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Geological Branch

Open File Report 5018

Geology of Halliday and Midlothian Townships, Districts of Sudbury and Timiskaming

1968

ONTARIO DEPARTMENT OF MINES

GEOLOGICAL BRANCH

OPEN FILE REPORT

No. 5018

GEOLOGY OF HALLIDAY AND MIDLOTHIAN TOWNSHIPS

DISTRICTS OF SUDBURY AND TIMISKAMING

By

E. G. Bright

MAY 23, 1968

1968

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GEOLOGICAL REPORT NO. 5018

GEOLOGY OF

HALLIDAY AND MIDLOTHIAN TOWNSHIPS

by

E. G. Bright

Project 65-17

APPROVED FOR PUBLICATION

APR 19 1968

J. E. THOMSON,
Director, Geological Branch

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Scale 1 inch to 1/4 mile. (revised 1968)

P.386 Midlothian township, District of Timiskaming,
Scale 1 inch to 1/4 mile. (revised 1968)

Preliminary maps for Halliday (P.385) and Midlothian (P.386) townships may be purchased at the Publications Office, Ontario Department of Mines, Whitney Block, Parliament Buildings, Toronto.

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 on the northwest flank of the Round Lake granitic batholith.

Dacitic to rhyolitic volcanic rocks in the central area of the dome are interstratified with (and surrounded by) andesitic to dacitic volcanic rocks. On the northeast margin of the dome, sedimentary rocks are intercalated with minor disconformity between a younger and older volcanic series. The volcanic and sedimentary rocks along the margins of the dome occupy axial areas of tight folds. Ultramafic to mafic sills and stocks intrude the outer rhyolitic strata of the dome, and younger 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 in the outer rhyolitic strata of the Halliday dome. Gold-bearing quartz veins are in the steeply dipping sedimentary rocks above the contact with older rhyolitic strata. Stairs Midlothian township mine produced 2,674 oz. gold and 1,318 oz. 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.

Figure 1. Key-map showing the location of Halliday-Midlothian area. Scale, 1 inch to 8 miles.

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 western most township is in the District of Sudbury; Midlothian township is in the District of Timiskaming. Stairs Exploration and Mining Company Limited, Midlothian township mine produced 2,674 oz. gold and 1,318 oz. silver between 1965 and 1966. The Ashley Gold Mine, a past producing gold mine is in Bannockburn, the township northeast of Midlothian. The nickel-copper deposit of Kirkland Minerals Corp. Ltd. 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

Provincial 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 electric power 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.

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

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 same source were used in the field. The geology was tied to lakes, roads, and other landmarks identified on air photographs.

Heavy 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 of Halliday township (P. 385) and Midlothian township (P. 386) may be obtained from the Ontario Department of Mines, Toronto or from the mining recorder, Montreal River mining division, Kirkland Lake, Ontario.

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

[1] Resident geologist, Ont. Dept. of Mines, Kirkland Lake, Ont.
[2] Stairs resident geologist and mine manager

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 north-and-east trending valleys occurs to the east in Midlothian township. The western part of Midlothian township which is underlain by Huronian sedimentary rocks, has a maximum relief of about 500 feet above the surrounding country side.

The height-of-land separating the watershed of the St. Lawrence River system from that of James Bay passes through the southeast 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.

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 the Feldman lumber camp of Timmins, Ontario, operated a large scale timber operation in Sothman township and the central and southern parts of Halliday township. A fire had swept through this area earlier that year. 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 is present in Midlothian Lake. Moose and bears are abundant, as are otters, muskrats, partridges, and ducks. Beavers, lynxes, and deer are more scarce. During the fall and winter, many sportsmen frequent the area to hunt moose and bears.

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 on the northwest flank of the Round Lake granitic batholith (See ODM Map 2046)

All the bedrock in the map-area is of Precambrian age. Dacitic to rhyolitic volcanic rocks in the central area of the Halliday dome are interstratified with (and surrounded by) andesitic to dacitic volcanic rocks. On the northeast margin of the dome, sedimentary rocks are intercalated with minor disconformity, between a younger and older volcanic series. The volcanic and sedimentary rocks along the margins of the dome occupy axial areas of tight folds. Ultramafic to mafic sills and stocks intrude the outer rhyolitic strata of the dome, and younger 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 sand, silt and gravel are chiefly of Pleistocene age.

TABLE OF FORMATIONS

CENOZOIC

Recent: Swamp and stream deposits

Pleistocene: Sand, gravel, and silt

Unconformity

P R E C A M B R I A N

PROTEROZOIC

Mafic Intrusive Rocks (Nipissing):

Diabase

Intrusive Contact

HURONIAN

Cobalt Group, Gowganda Formation:

Greywacke and pebble greywacke, quartzite, conglomerate, argillite, arkose

Unconformity

ARCHEAN

Mafic Intrusive Rocks (Matachewan):

Diabase

Contact Unknown

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

Metasedimentary Rocks:[1]

Conglomerate, greywacke, arkose, slaty argillite, graphitic tuff and slate, green carbonate rock and intermediate pyroclastic rocks.

Disconformable and Interfingering Contact

Metavolcanic Rocks:[2]

Intermediate and Mafic Volcanic Rocks:

Andesitic to dacitic breccias, tuffs, agglomerate-breccias and flows, amygdaloidal and pillowed andesite, graphitic tuff and slate, and massive basalt.

Felsic Volcanic Rocks:

Rhyolitic to dacite flows, breccias and tuffs, massive and amygdaloidal rhyodacite, graphitic tuff and slate.

1 Some volcanic rocks are younger than the sedimentary rocks.

2 The metavolcanic rocks are interstratified but felsic volcanic rocks predominate in the lower part of the stratigraphic succession.

A R C H E A N

METAVOLCANIC ROCKS

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. Because rhyolitic rocks predominate in the core area of the dome (the lower part of the volcanic assemblage), they represent the earliest phases of volcanism. On the margin of the dome, in the northeast part of Halliday township and the northwest part of Midlothian township, sedimentary rocks are intercalated with minor disconformity 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.

Felsic Volcanic Rocks

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 to mafic flows and pyroclastic rocks, predominate in the northern and southern parts of Halliday township. The felsic volcanic rocks 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 volcanic rocks are creamy white to greenish brown; the fresh surfaces are light grey, green to greenish yellow. The areas of coarsest and most abundant fragmental rhyolite or dacite are near Halliday and Relic lakes in Halliday township, and near Weary, Bess and Mavis lakes in

Midlothian township (see photos 1 and 2). 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.

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 south of Mac Lake in Midlothian township.

The felsic volcanic rocks 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 graphite tuff and slate containing disseminated to massive pyrite and nodular marcasite are commonly interstratified with silicic tuffs and breccias in the outer 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 foot to 100 feet 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 northwestern Halliday township boundary; and between Mavis and Strange lakes in Midlothian township.

Intermediate and Mafic Volcanic Rocks

In Halliday township, andesitic to dacitic breccias, tuffs, agglomerates and flows are interstratified with the more abundant felsic volcanic rocks along the northern and southern margins of the Halliday dome. 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.

The weathered surfaces of the intermediate to mafic volcanic rocks are greenish grey to brownish grey; the fresh surfaces are grey, grey-green to dark

green. The smaller bands 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 dacite pyroclastic rocks form the widest and most continuous interbeds in the outer 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 band of andesitic to dacitic pyroclastic rocks about 2,000 feet wide extends across most of the township. The band consists of interbedded dark grey to greenish grey breccias, tuffs, and agglomerates containing some zones of disseminated pyrite–pyrrhotite–minor chalcopyrite. In places, the band is crossfaulted, strongly sheared and locally carbonatized. On the hydro line west of Annie Lake, several crossfaulted sections of this band 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 (see photo 3). The fragments generally range in size 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 (see photo 4). In order of abundance the fragments are massive or amygdaloidal rhyodacite to dacite, massive and flow banded rhyolite, scoriacious dacitic bombs, andesitic lava and graphitic tuff and slate. The nature and variety of rock fragments suggests a nearby explosive volcanic source.

METASEDIMENTARY ROCKS

In the northern part of Midlothian township, a belt of metasedimentary rocks occupies the south limb of a syncline on the margin of the Halliday dome. The rocks consist of conglomerate, greywacke, arkose and slaty argillite, with minor interbeds of graphitic slate, green carbonate rock, and volcanic 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. West of Campbell Lake, the sedimentary rocks 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 volcanic rocks.

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 conglomerate 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 bands of dark green to black finely bedded slaty argillite and fine-to-medium grained, massive, pinkish grey pebble arkose. Minor andestic tuff-agglomerate lenses are interstratified with the greywacke and slaty argillite near the top of the 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 greywacke. North-facing beds of greywacke ranging from 1 foot to 10 feet wide exhibit crossbedding (see 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 display a polygonal fracture pattern (see 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 volcanic pyroclastic rocks in the upper part of the sedimentary 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 sedimentary rocks the author believes that these rocks are the products of sedimentary processes and subsequent metamorphism.

ULTRAMAFIC to MAFIC INTRUSIVE ROCKS

In the vicinity of the map-area, ultramafic to mafic intrusive rocks form a continuous belt along the southern, western and northwestern margins of the Halliday dome (see fig. 2).

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 shear zones.

Green to greenish-black coloured peridotite, pyroxenite and dunite dominate 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 peridotite is from a previous report by Marshall (1947, p. 10):

"For the most part, the texture is fibrous; ophitic texture is not common. The mineral constituents are chiefly olivine, pyroxene (enstatite), serpentinite 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."

Grey to grey-green coloured gabbro with some peridotite, dominates the intrusive belt south of Dumbell and Rhyolite lakes. The following description is from a previous 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."

FELSIC INTRUSIVE ROCKS

Four small felsic dikes were recognized in the map-area. Fine-to-medium-grained grey granite or granodiorite dikes intrude the felsic volcanic rocks 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 sedimentary rocks 500 feet northwest of the western end of Midlothian Lake. In Halliday township on the

hydro line northwest of Annie Lake is a fine-to-medium-grained reddish green mafic syenite or lamprophyric dike.

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.

The reddish brown weathering diabase is a medium to coarse-grained, dark grey rock 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 an earlier report by 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."

P R O T E R O Z O I C

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. Well bedded greywacke with subordinate beds of conglomerate, argillite and quartzite are exposed along the east shore of Lloyd Lake.

Conglomerate beds, ranging from 6 inches wide to 5 feet wide consist of an open framework of "granite" and "greenstone" pebbles in a dark green to grey coloured greywacke or quartzite 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 congomerate 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 an earlier report by 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 southeast shore of Lloyd Lake are pinkish grey, medium-grained rocks. In places where the proportion of feldspar is very

high, the rock is 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 beds of argillite, and argillite and greywacke show slump and scour-and-fill structures.

POST - HURONIAN

Late Mafic Intrusive Rocks

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 occurs within a few feet of the Huronian rocks, northeast of Roche Lake. The following description of the diabase is taken from Marshall's report (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. Parabolic dunes in the northwest and southwest parts of the 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, the township to the east of Halliday 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 on the northwest flank of the Round Lake granitic batholith. Along the margins of the dome, intermediate to mafic volcanic rocks, and in places sedimentary rocks occupy axial areas of tight folds. The regional trend of volcanic, sedimentary, and associated ultramafic and mafic intrusive rocks, together with the majority of top determinations agree with the above structural interpretation.

In the northeastern part of the map-area, a belt of sedimentary rocks 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 sedimentary rocks, particularly south of Roche bay on Midlothian Lake and near Slipper and Fold lakes at the western end of the belt. The volcanic rocks overlying the older sedimentary rocks occupy the axial plane area of the syncline. The axis of the syncline trends N. 75° 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, indicates an east-plunging fold.

In Halliday township structural interpretation is hampered by major crossfaulting, poorly exposed bedrock and the lack of reliable features for the determination of tops. A prominent east 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 the accompanying maps (in 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. The 7,000 foot apparent horizontal displacement of the volcanic strata along the east branch of the Grassy River, might be in part the result of another system of north to northeast-trending right-lateral faults which are 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 volcanic-sedimentary contact about 3,500 feet and 600 feet respectively. The abrupt termination of the sedimentary rocks 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 volcanic rocks with the sedimentary rocks is a prominent zone of intensive shearing.

A northeast-trending zone of sheared felsic volcanic rocks 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 volcanic and sedimentary rocks. If the northeast-trending right-lateral faults and this shear zone are related, the Mitt Lake and associated left-lateral faults are the youngest major faults in the map-area.

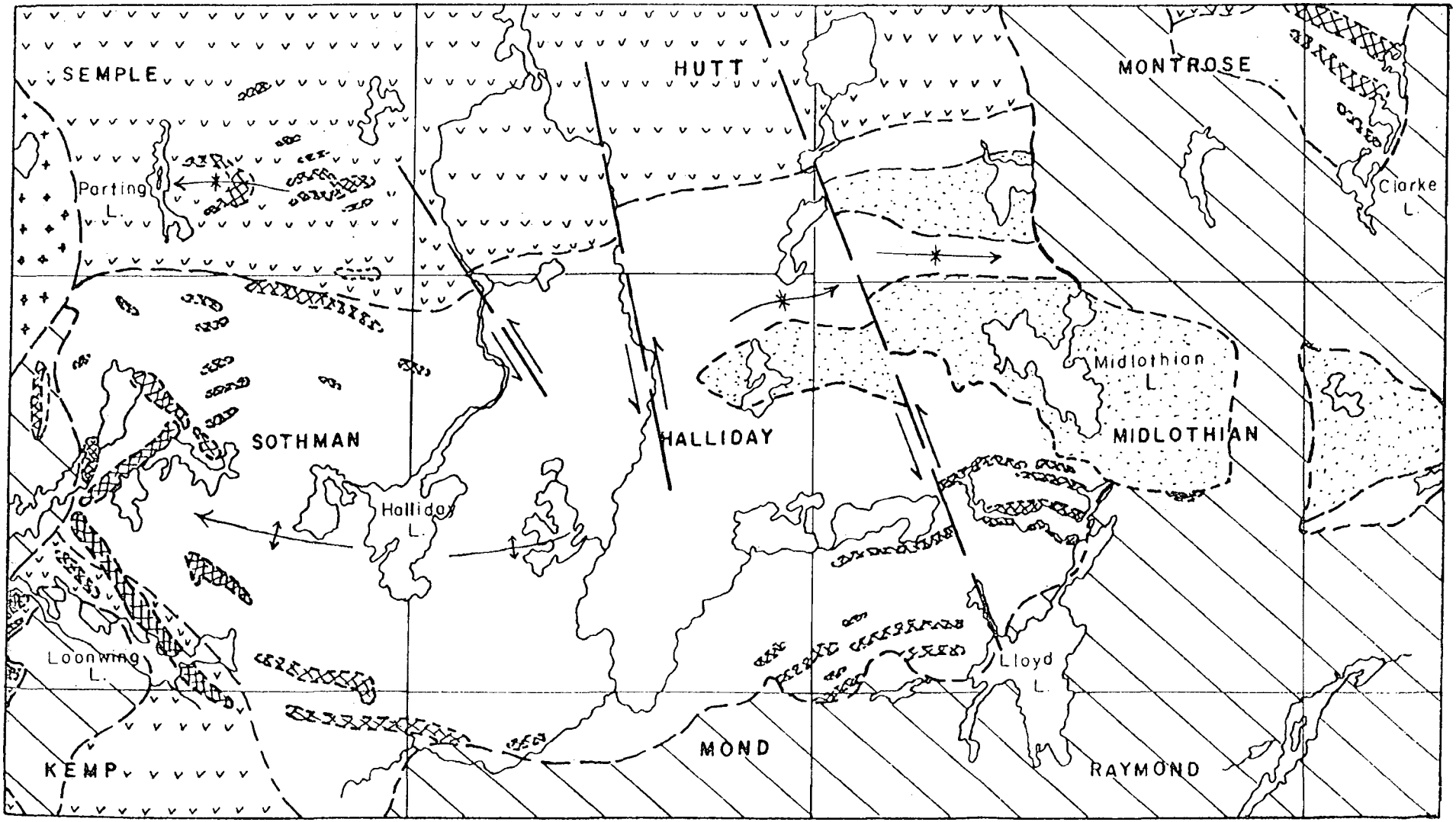


Figure 2 — Main structural features of the Interpreted Halliday Dome

LEGEND

- Cobalt sedimentary rocks
- Granite
- Peridotite-gabbro
- Older sedimentary rocks
- Basalt-andesite
- Dacite-rhyolite

SYMBOLS

- Geological contact
- Fault (assumed)
- Plunging syncline
- Plunging anticline

ECONOMIC GEOLOGY

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

During the 1950's and early 1960's most investigations were concentrated on the potential gold-bearing sedimentary rocks and the principal asbestos and copper-nickel showings associated with ultramafic to 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.

A list of assessment work reports filed to the end of 1967 is given in Table 1.

Table I — Assessment work reports for Halliday and Midlothian townships to end of 1967 filed with O.D.M. Resident Geologist at Kirkland Lake.

Name	Year	Type of Information
Amax Exploration, Incorporated	1967	Drilling
Canadian Johns-Manville Company Limited	1952	Drilling
Cominco Limited (Annie Lake claims)	1965	Drilling
Cominco Limited (Lloyd Lake claims)	1965	Drilling
Cominco Limited (Ragan Property)	1945	Geological
Dominion Gulf Company (Halliday township)	1950	Geological
Dominion Gulf Company (Midlothian township)	1956	Geological, drilling and magnetometer survey
Halliday Mines Limited	1965	Geological, drilling
Laroma Midlothian Mines Limited	1966	Geological, drilling and airborne geophysical
Morgan, C.R.	1963	Drilling
Riocanex Limited	1964	Geological, drilling
Sherwood Gold Mines Limited	1946	Geological
Stairs Exploration and Mining Company Limited	1964	Geological, drilling, airborne E-M survey
Sylvanite Gold Mines Limited	1943	Geological
Texas Gulf Sulphur Company Incorporated	1968	Drilling

DESCRIPTIONS OF PROPERTIES AND AREAS OF MINERALIZATION

ASBESTOS

Stringers and veinlets of cross-and-slip-fibre asbestos cut the serpentinized ultramafic intrusive rocks in the southeastern part 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. A summary of work done is given below under present property owners, and company name headings followed by the year in which the work was completed.

Asbestos Lloyd Mines Limited

No. 4 on Map No. *

The company was incorporated in 1953, and acquired their present group of 6 surveyed claims along the north shore of the west arm of Lloyd Lake in Midlothian township. The property consists of claims MR. 18031 to MR. 18036 inclusive and was formerly held by W.E. Vanclieaf.

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

In 1950, Canadian Johns-Manville, Limited optioned the property from W.E. Vanclieaf, as well as the Miller property farther west, and the Copeland property farther east. Seventeen drillholes with a total length of 11,400 feet were drilled

* Numbers refer to those on Preliminary Maps, P.385 and P.386, in back pocket.

in an east-west cross-section of claims MR. TR1930, MR. 18031, MR. 18032, MR. 18034, MR. 18036, MR. 18072 and MR. 18071. The drilling 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 (Canadian Johns-Manville Ltd.,1952).

Dominion Gulf Company [1952 - 1954]

No. 8 on Map No. ——

In May 1952, Dominion Gulf Company, held a group of 28 unsurveyed claims near the west arm of Lloyd Lake in Midlothian township. These claims surrounded the T.H. Miller property and the former Vanclieaf and Copeland 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 drillhole on claim MR. 20051 intersected serpentinized pyroxenite and peridotite containing cross-fibre asbestos.

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

T. H. Miller, Executor

No. 11 on Map No. ——

The T.H. Miller claims, TR. 1929 to 1931 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 and Copeland claims farther west. Five holes with a total length of 1,915 feet were drilled in the central and southern parts of claim TR. 1930. The drilling indicated, that a 3,000 foot cross-fibre asbestos zone to the east on the former Vanclieaf property continued for about 1,000 feet across claim TR. 1930. Most of the fibre is about 1/8-inch long but in places reaches lengths of ¼-inch (Canadian Johns-Manville, Ltd., 1952).

In 1952, the property was optioned by Dominion Gulf Company. Three holes were drilled on claim TR. 1930 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

No. 13 on Map No. ——

In 1967, Garfield E. Parsons held a surveyed claim (MR. 20051) 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 which is underlain by rhyolite intruded by peridotite and gabbro.

W. E. Vanclieaf

No. 20 on Map No. ——

In 1967, Wilbert Earl Vanclieaf held a group of nine surveyed claims, the former Copeland property, north of Lloyd Lake in Midlothian township. The

claims are MR. 18066 to MR. 18074 inclusive.

In 1950, Canadian Johns-Manville optioned this property together with the adjoining claims farther west. Two drillholes, one on claim MR. 18071 and the other on MR. 18072, 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 sedimentary rock 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 to mafic intrusive sills and stocks. A copper-nickel showing in rhyolite, adjacent to serpentinite is on the south shore of Bray Lake in Midlothian township. Significant concentrations of copper and nickel in the ultramafic to 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.

A summary of work done is given below under present property owners, and company name headings followed by the year in which the work was completed.

Amax Exploration Incorporated [1967]

Nos. 1, 2, 3 on Map No. ——

In 1967, Amax Exploration Incorporated, held three large groups of unsurveyed claims in Halliday township: the Adele group, a block of 35 claims near the hydro line along the northern boundary of the township; the Pat group, a block of 25 claims northwest of Annie Lake; and the Barbara group, 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[1], and an induced polarization survey and several drillholes tested the most promising conductive zones outlined by airborne geophysics.

On the Adele group, No. 1 on the map, 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 dacite flows and breccias containing an average of 6 percent pyrite. In the core from another hole drilled farther east, the author saw a stringer of massive chalcopyrite about ½-inch wide cutting rhyolite-dacite.

On the Pat group, No. 2 on the map, a drillhole 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-southeast across Annie Lake. This band of intermediate pyroclastic rocks contains zones of disseminated pyrite, pyrrhotite and minor

1 Geologist, Amax Exploration Incorporated.

chalcopyrite. Lenses of graphite-pyrite-marcasite occur near its northern and southern contacts with rhyolitic strata.

Cominco Limited [1965]

No. 5 on Map No. ——

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 drillholes intersected zones of graphitic tuff and slate containing disseminated to massive pyrite and nodular marcasite.

No. 6 on Map No. ——

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 volcanic rocks a few hundred feet south of an ultramafic-mafic sill or plug. A 100 foot drillhole in the southeast corner of claim MR. 39864 intersected about 50 feet of disseminated pyrite, pyrrhotite, and minor chalcopyrite. Cominco (1965) estimated the amount of pyrite to be 10 to 12 percent and pyrrhotite, 3 to 5 percent.

Dominion Gulf Company [1956]

No. 7 on Map No. ——

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).

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 MR. 18073. The other, a smaller anomaly lies about ¼ mile farther west. The author knows of no drilling done on these anomalies.

C. R. Morgan [1966]

No. 12 on Map No. ——

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 in the southeast shore of Bray Lake. A one 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 contained a trace of nickel. The sheared countryrock is cut by veinlets of serpentine which emanate from a peridotite sill intruding the volcanic rocks a short distance north and west of the mineralized zone.

In 1963, Morgan drilled two holes on claim MR. 43151 west of Bray Lake, and intersected disseminated pyrite, pyrrhotite, and sphalerite in a rhyolite breccia. No assays for these sections are available. A drillhole on the west shore of Lloyd Lake south of claim TR. 1929 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 [1967]

No. 18 on Map No. ——

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 milepost 5, that lie north of the property of Texas Gulf Sulphur Company Incorporated; and a group of 9 unsurveyed claims, near milepost 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 plug.

The company's southern claim group is underlain by an area of intensely brecciated rhyolite, whose silicic matrix contains disseminated pyrite. Talisman reports several good electromagnetic conductors on their property (The Northern Miner, Nov. 9, 1967, p. 15).

Texas Gulf Sulphur Company Incorporated [1967]

No. 19 on Map No. ——

In 1967, Texas Gulf Sulphur Company held a group of 11 unsurveyed claims near the 4-milepost on the western boundary of Halliday township.

A east-trending band 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 sedimentary rocks, particularly near the contact with the older rhyolitic strata. Native gold and gold-silver amalgam are associated with chalcopyrite, freibergite, tetrahedrite, sphalerite and galena.

On July 2nd 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 oz. gold and 1,318 oz. silver valued at $100,729. A summary of work done is given below under present property owners, and company name headings followed by the year in which the work was completed.

Cominco Limited [1945]

No. 6 on Map No. ——

In 1945, Cominco Limited, formerly Consolidated Mining and Smelting Company of Canada Limited optioned a group of 20 unsurveyed claims near Patricia Lake 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 oz. gold per ton (Cominco Ltd., 1946).

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

L. Lamothe [circa 1951]

No. 10 on Map No. ——

In the early 1950's, 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 claim S.56711. Between 1962 and 1967, Stairs Exploration and Mining Company Limited held the property.

Laroma Midlothian Mines Limited

No. 10 on Map No. ——

In 1967, Laroma Midlothian Mines Limited held three surveyed claims, MR. 13317, MR. 13320 and MR. 13321 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 volcanic-sedimentary

contact. At this time, the company drilled 17 drillholes with a total length of 7,214 feet on claims MR. 13317, MR. 13320 and MR. 13321.

In 1962, Laroma began a new program of stripping, trenching, and drilling around the original gold showing on claim MR. 13321. 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 MR. 13321, 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 oz. gold per ton (The Northern Miner, Dec. 5, 1963). The author observed gold in a $\frac{1}{4}$ inch wide quartz vein in a network of narrow quartz veins in the large pit on claim MR. 13317. A bulk sample of about 60 lbs. taken from this pit gave an assay of 0.76 oz. gold per ton (The Northern Miner, Dec. 5, 1963). Two holes were drilled near these pits to test the showings at depth.

Several holes drilled along the volcanic-sedimentary contact northwest of the green carbonate zone intersected several zones of disseminated to massive graphite-pyrite-marcasite.

Pitchvein Mines Limited [1963]

No. 14 on Map No. ——

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

Riocanex Limited [1963]

No. 15 on Map No. ——

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 MR. 33463. Stairs reported assays averaging 0.53 oz. gold per ton over an 8 foot core section of sheared carbonatized conglomerate (The Northern Miner, Nov. 15, 1962).

Riocanex Limited carried out a program of stripping, trenching and sampling on several zones of shearing and quartz veining, before making a detailed geological map of the property. A drillhole was put down near the western end of the Wood Lake (No. 2) auriferous zone in claim MR. 33462.

J. Lehto (Riocanex company report, 1964) described some showings on the property as follows:

1. " '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

of Holbrooke Lake ..... Most of the quartz material conforms with the intense shearing ..... sampling which followed the stripping revealed trace of gold only."

2. " '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 were 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 500 feet west of Strike Lake, and 400 feet northwest of Midlothian Lake.

Stairs Exploration and Mining Company Limited

No. 16 on Map No. ——

History and Development

In 1967, Stairs Exploration and Mining Company Limited held a group of 18 leased claims in the northwest part of Midlothian township and a large group of unsurveyed claims surrounding them. The leased claims that form the nucleus of the property are numbered MR. 26660 to 26665, MR. 27268, MR. 27269, MR. 33348 to MR. 33352, MR. 33457 to 33460 and MR. 3370. The original gold showing on Stairs claims MR. 26664 and MR. 26665, (the present location of underground mine workings) was staked in 1944 by Upper Canada Mines Limited (see Marshall, 1947). In 1947,

Sherwood Gold Mines, a subsidiary of Upper Canada Mines Limited, 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. 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 2.

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 oz. gold and 1,318 oz. silver.

Table 2[1] The development footage at Stairs Mine in 1966, and the accumulated footage to the time of closure, 30 April 1966.

Level	Drifts	Crosscuts		Raises
	Total	1966	Total	Total
	feet	feet	feet	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

Geology

The mine is in on the southern edge of a belt of steeply dipping sedimentary rocks which disconformably overlie older rhyolitic strata. In the following geological description, the position of the mine shaft on the volcanic-sedimentary 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 mine, the shaft is confined to an extremely hard volcanic breccia.

1 With the property owners' permission, the level plans of the mine may be seen at the office of the resident geologist, Kirkland Lake, Ontario.

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 carbonatitized 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 volcanic-sedimentary contact trends N. 80° 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 volcanic-sedimentary contact. The western end of the shaft breccia's hanging wall is displaced a few feet southwest by post-ore movement along the volcanic-sedimentary contact.

Wallrock Alteration

Pre-ore wallrock alteration consisting of silicification, sericitization, carbonatization, and the development of some chrome micas, imparts a yellowish-brown color 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 sedimentary rocks. This bed might have acted as a barrier to the altering solutions advancing northward from the shaft breccia.

Veining 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 from 1 foot to 2 feet wide strikes N. 55° 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 inches 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° N.W. and strikes N. 55° E., but from the 200-foot level to the 350-level, the Pope vein changes its strike to N. 35° E. Because the drag fold plunges approximately 60° west, and the Pope vein dips more steeply in the same direction, the vein between the 200-foot level and the 350-foot

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 veining is 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 amalgam 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 mineralized 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. 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 N. 55° 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. The company geologist R.J. Roach, reported that a sample taken from the vein gave an assay of about 90 oz. silver and 0.8 oz. gold per ton.

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. The zone can be reached by a 1 mile tractor road from the Stairs Mine. Stairs reported assays averaging 0.53 oz. gold per ton over an 8-foot section of core from a sheared carbonatized conglomerate (The Northern Miner, Nov. 15, 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 MR. 33463. In 1963, Stairs optioned this property to Riocanex Limited.

Slipper Lake Zone: Narrow gold-bearing quartz veins and stringers in sheared conglomerate are present on leased claim MR. 26662 near Slipper Lake.

Campbell Lake Zone: An 800-foot long and 2- to 4-foot wide quartz vein is present 1,000 feet northeast of the east bay on Campbell Lake. The vein strikes N. 50° 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 drillholes 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 drillhole 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. 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 a trace of gold, 0.30 oz. silver per ton, 0.70 per cent zinc, 0.27 per cent nickel, 0.15 per cent copper and 0.10 per cent lead (Stairs, 1966).

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

Sylvanite Gold Mines Limited [circa 1945]

No. 17 on Map No. ——

In 1945, Sylvanite Gold Mines Limited, held a large block of unsurveyed claimsbetween Campbell Lake and Slipper Lake in the north-central part of the map-area. The company investigated a number of sheared carbonatized zones in the

sedimentary rocks along the northern and southern sedimentary-volcanic contacts. Trenching and sampling of quartz veinlets and stringers in some of these zones, particulary near Fold, Bluebottle and Slipper lakes yielded little more than a trace of gold.

Miscellaneous Occurrences

Elizabeth Lake Showing. In 1946, Marshall (1947) observed a gold-bearing quartz stringer cutting greywacke on the creek south of Elizabeth Lake.

Tory Lake Showing. In 1946, Marshall (1947) 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.

RECOMMENDATIONS FOR FUTURE EXPLORATION

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

1. The best possibilities for nickel mineralization in the map-area are the ultramafic-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 per cent nickel, plus approximately 400,000 tons of 0.90 per cent material (Financial Post Survey of Mines, 1968, p. 153).

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 in Midlothian township. This zone continues west about 1,000 feet on the adjoining Miller property.

2. In future exploration for gold, take into account the fact that the known gold-bearing zones are in the lower sedimentary beds overlying older rhyolitic strata; and the altered conglomerate is a more favourable host rock for gold-bearing quartz veins than are the altered arkose or greywacke.

3. 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 rhyolite or dacite 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 raises the possibility of a volcanic origin of these sulphide ores and their concentration near or at 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:

1. Northwest of Halliday Lake where the black cherty matrix of the brecciated rhyolitic strata contain disseminated pyrite-pyrrhotite-minor chalcopyrite.
2. Near Annie Lake and north of Halliday, Relic and Radio lakes, both the fragmental rhyolite and dacite, and the adjacent large band of andesite tuff-agglomerate-breccia contain zones of disseminated pyrite-pyrrhotite-minor chalcopyrite and lenses of graphite-pyrite-marcasite.
3. Near Weary and Mavis lakes, coarse fragmental rhyolite containing lenses of disseminated to massive graphite-marcasite-pyrite, lies near a belt of ultramafic to mafic sills and stocks.
4. South of Relic Lake, the southern margin of the Halliday dome is covered by aeolian sand and esker material and for this reason the areas has received little attention.

Selected References

Abraham, E.M.

1953: Geology of Sothman Township; Ont. Dept. Mines, Vol. 62, pt. 6.

Gledhill, T.L.

1926: Grassy River Area, District of Sudbury; Ont. Dept. Mines, Vol. 35, pt. 6, p. 57–76.

Marshall, H.I.

1947: Geology of Midlothian Township; Ont. Dept. Mines, Vol. 56, pt. 5.

Moorhouse, W.W.

1965: Stratigraphic Position of Sulphides in the Archean; C.I.M.M. Bull., Vol. 58, p. 261–264.

Rickaby, H.C.

1932: Bannockburn Gold Area; Ont. Dept. Mines, Vol. 41, pt. 2, p. 1–24.

Wilson H.D.B.

1967: Presidential Address, Volcanism and Ore deposits in the Canadian Archaean; Proc. Geol. Ass. of Canada, Vol. 18, p. 11–31.

Maps

Geol. Surv. Canada

Aeromagnetic maps: No. 286G, Sinclair Lake; No. 287G, Matachewan; No. 291G, Muskasenda Lake. Scale, 1 inch to 1 mile. Geol. Surv. Canada; published 1956.

Ontario Dept. Mines

No. 2046 - Timmins-Kirkland Lake sheet. Scale, 1 inch to 4 miles (compilation sheet). Published 1964.

No. 1953-3 - Geology of Sothman Township, District of Sudbury. Scale, 1 inch to 1,000 feet. Geology by E.M. Abraham 1953. Published 1953.

No. P. 385 (prel. map) - Halliday township, District of Sudbury, Ontario. Scale, 1 inch to ¼ mile. Geology by E.G. Bright 1966. Published 1967, revised 1968.

No. P. 386 (prel. map) - Midlothian township, District of Timiskaming, Ontario. Scale, 1 inch to ¼ mile. Geology by E.G. Bright 1966. Published 1967, revised 1968.

ONTARIO DEPARTMENT OF MINES

PRELIMINARY GEOLOGICAL MAP NO. P. 385

HALLIDAY TOWNSHIP

DISTRICT OF SUDBURY

Scale 1 inch to 1/4 mile

N.T.S. Reference 41P/15
G.S.C. Aeromagnetic Map 2866

MARGINAL NOTES FOR HALLIDAY AND MIDLOTHIAN TOWNSHIPS

Location and Access: Halliday and Midlothian townships, which are on the borders of the Districts of Sudbury and Timiskaming are situated 18 miles west of Matachewan. They are easily accessible via Highway 566. The route follows 28 miles of good secondary gravel road to a 9-mile access road which extends southward to Stairs Midlothian mine. Further westward on the main gravel road, logging roads and an Ontario Hydro road give ready access to Halliday township.

Mineral Exploration: There have been four periods of particular staking activity in Midlothian and parts of Halliday townships, namely 1909, 1917, 1944 and 1962.

In 1962, the Sherwood Gold Mine's property in Midlothian township was acquired by Stairs Exploration and Mining Co. Ltd. By July 1965, 1,928 feet of trenching, 45,077 feet of surface diamond drilling, 7,647 feet of underground drilling, and 30 square miles of air-borne geophysical coverage had been completed. The Stairs mine produced 2,674 oz. gold and 1,318 oz. silver valued at $100,729 from Sept. 1965 to Apr. 1966. The company is now engaged in further exploration in the area.

Geological and geophysical surveys were conducted over many of the adjoining claim groups and diamond drilling programs were carried out on favourable zones by Laroma Midlothian Mines Ltd. during 1963 and 1964; Riocanex in 1963; Pitchvein Ltd. in 1963 and Halliday Mines Ltd. during the summer of 1964.

In 1952 and 1953, The Dominion Gulf Co. optioned the Miller claims (TR 1929, 1930, 1931) in Midlothian township. Drilling and surface work on this zone of ultramafic intrusive rocks, indicated an asbestos fibre zone 1,200 feet long and with a probable average width of 200 feet. In the summer of 1956, further work was carried out on the nickel showing on the south shore of Bray Lake.

In 1965 a geophysical survey and a minor amount of drilling was done by Cominco Ltd. on the southwest side of Lloyd Lake in Midlothian township and on the west shore of Annie Lake in Halliday township.

General Geology: Precambrian metasediments consisting mainly of conglomerate, greywacke, arkose and slate with subordinate lenses of marcasite-graphite schist, form an east-west trending belt, crossing most of the northern part of Midlothian township and extending westward into Halliday township. This belt abruptly disappears beneath the overburden west of Campbell Lake and only reappears as small outliers in central Halliday township.

Along the flanks of this belt are thick sequences of older east-west trending metavolcanics, which underlie the remaining part of the area. The metavolcanics on the northern flank include massive, amygdaloidal, breccia and pillowed dacites and andesites, with which are intercalated subordinate rhyolite tuffs and breccias. The metavolcanics on the southern flank consist mainly of rhyolite flows, tuffs, and breccias. Intermediate flows are most prominent in Halliday township, particularly in the northern half where they grade into mafic extrusive rocks.

Intrusive into the metavolcanics is a zone of ultramafic to mafic sill-like bodies. This zone comprises a complex with a dunite and peridotite centre and a pyroxenite and gabbro marginal phase. The smaller isolated bodies may show only one or two of these phases.

A very small number of medium- to fine-grained granitic dikes crosscut these older rocks. Similarly these older rock units are cut by regular to irregular north-trending Matachewan diabase dikes. There is a very noticeable decrease in their occurrence going westward from Midlothian to Halliday township.

Younger, probably Huronian, conglomerates, quartzites, greywackes and argillites, unconformably overlie the previously described rock units. Younger quartz diabase lenses occur in these sedimentary rocks.

Structural Geology: The major structural element is the belt of older metasediments, which occupies the central portion of a large easterly-plunging syncline, whose axis has been displaced by a series of north-south shear zones. The abrupt termination of the metasedimentary belt west of Campbell Lake, may be due to erosion, acting in conjunction with the plunge of the fold, or it may be due to faulting parallel to the Grassy River System. Top determinations on the overturned northern limb of the fold are scarce, while excellent examples of graded bedding and crossbedding are to be found south of Roche Bay on Midlothian Lake.

Strong east-west faults cross Midlothian and Halliday townships. One of the strongest of these crosses a few hundred feet south of Stairs mine, near the contact between the metasediments and metavolcanics. Two other major sets of faulting have northeast and north-northwest strikes. The largest offsets have occurred along these later left-handed north-northwest faults.

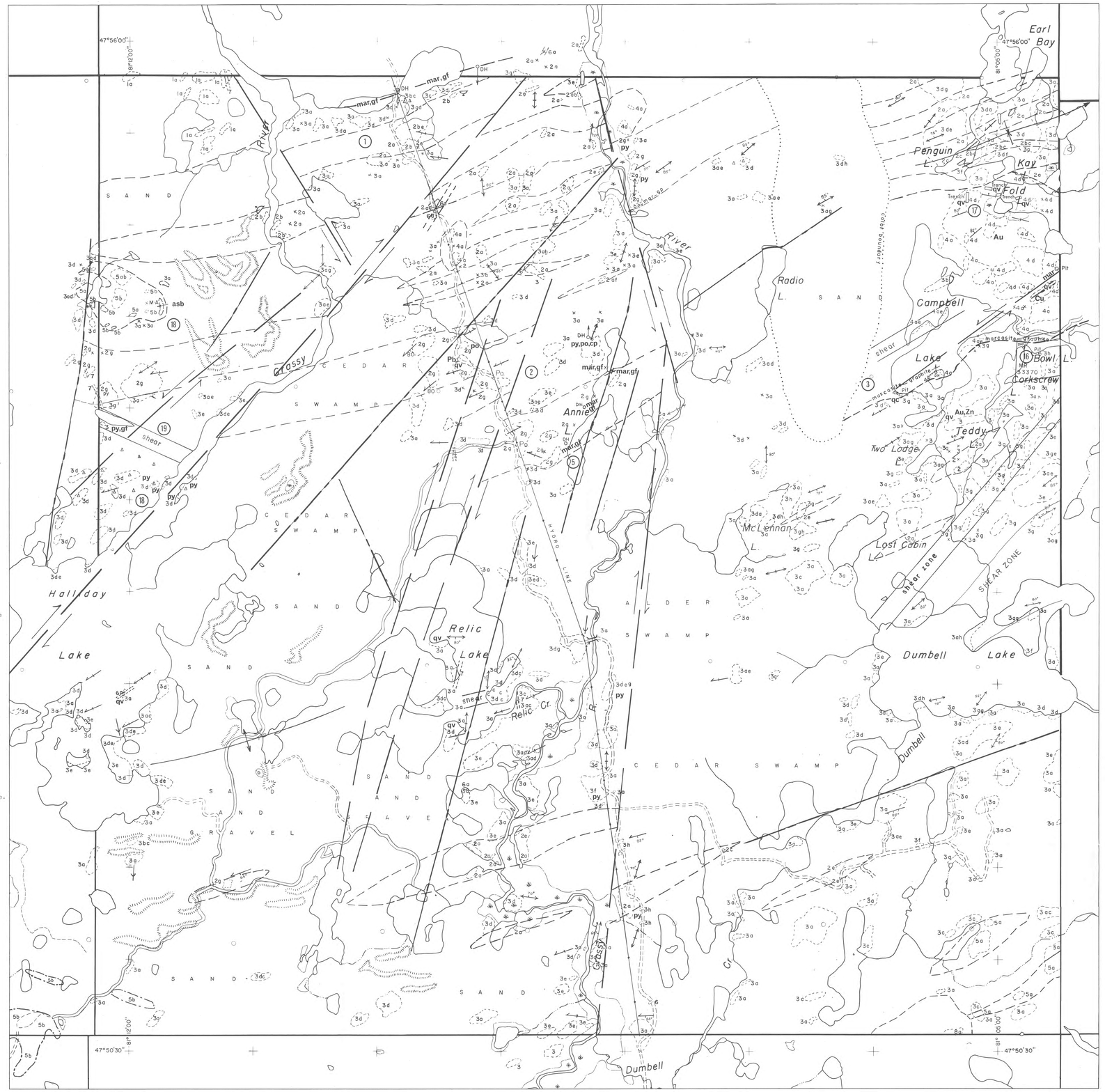
Economic Geology: The Stairs mine, situated on the southern limb of the syncline, produced gold and silver from 1965 to 1966. The gold-bearing quartz veins occur in two zones of intense shearing and sericitization, each 30-40 feet wide separated by about 125 feet of altered arkose and conglomerate. The quartz veins emanate from a carbonatized fault zone; and strike N50°E. Gold is associated with chalcopyrite, galena, tetrahedrite, and sphalerite.

On the Laroma Midlothian Mines property, gold occurs in a network of quartz stringers, in a green carbonate zone. Relic textures and unaltered fragments in this zone suggest that it was originally an ultramafic body. Minor pyrite, chalcopyrite, galena and sphalerite are observable in this zone. According to Marshall (1947, p. 18) the company reported assays of 0.07 oz. gold per ton from core and selected samples; visible gold occurs sparingly on surface showings.

Reports filed for assessment work credit at the Resident Geologist's Office, Kirkland Lake indicate that very restricted but good gold values have been found in northeast Halliday and northern Midlothian townships.

A grab sample from the pit on the south shore of Bray Lake assayed 0.14% nickel.

Asbestos was seen in the ultramafic rocks on the northwestern arm of Lloyd Lake (see also Marshall 1947, p. 21).



LEGEND FOR HALLIDAY AND MIDLOTHIAN TOWNSHIPS

CENOZOIC
RECENT AND PLEISTOCENE
Glacial drift, gravel, sand and silt
UNCONFORMITY

PRECAMBRIAN
PROTEROZOIC
LATE MAFIC INTRUSIVE ROCKS
9 Diabase
INTRUSIVE CONTACT

HURONIAN
COBALT GROUP (Gowganda Formation)
8 Undifferentiated
8a Conglomerate
8b Greywacke, quartzite and arkose
8c Argillite
UNCONFORMITY

ARCHEAN
MAFIC INTRUSIVE ROCKS (MATACHEWAN)
7 Diabase
INTRUSIVE CONTACT

FELSIC INTRUSIVE ROCKS
6 6a Medium-grained granitic dikes
6b Fine-grained porphyry (dikes)
INTRUSIVE CONTACT

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS
5 Undifferentiated
5a Gabbro
5b Peridotite, pyroxenite, dunite
5c Serpentinite
INTRUSIVE CONTACT

METASEDIMENTS[a]
4 Undifferentiated
4a Arkose
4b Greywacke
4c Slaty argillite
4d Conglomerate
4e Sericitized sedimentary rocks
4f Pyroclastic sedimentary rocks
DISCONFORMABLE AND INTERFINGERING CONTACT

FELSIC METAVOLCANICS[b]
3 Undifferentiated
3a Rhyolite-dacite
3b Pillowed dacite
3c Amygdaloidal rhyolite-dacite
3d Rhyolite-dacite breccia
3e Porphyritic rhyolite-dacite
3f Rhyolitic tuff
3g Sericite schist
3h Chlorite-sericite schist

INTERMEDIATE METAVOLCANICS
2 Undifferentiated
2a Andesite
2b Pillowed andesite
2c Amygdaloidal andesite
2e Porphyritic andesite
2g Andesite-dacite tuff-agglomerate-breccia

MAFIC METAVOLCANICS
1 1a Massive basalt

[a] Some volcanic rocks are younger than the sedimentary rocks.
[b] The metavolcanic rocks are interstratified, but felsic volcanic rocks predominate in the lower part of the stratigraphic succession. The order does not imply age relationships.

Breccia

Carbonatized Rock

GEOLOGICAL AND MINING SYMBOLS

- Glacial striae.
- Parabolic sand dunes.
- 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, deduced from geophysics.
- Fault; (observed, assumed).
- Lineament.
- Drag folds with plunge.
- Anticline, syncline, with plunge.
- Drill hole; (vertical, inclined).
- Vein, vein network. Width in inches.
- Shaft; depth in feet.

MINERAL OCCURRENCE REFERENCE

asb	Asbestos	Ni	Nickel
Au	Gold	Pb	Lead
Ag	Silver	po	Pyrrhotite
Cu	Copper	py	Pyrite
gf	Graphite	q.c.	Quartz-carbonate
hem	Hematite	q.v.	Quartz vein
mar	Marcasite	Zn	Zinc

LIST OF PROPERTIES AND AREAS OF MINERAL EXPLORATION FOR HALLIDAY AND MIDLOTHIAN TOWNSHIPS

1. Amax Exploration Incorporated, Adele group
2. Amax Exploration Incorporated, Pat group
3. Amax Exploration Incorporated, Barbara group
4. Asbestos Lloyd Mines Limited (MR.18031-6)
5. Cominco Limited, Halliday township
6. Cominco Limited, Midlothian township
7,8. Dominion Gulf Company
9. Lamothe, L.
10. Laroma Midlothian Mines Limited.
11. Miller, Thomas Henry, Executor (TR. 1929-31)
12. Morgan, C.R.
13. Parsons, Carfield E. (MR.20051)
14. Pitchvein Mines Limited
15. Riocanex Limited
16. Stairs Exploration and Mining Company Limited
17. Sylvanite Gold Mines Limited
18. Talisman Mines Limited
19. Texas Gulf Sulphur Company Incorporated
20. Vanclieaf, Wilbert Earl (MR.18070-4, 18066-9)

SOURCES OF INFORMATION

Geology by E.G. Bright and assistants, 1966.
Marshall, H.I., Geology of Midlothian township; Ontario Dept. Mines, Vol. LVI, 1947, pt. 5, accompanied by Map 1947-4.
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Base map derived from maps of the Forest Resources Inventory of the Ontario Department of Lands and Forests, with revisions by E. G. Bright.
Magnetic declination, 1966, approximately 11°W.

Issued 1967. Additions and corrections, May 1968. Re-issued 1968.

ODM 4180,4322

ONTARIO DEPARTMENT OF MINES

PRELIMINARY GEOLOGICAL MAP NO. P. 386

MIDLOTHIAN TOWNSHIP

DISTRICT OF TIMISKAMING

Scale 1 inch to 1/4 mile

N.T.S. Reference 41P/14, 41P/15
G.S.C. Aeromagnetic Maps 286G, 287G

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CENOZOIC
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3g Sericite schist
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Au	Gold	Pb	Lead
Ag	Silver	po	Pyrrhotite
Cu	Copper	py	Pyrite
gf	Graphite	q.c.	Quartz-carbonate
hem	Hematite	q.v.	Quartz vein
mar	Marcasite	Zn	Zinc

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20. Vancleaf, Wilbert Earl (MR.18070-4, 18066-9)

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Base map derived from maps of the Forest Resources Inventory of the Ontario Department of Lands and Forests, with revisions by E. G. Bright.
Magnetic declination, 1966, approximately 11°W.

Issued 1967. Additions and corrections, May 1968. Re-issued 1968.

ODM 4181, 4323

MARGINAL NOTES FOR HALLIDAY AND MIDLOTHIAN TOWNSHIPS

Location and Access: Halliday and Midlothian townships, which are on the borders of the Districts of Sudbury and Timiskaming are situated 18 miles west of Matachewan. They are easily accessible via Highway 566. The route follows 28 miles of good secondary gravel road to a 9-mile access road which extends southward to Stairs Midlothian mine. Further westward on the main gravel road, logging roads and an Ontario Hydro road give ready access to Halliday township.

Mineral Exploration: There have been four periods of particular staking activity in Midlothian and parts of Halliday townships, namely 1909, 1917, 1944 and 1962.

In 1962, the Sherwood Gold Mine's property in Midlothian township was acquired by Stairs Exploration and Mining Co. ltd. By July 1965, 1,928 feet of underground drilling, and 30 square miles of air-borne geophysical coverage had been completed. The Stairs mine produced 2,674 oz. gold and 1,318 oz. silver valued at $100,729 from Sept. 1965 to Apr. 1966. The company is now engaged in further exploration in the area.

Geological and geophysical surveys were conducted over many of the adjoining claim groups and diamond drilling programs were carried out on favourable zones by Laroma Midlothian Mines Ltd. during 1963 and 1964; Riocanex in 1963; Pitchvein ltd. in 1963 and Halliday Mines Ltd. during the summer of 1964.

In 1952 and 1953, The Dominion Gulf Co. optioned the Miller claims (TR 1929, 1930, 1931) in Midlothian township. Drilling and surface work on this zone of ultramafic intrusive rocks, indicated an asbestos fibre zone 1,200 feet long and with a probable average width of 200 feet. In the summer of 1956, further work was carried out on the nickel showing on the south shore of Bray Lake.

In 1965 a geophysical survey and a minor amount of drilling was done by Cominco ltd. on the southeastern side of Lloyd Lake in Midlothian township and on the west shore of Annie Lake in Halliday township.

General Geology: Precambrian metasediments consisting mainly of conglomerate, greywacke, arkose and slate with subordinate lenses of marcasite-graphite schist, form an east-west trending belt, crossing most of the northern part of Midlothian township and extending westward into Halliday township. This belt abruptly disappears beneath the overburden west of Campbell Lake and only reappears as small outliers in central Halliday township.

Along the flanks of this belt are thick sequences of older east-west trending metavolcanics, which underlie the remaining part of the area. The metavolcanics on the northern flank include massive, amygdaloidal, breccia and pillowed dacites and andesites, with which are intercalated subordinate rhyolite tuffs and breccias. The metavolcanics on the southern flank consist mainly of rhyolite flows, tuffs, and breccias. Intermediate flows are most prominent in Halliday township, particularly in the northern half where they grade into mafic extrusive rocks.

Intrusive into the metavolcanics is a zone of ultramafic to mafic sill-like bodies. This zone comprises a complex with a dunite and peridotite centre and a pyroxenite and gabbro marginal phase. The smaller isolated bodies may show only one or two of these phases.

A very small number of medium- to fine-grained granitic dikes crosscut these older rocks. Similarly these older rock units are cut by regular to irregular north-trending Matachewan diabase dikes. There is a very noticeable decrease in their occurrence going westward from Midlothian to Halliday township.

Younger, probably Huronian, conglomerates, quartzites, greywackes and argillites, unconformably overlie the previously described rock units. Younger quartz diabase lenses occur in these sedimentary rocks.

Structural Geology: The major structural element is the belt of older metasediments, which occupies the central portion of a large easterly-plunging syncline, whose axis has been displaced by a series of north-south shear zones. The abrupt termination of the metasedimentary belt west of Campbell Lake, may be due to erosion, acting in conjunction with the plunge of the fold, or it may be due to faulting parallel to the Grassy River System. Top determinations on the overturned northern limb of the fold are scarce, while excellent examples of graded bedding and crossbedding are to be found south of Roche Bay on Midlothian Lake.

Strong east-west faults cross Midlothian and Halliday townships. One of the strongest of these crosses a few hundred feet south of Stairs mine, near the contact between the metasediments and metavolcanics. Two other major sets of faulting have northeast and north-northwest strikes. The largest offsets have occurred along these later left-handed north-northwest faults.

Economic Geology: The Stairs mine, situated on the southern limb of the syncline, produced gold and silver from 1965 to 1966. The gold-bearing quartz veins occur in two zones of intense shearing and sericitization, each 30-40 feet wide separated by about 125 feet of altered arkose and conglomerate. The quartz veins emanate from a carbonatized fault zone; and strike N50°E. Gold is associated with chalcopyrite, galena, tetrahedrite, and sphalerite.

On the Laroma Midlothian Mines property, gold occurs in a network of quartz stringers, in a green carbonate zone. Relic textures and unaltered fragments in this zone suggest that it was originally an ultramafic body. Minor pyrite, chalcopyrite, galena and sphalerite are observable in this zone. According to Marshall (1947, p. 18) the company reported assays of 0.07 oz. gold per ton from core and selected samples; visible gold occurs sparingly on surface showings.

Reports filed for assessment work credit at the Resident Geologist's Office, Kirkland Lake indicate that very restricted but good gold values have been found in northeast Halliday and northern Midlothian townships.

A grab sample from the pit on the south shore of Bray Lake assayed 0.14% nickel.

Asbestos was seen in the ultramafic rocks on the northwestern arm of Lloyd Lake (see also Marshall 1947, p. 21).