRIAN (ARCHEAN)

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS[d]

8 Unsubdivided
8a Felsite
8b Quartz porphyry
8c Feldspar porphyry
8d Quartz-feldspar porphyry
8e Fine-grained albite trondhjemite[e]
8f Foliated to cataclastic biotite granodiorite to quartz monzonite[f]
8g Microcline megacrystic to porphyritic biotite quartz monzonite
8h Homogeneous-equigranular to foliated biotite quartz monzonite to granodiorite
8j Inhomogeneous (pegmatitic to medium-grained equigranular) biotite granite.
8k Aplite[g]
8m Plagioclase-microcline-quartz pegmatite
8n Biotite-plagioclase-microcline-quartz pegmatite
8p Biotite-muscovite-quartz-microcline-plagioclase pegmatite
8q Garnet-muscovite-microcline-quartz-plagioclase pegmatite
8r Fine-to medium-grained trondhjemite, trondhjemite porphyry
8s Granodioritic gneiss[h]

INTRUSIVE CONTACT

MAFIC TO ULTRAMAFIC INTRUSIVE ROCKS[d]

7a Metagabbro[i]
7b Metapyroxenite
7c Foliated to equigranular actinolite rock

INTRUSIVE CONTACT

METASEDIMENTS AND DERIVED SCHISTS[d,j]

6 Unsubdivided
6a Lithic subarkosic wacke, lithic wacke

6b Siltstone, fine lithic wacke
6c Slate
6d Biotite-feldspar-quartz schist
6e Garnet-biotite schists
6f Quartz-magnetite-biotite-garnet schist
6g Pyrrhotite-pyrite-quartz ironstone

METASEDIMENTS[d,k]
5 Unsubdivided
5a Polymict boulder, cobble, and pebble conglomerate
5b Pebbly subarkosic wacke, subarkosic to arkosic wacke
5c Thin-bedded to laminated siltstone and argillite

UNCONFORMITY

METASEDIMENTS[d,l]
4 Unsubdivided
4a Mafic volcanic and quartz clast conglomerate, polymictic volcanic boulder conglomerate
4b Lithic wacke, lithic subarkosic wacke
4c Argillite
4d Pebbly mudstone
4e Slate

FELSIC METAVOLCANICS[d]
3 Unsubdivided
3a Massive aphanitic lava[m]
3b Massive porphyritic lava[m]
3c Breccia, tuff-breccia, agglomerate
3d Lapillistone, lapilli-tuff
3e Crystal-lithic tuff, lithic tuff
3f Garnet-biotite-muscovite-plagioclase-quartz schist

INTERMEDIATE METAVOLCANICS[d]
2 Unsubdivided
2a Massive aphanitic lava[m]
2b Massive porphyritic lava[m]
2c Breccia, tuff-breccia, agglomerate
2d Lapillistone, lapilli tuff, lapilli-crystal tuff
2e Crystal tuff, crystal-lithic tuff
2f Schistose or lineated intermediate metavolcanics
2g Muscovite-biotite-plagioclase-quartz schist
2v Variolitic lava

MAFIC METAVOLCANICS[d]
1 Unsubdivided
1a Massive lava
1b Plagioclase phenocryst or megacryst lava
1c Mafic phenocryst to ophitic lava
1d Pillow lava
1e Coarse mafic fragmental rocks, unsubdivided[n]
1f Lithic tuff, crystal-lithic tuff

1g Schistose or lineated mafic metavolcanics
1h Fine- to medium-grained amphibolite
1j Coarse-grained amphibolite
1k Garnet amphibolite
1m Layered amphibolite[o]

NOTES:

The letter "C" preceding a code refers to data compiled from existing maps covering portions of the Lateral Lake area and listed in sources of information.
The letter "D" preceding a code refers to data compiled from diamond drill logs filed for assessment work credits.

a) The lithologic codes given are basically a field legend and may be changed as a result of subsequent laboratory investigations.
b) Unconsolidated deposits. Cenozoic deposits are not differentiated on the map.
c) Bedrock geology. Where in places a unit is too narrow to be shown with separate contacts and must be represented in block, a short block bar appears in the appropriate block.
d) Rocks in these groups are subdivided lithologically and the order does not necessarily imply age relationship within or among groups.
e) Locally silicified.
f) Locally cataclastic.
g) Occurs both as potassium-rich and sodium-rich phases; occurs locally as apatite + tourmaline bearing, sodium-rich phase, associated with spodumene-bearing pegmatite.
h) May represent highly deformed intrusive material.
i) May locally include highly recrystallized mafic metavolcanics in the Gullwing Lake area.
j) Defined and probable lateral equivalents, and high metamorphic grade equivalents of part of the "Daredevil Formation" and all of the "Little Vermilion Formation; equivalent to the "Minnitaki Group" in southeastern Echo Township.
k) Equivalent to the "Ament Bay Formation".
l) Equivalent to the "Patara sediments" of Pettijohn (1935).
m) Interpreted and defined as lava or extrusive dome material, but may include sub-volcanic intrusive phases.
n) Includes breccia, tuff-breccia, agglomerate, lapilli-tuffs, and pillow-associated hyaloclastites.
o) Mostly represents pillow lavas and related mafic fragmental rocks.

METAL AND MINERAL ABBREVIATIONS

act ....Actinolite
Ag ....Silver
ap ....Apatite
asp ....Arsenopyrite
Au ....Gold
bm ....Bismuthinite
Cs ....Cesium
cp ....Chalcopyrite
Cu ....Copper
gt ....Garnet
gf ....Graphite
Li ....Lithium
mag ....Magnetite
mo ....Molybdenite
Mo ....Molybdenum
mus ....Muscovite
Pb ....Lead
pol ....Pollucite
po ....Pyrrhotite
py ....Pyrite
gc ....Quartz-carbonate vein
gv ....Quartz vein
sp ....Sphalerite
spd ....Spodumene
Ta ....Tantalum
tour ....Tourmaline
U ....Uranium
Zn ....Zinc

LIST OF PROPERTIES AND OCCURRENCES

1) Alberts Occurrence
2) Avonda, F.P.
3) Canadian Nickel Occurrences
4) Choi, W.P.H. and Choi, E.K.S.
5) Coates Occurrence
6) East Lun Gold Mines Limited
7) Glen Echo Mines Limited (1951)
8) Goddan, O.N., Kendall, A.M., and Young, J.W.
9) Goldlund Mines Limited (Newlund Prospect)
9a) Goldlund Mines Limited (North Denison Prospect)
9b) Goldlund Mines Limited (Villbona Prospect)

10) Kuryliw, C.J. and Broadhurst, P.S.

11) Lewis, M.I.

12) McGregor, J.G. (1954)

13) Mehagan, R. (estate)

14) Morton, C. (1967)

15) Penarroya Canada Limited (1965)

16) Phelps-Dodge Prospect

17) Pidgeon Molybdenum Mines Limited

18) Rio Algom Limited (Conecho Prospect)

19) Rio Tinto Canadian Exploration Limited

19a) Rio Tinto Canadian Exploration Limited (De Coursey Brewis Prospect)

19b) Rio Tinto Canadian Exploration Limited (Denison Prospect)

20) Selco Mining Corporation Limited

21) Sweany, D.

22) Tantalum Mining Corporation of Canada Limited

23) Thompson, W.

24) Wikinson, D.

25) Windfall Oils and Mines Limited (Windward Prospect)

26) Woitowicz Occurrence

27) Woodney Occurrence

Information current to mid-September 1979. Former properties on ground now open to staking are shown only where exploration information is available. A date in square brackets indicates the last year of major exploration activity.

Glacial striae

Shore bluff or scarp

Beach ridges and near shore bars.

Small bedrock outcrop.

Area of bedrock outcrop.

Bedding, top unknown; (inclined, vertical).

Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).

Bedding, top (arrow) from cross bedding; (inclined, vertical, overturned).

Lava flow; top (arrow) from pillows shape and packing.

Schistosity; (horizontal, inclined, vertical).

Foliation; (horizontal, inclined, vertical).

Lineation with plunge.

Geological boundary, observed.

Geological boundary, position interpreted.

Fault; (observed, assumed).

Spot indicates down throw
side, arrows indicate horizontal
movement.

Lineament.

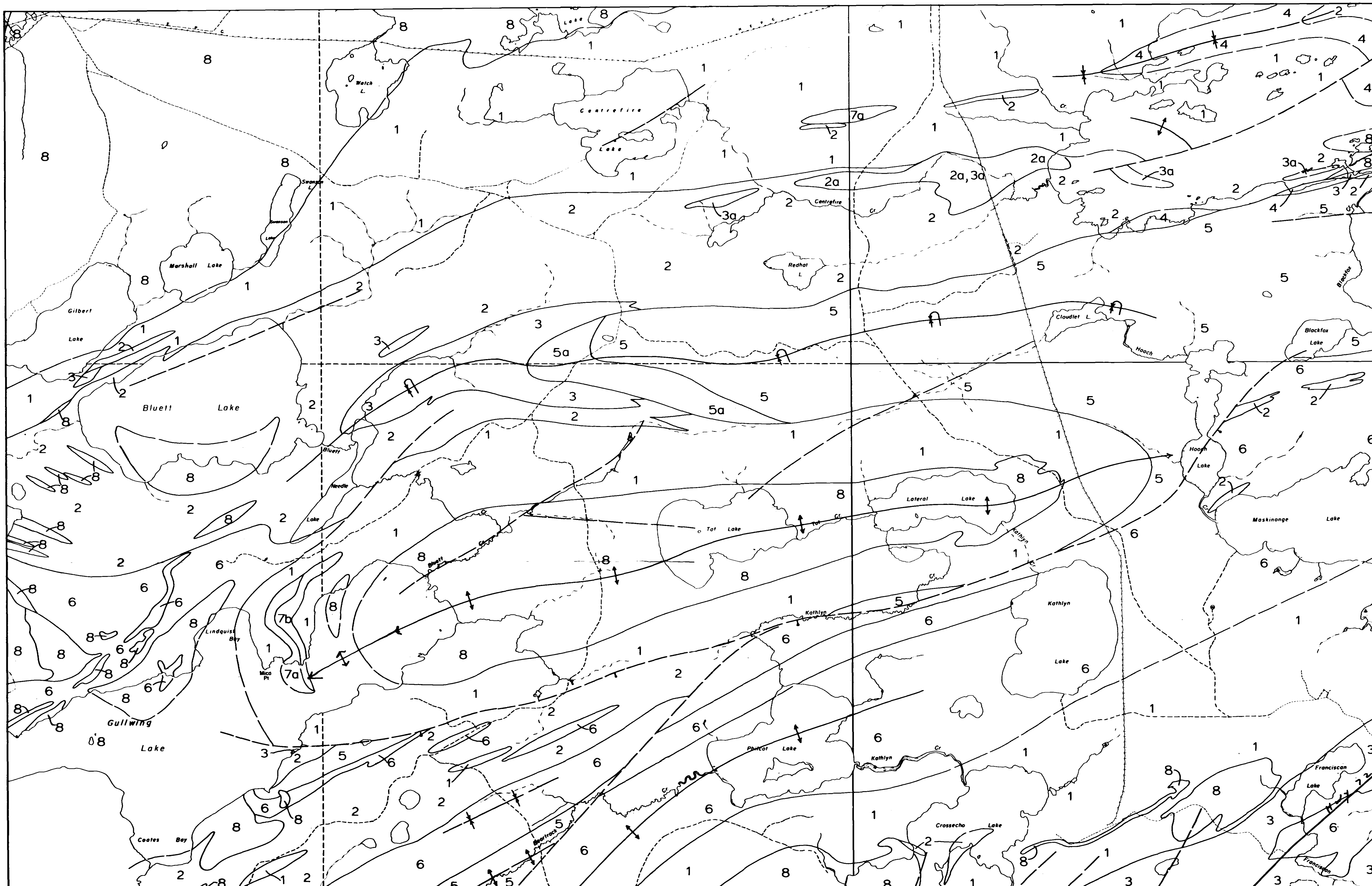
Anticline, syncline, with plunge.

Drill hole; (vertical, inclined).

Drill hole; (projected vertically;
projected up dip). Overburden shown.

Shaft; depth in feet.

Magnetic attraction.



8 Felsic to intermediate intrusive rocks
7a Metagabbro
7b Metapyroxenite
6 Lithic wacke and slate, unsubdivided
5 Ament Bay Fm.: sandstone, siltstone
5a Ament Bay Fm.: polymictic conglomerate
4 Patara metasediments
3 Felsic pyroclastic rocks
3a Felsic lavas
2 Intermediate pyroclastic rocks
2a Intermediate lavas
1 Mafic metavolcanics

N

Major folds
Major faults and lineaments

1 0.5 0 1 miles
1 0.5 0 1 2 kilometers

FIGURE 2: GENERAL GEOLOGY OF THE LATERAL LAKE AREA

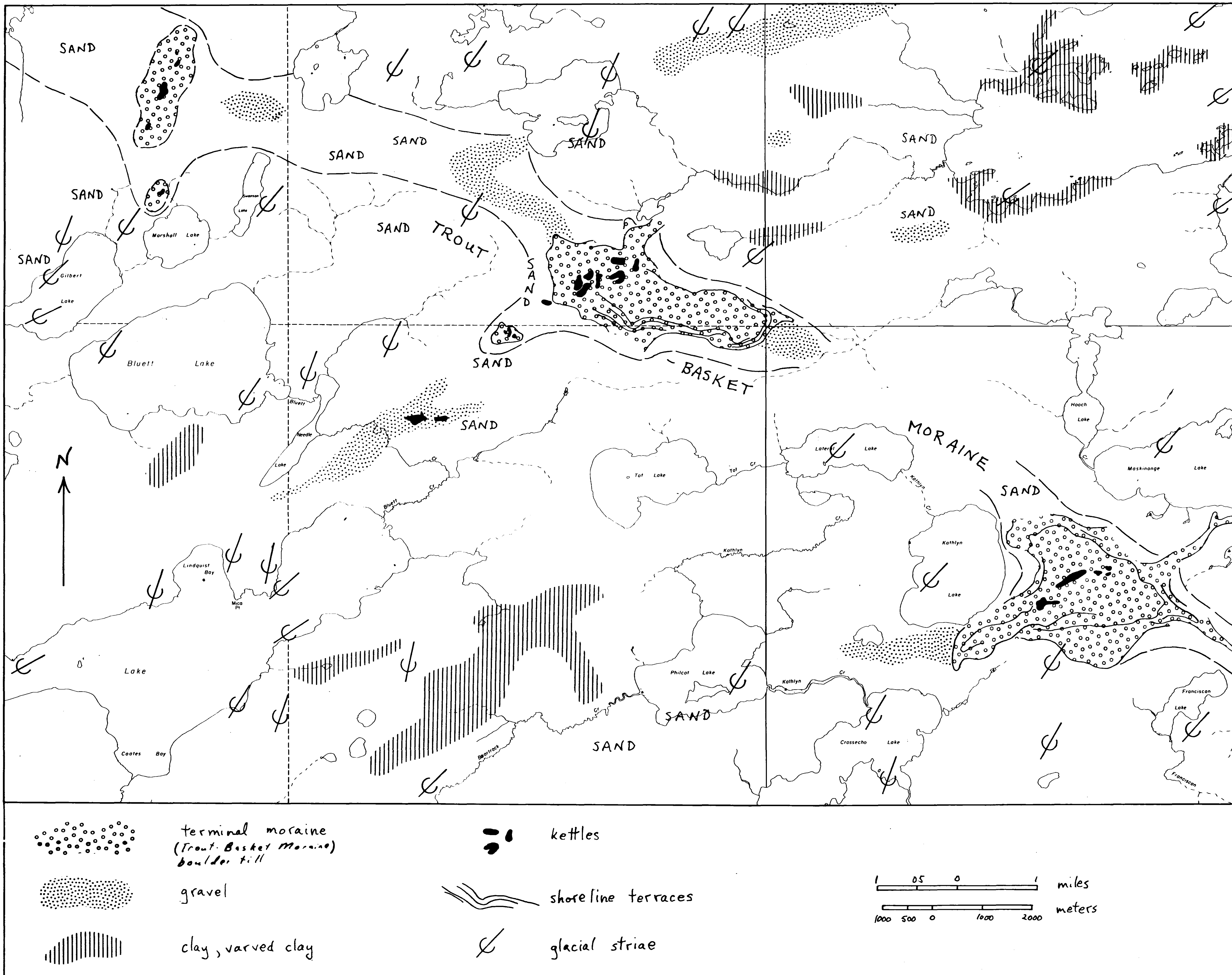


FIGURE 3: Generalized Pleistocene geology of the Lateral Lake map-area.

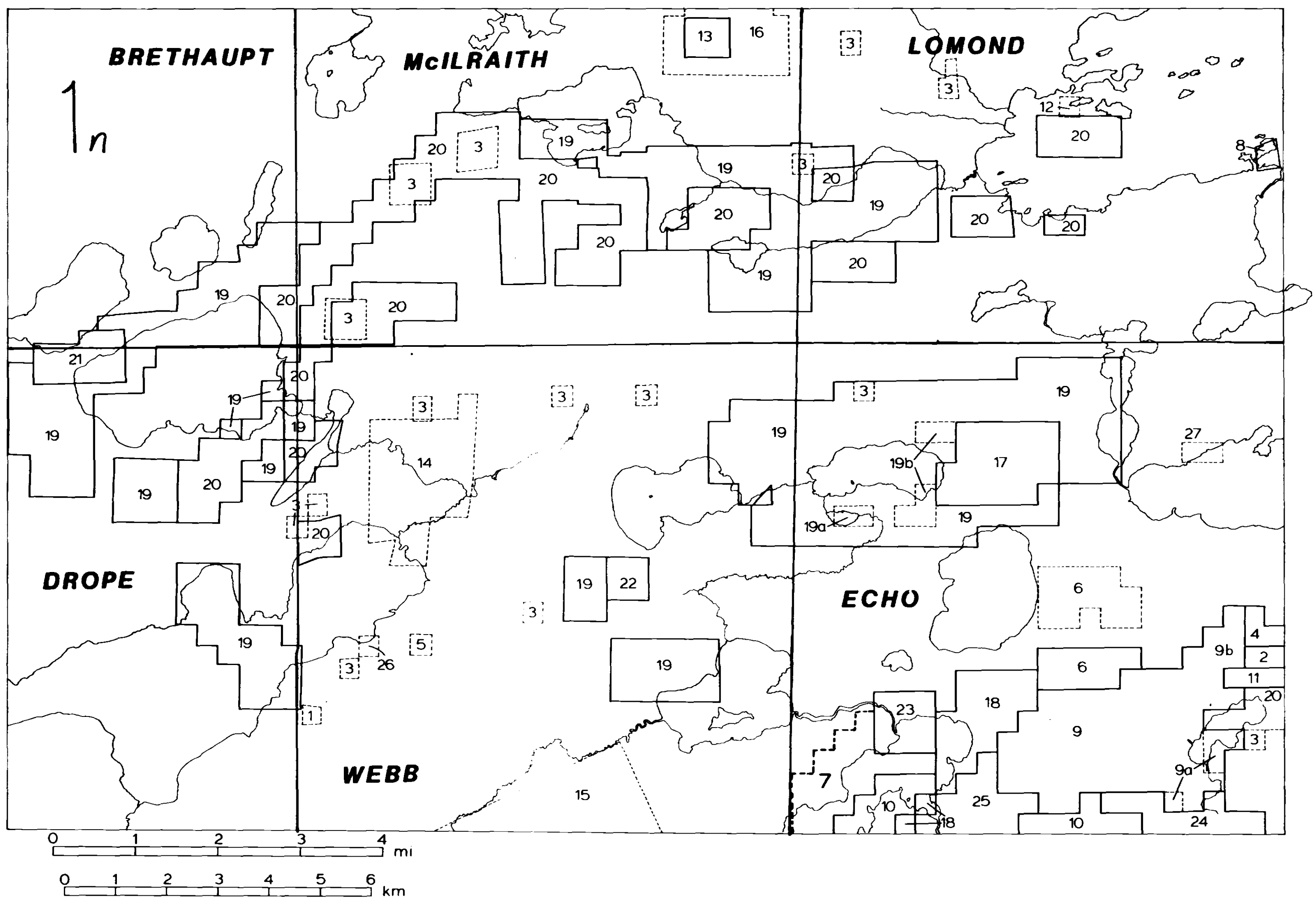


Figure : Property and Exploration Location Map, Lateral Lake Area.

Figure 5 : Assay and chemistry sample location map, Lateral Lake area.

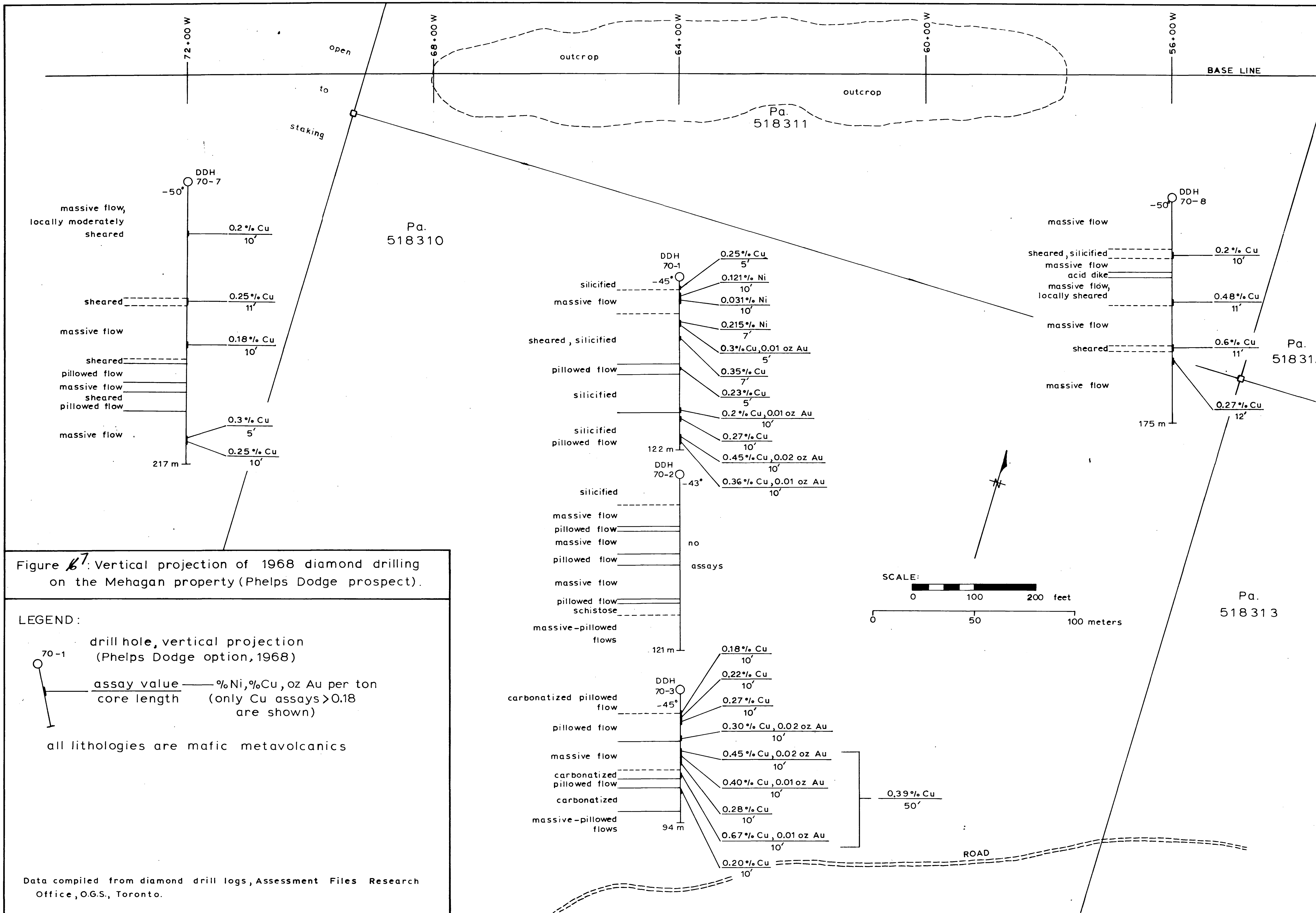


Figure 67: Vertical projection of 1968 diamond drilling on the Mehagan property (Phelps Dodge prospect).

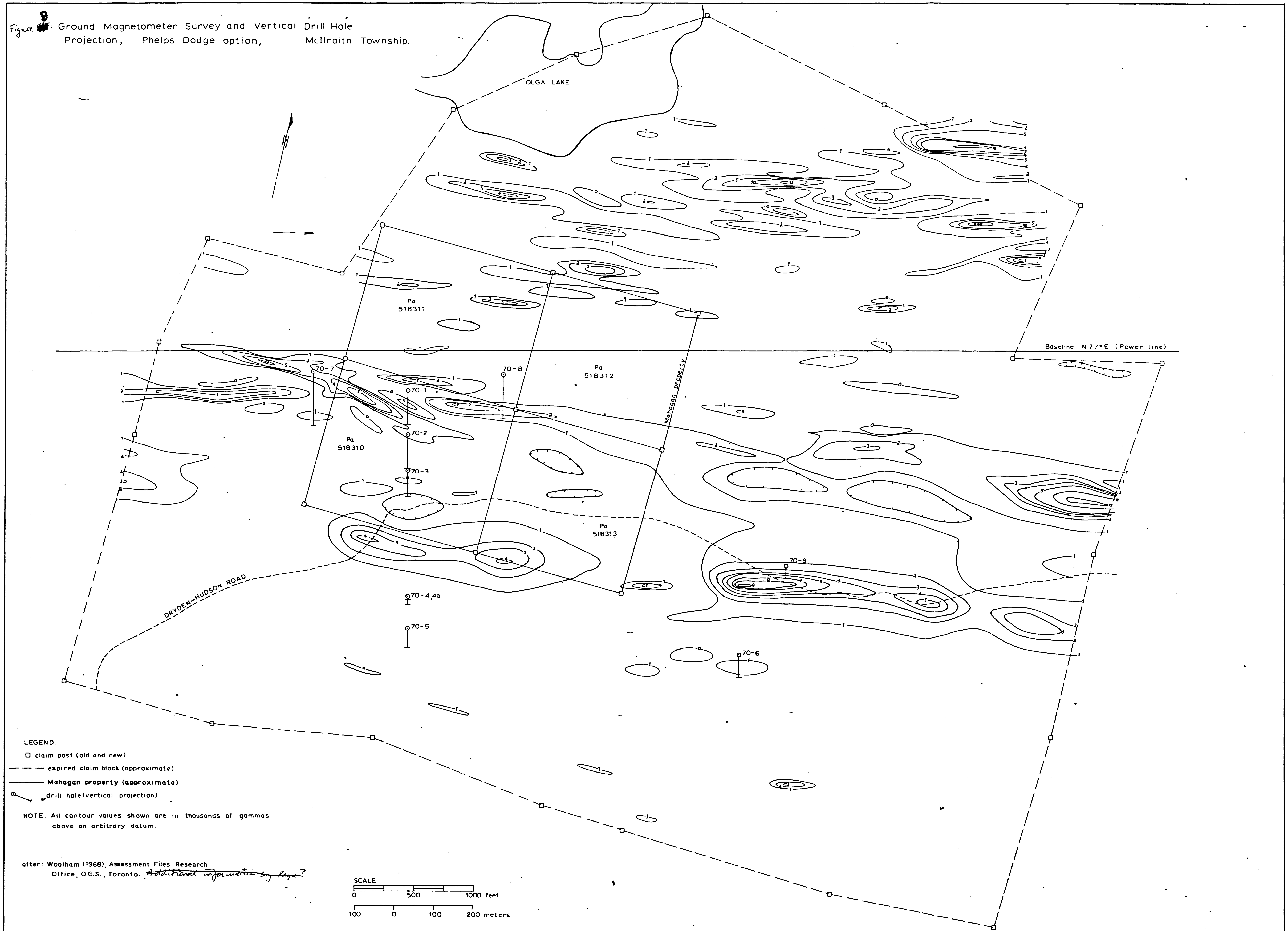


Figure 8: Ground Magnetometer Survey and Vertical Drill Hole Projection, Phelps Dodge option, McIlraith Township.

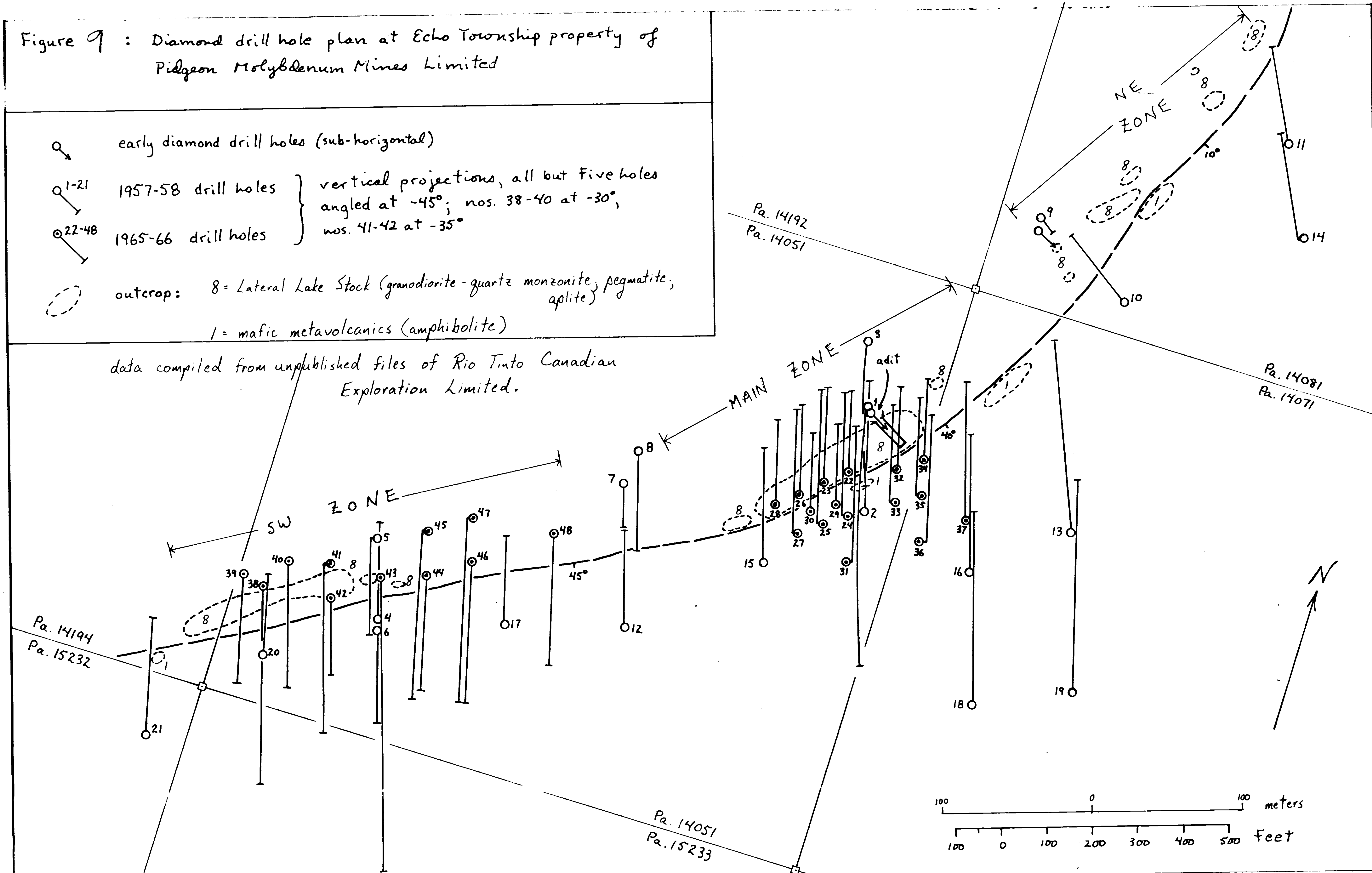


Figure 9 : Diamond drill hole plan at Echo Township property of Pidgeon Molybdenum Mines Limited

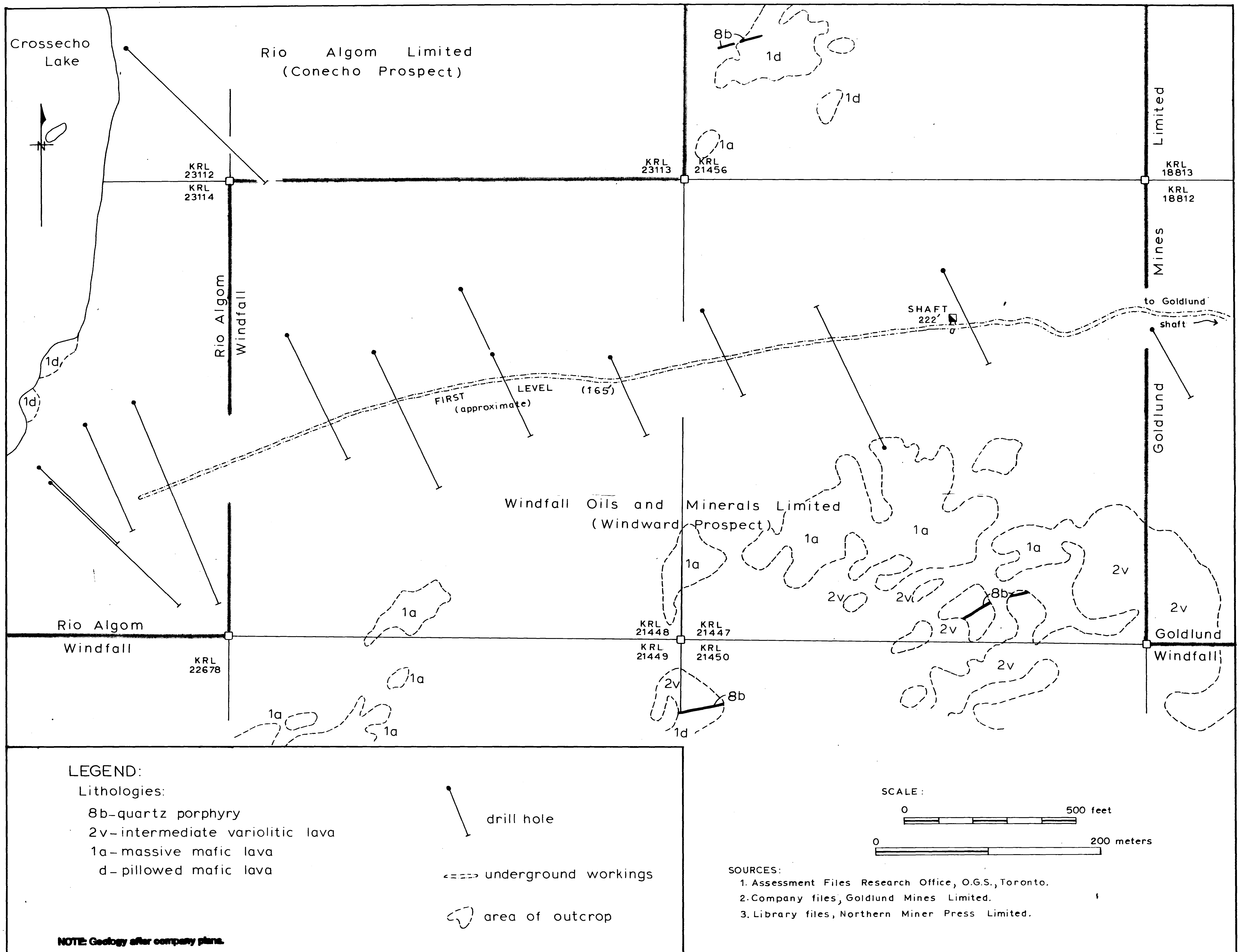
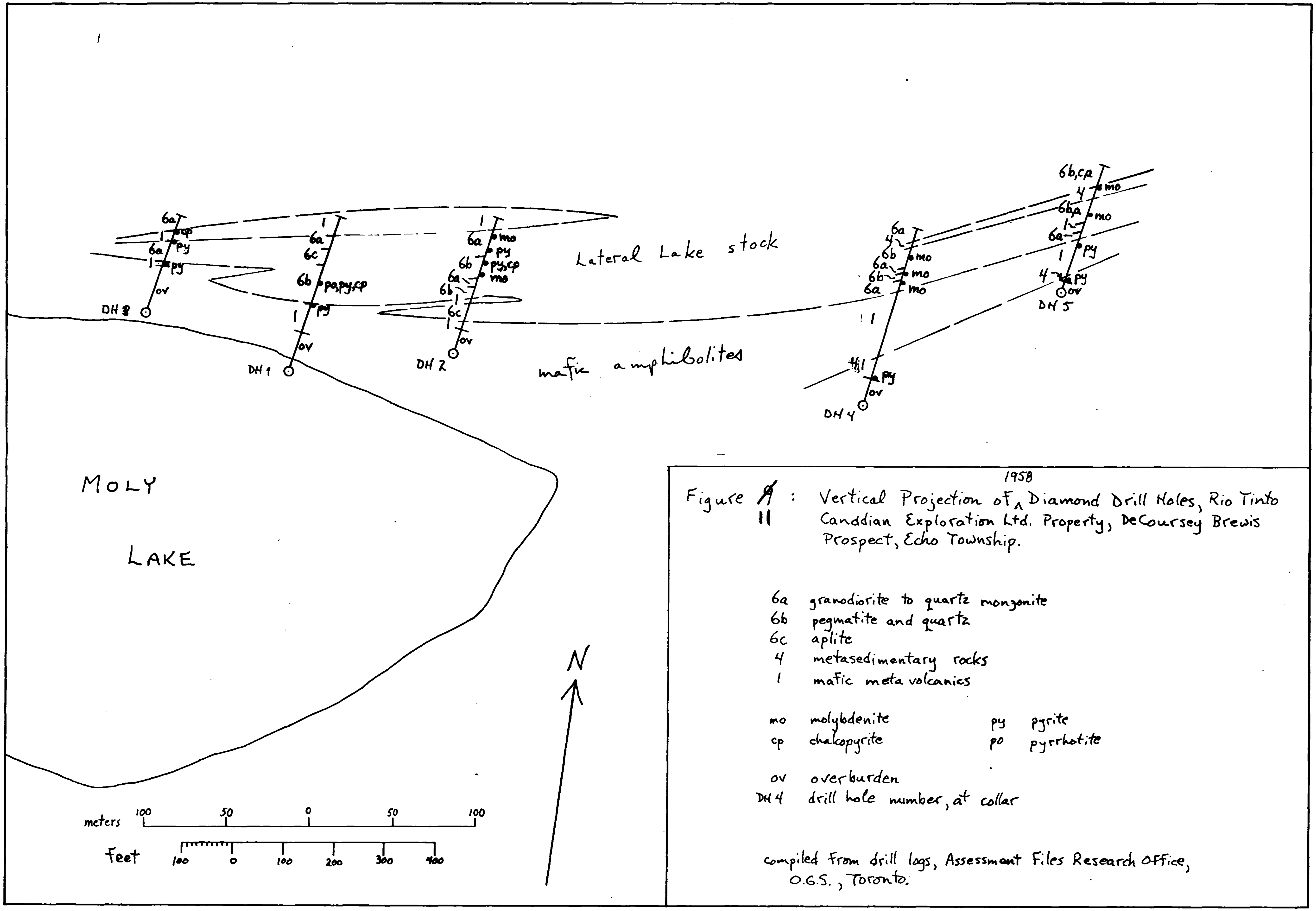


Figure ~~8~~ 10: Vertical Projection of Diamond Drill Holes and Underground Workings, Properties of Windfall Oils and Minerals Limited and Rio Algom Limited, Echo Township.



1958

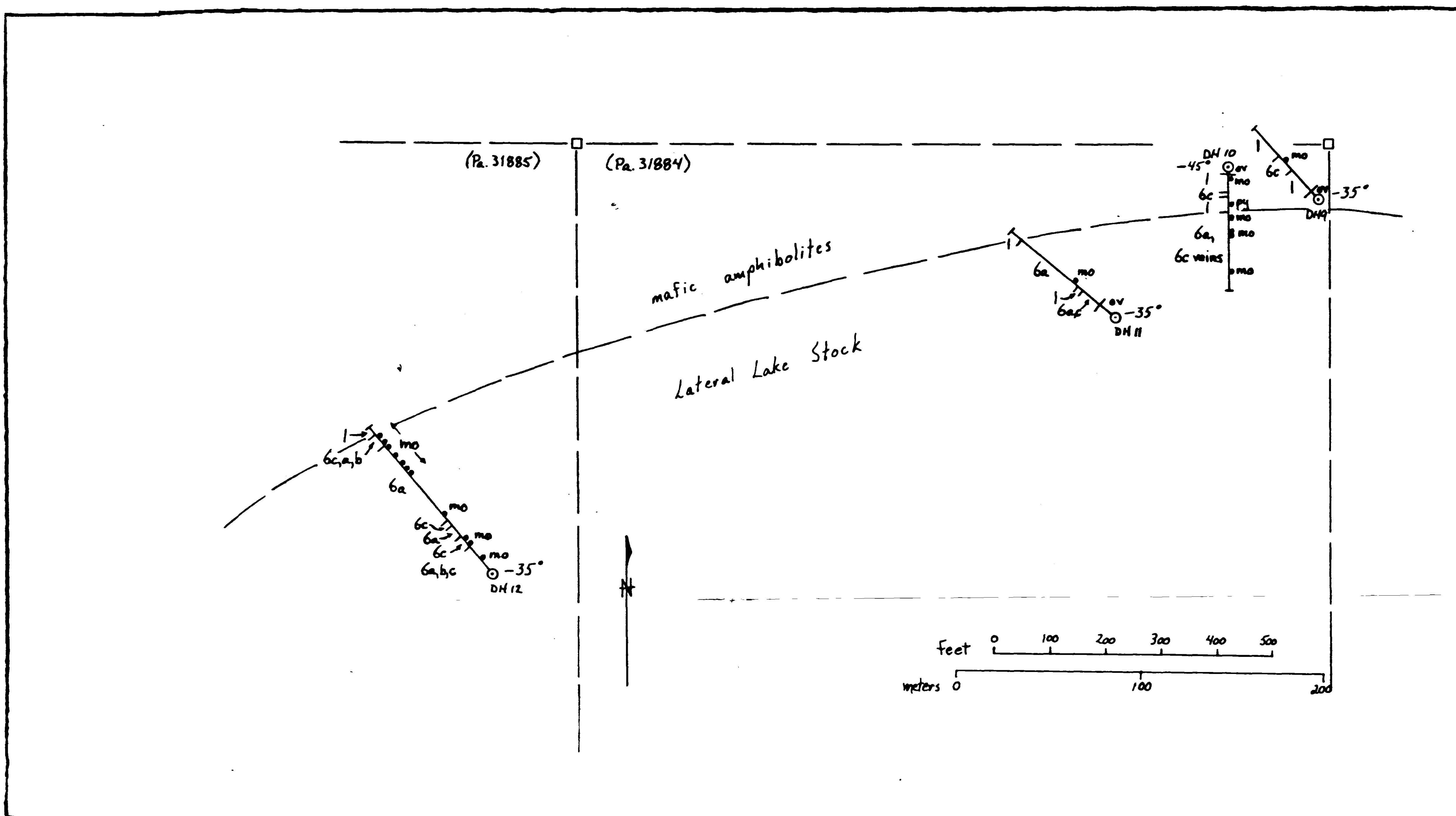
Figure ~~9~~ 11 : Vertical Projection of 1958 Diamond Drill Holes, Rio Tinto Canddian Exploration Ltd. Property, DeCoursey Brewis Prospect, Echo Township.

6a	granodiorite to quartz monzonite
6b	pegmatite and quartz
6c	aplite
4	metasedimentary rocks
1	mafic meta volcanics

mo	molybdenite	py	pyrite
cp	chalcopyrite	po	pyrrhotite

ov	overburden
DH 4	drill hole number, at collar

compiled from drill logs, Assessment Files Research Office, O.G.S., Toronto.



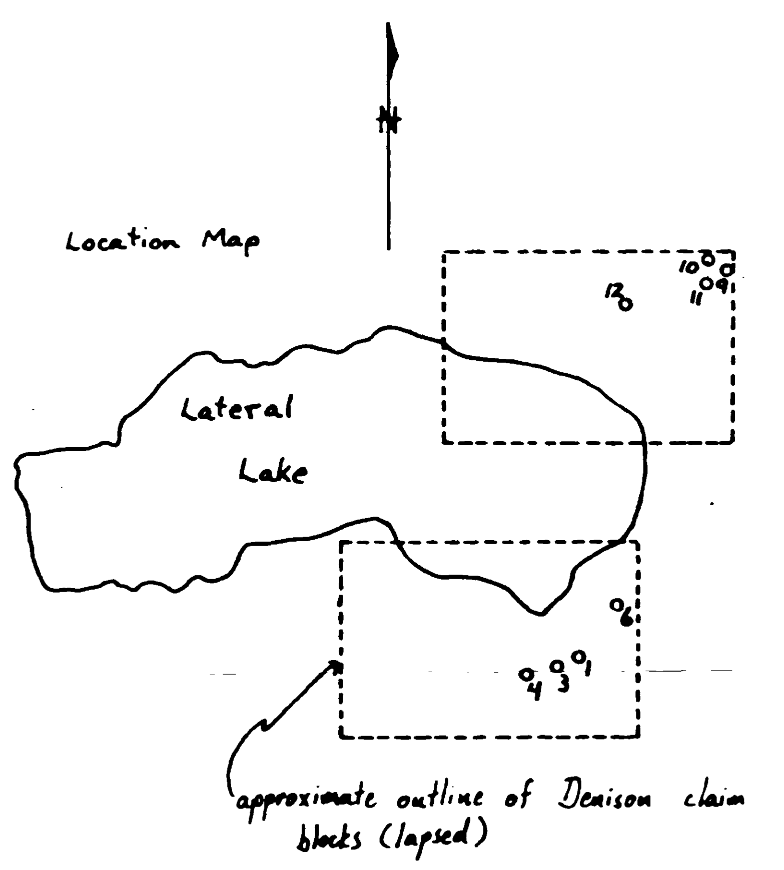
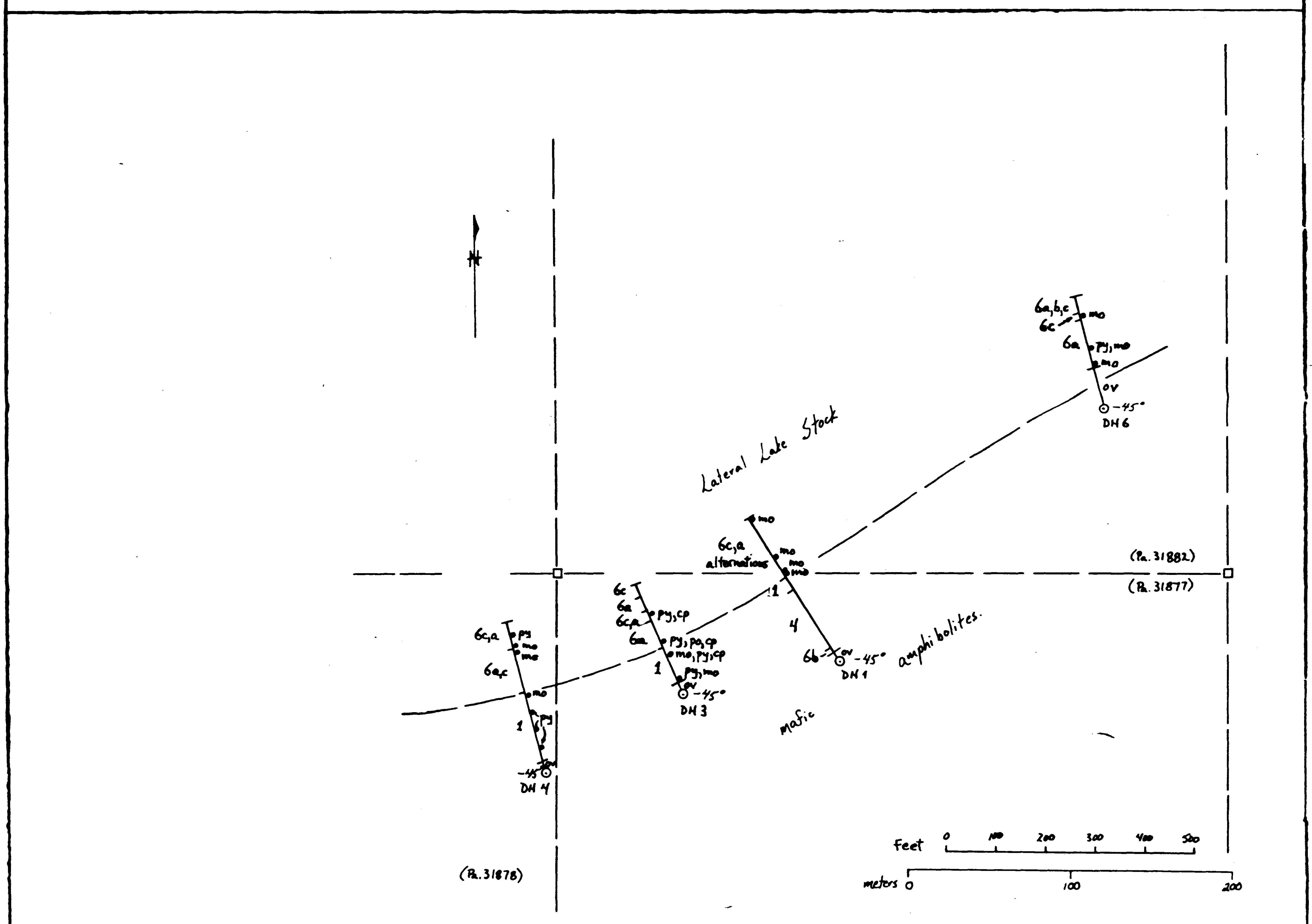


Figure 12: Vertical Projection of 1963 Diamond Drill Holes, Rio Tinto Canadian Exploration Ltd., Denison Prospect, Echo Township.

6a	granodiorite and quartz monzonite
6b	pegmatite and quartz
6c	aplite
4	metasedimentary rocks
1	mafic metavolcanics
mo	molybdenite
py	pyrite
cp	chalcopyrite
ov	overburden
DH12	drill hole number, at collar

compiled from drill logs, Assessment Files Research Office, O.G.S., Toronto



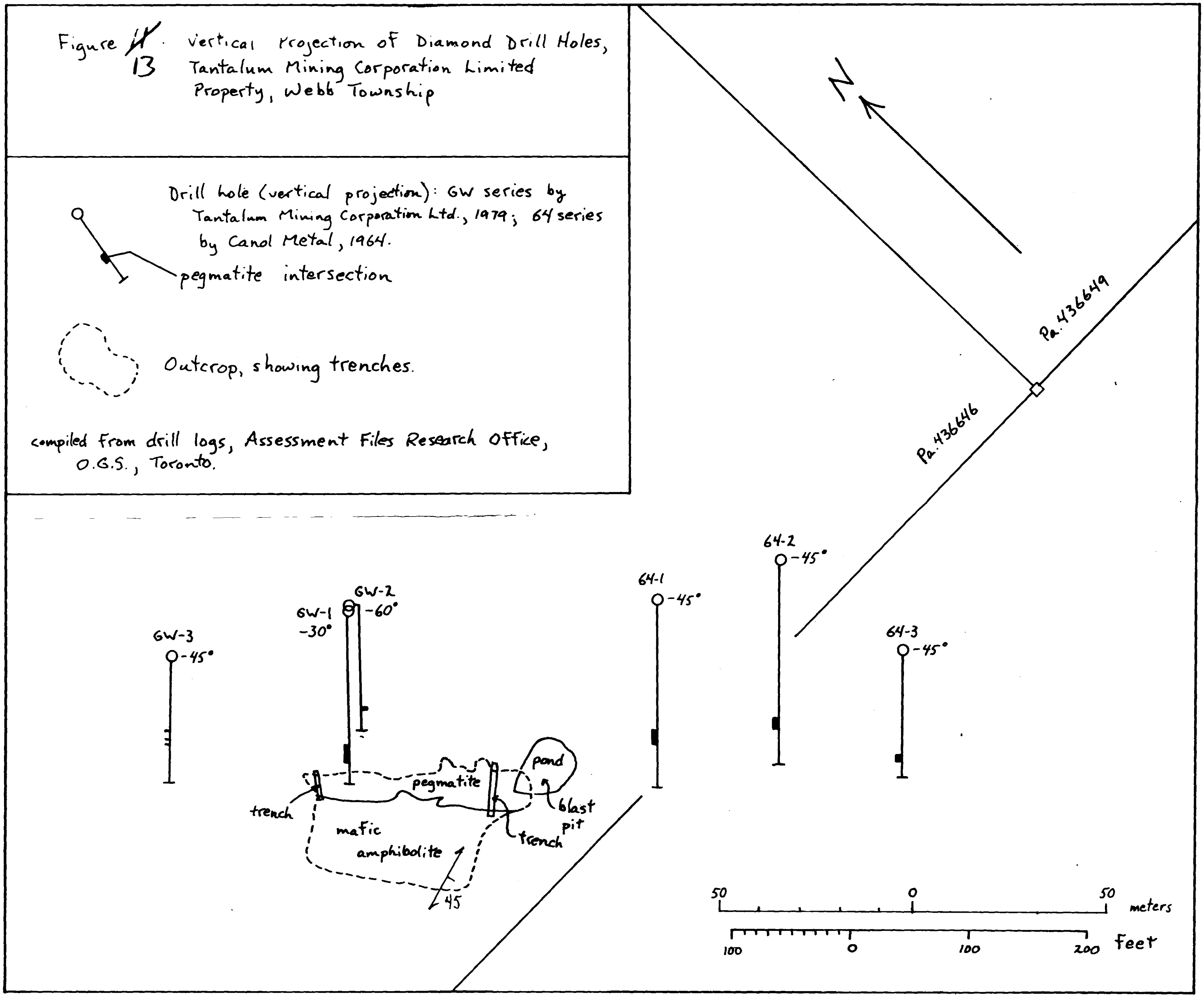
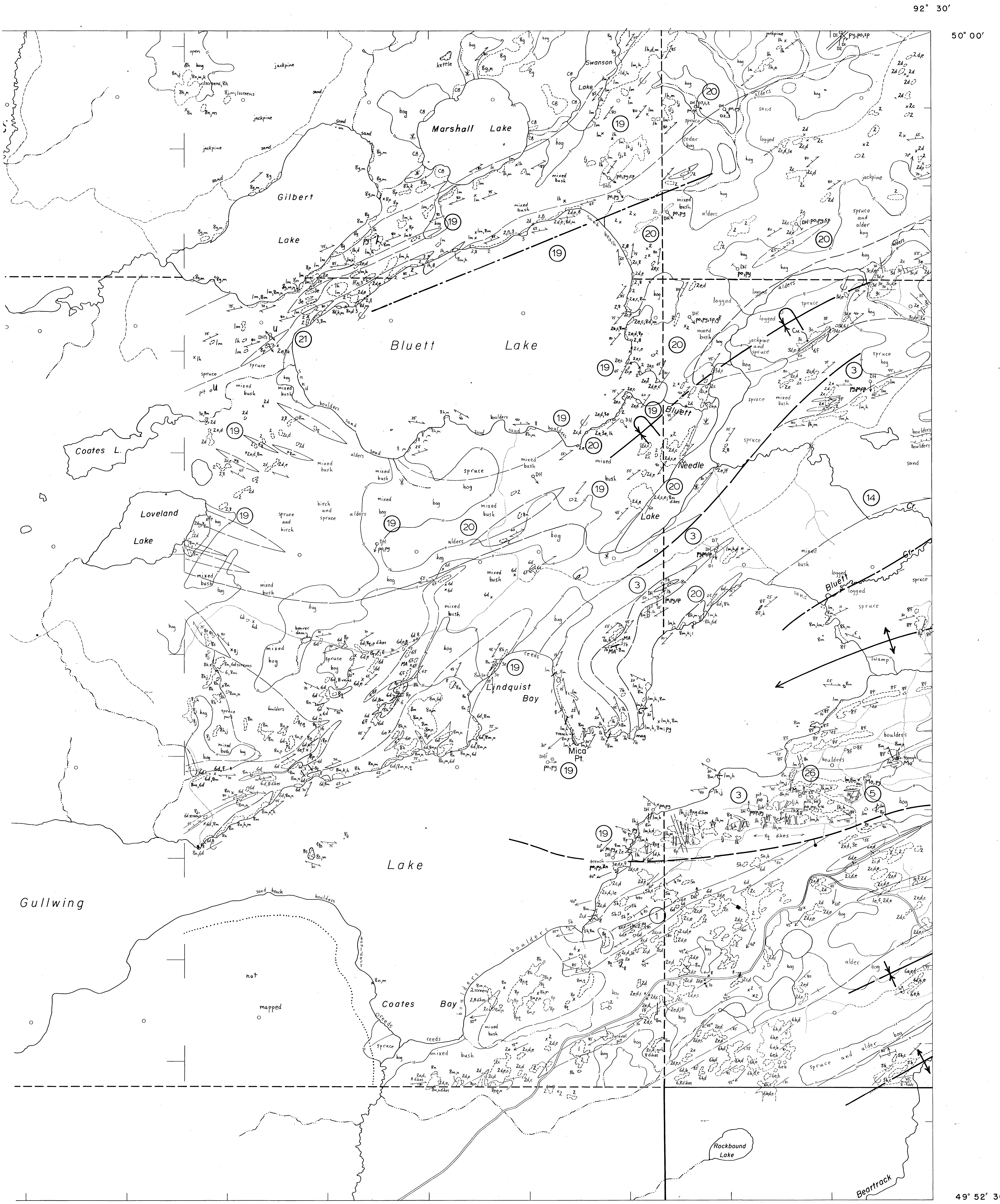


Figure ~~11~~ 13 · vertical projection of Diamond Drill Holes, Tantalum Mining Corporation Limited Property, Webb Township

A

B



NOTE: Geology must be submitted on cronaflex base supplied.
Do not erase geographical intersections or ODM number.

92° 30'

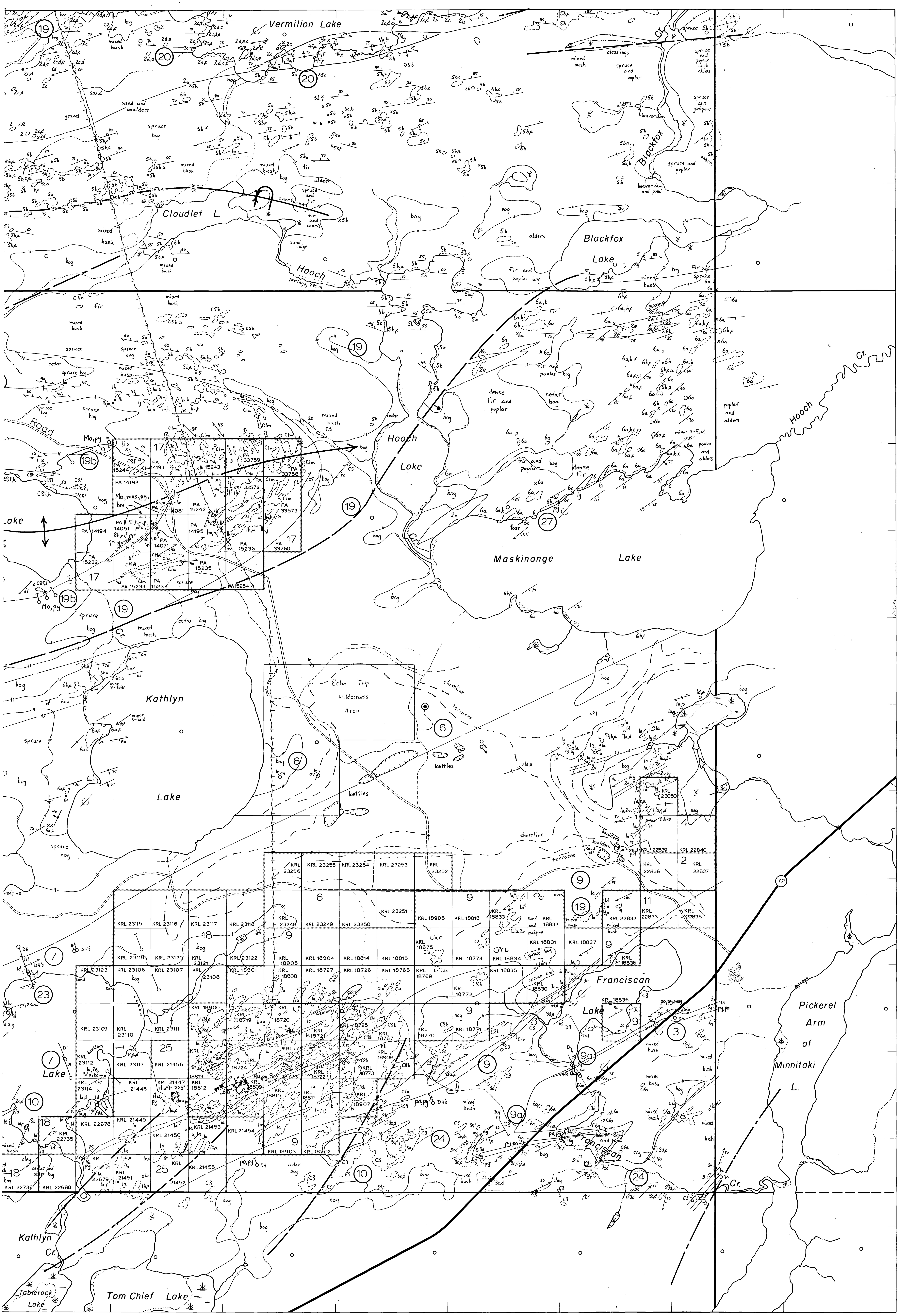
LATERAL L. AREA
Scale 1" = 1/4 mile
SMC. # 14417
FRI # 498923

C

D

92° 15′

50° 00′



49° 52′ 30″

92° 15′

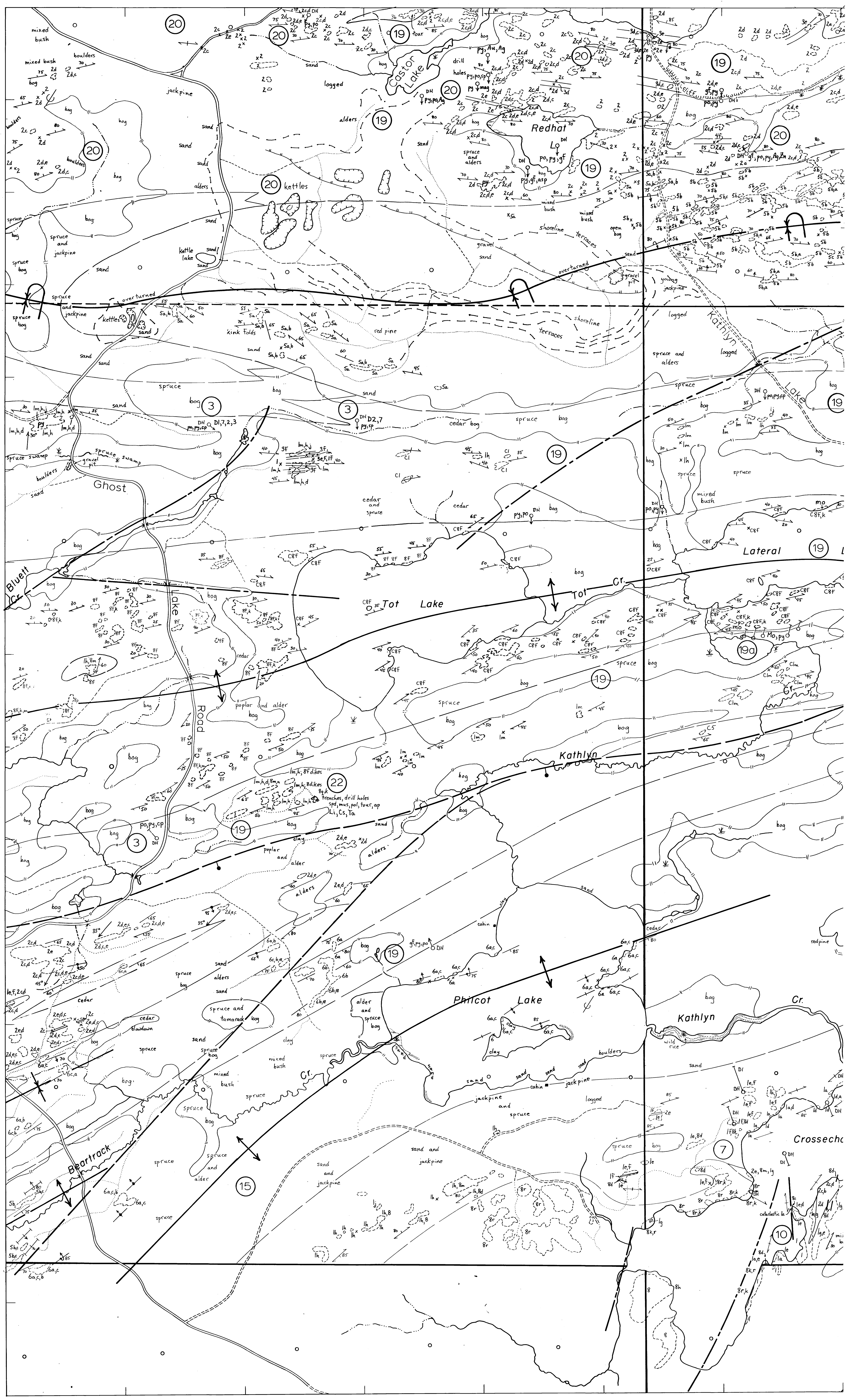
NOTE: Geology must be submitted on cronaflex base supplied.
Do not erase geographical intersections or ODM number.

LATERAL L. AREA
SMC. #14417
FRI. 498922
Scale: 1″ = 1/4 mile

ole Sheet

92° 30′

50° 00′



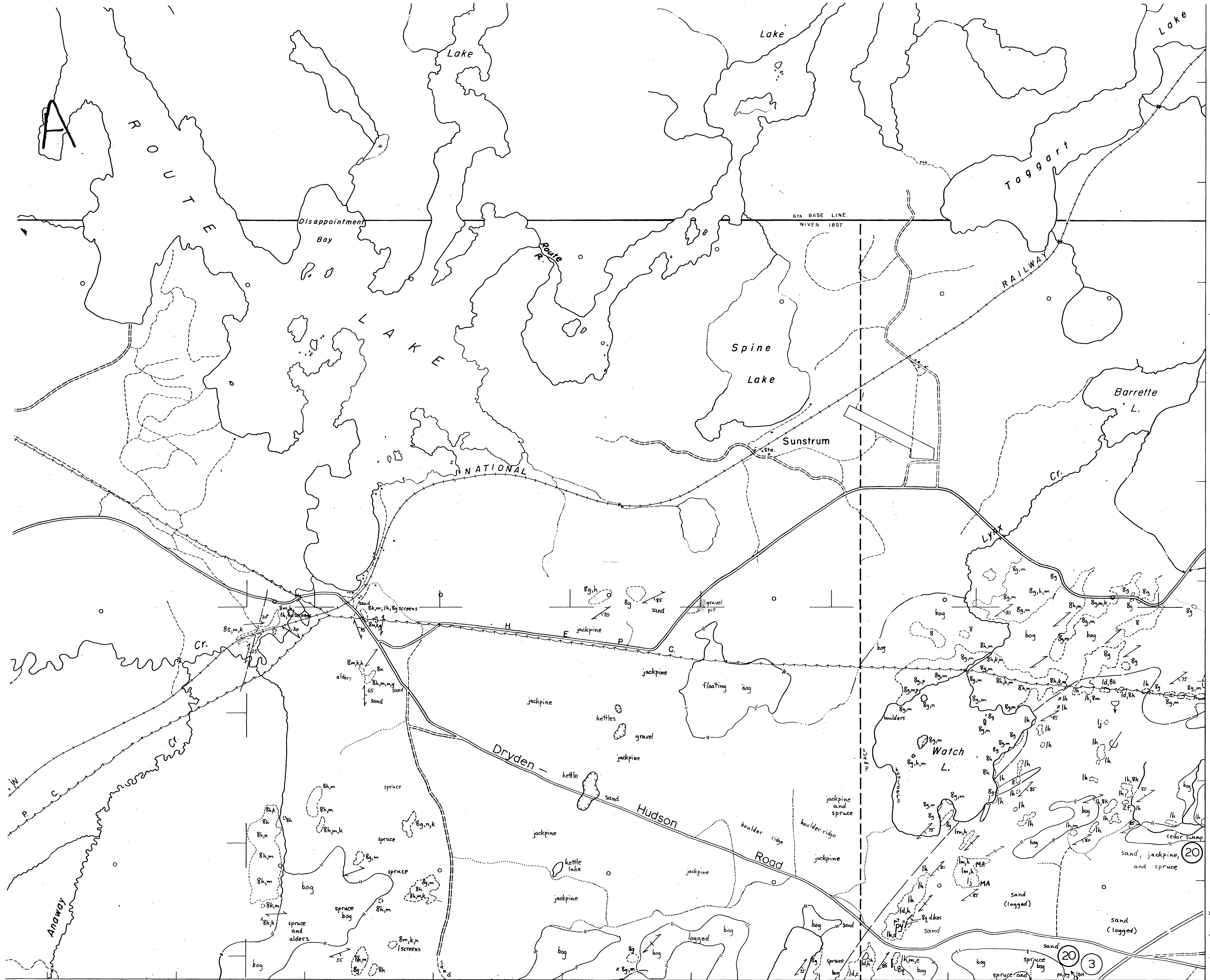
49° 52′ 30″

92° 30′

Wh

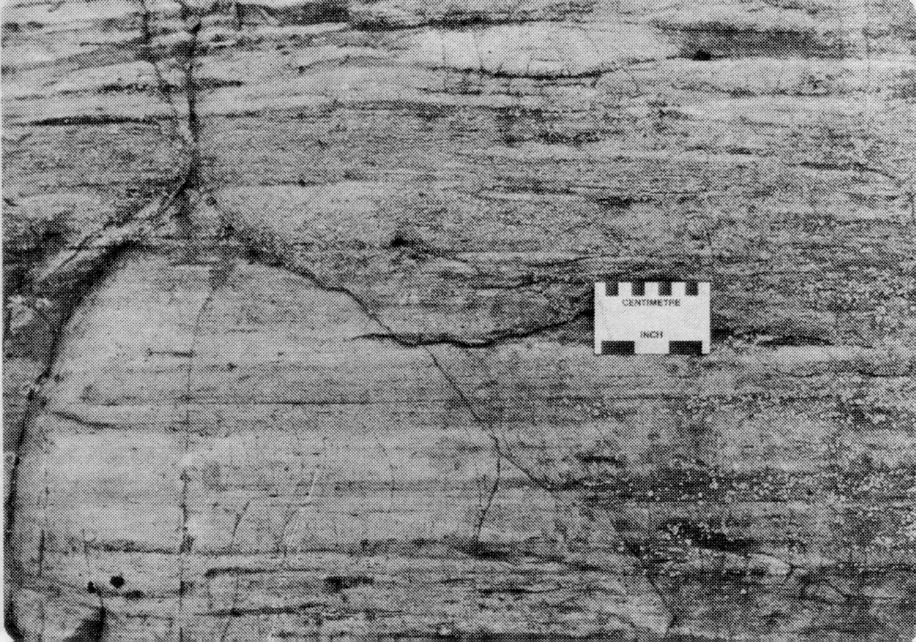
NOTE: Geology must be submitted on cronaflex base supplied.
Do not erase geographical intersections or ODM number.

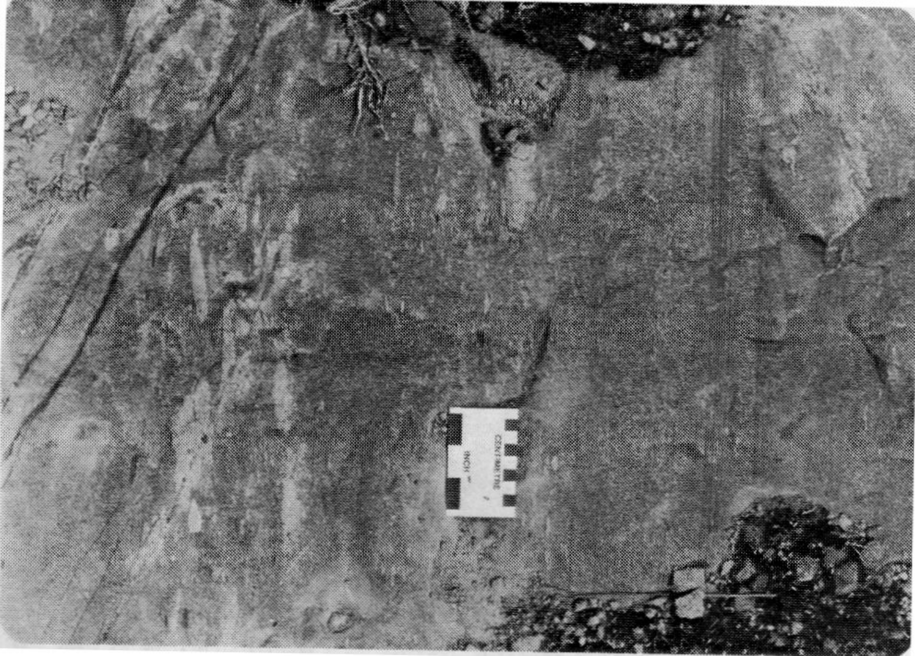
LATERAL L. AREA
SMC.# 14417: F.R.I. #501922
Scale: 1" = 1/4 Mile



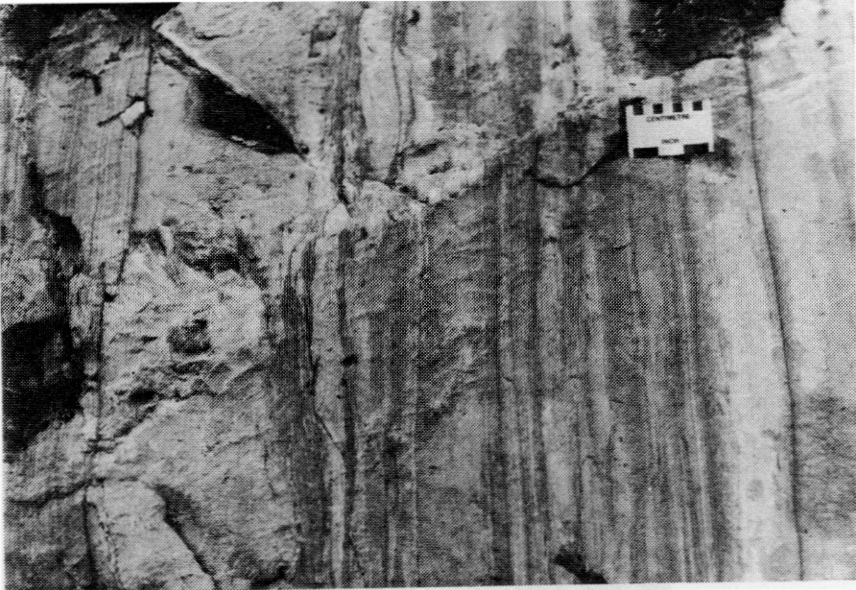
LATERAL L. AREA
Scale 1" = 1/4 mile
SMC# 14417
FRI. # 501923

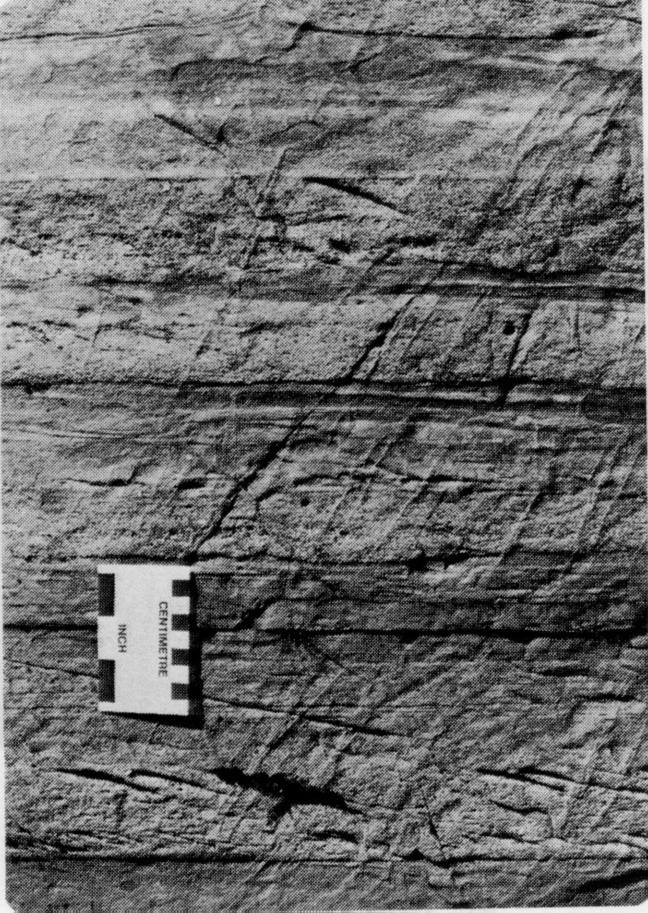
NOTE: Geology must be submitted on cronaflex base supplied.
Do not erase geographical intersections or ODM number.


CENTIMETRE
INCH




CENTIMETRE
INCH




CENTIMETRE
INCH