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GEOLOGY OF THE
VERMILION-ABRAM LAKES AREA
DISTRICT OF KENORA

By

F. J. Johnston

Geological Report 101

TORONTO
1972

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Geological Maps (Back pocket)

- Map 2242 (coloured)—Vermilion Lake Sheet, Kenora District.
Scale 1 inch to ½ mile.
- Map 2243 (coloured)—Abram Lake Sheet, Kenora District.
Scale 1 inch to ½ mile.

ABSTRACT

This report describes the geology and mineral occurrences in the Vermilion-Abram Lakes area, District of Kenora. The area comprises about 260 square miles and includes the town of Sioux Lookout and the settlement of Hudson. The main line of the Canadian National Railways goes through the area. Geological Maps 2242 and 2243 at a scale of 1 inch to 1/2 mile accompany this report.

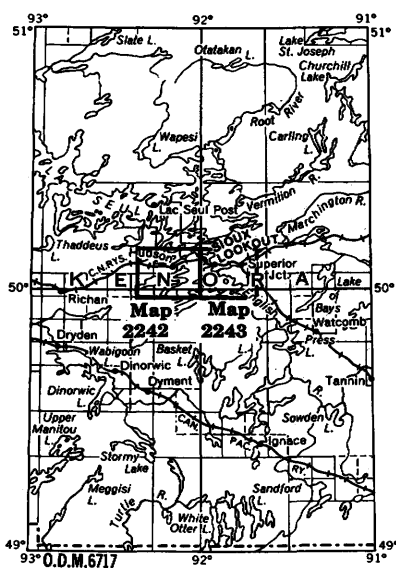


Figure 1—Key map showing location of the Vermilion-Abram Lakes area. Scale, 1 inch equals 50 miles.

The Vermilion-Abram Lakes area is part of a regional belt of alternating metavolcanic and metasedimentary sequences which are bordered on the north and south by batholithic areas of granite and in many places have been invaded by tongues and stocks of more mafic granitic rocks.

There are two main metavolcanic belts in the Vermilion-Abram Lakes area and each is bordered on the south by metasediments. The metasediments south of the northern Vermilion-Pelican Lakes metavolcanic belt consist of an older sequence of metasediments and pyroclastics called the Patara metasediments that rest disconformably on the metavolcanics; and a younger sequence called the Abram metasediments that rest unconformably upon the Patara rocks and the metavolcanics or are in fault contact with them.

The metasediments bordering the southern or Minnitaki-Little Vermilion belt of metavolcanics are probably correlative with the younger Abram metasediments and rest unconformably on or are in fault contact with the metavolcanics.

Early intrusive rocks consist of quartz porphyry and dikes of felsic rocks that do not intrude the Abram metasediments. The later intrusives are granitic and dioritic to gabbroic stocks.

The area is characterized by large northeast-trending fault structures that trend mainly along the larger lakes and water courses. Major folding was defined only in the East Bay area of Minnitaki Lake.

Gold, pyrite and minor copper, and lead and zinc occurrences have been investigated but the only mineral production of consequence has come from the pyrite deposit of North Pines Mines Limited.

Geology
of
The Vermilion-Abram Lakes Area¹
District of Kenora

By
F. J. JOHNSTON²

INTRODUCTION

The Vermilion-Abram Lakes area, in the District of Kenora, is about 260 square miles in extent and includes Vermilion, Vermilion Additional, and Jordan Townships and the east half of Lomond Township and most of Drayton Township as well as part of Block 10, the southern part of Indian Reserve No. 28 and unsurveyed areas south of Drayton Township and west of Indian Reserve No. 28.

Latitude 50°08'00" constitutes the northern boundary and the south boundary is approximately that of a line along the south boundary of Jordan and Vermilion Townships. Longitudes 91°45'00" and 92°20'37" approximately mark the east and west boundaries respectively.

The town of Sioux Lookout and the settlement of Hudson are in the map-area. The former is at the northern terminus of Highway 72 and the latter at the western terminus of Highway 116. Both centres of population are on the Canadian National Railways main line. A branch line goes from Superior Junction to Thunder Bay. Highway 642 extends eastward from Sioux Lookout to Alcona.

Travel in the area is facilitated by the three above-mentioned highways and by forest access roads northeast of Sioux Lookout and west of Hudson. Many large lakes provide excellent water routes to areas inaccessible by roads.

ACKNOWLEDGMENTS

The writer was assisted in the field in 1965 by A. P. Pryslak, the late E. W. Schlichting, G. W. Burns, and W. K. Coleman. In 1966, able assistance was given by A. P. Pryslak, C. F. Lamb, T. C. Short, and D. R. Smith, and in 1967 by W. Moon, T. C. Short, and R. Kwiatkowski. Assistant geologists Pryslak and Moon, were responsible for about half of the field mapping.

Mr. K. R. Clemis, mining recorder of Sioux Lookout, provided information on mining claims in the area and assisted the field parties in many ways. Dr. J. C. Davies, Resident Geologist, of Ontario Department of Mines and Northern Affairs, in Kenora, Ontario, provided details of assessment work in the area.

¹Manuscript accepted for publication by the Chief Geologist, 26 May, 1970.

²Geologist, Ontario Department of Mines and Northern Affairs, Toronto.

Vermilion-Abram Lakes Area

The writer and his assistants are indebted to many individuals from Sioux Lookout and Hudson who provided information and assistance and extended their hospitality. In particular, the author acknowledges the courtesies extended by A. Vezina, R. McCombe, and W. Solomon of Sioux Lookout; H. Colberg, prospector, from Webster Station; Mr. and Mrs. H. S. Johns of Minnitaki Lodge; J. Bernier and Sons, general merchants; the late S. Matusow and the late Leo Gastmaier of Hudson. Mr. J. Leliever, Toronto, kindly supplied the writer with information on the Burnthut Island property of Ourgold Mining Company Limited.

Mineralized samples from the area were analyzed by the Laboratory and Research Branch of the Ontario Department of Mines and Northern Affairs.

TOPOGRAPHY AND DRAINAGE

The area is one of low to moderate relief, typical of most Precambrian areas, with the average elevation being about 1,200 feet above sea level.

Maximum local relief occurs in the areas between Lyons Bay and Abram Lake and the west shore of Pelican Lake opposite Sioux Lookout, where hills of metavolcanics rise to more than 250 feet above the level of adjacent lakes. Granitic hills bordering Webster Bay of Lost Lake are 150 to 250 feet above the lake level.

Much of the area between outcrops is mantled by deposits of clay, varved clay, sand and gravel, and recent vegetal deposits. There are only very local areas of open wet muskeg and these usually border creeks and small stagnant lakes.

The drainage system of the Vermilion-Abram Lakes area is part of the major English River drainage system. The English River flows into Minnitaki Lake at the southeastern corner of Southeast Bay and exits between Lost and Pelican Lakes.

Abram Lake (elevation 1,171 feet) receives the southwest flow of the waters of Sturgeon River and the northwest discharge from Minnitaki Lake (elevation 1,177 feet) via Abram Chute. Abram Lake drains via Frog Rapids Narrows into Pelican Lake and thence into Lost Lake and north into the English River.

Vermilion Lake receives the waters of Little Vermilion Lake at Twin Falls and drains northeast through Botham Bay and Vermilion River to Pelican Lake to meet the waters of the English River system.

PREVIOUS WORK

Earliest references to the geology of the area are contained in reports of R. Bell (1872), A. P. Coleman (1895, p.56-60), W. A. Parks (1898), and J. A. Bow (1899).

In 1901, W. McInnes (1901) examined the geology bordering the major lakes in the area and, in 1907, W. H. Collins (1909) mapped parts of Pelican, Abram, and Lost Lakes. Also, in 1907, E. L. Fraleck (1907) examined pyrite occurrences in the area. In 1911, E. S. Moore (1911) studied the North Pines Mines Limited (5, 12) pyrite deposits and surrounding area.

M. E. Hurst (1932) mapped an area on a scale of 1 inch to 1½ miles that included all of the metavolcanic-metasedimentary belts in the area. F. J. Pettijohn (1934; 1935; 1936; 1937) mapped, in detail, parts of East Bay of Minnitaki Lake, part of Vermilion Township, and the shoreline and areas bordering the major lakes of the area.

The Superior Junction-Sturgeon Lake area was mapped in 1937 by H. C. Horwood (1937).

The Gullwing Lake-Sunstrum area, including the western part of Lomond Township, was mapped by W. D. Harding (1950) and detailed mapping of adjacent Echo Township was completed by H. S. Armstrong (1950).

A report on mining activities in the area was made by E. O. Chisholm (1951); T. H. Janes (1952) and D. F. Hewitt (1967) compiled reports on the pyrite occurrences.

PRESENT GEOLOGICAL SURVEY

The geological mapping for this report was carried out during the 1965, 1966, and 1967 field seasons. Pace-and-compass traverses were run at ¼-mile intervals across the strike of the various geological units and were supplemented by outcrop mapping along the shorelines of all major lakes. Topographic control was provided by vertical air photographs on a scale of 1 inch to ¼ mile. Traverses were tied into recognizable features such as lakes, streams, and roads. The maps were prepared by the Cartography Section, Geological Branch, Ontario Department of Mines and Northern Affairs, from sheets of the Forest Resources Inventory of the Ontario Department of Lands and Forests.

GENERAL GEOLOGY

The Vermilion-Abram Lakes area is part of a regional belt of alternating metavolcanic and metasedimentary sequences which are bordered on the north and south by batholithic areas of granite and in many places are pierced by tongues and stocks of granite and more mafic igneous rocks. All the consolidated rocks are considered to be of Archean (Early Precambrian) age.

The regional metavolcanic-metasedimentary belt is 15 to 20 miles wide in the vicinity of Sioux Lookout and is over 200 miles in length extending from the Lake of the Woods area to the vicinity of Savant Lake.

There are two main metavolcanic belts in the Vermilion-Abram Lakes area and each is bordered on the south by metasediments. The metasediments south of the northern Vermilion-Pelican Lakes metavolcanic belt consist of an older sequence of metasediments and pyroclastics called the Patara metasediments that rest unconformably on the metavolcanics and a younger sequence called the Abram metasediments that rest unconformably upon the Patara rocks and the metavolcanics or are in fault contact with them.

The metasediments bordering the southern or Minnitaki-Little Vermilion belt of metavolcanics are probably correlative with the younger Abram metasediments and are unconformable on or are in fault contact with the metavolcanics.

The geological succession of the area is summarized in the Table of Lithologic Units.

ARCHEAN

Mafic to Intermediate Metavolcanics and Metasediments

There are two main metavolcanic belts in the Abram-Vermilion Lakes area. One belt extends from the west end of Vermilion Lake to east of Pelican Lake. The other is south

Vermilion-Abram Lakes Area

Table 1

TABLE OF LITHOLOGIC UNITS

CENOZOIC

RECENT

Lake and stream deposits, vegetal deposits

PLEISTOCENE

Clay, varved clay, sand, gravel, silt

Unconformity

PRECAMBRIAN

ARCHEAN

LATE INTRUSIVE ROCKS

GRANITIC ROCKS

Hybrid granite, porphyritic granite, quartz-'eye' granite, feldspar porphyry, granodiorite, quartz diorite, trondhjemite

Intrusive Contact

MAFIC INTRUSIVE ROCKS

Syenodiorite, diorite, gabbro, lamprophyre

Intrusive Contact

ABRAM METASEDIMENTS

Conglomerate, arkose, greywacke, slate, varved slate, chlorite schist, iron formation, tuffs and tuffaceous metasediments

Unconformity

EARLY FELSIC INTRUSIVE ROCKS

Quartz porphyry, felsite, trachyte dikes

Intrusive Contact

PATARA METASEDIMENTS

Volcanic boulder conglomerate and agglomerate tuff, crystal tuff, tuffaceous sediments, slate and argillite, chert, siliceous sediments, greywacke, chlorite schist, arkose

Minor Unconformity

FELSIC METAVOLCANICS

Rhyolite, porphyritic rhyolite, dacite, tuff, agglomerate, pillow lavas

MAFIC TO INTERMEDIATE METAVOLCANICS AND METASEDIMENTS

Greenstone, tuff, tuffaceous sediments, agglomerate, breccia, pillow lavas, porphyritic basalt (leopard rock), crystal tuffs and crystal-rich flows, dioritic flows, amphibolite, epidote amphibolite, variolitic lavas, iron formation, quartzite, schists

of Abram and Little Vermilion Lakes, and is separated from rocks to the north by the Little Vermilion Fault. A small elongate arch of metavolcanics also lies between East Bay and Southeast Bay.

VERMILION-PELICAN LAKES METAVOLCANICS

The rocks of the Vermilion-Pelican Lakes metavolcanic belt consist of massive to schistose mafic to intermediate flows and abundant pillow lava with minor pyroclastics and intercalated iron formation, quartzite, and tuffaceous sediments of very minor importance. Metamorphosed equivalents, including amphibolite, occur most abundantly in proximity to the granitic rocks to the north.

Massive medium-grained dioritic rocks, some of which may be intrusives, are common throughout. Porphyritic basalt, consisting of blocky saussuritized plagioclase feldspar phenocrysts up to 1 inch in maximum dimension set in a schistose, chlorite- and epidote-rich matrix, occurs sparingly in the western part of the belt. Pillow lavas are abundant in the southern half of the belt, particularly near the contact with the Patara metasediments. Some of the pillow varieties near this contact are considerably more felsic and approach dacite in composition.

In the northern part of the belt, layered epidote amphibolite and amphibolitic rocks are more abundant nearer the granitic areas. Some of these rocks are bedded mafic tuffs or sediments such as those on the west side of Italian Bay. Others are sheared and highly altered volcanic flow rocks.

Pyroclastic rocks occur in an oblong mass over 2 miles long and generally less than 1,000 feet wide in the vicinity of the North Pines Mines Limited (5, 12) pyrite deposit. These rocks, which are basaltic lapilli tuffs, form the hanging-wall of the deposit. The largest fragment observed was a semiround piece of felsic volcanic material 2 inches in diameter. The majority of fragments are oblong fragments of altered basaltic material less than $\frac{1}{2}$ inch long cemented by calcite and minor quartz.

Elsewhere in this belt, pyroclastics occur only as rare interflow deposits not more than a few feet thick.

There is a gradual increase in the grade of metamorphism from south to north toward the area of granitic rocks. The metavolcanic rocks on Vermilion Lake are greenschist facies that gradually give way to epidote-amphibolite and almandine-amphibolite facies. Coarse garnet and some sillimanite are developed in the thin remnant of metavolcanics on the north shore of Lost Lake.

Top determinations within the Vermilion-Pelican Lakes metavolcanics indicate a south- or southeast-facing succession with the only major exception being at the west end of Vermilion Lake where north-facing tops indicate tight fold structures.

Iron formation occurs at a number of places in the Vermilion-Pelican Lakes belt. The rocks are lean quartzite or cherty magnetite-bearing iron formation locally containing abundant pyrite and pyrrhotite. Mariposite and pyrite are common constituents of the more siliceous varieties. Other varieties consist of graphitic black schists or tuffaceous sediments containing pyrrhotite, pyrite, and magnetite. Such are those on the east shore of Pelican Lake, north and west of Sioux Lookout.

Vermilion-Abram Lakes Area

MINNITAKI-LITTLE VERMILION LAKES METAVOLCANICS

The Minnitaki-Little Vermilion metavolcanics, in contrast with the Vermilion-Pelican metavolcanics, contain a variety of rock types and other features that characterize the belt. There is an abundance and wide variety of pyroclastic rocks, a number of variolitic flows not seen elsewhere in the area, and a wide variation in the types of pillow lavas. The rocks of this belt, particularly the pyroclastics, are in general more felsic and approach andesite to dacite in composition in contrast to the basaltic to andesitic rocks of the Vermilion-Pelican belt. These more felsic rocks are commonly amygdaloidal, a feature not generally observed in the other belt. There were no observed occurrences of iron formation in the Minnitaki-Little Vermilion belt.

There are certain broad trends within this belt of metavolcanics. The more mafic varieties of metavolcanics are found along the north and west margins of the belt becoming, in general, more felsic toward the east and to the south. The amount of pyroclastic rocks also increases in this direction. The eastern margin of the area is mostly composed of felsic metavolcanics which are described later.

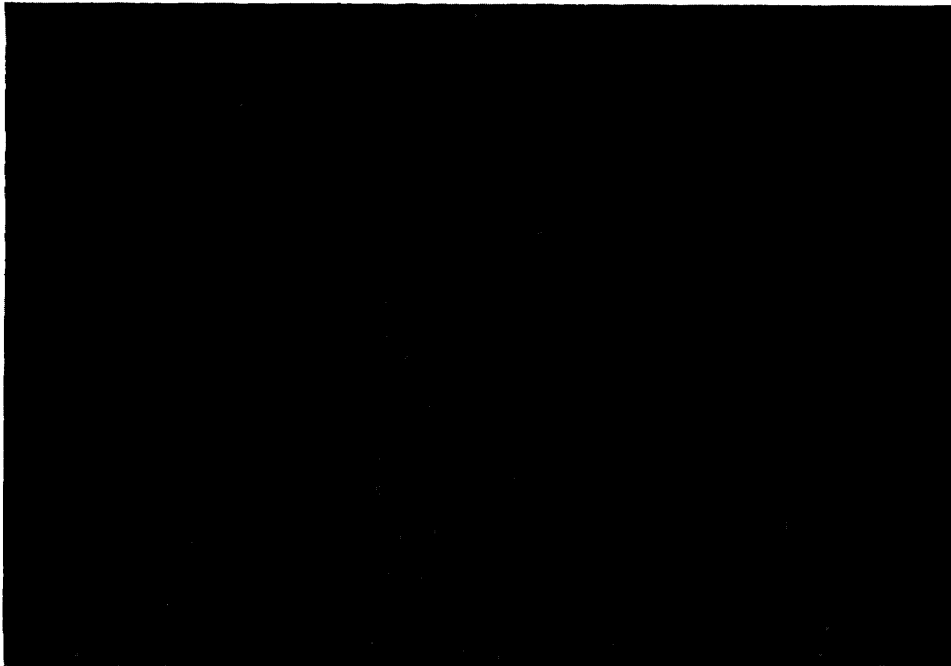
Most top determinations in the belt indicate a northeast-trending south-facing succession except in the area adjacent to the intrusive rocks in Northeast Bay where they trend northwest and face southwest.

Agglomerate, breccia, and tuffs are common in the Minnitaki-Little Vermilion metavolcanic belt. They form a wedge widening to the east from an area just west of Butterfly Lake and reach their maximum development in the area around Troutfish Bay. Toward the northeast they become increasingly intercalated with mafic flow rocks and seem to extend on strike north of Alcona Bay into an area of felsic pyroclastics and flows.

The overall composition of the pyroclastics in the Butterfly Lake-Troutfish Bay area is andesitic to dacitic, although basaltic varieties are present. The coarser agglomerates are between Lyons Bay and Troutfish Bay where large angular to lenticular blocks of volcanic material up to 3 feet by 2 feet are enclosed in a welded, porphyritic crystal tuff-like matrix. The fragments are most conspicuously those of felsic volcanic rocks, although more mafic varieties are present. In this locality, there is little or no sorting or stratification in the pyroclastic deposits, which appear to be mainly a chaotic assemblage of agglomerate, lithic tuff, and crystal tuff, similar in part to the flowing avalanche type of deposit. These deposits have probably been laid down subaerially.

Elsewhere the tuffs consist of finely bedded green to greyish green rocks containing occasional rock or crystal fragments. These rocks are most abundant on the islands in and along the east and north shores of Northeast Bay and are exposed on Highway 72 between September (Dien) Lake and Butterfly Lake. A fine example of interbedded pumiceous tuff and agglomerate lies on the northwest shore of Northeast Bay ½ mile north of Abram Chute. Epidotized volcanic bombs were observed in tuff and agglomerate on the southeast shore of Troutfish Bay.

Crystal-rich tuffs identical to the matrix of the coarse agglomerates are particularly abundant in the area of Lyons Bay. These rocks have a porphyritic appearance and consist of innumerable crystals and crystal fragments of white sodic plagioclase set in a fine-grained dacitic matrix. In some, volcanic fragments are visible, whereas, in others, the fragmental nature is not readily apparent with fragments and matrix being almost completely fused. An uneven distribution of crystals or crystal fragments may be the only clue to the pyroclastic nature of these rocks. There appears little doubt that some of them are pyroclastic flows.



ODM8598

Photo 1—Bedded tuff and agglomerate, Northeast Bay.

There is no stratification or sorting in the pyroclastic deposits located north of Lyons Bay, whereas on the extremities and margins of the pyroclastic wedge finely bedded tuffs and agglomerates, (Photo 1) some showing graded bedding, become increasingly abundant, particularly in the Northeast Bay area of Minnitaki Lake. There is also a gradual interfingering of pyroclastics with flows, mainly pillow lavas, and a decrease in the volume and coarseness of pyroclastic material away from the Lyons Bay area.

The above features would tend to indicate a centre of pyroclastic activity in the Lyons Bay area where a chaotic subaerially deposited assemblage representing the central volcanic area gives rise marginally to finer grained water-laid deposits.

Pillow lavas in the Minnitaki-Little Vermilion volcanic belt consist of a variety of types.

The common pillow lavas are of andesitic to basaltic composition. Individual pillows usually are found to consist of dark green to black selvages surrounding lighter green volcanic rock. The interstitial spaces between some of these are filled with calcite and (or) quartz or slaty material. The pillow lavas may be amygdaloidal and locally there is a concentration of amygdules at the top of the pillows. Used with caution, this criterion may verify top determinations.

Porphyritic pillow lavas occur on some of the islands and shores of Little Vermilion Lake south of Closs Lake and others occur on the islands of Northeast Bay, particularly the northern parts of Islands FP70 and FP74. Those in Little Vermilion Lake are essentially similar to the porphyritic basalts or "leopard-rock" and contain blocky to rounded yellowish feldspars as much as 1.5 inches in long dimension crowded within

Vermilion-Abram Lakes Area



ODM8599

Photo 2—Portion of porphyritic pillow lava, Island FP70, Northeast Bay.

the body of the pillows. The feldspar is completely saussuritized and is in a schistose matrix consisting essentially of chlorite, epidote, and carbonate. Similar rocks were observed southwest of Wabik Lake in the West Minnitaki Lake area (Johnston 1967, p.7).

Other porphyritic pillow lavas occur in the area of Troutfish Bay and, in particular, on Islands FP70 and FP74 in Northeast Bay. These rocks are more intermediate in composition and contain numerous randomly oriented euhedral laths of plagioclase set in a matrix of chlorite, epidote, and fine-grained feldspar and quartz (Photo 2). These pillows attain very large dimensions with the largest observed being 15 feet by 10 feet. Selvages are as much as 8 inches wide and these contain feldspar phenocrysts oriented parallel to the pillow margins (Photo 2). Some of these phenocrysts are broken and drawn out indicating at least partial crystallization of the feldspar in a viscous lava prior to pillow formation. The selvages are not as sharply defined as in other pillows, and this combined with the large size of these pillows makes recognition of them as such very difficult particularly when good exposures are not available.



ODM8600

Photo 3—Variolitic pillow lava. Island FP70.

Another type of pillow lava is a highly variolitic and amygdaloidal mafic lava with a concentric type of internal structure that is found on the northwest shore of Island FP70. Concentric structures in pillow lavas have been previously recorded by Moore (1930, p.138), Hurst (1932, p.6), and Satterly (1941, p.10-11), though variolites were not mentioned as being present. These rocks consist of an outer ropy or rough selvage 1 to 3 inches wide followed inward by increasing amounts of variolites arranged concentrically, like the annual growth rings of a tree, in a fine-grained altered basaltic matrix (Photo 3). The variolites increase in amount and also in size toward the central core of the pillow which becomes a ball of coalescing variolites as much as 5 inches in diameter. Individual variolites may reach a diameter of more than 1 inch but average about $\frac{1}{4}$ inch.

The variolites in hand specimen commonly have a light greyish blue core surrounded by a thin white rim. A radial distribution of white fibrous feldspar can also be observed on weathered surface.

In thin section, the variolites are somewhat coarser grained in the centres and consist of feathery needles or sheaves of feldspar that exhibit a wavy extinction pattern. The radial pattern is accentuated by aligned plates and grains of magnetite and by fine-grained chlorite, epidote, and carbonate aggregates. Interstitial quartz is abundant. In a large variolite, there may be a number of coalescing groups of feldspar sheaves all exhibiting a radiating pattern.

Vermilion-Abram Lakes Area

Felsic Metavolcanics

Felsic metavolcanics are sparse in the Vermilion-Abram Lakes area. They are present in abundance only in the eastern part of Drayton Township between Allan and Mullen Lakes and north of Alcona Bay. This area of felsic rocks extends northeast to Superior Junction and south of the railway tracks beyond the eastern limits of the map-area. Two reconnaissance traverses east of the area indicate a thickness well in excess of 6,000 feet.

The felsic metavolcanics are mainly porphyritic rhyolite and dacite, buff to greenish rhyolite exhibiting flow layering, and rhyolitic tuff and agglomerate. In places, these rocks are sheared and carbonatized or fractured with the fractures commonly filled with quartz veinlets. The rocks are devoid of mafic minerals except for very minor amounts of chlorite and biotite.

The porphyritic felsic metavolcanics range from buff to greyish black to greenish and contain numerous glassy quartz 'eyes' or feldspar phenocrysts in a dense micro-crystalline matrix. These rocks are best exposed in Block 10 just north of lot 4, concession I, Drayton Township. Some of these porphyritic rocks may be subvolcanic intrusions.

Grey to black porphyritic rhyolite from near the southwest end of Allan Lake contains euhedral phenocrysts of oligoclase and a few corroded quartz phenocrysts in a fine-grained matrix of feldspar, quartz, sericite with minor carbonate, biotite, sphene, apatite, pyrite, and chalcopyrite. The pyrite and chalcopyrite occur in quartz and carbonate veinlets filling tiny fractures.

Fine-grained rhyolitic rocks, with well-developed flow layering, occur in lot 6, concession I and also along the railway line in lot 4, concession I, Drayton Township. The rocks are buff to greenish and finely layered. The layering in places is contorted and streaky and locally quite indistinct. Slight differences caused by differential weathering accentuate the individual layers.

Felsic agglomerates and tuffs occur more commonly around the margins of the felsic metavolcanic area outlined on the map and can be most readily recognized where mafic volcanic material is also present. In places, the fragmental rocks consists of light-coloured felsic fragments in a matrix commonly similar in appearance, making it difficult to recognize them as fragmental rocks. Some of these rocks are welded tuffs.

Pillow lavas of felsic composition occur sparingly on the mainland and islands between Southeast Bay and East Bay of Minnitaki Lake. They occur as narrow layers intercalated with the predominant mafic to intermediate metavolcanics of this area.

The rocks weather greenish to yellowish white and usually the pillow structure is indistinct because of a lack of contrast between the composition of the selvages and body of the pillows. On wave-washed outcrops selvages form slightly elevated rims because of differential weathering.

Patara Metasediments

The Patara metasediments were first recognized and described by Pettijohn (1934, p.482-483; 1935, p.1894-1896) from exposures northwest of Patara Lake in Drayton Township. These rocks were mapped by him from the centre of Vermilion Lake east to Pelican Lake. The writer has mapped these rocks further to the northeastern part of the Abram Lake area and lithologically similar rocks are in Block 10 east of Sioux Lookout where they underlie coarse conglomerate of the Abram metasediments.

Structurally, the Patara rocks disconformably overlie the Vermilion-Pelican Lakes metavolcanics and, for the most part, form a southeast-facing succession. They are, however, infolded with the lavas at the west end of Vermilion Lake and a highly contorted area of finely layered cherty rocks on Highway 116 would tend to indicate a synclinal fold axis in this area. The southern limit of the Patara rock is probably marked in part by the extension of the Vermilion Lake and Whitefish Island Faults which would separate them from the Abram metasediments to the south.

North of the porphyry mass on the south shore of Vermilion Lake, volcanic conglomerates and tuffs lithologically similar to some rocks on the north shore have been included with the Patara sediments. They have been intruded and altered by the quartz porphyry. Farther to the southwest, however, the contact between the Abram metasediments and these volcanic conglomerates is indistinct and is arbitrarily drawn.

The Patara metasediments consists of a sequence of water-laid materials derived mainly from a volcanic source. They consist of mafic and felsic volcanic conglomerates, tuff, agglomerate, cherty and tuffaceous sediments, arkose, slate, argillite, and chloritic schist and phyllite. The contact with the metavolcanic rocks is everywhere well defined except near the granite contact in Block 10 north of Superior Junction where the metasediments have been metamorphosed to amphibolites and epidote amphibolites and the contact is indefinite.

The basal Patara rocks are mafic volcanic conglomerate and breccia that attain a thickness of more than $\frac{1}{2}$ mile in the western half of Drayton Township but rapidly thin to the east and west. Toward the west end of Vermilion Lake, felsic volcanic conglomerate becomes increasingly abundant as it also does higher in the sequence. The mafic volcanic conglomerate is composed almost totally of mafic volcanic fragments and debris in a fine-grained chloritic matrix. Quartzite and lean iron-formation pebbles and boulders are present but are not common. The fragments range in size from a fraction of an inch to more than 10 inches in maximum dimension and are subangular to rounded. The basal 100 to 300 feet show little evidence of stratification, consisting of tightly packed fragments in a subordinate matrix. Higher in the sequence, thinly layered argillaceous and cherty rocks become increasingly interlayered with the mafic volcanic conglomerate.

In the lower part of the volcanic conglomerate, some of the boulders have rims varying from $\frac{1}{8}$ inch to more than $1\frac{1}{2}$ inches around their peripheries. These rims outline the shape of the fragments and are generally finer grained. The rims may represent weathered margins or exfoliation rims indicating a period of weathering prior to incorporation into the conglomerate. However it seems more likely that they represent chilled margins of volcanic bombs dropped into water.

Quartzite and lean iron formation derived from interflow sedimentary deposits are not abundant but are the most characteristic pebbles and fragments in the volcanic conglomerate. In Block 10 east of Sioux Lookout where the rocks are more highly metamorphosed, the quartzite and iron-formation pebbles, being the only ones not destroyed, are commonly the only criterion for the recognition of the rocks as conglomerates.

In lots 24 and 25 near the boundary of concessions I and II, Drayton Township, a quartzitic iron formation lies at the contact of the volcanic conglomerate and metavolcanics. It is in this area that the conglomerate contains more fragments of quartzite and iron formation than usual, including large angular blocks of the nearby iron formation. This represents at least a minor period of erosion contemporaneous with deposition of the conglomerate. The source for the volcanic conglomerate was probably the adjacent volcanics with little transportation being involved.

Vermilion-Abram Lakes Area

Felsic volcanic conglomerates, cherty and felsic tuffaceous rocks, agglomerate, arkose, and greywacke form the upper part of the Patara sediments. There is a vertical progression from mafic to more felsic rocks which is well illustrated by exposures extending southeast along Highway 116 in lots 25, 24, 23, concession III. There is a similar lateral change from east to west.

The felsic volcanic conglomerates contain pebbles and cobbles of quartz, chert, felsic volcanic fragments, and mafic volcanics in a cherty and quartzitic matrix that contains abundant disseminated pyrite and pyrrhotite. These rocks may be traced intermittently from west of Patara Lake to Highway 116 to the southwest shore of Pelican Lake and through Frog Rapids Narrows. Finely laminated cherty rocks and felsic tuffs containing rusty pyrite and pyrrhotite patches occur to the southwest and to the northwest along the south shore of Pelican Lake and the north shore of Abram Lake.

On the north shore of Abram Lake in the northern part of lot 21, concession III, Drayton Township, layered rocks of arkosic composition contain lenticular chloritic layers as much as 6 inches wide and 15 feet long. These layers have been interpreted as highly stretched mafic volcanic fragments and the enclosing rocks as fine-grained tuffaceous sediments. On strike to the northeast at the site of an old sawmill directly north of Island FP53, large angular felsic volcanic fragments are similarly enclosed by fine-grained felsic tuffaceous sedimentary material.

Intermediate to felsic dikes that are probably related to Archean volcanic activity in the area are in the Patara metasediments, particularly in the lower part. Dacitic and trachytic dikes occur between Highway 116 and the radar base and on the south shore of Pelican Lake, ½ mile north of Frog Rapids Narrows. Trachyte dikes were also observed at the site of the old sawmill in Drayton Reserve north of Island FP53. Similar rocks are on the large island west of Whitefish Island, and quartz porphyry and other felsic porphyritic rocks, some of which may be welded tuffs, are in the same area and on the south shore of Whitefish Island.

The contact between the Patara metasediments and the underlying metavolcanics can be over a few feet. In a number of outcrops, the metavolcanics are fractured and altered pillow lavas of intermediate composition. Near the contact, the lower part of the Patara metasediments contains either disseminated or massive carbonate in considerable amounts. This feature is most noticeable on some of the islands in Vermilion Lake and in the area south of Botham Bay. Whereas the secondary carbonate resulting from shearing and carbonatization is usually dolomite or ankerite, this carbonate is calcite and occurs in a dense massive rock consisting of quartz, chlorite, epidote, and plagioclase. Perhaps some of this carbonate is an original constituent of the rocks, being derived from hot spring or fumarolic activity following the main episode of volcanic activity.

The Patara metasediments mark an abrupt cessation of effusive intermediate to mafic volcanism and the initiation of explosive pyroclastic activity and sedimentation. The thick and persistent volcanic conglomerate succession at the base with little matrix, the lack of stratification, and the generally poor sorting indicate a rapid accumulation of volcanic debris derived from an adjacent volcanic highland. Higher in the sequence, sorting, stratification, and a vertical transition to felsic metasediments and pyroclastic rocks typifies deeper water conditions and a change from mafic volcanism to felsic pyroclastic activity.

Early Felsic Intrusive Rocks

The early intrusive rocks in the area are quartz porphyry, felsite, and trachyte dikes.

Quartz porphyry forms an elongated dome-shaped body and sill-like bodies on the south shore of Vermilion Lake, where it intrudes Patara metasediments and the volcanic conglomerates included with the Patara metasediments. It is overlain unconformably by Abram metasediments. Elsewhere, the quartz porphyry is in the metavolcanics on the islands and north shore of Northeast Bay. In most outcrops, it is sheared and altered. It weathers from creamy yellow to green and contains rounded opalescent grey to bluish grey quartz 'eyes', (as large as $\frac{3}{8}$ inch in maximum dimension although the average would be about $\frac{1}{8}$ inch), and a few plagioclase phenocrysts in a felsic fine-grained quartz-feldspar matrix containing minor sericite, opaque minerals, and apatite. The plagioclase is albite or albite-oligoclase and is usually well twinned and unaltered, although it is usually fractured.

Felsite dikes occur locally in the metavolcanics and Patara metasediments associated with the quartz porphyry bodies of Vermilion Lake. There are a few other small dikes east of May Lake south of Highway 72. On the islands of Vermilion Lake south of Botham Bay, a highly fractured and altered felsite intrusion cuts the Patara metasediments. The rock weathers a creamy yellow and contains ovoid nodules of white altered feldspar scattered sparsely over the body of the rock. The nodules may be best seen on a small reef adjoining the largest island east of Slate Island.

Trachytic to dacitic dikes intrude the Patara metasediments in a number of localities and may best be observed in road-cuts on Highway 116 near the contact with the metavolcanics, on the south shore of Pelican Lake on the peninsula north of Frog Rapids Narrows, and on the north shore of Abram Lake at the site of an old sawmill north of Island FP53. The dike rocks are grey to black, dense fine-grained felsic rocks containing $\frac{1}{8}$ - to $\frac{1}{4}$ -inch laths of feldspar in a trachytic texture. Others contain elongate, randomly oriented, hornblende grains in a felsic, quartz and plagioclase-rich or potassic feldspar-rich matrix. The rocks are hard and dense commonly splitting with a conchoidal fracture. Rocks of this type were only observed in the Patara metasediments.

Abram Metasediments

The Abram metasediments are in two distinct areas or basins. One is in the East Bay of Minnitaki Lake area and the other is between Abram and Vermilion Lakes. In both areas, metasediments unconformably overlie or are in fault contact with the older metavolcanics or the Patara metasediments. There are differences in the rocks of both belts and both will be described separately.

EAST BAY AREA

The metasediments exposed in East Bay are roughly divided into three main stratigraphic assemblages as outlined by F.J. Pettijohn (1936). These are in descending order of age:

Vermilion-Abram Lakes Area

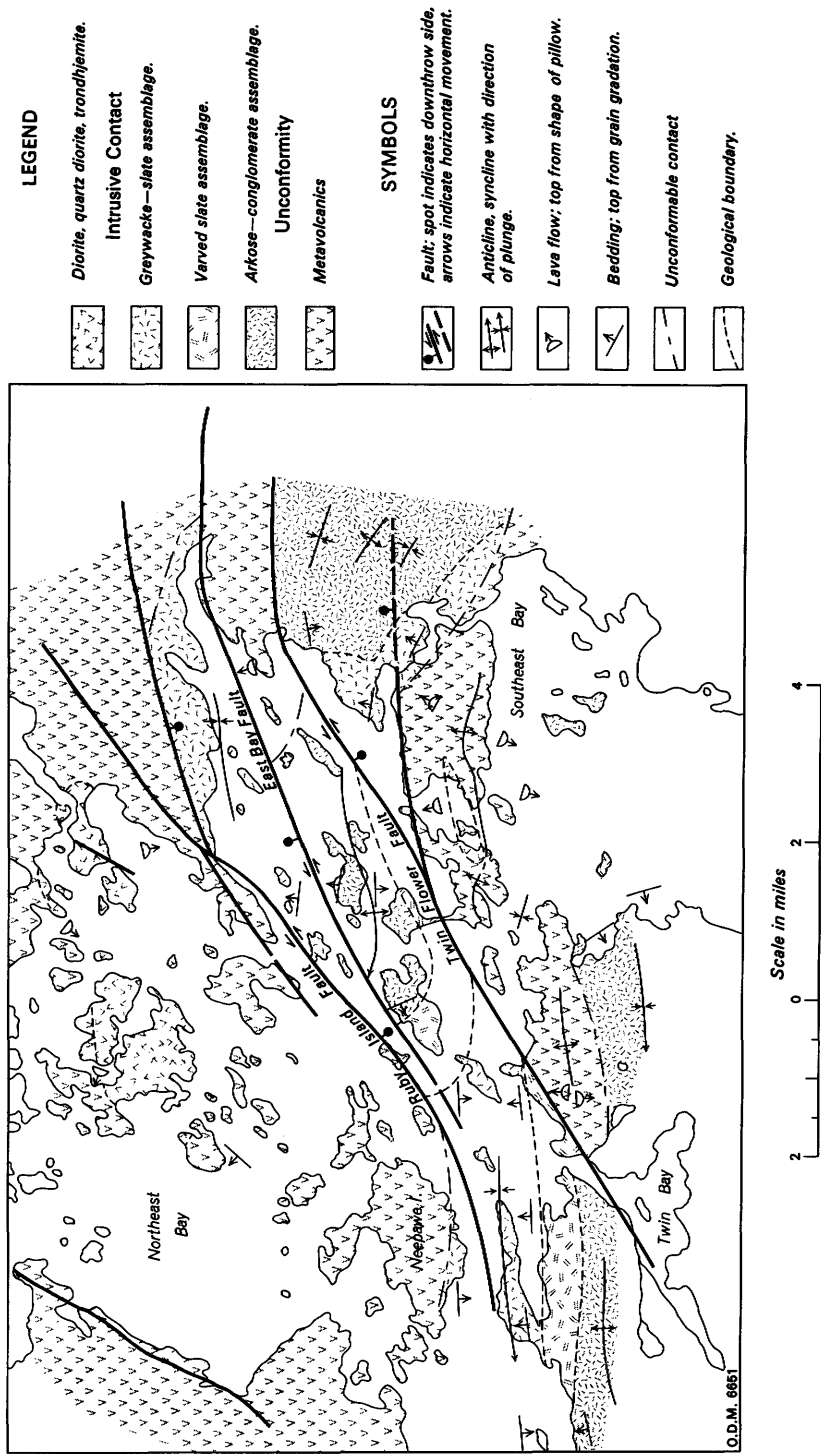
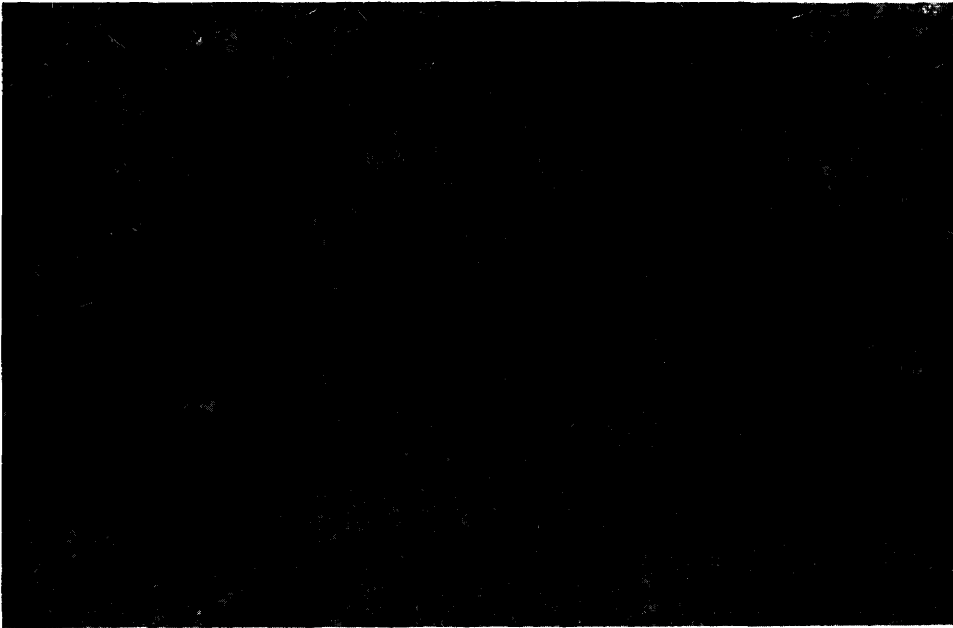


Figure 2—Structure and geological relationships, East Bay area, Minnitaki Lake.



ODM8601

Photo 4—Angular fragments of slate in arkose, Abram metasediments. East Bay.

- (a) greywacke-slate assemblage;
- (b) varve slate assemblage;
- (c) conglomerate and arkose assemblage.

The above rock assemblages are mutually gradational and any division among them would have to be arbitrarily drawn. The structural complexities of the rocks of East Bay and the fact that work is not sufficiently advanced or detailed makes it presently impossible to assign formal stratigraphic designation to these assemblages. The distribution of these assemblages is shown in Figure 2.

Conglomerate and Arkose

Conglomerate and arkose apparently form the base of the metasedimentary sequence of East Bay although rocks of this assemblage are not always in contact with the underlying basement rocks due to rapid thinning and a plunge to the southwest at about 45 degrees.

The conglomerates are light coloured, generally with a medium- to coarse-grained matrix of quartz, feldspar, and rock fragments including shale or slate chips; this matrix encloses rounded boulders and pebbles of quartz and quartz-feldspar porphyry with minor felsic and mafic volcanic and granitic fragments. Large angular fragments of slate and varved slate are common locally in the conglomeratic and arkosic rocks (Photo 4).

Vermilion-Abram Lakes Area

Generally in the map-area, there are very few mafic volcanic pebbles and boulders in the conglomerates as contrasted with the conglomerates of Abram Lake which contain significant amounts. Rounded clasts averaging less than 4 inches in diameter but with the largest observed diameter being 14 inches, are most common in the conglomerates of East Bay. Pettijohn (1936, p.344) reports that the conglomerates are much coarser and distinctive farther to the east with one boulder measuring 48 inches across. The area of provenance was probably to the east of the present area under discussion and it is in this area that the conglomerate unconformably overlies an earlier quartz porphyry intrusive (Pettijohn 1937, Plate 3, facing page 174).

The arkosic rocks can for the most part be referred to as grits, and grade laterally and vertically into greywacke and the conglomeratic rocks. The arkoses are light buff to grey, consisting of medium to coarse, angular to semiround grains of feldspar and quartz, with feldspar predominating, and a few fragments of chips of slate or other fine-grained dark rocks. Here and there a few pebbles occur. Ferromagnesian constituents are generally sparse and consist of chlorite and biotite. Sheared varieties contain sericite.

Varved Slates

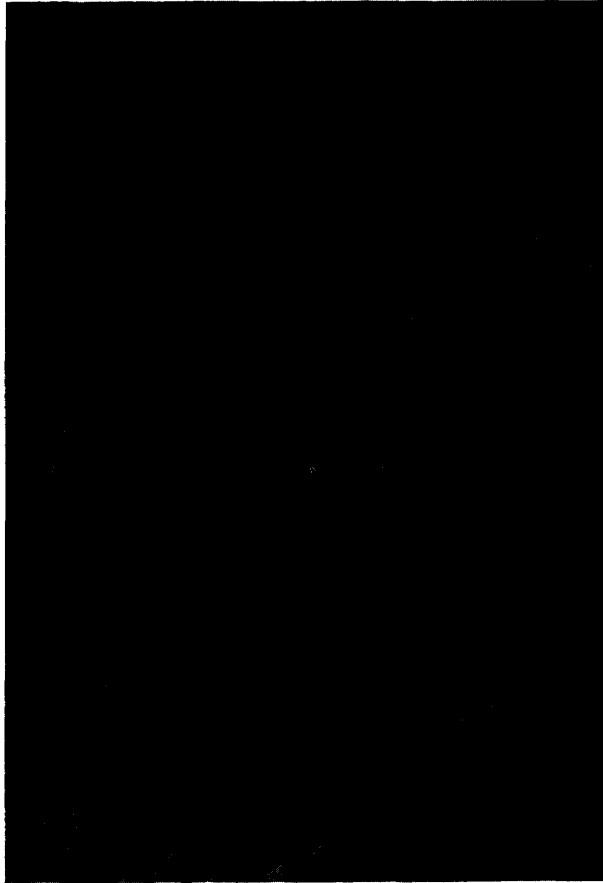
In the East Bay area, distinctively banded varved slates are well developed. These structurally overlie the conglomerate and arkose assemblage and underlie the greywacke-slate assemblage and are interbedded with both. In many places, slate chips and large fragments of slate of probable intraformational origin were also observed in the overlying and underlying assemblages (Photo 4).

The varved slates are extremely well layered (Photo 5) consisting of coarser grained light coloured silty layers and darker coloured very fine grained slate layers alternating in the manner characteristic of glacial varved clays. The thickness of individual layers range from a fraction of an inch to more than 4 inches with the average being about 1 inch. The silty light-coloured layers are usually somewhat thicker than the dark fraction. Graded bedding is almost everywhere well developed in these slates and has been attributed to seasonal deposition in glacial lakes in the manner of glacial varved clays (Coleman 1926, p.234) or to turbidite deposition (Kuenen and Migliovini 1950, p.91-127). There are essentially no varved slates in the Abram-Vermilion Lake belt to the north.

Greywacke-Slate

Stratigraphically above the varved slates, there is an assemblage consisting of greywacke and slate. The greywacke is usually thick bedded and contains thin bands of slate. The ratio of greywacke to slate is about 8:1. The regular alternation of greywacke and slate produces what has been referred to as huge varve-like couplets by Pettijohn (1936, p.345).

The greywacke is characteristically light to very dark and is usually structureless except locally where a faint foliation occurs. Greywacke beds range from a few inches to more than 5 feet in thickness whereas the slate beds seldom exceed 8 inches in thickness. The greywacke grades abruptly upward into the slaty tops. This graded bedding is well developed and is most useful in interpreting the structure of the rocks.



ODM8602

Photo 5—Varved slates. East Bay area.

Very commonly small chips and large fragments of slate and other felsic and mafic rock fragments are abundantly present in a gritty angular matrix composed of quartz, feldspar, fine rock fragments, and a fine-grained paste of biotite, chlorite, carbonate, and opaque minerals. Pyrite is a common constituent in many outcrops and is present as large cubic crystals, some of which are completely weathered, leaving the rock with a pitted honeycomb appearance.

ABRAM-VERMILION LAKES AREA

Abram metasediments occur in two main areas in the Abram-Vermilion Lakes belt; on the islands and north shore of Abram Lake including Block 10, and as a wedge-shaped area between Vermilion and Little Vermilion Lakes. The area between the two consists of a thin ribbon of conglomerate and arkose that is probably in a fault block (Figure 3).

Vermilion-Abram Lakes Area

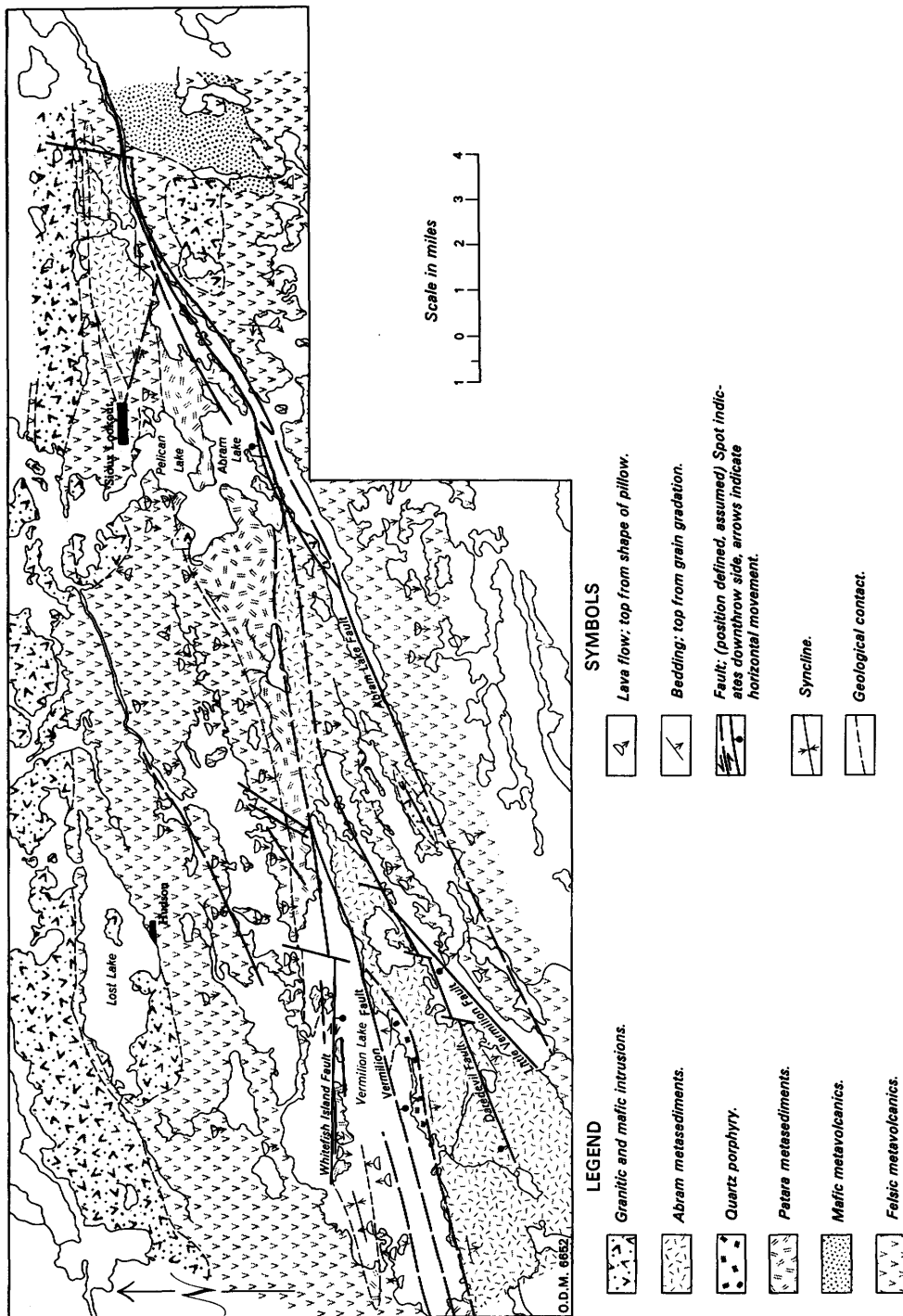


Figure 3—Generalized geology and structure, Vermilion-Pelican Lakes area.

East of Sioux Lookout in Block 10, the basal, coarse, boulder conglomerates rest directly on a thin mantle of Patara volcanic conglomerate and breccia. There is no evidence to suggest that the contact between the rocks here is a fault contact.

In the same area, Abram metasediments show a progression from north to south from coarse boulder conglomerates to pebble conglomerates, arkose, and thence to fine-grained argillaceous and mafic metasediments including narrow layers of chloritic iron formation. This indicates that stratigraphic tops are to the south and the Abram rocks either represent the north limb of a basin or syncline with the south limb having been eliminated by northeast-striking faults along the trend of Abram Lake, or the Abram metasediments here may also represent a simple monoclinical south-facing succession.

In Block 10, the basal boulder conglomerates and other metasediments trend west toward Sioux Lookout and are terminated against the metavolcanics. This termination probably represents an east-southeast-trending fault with an apparent left-hand separation of close to 3 miles. The coarse conglomerates on the islands, south shore, and the large peninsula of Drayton Reserve probably represent the faulted continuation of the conglomeratic rocks exposed in Block 10.

The conglomerates of the Abram metasediments are best developed on the islands of Abram Lake, on the large peninsula of Drayton Reserve, and east of Sioux Lookout in Block 10. Between the central part of Abram Lake and the northeast part of Little Vermilion Lake, the Abram metasediments consisting of arkose and conglomerate are probably contained in a block between the Little Vermilion and Whitefish Island or Vermilion Faults. The conglomerates become lensey and arkosic rocks become more abundant toward the west in the Ament Bay area.

The coarsest conglomerates occur on Island FP53 and on the peninsula to the south where rounded boulders as much as 36 inches in diameter occur tightly packed in a grey or greenish grey arkosic matrix. The majority of clasts consist of felsic igneous rocks, mainly trondhjemitic pebbles, quartz and quartz feldspar porphyries, and mafic volcanics. Locally pebbles of chert and quartzite derived from preexisting iron formation pebbles are present but are usually of small size.

On the large peninsula south of Island FP53 the cobbles and boulders have crude bedding and sorting and are interbedded with arkose (Photo 6).

Table 2 represents a count of rock types from two outcrop areas, each 8 feet square, in the Abram Lake area.

Table 2 | COUNT OF ROCK TYPES FROM TWO OUTCROPS OF CONGLOMERATE IN AREA

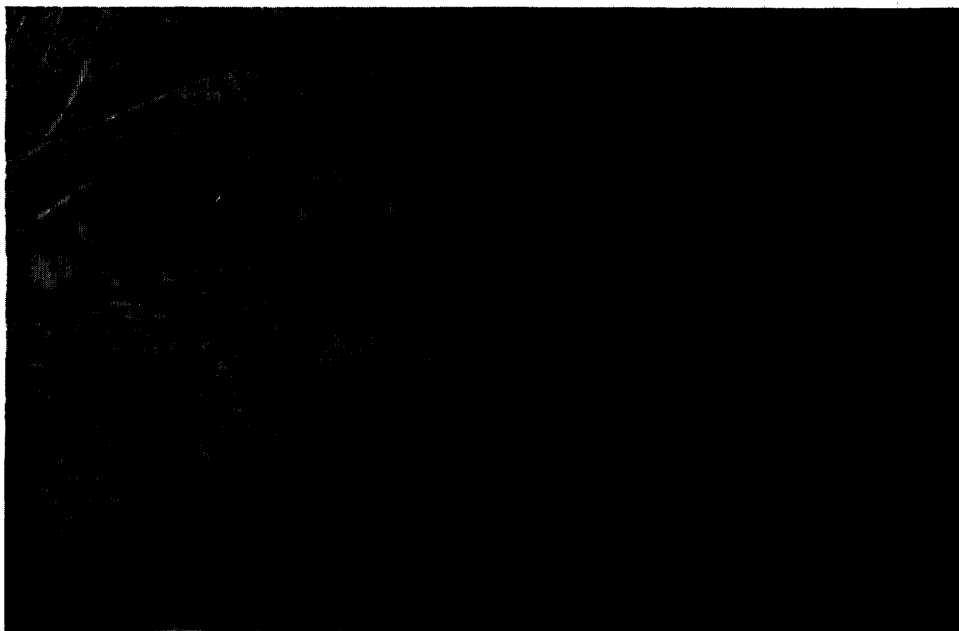
Outcrop 1: Peninsula, Drayton Reserve	
ROCK TYPE	No.
"Granitic" and felsic porphyritic rocks	367
Mafic volcanic rocks	246
Quartz and quartzite	22
Chert and iron formation	109
Felsite and felsic volcanic rocks	19
Outcrop 2: Large island west of Long Island	
ROCK TYPE	No.
"Granitic" and felsic porphyritic rocks	271
Mafic volcanic rocks	677
Quartz and quartzite	26
Argillite and tuff	13
Felsite and felsic volcanic rocks	38

Vermilion-Abram Lakes Area



ODM8603

Photo 6—Boulder conglomerate showing crude bedding. Peninsula south of Island FP53.



ODM8604

Photo 7—Sheared and stretched Abram conglomerate. Abram Lake.

The "granitic" fragments are the most conspicuous and largest rock types, although they may not always predominate. The composition of the majority of these rocks corresponds with trondhjemite or quartz diorite and are not unlike similar rocks belonging to the intrusive body in Northeast Bay. Potassic granites were observed only a few small reefs south of Twin Falls in Little Vermilion Lake. Some of these boulders are distinctively foliated to gneissic, a feature which they had prior to incorporation into the conglomerate, as shown by their random orientation.

The depressions in the quartz porphyry mass on the south shore of Vermilion Lake as well as its south margin are bordered by thin layers of conglomerate consisting of mafic volcanic fragments, debris from the underlying porphyry, and granitic rock fragments. These rocks mark the base of the Abram metasediments. It is interesting to note that the only crossbedding noted in any of the rocks in the area was observed in the basal sediments marginal to this quartz porphyry mass.

Shearing and carbonatization is common in many of the conglomerates and arkosic rocks. This is particularly true in the rocks adjacent to the Little Vermilion Fault and along the course of Abram Lake. Conglomeratic rocks with a high proportion of mafic volcanic fragments have been more susceptible to shearing and many of these have been stretched so that they resemble a "pebble gneiss". (Photo 7).

Arkosic rocks are most commonly associated with the conglomeratic rocks of Abram Lake and southwest as far as the Vermilion-Lomond Township boundary where they gradually give way to darker mafic greywacke. This trend coincides with the lensing and disappearance of the conglomerates in this area reflecting a transition to deeper water depositional environment.

The arkosic rocks in the vicinity of Ament Bay and to the west are a monotonous succession of thick-bedded rocks showing only faint traces of bedding and rarely pebbles of granitic material. Top determinations in the sediments northwest of Little Vermilion Lake indicate a southeast-facing succession.

The transition from arkose to greywacke is gradational and involves an increase toward the west in the mafic mineral content and rock fragments in the greywacke. Minor 1- to 3-inch wide argillaceous beds are found locally in the greywacke but not in the arkosic rocks. South of a line coinciding with the Daredevil Fault a greater variety of rock types is encountered. Tuffaceous and fine-grained pyroclastic rocks, slaty and chloritic rocks, and minor intraformational cherty conglomerates are interbedded with greywacke. This section of metasediments has been assigned to the Daredevil Formation by Pettijohn (1935, p.1900). It has, however, been impossible to recognize significant differences in the rocks to the southwest due mainly to a lack of good outcrop, and hence no subdivision could be made in this sequence of rocks.

Late Intrusive Rocks

DIORITE AND GABBRO

Dioritic and gabbroic rocks occur marginal to the Allan-David Lakes Stock and the intrusive rocks of Northeast Bay. Other dioritic and gabbroic rocks also occur along the Little Vermilion-Abram Fault zone in the northeastern part of Abram Lake and in the areas of and east of Little Vermilion Lake.

Vermilion-Abram Lakes Area

Dioritic sills occur in the metasediments and metavolcanics in East Bay of Minnitaki Lake. An elongate area consisting of multiple dikes and sills of dioritic and gabbroic rocks occurs between East and Southeast Bays of Minnitaki Lake.

An oval-shaped intrusive body consisting of an outer margin of hornblende diorite and metagabbro and a small inner core of quartz-'eye' trondhjemite is in the area between David and Allan Lakes. There is good correlation between the aeromagnetic data (ODM-GSC 1961b) and the geology as mapped. The mafic margins are reflected by magnetic "highs", whereas the trondhjemite core is reflected as a negative magnetic feature.

The diorite and metagabbro are mottled dark greenish to black fine- to medium-grained rocks that are usually massive, although there is a faint foliation in some outcrops.

GRANITIC ROCKS

The northern part of the area is underlain by a complex batholith made up of a variety of granitic rocks. The most common rock assemblage encountered consists of quartz-feldspar-biotite (-hornblende) gneiss consisting of alternating felsic and mafic layers intruded, usually parallel to the layering, by stringers and bodies of granite, pegmatite, and aplite.

The granitic rocks commonly contain large blocks and many xenoliths of amphibolite and metavolcanics particularly adjacent to the metavolcanics where granitic material has been intruded parallel to the foliation and schistosity. This contact zone could perhaps best be termed a "migmatite zone". The rocks were mapped as granitic rocks or metavolcanics depending on whether the granitic or metavolcanic component was found to predominate.

Foliated to gneissic, whitish to pink, porphyritic granitic rocks containing phenocrysts or metacrysts of sodic plagioclase and potassic feldspar are most commonly adjacent to the granite-metavolcanics contact.

There is a pronounced increase in metamorphism of the metavolcanics and metasediments as the batholithic granite area is approached. The rocks have mineral assemblages characteristic of the greenschist facies in the southern part of the northern volcanic belt and grade into the epidote-amphibolite and almandine-amphibolite facies toward the north. The highest grade metamorphic rocks lie along the north shore of Lost Lake and along the contact to the east. Rocks consisting mostly of large garnets about 1 inch in diameter and coarse hornblende occur on the north shore of Lost Lake.

The basal Patara volcanic conglomerates and breccias and the Abram conglomerates containing a high proportion of mafic volcanic fragments have been metamorphosed to amphibolitic rocks along the granite contact in Block 10.

QUARTZ-'EYE' GRANITIC ROCKS

Marginal to the batholithic granitic mass to the south, there are oval-shaped satellitic bodies of distinctive reddish quartz-'eye' granitic rock, the composition of which corresponds to trondhjemite. One body of such rock is in and around Lost Lake, another occupies the central part of Pelican Lake, and a small body is mainly in lot 23, concession I, Drayton Township. The latter probably also underlies a large part of the

southwest end of Pelican Lake. The central core of the David-Allan Lakes Stock is composed of a similar quartz-'eye' granitic rock, as is a small body on a small island south of Island FP70.

The contact of the quartz-'eye' granitic rocks with the adjacent metavolcanics is usually fairly well defined and sharp. The rocks form elongate, oval-shaped bodies around which the schistosity or foliation of the metavolcanics has been deflected.

The quartz-'eye' granitic rocks contain from 10 to 50 percent quartz, as much as 80 percent sodic plagioclase, 0 to 10 percent potassic feldspar with minor amounts of chlorite, biotite, sercite, apatite, and opaque minerals. Epidote is a very common constituent and as much as 5 percent is present in some rocks. The quartz 'eyes' range from $\frac{1}{8}$ inch to $\frac{1}{4}$ inch in maximum dimension. In some areas, they have bluish opalescence whereas in others they are a dull smoky grey. South of Lost Lake the quartz 'eyes' are elongated subparallel to one another, imparting a foliation and in places a lineation to the rocks.

The quartz-'eye' granitic rocks on the whole are massive, uniform, medium-grained rocks that have an unweathered appearance. They differ rather markedly from the complex hybrid granitic types related to the large batholithic gneissic granite areas to the north. Contacts with adjacent rocks are sharp and contact metamorphic effects do not appear to be very pronounced. Perhaps these quartz-'eye' granitic rocks are relatively young intrusions.

NORTHEAST BAY STOCK

There is a stock on some of the larger islands and part of the mainland near the entrance to Alcona Bay in Northeast Bay. This stock comprises a core, with rocks ranging in composition from trondhjemite to quartz diorite, and an outer zone, with rocks having the compositions of diorite and syenodiorite.

The trondhjemite and quartz diorite occur in two fairly well-defined areas. One area lies mainly in the southern part of Island FP70. The other is on Island FP61 and surrounding small islands and the peninsula at the entrance to Alcona Bay. These rocks form massive, light-coloured, well-jointed, uniformly textured outcrops. They grade into the diorite and syenodiorite by increase in mafic mineral content, increase in grain size, and decrease in the amount of quartz. The essential minerals of the core rocks are quartz, plagioclase (oligoclase), orthoclase, and minor magnetite, biotite, chlorite, sphene, apatite, and epidote. The plagioclase is commonly euhedral and zoned with the interior of the crystals being more highly altered than the margins. Cataclastic deformation is not too evident, but locally granulation of quartz and feldspar grains, bent twin lamellae in the plagioclase and undulatory extension of the quartz are present.

The diorite to syenodiorite forming the outer zone of the stock are medium- to coarse-grained rocks containing varying proportions of plagioclase (usually andesine), quartz, and mafic minerals. Plagioclase, which is commonly highly altered, makes up 50 to 75 percent of the rock and hornblende up to 40 percent. Quartz ranges from 1 to 10 percent in eight thin sections examined. Titaniferous magnetite is usually present, as are biotite, chlorite, and epidote.

The diorite of the core of the stock commonly was found to grade into the trondhjemite. In places, however, the contact between the two is marked by a poorly defined brecciated or contaminated zone, with the trondhjemite intruding the diorite.

Vermilion-Abram Lakes Area



ODM8605

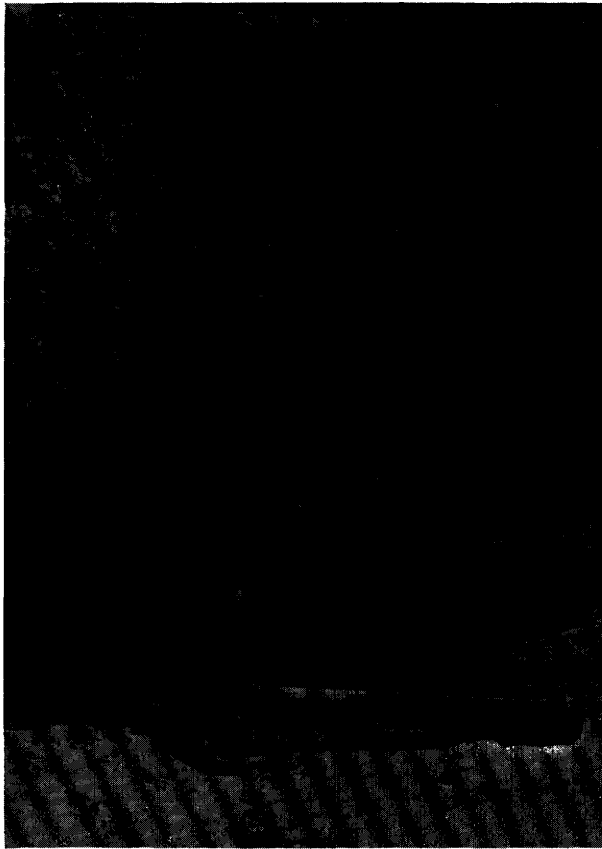
Photo 8—'Boulder' lamprophyre dike showing foliation and gneissosity of included boulders. Peninsula north of Whitefish Island, Vermilion Lake.

There is a hybrid zone in which the diorite contains abundant inclusions of mafic metavolcanics. The dioritic rocks are fine to medium grained, green, with the mafic materials predominating.

LAMPROPHYRE DIKES

Lamprophyre dikes, ranging from 15 inches to 48 inches wide, were noted in three places in the area. One occurs in the trondhjemite on the southeast side of Island FP61; one cuts the Patara pyroclastic rocks on Slate Island; one intrudes porphyritic schistose metavolcanics on the peninsula on the north shore of Vermilion Lake north of Whitefish Island. These rocks are probably the youngest in the area.

The most unusual of these dikes is exposed on the peninsula north of Whitefish Island (Photo 8). It ranges from 15 to 18 inches in width and cuts across the schistosity in porphyritic basalts. It is itself offset by a small north-trending fracture. The rock has fine-grained chilled margins and weathers dark brown to green. Oblong boulders and cobbles of foliated to gneissic granitic rocks ranging from 2 to 6 inches in maximum dimension are aligned in the central part of the dike. The nearest bodies of granitic rocks lie at least three miles to the northwest. The lamprophyre is fine grained, highly altered and sheared. It consists essentially of 50 percent pale green to yellowish chlorite containing needles of rutile (?), carbonate, and granulated poorly twinned to untwinned plagioclase and minor interstitial quartz and opaques. The rock could best be called a 'boulder lamprophyre.'



ODM8606

Photo 9—Varved clay. Vermilion Lake.

The lamprophyre dikes from Island FP61 and Slate Island are similar dark brown weathering, soft rocks consisting of $\frac{1}{8}$ inch biotite flakes, that are partly altered to purplish chlorite, in a fine-grained matrix composed of crushed and granulated sodic plagioclase, carbonate, fractured euhedral apatite, and opaque minerals.

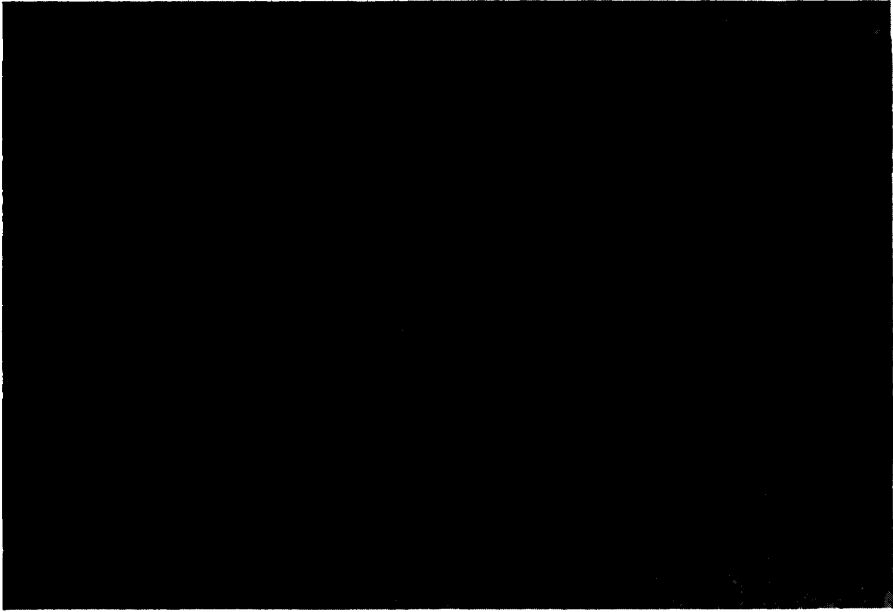
CENOZOIC

Pleistocene Deposits

Clay, varved clay, sand, and gravel deposits cover much of the bedrock in the area. Clays and varved clays are in the basins and marginal areas of the larger lakes. They are also in depressions between outcrops and form a thick mantle covering much of the outcrop.

Thicknesses of the varved clay vary considerably. The maximum observed being 15 feet in the basin of Lost Lake. Couplets range from $\frac{1}{2}$ inch to slightly more than 3 inches thick (Photo 9). The maximum thickness for couplets is near the base of the

Vermilion-Abram Lakes Area



ODM8607

Photo 10—Varved clay with convolute folding at the base. Neepawa Island.

varved clay sequence and the light grey silt portion is two to three times thicker than the darker grey and finer clay fraction. Most commonly, however, the couplets are only $\frac{1}{2}$ to 1 inch thick and the light and dark fractions are of equal thickness.

Deformation structures at the base of a varved clay section were observed on the southwest shore of Neepawa Island in Minnitaki Lake (Photo 10). These convolute folds and disturbed zones have resulted from a sliding and "piling up" of one fold on another. The disturbed convoluted zone in Photo 10 is made up of slightly coarser and grittier material than the varved sections above it, which tend to break up rather than fold in a plastic manner. Similar features have been described as *décollement* folds and faults and have been attributed to overriding glacial ice (Hansen *et al.* 1961).

Sand and gravel deposits are best developed in the outwash plain or kame deposits in the west central part of the area extending west and southwest from Hudson and in an area extending northeast from Sioux Lookout. Near the western border of the area south of the railway tracks, the sand and gravel deposits are pitted by kettles. The thickness of some of the deposits is more than 100 feet as shown by a section of poorly stratified gravel and sand south of Lost Lake and west of Hudson. This deposit has been used as a source of ballast and fill by the Canadian National Railways.

The distribution of the principal sand and gravel deposits and the trend of glacial striae are shown in Figure 4. The average of 101 readings of glacial striae is S40W with a range of S27W to S62W.

Recent Deposits

Recent deposits consist of lake, stream, and vegetal deposits.

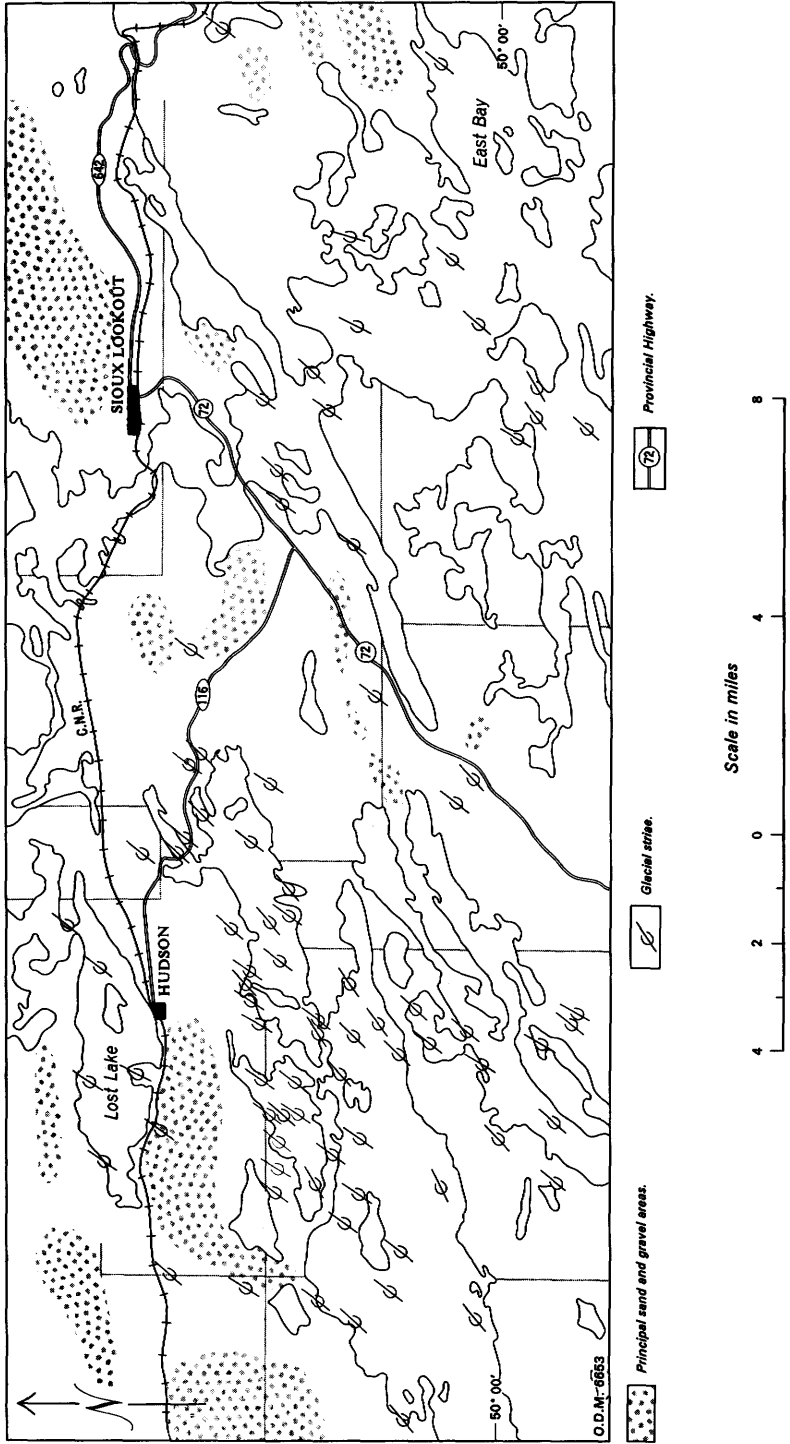


Figure 4—Principal sand and gravel areas and glacial striae.

Vermilion-Abram Lakes Area

STRATIGRAPHICAL RELATIONSHIPS

The geological relationships and structural features of the Vermilion-Abram Lakes area are illustrated in Figures 2 and 3.

It has been postulated that the Patara metasediments overlie the northern Vermilion-Pelican Lakes metavolcanics with apparent local disconformity. The significance of these minor "breaks" is minimal and for all intents and purposes the rocks should be considered as having no significant time break between them. The Patara rocks mark an abrupt end to effusive mafic volcanism and mark the onset of pyroclastic and sedimentary activity. In the area, the Patara metasediments are developed best between Patara and Pelican Lakes. To the east, they wedge out rapidly in Block 10 where only a basal volcanic conglomerate and breccia is present. Pettijohn (1934, p.499) considered that this type of deposit represented "a slope wash of the old greenstone surface".

Structurally, the Vermilion-Pelican Lakes metavolcanics and the Patara metasediments form a southeast-facing monoclinial succession with the most notable exception being a syncline at the west end of Vermilion Lake. There are no recognized equivalents of the Patara rocks in the East Bay-Southeast Bay section.

The Abram metasediments in the Abram-Vermilion Lakes area overlie the metavolcanics and the Patara metasediments unconformably or are in fault contact with them. In the area of East Bay, there are no rocks correlative with the Patara metasediments and, therefore, the Abram metasediments and the metavolcanics are in fault contact or the Abram metasediments rest unconformably and directly on the metavolcanics.

Direct evidence for an unconformity between the Abram metasediments and the underlying rocks is seen in three widely separated localities over a distance of 23 miles. In all three places, the unconformity is the same. An underlying weathered mass of quartz porphyry has supplied fine detritus and boulders to the basal portion of the Abram sediments. The material derived from the underlying porphyry can essentially be referred to as "porphyry wash". Since the porphyry bodies in question are known to be intrusive into the metavolcanics and the Patara metasediments, there is little doubt of an unconformity.

The best location to observe this feature is on claim K2234 on the south margin of the quartz porphyry mass south of Vermilion Lake. Here the basal conglomerate of the Abram metasediments consists of fragments of quartz porphyry up to 9 inches by 4 inches with a few mafic volcanic fragments in a gritty arkosic matrix containing numerous isolated glassy and opalescent quartz 'eyes' like those found in the porphyry. The amount of porphyry detritus diminishes rapidly to the south away from the contact, giving way to bedded and massive arkose. Another thin slice of conglomerate with the same relationship occurs on the south shore southeast of claim K2251. The contact in both places is well defined and sharp and there is no evidence of contact alteration, as there is above the shore in the vicinity of the mineral occurrences on claim K2234. Here volcanic conglomerates of the Patara metasediments are highly altered, pyritized, silicified, and metamorphosed to talcose and sericitic schists adjacent to the porphyry.

On mining location HW129 in the narrows at the northeast end of Pickerel Arm (Johnston 1967), similar "porphyry-wash" rocks with faint bedding occur marginal to an intrusive quartz porphyry body. The residual material derived undoubtedly from the adjacent porphyry forms the basal part of the sedimentary sequence at this location. The full significance of these exposures was not realized at the time of mapping.

Similar relationships between the Abram metasediments and underlying quartz porphyry probably occur beyond the map-area east of East Bay and east of the northeast part of Southeast Bay. Pettijohn (1937, Plate 3, facing page 174; unpublished field map) indicates an indefinite and irregular contact between a quartz porphyry boulder conglomerate and arkose and an adjacent mass of quartz porphyry. The same is true of the islands in the extreme southeastern part of the area which consist partly of brecciated and recemented fragments of quartz porphyry.

The quartz porphyry bodies referred to above are found marginal to the metavolcanic-metasediment contacts and are believed to have been topographic highs from which the basal sediments were partly derived, and over which they were deposited. If there is proof of an unconformity where certain of these porphyritic rocks and Abram metasediments are in contact, then it follows that an unconformity exists between the metavolcanics and the Abram metasediments.

The contact between the metavolcanics and metasediments is, however, difficult to ascertain. In the eastern part of East Bay and on the south shore of Neepawa Island, the metasediments appear to "lap up" on the metavolcanics and the contact is marked by as much as 40 feet of green chloritic rock or slaty material which is devoid of stratification. This may represent rocks derived from the weathering of the underlying mafic metavolcanic rocks just as the conglomerates mentioned above have derived a part of their material from underlying quartz porphyry. The nature of the underlying rocks, topography, and the sedimentary processes will ultimately determine the clarity with which the unconformity can be defined.

The Abram boulder conglomerates in Block 10 east of Sioux Lookout rest directly on a thin wedge of Patara volcanic conglomerate and breccia i.e., basal Patara rocks. Elsewhere to the southwest, the Abram conglomerates lie on a variety of Patara metasediments stratigraphically higher in the sequence provided that faulting did not intervene. Hence the contact between the Patara and Abram rocks could be considered a transgressive overlap.

Rocks mapped as Patara metasediments are locally intruded by quartz porphyry and felsite dikes, particularly in the lower part of the sequence. Quartz porphyry and felsite also intrude these rocks. There are no intrusives other than a few dioritic sills in East Bay that were observed in the Abram metasediments. This too may be considered additional evidence for an unconformity.

In the eastern part of East Bay in the block bounded by the Twinflower and East Bay Faults, the metasediments form an anticline and abruptly truncate the metavolcanics, which trend southwest. The overall trend of the metasediments would have to be northwest in this area. Hence there is a strong suggestion of structural discordance in this area.

Where structures in the metasediments and metavolcanics coincide, no unconformable relationships are evident. If an unconformity is folded, the folding may be along or parallel to preexisting fold trends, and the most obvious place for any discordance to be evident would be at the "noses" of the secondary folds (Ross 1962, p.298-306). There would be little chance of proving structural discordance where the fold limbs are parallel, except where the underlying basement rocks contained a distinctive rock type such as the quartz porphyry, and such a rock type formed a topographic high over which later sediments were laid.

There is an unconformity at the base of the Abram metasediments the magnitude of which is a matter of conjecture, but the fact that such a feature has been located at three localities over a distance of more than 23 miles is in itself significant.

Vermilion-Abram Lakes Area

It is interesting to note that Davis (1965, p.15-16) has described a "pre-Temiskaming" porphyry and unconformity from the vicinity of High Lake near Kenora, Ontario. The stratigraphy in this locality is very similar to that in the present area with relationships among the various rock types being also very similar.

Economically it may be important to know the relationship of "porphyry" intrusions to surrounding rocks. If certain mineral deposits can be shown to be related genetically to the "porphyry" bodies, then it may be possible to eliminate the younger sediments in search for other related deposits.

STRUCTURAL GEOLOGY

The structural geology of the Abram-Vermilion Lakes area is described below in two sections for the sake of simplicity and because of differing geological relationships in the two areas, namely the Vermilion-Pelican Lakes area and the East Bay-Northeast Bay area (See Figures 2 and 3).

VERMILION-PELICAN LAKES AREA

There are a number of major faults or shear zones in the area and these form part of a complex regional fault system. From topographic evidence and from a study of regional aeromagnetic maps (ODM-GSC 1965) the Little Vermilion Fault, Abram Lake Fault, and associated faults, collectively, seem to be the southern extension of the Miniss River Fault zone (Hudec 1965, p.21). In the Abram-Vermilion Lakes area, there is some bending of the fault structures with associated splitting and horsetailing from the main structure, which is assumed to be either the Little Vermilion Fault or the Abram Lake Fault.

Fault structures in the Northeast Bay-East Bay section are also major structures and probably extend into granitic areas to the east. They trend generally in an easterly direction, except for a sheared zone trending northeast through the peninsula between East and Northeast Bays and a shear zone on the west shore of Northeast Bay which upon extension to the northeast may join the regional fault system mentioned above.

Most of the faults in the area have been previously recognized and described by Pettijohn (1934; 1935; 1936; 1937) who considered that movement along them was essentially horizontal shear movement. Undoubtedly, the horizontal component is large in most areas but large vertical components appear necessary to eliminate large volumes of strata including whole limbs of major fold structures.

The Little Vermilion Fault trends northeast and separates the metasediments and metavolcanics along the course of Little Vermilion Lake to its northeast end where the fault bends to a more easterly direction toward the central part of Abram Lake and then once again swings to a more northeasterly direction. The fault is marked by a zone of intense shearing along the contact and heavy carbonatization of the adjacent rocks is common. Many of the conglomeratic rocks, particularly those with a high proportion of volcanic fragments, have been extremely sheared and stretched. The fragments are recognized only as thin streaks of slightly different colour and composition from those of the matrix.

Along the south shore of the peninsula south of Ament Bay, the Little Vermilion Fault may split to include the Daredevil Fault. There is also a possibility that the Vermilion Fault and Whitefish Island Fault represent splits off the Little Vermilion Fault in the vicinity of Patara Lake. The Abram Lake Fault may also join the Little Vermilion Fault at the northeast end of Abram Lake. The Abram Lake Fault follows the south shore of the northeastern part of Abram Lake and is assumed to follow the lake southwestward. A number of sheared and carbonatized zones occur along the northwest shore of the southwestern part of Abram Lake. Massive dioritic rocks also occur along the course of this assumed fault, indicating that they may have been intruded along a major structural "break".

The Vermilion Fault trends along the south shore of Vermilion Lake and may have eliminated part of the north limb of an anticlinal or domal structure with its axis trending east-northeast through the quartz porphyry in this area. This was first suggested by Pettijohn (1935, p.1897), a suggestion with which the present writer concurs in part, although the basal Abram sediments may have been draped over the east and south margins of the quartz porphyry dome and were not folded as suggested. Only a small part of the Abram metasediments were eliminated north of the fault. The extension of the Vermilion Lake Fault beyond Vermilion Lake is not known and the position of the fault is placed at the west end of the lake by the presence of a highly fractured and mylonitized reef composed of felsite and by a sheared zone in volcanic conglomerates observed beyond the west border of the area.

North- to north-northeast-trending faults are considered to be the youngest in the area. Recognizing these faults is difficult. Epidote-filled fractures, a small amount of shearing, and apparent offsets are the main criteria. Topographic evidence such as the existence of linear valleys and streams is not prominent nor are alteration effects or widespread shearing. Both the Daredevil and Little Vermilion Faults have been displaced by these younger north-northeast-trending faults in Little Vermilion Lake. Here, the left-hand strike separation on the younger faults is indicated.

Farther north in Vermilion Lake and between Vermilion Lake and Botham Bay, both left- and right-hand strike separations are indicated on the contact between the metavolcanics and the Patara metasediments and apparent offsets of the felsite intrusions south of the entrance to Botham Bay.

At the east end of the belt of metasediments north of lot 7, concession I, Drayton Township, there is a north-northeast fault with an assumed large vertical component, with the east side having moved up relative to the west side. A wide section of metasediments has been eliminated on the east side of this fault.

The Abram and Patara metasediments in Block 10 trend west-southwest and terminate against metavolcanics southeast of Sioux Lookout. The coarse boulder conglomerates at the base of the Abram metasediments are believed to be offset to the east by faulting and to be represented by the coarse boulder conglomerates on the islands and shoreline of Abram Lake. This would require an apparent left-hand separation of about 3 miles along an early fault trending east-southeast from Sioux Lookout. The Patara volcanic conglomerates are also displaced a similar distance and there is no evidence to suggest that folding has had any part in the repetition of these rock units.

Large-scale folding in the Vermilion-Pelican Lakes area has not been defined. The Patara metasediments are infolded with the metavolcanics at the west end of Vermilion Lake and some complex folding of cherty metasediments along Highway 116 indicates the possibility of a synclinal fold axis here. In general, the rocks of this area represent a south- or southeast-facing monoclinial succession.

Vermilion-Abram Lakes Area

EAST BAY-NORTHEAST BAY AREA

The Abram sediments of East Bay and the main body of Minnitaki Lakes have been divided into three main assemblages in accordance with the work of Pettijohn (1936, p.343). Starting with the oldest these are:

1. Quartz porphyry conglomerate and arkose
2. Varved slate
3. Greywacke-slate.

The iron formation described by Pettijohn (1936, p.343) is probably correlative with the lowermost conglomerate and arkose assemblage.

These assemblages have been idealized in Figure 1 where it can be seen that these rocks have been highly segmented by the East Bay, Twinflower, and Ruby Island Faults. These faults were first recognized and named by Pettijohn (1936, p.350-351). Characteristically they are marked by much shearing and carbonatization. The East Bay and Twinflower Faults trend about N65E whereas the Ruby Island Fault trends about N45E. The dip of all three faults is believed to be steep.

An anticlinal fold enclosed between the Twinflower and East Bay Faults has had parts of both limbs removed by the East Bay Fault and by the Twinflower Fault. The block between the two faults has been elevated and moved southwest relative to adjacent blocks. Postulated horizontal separation to the southwest is in excess of 10,000 feet. Hinge movement on the internal fault elevating the east side of the block more than the west could account for some of the apparent horizontal separation.

Folds as outlined by numerous top determinations and stratigraphic assemblages such as the characteristic varved slates and greywacke-slate assemblages have also been terminated obliquely by the Twinflower Fault.

The northern contact between metavolcanics and metasediments is in part marked by the Ruby Island Fault but the sediments on Neepawa Island and at the northeast end of East Bay appear to "lap up" against the metavolcanics. The course of the Ruby Island Fault beyond the north shore of East Bay is uncertain. It may continue northeast into the metavolcanics or it may continue along the metasediment-metavolcanic contact parallel to the north shore of East Bay. The later suggestion would require a very abrupt bend in the fault or it would require the fault to be offset by a later north-south fault with the east block moving north relative to the west block.

The sediments of Southeast Bay and East Bay probably join just east of the map-area. This area is covered by low swampy ground in the vicinity of the northeastern part of Southeast Bay.

The contact relations between the metavolcanics and metasediments on the west side of Southeast Bay are obscured by the intrusion of a mafic dike along the contact. The mafic volcanics in this area are very highly sheared whereas the metasediments are highly folded but are not particularly sheared.

A north-northeast-trending shear zone may be traced intermittently along the west shore of Northeast Bay toward Abram Chute. It could possibly continue northeast to join with the Abram and Little Vermilion Faults.

A number of lesser shear zones were observed on Neepawa Island and the islands to the east where they trend east and then slightly north of east. These shear zones are parallel and are probably related to the Ruby Island Fault.

A few north-trending shear zones were observed on the islands of East Bay in the southeastern part of the area. These north-trending faults like others previously described with similar trends are believed to be the youngest faults in the area.



ODM8608

Photo 11—Axial plane cleavage intersecting bedding at high angle. West shore Southeast Bay.

Numerous top determinations in the sediments of East Bay, based on grain gradations in the metasediments and the shapes of pillows in the metavolcanics, indicate tight isoclinal folding with a general west-southwest plunge of about 45 degrees.

In determining the various fold structures of East Bay, top determinations are necessary. Strike and dip have little significance because of the near vertical position and overturning of the beds. Schistosity (cleavage) is virtually useless in helping to unravel the structural picture. As a rule the schistosity parallels the bedding on the limbs of folds but intersects it at right angles on the noses (Photo 11). As a result schistosity gives little information on the presence of folding in this area of tight isoclinal folds.

In addition to the anticline between the Twinflower and East Bay Faults, a synclinal axis trends east-northeast through Twin Pine Island and a complementary anticline occurs in varved slates just north of Notlish Point. These folds also are terminated by the Twinflower Fault.

The metavolcanics between the East and Southeast Bays form an elongate dome structure on which the metasediments to the northeast rest unconformably. On the south shore of East Bay a zone of shearing marks the metasediment-metavolcanic contact. The nature and magnitude of movement along the sheared contact is not known.

A minor syncline preserves slaty and tuffaceous sediments and iron formation on Island RK425. This area probably represents a minor roll in the main domal structure as it is succeeded by a further narrow anticlinal volcanic area to the south.

Vermilion-Abram Lakes Area



ODM8609

**Photo 12—Crenulations and rodding in chloritic iron formation.
Southeast Bay.**

Linear elements consisting of the plunge of minor folds, crenulations, the intersection of bedding and cleavage, and rodding are well developed in the metasediments of East Bay. These elements plunge consistently west-southwest at about 45 degrees (Photo 12) and are parallel to axes of the known major fold structures.

ECONOMIC GEOLOGY

The main exploration activity in the past was concentrated mainly on the gold and the pyrite-pyrrhotite occurrences in the area. The only mineral production of any consequence was from the pyrite deposit of the North Pines Mines Limited during the years 1909 to 1921. A very limited amount of gold production was realized from the H. Eimiller claims on the south shore of Vermilion Lake.

DESCRIPTION OF PROPERTIES, OCCURRENCES, AND EXPLORATION AREAS

Pyrite and Pyrrhotite

Pyrite and pyrrhotite occur in the Vermilion-Pelican Lakes belt of metavolcanics in association with narrow bands of tuffaceous metasediments, quartzite, iron formation, and graphitic schists. Most commonly they are associated with magnetite-bearing iron formation.

Numerous small showings containing pyrite and lesser pyrrhotite occur in the Patara metasediments of Vermilion Lake. Pyrite and pyrrhotite are locally abundant disseminated constituents of felsic and mafic volcanic conglomerates and agglomerates further to the east.

The North Pines Mines Limited (5, 12) deposit is the most important deposit in the northern metavolcanic area.

The Whalen (15) occurrence is the only significant concentration of pyrite observed in the southern part of the area and is in the Abram metasediments near the contact with metavolcanics.

FANNING OCCURRENCE (3)

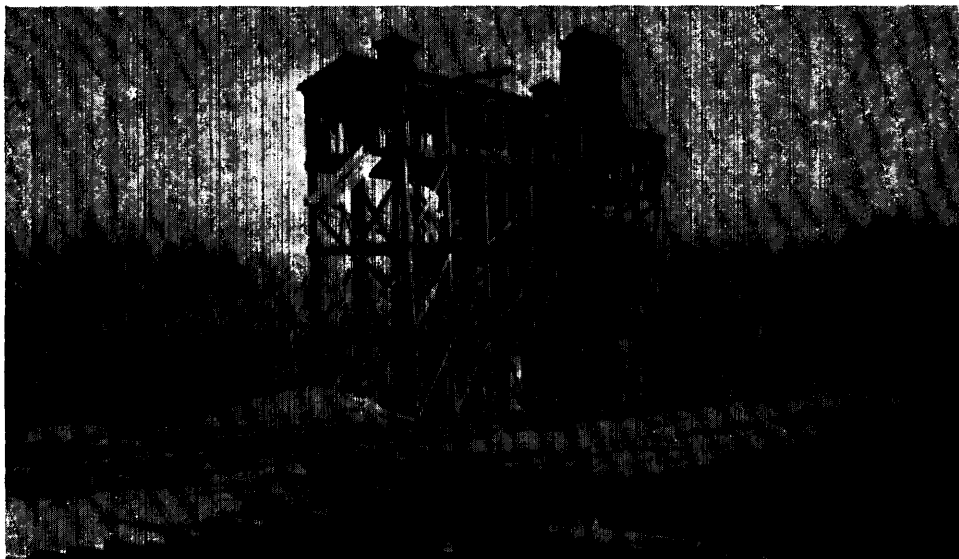
Hurst (1932, p.28) describes the Fanning occurrence as being on a point along the north shore of Vermilion Lake on mining location HW785. There is a 4-foot deep cribbed pit in clay at this point and some pyritic greenstone schist lies nearby. Hurst (1932, p.28) states; "Trenching through the drift has exposed seams of pyrite ranging from 2 to 6 feet in width contained in pillow lava. . . . Borings made out from the shore are said to have intersected a body of pyrite 20 feet in width".

MATUSOW OCCURRENCE (4)

An iron formation containing abundant pyrite and pyrrhotite and minor chalcopyrite in places occurs on the road just west of the west boundary of lot 12, concession I of Vermilion Additional Township. A shallow pit has been blasted at this location by the late S. Matusow exposing a mineralized zone over 10 feet wide. A grab sample taken by the author and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, was found to contain 0.22 percent copper and no nickel.

Farther west along the same road other occurrences of pyrite and pyrrhotite are associated with magnetite-bearing iron formation, and tuffaceous and quartzitic metasediments, but no economic concentrations of sulphides were observed.

Vermilion-Abram Lakes Area



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Photo 13—Loading bin of North Pines Mines Limited (5,12). 1.5 miles west of Pelican Lake.

NORTH PINES MINES LIMITED (5, 12)

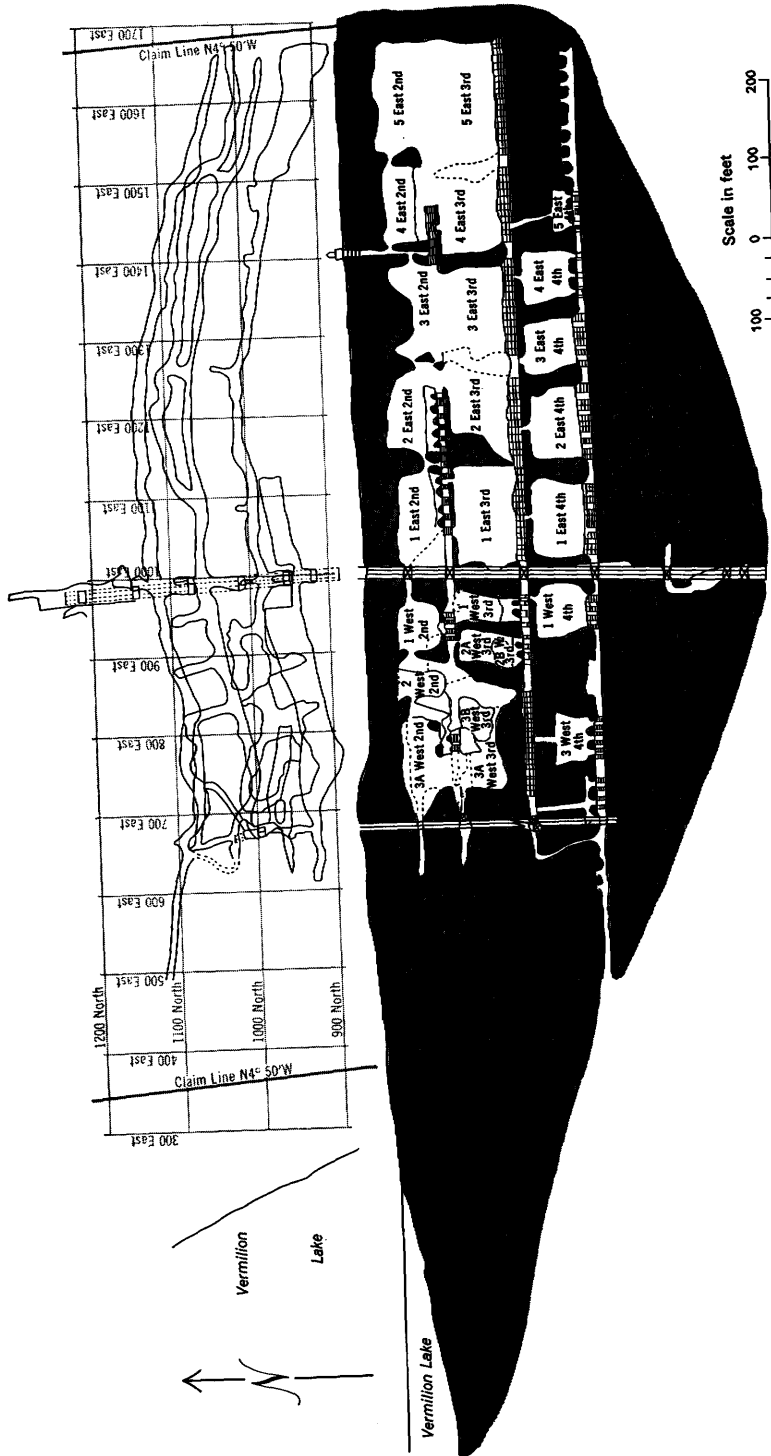
Allied Chemical Limited are owners of the North Pines Mines Limited property at the east end of Botham Bay, of Vermilion Lake in lot 32, concession I, Drayton Township.

The following material has been taken mainly from descriptions of the deposit by Hurst (1932, p.28-30) both by direct quote and by paraphrasing.

The occurrence of gossan along the lake shore first attracted attention to the deposit; and two claims, HW715 and HW716 were taken up by J. Shilton. In 1905, development of the Shilton Sulphur mine, as it was then called, was begun by E. R. Michie, and a shaft was sunk to a depth of 125 feet. Exploration of the deposit was contained in subsequent years, during which the property was known as the Michie mine, the Vermilion Pyrite mine, and the Northern Pyrites mine. In 1919, . . . the owners, the Nichols Chemical Company, renamed it the North Pines Mine.

The mine operated from 1909 to 1921 when it was closed permanently. During this interval production amounted to about 500,000 tons. The pyrite was transported to the railway and loading bins (Photo 13) at North Pines by aerial tramway. The mine workings consist of two shafts opening up four production levels and stations cut at the fifth and sixth levels. No. 1 Shaft is vertical and was sunk 337 feet in the hanging-wall of the deposit and opened up four levels. About 400 feet east of the No. 1 Shaft, No. 2 Shaft was sunk down the dip of the deposit to the sixth level, a slope distance of 624 feet. This shaft is 59 degrees northwest for the first 320 feet and 55 degrees northwest for the remainder. (Figure 5.)

The mineralization occurs in a sedimentary schist zone that strikes N50E and dips 55 degrees northwest. The hanging-wall is composed of a lenticular basaltic lapilli tuff unit consisting of numerous small oval basaltic fragments cemented by white carbonate, and the footwall consists of massive medium-grained dioritic lavas.



O.D.M. 6854
 Figure 5—Plan and longitudinal section of underground workings, North Pines Mines Limited (5, 12)—from company plans.

Vermilion-Abram Lakes Area

Stratigraphically, the lapilli tuff may underlie the sulphide deposits since tops from pillow lavas in the vicinity indicate a southeast-facing volcanic succession. However, the succession at the North Pines Mine is overturned.

The mineralization (Hurst 1932, p.30) consists of nearly pure pyrite with some pyrrhotite. Pyrrhotite occurs most abundantly along the hanging-wall. Very minor amounts of chalcopyrite, sphalerite, and magnetite are also reported. Some of the sheared country rock is graphitic. The pyrite is commonly banded and fine grained, but locally coarse pyrite has resulted from crushing and recrystallization. Quartz occurs interstitially among the pyrite grains and in some parts of the deposit is so abundant that crushing and concentration were necessary to obtain material of shipping grade.

It is reported by Hurst (1932, p.30) that "pyrite shipped from the property is said to have contained 45 to 48 percent of sulphur."

The deposit is known to contain a large reserve of pyrite as indicated in the report of Sutherland *et al.* (1915, p.95). "The deposit of pyrite at this mine is the largest so far worked in Ontario. The vein, or band, varies from 30 to 68 feet in width, with an average of probably 45 feet and is at least 1,000 feet long."

The origin of mineralization has been attributed to deposition along a fissure at the contact between diabase and the basaltic lapilli tuff by Moore (1911, p.208), the source of mineralization being considered the granitic rocks that outcrop to the north.

Hurst (1932, p.30) also relates the mineralization and shearing of the volcanics to the intrusion of the granitic rocks as does Hanson (1920).

The length and magnitude of the mineralization at the North Pines Mines and the distribution of mineralization between the lapilli tuff and dioritic lavas in a graphitic sedimentary schist band and the layered nature of the sulphides, suggest that the pyrite-pyrrhotite mineralization at the North Pines Mines Limited is related to sedimentary or volcanic-sedimentary processes and was deposited in a local basin during pauses in volcanic activity.

RITCHIE OCCURRENCE (14)

Hurst (1932, p.30-31) describes an occurrence of pyrrhotite and pyrite in impure quartzite in lots 24 and 25, concession I, Drayton Township. This was known as the Ritchie Group.

The quartzite, which is really a very lean type of iron formation, occurs between the metavolcanics, which are mainly pillow lavas, and the basal Patara metasediments. The iron formation trends N65E and is highly contorted in places and is sparingly mineralized with magnetite, pyrrhotite, pyrite, and minor chalcopyrite.

A few large trenches have been excavated across the mineralized zone north of Snair Lake. A grab sample, taken by the author from the largest trench and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, yielded 0.06 percent copper and trace of nickel. Hurst (1932, p.31) reports an analysis of 1.10 percent copper.

TINDALL OCCURRENCE (6)

At the east end of Whitefish Island, a shallow pit in felsic metasediments and pyroclastics has exposed some massive pyrite stringers. Hurst (1932, p.31) states that:

A vein of pyrite, 3 to 4 feet wide, is exposed near the water's edge. It occurs in schistose quartz porphyry and strikes N80E. A short distance inland a pit was sunk through 15 feet of drift to the vein. At this point the mineralization occurs at the contact between porphyry and sedimentary schist, and the vein contains nearly 2½ feet of nearly solid pyrite.

Little pyrite can be observed because of the decomposed nature of the rock and slumping in the pit.

WHALEN OCCURRENCE (15)

The Whalen occurrence is located on the south shore of East Bay of Minnitaki Lake and was explored by J. Whalen of Port Arthur in 1916 to 1917.

The mineralization occurs in conglomeratic and arkosic metasediments just north of the metavolcanic-metasediment contact. The mineralized rock is highly sheared and in part graphitic. Brecciated pyrite occurs in a schistose graphitic gangue at the shaft location. The shearing dips steeply north and trends about N80E parallel to the contact and shoreline.

A shaft, 75 feet deep, was sunk near the shoreline and a crosscut 80 feet long was driven north from the bottom to intersect the deposit.

At a point 50 feet from the shaft the crosscut entered 10 feet of mixed pyrite and rock, and then 20 feet of massive pyrite. The face was still in massive pyrite when it was stopped in November 1917. Four widely spaced drill holes along strike of the occurrence indicate mineralization over a length of more than ½ mile (Janes 1952, p.64-65).

Gold

MRS. H. EIMILLER (2)

This property, formerly known as the Botham-Henderson Group, was described by Hurst (1932, p.19-21). The property consists of four patented claims (K2227, K2228, K2230, K2234) on the south shore of Vermilion Lake.

The property was originally staked in 1928 by H. Botham and H.K. Mitchell and associates of Sioux Lookout. In 1932, Vermilion Lake Gold Mines Limited, took over the property and in September, 1934, control of operations was acquired by Reward Mining Company Limited. At a later date Denree Consolidated Mines Limited, held the property but has not done any work since 1956. At the present time the property is held in Mrs. H. Eimiller's name.

In 1930, 25 tons of material were mined and 15.75 ounces of gold were produced (Rogers and Young 1931, p.7). In 1935, 7.076 ounces gold and 2 ounces of silver were obtained from 18 tons of material (Young 1936, p.11).

The mineralization occurs in two zones at or near the contact of quartz porphyry and sediments.

The north zone is on claim K2230 and consists of a quartz stringer zone trending about N75E and dipping about 65 degrees north at the intrusive contact of a quartz porphyry body and volcanic boulder conglomerate. The quartz stringer zone appears to be about 5 feet wide and is over 100 feet long before it disappears under the waters of Vermilion Lake.

Vermilion-Abram Lakes Area

The rocks along the contact are highly sheared to quartz-sericite or talcose schists locally containing minor amounts of mariposite. The rocks are also silicified, carbonatized, and impregnated with much pyrite. Other minerals in the zone include minor arsenopyrite, galena, sphalerite, and chalcopyrite. A considerable amount of trenching and a deep rock-cut has been sunk at this location at the waters edge. There is also scattered drill core at the site. The production in 1930 and 1935 came from the north zone. Grab samples taken by the writer from the small rock dump were found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to assay 0.02 and 0.14 ounces gold per ton.

The south zone is on claim K2234 and consists of a sparsely mineralized milky white quartz vein up to 12 inches wide in sheared conglomerate 10 to 20 feet south of the porphyry contact. Here the conglomerate unconformably overlies the quartz porphyry and hence the mineralization is not related to it. A number of old shallow trenches expose the vein over 100 feet in length with a width of 1 to 3 feet. The veins contain small pockets of sphalerite and galena with very minor pyrite and chalcopyrite. A grab sample of vein material taken by the author yielded only a trace of gold when assayed by the Laboratory and Research Branch of the Ontario Department Mines and Northern Affairs.

The north zone mineralization with the heavy alteration including pyritization and carbonatization, is confined to the quartz porphyry contact and is probably genetically related to the intrusive, whereas the south zone mineralization occurs in rocks younger than the quartz porphyry.

KELORE MINES LIMITED [1951] (7)

Hurst (1932, p.24) reported on gold occurrences on claims SV106 and SV107 on Neepawa Island where low gold-values were obtained.

Some stripping and trenching was done on the shore of the lake near the centre of SV107. A heavily carbonatized zone about 100 feet wide containing disseminated pyrite and quartz stringers is in the volcanics north of the volcanic-sedimentary rock contact. A few narrow feldspar porphyry or fine-grained granodiorite dikes also occur in this zone and both dikes and the carbonatized zone are cut by quartz veinlets striking in three directions, N20E, S25W, and N85E. A grab sample of material taken from this area by the author assayed only a trace in gold.

In 1951, Kelore Mines Limited (now New Kelore Mines Limited) conducted a geological survey on SV106 and SV107 as well as the unpatented claims on the mainland south of the lake but no discoveries of consequence were reported.

J. L. MacDONALD (8)

A group of 6 unpatented claims (Pa31711 to Pa31716) on the west side of Neepawa Island are presently held by J.L. MacDonald of Schumacher, Ontario.

Spectacular gold discoveries were made on this island, particularly on former claim Pa11459 (now Pa31711) which was part of a group of 15 claims recorded in the name of J.H. Kolak in 1950. These claims were transferred to J.L. MacDonald in October, 1950, the same date as an option agreement was recorded with Central Manitoba Mines Limited. This company drilled 24 holes totalling 3,940 feet on claims Pa11455, Pa11456, and Pa11459, during 1950 and 1951.

The original group was cancelled July 22, 1957, but the property was later restaked by J.L. MacDonald in 1958 and again in 1962. During this interval, considerable trenching was carried out by Mr. MacDonald particularly on claim Pa31711 (originally Pa11459 but, in 1958, Pa22332).

Delnite Mines Limited optioned the property in April, 1963 and carried out some 2,600 feet of diamond drilling before dropping the option.

The main showing, which is located near the centre of claim Pa31711, occurs in heavily sheared, pyritized, and carbonatized agglomerate and andesite. Quartz veinlets strike in a northwesterly direction and in places crosscut the schistosity, which strikes about S85E and dips steeply north. The quartz stringers in places, display minute fold patterns and are usually quite narrow. The gold mineralization, according to Chisholm (1951, p.9), is associated with these stringers and is also associated with the pyrite.

The structural picture on Neepawa Island is complex and would have to be unravelled before an evaluation of drill results could be made. In the vicinity of the showing a northwest strike of the volcanics is combined with an east-trending schistosity, a feature common to most rocks in the Northeast Bay area. It is possible that tight folding in the vicinity of the showing has not been recognized. In the sediments of East Bay, axial plane cleavage trends at high angles to the bedding near the noses of folds and locally makes recognition of folding difficult where the rock types involved are homogeneous or similar.

A number of east-west shear zones also have been observed on Neepawa Island and may have an origin relating to the major faults of East Bay and may also have been the controlling factor for the mineralization.

MINING LOCATION K171 (10)

Some trenching and one diamond drill location was observed near the southeastern corner of Mining Location 171. The trenching occurs in a sheared and carbonatized zone in mafic volcanics that trends about N5E. A study of aerial photographs indicates that the sheared zone may be a continuation of one occurring on the peninsula between East and Northeast Bays and may be a branch of the Ruby Island Fault.

No information on the details of this work is available.

NEEPAWA ISLAND GOLD MINES LIMITED [1950] (11)

In 1950, Neepawa Island Gold Mines Limited, a company now defunct, drilled 18 short holes totalling 665 feet on former claims Pa11588 and Pa11590, east of the J.L. MacDonald property.

The area is grown over and only one shallow trench was located in which a 2-inch wide quartz vein occurs in rusty, carbonatized, massive and pillowed lavas. Results of the drilling were negative.

OURGOLD MINING COMPANY LIMITED (13)

The company holds 18 unpatented claims on and adjacent to Burnthut Island in Minnitaki Lake.

Vermilion-Abram Lakes Area

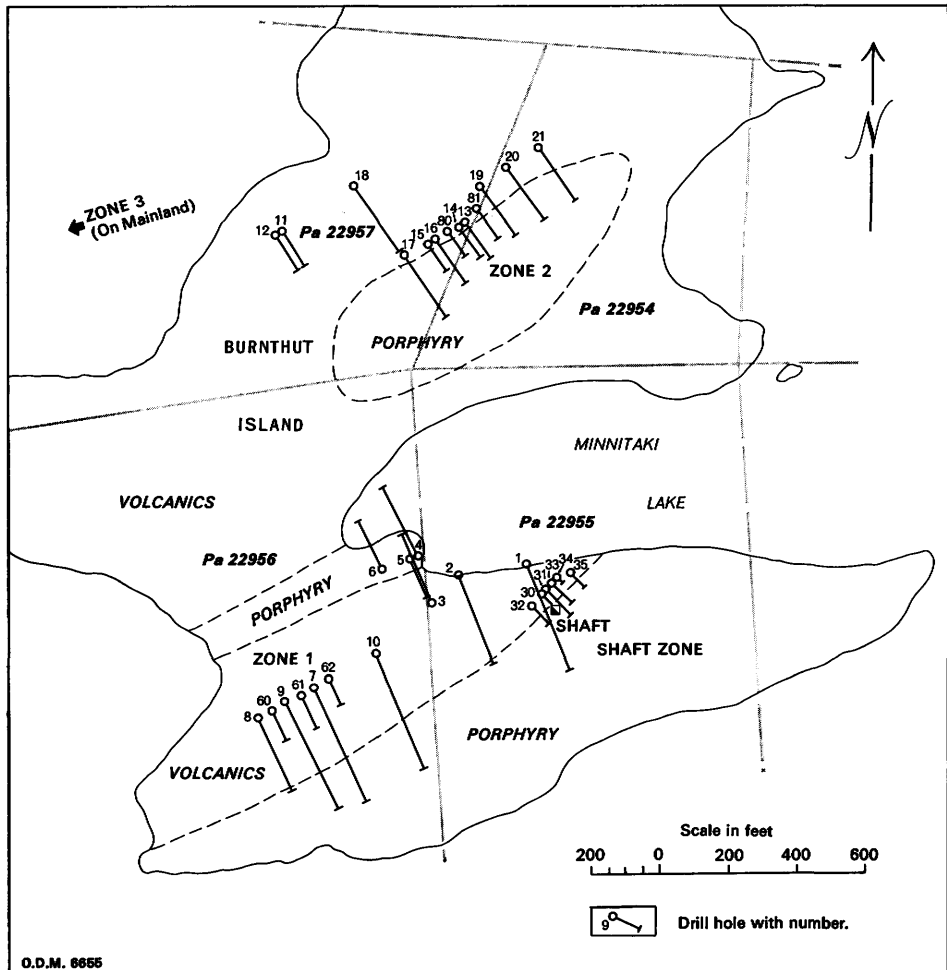


Figure 6—Diamond drill plan, Ourgold Mining Company Limited (13) Burnthut Island property.

Gold occurrences have been known on Burnthut Island as early as 1898 when a shaft about 50 feet deep was sunk on the contact between quartz porphyry and sheared "greenstone" in the southern part of the island (Hurst 1932, p.21).

The following information has been taken mainly from the reports of Oja (1962) and Hudson (1947; 1948).

A diamond drill program totalling 5,028 feet was completed in 1947 and, in 1961 to 1962, a further 2,300 feet were drilled and a magnetometer survey was conducted on ice.

There have been four areas where gold mineralization has been partially outlined on the property. These are designated as a shaft zone and numbers 1, 2, and 3 zones (Figure 6).

The shaft and number 1 zones occur at or near the contact of the quartz porphyry with schistose and massive fine-grained mafic metavolcanics on the southern part of the island. This contact is sheared and carbonatized over varying widths of up to 150 feet. Gold-bearing quartz veins and stringer zones accompanied by much mariposite and pyrite also occur along this contact over a distance of more than 1,300 feet. Small amounts of galena and chalcopyrite are also present.

Number 1 zone is essentially a continuation of the shaft zone except that mineralization in the former appears to lie wholly within the mafic metavolcanics and in the latter the mineralization is confined to the contact zone between porphyry and greenstone.

Number 2 zone lies about ¼ mile to the north of the shaft zone and is associated with quartz stringers in a fractured and sheared quartz porphyry dike. Diamond drilling of this one revealed low and erratic gold-values.

Number 3 zone lies on the mainland to the west of number 2 zone (claim Pa27918) where a few trenches have been excavated on small quartz veins in "greenstone". A grab sample by the writer from a small trench by the shore was found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs to assay 0.04 ounces gold.

Grab samples taken in the vicinity of the shaft are reported by Oja (1962) to assay up to \$21.00 per ton (\$35 U.S. per ounce) but assays from drill results were quite low over narrow widths. Better intersections were obtained from number 1 zone where drilling, in 1947, indicated a gold-bearing section 300 feet long, 4 feet wide, and grading \$6.15 per ton (\$35 U.S. per ounce). Further drilling, in 1961, failed to verify the continuity of this section.

Oja (1962) suggests that the gold-bearing stringers may lie transverse to the quartz-carbonate-mariposite zone and hence are roughly parallel to the drill holes, accounting for the lack of continuity and erratic values obtained.

WRIGHT-HARGREAVES MINES LIMITED [1951] (16)

A group of 31 unpatented claims on the north side of East Bay of Minnitaki Lake were optioned by Wright-Hargreaves Mines Limited from R.J. McCombe of Sioux Lookout in 1951.

The group of claims straddled the metasediment-metavolcanic contact north of East Bay. The contact zone trends N75E and is 20 to 40 feet wide. The rocks are heavily sheared and carbonatized and mineralized with pyrite and quartz and carbonate veinlets. Considerable trenching was done in 1948 prior to option and four short x-ray drill holes were put down on this contact zone with negative results when assayed for gold.

Vermilion-Abram Lakes Area

Another sheared and carbonatized zone trends more northerly (N50E) and lies wholly within the volcanics. A few quartz stringers are found at sporadic intervals in this shear zone.

Wright-Hargreaves mapped the property on a scale of 1 inch to 200 feet and took more than 225 samples with the highest assay being \$7.00 gold per ton (\$35 U.S. per ounce) over a narrow width (Assessment work files, Resident Geologist's office, Ontario Department of Mines and Northern Affairs, Kenora, Ontario.)

Copper

McCOMBE OCCURRENCE (9)

On Island FP61 on former claim Pa18312 in Northeast Bay of Minnitaki Lake, a northeast-trending brecciated contact zone between granitic and dioritic intrusive rocks contains some disseminated sulphides and threads of chalcopyrite, pyrrhotite, and pyrite, and rare specks of molybdenite in tiny fractures.

The hybrid contact zone consists of brecciated mafic metavolcanics, dioritic rocks as well as trondhjemitic rocks, crossed by dikes of trondhjemitic, granite, and diorite. It seems that the trondhjemitic rocks are the youngest.

Two large trenches have been excavated on the northwest shoreline and expose erratic mineralization. A picked sample showing good mineralization was found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to contain 1.26 percent copper and a trace of molybdenum.

In 1951, the claims were held by J. Donnelly of Port Arthur but were allowed to lapse. R.J. McCombe of Sioux Lookout restaked the claims and optioned them to Noranda Mines Limited in 1957 and 1958 who completed an electromagnetic survey before dropping the option.

In 1961, Rio Tinto Canadian Exploration Limited took an option on the property and completed an induced polarization survey and drilled five holes totalling 1,659 feet before dropping the option (Figure 7). Best results obtained in drilling were 0.57 percent copper across 44.5 feet (Assessment work files, Resident Geologist's office, Ontario Department of Mines and Northern Affairs, Kenora, Ontario).

Lead-Zinc

H. COLBERG (1)

This property is held by H. Colberg, prospector from Webster Station, and is located ½ mile south of the railway tracks and about ⅓ mile west of lot 12, concession II, Vermilion Additional Township. The showings are on two unpatented claims Pa25503 and Pa25506.

A number of trenches have exposed separate mineralized quartz veins intermittently over a distance of more than 1,000 feet and across widths of 1 to 8 feet.

The mineralization in the veins consist of pods of galena and sphalerite with a small amount of pyrrhotite and magnetite distributed in an irregular manner. The

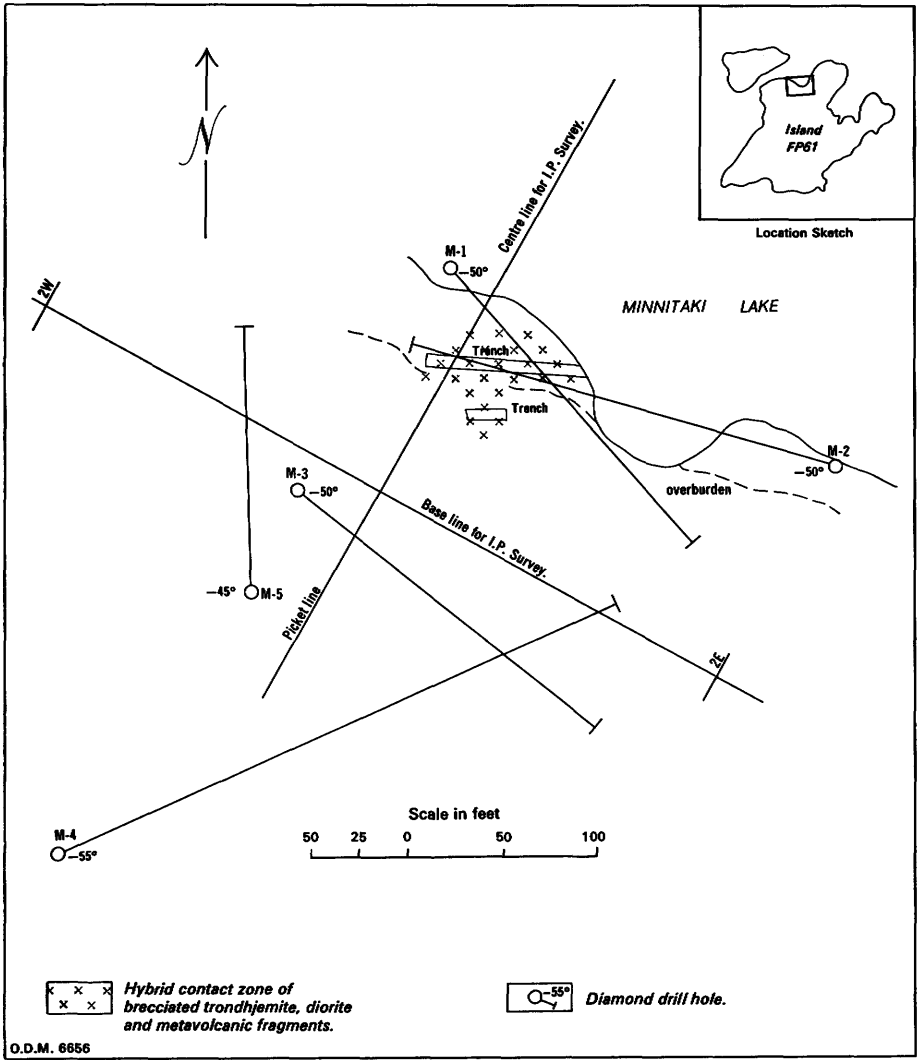


Figure 7—Surface plan of diamond drill holes, McCombe Occurrence (9). Drilled by Rio Tinto Canadian Exploration Limited.

Vermilion-Abram Lakes Area

exposures observed are too spotty and low-grade to be considered as a source of base metals, but the presence of galena and sphalerite in this area, not too far removed from the granite contact, might be deemed favourable to further exploration.

SUGGESTIONS FOR FUTURE EXPLORATIONS

No concentrations of base metals were observed in the area. However, small specks of chalcopyrite are common in the amygdules in the pyroclastic rocks in the Troutfish Bay-Northeast Bay area, and porphyritic rhyolite near the southwest end of Allan Lake contains a small amount of chalcopyrite. It would seem that this area of pyroclastics and the felsic metavolcanics further east would offer the best prospecting ground for base metals.

Many other occurrences of pyrite and pyrrhotite have been observed in the Patara metasediments, particularly in the Vermilion Lake area. These occurrences appear to be associated mainly with felsic volcanic conglomerates or agglomerates, particularly on Slate and Whitefish Islands. In some places, small trenches or pits have been sunk on the mineralized zones and those observed have been so marked on the accompanying maps.

Disseminated pyrite and pyrrhotite occur in the metavolcanics, particularly the pyroclastics of the Butterfly Lake, Troutfish Bay, and Northeast Bay areas, but only rare specks of chalcopyrite have been observed.

Magnetite-bearing iron formation occurs as narrow bands interlayered with intermediate to mafic metavolcanics in the Vermilion-Pelican Lakes belt. All observed occurrences of iron formation are well below economic grade and size, but, in some places, the iron formation contains considerable sulphides and locally consists almost wholly of pyrite and pyrrhotite with small amounts of chalcopyrite. The bodies of iron formation with accompanying sulphides might be explored in the event that they may locally contain base metal concentrations.

The Whalen pyrite occurrence near the metavolcanic-metasediment contact along the south shore of East Bay may offer some encouragement for prospecting.

The contacts of the differentiated intrusive stocks in Northeast Bay of Minnitaki Lake may be worthy of investigation for disseminated chalcopyrite deposits, particularly where the different intrusive phases have been brecciated and hybridized.

Gold occurrences are spatially related to east- or northeast-trending shear zones in the area. Most occurrences discussed to date have been discontinuous and narrow and values have been very spotty.

REFERENCES

- Armstrong, H.S.
1950: Geology of Echo Township; Ontario Dept. Mines, Vol.59, pt.5, 40p. (published 1951). Accompanied by Map 1950-1, scale 1 inch to 1,000 feet.
- Bell, R.
1872: Report on the country between Lake Superior and Lake Winnipeg; Geol. Surv. Canada, Report of Progress for 1872-73, pt.5, p.87-111, (published 1873).
- Bow, J.A.
1899: Mines of northwestern Ontario; Ontario Bur. Mines, Vol.8, pt.1, p.49-99.
1900: Mines of northwestern Ontario; Ontario Bur. Mines, Vol.9, pt.1, p.35-88.
- Chisholm, E.O.
1951: Recent activities in Sioux Lookout area; Ontario Dept. Mines, P.R. 1951-1. Accompanied by Index Map, scale ½ inch to 1 mile.
- Coleman, A.P.
1895: Second report on the gold fields of western Ontario; Ontario Bur. Mines, Ann. Rept., Vol.5, Sec.2, p.47-106, (published 1896).
1926: Ice ages recent and ancient; The MacMillan Company, New York, 296p.
- Collins, W.H.
1909: A geological reconnaissance of the region traversed by the National Transcontinental Railway between Lake Nipigon and Clay Lake, Ontario; Geol. Surv. Canada, Pub. No. 1059, 67p. Accompanied by Map 1061, scale 1 inch to 4 miles.
- Davies, J.C.
1965: Geology of High Lake-Rush Bay area, District of Kenora; Ontario Dept. Mines, GR41, 57p. Accompanied by Maps 2068 and 2069, scale 1 inch to ½ mile.
- Fraleck, E.L.
1907: Iron pyrites in Ontario; Ontario Bur. Mines, Vol.16, pt.1, p.149-201. Accompanied by Index Map.
- Hansen, E.H., Porter, S.C., Hall, B.A., and Hills, A.
1961: Décollement structures in glacial-lake sediments; Geol. Soc. America Bull., Vol.72, No.9, p.1415-1418.
- Hanson, George
1920: Some Canadian occurrences of pyritic deposits in metamorphic rocks; Econ. Geol., Vol.15, No.7, p.574-609.
- Harding, W.D.
1950: Geology of the Gullwing Lake-Sunstrum area, District of Kenora; Ontario Dept. Mines, Vol.59, pt.4, 29p. (published 1951). Accompanied by Map 1950-2, scale 1 inch to 1 mile.
- Hewitt, D.F.
1967: Pyrite deposits of Ontario; Ontario Dept. Mines, MRC5, 64p.
- Horwood, H.C.
1937: Geology of Superior Junction-Sturgeon Lake area, District of Kenora; Ontario Dept. Mines, Vol.46, pt.6, p.1-25, (published 1938). Accompanied by Map 46d, scale 1 inch to 2 miles and Map 46e, scale 1 inch to ¾ mile.
- Hudec, P.P.
1965: Geology of Highstone Lake-Miniss Lake area, Districts of Kenora and Thunder Bay; Ontario Dept. Mines, GR 32, 28p. Accompanied by Maps 2063 and 2064, scale 1 inch to 1 mile.
- Hudson, A.S.
1947: Private interim report on Burnthut Island property of Ourgold Mining Company Limited.
1948: Private interim report on Burnthut Island property of Ourgold Mining Company Limited.
- Hurst, M.E.
1932: Geology of the Sioux Lookout area; Ontario Dept. Mines, Vol.41, pt.6, p.1-33, (published 1933). Accompanied by Map 41h, scale 1 inch to 1½ miles.
- Janes, T.H.
1952: Sulphur and pyrites in Canada; Canada Dept. Mines and Tech. Surv., Mines Branch, Industrial Minerals Division, Memorandum Series 118, 103p., April, 1952.
- Johnston, F.J.
1967: Geology of West Minnitaki Lake area; Ontario Dept. Mines, Open File Report 5003, released April 3, 1967. Accompanied by Prelim. Geol. Maps P.268, P.269, scale 1 inch to ¼ mile.
- Kuenen, Ph.H., and Migliorini, C.I.
1950: Turbidity currents as a cause of graded bedding; Jour. Geol., Vol.58, No.2, p.91-127.

Vermilion-Abram Lakes Area

- McInnes, William
1901: Region south-east of Lac Seul; Geol. Surv. Canada, Summary Report, pt.A, p.89A-95A.
- Moore, E.S.
1911: Vermilion Lake pyrite deposits; Ontario Bur. Mines, Vol.20, pt.1, p.199-213. Accompanied by Map 20c, scale 1 inch to ½ mile.
1930: Notes on the origin of pillow lavas; Royal Society of Canada Proc. and Trans., Sec.4, 3rd. Ser., Vol.24, pt.1, p.137-139.
- Oja, R.V.
1962: Private report on the properties of Ourgold Mining Company Limited, Burnthut Island property.
- ODM-GSC
1961a: Yonde Sheet, Kenora District, Ontario; Ontario Dept. Mines-Geol. Surv. Canada, Aeromagnetic Series, Map 1137G, scale 1 inch to 1 mile. Survey flown 1961.
1961b: Sioux Lookout Sheet, Kenora District, Ontario; Ontario Dept. Mines-Geol. Surv. Canada, Aeromagnetic Series, Map 1138G, scale 1 inch to 1 mile. Survey flown 1961.
1961c: Sandybeach Lake Sheet, Kenora District, Ontario; Ontario Dept. Mines-Geol. Surv. Canada, Map 1146G, scale 1 inch to 1 mile. Survey flown 1961.
1961d: Hudson Sheet, Kenora District, Ontario; Ontario Dept. Mines-Geol. Surv. Canada, Aeromagnetic Series, Map 1147G, scale 1 inch to 1 mile. Survey flown 1961.
1965: Sioux Lookout Sheet, Ontario; Ontario Dept. Mines-Geol. Surv. Canada, Aeromagnetic Series, Map 7122G, scale 1 inch to 4 miles. Survey flown 1960 and 1961.
- Parks, W.A.
1898: Geology of base and meridian lines in Rainy River District; Ontario Bur. Mines, Vol.7, pt.2, p.161-183. Accompanied by Map 7a, scale 1 inch to 4 miles.
- Pettijohn, F.J.
1934: Conglomerate of Abram Lake, Ontario, and its extensions; Geol. Soc. America Bull., Vol.45, No.3, p.479-506.
1935: Stratigraphy and structure of Vermilion Township, District of Kenora, Ontario; Geol. Soc. America Bull., Vol.46, No.12, p.1891-1908.
1936: Geology of East Bay, Minnitaki Lake, District of Kenora, Ontario; Jour. Geol. Vol.44, No.3, p.341-357.
1937: Early pre-Cambrian geology and correlational problems of the Northern Sub-province of the Lake Superior region; Geol. Soc. America Bull., Vol.48, No.2, p.153-202.
- Ross, J.V.
1962: The folding of angular unconformable sequences; Jour. Geol., Vol.70, No.3, p.294-308.
- Satterly, J.
1941: Geology of the Dryden-Wabigoon area; Ontario Dept. Mines, Vol.50, pt.2, p.1-67, (published 1943). Accompanied by Map 50e, scale 1 inch to 1 mile.
- Sutherland, T.F., Collins, E.A., McMillan, J.G., and Bartlett, J.
1915: Mines of Ontario; Ontario Bur. Mines, Vol.24, pt.1, p.94-170.
- Young, A.C.
1936: Statistical review of the mineral industry of Ontario for 1935; Ontario Dept. Mines, Vol.45, pt.1, p.1-60, (published 1937).

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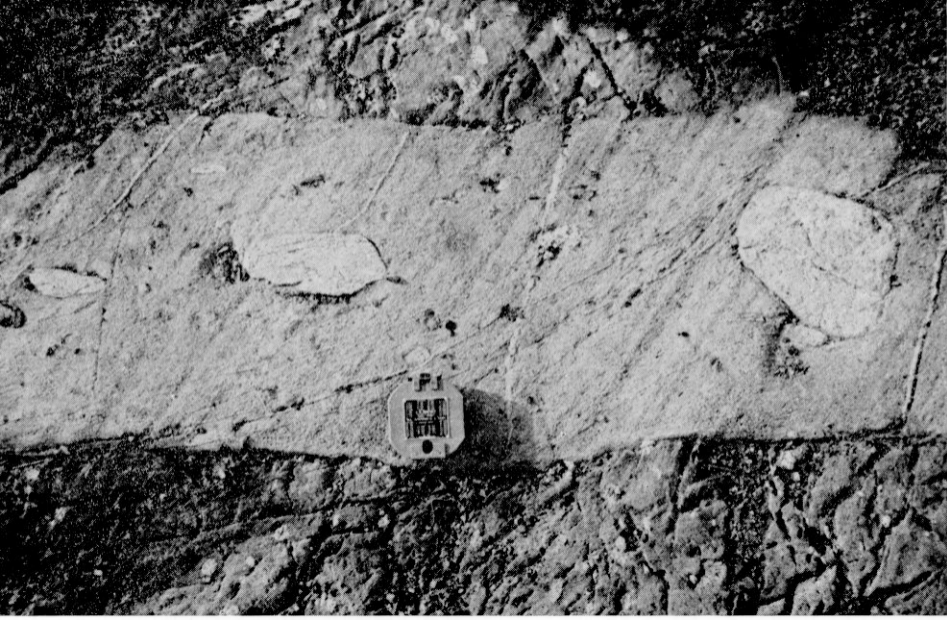
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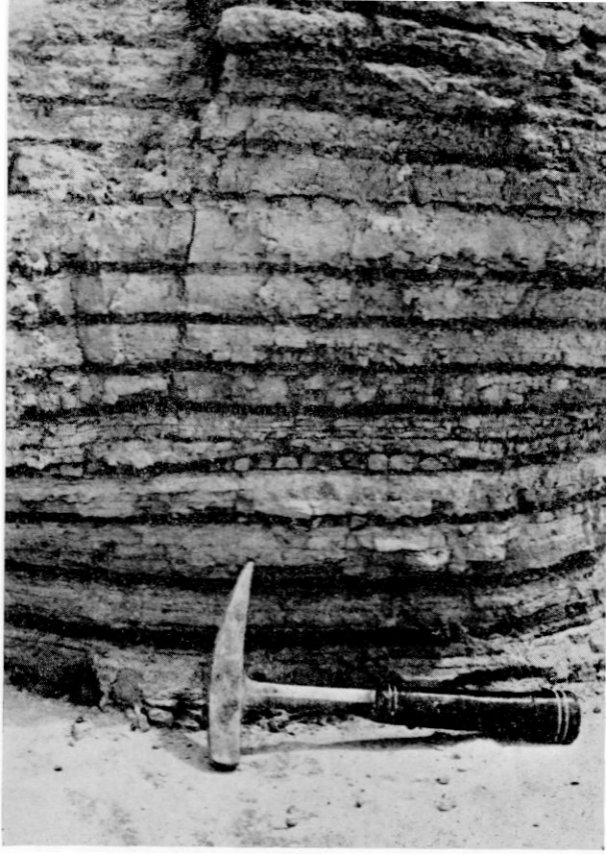






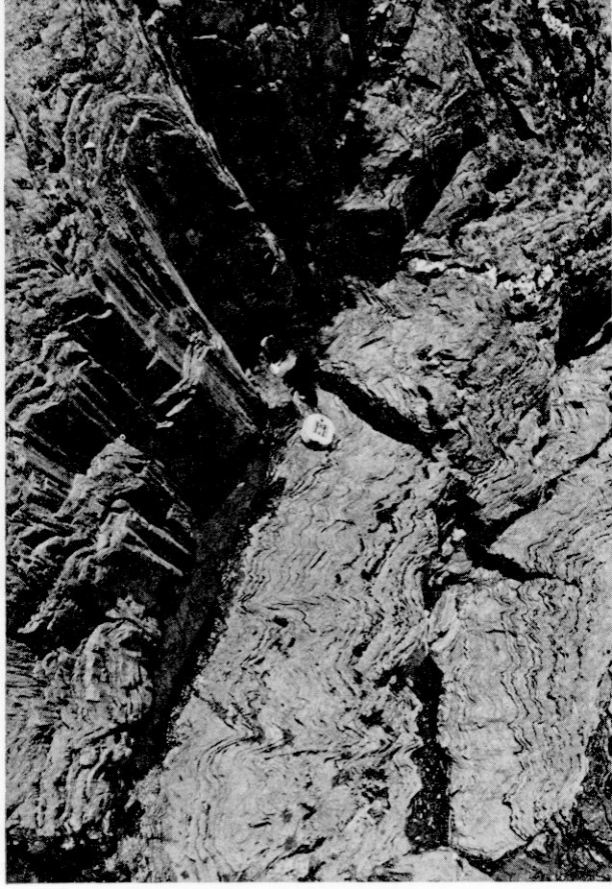


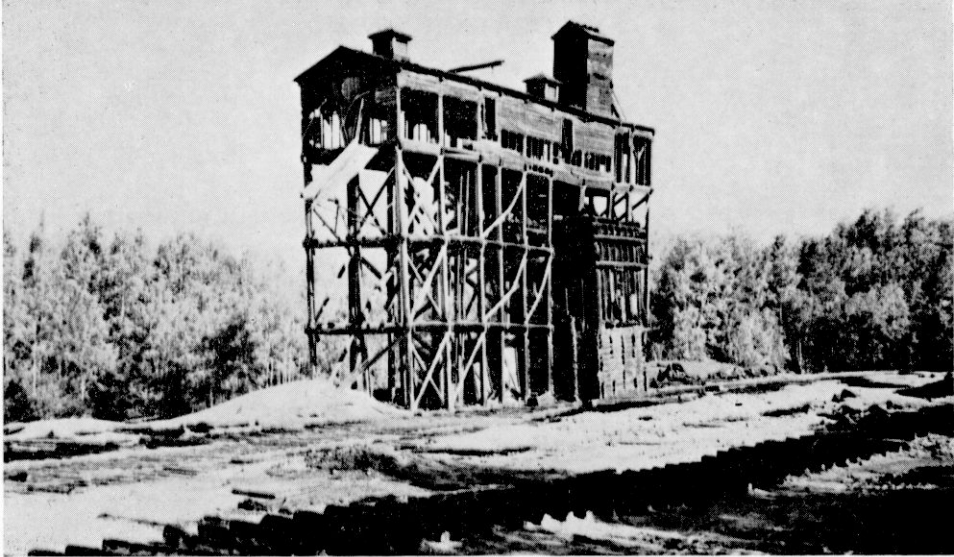




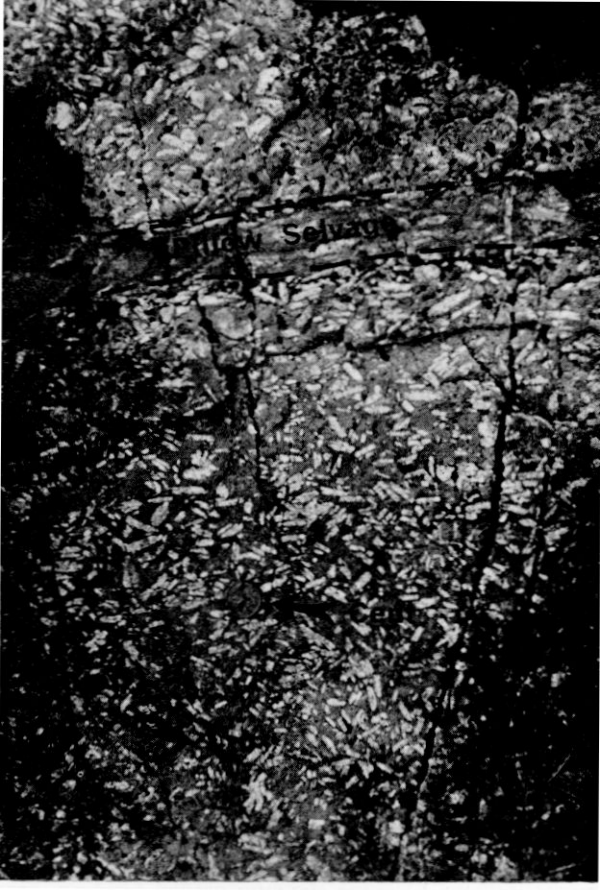






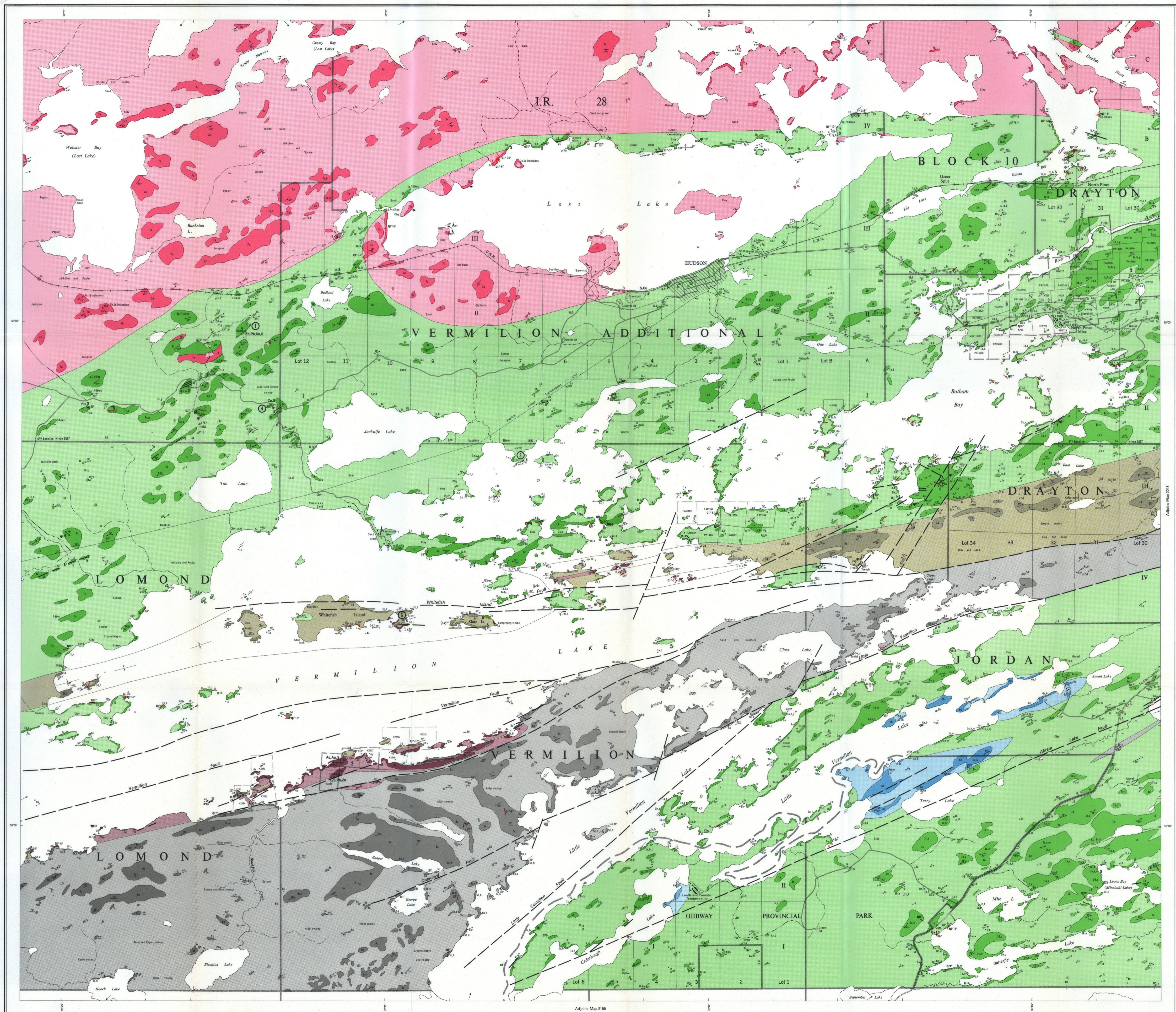






E. J. Selva





LEGEND

CENOZOIC*

RECENT
Lake, stream, and vegetal deposits.

PLEISTOCENE
Sand, gravel, clay and varved clay deposits.

UNCONFORMITY

PRECAMBRIAN*

LATE INTRUSIVE ROCKS
GRANITIC ROCKS*

- 7 Unsubdivided granitic rocks.
- 7a Hybrid granite and granitic gneiss.
- 7b Porphyritic granite.
- 7c Quartz porphyry and quartz porphyry.
- 7d Felsic porphyry, granodiorite.
- 7e Trondhjemite and quartz diorite.

INTRUSIVE CONTACT

MAFIC INTRUSIVE ROCKS*

- 6 Unsubdivided mafic intrusive rocks.
- 6a Diorite, syenodiorite.
- 6b Gabbro.

INTRUSIVE CONTACT

ABRAM METASEDIMENTS*

- 5a Arkose.
- 5b Slate and argillite.
- 5c Greywacke.
- 5d Granite and quartz porphyry conglomerate.
- 5e Chlorite schist, chloritic tuff.
- 5f Crystal tuff, tuffaceous metasediments.

IRON FORMATION*

UNCONFORMITY

EARLY FELSIC INTRUSIVE ROCKS*

- 4a Quartz porphyry.
- 4b Felsite.

INTRUSIVE CONTACT

PATARA METASEDIMENTS*

- 3a Arkose.
- 3b Slate and argillite.
- 3c Greywacke.
- 3d Volcanic breccia and pebble conglomerate and breccia.
- 3e Chert and siliceous metasediments.
- 3f Tuffs and tuffaceous metasediments.

MINOR UNCONFORMITY

FELSIC METAVOLCANICS*

- 2a Pillowed lava.
- 2b Agglomerate.
- 2c Rhyolite and porphyritic rhyolite.
- 2d Tuff.

INTERMEDIATE TO MAFIC METAVOLCANICS*

- 1a Intermediate to mafic lava, schistose granodiorite.
- 1b Pillowed lava.
- 1c Massive, chloritic lava.
- 1d Crystal tuff and crystal-rich flows.
- 1e Agglomerate.
- 1f Layered gneiss, amphibolite, epidote-amphibolite of probable volcanic origin.
- 1h Biotite and hornblende schists and gneiss, mainly of sedimentary or tuffaceous origin.
- 1j Porphyritic basalt (seaward rock).
- 1k Variscite lava.
- 1m Crystalline tuff, tuff and tuffaceous metasediments.

IRON FORMATION*

CARBONIZED ROCK*

SYMBOLS

- Glacial striae.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, top unknown; (inclined, vertical).
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
- Bedding, top (arrow) from cross bedding; (inclined, vertical, overturned).
- Bedding, top (arrow) from relationship of cleavage and bedding; (inclined, overturned).
- Lava flow top (arrow) from pillow shape and packing.
- Schistosity; (horizontal, inclined, vertical).
- Gneissosity; (horizontal, inclined, vertical).
- Lineation with plunges.
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Jointing; (horizontal, inclined, vertical).
- Drag folds with plunges.
- Anticline, syncline, with plunges.
- Drill hole; (vertical, inclined).
- Well, vein network. Width in inches.
- Shaft; depth in feet.
- Magnetic attraction.
- Muskeg or swamp.
- Motor road. Provincial highway, number encircled where applicable.
- Other road.
- Trail, portage, winter road.
- Building.
- Build-up area.
- Township boundary with milepost, approximate location only.
- Base line with milepost, approximate location only.
- Surveyed line, approximate location only.
- Property boundary, approximate location only.
- Location of mining property or occurrence. (surveyed, unsurveyed). See list of properties.

NOTES

*Unconsolidated deposits. Cenozoic deposits are not differentiated on the map. For the most part they coincide with the higher coloured parts of the map.

*Recent geology. Outcrops and inferred outcrops of each rock unit are shown, respectively, in deep and light tones of the same colour. Where a place of formation is too narrow to show colour and must be represented in black, a short black bar appears in the appropriate block.

*Rocks in these groups are subdivided lithologically and the order does not necessarily imply age relationship within or among groups.

*Occurs on companion sheet only, Map 2243 Abram Lake Sheet.

LIST OF PROPERTIES AND OCCURRENCES

1. Colberg, H.
2. Emiller, Mrs. H.
3. Fanning Occurrence.
4. Maturar Occurrence.
5. North Star Mines Limited.
6. Tindall Occurrence.

SOURCES OF INFORMATION

Geology by F. J. Johnston and assistants, 1965, 1966. Geology is not tied to surveyed lines.

F. J. Pettijohn: Conglomerate of Abram Lake, Ontario and its Extension; Bull. Geol. Soc. Amer., Vol. 48, No. 3, 1934, p. 479-506.

F. J. Pettijohn: Stratigraphy and Structure of Vermilion Township, District of Kenora, Ontario; Bull. Geol. Soc. Amer., Vol. 46, No. 12, 1935, p. 1981-1994.

Maps 4th, 1960-9 and 1969-9, Ontario Department of Mines.

O.D.M.—G.S.C., aeromagnetic maps: 1146G, 1147G.

Preliminary maps: P. 336 Vermilion Lake Area (west part); P. 337 Vermilion Lake Area (east part); P. 408 Vermilion Lake Area (North Pines Sheet); scale 1 inch to 1/2 mile, issued 1966, 1966, and 1967 respectively.

Cartography by C. C. Cashin and assistants, Ontario Department of Mines and Northern Affairs, 1971.

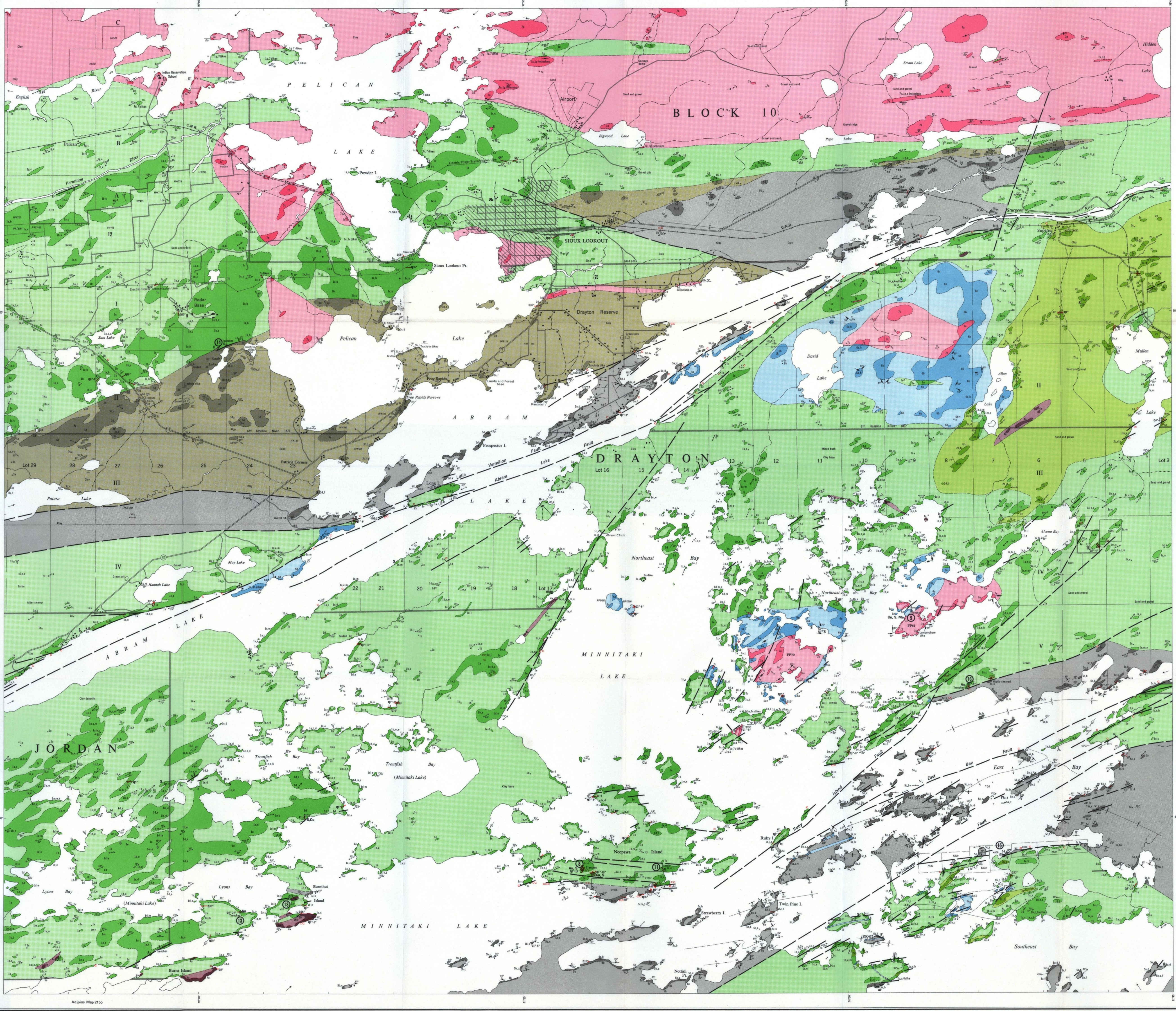
Base maps derived from Ontario Forest Resources Inventory maps, with revisions by F. J. Johnston. Magnetic declination in the area was 2°E., 1967.

ONTARIO
DIVISION OF MINES
HONOURABLE LEO BERNIER, Minister of Natural Resources
W. Q. MACNEE, Deputy Minister of Natural Resources
Executive Director, Division of Mines E. G. Pyle, Director, Geological Branch

Map 2242
VERMILION LAKE SHEET
KENORA DISTRICT

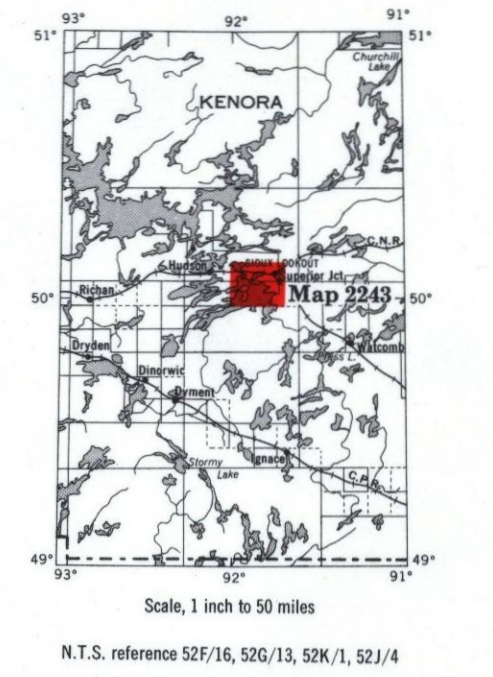
Scale 1:31,680 or 1 Inch to 1/2 Mile

Chains 0 10 20 30 40 50 60 70 80 90 100 Miles
Metres 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 Feet



CENOZOIC*

- RECENT**
Lake, stream, and vegetal deposits.
- PLEISTOCENE**
Sand, gravel, clay and varved clay deposits.
- UNCONFORMITY**
- PRECAMBRIAN[†]**
- ARCHEAN**
- LATE INTRUSIVE ROCKS**
- GRANITIC ROCKS[‡]**
- 7 Unsubdivided granitic rocks.
 - 7a Hybrid granite and granite gneiss.
 - 7b Porphyritic granite.
 - 7c Quartz-vein granite-quartz porphyry.
 - 7d Felsite porphyry, granodiorite.
 - 7e Trochilite and quartz diorite.
- INTRUSIVE CONTACT**
- MAFIC INTRUSIVE ROCKS[‡]**
- 8 Unsubdivided mafic intrusive rocks.
 - 8a Diorite, andesite.
 - 8b Gabbro.
- INTRUSIVE CONTACT**
- ABRAM METASEDIMENTS[‡]**
- 9a Arkose.
 - 9b Slate, varved slate, argillite.
 - 9c Greywacke.
 - 9d Granite and quartz porphyry conglomerate.
 - 9e Chlorite schist, chlorite tuff.
 - 9f Crystal tuff, tuffaceous metasediments.
- IRON FORMATION**
- UNCONFORMITY**
- EARLY FELSIC INTRUSIVE ROCKS[‡]**
- 4a Quartz porphyry.
 - 4b Felsite.
- INTRUSIVE CONTACT**
- PATARA METASEDIMENTS[‡]**
- 3a Arkose.
 - 3b Slate and argillite.
 - 3c Greywacke.
 - 3d Volcanic boulder and pebble conglomerate and breccia.
 - 3e Chert and siliceous metasediments.
 - 3f Tuffs and tuffaceous metasediments.
- MINOR UNCONFORMITY**
- FELSIC METAVOLCANICS[‡]**
- 2a Pillowed lava.
 - 2b Amphibolite.
 - 2c Rhyolite and porphyritic rhyolite.
 - 2d Tuff.
- INTERMEDIATE TO MAFIC METAVOLCANICS[‡]**
- 1a Intermediate to mafic lava, schistose gneissite.
 - 1b Pillowed lava.
 - 1c Massive dioritic lava.
 - 1d Crystal tuff and crystal-rich flows.
 - 1e Amphibolite.
 - 1f Layered gneissite, amphibolite, epidote-amphibolite of probable volcanic origin.
 - 1h Basalt and hornblende schists and gneiss mainly of sedimentary or tuffaceous origin.
 - 1i Porphyritic basalt (leopard rock).
 - 1k Variolite lava.
 - 1m Crystal-lithic tuff, tuff and tuffaceous metasediments.



EARLY FELSIC INTRUSIVE ROCKS[‡]

- INTRUSIVE CONTACT**
- PATARA METASEDIMENTS[‡]**
- MINOR UNCONFORMITY**
- FELSIC METAVOLCANICS[‡]**
- INTERMEDIATE TO MAFIC METAVOLCANICS[‡]**

- IRON FORMATION**
- CARBONIZED ROCK**
- Au** Gold.
- Cu** Copper.
- G** Garnet.
- mag** Magnetite.
- Myl** Molybdenum.
- P** Pyrite.
- Q** Quartz.
- S** Sulphide mineralization.

* Unconsolidated deposits. Cenozoic deposits are not differentiated on the map. For the most part they coincide with the higher coloured parts of the map.

† Bedrock geology. Outcrop and inferred extensions of each rock unit are shown, respectively, in deep and light lines of the same colour. Where a place is for mention is too narrow to show colour and must be represented in black, a short black bar appears in the appropriate block.

‡ Rocks in these groups are subdivided lithologically and the order does not necessarily imply age relationship within or among groups.

§ Occurs on companion sheet only. Map 2246 Vermilion Lake Sheet.

NOTES

- Only island numbers referred to in the report have been shown.
- LIST OF PROPERTIES AND OCCURRENCES**
- 7. Kelso Mines Limited (1951).
 - 8. MacDonald, J. L.
 - 9. McCone Occurrence.
 - 10. Mining Location K171.
 - 11. Neepawa Island Gold Mines Limited (1950).
 - 12. North Pines Mines Limited.
 - 13. Cuspid Mining Company Limited.
 - 14. Ritchie Occurrence.
 - 15. Whalen Occurrence.
 - 16. Wright-Hargreaves Mines Limited (1951).
- Date in square brackets (1951) indicates year of last major work on property. For further information, see report.

SOURCES OF INFORMATION

Geology by F. J. Johnston and assistants, 1966, 1967. Geology is not tied to surveyed lines.

M. E. Hurst. Geology of the Sioux Lookout area: Ontario Department of Mines, Vol. 41, pt. 6, 1935.

F. J. Phillips. Geology of the Kenora District and its extensions: Bull. Geol. Soc. Amer., Vol. 45, No. 3, 1934, p. 479-506.

Map 4th and Preliminary Report 1951-1, Ontario Department of Mines.

O.D.M.-C.S.C., aeromagnetic maps, 1137G, 1138G, 1144G, 1147G.

Preliminary maps: P. 421 Abram Lake Area (west part) and P. 409 Abram Lake Area (east part), scale 1 inch to 1/2 mile, issued 1967 and 1968 respectively.


Cartography by C. C. Cahill and assistants, Ontario Department of Mines and Northern Affairs, 1971.

Base maps derived from Ontario Forest Resources Inventory maps, with revisions by F. J. Johnston.

Magnetic declination in the area was 2° E., 1967.

SYMBOLS

- Glacial striae.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, top unknown; (inclined, vertical).
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
- Bedding, top (arrow) from relationship of cleavage and bedding; (inclined, overturned).
- Bedding, top (arrow) from relationship of cleavage and bedding; (inclined, overturned).
- Lava flow, top (arrow) from pillow shape and packing.
- Schistosity; (horizontal, inclined, vertical).
- Gneissosity; (horizontal, inclined, vertical).
- Lineation with plunge.
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Fault; (observed, assumed). Spd indicates down throw side, arrows indicate horizontal movement.
- Jointing; (horizontal, inclined, vertical).
- Drag folds with plunge.
- Anticline, syncline, with plunge.
- Drill hole; (vertical, inclined).
- Vein, vein network. Width in inches.
- Shaft; depth in feet.
- Magnetic attraction.
- Muskeg or swamp.
- Motor road, Provincial highway, number encircled where applicable.
- Other road.
- Trail, portage, winter road.
- Building.
- Build-up area.
- Township boundary with milepost, approximate location only.
- Base line with milepost, approximate location only.
- Surveyed line, approximate location only.
- Property boundary, approximate location only.
- Location of mining property or occurrence, (surveyed, unsurveyed). See list of properties.


ONTARIO
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 W. G. MACNEE, Deputy Minister of Natural Resources
 Executive Director, Division of Mines
 E. G. Pys, Director, Geological Branch

Map 2243
ABRAM LAKE SHEET
 KENORA DISTRICT
 Scale 1:31,680 or 1 inch to 1/2 Mile

Chans 0 20 40 60 80 100 120 140 160 180 200
 Metres 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
 Feet 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000