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Geology of

Halliday and Midlothian Townships

Districts of Sudbury and Timiskaming

By

E. G. BRIGHT

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Geological Map
(back pocket)

Map 2187 (coloured)—Halliday and Midlothian Townships,
Sudbury and Timiskaming Districts.
Scale, 1 inch to ½ mile.

ABSTRACT

Halliday and Midlothian Townships are approximately 40 miles south of the Timmins gold-base metal mining area and 20 miles west of the Matachewan former gold mining area. The report is the result of systematic mapping (at one inch to one quarter mile) during the summer of 1966.

Precambrian rocks occupy the greater part of the Halliday dome, a felsic volcanic dome which covers the adjoining townships of Sothman, Halliday, and Midlothian. The Halliday dome lies near the western flank of the Round Lake granitic batholith.

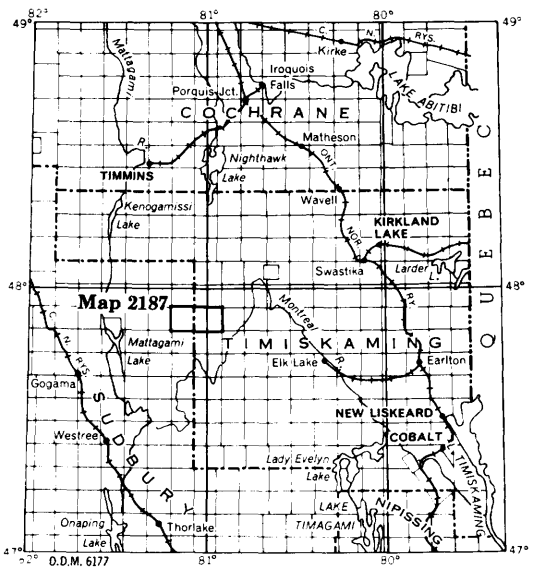

Figure 1–Key map showing location of Halliday and Midlothian Townships. Scale 1 inch equals 1 mile.

Felsic (dacitic to rhyolitic) metavolcanics in the central area of the dome are interstratified with, and surrounded by, intermediate (andesitic to dacitic) metavolcanics. On the northeast margin of the dome, metasediments are intercalated, with minor disconformity, between a younger and older volcanic series. The metavolcanics and metasediments along the margins of the dome occupy axial areas of tight folds. Ultramafic and mafic sills and stocks intrude the outer rhyolitic strata of the dome, and younger, Matachewan-type, diabase dikes occupy some of the north-trending faults and fractures that traverse the map-area. Flat-lying Proterozoic sedimentary rocks in the eastern part of the map-area are intruded by a few small diabase dikes and sills.

Gold and base metal mineralization is found in the outer rhyolitic strata of the Halliday dome. Gold-bearing quartz veins are in the steeply dipping metasediments above the contact with older rhyolitic strata. In Midlothian Township, Stairs Mine produced 2,674 ounces of gold and 1,318 ounces of silver between 1965 and 1966.

Base metal mineralization consists of nickel-copper bearing peridotite and gabbro, lenses of massive graphite-pyrite-marcasite, and zones of disseminated pyrite-pyrrhotite-minor chalcopyrite in the interstratified felsic and intermediate pyroclastic rocks.

Geology

of

Halliday and Midlothian Townships

District of Sudbury and Timiskaming

by

E. G. Bright[1]

INTRODUCTION

Halliday and Midlothian Townships occupy the greater part of a rhyolitic dome approximately 40 miles south of the Timmins gold-base metal mining area and 20 miles west of the Matachewan former gold mining area. Halliday, the westernmost township is in the District of Sudbury; Midlothian Township is in the District of Timiskaming. The Stairs Exploration and Mining Company Limited, Midlothian Township mine produced 2,674 ounces of gold and 1,318 ounces of silver between 1965 and 1966. The Ashley gold mine, a past producing mine is in Bannockburn, the township northeast of Midlothian. The nickel-copper deposit of Kirkland Minerals Corporation Limited is in the southeast corner of Sothman, the adjacent township west of Halliday.

To aid mineral exploration, the Ontario Department of Mines began a systematic geological survey of the "greenstone" belt along the western flank of the Round Lake granitic batholith. This program commenced in 1966 with the mapping of Halliday and Midlothian Townships.

Access

Highway 566, from Matachewan, connects with an all-season secondary road that passes 6 miles north of the map-area. At mileage 28 and 35 from Matachewan a logging road and an extra-high voltage hydro-electric transmission line maintenance road give convenient access to Midlothian and Halliday Townships respectively. Access is provided by aircraft from Timmins or Long Point Lodge near Gowganda.

Field Methods

Field mapping was conducted by pace-and-compass traverses, at a scale 1 inch to ¼ mile. Geological data were plotted on basemaps (cronaflex) provided by the Cartographic Unit of the Ontario Department of Mines. Air photographs from the Silviculture Section, Timber Branch, Ontario Department of Lands and Forests were used in the field. The geology was tied to lakes, roads, and other landmarks identified on the air photographs.

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[1]Geologist, Ontario Department of Mines, c/o Resident Geologist, 4 Government Road East, Kirkland Lake, Ontario. Manuscript received by The Director, Geological Branch, 19 April 1968.

Heavily drift-covered areas received only minimum attention. The geology of the eastern part of Midlothian Township, which is underlain by Huronian sedimentary rocks, was transferred from a map by Marshall (1947), with additional air photographic interpretation by the author. Outcrops of Huronian rocks readily accessible from the shores of Midlothian and Lloyd Lakes were examined.

Uncoloured preliminary geological maps, at a scale of 1 inch to ¼ mile, were published in 1967 and revised in 1968 and may be obtained from the Ontario Department of Mines, Toronto or from the Mining Recorder, Larder Lake Mining Division, Kirkland Lake, Ontario (Halliday Township, P.385 and Midlothian Township, P.386, Bright 1967a and b).

Previous Geological Work

Halliday Township was included in a larger area mapped by T. L. Gledhill, on a reconnaissance scale in 1926 (Gledhill 1926). In 1946, H. I. Marshall made a detailed geological examination of Midlothian Township for the Ontario Department of Mines (Marshall 1947).

Acknowledgments

The author is indebted to Stairs Exploration and Mining Company Limited, for the use of their facilities and for permission to refer to the company's geological maps and reports of the area. Discussions with H. L. Lovell[1] and R. J. Roach[2] on problems pertaining to the geology of the mine and surrounding area were most helpful.

Field assistants were G. H. Cockburn who acted as senior assistant and D. W. Otterman, J. W. Ponikvar, and R. G. Cuddy. Their co-operation is appreciated.

Topography and Drainage

Halliday Township, much of which is covered by glacial drift, has a monotonous flat relief rarely exceeding 100 feet. A more rugged relief, characterized by low rocky ridges separated by narrow northerly and easterly trending valleys, occurs to the east in Midlothian Township. The eastern part of Midlothian Township, which is underlain by Huronian sedimentary rocks, has a maximum relief of about 500 feet above the surrounding countryside.

The height-of-land separating the watershed of the St. Lawrence River system from that of James Bay passes through the southeastern part of Midlothian Township. The eastern part of the map-area is drained by Midlothian Creek which rises in Midlothian Lake and flows north and west to the Grassy River. Lloyd Lake drains to the southwest by way of Rhyolite Lake, Dumbell Lake, and the Grassy River respectively. The Grassy River and two of its branches, one from Halliday Lake and the other from Canoeshed Lake in Hutt, the township to the north, form the drainage system of Halliday Township.

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[1]Resident Geologist, Ontario Department of Mines, Kirkland Lake, Ontario.

[2]Stairs' Resident Geologist and Mine Manager (1967).

Natural Resources

Midlothian Township is well forested with mixed growth of poplar, birch, jackpine, balsam, spruce, and cedar. In contrast, the extensive areas of sand plain in Halliday Township are covered by poplar and birch with jackpine and some red and white pine. Most of the balsam, cedar, spruce, and tamarack are confined to swamps and margins of kettle lakes. In 1951 a fire swept through Sothman and Halliday Townships. Later that year the Feldman Lumber Company of Timmins, Ontario, operated a large scale timber operation in Sothman Township and the central and southern parts of Halliday Township. The second-growth pine that covers much of the sand plain in Halliday Township will be of economic importance in the near future.

The plentiful pike and pickerel in the Grassy River and Halliday Lake are well known to sporting fishermen who frequent the area. Pike and pickerel are also found in Lloyd, Rhyolite, and Dumbell Lakes, and lake trout are present in Midlothian Lake. Moose and bear are abundant, as are otter, muskrat, patridge, and duck. Beaver, lynx, and deer are more scarce. During the fall and winter, many sportsmen frequent the area to hunt moose and bear.

GENERAL GEOLOGY

The map-area occupies the greater part of a felsic volcanic dome which covers the adjoining townships of Sothman, Halliday, and Midlothian. The Sothman-Halliday-Midlothian dome, hereafter referred to as the Halliday dome, lies near the western flank of the Round Lake granitic batholith. The regional geology is shown on the compilation map by Ginn *et al.* (1964).

All the bedrock in the map-area is of Precambrian age. Felsic (dacitic to rhyolitic) metavolcanics in the central area of the Halliday dome are interstratified with, and surrounded by, intermediate (andesitic to dacitic) metavolcanics. On the northeast margin of the dome, metasediments are intercalated, with minor disconformity, between a younger and older volcanic series. The metavolcanics and metasediments along the margins of the dome occupy axial areas of tight folds. Ultramafic and mafic sills and stocks intrude the outer rhyolitic strata of the dome, and younger, Matachewan-type, diabase dikes occupy some of the north-trending faults and fractures that traverse the map-area. Flat-lying Proterozoic sedimentary rocks in the eastern part of the map-area are intruded by a few small diabase dikes and sills.

The unconsolidated silt, sand, and gravel are chiefly of Pleistocene age.

ARCHEAN

METAVOLCANICS

Rhyolitic to dacitic flows, breccias, and tuffs dominate the central region of the Halliday dome and are interstratified with, and surrounded by, andesitic to basaltic flows and pyroclastic rocks (see Figure 2). Because rhyolitic rocks predominate in the core area of the dome (the lower part of the metavolcanic assemblage), they represent the earliest phases of volcanism exposed in the area. On the margin of the dome, in the northeastern part of Halliday Township and the northwestern part of Midlothian Township, metasediments are intercalated with minor discon-

formity between the older rhyolitic strata and a younger series of interbedded andesite and dacite. The interfingering of the volcanic and sedimentary facies suggests that in the later evolutionary stages of the volcanic pile, volcanism was dominant in the western part of the map-area and normal sedimentation was dominant in the eastern part.

Table 1 | TABLE OF LITHOLOGIC UNITS

CENOZOIC

RECENT
Swamp and stream deposits

PLEISTOCENE
Sand, gravel, and silt

Unconformity

PRECAMBRIAN

PROTEROZOIC

LATE MAFIC INTRUSIVE ROCKS ("NIPISSING")
Diabase

Intrusive Contact

HURONIAN

COBALT GROUP (GOWGANDA FORMATION)
Greywacke and pebble greywacke, quartzite, conglomerate, argillite, and arkose

Unconformity

ARCHEAN

MAFIC INTRUSIVE ROCKS (MATACHEWAN)
Diabase

Intrusive Contact

FELSIC INTRUSIVE ROCKS
Granite and feldspar porphyry (dikes)

Intrusive Contact

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS
Serpentinite, peridotite, dunite and pyroxenite, gabbro and diorite

Intrusive Contact

METASEDIMENTS*
Conglomerate, greywacke, arkose, slaty argillite, graphitic tuff and slate, green "carbonate" rock and minor intermediate pyroclastic rocks

Disconformable and Interfingering Contact

INTERMEDIATE AND MAFIC METAVOLCANICS**
Andesitic to dacitic breccias, tuffs, agglomerates, breccias, and flows, amygdaloidal and pillowed andesite, graphitic tuff and slate, and massive basalt

FELSIC METAVOLCANICS**
Rhyolitic to dacitic flows, breccias and tuffs, massive and amygdaloidal rhyodacite, graphitic tuff and slate

*Some metavolcanics are younger than the metasediments.
**The metavolcanics are interstratified, but felsic metavolcanics predominate in the lower part of the stratigraphic succession.

Felsic Metavolcanics

Interstratified rhyolite flows, breccias, and silicic tuff-breccias are most abundant north of Rhyolite and Lloyd Lakes, and along the north shore of Halliday Lake. Rhyodacitic to dacitic flows, breccias, and tuffs, which are interstratified with intermediate and mafic flows and pyroclastic rocks, predominate in the northern and southern parts of Halliday Township. The felsic metavolcanics south of the rhyolitic areas near Rhyolite Lake in Midlothian Township are chiefly massive or amygdaloidal rhyodacites and dacites. In places, finely bedded tuffs and pillowed dacites are present.

The weathered surfaces of the felsic metavolcanics are creamy white to greenish brown; the fresh surfaces are light grey, green to greenish yellow. The areas ot coarsest and most abundant fragmental rhyolite or dacite are near Halliday and Relic Lakes in Halliday Township (Photos 1 and 2), and near Weary, Bess, and Mavis Lakes in Midlothian Township. Some areas of rhyolite and dacite are intensely sheared, and now consist of zones of sericite schist, carbonate-sericite schist, and carbonate-chlorite-sericite schist. Some rocks identified as rhyolite in the field contain less than 5 percent free quartz and are actually trachyte.

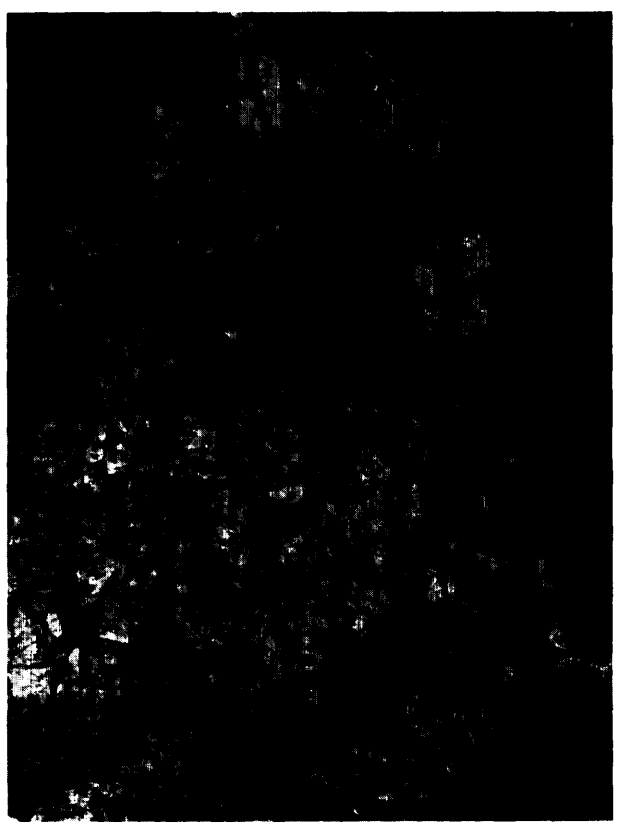

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Photo 1–Rhyolite breccia; 1,000 feet northwest of Halliday Lake.

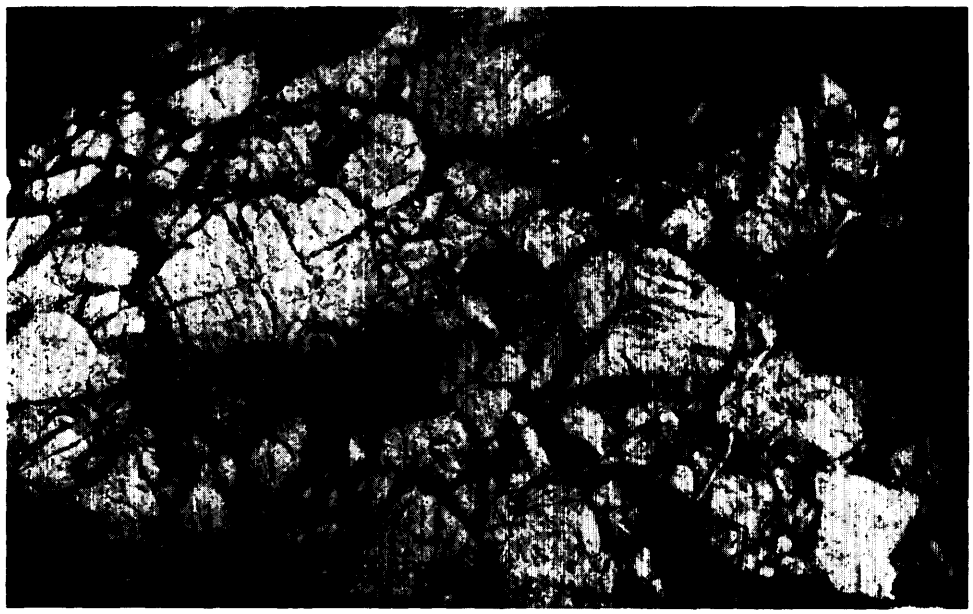

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Photo 2–Rhyodacitic fragments in a darker coloured dacitic matrix; east shore of Relic Lake.

On the southeast shore of Halliday Lake rhyolitic to dacitic mixed flows and breccias are particularly well exposed. Individual flows are massive, porphyritic, or flow laminated. The breccias consist of: rhyolitic or dacitic fragments (ranging in size from ½ inch to 8 inches in diameter) in a matrix of similar composition; or various coloured, massive, porphyritic, fragmental, or flow laminated fragments in a distinctly different felsic matrix.

Brecciated Rhyolite Zones. Northwest of Halliday Lake and south of the small lake on the west boundary of Halliday Township is an area of highly brecciated and silicified rhyolite flows and breccias. On the fresh surface some rock fragments display a distinct mottled green and white alteration. The black cherty matrix consists of a dense, fine-grained silicic material containing disseminated pyrite and minor pyrrhotite. Outcrops of this brecciated rhyolite exposed along the west branch of the Grassy River consist of 60 to 80 percent rock fragments and 20 to 40 percent black cherty matrix. West of the river, near the township boundary, the fractured country rock contains stringers and veinlets of this black cherty material. This area of secondary brecciation might be the product of local subsidence and fumarolic activity in the volcanic pile. Smaller areas of similar brecciated rhyolitic rocks are present: on the hydro line adjacent to the small lake near the northern boundary of Halliday Township; 2,500 feet north of Radio Lake; and a short distance east of Mac Lake in Midlothian Township.

The felsic metavolcanics along the south shore of Rhyolite Lake in Midlothian Township are intensely brecciated and carbonatized. Fine-grained granular white carbonate and calcite form the matrix of this coarse-grained secondary breccia.

Graphitic Zones. Lenses of graphitic tuff and slate containing disseminated to massive pyrite and nodular marcasite are commonly interstratified with silicic tuffs and breccias in the northern rhyolitic strata of the Halliday dome. The largest and most continuous lenses are found near a major change in rock type. Near Frank Lake, a short distance southwest of the Stairs mine shaft is a large zone of graphitic tuff and slate intercalated with the rhyolitic pyroclastic rocks. This 50- to 100-foot wide zone contains disseminated to massive pyrite and nodular marcasite, and extends farther west along strike for about 2 miles. Other major graphitic zones are present: north and northwest of Annie Lake; north of Halliday Lake; on the hydro line near the small lakes along the Halliday Township northern boundary; and between Mavis and Strange Lakes in Midlothian Township.

Intermediate and Mafic Metavolcanics

In Halliday Township, andesitic to dacitic breccias, tuffs, agglomerates, and flows are interstratified with the more abundant felsic metavolcanics along the northern and southern margins of the Halliday dome (see Figure 2). In the northwestern corner of the map-area some fine-grained massive basalt is present. These basaltic lavas occupy the southern edge of a larger area of basaltic to andesitic pillow lavas that underlie the southern part of Hutt, the township north of Halliday (Ginn *et al.* 1964).

The weathered surfaces of the intermediate and mafic metavolcanics are greenish grey to brownish grey; the fresh surfaces are grey, grey-green to dark green. The thinner layers and lenses are predominately massive, porphyritic or amygdaloidal flows with associated minor tuffs and breccias. Pillow structures are scarce and insufficiently developed to provide stratigraphic information. Andesitic to dacitic pyroclastic rocks form the widest and most continuous interbeds particularly in the northern rhyolitic strata of the dome. Lenses of graphitic tuff and slate and zones of disseminated pyrite-pyrrhotite-minor chalcopyrite are associated with these areas of interstratified felsic and intermediate pyroclastic rocks.

In the northern part of Halliday Township, a prominent unit of andesitic to dacitic pyroclastic rocks, about 2,000 feet wide, extends across most of the township. The unit consists of interbedded dark grey to greenish grey breccias, tuffs, and agglomerates containing some zones of disseminated pyrite-pyrrhotite-minor chalcopyrite. In places, the unit is crossfaulted, strongly sheared, and locally carbonatized. On the hydro-electric transmission line west of Annie Lake, several crossfaulted sections of this unit are particularly well exposed. Characteristically the breccias and agglomerates contain a mixture of angular, subangular to rounded, and elongated volcanic fragments which are generally more felsic in composition than the matrix (Photo 3). The fragments generally range from ¼ inch to 1 foot in diameter, but in one outcrop the author observed a 3-foot long subrounded block of banded cherty rhyolite (Photo 4). In order of abundance the fragments are massive or amygdaloidal rhyodacite to dacite, massive and flow banded rhyolite, scoriaceous dacitic bombs, andesitic lava, and graphitic tuff and slate. The nature and variety of rock fragments suggest a nearby explosive volcanic source.

ODM8208

Photo 3—Andesitic tuff-agglomerate-breccia; on hydro-electric transmission line west of Annie Lake.

ODM8209

Photo 4—Flow banded fragments of cherty rhyolite in andesitic tuff-agglomerate-breccia; on hydro-electric transmission line west of Annie Lake.

METASEDIMENTS

In the northern part of Midlothian Township, a belt of metasediments occupies the south limb of a syncline on the margin of the Halliday dome (see Figure 2). The rocks consist of conglomerate, greywacke, arkose, and slaty argillite, with minor interbeds of graphitic slate, green "carbonate" rock, and pyroclastic rocks. The sedimentary assemblage is intercalated with minor disconformity, between a younger and older volcanic assemblage.

Distribution and Thickness

The sedimentary belt extends from Elizabeth Lake, in Midlothian Township, west for about 7½ miles to Campbell Lake, in Halliday Township. East of Elizabeth Lake, the belt is concealed beneath the overlying Huronian strata and just reappears at the eastern boundary of Midlothian Township. West of Campbell Lake, the metasediments disappear beneath thick overburden. Farther west in the northern part of Halliday Township are two small isolated areas of sheared arkose which might be interstratified with the surrounding metavolcanics.

The western part of the belt, which is offset about 3,000 feet to the south by the Mitt Lake Fault, has an average thickness of 5,000 feet. East of the Mitt Lake Fault, the eastern part of the belt ranges from 8,000 feet to 12,000 feet thick.

Description

In the western part of the belt, interbedded pinkish grey to grey arkose, tuffaceous arkosic grit, and black graphitic tuff and slate form the base of the stratigraphic succession. This assemblage disconformably (and in part gradationally) overlies older rhyolitic pyroclastic rocks. The basal arkosic beds are overlain by a thick sequence of grey-green to greenish black weathering pebble conglomerate containing minor interbeds of greywacke and arkose. The conglomerates consist of an open framework of poorly sorted, subangular to rounded volcanic pebbles in a grey-green to dark grey greywacke matrix. In order of abundance, the pebbles are dacite, rhyolite, quartz-feldspar porphyry, "greenstone", and white vein quartz. These characteristics suggest a nearby source area for the sedimentary rocks.

In the eastern part of the belt, pebble conglomerates similar to those described to the west form the base of the stratigraphic succession. Interbedded with the basal conglomerate are subordinate greywacke, arkose, and slaty argillite. In places zones of graphitic tuff and slate, and green carbonate rock separate the conglomerate from the underlying older rhyolitic strata. The basal conglomerate near the southwest shore of Midlothian Lake is overlain by a 6,000- to 8,000-foot thick sequence of interbedded greywacke and conglomerate. Interbedded with these rocks are subordinate layers of dark green to black finely bedded slaty argillite and fine- to medium-grained, massive, pinkish grey pebble arkose. Minor andesitic tuff-agglomerate lenses are interstratified with the greywacke and slaty argillite near the top of the sedimentary stratigraphic succession.

On the portage between Midlothian and Mitre Lakes, stripping with a high pressure hose has exposed an excellent section of interbedded conglomerate and grey-

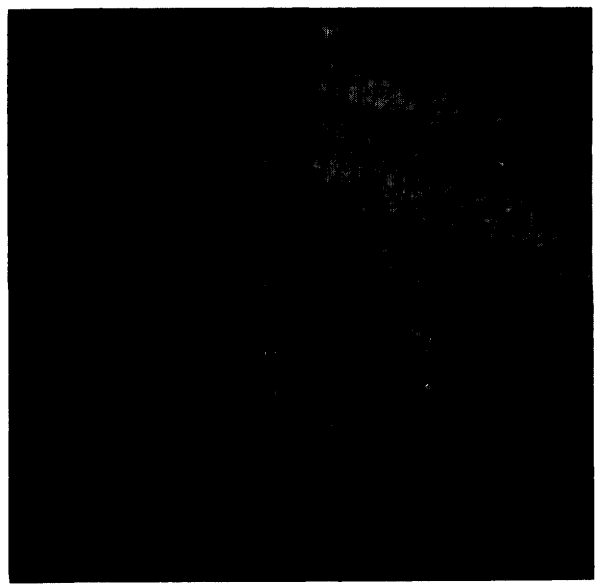

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Photo 5—Interbedded conglomerate and crossbedded greywacke, tops face north; 500 feet south of Roche Bay on Midlothian Lake.

wacke. North-facing beds of greywacke ranging from 1 foot to 10 feet in width exhibit crossbedding (Photo 5), grain gradation, and scour-and-fill structures.

Green Carbonate Zones. East of Mitre Lake in Midlothian Township, a zone of "green carbonate" rock about 2,000 feet long and 250 to 350 feet wide conformably overlies the rhyolitic strata and underlies the sedimentary strata. Northwest along strike, the zone narrows and passes into a zone of graphitic tuff and slate containing disseminated pyrite and nodular marcasite. The green carbonate zone contains irregular patches of fine-grained massive dolomite(?), talc-carbonate rock, and serpentinite. In places, the reddish brown weathered surface of the rocks in this zone displays a polygonal fracture pattern (Photo 6), that is also characteristic of weathered ultramafic intrusive rocks. Similar zones of graphitic tuff and slate and green carbonate rock are intercalated with greywacke, slaty argillite, and minor pyroclastic rocks in the upper part of the metasedimentary sequence near Strike and Tory Lakes.

In the past these green carbonate zones have been considered hydrothermal alteration zones. Because of their conformability and close association with the metasediments the author believes that these rocks are the products of sedimentary processes and subsequent metamorphism.

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS

In the map-area and the adjacent townships, ultramafic and mafic intrusive bodies occur in a belt along the southern, western, and northwestern margins of the Halliday dome (Figure 2).

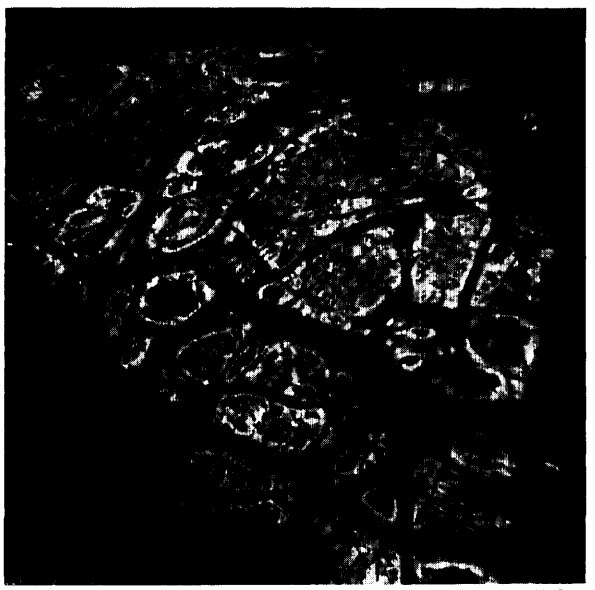

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Photo 6–Weathered surface of green carbonate zone showing polygonal pattern; 1,000 feet northeast of Mitre Lake.

The map-area covers most of the southern part of this belt. Sills and stocks ranging from serpentinite to diorite intrude the outer rhyolitic strata of the dome, and are essentially concordant with the invaded strata. Dense, greenish black serpentinite and fine-grained grey gabbro form sharp contacts with the massive rhyolitic rocks and irregular contacts with fragmental rhyolite or dacite. Slip-fibre asbestos is common along contacts and cross-fibre asbestos is well developed in some shear zones.

Green to greenish black peridotite, pyroxenite, and dunite form a large part of the belt near Rhyolite Lake and the northwest arm of Lloyd Lake. A large sill or stock underlying the northwest arm of Lloyd Lake has a peridotite-dunite centre and a pyroxenite-gabbro marginal phase. Most of the narrower ultramafic intrusions are serpentinized throughout. The following description of the peridotite is from a report by Marshall (1947, p. 10):

> For the most part, the texture is fibrous; ophitic texture is not uncommon. The mineral constituents are chiefly olivine, pyroxene (enstatite), sepentinite and magnetite with minor amounts of plagioclase and quartz. Most of the olivine has been altered to serpentinite with separation of a fairly large percentage of minute particles of magnetite or ilmenite. The pyroxene has been altered to serpentine. Other alteration products are sericite, chlorite, talc, calcite, and leucoxene.

The intrusive belt south of Dumbell and Rhyolite Lakes consists mainly of grey to grey-green gabbro; peridotite was seen locally. The following description is also from the report by Marshall (1947, p. 11):

> The gabbro is quite similar to the peridotite in appearance except that it is somewhat fresher and much harder. Commonly the texture is ophitic rather than fibrous. The mineral constituents are feldspar (labradorite or andesine), augite or hornblende, olivine, magnetite, and ilmenite.

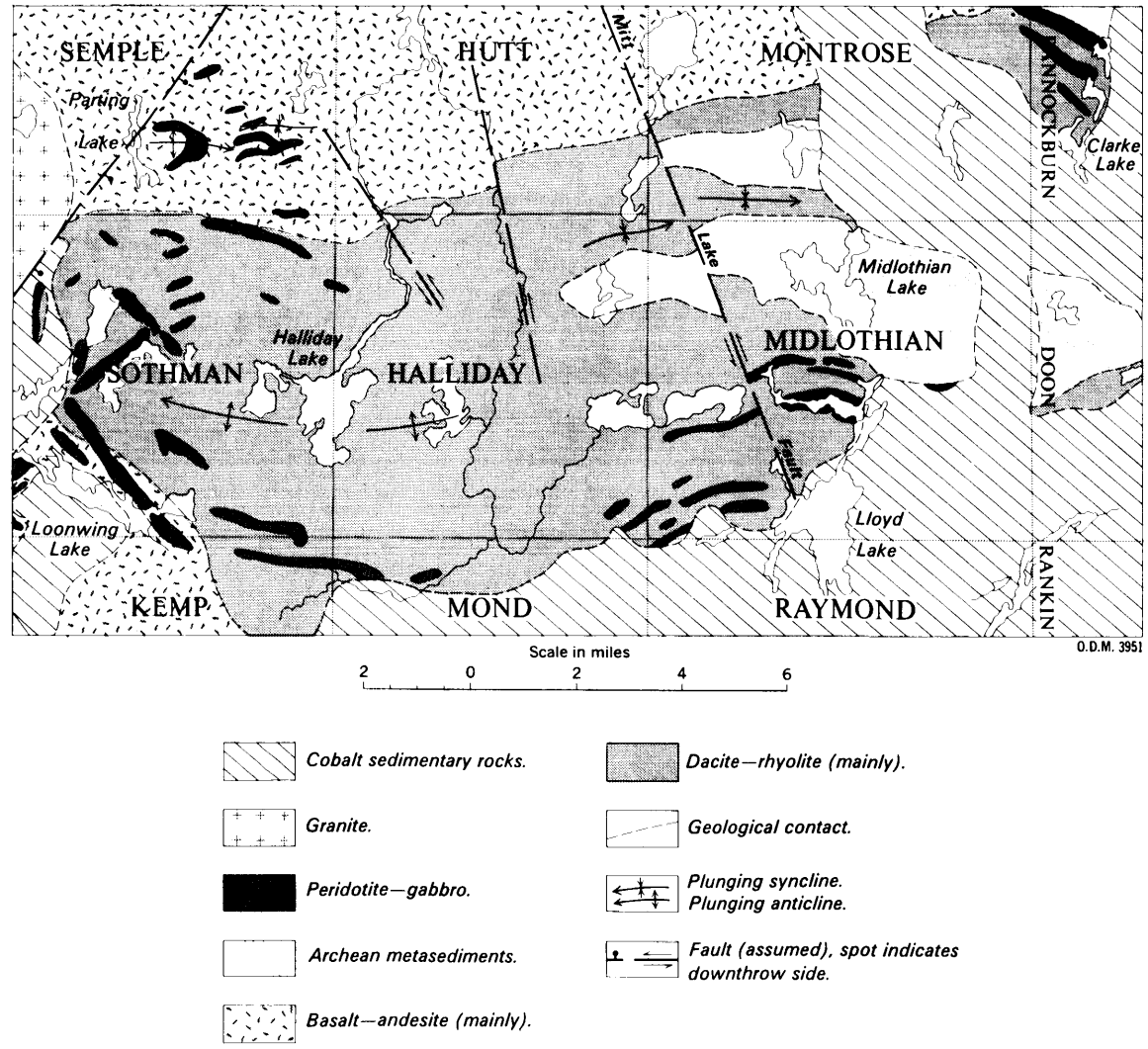

Figure 2—Main structural features of the interpreted Halliday dome.

FELSIC INTRUSIVE ROCKS

Several small felsic dikes were recognized in the map-area. Fine- to medium-grained grey granite or granodiorite dikes intrude the felsic metavolcanics 2,000 feet south of Sirola Lake, and along the northwest-trending arm of Lloyd Lake. A fine-grained reddish brown feldspar porphyry dike cuts the metasediments 500 feet northwest of the western end of Midlothian Lake.

LAMPROPHYRE

In Halliday Township a mafic dike is exposed on the hydro-electric transmission line northwest of Annie Lake; this dike is a fine- to medium-grained reddish green mafic syenite or lamprophyre.

MAFIC INTRUSIVE ROCKS ("MATACHEWAN")

Dikes of "Matachewan" diabase are numerous in the map-area, particularly between Rhyolite and Midlothian Lakes. These diabase dikes occupy many of the north-trending faults and fractures in the country rock. Nowhere in the map-area are the "Felsic Intrusive Rocks" and the "Matachewan-type" rocks found in contact although they are found in close proximity, for example along the northwest arm of Lloyd Lake.

The diabase weathers reddish brown and is medium- to coarse-grained, and dark grey on the fresh surface. Oval or spherical phenocrysts of altered plagioclase, a characteristic of the north-trending dikes in the Matachewan area, were observed on the west shore of Relic Lake. The following description is taken from Marshall (1947, p. 11, 12):

> The texture is ophitic. The mineral constituents are labradorite feldspar, augite, quartz, magnetite, and ilmenite, with minor amounts of biotite, apatite, and epidote. Alteration products are sericite, kaolin, and leucoxene. The plagioclase occurs in lath-shaped crystals, which show strain extinction. Quartz although very minor in amount in some specimens, is present in all . . . . Although alteration is present, the rocks are quite fresh in comparison to the Haileyburian peridotites.

PROTEROZOIC

Huronian

COBALT GROUP (GOWGANDA FORMATION)

The Gowganda Formation, the lowest division of the Cobalt Group, unconformably overlies the Archean rocks in the eastern part of the map-area. The upper contact of the Gowganda Formation is an intrusive contact where the younger rock is "Nipissing" diabase. The rocks of the Gowganda Formation consist of horizontal or gently dipping interbedded greywacke, conglomerate, quartzite, argillite, and some arkose.

Massive fine-grained greywacke and bedded pebble greywacke predominate in the map-area. The rocks are reddish brown (hematite-stained) to brownish grey on the weathered surface and dark greenish grey on the fresh surface. Well bedded greywacke with subordinate beds of conglomerate, argillite, and quartzite are exposed along the eastern shore of Lloyd Lake.

Conglomerate beds, ranging in thickness from 6 inches to 5 feet, consist of an open framework of "granite" and "greenstone" pebbles in a dark green to grey greywacke or quarzite matrix. The well rounded pebbles average between 2 and 5 inches in diameter and the matrix of the conglomerates is commonly hematite-stained. A few outcrops of coarse pebble and boulder conglomerate are exposed near the base of the Gowganda Formation. The following description of a basal conglomerate exposed near the older sedimentary rocks west of Maher Lake is taken from Marshall (1947, p. 12):

> The conglomerate consists largely of boulders of granite in a matrix of granitic and greenstone material. Other boulders noted were greenstone, gneiss and quartz. The boulders are generally well rounded and average 1 foot in diameter.

Other exposures of boulder conglomerate are present north of Upper Winding Lake, southwest of Jean Lake, and west of Lakoma Lake.

Massive interbeds of quartzite and feldspathic quartzite in the conglomerates and greywacke along the southwest shore of Lloyd Lake are pinkish grey, medium-grained rocks. In places where the proportion of feldspar is very high, the rock is an arkose.

In the southeast corner of Midlothian Township, thinly bedded, dark reddish green to black, fissile argillite is interbedded with greywacke.

The upper contacts between some beds of argillite, and argillite and greywacke show slump and scour-and-fill structures.

Post-Huronian

LATE MAFIC INTRUSIVE ROCKS ("NIPISSING")

Marshall (1947) identified and mapped a few small outcrops and sill-like bodies of very fresh looking, medium- to coarse-grained, dark grey diabase which seemed to intrude the Huronian rocks, east of Lloyd Lake. The diabase was not observed in direct contact with the Huronian rocks, but Marshall (1947, p. 13) reported, that a dike-like outcrop of diabase occurred within a few feet of the Huronian rocks, northeast of Roche Lake. The following description of the diabase is from Marshall (1947, p. 13):

> The texture is ophitic. The mineral constituents are hypersthene, labradorite, olivine, apatite, and magnetite, with minor amounts of pyrite. All the minerals are very fresh with little or no evidence of alteration.

CENOZOIC

PLEISTOCENE AND RECENT

Most of Halliday Township is covered by a gently rolling glacial outwash plain containing many kettle lakes. Sediments in the outwash plain consist of moderately well sorted sand and lenses of sand and gravel. Upsiloidal and irregular dunes in the northwest and southwest parts of Halliday Township were formed by prevailing northwesterly winds during early post-glacial times. Interspersed between the present major drainage systems of the outwash plain are large areas of muskeg and swamp accumulation.

Midlothian Township has a much thinner drift-cover consisting principally of poorly sorted glacial sand, silt, and gravel.

STRUCTURAL GEOLOGY

FOLDS

The regional structure (see Figure 2) indicates that Halliday and Midlothian Townships occupy the greater part of a rhyolitic dome. The Halliday dome which covers the adjoining townships of Sothman, Halliday, and Midlothian is about 20 miles long and 9 miles wide, and lies near the western flank of the Round Lake granitic batholith. Along the margins of the dome intermediate to mafic metavolcanics, and in places metasediments, occupy axial areas of tight folds. The regional trend of metavolcanic, metasedimentary, and associated ultramafic and mafic intrusive rocks, together with the majority of top determinations agree with the above structural interpretation.

In the north-central part of the map-area, a belt of metasediments lies on the south limb of an east-trending syncline. Stratigraphic top determinations are indicated by grain gradation, crossbedding, and scour-and-fill structures developed in the metasediments, particularly south of Roche Bay on Midlothian Lake and near Slipper and Fold Lakes at the western end of the belt. The metavolcanics overlying the metasediments occupy the axial plane area of the syncline. The axis of the syncline trends N70°E through Cecil Lake to the Mitt Lake Fault, where it is displaced north about 3,500 feet into Montrose, the township north of Midlothian. Drilling information supplied by Stairs Exploration and Mining Company Limited (Roach and Hope 1964), indicates an east-plunging fold.

In Halliday Township structural interpretation is hampered by major cross-faulting, poorly exposed bedrock, and the lack of reliable features for the determination of tops. A prominent easterly trend to the country rock is indicated from strikes and dips taken on: major rock-type contacts; mixed bedded tuffs, agglomerates, and breccias; and laminated flows.

FAULTS AND SHEARS

The faults shown on Map 2187 (back pocket) were determined from the displacement of major marker strata indicated by field mapping and interpretation of air photographs. Some fault zones are narrow and the exposed adjacent rocks are non-schistose.

In Halliday Township, north-trending faults and northeast-trending shear zones are common. North- to northwest-trending left-lateral faults, along the east and west branches of the Grassy River, offset the volcanic strata about 7,000 feet and 1,500 feet respectively. These faults intersect an older system of north- and northeast-trending right lateral faults which are particularly numerous near Relic and Annie Lakes.

To the east in Midlothian Township, a system of north-trending left-lateral faults along Mitt Lake and Fault Lake offset the metavolcanic-metasedimentary contact about 3,500 feet and 600 feet respectively. The abrupt termination of the metasediments between Campbell and Radio Lakes suggests either a major fault displacement or a very rapid pinching out of the strata.

Local strike-slip shearing possibly related to folding is common near major contacts and in graphitic tuffs, slates, and breccias. The east-trending contact of the metavolcanics with the metasediments is a prominent zone of intensive shearing.

A northeast-trending zone of sheared felsic metavolcanics, averaging 2,500 feet in width, extends 2½ miles from Dumbell Lake to Sirola Lake. A short distance east of Sirola Lake, the shear zone is offset about 2,000 feet to the north by the left-lateral Mitt Lake Fault. The northeast faulted extension of this shear zone cuts both the metavolcanics and the metasediments. If the northeast-trending right-lateral faults and this shear zone are related, the Mitt Lake and associated north-trending left-lateral faults are the youngest major faults in the map-area.

ECONOMIC GEOLOGY

The northern part of the map-area has been intensively prospected for gold since as early as 1909, but not until 1966 was production obtained; this production was from the Stairs Exploration and Mining Company Limited mine in the north-western part of Midlothian Township.

During the 1950s and early 1960s most investigations were concentrated on the potential gold-bearing metasediments and the principal asbestos and copper-nickel showings associated with ultramafic and mafic sills and stocks intruding the rhyolitic strata.

Since 1965, the search for base metal sulphide deposits has been concentrated in areas of interstratified fragmental rhyolites and andesites containing lenses of graphite-pyrite-marcasite and zones of disseminated pyrite-pyrrhotite-minor chalcopyrite.

The summary of the exploration work carried out in the map-area is listed under the main mineral headings of Asbestos, Base Metal Sulphides, and Gold and Silver, and then described either under the name of the current property owner or, for unclaimed areas, under the name of a previous owner with the date of the last major work in square brackets following the name.

A list of assessment work reports filed to the end of March, 1968 is given in Table 2.

DESCRIPTIONS OF PROPERTIES AND EXPLORATION AREAS

Asbestos

Stringers and veinlets of cross- and-slip-fibre asbestos cut the serpentinized ultramafic intrusive rocks of the map-area. A cross-fibre asbestos zone approximately 4,000 feet long and 200 feet wide is present along the north shore of the west arm of Lloyd Lake in Midlothian Township.

ASBESTOS LLOYD MINES LIMITED (10)*

The company was incorporated in 1953, and at that time acquired their present group of 6 surveyed claims along the north shore of the west arm of Lloyd Lake in Midlothian Township. In 1967, the property consisted of claims MR18031 to MR18036 inclusive; this property was formerly held by W. E. VanClieaf.

The greater part of the property is occupied by an ultramafic sill or stock with a dunite-peridotite core surrounded by pyroxenite and gabbro. An east-trending shear zone exists along the north shore of the lake.

*Numbers in brackets refer to property numbers on Map 2187, back pocket.

Table 2 — PROPERTIES FOR WHICH ASSESSMENT DATA IS ON FILE WITH THE ONTARIO DEPARTMENT OF MINES, AS OF 31 MARCH 1968

PROPERTY* NUMBER	FILE NAME	DATE OF WORK	TYPE OF WORK	NUMBER OF DRILL HOLES	FEET DRILLED	TORONTO FILE NO.	TOWNSHIP H-HALLIDAY M-MIDLOTHIAN	FILED AT KIRKLAND LAKE ONLY[1]
1, 2, 3	Amax Exploration	1967	DD	....	....	....	H	X
10	Canadian Johns-Manville	1950	DD	3	1,604	7-2-38	M	....
....	Canadian Johns-Manville	1952	DD	....	....	....	....	X
4	Cominco (Annie Lake)	1965	DD	....	....	....	H	X
11	Cominco (Lloyd Lake)	1965	DD	....	....	....	M	X
12	Cominco (Ragan)	1945	DD	....	....	....	M	X
....	Dominion Gulf	1950	GL; dip needle	....	....	63A.117	H	....
8	Dominion Gulf	1952	DD; GL; GP, Mag	5	2,171	63.301	H	....
13, 14, 18	Dominion Gulf	1956	DD; GL; GP, Mag	3	....	63.366	M	....
....	Halliday Mines (W. J. Cooper)	1964	GL	....	....	63A.440	H	....
....	Halliday Mines	1964	DD	3	830	7-3-12	H	....
10, 14, 15, 17, 23	Laroma Midlothian	1963	GL; GP, (A)EM	....	....	63.1311	M	....
15	Laroma Midlothian	1964	DD	6	2,051	7-1-41-43	M	....
....	Morgan, C. R.	1963	DD	....	....	....	....	X
20	Riocanex	1964	DD; GL	....	....	....	....	X
21	Sherwood Gold Mines	1946-47	GL	....	....	63A.30	M	....
21	Stairs Exploration & Mining	1959-61	DD	10	1,031	7-10-37	M	....
21	Stairs Exploration & Mining	1962	DD	8	2,811	7-8-36	M	....
21	Stairs Exploration & Mining	1963	DD	1	1,198	7-1-35	M	....
6, 21	Stairs Exploration & Mining	1963	DD; GL; GP, (A) Mag	....	....	63.1224	H; M	....
6	Stairs Exploration & Mining	1963	DD	4	1,380½	7-4-13	H	....
6	Stairs Exploration & Mining	1963	DD	1	494	7-1-11	H	....
6, 21	Stairs Exploration & Mining	1964	DD; GL; GP, (A) EM	....	....	....	H; M	X
21	Stairs Exploration & Mining	1964	DD	2	682½	7-1-39-40	M	....
6, 21	Stairs Exploration & Mining	1965	DD	2	735	7-2-14	H; M	....
6	Stairs Exploration & Mining	1965	DD	1	606	7-1-15	H	....
....	Stairs Exploration & Mining	1966	DD	1	300	7-1-315	H	....
....	Sylvanite Gold Mines	1943	GL	....	....	....	....	X
8	Talisman Mines	1967	GP, EM,Mag	....	....	63.2270	H	....
9	Texas Gulf Sulphur	1968	DD	....	....	....	H	X

Abbreviations used: (A)-Airborne; DD-Diamond drilling; EM-Electromagnetic; GL-Geological; GP-Geophysical; Mag-Magnetic.

*Number refers to property number on Map 2187, back pocket.

[1]For more details of data filed at Kirkland Lake see Lovell 1968, p. 111-116.

In 1950, Canadian Johns-Manville Limited optioned this property (from W. E. VanClieaf) as well as the Miller property (16) farther west, and the Copeland property (23) farther east. Seventeen holes with a total length of 11,400 feet were drilled in an east-west cross-section of claims TR1930, MR18031, MR18032, MR18034, MR18036, MR18072, and MR18071. The drilling results indicated a cross-fibre asbestos zone approximately 4,000 feet long and 200 feet wide. Most of the fibre is about 1/8 inch long but in many places reaches lengths of ¼ inch (Koski and Garvie 1950)

DOMINION GULF COMPANY [1952-1954] (13)

In May 1952, Dominion Gulf Company held a group of 28 unsurveyed claims near the west arm of Lloyd Lake in Midlothian Township (the area of this claim group included the surveyed claims MR20050 and MR20051). These claims surrounded the T. H. Miller property (16) and the former VanClieaf (10) and Copeland (23) claims, all of which were under option at that time to Canadian Johns-Manville Limited.

Dominion Gulf made detailed geological and ground magnetometer surveys of their claim group. A drill hole on claim MR20051 (property 18) intersected serpentinized pyroxenite and peridotite containing cross-fibre asbestos.

In 1952, the company optioned the Miller property (16) near their holdings, to investigate a cross-fibre asbestos zone.

T. H. MILLER, EXECUTOR (16)

The T. H. Miller claims TR1929 to TR1931 are in Midlothian Township at the western end of the northwest arm of Lloyd Lake. The claims are underlain by a differentiated ultramafic sill or stock intruded into rhyolitic flows.

In 1950, Canadian Johns-Manville Limited optioned the property together with the former VanClieaf (10) and Copeland (23) claims farther east. Five holes with a total length of 1,915 feet were drilled in the central and southern parts of claim TR1930. The drilling indicated that a 3,000-foot cross-fibre asbestos zone to the east, on the former VanClieaf property (10), continued for about 1,000 feet across claim TR1930. Most of the fibre is about 1/8 inch long but in places reaches lengths of ¼ inch (Koski and Garvie 1950).

In 1952, the property was optioned by Dominion Gulf Company. Three holes were drilled on claim TR1930 and several asbestos showings on the property were trenched and sampled. W. S. Savage, Resident Geologist for the Ontario Department of Mines at Kirkland Lake, visited the property in July 1952, and was later informed by the company geologists that their work indicated a fibre zone about 1,200 feet long and 200 feet wide.

G. E. PARSONS (18)

In 1967, Garfield E. Parsons held a surveyed claim (MR20051) north of Marshall Lake in Midlothian Township. In 1953, Dominion Gulf Company made a geological and ground magnetometer survey of the claim; the southwestern part of the claim is underlain by rhyolite intruded by peridotite and gabbro.

TALISMAN MINES LIMITED (8)

Cross-fibre asbestos stringers were found. See property description under "Base Metal Sulphides".

W. E. VanCLIEAF (23)

In 1967, Wilbert Earl VanClieaf held the former Copeland property, a group of nine surveyed claims, on and north of Lloyd Lake in Midlothian Township. The claims are MR18066 to MR18074 inclusive.

In 1950, Canadian Johns-Manville Limited optioned this property together with

the adjoining claims farther west. Two drill holes, one on claim MR18071 and the other on MR18072, intersected serpentinized dunite containing slip-fibre asbestos.

Base Metal Sulphides

Disseminated chalcopyrite, sphalerite, galena, and in places silver-bearing tetrahedrite, are associated with gold-bearing quartz veins in the lower part of the metasedimentary sequence which disconformably overlies the older rhyolitic strata.

Scattered occurrences of pyrrhotite, sphalerite, and chalcopyrite mineralization are found in fragmental rhyolite or dacite near the contact with ultramafic and mafic intrusive sills and stocks. A copper-nickel showing in rhyolite, adjacent to serpentinite, is on the south shore of Bray Lake in central Midlothian Township. Significant concentrations of copper and nickel in the ultramafic and mafic intrusive rocks have not been reported.

Minor chalcopyrite is associated with zones of disseminated pyrite and pyrrhotite in the interstratified rhyolitic to andesitic pyroclastic rocks, particularly in the northern part of Halliday Township.

AMAX EXPLORATION INCORPORATED (1, 2, 3)

In 1967, Amax Exploration Incorporated held three large groups of unsurveyed claims in Halliday Township: the Adele Group (1), a block of 35 claims near the hydro-electric transmission line along the northern boundary of the township; the Pat Group (2), a block of 25 claims northwest of Annie Lake; and the Barbara Group (3), a block of 11 claims on the west side of Campbell Lake. In August 1966, an airborne magnetic and electromagnetic survey of Halliday and nearby townships was made. During the spring and summer of 1967 geological mapping was carried out under the direction of J. M. Patterson* and an induced polarization survey and several drill holes tested the most promising conductive zones outlined by airborne geophysics.

Adele Group (1). On this group, a hole drilled to a depth of 810 feet intersected: 48 feet of rhyolitic breccia containing 1 to 2 percent pyrite; followed by 256 feet of graphitic tuff and slate containing disseminated to massive pyrite; followed by 506 feet of interstratified rhyolitic to dacitic flows and breccias containing an average of 6 percent pyrite. In the core from another hole drilled farther east, the author saw an isolated stringer of massive chalcopyrite about ½ inch wide cutting rhyolite-dacite.

Pat Group (2). A drill hole about 2,000 feet north of Annie Lake intersected 358 feet of interbedded andesitic-dacitic lapilli-tuff and graphitic tuff-breccia containing disseminated pyrite, pyrrhotite, and minor chalcopyrite. A band of dark grey andesitic-dacitic tuff-agglomerate-breccia about 2,000 feet wide trends east-northeast across Annie Lake. This band of intermediate pyroclastic rocks contains zones of disseminated pyrite, pyrrhotite, and minor chalcopyrite. Lenses of graphite-pyrite-marcasite occur near its northern and southern contacts with rhyolitic strata.

*Geologist, Amax Exploration Incorporated.

Barbara Group (3). The Barbara Group of claims is not described in this report.

COMINCO LIMITED [1965] (4, 11)

Annie Lake Group (4). In 1965, Cominco Limited held a group of unsurveyed claims around Annie Lake in Halliday Township. On the west side of Annie Lake, the company drilled several holes to investigate an electromagnetic conductor in a wide band of intermediate pyroclastic rocks containing disseminated pyrite, pyrrhotite, and minor chalcopyrite. The drill holes intersected zones of graphitic tuff and slate containing disseminated to massive pyrite and nodular marcasite.

Lloyd Lake Group (11). In 1965, Cominco also held a group of 20 unsurveyed claims on the southwest shore of Lloyd Lake in Midlothian Township. The company drilled several holes in the felsic metavolcanics a few hundred feet south of an ultramafic-mafic sill. A 100-foot drill hole in the southeast corner of claim MR39864 intersected about 50 feet of disseminated pyrite, pyrrhotite, and minor chalcopyrite. Cominco (Snodin 1965) estimated the amount of pyrite to be 10 to 12 percent and pyrrhotite, 3 to 5 percent.

DOMINION GULF COMPANY [1956] (14)

Between 1953 and 1956, Dominion Gulf Company held a large block of unsurveyed claims, north of Lloyd Lake, that included the Bray Lake copper-nickel showing (see Morgan property 17).

The Dominion Gulf geological and ground magnetometer surveys of the area show two small magnetic anomalies directly related to pyrite, pyrrhotite, and minor chalcopyrite mineralization in rhyolitic to dacitic flows and breccias. One magnetic anomaly, approximately 600 feet long and 200 feet wide lies about 300 feet northwest of the No. 1 post on claim MR18073. The other, a smaller anomaly, lies about a quarter mile farther west. The author knows of no drilling done on these anomalies.

C. R. MORGAN (17)

In 1966, C. R. Morgan of Swastika, Ontario, held a group of 12 unsurveyed claims including the Bray Lake copper-nickel showing. Between 1953 and 1956 the showing was examined by Dominion Gulf Company, and a geological and geophysical survey was made. The showing is on the north-facing slope of a hill at the southeast shore of Bray Lake. A 1-mile trail from Roche Bay on Midlothian Lake and a 2-mile trail from Sirola Lake both come within a ½ mile of Bray Lake. The showing consists of a sheared rhyolitic agglomerate-breccia containing disseminated pyrite, pyrrhotite, chalcopyrite, and sphalerite over a length and width of 50 feet and 20 feet respectively. A grab sample taken by the author and analysed by the Laboratory Branch, Ontario Department of Mines gave only a trace of nickel. The sheared country rock is cut by veinlets of serpentine which emanate from a peridotite sill

intruding the metavolcanics a short distance north and west of the mineralized zone.

In 1963, Morgan drilled two holes on claim MR43151 west of Bray Lake, and intersected disseminated pyrite, pyrrhotite, and sphalerite in a rhyolite breccia. No assays for these sections are available. A drill hole on the west shore of Lloyd Lake, south of claim TR1929, also intersected disseminated pyrite and pyrrhotite in rhyolitic flows. The author observed galena in a quartz stringer cutting rhyolite on the east shore of the bay, opposite this drill site.

TALISMAN MINES LIMITED (8)

In 1967, Talisman Mines Limited held two separate claim blocks in Halliday Township: a group of 16 unsurveyed claims, along the western township line near mile post 5, that lie north of the property of Texas Gulf Sulphur Company Incorporated (9); and a group of 9 unsurveyed claims, near mile post 3, south of the Texas Gulf property.

In 1950, Dominion Gulf Company held part of the northern claim group on which they found some cross-fibre asbestos stringers cutting an ultramafic stock.

The company's southern claim group is underlain by an area of intensely brecciated rhyolite, whose black silicic matrix contains disseminated pyrite. Talisman reports several good electromagnetic conductors on their property (The Northern Miner 1967).

TEXAS GULF SULPHUR COMPANY (9)

In 1967, Texas Gulf Sulphur Company held a group of 11 unsurveyed claims near mile post 4 on the western boundary of Halliday Township.

An east-trending belt about 2,000 feet wide, of dark grey intermediate tuff-breccia containing disseminated pyrite, crosses the northern part of the property. Zones of graphitic tuff and slate containing disseminated to massive pyrite are found within and along the southern boundary of the tuff-breccia. South of the intermediate tuff-breccia, the rhyolitic flows and breccias are intensely brecciated and silicified. The black cherty matrix of this brecciated area is a dense fine-grained silicic material containing disseminated pyrite and minor pyrrhotite. A wide shear zone, which in places contains graphite-pyrite-marcasite, strikes west-northwest across the southern part of the property. In early 1968, Texas Gulf drilled a few holes on a conductive zone near this shear zone.

Gold and Silver

Gold was first discovered in Midlothian Township in 1909. Since then the three peak periods of prospecting and staking activity were 1917, 1944, and 1962.

Gold-bearing quartz veins occupy sheared and altered zones in steeply dipping metasediments, particularly near the contact with the older rhyolitic strata. Native gold and gold-silver electrum are associated with chalcopyrite, freibergite, tetrahedrite, sphalerite, and galena.

On 2nd July 1965, Stairs Exploration and Mining Company Limited opened the first producing mine in the map-area. From September, 1965 to April, 1966, the mine produced 2,674 ounces of gold and 1,318 ounces of silver valued at $100,729.

COMINCO LIMITED [1945] (12)

Ragan Group. In 1945, Cominco Limited, formerly Consolidated Mining and Smelting Company of Canada Limited, optioned a group of 20 unsurveyed claims near Patricia Lake, Midlothian Township, from J. H. Ragan of Elk Lake and A. D. Williams of Toronto. Chip samples of sericite and sericite-chlorite schist from a pit 2,000 feet southwest of Patricia Lake gave an assay of 0.44 ounces of gold per ton (Gardiner 1946).

From 1962 to 1966, Stairs Exploration and Mining Company Limited held these claims.

L. LAMOTHE [circa 1951] (5)

In the early 1950s, L. Lamothe held a group of nine unsurveyed claims southeast of Campbell Lake in Halliday Township. In 1952, W. S. Savage, Resident Geologist for the Ontario Department of Mines at Kirkland Lake, observed disseminated pyrite and sphalerite in sheared rhyolite on what was then claim S56711. Between 1962 and 1967, Stairs Exploration and Mining Company Limited held the property.

LAROMA MIDLOTHIAN MINES LIMITED (15)

In 1967, Laroma Midlothian Mines Limited held three surveyed claims, MR13317, MR13320, and MR13321 on the southwest shore of Midlothian Lake. The company was incorporated in 1944, following the discovery of gold between Midlothian and Mitre Lakes.

During 1944 and 1945, the company investigated gold-bearing quartz veins in a zone of "green carbonate" rock along the steeply dipping metavolcanic-metasedimentary contact. At this time, the company drilled 17 holes with a total length of 7,214 feet on claims MR13317, MR13320, and MR13321 (Marshall 1947, p. 18).

In 1962, Laroma began a new program of stripping, trenching, and drilling around the original gold showing on claim MR13320. Stripping uncovered a silicified zone of "green carbonate" rock, about 2,000 feet long and 250 to 350 feet wide which contains irregular lenses of fine-grained green dolomite(?), talc-carbonate rock, and serpentinite. Narrow quartz veins and stringers are scattered throughout the green carbonate zone but are particularly concentrated, and in some places gold-bearing, in the lenses of green dolomite. The northwestern extension of the green carbonate zone passes along strike into a zone of graphitic tuff and slate containing disseminated pyrite and nodular marcasite.

In the pit on claim MR13320, the author observed minor amounts of pyrite, chalcopyrite, and sphalerite in the quartz veins and dolomitic wallrock. A chip sample from this pit gave an assay of 1.34 ounces of gold per ton (The Northern Miner 1963). The author observed gold in a ¼-inch wide quartz vein, in a network of narrow quartz veins, in the large pit on claim MR13317. A bulk sample of about 60 pounds taken from this pit gave an assay of 0.76 ounces of gold per ton (The Northern Miner 1963). Two holes were drilled near these pits to test the showings at depth.

Several holes drilled along the metavolcanic-metasedimentary contact northwest of the green carbonate zone (in claim MR13583) intersected a number of zones of disseminated to massive graphite-pyrite-marcasite.

PITCHVEIN MINES LIMITED [1963] (19)

In 1963, Pitchvein Mines Limited held a group of 16 unsurveyed claims along the west shore of Midlothian Lake, in Midlothian Township. Several quartz veins and stringers containing minor amounts of pyrite and chalcopyrite were encountered in sheared metasediments on the large peninsula on the south shore of the lake.

RIOCANEX LIMITED [1963] (20)

In 1963, Riocanex Limited* optioned a block of 28 claims, surrounding Holbrooke Lake, from Stairs Exploration and Mining Company Limited. The property included the Stairs' Wood Lake (No. 2) auriferous zone. Before 1963, Stairs had drilled 5 holes on the eastern end of the Wood Lake shear zone in claim MR33463. Stairs reported assays averaging 0.53 ounces of gold per ton over an 8-foot core section of sheared carbonatized conglomerate (The Northern Miner 1962).

Riocanex Limited carried out a program of stripping, trenching, and sampling on several zones with shearing and quartz veins before making a detailed geological map of the property. A drill hole was put down near the western end of the Wood Lake (No. 2) auriferous zone in claim MR33462.

J. Lehto (1963) described some showings on the property as follows:

"A" Zone

Numerous thin quartz veinlets and quartz lenses were uncovered by stripping an area of about 400 feet by 300 feet, 600 feet due north of the eastern end of Holbrooke Lake . . . . Most of the quartz material conforms with the intense shearing . . . . sampling which followed the stripping revealed trace of gold only.

"B" Zone

An area of about 100 feet by 200 feet located 300 feet south of 'A' Zone was stripped. Here there is a quartz lens 25 feet in length and 6 feet wide, in a two pattern shear zone . . . . The host rock is sericitic greywacke. The alteration minerals fuchsite and sericite are abundant, accompanied by much pyrite and some chalcopyrite. Of several samples taken all . . . . [gave] traces in gold values except one that assayed 0.01 oz. gold per ton.

The company also examined some quartz stringers containing minor pyrite and chalcopyrite encountered in two areas; 500 feet west of Strike Lake, and 400 feet northwest of Midlothian Lake.

Tory Lake Showing. In 1946, Marshall (1947, p. 17) observed gold in a carbonatized zone between Strike and Tory Lakes, on the former V. Clement and O. Hill claims. In 1945, Freeport Exploration Company, a subsidiary of Freeport Sulphur Company, New York did some trenching and stripping without apparent results. In 1963, Riocanex Limited optioned the claims in this area from Stairs Exploration and Mining Company Limited.

STAIRS EXPLORATION AND MINING COMPANY LIMITED (6, 21)

History and Development

In 1967, Stairs Exploration and Mining Company Limited held a group of 18 leased claims, 17 in the northwest part of Midlothian Township, one claim adjoining

*Short form for Rio Tinto Canadian Exploration Limited.

these in Halliday Township and a large group of unsurveyed claims surrounding them. The leased claims that form the nucleus of the property are numbered MR26660 to MR26665, MR27268, MR27269, MR33348 to MR33352, MR33457 to MR33460 in Midlothian Township (property 21) and MR33370 in Halliday Township (property 6). The original gold showing on Stairs claims MR26664 and MR26665, (the present location of underground mine workings) was staked in 1944 by Upper Canada Mines Limited (Marshall 1947, p. 20). In 1947, Sherwood Gold Mines Limited, a subsidiary of Upper Canada Mines, optioned the property. In 1958, the property reverted to the crown.

Stairs Exploration and Mining Company Limited, was incorporated in 1962 and at that time acquired the property. By August 1962, surface drilling on the former Sherwood gold showing indicated a gold-quartz fracture-filled zone 300 feet long and 250 feet deep. In late 1962, an inclined adit dipping 20 degrees northwest was driven to a vertical depth of 100 feet, and extended on strike by a crosscut across the main shear zone. Shaft sinking, followed by underground development, commenced in 1963 (Photo 7). By the end of 1964 the shaft was 700 feet deep, and lateral work had been done on five levels at 80, 200, 350, 500, and 650 feet. The underground development footage is shown in Table 3.

Table 3 THE DEVELOPMENT FOOTAGE AT STAIRS MINE* IN 1966, AND THE ACCUMULATED FOOTAGE TO THE TIME OF CLOSURE, 30 APRIL, 1966 (information from statistical files of Ontario Department of Mines).

	Drifts	*Crosscuts*		*Raises*
Level	Total feet	1966 feet	Total feet	Total feet
Service adit	..	..	149	..
80	682	..	952	136
200	695	..	236	425
350	452	..	237	152
500	782	88	1,126	237
650	580	..	335	195
Total	3,191	88	3,035	1,145

*With the property owners' permission, the level plans of the mine may be seen at the office of the Resident Geologist, Kirkland Lake, Ontario.

A mill was installed underground on the 80-foot level, largely in a section opened by the original inclined adit that serves this level. Milling, using a gravity-amalgamation circuit of 50 to 75 tons initial capacity, began in September, 1965. Insufficient ore reserves, increased mining costs, and a lack of skilled labour forced the closure of the mine and mill in June, 1966. The mine milled 11,952 tons of ore and produced 2,764 ounces of gold and 1,318 ounces of silver.

Geology

The mine is on the southern edge of a belt of steeply dipping metasediments which disconformably overlie older rhyolitic strata. In the following geological description, the position of the mine shaft on the metavolcanic-metasedimentary contact is used as a reference point.

The shaft is collared in a dark grey pebble conglomerate containing disseminated pyrite and nodular marcasite, but from about the 80-foot level to the bottom of the

ODM8212

Photo 7–Headframe of Stairs Exploration and Mining Company Limited.

mine, the shaft is confined to an extremely hard volcanic breccia. The shaft breccia consists of angular fragments of grey and green rhyolite in a dark grey cherty matrix containing some marcasite nodules. South of the shaft breccia is a zone of interstratified carbonatized silicic tuff-breccia, and graphitic tuff and slate. West along strike from the shaft, the shaft breccia and the overlying dark grey pebble conglomerate pinch out and their stratigraphic position is taken by tuffaceous arkose and arkosic grit.

North (up the stratigraphic section) from the shaft, the sedimentary sequence consists of about 40 feet of dark grey pebble conglomerate overlain by 15 feet of interbedded arkosic grit and greywacke. The arkosic grit and greywacke grade upward into a thick sequence of pale brown pebble conglomerate with minor interbeds of greywacke and arkose.

Structure

The Stairs ore zone seems to be confined to the trough of a westward-plunging right-lateral drag fold on the south limb of an east-plunging syncline. The drag-folded metavolcanic-metasedimentary contact trends N80°W at the mine and dips steeply to the north. The anticlinal crest of the drag fold is about 500 feet northeast of the shaft.

Gold-bearing quartz veins form tight fracture-fillings in a northeast-trending shear zone which intersects the trough of the plunging drag fold. The quartz veins emanate from the hanging wall of the unsheared shaft breccia.

South of the shaft breccia, the intercalated silicic tuff-breccia, and graphitic tuff and slate are highly sheared parallel to the metavolcanic-metasedimentary contact. The western end of the shaft breccia's hanging wall is displaced a few feet southwest by post-ore movement along the metavolcanic-metasedimentary contact.

Wallrock Alteration

Pre-ore wallrock alteration consisting of silicification, sericitization, carbonatization, and the development of some chrome micas, imparts a yellowish brown colour to the wallrocks. The conglomerates, some with ghost pebble structures, are the most intensely altered. The effects of this alteration are less in the basal arkose, and negligible in the shaft breccia. A three-foot wide bed of fine-grained slaty greywacke near the anticlinal crest of the drag fold is the approximate northern limit of this alteration in the metasediments. This bed might have acted as a barrier to the altering solutions advancing northward from the shaft breccia.

Veins and Mineralization

Gold-bearing quartz veins emanating from the hanging wall of the shaft breccia form tight fracture-fillings in a northeast-trending shear zone. The ore zone ('A' Zone) consists of the Pope vein and two subsidiary veins, the Marcasite and the Chromic veins.

Pope Vein. The Pope vein, which ranges in width from 1 foot to 2 feet, strikes N55°E and extends from the shaft breccia approximately 500 feet north to the anticlinal crest of the drag fold. At the crest of the drag fold, the vein narrows and changes to a system of 1-inch to 3-inch wide horsetail fracture-fillings.

Near the shaft, the Pope vein, from the surface to the 200-foot level, is in conglomerate and has an average dip of 75°NW and strikes N55°E, but from the 200-foot level to the 350-foot level, the Pope vein changes its strike to N35°E. Because the drag fold plunges approximately 60°W, and the Pope vein dips more steeply in the same direction, the vein between the 200-foot level and the 350-foot level swings in and out of the contact of the conglomerate with the basal arkose. Below the 350-foot level, the vein is confined to the basal arkose.

The veins are narrower in the arkose than in the more intensely altered conglomerate. Similarly, at the anticlinal crest of the drag fold, where the vein narrows and changes to a system of horsetail fracture-fillings, the basal arkose first appears on the 80-foot level of the mine. The gold content of the veins is also higher in the altered conglomerate than in the altered arkose.

Bright yellow gold is disseminated in white to translucent quartz veins; pale yellow gold-silver electrum is associated with pale green sericite in fractures and along the walls of the quartz veins. Gold and silver are also closely associated with chalcopyrite, sphalerite, galena, and tetrahedrite. Gold and silver are not associated with disseminated pyrite in the quartz veins. Common gangue minerals are pale green sericite, white calcite, and reddish brown siderite.

Marcasite Vein. The 10-inch wide Marcasite vein is about 125 feet southeast of the Pope vein. The Marcasite vein strikes subparallel to the Pope vein at depth, but near the 80-foot level the two veins converge to form one vein system.

Between the 80- and 200-foot levels, a narrow zone of massive marcasite borders the gold-bearing vein. In some places, the massive marcasite contains high concentrations of gold and silver. Below the 200-foot level, the massive marcasite border disappears, and the gold is associated with chalcopyrite and silver-bearing tetrahedrite.

Chromic Vein. The Chromic vein lies 80 feet northwest of the Pope vein and strikes parallel to it. This 6-inch wide gold-bearing quartz vein did not provide ore for the mill.

"B" Zone. In the "B" Zone, a single vein about 10 inches wide is exposed on the 500-foot level, approximately 500 feet west-northwest of the Pope vein. The vein, which is in arkose on the 500-foot level, strikes N55°E. Samples taken from the vein at this level contained silver-bearing tetrahedrite (freibergite), and minor pyrite and chalcopyrite. No gold was seen by the author.

Other Mineralized Zones

Wood Lake (No. 2) Zone. Gold-bearing quartz veins and stringers are found in a zone of sheared and altered conglomerate and arkose northeast of Wood Lake, Midlothian Township. The zone can be reached by a 1-mile tractor road from the Stairs Mine. Stairs reported assays averaging 0.53 ounces of gold per ton over an 8-foot section of core from a sheared carbonatized conglomerate (The Northern Miner 1962). Assays from each side of this core section are much lower grade. Five holes were drilled on this zone in the eastern part of claim MR33463. In 1963, Stairs optioned this property to Riocanex Limited (see the section on Riocanex Limited property 20).

Slipper Lake Zone. Narrow gold-bearing quartz veins and stringers in sheared conglomerate are present on leased claim MR26662 near Slipper Lake, Midlothian Township.

Campbell Lake Zone. Claim MR33370 and adjacent unsurveyed claims. An 800-foot long and 2-foot to 4-foot wide quartz vein is present 1,000 feet northeast of the east bay on Campbell Lake (property 6, Halliday Township). The vein strikes N50°E through an area of sercitized arkose. The author observed disseminated pyrite, chalcopyrite, and sphalerite in some parts of the vein.

Recent Developments

In 1966, Stairs began a program to investigate several conductive zones indicated by an airborne magnetic and electromagnetic survey on their large claim holdings in Halliday and Midlothian Townships. South of the mine shaft, several drill holes intersected a zone of graphitic tuff and slate about 100 feet wide containing disseminated to massive pyrite and nodular marcasite. Farther west along strike, near the west end of Bowl Lake in Halliday Township, drilling intersected 189 feet of graphitic tuff and slate. Still farther west along strike, a drill hole collared on the island in Campbell Lake intersected about 200 feet of the same sulphide zone. Geological and drilling information indicate a possible strike length of 13,000 feet for this graphite-pyrite-marcasite zone.

In May, 1966, several holes were drilled on a peridotite-rhyolite contact near the west end of Strange Lake, Midlothian Township. Small areas of carbonate replacement in the rhyolite adjacent to the contact contain disseminated pyrrhotite, chalcopyrite, and sphalerite. A 1½- by 2-inch core section assayed gave: a trace of gold; 0.30 ounce of silver per ton; 0.70 percent zinc; 0.27 percent nickel; 0.15 percent copper; and 0.10 percent lead (Roach 1966).

Halliday and Midlothian Townships

During the summer of 1967, Stairs began a stripping program on the east shore of Campbell Lake, Halliday Township, to investigate a conductive zone along the metavolcanic-metasedimentary contact. Some stripping was also done on the Campbell Lake Zone.

SYLVANITE GOLD MINES LIMITED [circa 1945] (7, 22)

In 1945, Sylvanite Gold Mines Limited, held a large block of unsurveyed claims between Campbell Lake and Slipper Lake in the north-central part of the map-area (property 7, Halliday Township; property 22, Midlothian Township). The company investigated a number of sheared carbonatized zones in the metasediments along the northern and southern metasedimentary-metavolcanic contacts. Trenching and sampling of quartz veinlets and stringers in some of these zones, particularly near Fold, Bluebottle, and Slipper Lakes yielded little more than a trace of gold.

MISCELLANEOUS OCCURRENCES

East-Central Midlothian Lake Exploration Area. Marshall (1947, p. 18, 20) described exploration carried out in this area as follows:

> Millothia Gold Mines, Limited, was incorporated in 1944 and acquired a group of 14 unpatented claims, Nos. 13,650 to 13,663, located on the east shore of Midlothian lake in the north central part of the township. The claims were examined in 1945. Some stripping was done, and one diamond-drill hole put down. The rocks on this property are Timiskaming conglomerate and greywacke, which are intruded by north-south trending diabase dikes. Little or no mineralization was observed. Results were reported to be negative.

Elizabeth Lake Showing. In 1946, Marshall (1947, p. 17) visited the area and described the showing as follows:

> Goodwin et al. have a group of unpatented claims around Elizabeth lake adjoining those of Laclothian Mines, Limited. The area is covered with considerable overburden, but a few outcrops of Timiskaming sedimentary rocks were mapped. Some stripping and trenching were done in 1945. Several small quartz stringers were noted, and mineralization, chiefly pyrite, is scant. Visible gold was noted in an outcrop on the creek south of Elizabeth lake.

Fraser Bay Exploration Area. Some surface exploration was carried out on a group of unpatented claims north of Midlothian Lake in the 1940s. Marshall (1947, p. 18) discussed this area under Linlothian Mines Limited but mentioned that results from this work were not available.

Lipton Lake Exploration Area. Exploration carried out in this area was described by Marshall (1947, p. 17-18) as follows:

> Laclothian Mines, Limited, incorporated in 1944, acquired a group of 51 unpatented claims from the Conwest Exploration Company, Limited, Roche Long Lac Gold Mines Limited, and Evenlode Gold Mines, Limited. The east group consists of 37 claims between Midlothian and Elizabeth lakes. The west group lies in the northwestern part of the township.
>
> The rocks of the east group are chiefly rhyolite and Timiskaming sedimentary rocks with minor diabase dikes. A considerable amount of line-cutting, trenching, and stripping was done in 1945. Small carbonatized zones were noted. Mineralization, chiefly pyrite, occurs sparingly. No commercial gold values are reported.

RECOMMENDATIONS FOR FUTURE EXPLORATION

The most favourable areas for future mineral exploration are those of rhyolitic rocks with associated intermediate pyroclastic rocks and ultramafic and mafic intrusive rocks. Important features of the more promising areas are discussed below:

Nickel. The best possibilities for nickel mineralization in the map-area are the ultramafic and mafic sills and stocks in the upper (outer) rhyolitic strata. A zone of peridotite and gabbro sills and stocks intruding the outer rhyolitic strata, extends eastward from Sothman Township, east-northeastward into Halliday and Midlothian Townships. The nickel-copper bearing ultramafic sill of Kirkland Minerals Corporation Limited, in the southeast corner of Sothman Township, lies within this zone. Drilling on the Kirkland Minerals deposit has established 210,000 tons averaging 1.29 percent nickel, plus approximately 400,000 tons of 0.90 percent nickel (Survey of Mines, 1968, p. 153).

Asbestos. In many places within this zone, the ultramafic rocks are cut by veinlets of cross-fibre asbestos. The potential of this zone for asbestos is indicated by a cross-fibre asbestos zone approximately 3,000 feet long and 200 feet wide on the Asbestos Lloyd Mines Limited property (10) in Midlothian Township. This zone continues west about 1,000 feet on the adjoining Miller property (16).

Gold. In exploration for gold in this area, it should be noted that the known gold-bearing zones are in the lower metasediments overlying older rhyolitic strata; and also that the altered conglomerate is a more favourable host rock for gold-bearing quartz veins than are the altered arkose or greywacke.

Base metals. The majority of the copper, and copper-lead-zinc orebodies in the Canadian Shield are found as replacement and "strata-bound" sulphide bodies in fragmental volcanic rocks of rhyolitic or dacitic composition. The replacement sulphide bodies lie in favourable structural positions with feeder fracture systems below; the "strata-bound" sulphide bodies lie in permeable breccias capped by impermeable andesite or rhyolite. This common relationship may indicate a volcanic origin for these sulphide ores and their concentration at or near a volcanic centre.

The Halliday rhyolitic dome is a volcanic centre and could have excellent possibilities of associated base metal sulphide deposits if the above theories are correct. The most promising areas to investigate are listed below:

a. Northwest of Halliday Lake where the black cherty matrix of the brecciated rhyolitic strata contain disseminated pyrite-pyrrhotite-minor chalcopyrite.

b. Near Annie Lake and north of Halliday, Relic, and Radio Lakes, both the fragmental rhyolite and dacite, and the adjacent large belt of andesite-dacite tuff-agglomerate-breccia contain zones of disseminated pyrite-pyrrhotite-minor chalcopyrite and lenses of graphite-pyrite-marcasite.

c. Near Weary and Mavis Lakes, coarse fragmental rhyolites containing lenses of disseminated to massive graphite-marcasite-pyrite, lie near a belt of ultramafic and mafic sills and stocks.

d. South of Relic Lake, the southern margin of the Halliday dome is covered by aeolian sand and esker material and for this reason the area has received little attention.

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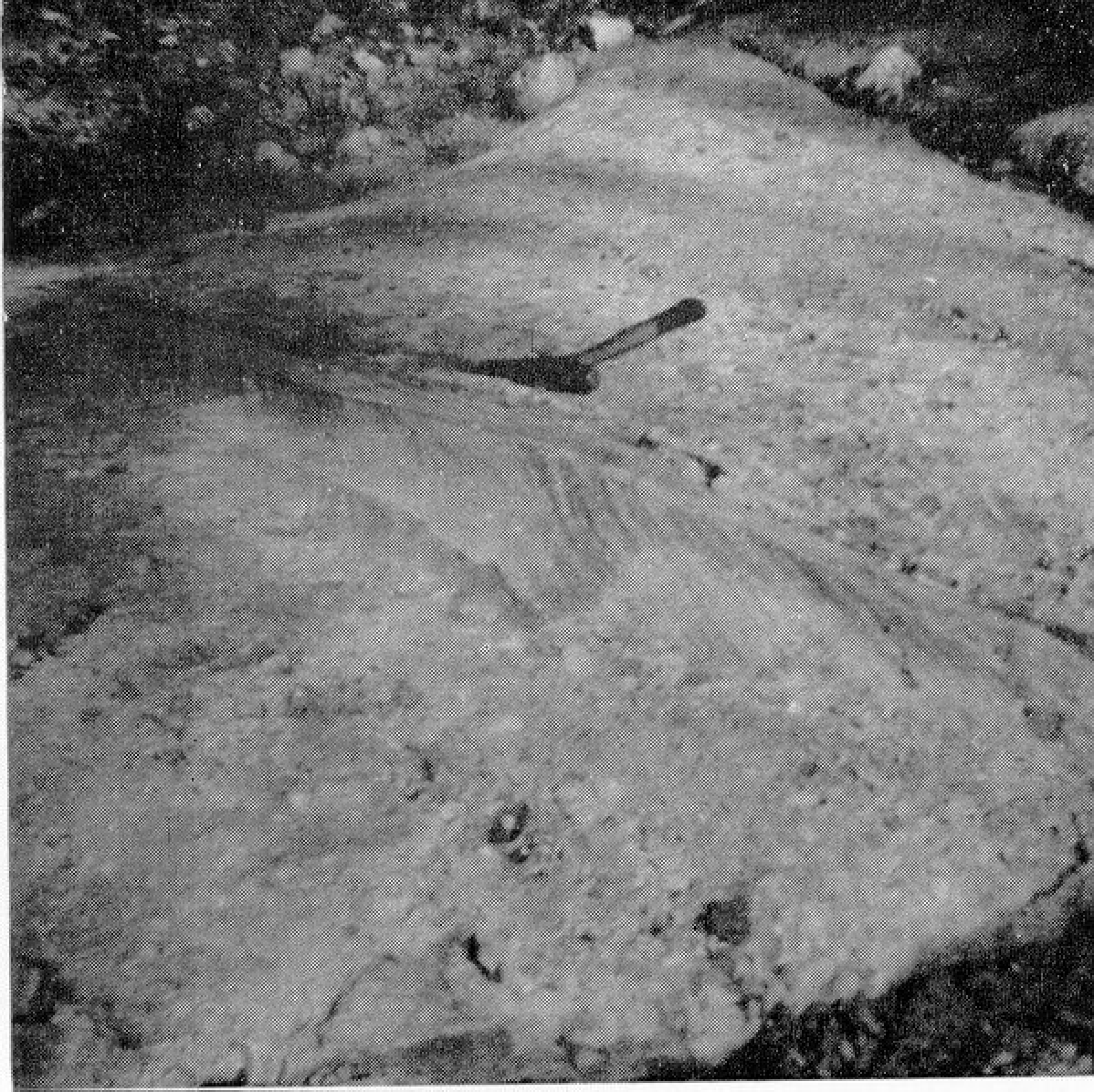
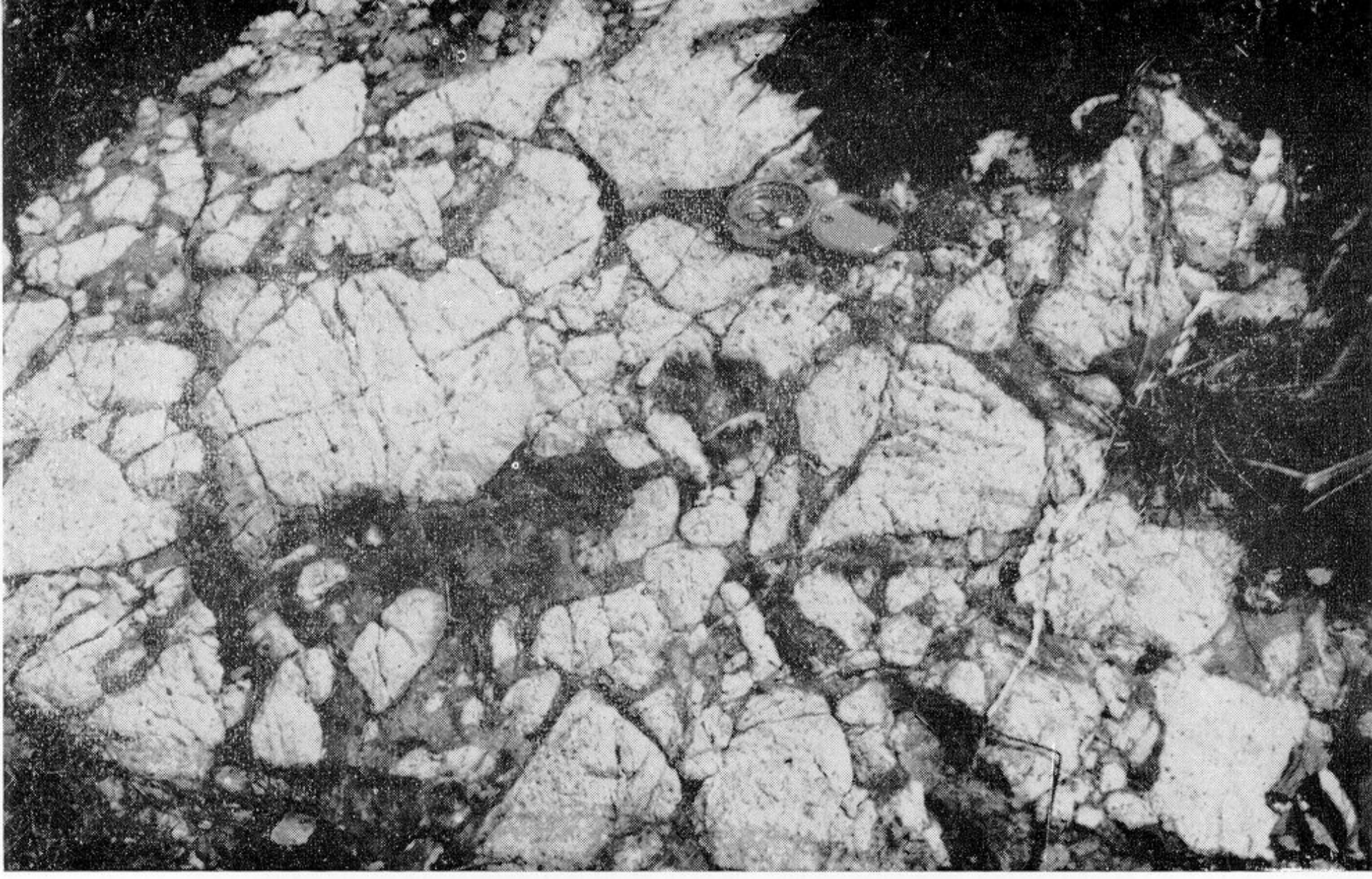
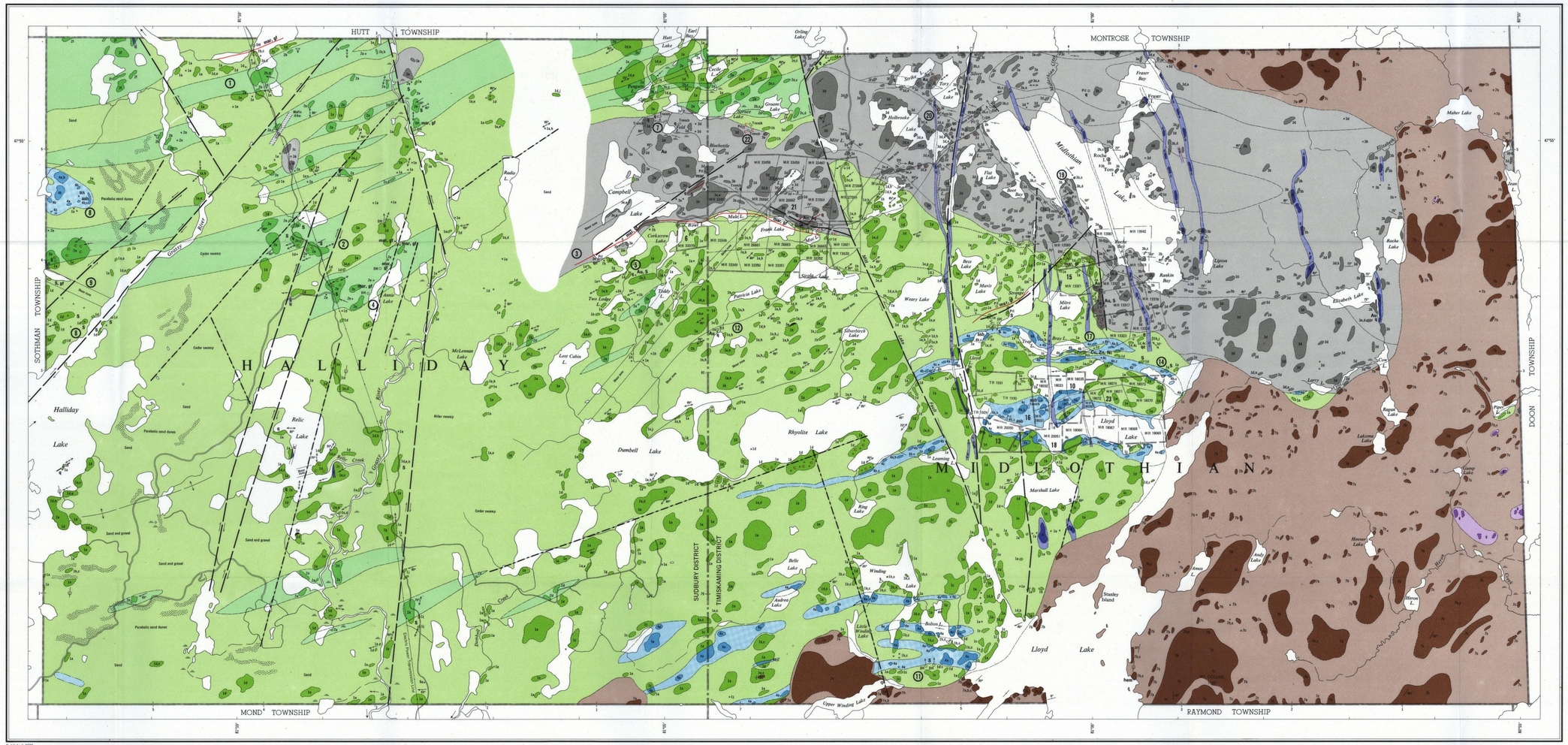




ONTARIO
DEPARTMENT OF MINES
HON. ALLAN F. LAWRENCE, *Minister of Mines*
D. P. Douglass, *Deputy Minister* J. E. Thomson, *Director, Geological Branch*



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SYMBOLS

- Glacial striae.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, horizontal.
- 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).
- Banding; (horizontal, inclined, vertical).
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Geological boundary, deducted from geophysics.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Lineament.
- Drag folds with plunge.
- Anticline, syncline, with plunge.
- Drill hole; (vertical, inclined).
- Vein, vein network.
- Shaft, vertical.
- MA Magnetic attraction.
- Muskeg or swamp.
- Motor road.
- Other road.
- Trail, portage, winter road.
- District boundary, approximate position only.
- Township boundary, approximate position only.
- Property boundary, approximate position only.
- Survey line, approximate position only.
- 5 Location of mining property. (See list of properties.)

LIST OF PROPERTIES

HALLIDAY TOWNSHIP

Amax Exploration Incorp.
1. Adele Group.
2. Pat Group.
3. Barbara Group.
4. Cominco Ltd., Annie Lake Group. [1965]
5. Lamothe, L. [circa 1951]
6. Stairs Exploration and Mining Co. Ltd.
7. Sylvanite Gold Mines Ltd. [circa 1945]
8. Talisman Mines Ltd.
9. Texas Gulf Sulphur Co.

MIDLOTHIAN TOWNSHIP

10. Asbestos Lloyd Mines Ltd.
11. Cominco Ltd., Lloyd Lake Group. [1965]
12. Cominco Ltd., Regan Group. [1945]
13. Dominion Gulf Co. [1952-1954]
14. Dominion Gulf Co. [1956]
15. Laroma Midlothian Mines Ltd.
16. Miller, T. H.—Executor.
17. Morgan, C.R. [1966]
18. Parsons, G. E.
19. Pilotwein Mines Ltd. [1963]
20. Riocanex Ltd. [1963]
21. Stairs Exploration and Mining Co. Ltd.
22. Sylvanite Gold Mines Ltd. [circa 1945]
23. VanCliief, W. E.

Ownership of properties as of March 31, 1968. Date in square brackets [1965] indicates year of last major work on property. For further information, see report.

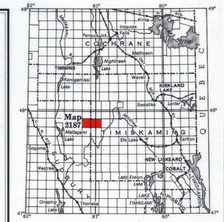
Map 2187

HALLIDAY and MIDLOTHIAN TOWNSHIPS

SUDBURY and TIMISKAMING DISTRICTS

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles
Metres 1000 0 1 2 3 Kilometres
Feet 1000 0 5,000 10,000 Feet



N.T.S. reference 41P/14, 41P/15

LEGEND

CENOZOIC[a]

PLEISTOCENE AND RECENT
Glacial drift, gravel, sand and silt.

UNCONFORMITY

PRECAMBRIAN[b]

PROTEROZOIC

LATE MAFIC INTRUSIVE ROCKS

8 *8 Diabase.*

INTRUSIVE CONTACT

HURONIAN

COBALT GROUP (GOWGANDA FORMATION)

7 *7a Conglomerate.*
7b Greywacke, quartzite, and arkose.
7c Argillite.

UNCONFORMITY

ARCHEAN

MAFIC INTRUSIVE ROCKS (MATACHEWAN)

6 *6 Diabase.*

INTRUSIVE CONTACT

FELSIC INTRUSIVE ROCKS

5a Granite, granodiorite (dikes).
5b Feldspar porphyry (dikes).

INTRUSIVE CONTACT

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS

4 *4a Gabbro, diorite.*
4b Peridotite, pyroxenite, dunite.
4c Serpentinite.

INTRUSIVE CONTACT

METASEDIMENTS[c]

3 *3 Undifferentiated.*
3a Arkose.
3b Greywacke.
3c Slaty argillite.
3d Conglomerate.
3e Sericitized metasediments.
3f Pyroclastic rocks.

DISCONFORMABLE AND INTERFINGERING CONTACT

INTERMEDIATE AND MAFIC METAVOLCANICS[d]

2 *2a Andesite.*
2b Pillowed andesite.
2c Amygdaloidal andesite.
2d Porphyritic andesite.
2e Andesite-dacite tuff-agglomerate-breccia.
2f Massive basalt.

FELSIC METAVOLCANICS[d]

1 *1a Rhyolite-dacite.*
1b Pillowed dacite.
1c Amygdaloidal rhyolite-dacite.
1d Rhyolite-dacite breccia.
1e Porphyritic rhyolite-dacite.
1g Rhyolitic tuff.
1h Sericite schist.
1i Chlorite-sericite schist.

Breccia.

Carbonatized rock.

Ag	*Silver.*
asb	*Asbestos.*
Au	*Gold.*
Cu	*Copper.*
gf	*Graphite.*
hem	*Hematite.*
mar	*Marcasite.*
Ni	*Nickel.*
Pb	*Lead.*
q	*Quartz.*
qc	*Quartz-carbonate.*
S	*Sulphide mineralization.*
Zn	*Zinc.*

[a] *Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured parts on the map.*

[b] *Bedrock geology. Outcrops and inferred extensions of each rock map unit are shown, respectively, in deep and light tones of the same colour. Where in places a formation is too narrow to show colour and must be represented in black, a short black bar appears in the appropriate block.*

[c] *Some metavolcanics are younger than the metasediments.*

[d] *The metavolcanics are interstratified, but felsic metavolcanics predominate in the lower part of the stratigraphic succession. The order does not imply age relationships.*

SOURCES OF INFORMATION

Geology by E. G. Bright and assistants, 1966. Geology is not tied to surveyed lines.

Marshall, H. I., Geology of Midlothian Township, Ontario Department of Mines, Vol. 56, 1947, pt. 5, accompanied by Map 1947-4.

Geological and geophysical maps and reports of mining companies.

Preliminary maps, P. 385 Halliday Township and P. 386 Midlothian Township, scale 1 inch to ¼ mile, issued 1967.

Cartography by C. C. Cashin, Ontario Department of Mines, 1969.

Base map derived from maps of the Forest Resources Inventory, Ontario Department of Lands and Forests, with revisions by E. G. Bright.

Magnetic declination in the area was 11°W, 1966.