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Geology of Scarfe, Mack, Cobden,
and Striker Townships
District of Algoma

By
JAMES A. ROBERTSON

Geological Report No. 20

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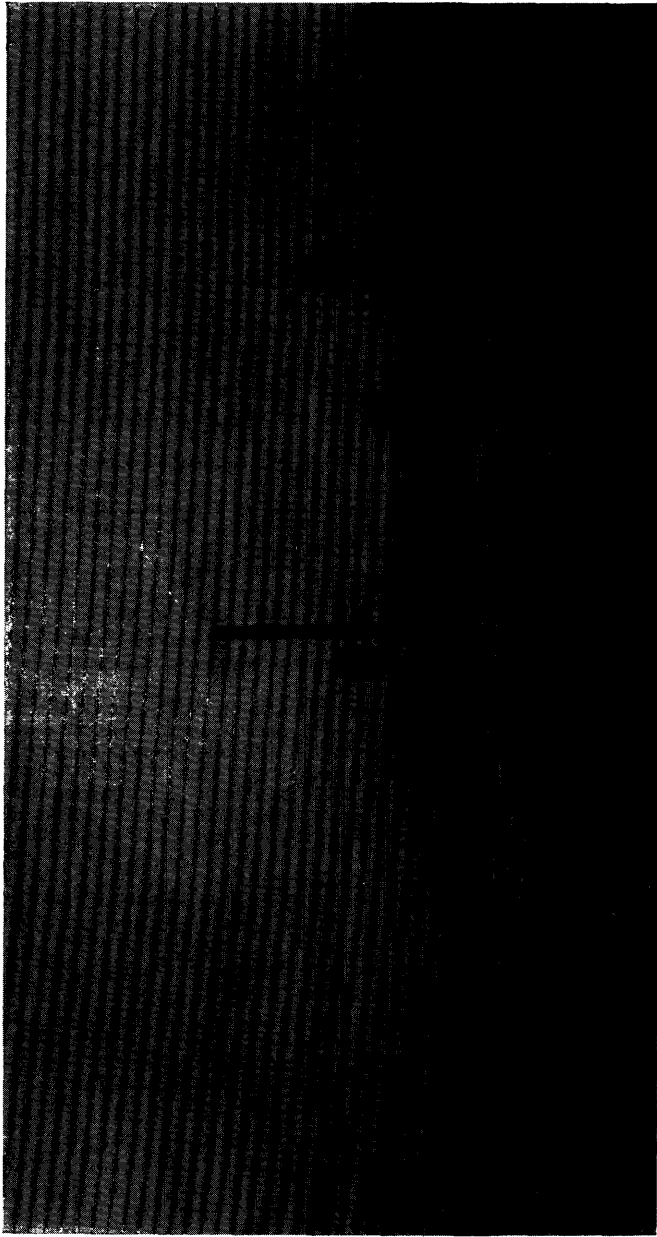
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Map No. 2032—Blind River—Elliot Lake area, District of Algoma. Scale 1 inch to 2 miles.



J. J. McFadden lumber mill (Domtar Construction Materials Ltd.), Blind River.

ABSTRACT

This report describes the stratigraphy, structure, and economic geology of Scarfe, Mack, Cobden, and Striker townships of the Blind River–Elliot Lake region, District of Algoma. The town of Blind River is the principal community. Semi-detailed mapping, using air photographs, was carried out in 1954, 1955, and 1960.

Geologically the area may be divided into two parts: that lying north of the depression containing the Mississagi River, Blind River, and the southern arm of Lauzon Lake; and that lying to the south. The depression is an erosional expression of the Murray Fault.

The oldest rocks exposed are variable, gneissic to massive, grey to pink granites containing inclusions of volcanic and sedimentary rocks that may have been derived from the Keewatin(?) or Sudbury groups. The granitic rocks are exposed in the vicinity of Pistol Lake, southeast of Magog Lake, and south of the Murray Fault west of Lauzon Lake.

The granite complex was eroded to a peneplane, and the resulting soils are locally preserved. These soils formed in a reducing environment.

Huronian sedimentation began with coarse-grained sediments derived from a weathered granitic terrane. The Bruce Group is represented by: the Lower Mississagi Formation—arkose and quartzite; Middle Mississagi Formation—basal conglomerate and argillite in the north and interbedded quartzite and siltstone in the south; Upper Mississagi Formation—quartzite and pebbly quartzite in the north and quartzite in the south; Bruce Formation—polymictic conglomerate thinning from north to south; and the Bruce Limestone member of the Espanola Formation—thinly-bedded limestone and siltstone. These rocks were all derived from the northwest and were deposited in cool water, which increased in depth from north to south.

The Bruce Group is overlain unconformably by the Gowganda Formation of the Cobalt Group—a heterogeneous assemblage of conglomerates, siltstones, and quartzites formed under subtemperate to glacial conditions.

These rocks were folded about an anticlinal axis striking slightly north of west and plunging gently west in the northern part of the map-area. Nipissing diabase sills were intruded into the tensional areas of the fold and differentiated *in situ*. Faults and joints were developed parallel to the axial plane of the fold and also with northwest or northeast strikes (the majority of these are strike-slip faults indicative of a north-south compression). During relaxations of the compressive forces these fractures were intruded by diabase dikes. Locally, albitization, chloritization, and the introduction of sulphide mineralization are associated with the contacts of the diabase intrusions.

More faults, particularly the Lake of the Mountains fault, formed after the main tectonic disturbance had ceased. There is one thin northwest-striking dike of olivine diabase, which is believed to be the youngest Precambrian rock in the area. There is no indication of Post-Huronian granite in the map-area.

Pleistocene glaciation resulted in removal of soil; sand and gravel flats represent former extensions of Lake Huron or ice-dammed lakes.

The area has been extensively prospected, mainly for copper and uranium. During 1954–56, diamond-drilling exploration for uranium was carried out in Mack, Striker, and northeast Scarfe townships, but the results were disappointing. In 1962, small shipments of low-grade copper ore were trucked from northwest Cobden township to the mill at Pronto Mine. There is sufficient sand and gravel to meet local needs.

Geology of Scarfe, Mack, Cobden, and Striker Townships

By

James A. Robertson¹

INTRODUCTION

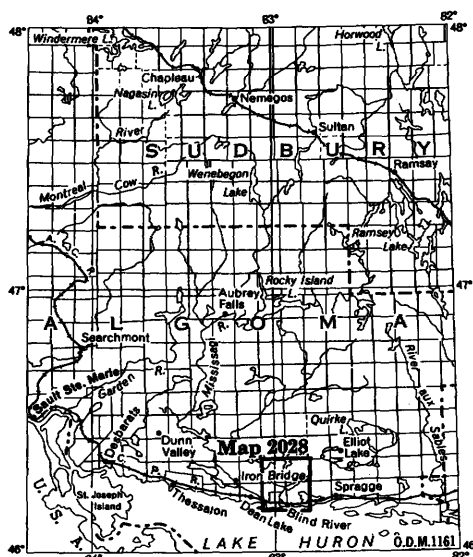


Figure 1 — Key map showing location of map-area. Scale, 1 inch to 50 miles.

During the field seasons of 1954 and 1955, Ontario Department of Mines field parties under the leadership of E. M. Abraham carried out geological mapping in the townships of Scarfe, Mack, Cobden, and Striker, and Indian Reserve No. 8, in the District of Algoma. The town of Blind River (approximate population 5,000), which lies in the south-central part of the map-area, is the principal community. Algoma, at the southeast corner of the map-area, is the only other community.

Blind River town lies on the north shore of Lake Huron at the mouth of the Blind River and is about half-way between Sudbury and Sault Ste. Marie. The Trans-Canada Highway (No. 17) and the Canadian Pacific railway (Sault Ste. Marie branch) pass through the town. Modest docking facilities are available for the smaller lake vessels and for motor cruisers.

¹Geologist, Ontario Department of Mines.

Scarfe, Mack, Cobden, Striker Townships

Prospecting throughout the North Shore of Lake Huron has been carried out since the discovery of copper at Bruce Mines in 1846. There are several small copper showings near the west margin of the map-area. In 1962, one of these showings was stripped, and shipments of ore were trucked to the mill at Pronto Mine, about 11 miles east of Blind River. During the period 1953-54, there was intensive exploration for uranium but with negative results. Diamond-drilling was undertaken in Mack and Striker townships and, to a lesser extent, in the northeastern parts of Scarfe township.

In 1954 and 1955, the work performed by Abraham and his party consisted of traverses perpendicular to the strike of the formations at quarter-mile intervals. The data were plotted on a scale of 1 inch to 1,320 feet, on transparent acetate sheets attached to air photographs, which had been flown in 1949. Control was provided by readily identifiable points.

Subsequent to the completion of this field work, Abraham's attention was diverted to the Blind River-Elliot Lake uranium deposits. The wealth of information that became available on the regional geology necessitated revision of the earlier work. Abraham was unable to complete the compilation of the pertinent data before leaving the Department in 1957. The author was, therefore, instructed to compile the present map (No. 2028, back pocket) and to prepare a report on the area as part of the work for the 1960 field season. The original data, together with supplementary information collected during the 1960 field season, were transferred, using a sketchmaster, from the air photographs to a cronaflex base-map provided by the cartographic unit of the Ontario Department of Mines, at a scale of 1 inch to 1,320 feet. Preliminary maps were made available to the public: these were maps P.68, Scarfe township; P.69, Mack township; P.71, Cobden township; and P.72, Striker township. The final map, on the scale 1 inch to 2,640 feet, was prepared for publication by the cartographic unit of the Ontario Department of Mines. The larger-scale preliminary maps (uncoloured) remain available, at a nominal charge, from the Department's publications office. Although the compilation and the interpretation are the author's, most of the information used in the preparation of this report is that originally collected by Abraham and his assistants.

Acknowledgements

The following persons took part in the field work, as indicated:

1954: Southern part of Striker township:

E. M. Abraham, W. J. Pearson, G. E. Bouchier, J. A. Robertson, D. K. Brodie, and A. E. Wilson. Messrs. Abraham, Pearson, and Bouchier were responsible for the mapping.

1955: Scarfe, Cobden, and Mack townships, and the northern part of Striker township:

E. M. Abraham, W. J. Pearson, G. E. Bouchier, J. A. Robertson, D. K. Brodie, and D. S. Sinclair. The bulk of the mapping was carried out by Messrs. Pearson, Bouchier, and Robertson. Abraham logged drillholes and collected information from the rest of the mining camp.

1960: During the work throughout the Blind River–Elliot Lake area, the author was assisted by:

D. S. Sinclair, G. E. Bouchier, J. M. Johnson, R. Balgalvis, T. Nou, T. Stem, and C. J. Hodgson. The ability of Messrs. Bouchier and Sinclair to evaluate much of the original field work was greatly appreciated. Mr. Balgalvis was responsible for most of the drafting.

Throughout the years of field work many local residents, businessmen, tourists, and representatives of mining companies freely rendered services, information, and hospitality. Rio Algom Mines Limited (Pronto Division) provided the author with living quarters and office facilities during the 1960 field season. Many interesting discussions on the origin of the Gowganda Formation were shared with Thomas Ovenshine, graduate student at U.C.L.A.

During the field seasons of 1959 and 1960, M. J. Frarey of the Geological Survey of Canada carried out semi-reconnaissance mapping for the Dean Lake and Wakwekobi Lake sheets of the National Topographic System (Frarey 1961a; 1961b). The west halves of Scarfe and Cobden townships lie within these map-areas. Close co-operation was maintained between the two parties.

Means of Access

From Blind River, highway No. 557 runs north to the south end of Matinenda Lake, and highway No. 555 runs northeast near the south shore of Lake of the Mountains to the southwest end of Magog Lake. An unimproved road runs southeasterly through Scarfe township, connecting a control dam at Chiblow Lake and a forestry research station at the east end of Plump Lake with highway No. 557. Permission to use this road west of Clear Lake must be obtained from the Ontario Department of Lands and Forests in Blind River. A lumber road runs northeast through Mack township, from highway No. 557 near Heron Lake to about $\frac{1}{2}$ mile west of the west end of Pistol Lake; minor repairs would be required before this road could be used. In Cobden township, a partially improved road connects the Whitefish Falls power station, between Scarfe and Cataract lakes, with highway No. 17. An old gravel road formerly connecting Blind River and Iron Bridge runs along the north side of the Cobden River; this road is passable within the map-area. To the south of this road, an access road along the Ontario Hydro transmission line is also passable to approximately the west limit of the map-area. The greater part of Striker township is served by gravel or unimproved roads leading to farms, tourist camps, and cottages. The greater part of the map-area is thus accessible by road. The larger lakes may be reached by plane; charter float-plane service is available from two companies with bases on Lauzon Lake west of Algoma.

Trails and portages lead to most of the lakes not served by roads suitable for vehicular traffic. Tractor roads to drill sites, now overgrown, also facilitate travel through the bush. The Blind River system is navigable by canoe with short portages around falls and rapids. The Cobden and Mississagi rivers are also navigable by canoes or small boats. There are portages to Plump and Clear lakes from Chiblow Lake, to Bearhead Lake from Matinenda Lake, and to Emerald Lake from either the east end of Matinenda Lake or from the northeast end of Lake of the Mountains. Norse Lake and Pistol Lake may be reached from Bakers

Scarfe, Mack, Cobden, Striker Townships

Bay of Matinenda Lake (Township 161), and Peak Lake from the northeast end of Magog Lake. McGiverin Lake in McGiverin township, and subsequently Rossmere Lake, McGiverin township, and Pistol Lake, can be reached by a disused lumber road running to the south of Magog Lake.

The following lakes are suitable for light planes: Chiblow, Clear, Bearhead, Matinenda, Pistol, Emerald, Lake of the Mountains, Magog, and Lauzon. The following lakes may be used, depending on wind, load, and the power of the aircraft: Plump, High, Falls, Scarfe, Cataract, Peak, and Thurston. Blind River adjacent to the town may be used, but the Mississagi River is unsuitable for aircraft.

Previous Geological Work

After the discovery of copper at Bruce Mines in 1846, the North Shore of Lake Huron became the scene of much geological activity. Between 1847 and 1858, considerable work was done in the area by Logan and Murray, the pioneer officers of the Geological Survey of Canada. The results of the mapping, largely Murray's responsibility, are given in *The Geology of Canada* (Logan 1863) and a map "showing the distribution of the Huronian rocks between Rivers Batchewahnung and Mississagui" is included in the atlas accompanying this work. Scarfe and Cobden townships and the northwestern part of Mack township lie within the limits of Murray's map. The succession given by Logan and Murray for the "original Huronian" of Bruce Mines is given as column 1 of Table I. Pre-Huronian granite was recognized south of a major fault near Lake Huron. Of the sedimentary units, white quartzite, lower slate conglomerate, limestone, and upper slate conglomerate were identified in the Blind River area. A large greenstone body was mapped on the west and south shores of Lake Tendinendah (now Matinenda Lake). The sedimentary units and the greenstone were traced in an anticlinal structure around Chiblow and Matinenda lakes; the exposure of limestone on the south limb of the anticline lies close to the course of Blind River. The limestone unit was believed to be exposed also in the valley of the Marsh River (now Cobden River). Those rocks exposed between the Marsh River and the Mississagi River-Blind River valley (Murray's great fault) were correlated with the lower slate conglomerate.

In 1905, attempts were made to develop copper showings in Thompson township, and in 1906 copper was reported in the northwest corner of Cobden township. Surface exploration was carried out, but apparently no ore was shipped (Corkill 1906, p. 69; 1907, p. 70).

By 1913 the need for field work and correlation between the "original Huronian" of Bruce Mines and the rocks of the Sudbury-Cobalt area was obvious. In 1913, A. P. Coleman published *The Pre-Cambrian Rocks north of Lake Huron with special reference to the Sudbury Series*. Coleman's table of formations, in so far as it applies to the Blind River area, is given as column 2 of Table I. In a preface to Coleman's paper, W. G. Miller introduced the term Algoman, defined in 1913 by A. C. Lawson in the Rainy Lake area, for the bulk of the granitic rocks of the area.

In 1914, W. H. Collins of the Geological Survey of Canada carried out systematic mapping in the North Shore region. In this he was assisted by T. T. Quirke (1917) and, later, by P. Eskola. Certain areas were selected; each was mapped and then correlated with the others on the basis of lithology and structure. Collins' stratigraphical column is given as column 3 of Table I. Cobden and

Striker townships, but only those parts of Scarfe and Mack townships adjacent to the major drainage systems, were included in Collins' map of the Blind River region. In the areas of overlap, Collins was able to confirm much of Murray's original mapping. However, although recognizing the equivalence of Murray's lower slate conglomerate and the Bruce conglomerate and of Murray's limestone and the Bruce limestone, Collins maintained that the conglomerate and limestone exposed along the Blind River were part of the Upper Huronian or Cobalt series. No indication of limestone was found along the Marsh (Cobden) River, and all rocks north of the great fault and overlying the Mississagi quartzite were placed in the Gowganda formation of the Cobalt series. The presence of the great fault was confirmed, and it was named the Murray Fault after its discoverer.



Figure 2 — Map showing subdivision of map-area into lots and concessions.

In the Elliot Lake-Quirke Lake area the structure was shown to be a west-striking, gently west-pitching syncline. To the south of this, in the Elliot Lake-Blind River area, there lies an anticline with its south limb cut and repeated by the Murray Fault. The surface expression of this regional structure is a reverse-S exposure of the sedimentary units. The present map-area lies on the southernmost limb of the anticlinal structure, the nose of the anticline lying just west of the northwest corner.

To the east of the Blind River area, the geology is complicated by faulting and the presence of granite, which Collins believed to be either intrusive or to be granitized Huronian sediments (Collins 1925; Quirke and Collins 1930). In this latter area, from Algoma in Long township eastward, Coleman (1914) had called all the rocks south of the Murray Fault the Sudbury series. Collins (1925) and

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Quirke (1917), repeated in Quirke and Collins (1930), maintained that both Huronian and Pre-Huronian sedimentary rocks occurred to the south of the Murray Fault, yet they admitted difficulty in delineating any unconformity between those rocks assigned to the two units.

In 1929, on the basis of field relationships immediately east of Algoma, A. C. Lawson argued that the Sudbury series was in fact the Cobalt series.

However, the early mapping was not continuous, and geological terminology and the correlation of ideas of different workers had become largely incomprehensible. In 1950 and 1951, J. E. Thomson carried out detailed mapping in Baldwin township. Thomson (1953a, p. 13) pointed out: (a) one stratigraphic unit can show great lithological variation, and (b) different units can show markedly similar lithology; he suggested the establishment of local successions, leaving the regional correlation to await completion of detailed structural mapping.

In 1953, E. M. Abraham of the Ontario Department of Mines began semi-detailed mapping in the Iron Bridge area (Bright and Gladstone townships) with a view to mapping the gap between Collins' Bruce Mines and Blind River mapsheets (G.S.C. 1925a; 1925b). With the discovery of economic uranium deposits at the east end of Lauzon Lake (later the Pronto Mine), about 10 miles east of Blind River, the Blind River-Elliot Lake area became the scene of intense exploration and development. In addition to the mapping, drilling, and underground work carried out by mining companies, both the Geological Survey of Canada and the Ontario Department of Mines have undertaken extensive programs within the area. The provincial department has been responsible for the regional mapping, and the federal department for a study of the uranium deposits and their origin.

During the second half of the 1953 field season, Abraham carried out detailed mapping in the vicinity of the Pronto discovery, and a preliminary map and report were published (Abraham 1953). During the first part of the 1954 field season, Abraham's field party mapped Patton and Thompson townships, adjacent to the west boundary of the present map-area, and during the second part of the season the territory between Pronto Mine and Blind River, including the southern part of Striker township, were mapped. In 1955, mapping was carried out in Scarfe, Mack, Cobden (including Indian Reserve No. 8), and Striker townships. However, apart from a brief paper (Abraham 1957, pp. 59-62) no data were published. Abraham used Collins' terminology but divided the Mississagi quartzite into three formations: Upper, Middle, and Lower. Within the confines of the Blind River map-area the interpretation, including the identification of all rocks younger than the Upper Mississagi Formation with the Gowganda Formation of the Cobalt Series, was essentially that proposed by Collins.

In 1954-55, the Ontario Department of Mines published a series of aeromagnetic-aeroradioactivity maps covering individual townships of the Blind River uranium area on a scale of 1 inch to 1,320 feet. Such maps are available for each township included in the present map-area.

Throughout 1954 and 1955, considerable surface exploration and diamond-drilling were carried out within the area, particularly within the outcrop of the Mississagi formations. The radioactivity anomalies shown on the above-mentioned maps were drilled, but were found to represent thorium rather than uranium (Friedman 1958, pp. 889, 890). No further development was undertaken.

During the field seasons of 1956 and 1957, J. P. McDowell (1957; 1963) studied the sedimentary petrology of the Mississagi quartzite throughout the Bruce Mines-Blind River-Spanish area. In 1956, Abraham mapped Townships 149 and 150 (Abraham 1956: O.D.M. Maps 1956) and again adhered to Collins' terminology with only slight modifications (*see* Table I, column 4). In the same year, S. M. Roscoe published preliminary results of work carried out in the Quirke Lake-Elliott Lake area and recommended the adoption of a new stratigraphical nomenclature (*see* Table I, column 5). This nomenclature has been used in his subsequent papers but has not received wide support.

In 1957 the author took over Abraham's field work in the area, and since then the following work has been carried out:

1957: Townships 143 and 144 (Robertson 1961).

1958: Townships 137 and 138 (Robertson 1962).

1959: Townships 155, 156, 161, 162 and parts of 167 and 168 (Robertson 1963a).

1960: Long and McGiverin townships (O.D.M. Maps 1960, Nos P.70, P.73) also local revision of Iron Bridge map (*see* Robertson 1963b, map 2012) and compilation and revision of maps of Scarfe, Mack, Cobden, and Striker townships (O.D.M. Maps 1960, Nos. P.68, P.69, P.71, P.72). (*See* map 2028, back pocket).

1961: Esten and Spragge townships and the west half of the Serpent River Indian Reserve (I.R. No. 7) (O.D.M. Maps 1961, Nos. P.130, P.131).

Meanwhile in 1956, M. J. Frarey of the Geological Survey of Canada began mapping in the Echo Lake area; this work was completed in 1958 (Frarey 1959). In 1959-60, Frarey mapped the Dean Lake and Wakwekobi Lake sheets of the National Topographic series (Frarey 1961a; 1961b). The west halves of Scarfe and Cobden townships are contained within these maps. In 1961, Frarey carried out mapping in the vicinity of Lake George, Bruce Mines, and Thessalon (Frarey 1962a, 1962b). Close contact was maintained between Frarey and the author, and there is general agreement between them on matters of interpretation and terminology. The author has conformed to the usual practice in the Blind River area and used a modified form of Collins' stratigraphical nomenclature. (*See* Table I, column 6).

Thus, since 1953, the region between Sault Ste. Marie and the mouth of the Serpent River has been subjected to either detailed or semi-detailed mapping, and the correlation of the Blind River camp and the "Original Huronian" of Bruce Mines has been established. During the same period much work has been carried on in the area between Blind River and Sudbury, notably by Thomson (1953a; 1953b; 1960; 1962), Ginn (1960; 1961), and Card (report in preparation); but regional correlation, particularly for those rocks south of the Murray Fault, has not yet been accomplished.

Geologists and mineralogists working for, or in association with, the mining companies have published papers in which general accounts of the regional geology are given. Age-determination research has been undertaken on the granitic rocks (Fairbairn *et al.* 1960; Wetherill *et al.* 1960; Lowdon 1960; 1961; Lowdon *et al.* 1963) and on the post-Huronian diabasic intrusions (Van Schmus *et al.* 1963) of the region, but, as yet, no samples from the map-area have been determined.

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Topography

Topographically, the map-area shows the same features that characterize the North Shore area as a whole (*see* Photos 7, 15), namely a lack of major relief contrasted with rugged detail (*cf.* Collins 1925: Quirke 1917). The general uniformity of the skyline is a reflection of the peneplanation of the Precambrian Shield. This surface rises from 600 feet near Lake Huron to about 1,000 feet near Chiblow Lake and 1,100 feet near Pistol Lake; a local high of 1,374 feet is found at the trigonometrical station in central Mack township. The local relief is generally less than 250 feet, but 350–400 feet is found on the west side of Matinenda Lake, and a maximum of 595 feet on the north shore of Lake of the Mountains. The shores of Emerald Lake and the north shore of Magog Lake are characterized by steep cliffs about 200 feet high. The higher ground is developed over the more siliceous rocks and over massive diabase, whereas lower ground tends to develop over the softer more argillaceous rocks and along faults, dikes, and shear zones. Commonly the lower areas are swampy.

In the greater part of Cobden township and the southern part of Striker township, glaciofluvial sands, gravels, and clays form low-lying agricultural land or swampy areas. Locally along highway No. 557, the Clear Lake road, and in the Cobden River valley, attempts have been made to operate farms on drift and old lake deposits, but many of these farms have now been abandoned. Extensive farming is carried out only in the southwestern part of Striker township and along the Mississagi River in Cobden township.

Drainage

Both the Mississagi and the Blind rivers enter Lake Huron within the map-area, but only the latter river effectively drains the area. The lower reaches of the Blind River flow west from Matinenda Lake to Chiblow Lake near the north edge of the map-area, and then south from Chiblow Lake to High Lake near the west edge of the map-area. The river then flows through High Lake, and then swings southeast through Falls Lake, Scarfe Lake, and Cataract Lake to the northwest corner of Lake of the Mountains. From the southwest corner of this lake the river flows southwards in a tilted S-shaped course to reach Lake Huron at Blind River. As a result of damming there are two outlets: one through the town, and one 2 miles to the west. The Cobden River, which drains a large area to the northwest (Robertson 1963b, map 2012) flows south-southeast across central Cobden township to join the Blind River just south of Lake of the Mountains. The northern part of Mack township drains westwards to Matinenda Lake. Lake of the Mountains lies in a prominent northeast-trending valley, which is drained by Magog Creek from McGiverin Lake (in McGiverin township) to Magog Lake thence to Lake of the Mountains. Southeast Scarfe and southwest Mack townships are drained by Bearhead Creek and its tributaries. The main creek flows southeast from Bearhead Lake to Heron Lake, Skull Lake, and Lake of the Mountains. The central parts of Mack township drain to Emerald and Peak lakes. A creek connects Emerald Lake to Peak Lake and Peak Lake to Magog Lake. The southern part of Striker township drains into Lauzon Lake, which is connected to Lake Huron by a short creek at Algoma just east of the Striker-Long townships boundary.

Resources

Blind River town lies about 10 miles west of the Pronto uranium deposits and about 20 miles southwest of those near Elliot Lake. In the period 1953-55 much of the map-area was staked, and during 1954-55 surface exploration and diamond-drilling were carried out in the outcrop area of the Mississagi formations. Occasional thorium but no uranium assays of economic value were obtained. By 1960, most of the ground had reverted to the Crown or to the original patent holders.

Small copper showings south of the Mississagi River and in northwest Cobden township have been known since the first decade of the century. In 1960, new copper showings were found in quartz veins in the bed of the Blind River at the outlet from Chiblow Lake, and at the northwest end of Plump Lake, both in Scarfe township. Both showings were explored, but later dropped, by McIntyre Porcupine Gold Mines Limited. In 1962 a showing, on the Gouling farm (*see* p. 62) in the northwest corner of Cobden township, was stripped, and a few hundred tons of low-grade ore was trucked from an open-pit operation to the Pronto mill.

The chief industries are the J. J. McFadden lumber mill in Blind River (*see* Frontispiece), mixed farming, sporadic lumbering, and the tourist trade. The Ontario Department of Highways and the Ontario Department of Lands and Forests have local headquarters at Blind River.

A small power plant is maintained on Blind River between Scarfe and Cataract lakes, but now much of the power used is supplied from the Ontario Hydro-Electric Power Commission transmission line running through Cobden and Striker townships.

Prior to the development of uranium mining, the major industry in the area was lumbering. This has been carried out on the North Shore of Lake Huron since the beginning of the century.

The present sawmill was constructed in 1927 by Carpenter Hixon Company, who in 1926 bought out local interests held by J. J. McFadden. Mr. McFadden resumed ownership of the firm in 1936; following his retirement in 1946, it was held by Huron Forest Products Company Limited, being eventually purchased by Dominion Tar and Chemical Company Limited, operating under the name of McFadden Lumber Company, division of Domtar Construction Materials Limited. The plant was modernized in 1962 and is now worked on a year-round basis. The company has a 3,000 square-mile timber concession from the Crown covering the area drained by the Mississagi and the Little White rivers. These rivers are used for driving logs, and storage booms are sited at the mouth of the Mississagi and at the Blind River mill. About 85 percent of the raw material is white pine. The operation is fully integrated: the chief product is lumber; the larger pieces of waste are used to make "bonded pine", the smaller pieces are chipped and sent by rail to the K. V. P. pulp mill at Espanola; the sawdust and bark are burnt, providing all heat, steam, and electricity required. Employment is given to some 600 persons, approximately half of whom work at the Blind River mill and half in the bush. Production for the 1963 field season was approximately 36,000,000 board feet.

Wild life abounds within the area, particularly in the more remote parts. Bear, deer, fox, and moose, as well as many smaller animals, are common. In 1960, beaver activity was more apparent than in 1954. Of the game birds there are several varieties of duck and partridge. Most of the lakes and rivers provide good fishing. Facilities for hunting, fishing, and aquatic sports, together with the easy accessibility, make the area popular with tourists.

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TABLE I—COMPARISON OF STRATIGRAPHICAL NOMENCLATURES USED IN THE SOUTHERN LIMB OF THE BLIND RIVER REVERSE-S STRUCTURE

1	2	3	4	5	6
Logan and Murray (1863)	Coleman (1913)	Collins (1925)	Abraham (1956, 1957)	Roscoe (1956)	Robertson (1960)
Greenstone Intrusions	Intrusions	Keweenaw	Keweenaw	Keweenaw	Keweenaw
(Upper Members)		(Upper Members)	(Upper Members)	(Upper Members)	(Upper Members)
Upper slate conglomerate	Upper Huronian	Lorrain	(Lorrain)	(Lorrain)	(Lorrain)
Limestone		Gowganda	Gowganda	Gowganda	Gowganda
Lower slate conglomerate		Espanola Bruce Limestone	Espanola Bruce Limestone	Espanola Bruce Limestone	Espanola ⁽¹⁾ Bruce Limestone
White quartzite		Bruce	Bruce	Bruce	Bruce
Green chlorite slate ⁽²⁾			Upper Mississagi	Ten Mile	Upper Mississagi
Grey quartzite			Middle Mississagi	Whiskey	Middle Mississagi
			Lower Mississagi	Nordic	Lower Mississagi
				Matinenda	
Laurentian Granite	Laurentian Granite	Granite	Algonam Granite	Algonam Granite	Algonam Granite
	Sudbury	Sudbury			Sudbury ?
	Granite				Relationship unknown
	Keewatin	Keewatin	Keewatin	Keewatin	Keewatin ?

⁽¹⁾The upper members of the Espanola Formation and the entire Serpent Formation are not found in the southern limb of the Blind River reverse-S structure.
⁽²⁾Later defined as intrusions.

TABLE OF FORMATIONS

CENOZOIC

RECENT: Swamp, lake, and stream deposits.
PLEISTOCENE: Gravel, clay, sand, till.

Great Unconformity

PRECAMBRIAN

PROTEROZOIC

Keweenawan: Olivine diabase.

Intrusive Contact

Diabase, gabbro, diorite, and granophyre, cut by later acidic and basic dikelets.

Intrusive Contact

Huronian:

Cobalt Group: Gowganda Formation: Conglomerate, greywacke, feldspathic quartzite, argillite.

Unconformity

Bruce Group: Espanola Formation:¹ Bruce Limestone: limestone, siltstone.
Bruce Formation: Bruce Conglomerate: conglomerate, local quartzite lenses.
Upper Mississagi Formation: Arkose, quartzite, (quartzite in south).
Middle Mississagi Formation: {Argillite
Conglomerate} (in north).
Argillaceous quartzite (in south).
Lower Mississagi Formation: Arkose, quartzite. (Not exposed in map-area.).

Great Unconformity

ARCHEAN

Algonan: Granite regolith.
Granite gneiss, granite, aplite, and allied rock types.

Intrusive Contact

Keewatin(?): Undifferentiated metavolcanic rocks and metasedimentary rocks (as inclusions in granite).

¹Upper members of the Espanola Formation removed by Pre-Cobalt erosion.

GENERAL GEOLOGY

The map-area includes part of the south limb of the Blind River reverse-S structure; the surface trace of the axial plane of the Chiblow anticline lies close to the north edge of the map-area. North of the Murray Fault, the following formations are exposed, from northeast to southwest: Algoman granite with Keewatin(?) inclusions; Lower Mississagi Formation, Middle Mississagi Formation, Upper Mississagi Formation, Bruce Formation, Espanola Formation (Bruce Limestone member only) all of the Bruce Group; and the Gowganda Formation of the Cobalt Group. Along the linear forming the Mississagi River, the Blind River, and the south arm of Lauzon Lake, the above sequence is cut by the Murray Fault. To the south of the Murray Fault, the following units are exposed: Algoman granite; Lower Mississagi Formation; Middle Mississagi Formation; Upper Mississagi Formation; and at one locality southwest of Blind River, Bruce Formation and the Bruce Limestone member of the Espanola Formation. Throughout the whole map-area, the above-named sedimentary formations and the granite complex are cut by numerous diabase dikes and large irregular Nipissing-type gabbro bodies.

The unconformity at the base of the Lower Mississagi Formation is well-exposed throughout the northeastern part of the map-area and again on the north shore of Lauzon Bay, but elsewhere to the south of the Murray Fault it is obscured by drift. The unconformity at the base of the Gowganda Formation is not exposed, but near the Blind River, fragments of the older formations are found in the basal beds.

After the deposition of the Cobalt Group the area was folded and faulted; the Chiblow anticline and the Murray Fault were formed. Dikes and irregular differentiated bodies of Keweenawan (Nipissing-type) quartz diabase were then intruded. Further folding and faulting took place. The Lake of the Mountains fault, the youngest fault in the Blind River area, strikes northeast through the southern part of the map-area. There is only one northwest-striking olivine diabase dike (north of Intersect Lake in the southeast corner of Mack township) exposed in the map-area. Olivine diabase is commonly regarded as the last phase of the Keweenawan igneous cycle.

The Precambrian Shield was flooded by shelf seas during Lower Paleozoic time, since when it has remained a stable positive area subject to periodic rejuvenation. The present immature topography developed at the expense of the modified Precambrian peneplane prior to the Pleistocene glaciation.

Glaciation removed the soil that had developed, and glaciofluvial clays, sands, and gravels were deposited. The greater part of the drainage system shows marked geological control, but locally irregular drainage may be due to Pleistocene deposits. Glacial rounding, grooving, and polishing of outcrops, scouring of the softer beds, striae, and chatter-marking are common. These indicate that the direction of ice flow was about S.15°W.

The early mapping by Murray and the modifications suggested by Collins have proved surprisingly accurate. The recent mapping has shown that the limestone and the underlying conglomerate exposed along Blind River (*see* page 5) are continuous with the Bruce Limestone and the Bruce Conglomerate of the Quirke syncline (*see* map 2032, back pocket). Much detail, particularly regarding the distribution of diabase and other specific rock types, has been added. However, the outstanding accomplishments of Murray and Collins, considering the conditions under which they worked, should be recognized.

Archean

Throughout the Blind River region the Archean consists of (a) Keewatin-type metavolcanics interbedded with metasediments ascribed to the Sudbury Group and (b) the Algonian granite, which is subdivided into two broad classes: the first comprising grey to pink, massive to gneissic granodiorite to granite; and the second, possibly younger, comprising red, massive, equigranular to porphyritic quartz monzonite. Within the map-area, the only Archean rocks that are exposed or that were intersected by drillholes belong to the first class of granite, with or without small, partially assimilated inclusions of Keewatin-type rocks.

Photo 1



Amphibolite inclusions in Algonian granite; north shore of Pistol Lake, Mack township.

ALGOMAN BASEMENT COMPLEX

Granitic rocks of the Algonian basement complex are exposed in the following areas: (1) Pistol Lake in northeast Mack township; (2) southeast of Magog Lake in southeast Mack township; and (3) in a narrow intermittent strip along the south side of the Murray Fault, in Cobden and Striker townships. Only in the Pistol Lake area are there good outcrops.

In the vicinity of Pistol Lake, the basement rocks are exposed in the axial area of the Chiblow anticline. In the Matinenda Lake and the Magog Lake-Lauzon Lake areas, diamond-drilling passed through the Lower Mississagi Formation reaching the Algonian basement. The rocks are medium-grained, equigranular to subporphyritic, and range in colour from grey to pale pink. The grey type has plagioclase in excess of microcline and up to 5 percent of ferromagnesian minerals. The pink type is fine-grained and has little or no microcline and a

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restricted development of ferromagnesian minerals. Quartz veins, aplite, pegmatite dikes, and segregations are present but are not common. In the Pistol Lake area, however, the basement rocks show pronounced changes towards the north and east. The rocks to the west of Pistol Lake are similar to those found in the Magog Lake area and in the drillholes. However, on the shores of Pear Lake, several outcrops consist of red, fine-grained, equigranular quartz monzonite with no gneissosity or inclusions. The boundaries of these red bodies were not observed. Patches of ferromagnesian minerals, frequently coarsely crystalline amphibole, mark the site of assimilated basic inclusions. A few small inclusions of crystallized iron-formation were found between Pear and Pistol lakes. On well-washed outcrop on the shores of Pistol Lake, abundant basic inclusions are visible (*see* Photo 1). These are cut by acidic stringers and dikelets. In many cases, the boundaries of the inclusions are seen to correspond almost exactly with those of the neighbouring inclusions. Some inclusions show both sharp and blurred contacts with the surrounding granite. The granite itself ranges from a medium- to coarse-grained, pinkish-weathering, equigranular rock, in which quartz, microcline, and sodic plagioclase occur in approximately equal amounts with several percent of chloritized biotite, to a grey-weathering rock in which plagioclase dominates over quartz and potash feldspar, and which contains up to 10 percent of chloritized biotite and amphibole. Fine-grained, red, equigranular quartz monzonite similar to that exposed at Pear Lake is also exposed and becomes more common towards the east end of the lake. To the north of Pistol Lake, there are thick deposits of glacial drift, and outcrops are isolated. Subsequent mapping revealed a body of porphyritic quartz monzonite in the southern part of Township 155 extending eastwards to the Elliot Lake townsite in Township 149 (Robertson 1963a, map 2014; Abraham 1956, map No. P. 1). Table II compares the general chemical character of the rocks in the Matinenda Lake, Pistol Lake-Magog Lake, and Magog Lake-Lauzon Lake areas with that of the "red" and "grey" Algonman granites throughout the Blind River region.

TABLE II—COMPARISON OF THE CHEMICAL NATURE OF GRANITES
WITHIN THE MAP SHEET AND THE BLIND RIVER-
ELLIOT LAKE AREA AS A WHOLE
(After Robertson (1960); analyses by J. A. Robertson)

Type	K ₂ O	Na ₂ O	$\frac{K_2O}{Na_2O}$	CaO	FeO	MgO	$\frac{MgO}{FeO}$	MnO
	percent	percent		percent	percent	percent		percent
Algonman grey phase.	2.66	5.29	0.51	1.91	1.66	1.22	0.62	0.038
Mean deviation...	0.70	0.64	0.14	0.80	0.58	0.57	0.25	0.017
Algonman red phase...	4.70	3.68	1.29	1.06	0.88	0.52	0.60	0.016
Mean deviation...	0.78	0.44	0.26	0.62	0.42	0.37	0.22	0.008
Matinenda sector...	2.08	5.99	0.36	1.80	1.73	0.87	0.51	0.025
Mean deviation...	0.85	0.75	0.15	0.48	0.33	0.21	0.13	0.014
Pistol Lake-Magog Lake (grey phase).	3.56	5.91	0.60	0.60	0.86	0.44	0.68	0.030
Pistol Lake-Magog Lake (small patches red phase)	5.32	3.70	1.44	1.27	0.84	0.19	0.41	0.018
Magog Lake-Lauzon Lake.....	2.17	5.10	0.43	(1)3.92	3.53	1.92	0.54	0.020

(1)Secondary calcite was present in the sample analysed.

Granitic rocks are also exposed intermittently along the south side of the Murray Fault, from the west boundary of the map-area to Lauzon Bay on the south arm of Lauzon Lake. Brick-red granitic rocks are exposed in southwest Cobden township close to highway No. 17 and the Canadian Pacific railway, west of Blind River. These rocks are continuous with those mapped in the southern part of Thompson township (Robertson 1963b, map 2012). The composition ranges from quartz monzonite to granodiorite. Within the map-area gneissosity was not recorded, but this becomes apparent to the west (Robertson 1963b). Between Blind River and the west end of Lauzon Lake there are intermittent outcrops of grey- to pink-weathering quartz monzonite to granodiorite with scattered, small, partially assimilated, basic inclusions. A faint gneissosity, striking approximately east-west and dipping steeply south, is locally discernible. The mineralogical composition of these rocks is similar to those exposed in Mack township.

Age-determinations have been carried out on the granitic rocks of the Blind River area. No determinations have been reported on samples taken within the present map-area. Results to date indicate an age of more than 2,000 million years, possibly as much as 2,500 million years (Fairbairn *et al.* 1960; Lowdon 1961, pp. 61-62; Wetherill *et al.* 1960).

POST-ALGOMAN INTERVAL

Throughout the Blind River area, the Huronian rests with marked unconformity on the Algonman basement complex. Within the map-area, however, the actual contact is only exposed on the outcrops to the southeast of Magog Lake and again on the outcrops on the north and south shores of Lauzon Bay. The contact between the basal members of the Lower Mississagi Formation and the Algonman is also cut by many of the drillholes.

At more than 100 yards from the contact with the overlying Huronian, the granitic rocks exposed at surface are perfectly normal. However, as the actual contact is approached, the plagioclase feldspars become yellow, owing to the development of sericite, and the ferromagnesian minerals disappear. This passes into a yellow-green, unsorted, quartz microcline aggregate set in a sericite matrix with scattered angular fragments of vein quartz and partially altered granite. This is, in turn, overlain by sorted, sericitic, arkose in which bedding is visible (*see* Photo 2). This sequence is well-exposed on a small outcrop in the southeast corner of the field at the southwest end of Magog Lake. To the east of this exposure and to the south of Intersect Lake, the actual base of the sedimentary rocks is marked by a band of angular to subangular quartz fragments, up to an inch across.

In drillholes, unless a basal pebble bed is present, the actual contact between the Mississagi Formation and the granite is difficult to place. In consequence, in many holes the highly sericitic material was logged as "transition zone." This "transition zone" is generally interpreted as a regolith or fossil soil developed during the Archean-Proterozoic interval.

Both P. J. Pienaar, formerly a postgraduate student at Queen's University at Kingston who carried out research on the origin of the Blind River uranium deposits under the sponsorship of the Geological Survey of Canada, and the author have investigated the chemical nature of the regolith. The author analyzed

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two samples, one from near the top and one from near the base of the unsorted regolith as intersected in a drillhole at the east end of Demorest Lake in Township 167, about $\frac{1}{2}$ mile northeast of the northwest corner of the map-area. Pienaar

Photo 2



Contact of regolith developed from Algomian granite (speckled) and basal sericitic arkose (smooth) of Lower Mississagi Formation; southwest end of Magog Lake, Striker township.

analyzed regolith developed over red granite in the Quirke Lake area. Figure 3 is a straight line diagram comparing:

- 1) Red granite and regolith, Quirke Lake.
- 2) The average composition of six grey granites intersected by drillholes in the Matinenda Lake sector of the present map-area and the upper transition material from the Demorest Lake drillhole.
- 3) The upper and lower transition material developed above grey-phase granite at the east end of Demorest Lake.

The diagram reveals the relative gains and losses of constituents during the formation of the regolith. They show the following features. In all three cases,

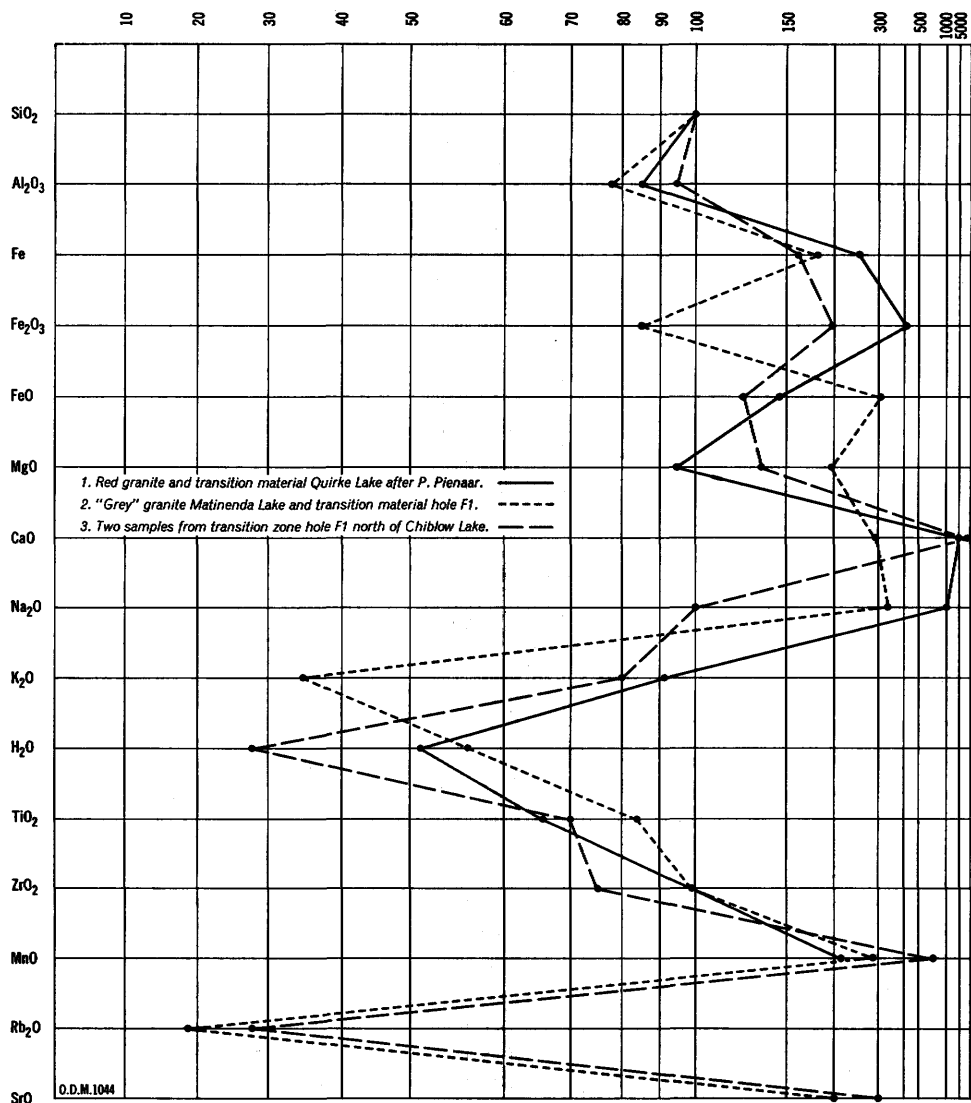


Figure 3 — Straight-line diagram illustrating formation of Pre-Huronian soils in the Blind River area.

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silica remains constant, and alumina shows a slight increase. This compares with observations by Leith and Mead (1915), who showed that, during weathering, alumina remains constant, and silica is slightly reduced. In two cases, zirconia is constant and in one case is enriched—an expression of the stability of zircon. Of the other components: total iron, ferric iron, ferrous iron (the former in preference to the latter), magnesia, and manganese have been partially lost; soda and lime have been almost completely lost; whereas potash and water are enriched in the regolith. This reflects the removal of soluble constituents, the stability of potash feldspar, and the formation of hydrated clay minerals at the expense of plagioclase feldspar. The trace elements follow the major elements in the pairs Mn-Mg, Rb-K, and Sr-Ca.

In two of the three cases (Nos. 1 and 3) ferric iron has been lost. (That ferric iron is enriched in case No. 2 is probably due to a difference in the composition of the parent rock from the average rock of the Matinenda Lake area, since case No. 3 shows that in the formation of the regolith, which must be regarded as progressive, ferric iron was removed.) In all three cases total iron has been reduced, suggesting that ferric iron was converted to ferrous and removed by leaching. Such a reduction may have been due to exclusion from the atmosphere by the overlying material or to an atmosphere deficient in oxygen. Whatever the cause it is of interest since regolith material contributed to the formation of the uraniferous, pyritiferous, oligomictic conglomerates of the basal Lower Huronian.

Proterozoic

HURONIAN

Rocks of Proterozoic age, the Huronian sedimentary rocks and the post-Huronian diabase intrusions, form the bedrock throughout those parts of the area not underlain by granite.

The exposed Huronian is divided into the Bruce Group and the unconformably overlying Cobalt Group. The Bruce Group is made up of the Lower Mississagi Formation, the Middle Mississagi Formation, the Upper Mississagi Formation, the Bruce Formation, and the Bruce Limestone member of the Espanola Formation. Of the Cobalt Group only the basal formation—the Gowganda Formation—is exposed within the map-area, though numerous boulders of the well-known Lorrain Formation are found in the drift. In the Bruce Group, the common rock types are quartzite, arkose, polymictic conglomerate, siltstone, greywacke, and limestone. The Gowganda Formation is an heterogeneous assemblage of conglomerate, quartzite, arkose, greywacke, argillite, and siltstone. The Huronian rocks are only slightly metamorphosed, and original structures such as bedding, crossbedding, ripple-marks, and mud-cracks are present. The complete Table of Formations is given on page 11, and a comparison of the different stratigraphical nomenclatures that have been used in the Blind River area is given on page 10.

Bruce Group

The lowermost group of the Huronian is the Bruce Group, the formations of which are described later. The uppermost formations of the group are not exposed in the map-area probably because they were removed by pre-Gowganda

erosion or, possibly, because they were never deposited in the area. The basal members of the Gowganda Formation lie unconformably on the Bruce Limestone member of the Espanola Formation. The individual formations of the Bruce Group are easily distinguished in the field and in drill core and can be readily traced, except where they are cut out by the Gowganda Formation.

MISSISSAGI FORMATIONS

The Mississagi Formation, as originally defined by Winchell (1887) and understood by Collins (1925), comprises the oldest Huronian sedimentary rocks in the area and, since the lowermost beds contain uranium and thorium, it is the formation that has attracted most interest. The formation, as mapped by Collins, may now, within the confines of the Blind River area, be subdivided into three formations; these are:

Upper Mississagi: quartzite and feldspathic quartzite.

Middle Mississagi: basal polymictic conglomerate overlain by argillite with minor greywacke.

Lower Mississagi: arkose, oligomictic conglomerate, and quartzite.

S. M. Roscoe has introduced a new local nomenclature for the Huronian (*see* Table I, column 5). Roscoe's formational boundaries coincide with the author's, except that an argillite-greywacke sequence at the top of the Lower Mississagi, as exposed in Townships 155, 149, and 143, has also been given formation status.

These formations and their members are easily discernible within the Quirke syncline (Robertson 1960; 1961; 1962; 1963a). However the Middle Mississagi basal conglomerate cannot be traced along the south limb of the Chiblow anticline to the south and east of Lake of the Mountains in Striker township (map No. 2028, back pocket). The argillite, when traced in a similar direction, passes into a sequence of interbedded quartzite, silty quartzite, and minor argillite, with transitional boundaries to both the Lower and the Upper Mississagi formations. This latter type of sequence is repeated on the upthrow (south) side of the Murray Fault, between Algoma and Blind River and westwards to Mississagi Bay.

LOWER MISSISSAGI FORMATION

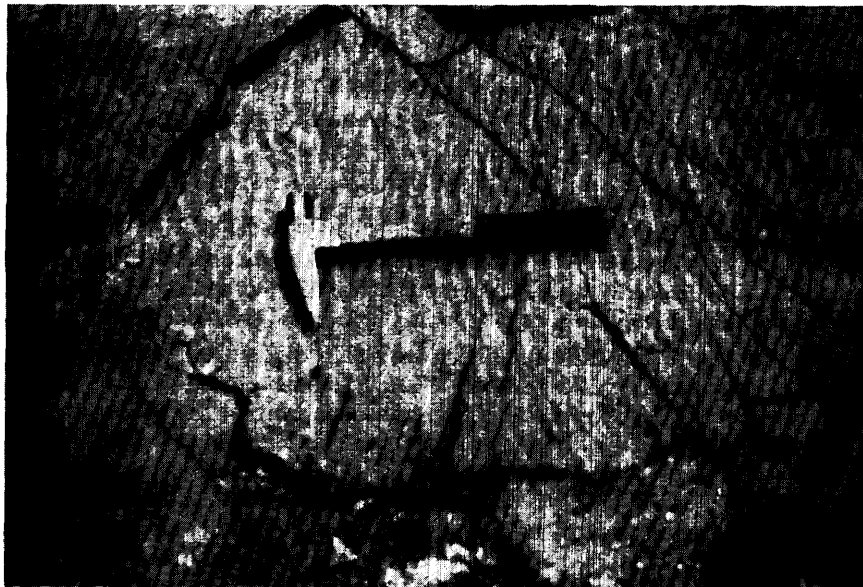
The Lower Mississagi Formation is exposed in the following parts of the map-area: between Matinenda and Pistol lakes striking southeast, by Peak and Emerald lakes, to the northwest shore of Magog Lake and the northeast end of Lake of the Mountains; between Lake of the Mountains, Magog Lake, and the north shore of Lauzon Lake; and as intermittent outcrops between Blind River and Lauzon Bay of Lauzon Lake to the south of the Murray Fault. In addition to surface data there is considerable information from diamond-drilling. In Scarfe township and adjacent parts of Township 167, diamond-drillholes, collared in the upper formations of the Bruce Group, penetrate the Lower Mississagi Formation.

The Lower Mississagi Formation rests with marked unconformity on the surface of the Algonian granites; as noted on pages 15-18, relicts of the post-Algonian soils are normally preserved. The actual base of the Lower Mississagi Formation is marked by the onset of sorting and bedding. Unless a basal bed of angular quartz pebbles is present, the contact may be difficult to identify, particularly in drill core.

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The lowermost beds consist of poorly sorted, angular to subangular quartz and microcline grains set in a groundmass of comminuted fragments and sericite, the latter probably derived from the weathered granite. Pyrite may or may not be present. Interbedded with the arkosic quartzites are beds, up to 4 inches thick, consisting largely of sericitic feldspar debris; on weathering, these beds take on a yellow-green colour. On outcrops these green bands clearly define the bedding. The upper surface of the green bands may show small ripple-marks (Photo 3). Pebble bands, 1-3 inches thick, are randomly scattered through this part of the formation. The pebbles are subangular to well-rounded, well-sorted, and are

Photo 3



Ripple-marks on arkose, Lower Mississagi Formation; north-central Striker township.

almost entirely of quartz, although pebbles of chert, jasper, and occasionally non-siliceous rock are also found. Pyrite is usually a conspicuous component of the matrix of these pebble bands. The pyrite may be euhedral or anhedral and is restricted to the matrix. Accessory minerals are monazite, magnetite, apatite, and zircon. These pyritiferous cligomictic conglomerates are also slightly radioactive (generally less than 3 times background) and are similar in type to the ore conglomerates found elsewhere in the camp (Robertson 1961, p. 43; 1962, p. 57). The chief difference is that the content of uranium and thorium, over mineable widths, is below commercial grade. The aeromagnetic maps for Mack and Striker townships (O.D.M. Maps 1955) show a zone of small radioactivity anomalies coincident with outcrop area of the Lower Mississagi Formation. These have been drilled, but no deposits of economic significance have been found. The anomalies are rather a "mass effect" resulting from the slight radioactivity of the formation as a whole.

The sequence of arkose, green beds, and pebble bands passes up into feldspathic quartzite interbedded with green bands and micaceous siltstone or argillite. The arenite members are now represented by feldspathic quartzites in which the

grains are rounded and sorted; microcline now forms a smaller proportion of the rock and sericite a smaller proportion of the matrix. The cement is now obviously silica. Pyrite and rarely chalcopyrite are scattered through the rock. Planar and festoon crossbedding are conspicuous. This crossbedding indicates a southeast current-direction (McDowell 1957, fig. 5; 1963). Other directions and even reversals of the principal direction are observed, but statistically these are insignificant. McDowell's observations were restricted to outcrops north of the Murray Fault, but there is no reason to suppose that outcrops to the south deviate in this respect. This southeasterly current-direction has been observed throughout the Blind River area (McDowell 1957; 1963; Pienaar 1958; Robertson 1960; 1961; 1962). The argillites and siltstone interbeds are up to 6 inches thick, pale to dark grey when fresh, and rusty when weathered. Mica flakes are scattered on the bedding planes. Pyrite is disseminated through the rock to a greater extent than in the adjacent feldspathic quartzites. The surfaces of these more argillaceous beds are frequently ripple-marked. The little work that has been done on the orientation of the ripples tends to confirm a southeast current-direction. Green bands are still present but are not as common as in the lowermost members of the formation and, as with the argillaceous bands, they are frequently ripple-marked. One argillite bed, 25 feet thick, can be traced for about a mile on surface to the east of Emerald Lake; this is the only example in the map-area of a mappable argillite bed in the Lower Mississagi Formation.

The uppermost part of the Lower Mississagi Formation is characterized by well-bedded, light grey- to white-weathering, grey, feldspathic quartzite. The rock consists of an aggregate of well-sorted, subangular to subrounded, quartz and microcline grains in a silica cement. Occasional grains of plagioclase, magnetite, and zircon are present. Pyrite, and very rarely chalcopyrite, are found scattered throughout the rock. Normal to planar crossbedding indicative of a northwest source is still characteristic, but the ripple-marked argillaceous and sericitic green beds are absent. Quartz pebbles are occasionally found in the quartzite beds but are not found as conspicuous bands or pockets. In the uppermost 50 feet of the formation, as exposed along the north shore of Lauzon Lake and between Blind River and Algoma, siltstone and argillite interbeds are again common, becoming more so up the sequence until they form the dominant rock type. The boundary of the Lower Mississagi and the Middle Mississagi formations is arbitrarily chosen as that horizon at which the argillaceous beds are at least equivalent to the quartzite beds in thickness.

The results of diamond-drilling, particularly in Scarfe and Striker townships, allow some estimate of the thickness of the Lower Mississagi Formation. Diamond-drillholes throughout the area are generally listed as vertical, and no correction can be made for "wandering."

In the vicinity of Chiblow Lake, Demorest Lake (Township 167), and Matinenda Lake the thickness is about 950 feet and is apparently uniform. This is considerably more than the maximum of 700 feet found on the south limb of the Quirke syncline (Roscoe 1956; Robertson 1961; 1962; 1963a). At Emerald Lake, in central Mack township, the thickness is again estimated as 950 feet.

Half-way along the north shore of Lake of the Mountains, a drillhole, put down by Power Uranium Company Limited, intersected at least 1,330 feet of quartzite below an argillite (probably correlative with the Middle Mississagi Formation) without reaching the pre-Huronian basement. Virginia Mining Corporation's drillhole at the northwest end of Lauzon Lake intersected 960 feet

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of quartzite, and a nearby hole (Old Smokey) cut 750 feet of quartzite without reaching basement. Even if some allowance is made for possible "wandering" of the drills and for the uncertainties in placing the contact of the Lower and Middle Mississagi formations (in the absence of the Middle Mississagi Conglomerate), these figures indicate a considerable thickening of the Lower Mississagi Formation in the vicinity of Lake of the Mountains and the west-central part of Lauzon Lake.

At the Long-Striker townships boundary the formation is 1,250 feet thick, gradually decreasing eastwards to about 700 feet at Pronto Mine, east of which the thickness may be 300-600 feet (O.D.M. Maps 1960, No. P.73; 1961, No. P.131) but is typically between 300-400 feet. Surface data indicate that midway between Magog and Lauzon lakes the formation is about 1,100 feet thick. These figures and the marked southeast current-direction suggest that the area of increased thickness may have a northwest-southeast trend; the Pronto orebody may lie at the eastern limit of the thicker zone.

South of the Murray Fault, where thickness estimates are unreliable due to strike-faults and diabase intrusions, the formation could be 1,100 feet thick.

The Lower Mississagi Formation is, therefore, dominantly a coarse-grained arkose derived from weathered granite and deposited in shallow water by south-easterly-flowing currents. A zone of greater thickness underlies the Lake of the Mountains-Lauzon Lake area. Scattered pebble bands and radioactivity are characteristic of the lower part of the formation, but no significant uranium or thorium deposits have been discovered.

MIDDLE MISSISSAGI FORMATION

The normal facies of the Middle Mississagi Formation comprising a basal polymictic conglomerate followed by argillite is found at depth in drillholes between Demorest Lake (Township 167), Chiblow Lake, and Matinenda Lake. The conglomerate is found as cappings on high ground to the west of Matinenda Lake. The conglomerate and argillite, both much reduced in thickness, can be traced to the south of Emerald Lake in Mack township. The southern facies, consisting of interbedded quartzite, silty quartzite, and siltstone, is exposed between Lake of the Mountains and the northwest bay of Lauzon Lake and eastwards along the north arm of Lauzon Lake. This sequence is repeated south of the Murray Fault from Algoma westward.

In drillholes near the northwest corner of the map-area, the Middle Mississagi basal conglomerate consists of 14-40 feet of dark grey to black, siliceous, greywacke conglomerate. Small boulders and pebbles of white granite, greenstone, and angular to subrounded fragments of quartz, chert, and slivers of argillite and siltstone are randomly scattered through a coarse-grained, siliceous greywacke matrix characterized by large grains of smoky quartz. Interstitial pyrite is common but sparse; local concentrations may be found surrounding or replacing the rock fragments. The pebbles and boulders are mainly white, massive to gneissic granite and range up to 3 inches in diameter.

Drillhole No. 2, sunk by Temple Gold Mines Limited (*see* page 79) to the east of Chiblow Lake, intersected 160 feet of conglomerate, a thickness comparable with the local maxima found on the south limb of the Quirke syncline but considerably greater than the typical thickness. The lowermost 20-30 feet has a light grey, quartzitic matrix, which may be transitional to the Lower Mississagi Quartzite. The next 50 feet consists of a sparse conglomerate with a dark grey to black matrix; the uppermost 80 feet is moderately dense.

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The conglomerate is exposed as cappings on the high ground west of Matinenda Lake. The upper part of the unit has been removed by erosion, and a maximum thickness of only 20 feet is exposed. The matrix is a coarse-grained, gritty, light grey, impure quartzite. The boulder assemblage is similar to that given above, but the distribution is erratic—ranging from close-packed gravel in some places to only a few pebbles or boulders per square yard elsewhere. As the boulders and pebbles weather more rapidly than the matrix of the rock, the surface is pitted. Oxidation of the interstitial pyrite gives rise to irregular rusty streaks. Both gradational and sharp contacts with the underlying Lower Mississagi Formation are seen.

Photo 4



Moderately dense conglomerate, Middle Mississagi Formation; north shore of Lake of the Mountains, Striker township.

The Middle Mississagi Conglomerate is again exposed south of Emerald Lake (*see* Photo 7). Here it is only about 5–10 feet thick and is made up of quartz, greywacke, shale, red and white granite, and pebbles and boulders up to 2 inches in diameter sparsely scattered in a light to dark grey matrix. Dark quartz grains are common but not predominant. Pyrite is disseminated throughout the rock and also replaces some quartz, feldspar, and greywacke fragments. Locally the matrix may be slightly calcareous. Similar conglomerate is exposed on the north shore of Lake of the Mountains (Photo 4), but the total thickness is not seen; there is no conglomerate at the corresponding horizon in the nearby drillhole put down by Power Uranium Mines Limited.

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No conglomerate has been identified at the base of the Middle Mississagi Formation in Striker township to the southeast of Lake of the Mountains nor eastwards in Long and Spragge townships (O.D.M. Maps 1960, No. P.73; 1961, No. P.131).

No Middle Mississagi Conglomerate has been found south of the Murray Fault between Algoma and Blind River; however, in view of the sparse outcrops and lack of diamond-drillholes the absence is not proven. The nature of this conglomerate suggests that it was deposited very rapidly; both glacial and mud-flow deposition have been suggested (McDowell 1957, p. 31). Possibly it represents a basal conglomerate formed after a short break in the sedimentation sequence. Roscoe believed that the conglomerate bevelled the lower members of the Huronian and was a "time-rock unit" and, regarding it as the most useful marker in the Lower Huronian, he used it as the basis for his classification of the Huronian (Roscoe 1957, p. 9). Roscoe's observations were largely confined to the Quirke syncline. Relationships in the present map-area, however, reveal the danger of correlating the Lower Huronian outside the Quirke syncline with that inside it on the basis of units that cannot be continuously traced. The thickening and thinning relationships suggest a northwest source.

In the drillholes near Chiblow, Demorest, and Matinenda lakes, the Middle Mississagi Conglomerate is overlain, as in the Quirke syncline, by thin-bedded, black to grey argillites and greywackes. In this area, these rocks are about 400 feet thick, which is considerably less than the 600–700 feet observed in the Little Moon Lake–Elliot Lake sector of the Quirke syncline, about 6 miles to the northeast (Robertson 1963a, p. 20). The argillite has a marked cleavage sub-parallel to the bedding. Pyrite and traces of pyrrhotite and chalcopyrite are disseminated through the argillite, and small blebs were encountered in drillholes. Upwards the argillite passes through interbedded quartzite, greywacke, and argillite into the Upper Mississagi Formation, which consists of quartzite and feldspathic quartzite.

No argillite is exposed in the vicinity of Matinenda Lake, but a few small baked inclusions have been found in the large gabbro body between Chiblow and Matinenda lakes.

Argillite is exposed in cliff faces capped by Upper Mississagi Formation south of Emerald Lake (*see* Photo 7) and can be traced as far south as the west end of Black Lake. Here the unit is only 40 feet thick. Radiation surveys carried out by companies in the Emerald Lake–Black Lake area, indicated that the Middle Mississagi Argillite was slightly radioactive, but insufficiently so to warrant extensive development or exploration. The Middle Mississagi Conglomerate passes upwards, by diminution in the number of the pebbles and an increase in the argillaceous component of the matrix, into argillite. The lower-most few feet of the argillite is strongly sheared and impregnated with quartz. The argillite is a finely-laminated, grey- to rusty-weathering, dark grey to black, fine-grained rock. There is a well-developed cleavage dipping south at an angle slightly greater than the dip of the bedding. The original bedding is revealed by slight variations in colour and composition. Graded bedding is normally visible. In thin section the argillite is seen to be composed of finely-divided, subangular, quartz and minor feldspar grains in a chlorite groundmass. Black iron oxide, probably magnetite, is the principal accessory. The lineation of the chlorite flakes is oblique to the bedding as defined by variations in the number and packing

of the detrital grains. The uppermost beds become more siliceous in character, and small-scale ripple-marks are common.

Middle Mississagi argillite is not exposed on the north shore of Lake of the Mountains, but in the drillhole of Power Uranium Mines Limited the whole Middle Mississagi Formation is represented by 89 feet of argillaceous rock, of which the lowermost 14 feet is siltstone and the uppermost 75 feet argillite with minor interbedded siltstone.¹

Between the southeast shore of Lake of the Mountains and the northwest bay of Lauzon Lake, and continuing east along the north arm of Lauzon Lake, the Middle Mississagi Formation is represented by interbedded siltstone and quartzite with little argillite. Individual beds are only a few feet thick, but a few beds of massive siltstone are as much as 30 feet thick. The latter may be traced for considerable distances on surface. New Kelore Mines Limited reported that on their property the outcrop of siltstone and greywacke beds coincided with low radioactivity anomalies. It was estimated that the siltstone-greywacke beds were twice background (the quartzite being taken as background). Exploration failed to reveal uranium or thorium mineralization of economic significance (company report filed for assessment credit, O.D.M. Files 63.582).

The quartzite beds are medium- to coarse-grained, feldspathic and may be massive, laminated, or crossbedded (Photo 5). It is difficult to distinguish the quartzite from either that of the overlying Upper Mississagi Formation or that of the underlying Lower Mississagi Formation. Some beds, particularly thin crossbedded ones between two siltstone beds, are calcareous—differential weathering on the calcareous laminae making the crossbedding readily visible. Crossbedding is generally planar to normal and indicates a southeasterly current-direction. However, there are wide variations, and even reversals, of the dominant direction. The silty quartzite and siltstone beds range in thickness from a few inches to 30 feet, but are normally 1–4 feet. They are dark grey to black when fresh but weather light to dark grey. A conchoidal to subconchoidal fracture is characteristic. Minute amounts of disseminated pyrite and, more rarely, chalcocopyrite may be visible. Siltstone partings and beds and, less commonly, the quartzite beds, show ripple-marks. Normally these are of small amplitude and extent, but north of the northwest bay of Lauzon Lake there is an excellent exposure of large-scale ripple-marks (Photo 6). These have been illustrated and discussed in some detail by McDowell (1957, pp. 8-12). The presence of crossbedding and ripple-marking indicates that this phase of the Middle Mississagi Formation formed in very shallow water, and that the fine-grained character of many of the beds is due to a lack of coarse material in the sediment rather than deposition at depth some distance from shore.

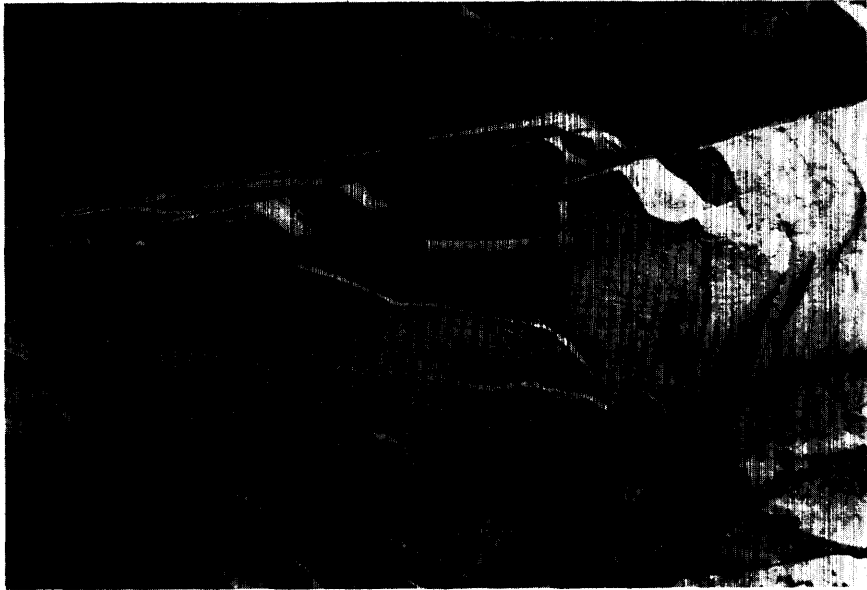
The Middle Mississagi Formation in the vicinity of the northwest bay of Lauzon Lake is about 800 feet thick. This thickness is apparently maintained eastwards to Pronto Mine in Long township (O.D.M. Maps 1960, No. P.73).

Similar rock types and thicknesses are found to the south of the Murray Fault between Algoma and Blind River, and the upper part of the formation can be traced westwards to the French Islands in Mississagi Bay. As outcrop is relatively sparse and the area is one of structural disruption, it is not possible to trace individual beds for any distance or to give a reliable estimate of the total thickness of the formation.

¹Derived from company drill-log submitted for assessment credit.

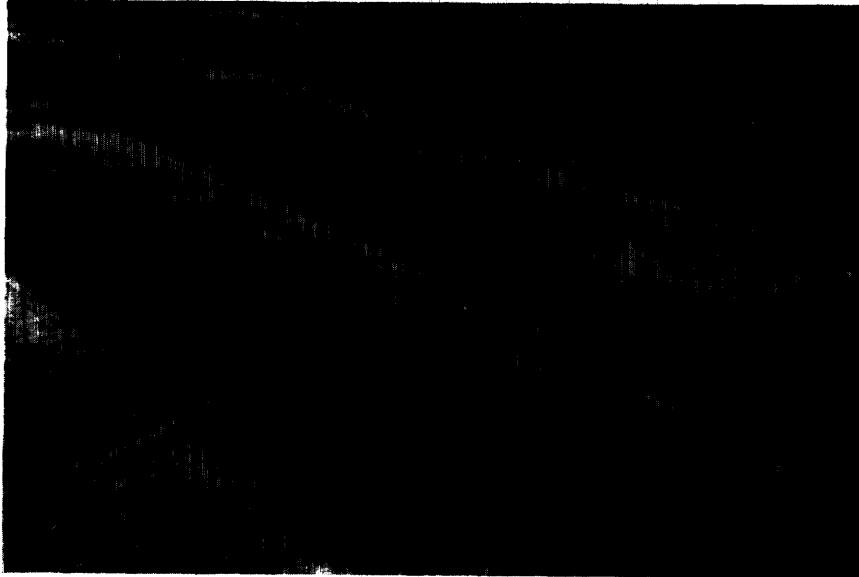
Scarfe, Mack, Cobden, Striker Townships

Photo 5



Interbedded siltstone and crossbedded quartzite; Middle Mississagi Formation; north shore of Lauzon Lake, Striker township.

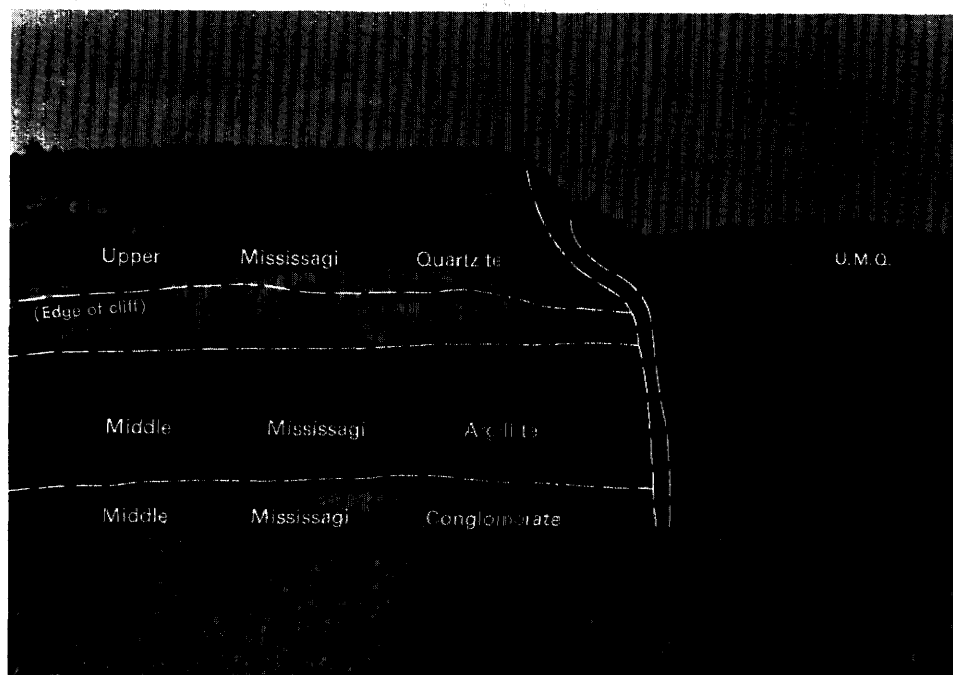
Photo 6



Megaripples on siltstone, Middle Mississagi Formation; north-central Striker township (reprinted from McDowell 1957, p. 11).

From the foregoing it is clear that within the map-area there is considerable variation in both the lithology and in the thickness of the Middle Mississagi Formation. The southwards thickening observed within the Quirke syncline (Roscoe 1956; Robertson 1960; 1961; 1962; 1963a) does not continue into the map-area; on the contrary there is a marked thinning of both the members and of the formation as a whole, particularly in the northeast-central part of the map-area. The facies change is such that towards the south of the area the Middle Mississagi Formation tends to lose its identity. The southwards disappearance of the basal conglomerate prohibits the positive correlation of any conglomerate found outside the Quirke syncline and reduces the validity of using such a conglomerate as the most useful horizon marker within the lower part of the Huronian succession (Roscoe 1956, p. 9).

Photo 7



Middle and Upper Mississagi Formation (U.M.Q. is Upper Mississagi Quartzite); near Emerald Lake, Mack township.

UPPER MISSISSAGI FORMATION

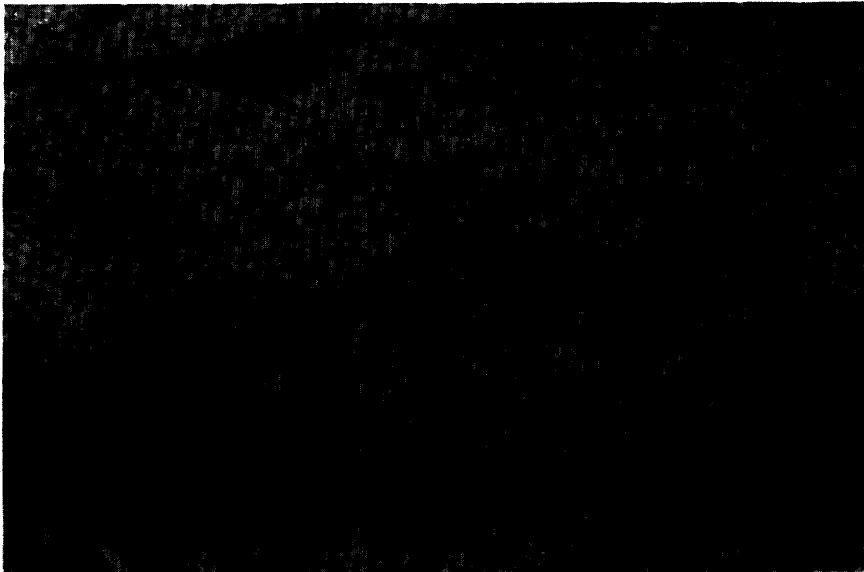
The Upper Mississagi Formation is composed essentially of quartzite and feldspathic quartzite, but locally, pebble conglomerate, polymictic conglomerate, calcareous quartzite, and siltstone form part of the formation. The formation is exposed in a belt running southeast across Scarfe, Mack, and Striker townships in the vicinity of Chiblow, Plump, Clear, Bearhead, Emerald (Photo 7), Heron, and Skull lakes, to the northwest shore of Lake of the Mountains. Southeast of Lake of the Mountains the formation is exposed with the same strike towards Thurston Lake and the west and south shores of the northwest arm of Lauzon Lake (see Photo 15). Upper Mississagi quartzites are poorly exposed south of the

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Murray Fault between Algoma and Blind River but are better exposed from Blind River westwards to Mississagi Bay.

The Upper Mississagi Formation, as exposed in Scarfe and Mack townships, and the greater part of the formation exposed southeast of Lake of the Mountains, consists of well-bedded, light to dark grey, medium- to coarse-grained, feldspathic, crossbedded quartzite with numerous quartz, chert, and jasper pebbles. These pebbles may be scattered through the beds, concentrated as pockets on the bedding planes, or as thin beds (Photo 8). Crossbedding usually planar or concave in type is well-developed. However, there is a wide variation in current-direction both within each bed and from one bed to another. The southwest

Photo 8



Quartz-chert-jasper pebble band, Upper Mississagi Formation; northeast shore of Lake of the Mountains, Striker township.

current-direction that is characteristic of the formation throughout the area prevails (McDowell 1957, fig. 5), but reversals of this direction are common.

McDowell studied the size distribution of the chert pebbles in the formation and suggested that this, taken with the crossbedding data, indicated a source area 130–250 miles west-northwest of Thessalon.

Partings, a few inches thick, of green-weathering sericitic arkose or of rusty-weathering micaceous siltstone are not uncommon; however, in the uppermost part of the formation there is not an abundance of ripple-marked flaggy quartzite and siltstone such as is found at the west end of Chiblow Lake (Robertson 1963b, p. 21).

Drillhole evidence indicates that the lowermost part of the formation, which is not exposed at surface, amounts to several hundred feet and is almost devoid of pebbles, and that both coarse-grained arkose and siltstone interbeds are rather more common than in the upper part.

In the Chiblow Lake–Matinenda Lake–Bearhead Lake area, the thickness is about 1,400 feet, which is similar to that in the south limb of the Quirke syncline (Robertson 1961, p. 16; 1963a, p. 22).

In the northeast corner of Cobden township, the character of the uppermost part of the formation changes, and units not found elsewhere make their appearance. The lowermost of these is a zone characterized by polymictic conglomerate and siltstone. This zone can be traced from the northeast corner of Cobden township to the Lake of the Mountains fault, where it consists of polymictic conglomerate. The conglomerate consists of boulders of red granite and white granite (the red exceed the white), and diabase or greenstone, and pebbles of shale, quartz, chert, and jasper, in a dark grey-green to black, gritty, calcareous quartzite to siliceous greywacke matrix. The boulders are typically less than 6 inches in diameter but may be up to 2 feet. Smoky quartz, clear quartz, and pale blue quartz grains are distinguishable. These are rounded, and the outer surfaces are frosted. Minor pyrite is disseminated through the matrix and may surround or replace quartz grains. Packing of the rock ranges from dense boulder or gravel conglomerate to sparse boulder conglomerate. On the southeast shore of Lake of the Mountains, on the first headland east of Battle Point, there is no longer a single conglomerate member but interbedded conglomerate, siltstone, greywacke, argillite, and quartzite, which can be traced southeast along the north shore of Thurston Lake and to the south of the headlands defining the north arm of Lauzon Lake. In the vicinity of the narrows on Lauzon Lake, the siltstone dies out, and near the east margin of the map-area there is again a single unit of polymictic conglomerate, which can be traced eastwards through Long township (O.D.M. Maps 1960, No. P.73) to about a mile west of Pronto Mine.

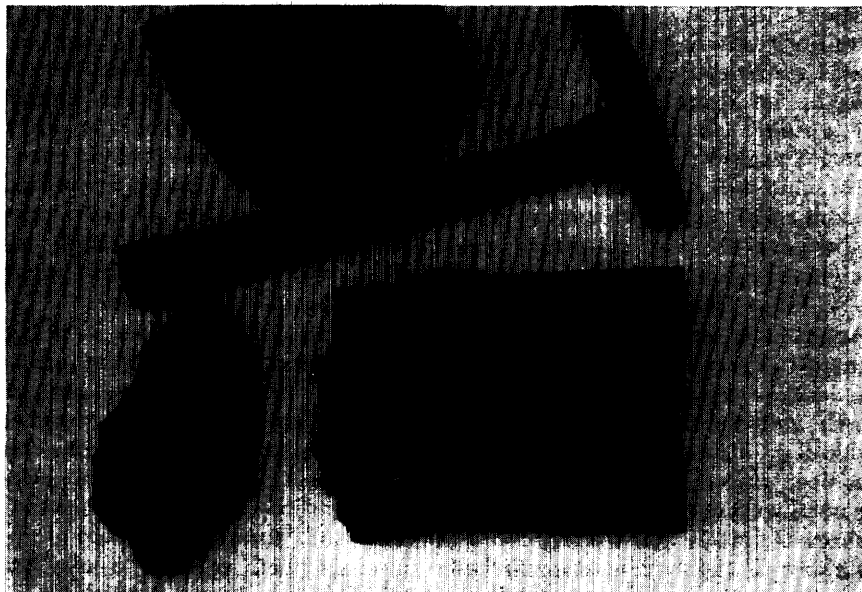
About 300 feet above the conglomerate-siltstone unit there is a bed of laminated calcareous quartzite. This bed is 15–20 feet thick, and the individual laminae range from $\frac{1}{16}$ to $\frac{1}{2}$ inch in thickness. The calcareous laminae are recessed, and the thicker ones take on a rusty-brown colour on weathering. Individual grains are seen to be well rounded and frosted. This calcareous quartzite has been traced intermittently from the northeast corner of Cobden township to the northwest shore of Lake of the Mountains, and continuously from the northeast shore of Battle Point along the south shore of Thurston Lake and along the south shore of the bay of Lauzon Lake that lies north of the Ontario Hydro-Electric Power Commission transmission line. This rock type has not been identified east of the Striker-Long township boundary.

Within the Lake of the Mountains–Lauzon Lake sector, in which both the conglomerate-siltstone sequence and the laminated calcareous quartzite are found, the quartzite members become finer grained, and the size and frequency of the quartz-jasper-chert pebbles show a marked decrease. This trend continues eastwards into Long township. A conglomerate dike, 10 inches wide, was observed in Upper Mississagi quartzite exposed immediately east of the dock at the Department of Lands and Forests' seaplane base on Lauzon Lake. No detailed description of either the conglomerate or its structural relationship is given in the original field notes. Conglomerate dikes have been observed in the Upper Mississagi Formation in Township 143 and Township 144 (Robertson 1961, p. 17). These observations are at variance with those of Collins who stated that such features have not been found in strata older than the Espanola Formation (Collins 1925, p. 53). It is believed that the fractures filled with conglomerate opened as the result of penecontemporaneous earthquake activity.

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In the northwestern part of the map-area, a reliable estimate of the thickness of the Upper Mississagi Formation is not possible. Near the northwest shore of Lake of the Mountains, the Upper Mississagi Formation attains a total thickness of about 1,500 feet. The conglomerate member, which is rather less than 100 feet thick, lies about 900 feet above the base of the formation. In the Thurston Lake area, the formation may be as much as 2,700 feet, and the conglomerate-siltstone sequence, which is 1,600 feet above the base of the formation, is about 500 feet thick. At the Long-Striker townships boundary the formation is 2,200 feet thick, and the conglomerate unit, which is 900 feet above the base, is less than 200 feet thick.

Photo 9



Rock types, St. Onge showing, Scarfe township. Upper sample is chloritized matrix Bruce Conglomerate (dark) with chalcopyrite patches (light); bottom left, Bruce Conglomerate; bottom right, finely laminated Bruce Limestone.

The Upper Mississagi Formation, as exposed south of the Murray Fault, consists of well-bedded, medium-grained, grey, white- to rusty-weathering, feldspathic quartzite with thin argillaceous partings. Pebbles of quartz, chert, and jasper are restricted in number. Ripple-marks are not common. Crossbedding is well-developed, and measurements by McDowell (1957, Fig. 5) indicate that the currents were easterly-flowing within the map-area, rather than southeasterly as is characteristic of the region as a whole.

A thin bed of polymictic conglomerate, lying about 750 feet above the arbitrary boundary with the Middle Mississagi Formation, has been mapped in the vicinity of Algoma village. It is not clear whether this is correlative with the conglomerate found in the Lake of the Mountains-Lauzon Lake area. Siltstone is not a significant part of the sequence. No calcareous laminated quartzite has been identified south of the Murray Fault.

The maximum thickness of the Upper Mississagi Formation exposed in the Algoma area is 1,700 feet; however, west of Blind River the formation is apparently about 2,700 feet thick.

Thus the Upper Mississagi Formation consists of medium- to coarse-grained arenites rapidly deposited in shallow water by currents flowing in an easterly to southeasterly direction. Towards the south and southeast the formation thickens and becomes more uniform in character. In the area of Lake of the Mountains and Lauzon Lake, there is a thickening of the formation as a whole, and rock types not common elsewhere form a significant proportion of the upper part of the sequence.

BRUCE FORMATION

The Bruce Formation, consisting of siliceous polymictic conglomerate and minor amounts of quartzite, is exposed in a wide zone trending southeast across Scarfe township, from Chiblow Lake to Lake of the Mountains, thence from Battle Point on the southeast shore of Lake of the Mountains, along the south side of Thurston Lake, passing out of the map-area just east of the narrows on Lauzon Lake. Throughout the greater length of its outcrop, the formation forms a prominent north-facing scarp.

The contact with the upper members of the Upper Mississagi Formation may be sharp or it may be gradational; there is no change in attitude between the formations. Rarely, boulders of Mississagi-like quartzite have been identified within the Bruce Formation. The local sharp contact and the occurrence of quartzite boulders indicate an erosional break between the formations.

The rocks assigned here to the Bruce Formation were mapped as lower slate conglomerate by Murray. Collins believed that they were part of the Cobalt Group (Murray's upper slate conglomerate). Recent mapping, however, has confirmed the pre-Cobalt age of these rocks and their continuity with the Bruce Formation of the Quirke syncline (Robertson 1960; 1961; 1962). (*See map 2032, back pocket.*)

The typical conglomerate of the Bruce Formation consists of subangular to subrounded boulders and cobbles of granite, gneiss, diabase, and greenstone, and angular to rounded pebbles and fragments of quartz, feldspar, chert, and jasper, set in a highly siliceous gritty greywacke to quartzite matrix. The matrix is characterized by well-rounded grains of smoky quartz. Pyrite is disseminated throughout the matrix and is often found between the pebbles and the matrix, occasionally replacing the quartz and feldspar fragments. On the weathered surface of the rock, this pyrite gives rise to irregular rusty patches. The outer quarter-inch of rock is generally light grey in colour owing to leaching during weathering. There is wide variation in the packing of the conglomerate; dense boulder and gravel conglomerates are found (Photo 10), particularly near the base of the formation, but a moderately sparse distribution is more typical (*see Photo 9, lower left*). The granite boulders may be white or red, but white granite predominates over all other rock types. Pink or red granite boulders are commonest in the lower members of the formation, particularly in central Scarfe township. The mineralogical and textural features of the granites are similar to those of the Algonian granites. The diabase boulders weather rapidly at the edges and the centres, giving the effect of an upturned saucer. Since the matrix is harder than the boulders the latter tend to weather more rapidly, giving the rock a pitted surface. Where the matrix is less siliceous, or where the surface of the outcrop has been protected from weathering, there is no such differential weather-

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ing between the pebbles and the matrix. Locally, as along the north bank of the Blind River east of Cataract Falls, the matrix of the conglomerate is a fine- to medium-grained, dark green to black greywacke. The pebbles are relatively sparse and tend to stand out above the matrix. The greywacke matrix in this locality shows a poorly-developed lamination. The relationship of the pebbles to the lamination suggests that the pebbles were dropped into partially consolidated sediment—possibly from floating ice. Such laminated conglomerates are well-known in the Gowganda Formation of the Cobalt Group, and it is possible that

Photo 10



Dense boulder conglomerate, Bruce Formation; south of Clear Lake, central Scarfe township.

the occurrence of this rock type led Collins to correlate the conglomerate along Blind River with the Gowganda Formation. Coleman suggested that the Bruce Conglomerate, as well as the conglomerates of the Gowganda Formation, is tillite. However, the character of the rock is more consistent with deposition in water.

Occasionally there are small lenses of well-washed, rusty-weathering, white, feldspathic quartzite, which are found in the lowermost part of the formation. Frequently these are cross-laminated and slightly calcareous. Where calcareous, there is usually a zone of secondary iron minerals within an outer leached skin. These quartzite lenses cannot be traced for more than a few tens of feet. A continuous quartzite bed can be traced to the north and east of Falls Lake in west-central Scarfe township. This bed is about 50 feet thick and resembles the Upper Mississagi feldspathic quartzite. The underlying conglomerate is densely packed boulder conglomerate, whereas that overlying the quartzite is moderately packed siliceous greywacke conglomerate.

In the Chiblow Lake–Denman Lake area the Bruce Formation is about 250 feet thick (Robertson 1963b, p. 23). In the Chiblow Lake–Lake of the Mountains area it is 200–250 feet. From the southeast shore of Lake of the Mountains to the east boundary of the map-area it is approximately 300 feet thick. These thicknesses are considerably greater than those found throughout the Quirke syncline (Robertson 1960; 1961; 1962; 1963a; Roscoe 1957).

Bruce Formation is exposed at one locality south of the Murray Fault; this is in a small headland about $\frac{1}{2}$ mile west of Comb Point and about 1 mile southwest of the Blind River lumber mill. Here about 60 feet of sparse pebble conglomerate overlies quartzite of the Upper Mississagi Formation and is overlain by the Bruce Limestone member of the Espanola Formation. The matrix is finer grained, lighter in colour, and more quartzitic than normal; the pebbles are smaller and more sparsely distributed. Collins, however, identified this outcrop as Bruce Conglomerate (Collins 1925, p. 47).

The Bruce Formation is thus a polymictic conglomerate with local quartzite lenses, particularly near the base, and laminated greywacke in the upper parts of the formation. The thickness throughout the area of outcrop north of the Murray Fault is reasonably uniform but is considerably greater than that normally found in the region. One outcrop has been found south of the Murray Fault, and here the thickness is less than normal. Whether this indicates that, like the Middle Mississagi Conglomerate, the Bruce Formation is dying out southwards or whether this is just a local variation cannot be determined. Both ice and mud flows have been suggested as transportational agents for the Bruce Formation; however, it is clear that, no matter how it may have been transported initially, the material has been subjected to water-sorting and to a winnowing of the finer products of rock disintegration.

ESPANOLA FORMATION

Throughout the North Shore district a series of limestones, mudstones, and dolomites overlies the Bruce Formation conformably. In the Blind River–Elliot Lake region it is possible to map three units: a lower, characterized by limestone—the Bruce Limestone; a middle, characterized by mudstone and greywacke—the Espanola Greywacke; and an upper unit, having a marked development of ferruginous dolomite—the Espanola Limestone. However, elsewhere in the North Shore district, Collins (1925, p. 54) found it was not possible to make the above distinction, and he accordingly grouped all three as the Espanola Formation. Quirke (1917, p. 33–38) had previously ascribed formational rank to each of the above-mentioned units as exposed in the Espanola region. Abraham (1957) followed Collins in considering the limestone in the Chiblow Lake–Blind River area as an integral part of the Gowganda Formation. When mapping in the Quirke syncline, Abraham (O.D.M. Maps 1956, No. P.1) removed the Bruce Limestone from the Espanola Formation and placed it in the Bruce Formation with the underlying Bruce Conglomerate. This arrangement has the merit of emphasizing the cyclical nature of the Bruce Group, which can be divided into a number of units each characterized by an arenaceous or rudaceous basal member grading upwards into an argillaceous or calcareous upper member. The mine geologists (C.I.M.M. 1957, p. 8) used the following formational names: Bruce Conglomerate, Bruce Limestone, and Espanola Formation. Frarey (1961a; 1961b), Heinrich (1958), Roscoe (1957), and the author (Robertson 1960; 1961; 1962; 1963a; 1963b) have followed Collins' nomenclature in this respect.

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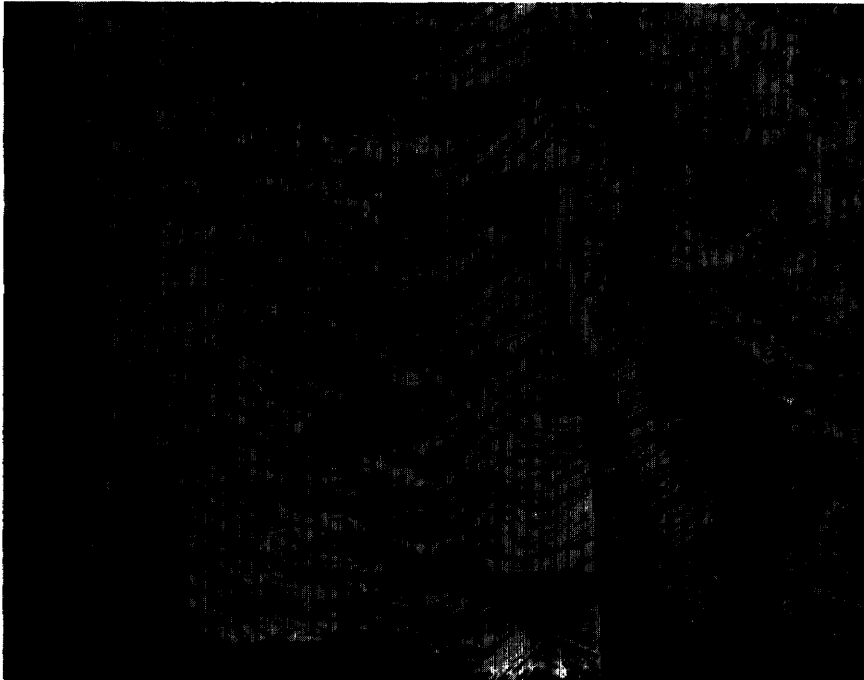
Of the three members of the Espanola Formation, only Bruce Limestone is present within the map-area; the upper members were either not deposited at all or were, more probably, removed by pre-Gowganda erosion.

Bruce Limestone

The Bruce Limestone is exposed as a narrow band, up to 50 feet thick, lying immediately south of the Bruce Formation.

The Bruce Limestone–Bruce Conglomerate contact is not exposed within the map-area. Elsewhere in the Blind River–Elliot Lake region it is a conformable and, locally, a gradational contact (Robertson 1961, p. 18).

Photo 11



Bruce Limestone (Espanola Formation); east bank of the Blind River, south of Chiblow Lake, Scarfe township. (Note dragfolds and differential etching of calcareous bands.)

The Bruce Limestone is made up of finely banded, interbedded creamy limestone, grey siltstone, and rusty dolomitic limestone (Photo 9, lower right). The weathered surface is strongly etched (Photo 11), reflecting the different weathering susceptibilities of the various components. The rock is characterized by contortion of the bedding, which combined with the etching gives the outcrops a striking appearance. Holmes (C.I.M.M. 1957) and Pienaar (1958) have contended that this contortion is due to slumpage in the partially consolidated stage. However, the majority of the folds observed are congruent with the major folds. An axial-plane cleavage may be associated with these minor folds and, where present, dips at a steeper angle than the general dip of the bedding. These features suggest that the contortions are dragfolds superimposed on the Bruce Limestone,

which acted as an incompetent member during the folding of the region. In places, well-bedded limestone passes laterally into breccia consisting of disoriented angular fragments of banded limestone set in a structureless limestone matrix. These breccias are intraformational breccias; in addition to limestone fragments they may contain pea-sized pebbles of quartz and granite. Ripple-marks and mud-cracks have been observed in Bruce Limestone elsewhere, but none have been recorded in the present area.

The limestone bands range in thickness from a few millimetres to 10 centimetres or more. Generally they are composed of fine- to medium-grained recrystallized calcite. Minor amounts of pale green chlorite, sericite, angular to subrounded grains of quartz, microcline, and fresh plagioclase are scattered throughout the rock. Occasional grains of zircon, apatite, and magnetite are present. Pyrite and, more rarely, chalcopyrite are found as scattered cubes or blebs. The siltstone bands alternate with the limestone and consist of similar materials, except that the grains of quartz, feldspar, and rock debris now form the greater part of the rock. Carbonate forms the cement in both the limestone and the siltstone layers.

Metamorphosed Bruce Limestone, about 20 feet thick, is exposed about $\frac{1}{2}$ mile west of Comb Point and 1 mile south of the Blind River lumber mill. At this locality the limestone is separated from the Bruce Conglomerate by a few feet of non-conglomeratic greywacke. The upper part of the formation is obscured by the lake, and on small islands a few chains off-shore the Upper Mississagi Formation is exposed, indicating the presence of a fault.

Nowhere in, or near, the map-area is the full thickness of the Bruce Limestone preserved. In the Quirke syncline the total thickness of the limestone is approximately 100 feet. Within the present map-area, a maximum of 50 feet obtains, but normally less than 20 feet is found. South of Thurston Lake, near the Ontario Hydro-Electric Power Commission transmission line, only one outcrop has been found; this may be due to lack of exposure or to the formation having been totally removed prior to the deposition of the Gowganda Formation. The most easterly outcrops of this unit on the south limb of the Chiblow anticline, are on the shore of Lauzon Lake east of the narrows. It is believed that the limestone, having been removed by pre-Gowganda erosion, terminates near the Striker-Long township boundary, but the precise position is not known.

No economic use has been made of the Bruce Limestone within the present map-area.

The Bruce Limestone is thus a well-bedded series of limestones, siltstones, and dolomitic limestones with rare beds of conglomeratic intraformational breccia. The very fine laminations almost universally present indicate a seasonal deposition. Ripple-marks and mud-cracks suggest a shallow-water deposition.

Cobalt Group

The Bruce Group is followed unconformably by the Cobalt Group. The Cobalt Group consists of the Gowganda Formation, the Lorrain Formation, Banded Cherty Quartzite and, finally, the Upper White Quartzite and Cherty Quartzite (Collins 1925). Of these formations only the Gowganda Formation is exposed within the present map-area. The Gowganda Formation is a heterogeneous assemblage of conglomerates, greywackes, siltstones, arkoses, and quartzites. The Lorrain Formation is typically white quartzite with quartz, chert,

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and jasper pebble bands. Boulders and large erratics of Lorrain Quartzite are found in the drift throughout the map-area and in the boulder beaches along the North Channel of Lake Huron.

GOWGANDA FORMATION

The southwestern part of Scarfe township, a narrow belt between the Hydro transmission line and the Murray Fault in Striker township, and the greater part of Cobden township are underlain by the Gowganda Formation. A small wedge of Gowganda conglomerate, argillite, and quartzite overlying Upper Mississagi quartzite is caught between two faults of the Murray fault system and the Lake of the Mountains fault, in the vicinity of the west limit of the map-area south of the Mississagi River. This formation consists of conglomerate, quartzite, greywacke, siltstone, shale, and argillite. Many geologists believe that it accumulated under glacial or near-glacial conditions. It is generally not possible to trace individual beds for any great distance, although in Cobden township, and in Thompson township to the west, both quartzite and conglomerate beds can be followed for distances of up to 2 miles.

Although any one of the rock types mentioned above may be found anywhere in the sequence, there is a general progression upwards from a dominantly conglomerate-quartzite sequence, through quartzite-conglomerate-greywacke, to argillite-greywacke-quartzite with minor conglomerate. A similar sequence has been observed in the Quirke syncline (Robertson 1960; 1961; 1962; 1963a).

As the Gowganda Formation is the youngest sedimentary formation exposed within the map-area and as it is cut off down dip by the Murray Fault, the total thickness of the formation cannot be computed. The maximum thickness exposed within the map-area is about 1,600 feet (Collins 1925, p. 64), which is less than the thickness exposed in the Iron Bridge area to the west, but similar to the total (1,700 feet) obtained in the Quirke syncline (Robertson 1963a, p. 33) where the top of the formation has been identified. Therefore, probably the greater part of the formation is exposed within the map-area.

The contact of the Gowganda Formation and the underlying Bruce Limestone member of the Espanola Formation is exposed at a few localities throughout the map-area. The contact is sharp; the basal conglomeratic members of the Gowganda Formation contain numerous angular to subangular fragments of Bruce Limestone, and the matrix is sensibly calcareous. This clearly proves that there was a period of erosion prior to the deposition of the Cobalt Group. Moreover, as it is impossible to trace the Bruce Limestone east from the map-area, or between Denman Lake and the west bank of Blind River south of Chiblow Lake (Robertson 1963b, p. 27,) there is evidence for at least local angular discordance. Further observations within the Quirke syncline (Robertson 1960; 1961; 1962; 1963a) indicate that the base of the Gowganda Formation is an angular unconformity, and that tectonic disturbance with subsequent erosion had taken place between the deposition of the Serpent Formation (the uppermost formation of the Bruce Group preserved in the Blind River-Elliot Lake area) and that of the Gowganda Formation. (*See map 2032, back pocket.*)

The conglomerates—the best known rocks of the Gowganda Formation—show wide variations but typically consist of: boulders, cobbles, and pebbles of red granite, gneiss, diabase, and greenstone; pebbles of quartz, chert, jasper, siltstone; and, as already noted, in the lowermost members, limestone, scattered through a fine- to medium-grained greywacke matrix. Minor quantities of

pyrite are disseminated throughout the matrix. The granite boulders predominate; the majority of these have the same character as the red phase of the Algomian granite, from which they were probably derived. It may be noted that white granite similar to that observed in the Middle Mississagi Conglomerate and the Bruce Conglomerate is, locally, a significant component of the basal members, particularly where the Gowganda Formation rests directly on or near eroded Bruce Formation.

Photo 12



Gowganda Formation: dense boulder conglomerate; Whitefish Falls, west end of Cataract Lake, Cobden township. Boulders predominantly red granite.

As Collins (1925) has pointed out, the conglomerates fall into three broad types: (1) dense boulder conglomerates; (2) sparse boulder greywacke conglomerate; and (3) laminated greywacke conglomerate. Although all three types are found in the map-area, the second type is the most common, and the third type is found in only small amounts. Excellent exposures of all three types are to be seen at Whitefish Falls at the west end of Cataract Lake.

The dense boulder conglomerates occur particularly in the lower part of the formation, but may be found throughout it. These conglomerates are not as well-developed as in the Quirke syncline to the north, or in the Iron Bridge map-area to the west. The bedding of the conglomerates is normally well-defined but massive; frequently the basal contact is a definite erosional surface, and a crude graded bedding is visible. At Whitefish Falls, dense boulder conglomerate (Photo 12) fills linear channels in the underlying bed of sparse greywacke conglomerate.

The boulders may show considerable variation in size and shape, but normally there is a fairly high degree of sorting and some evidence of rounding suggestive of water transportation. The matrix is usually a gritty quartzose greywacke and forms a small part of the total rock. Fragments of quartzite, greywacke, and

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conglomerate similar to those of the Gowganda Formation are also found in small quantities; locally, fragments of contorted mudstone, obviously transported in a partially consolidated state, may be observed.

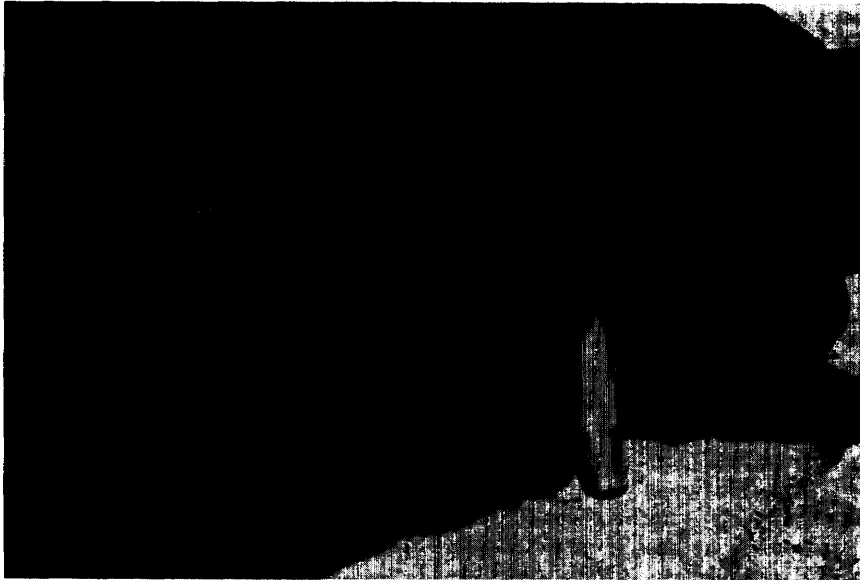
The boulder-greywacke conglomerates (Photo 17) are made up of the same materials as the boulder conglomerates, but the matrix here forms the greater part of the rock and is medium- to fine-grained, breaking with a subconchoidal fracture. Boulders and cobbles are scattered throughout the rock and are only rarely in contact with each other. The matrix consists of poorly-sorted, angular to subangular grains of quartz, plagioclase, and microcline in a groundmass of silica, chlorite shreds, and magnetite and other iron oxides. The feldspars are only slightly altered to clay minerals and sericite. Minor amounts of pyrite, and rarely chalcopyrite, may be present, scattered through the matrix, around grains or pebbles, or replacing quartz, feldspar, and chloritic fragments. The matrix may show a slight lamination. Where the rock has a cleavage or is well-jointed, the intersection of the laminae and the cleavage allows the rock to break up into triangular flakes and "pencils," which are scattered over the outcrop surface. The boulders are unsorted and may be up to several feet across, though the majority are less than 3 inches in diameter. Shapes show considerable variation, but are generally subrounded to angular; subrounded boulders and cobbles with one side flattened or "soled" are not uncommon. Such boulders, and the disparity of the boulder size and distribution compared with the fine grain and the disrupted texture of the matrix, led Coleman (1914) and Collins (1925) to conclude that these rocks were tillites, i.e., conglomerates of glacial origin. However, there is a growing school of opinion that such features may be explained by deposition from mud flows.

The laminated greywacke conglomerates are well-bedded greywackes with a few scattered rock fragments and pebbles with no characteristic shape or sorting. The matrix of the conglomerate is finely laminated, each lamina having a medium-grained base and a fine-grained top. These are reminiscent of Recent and Pleistocene varved clays and may be indicative of seasonal deposition under sub-temperate conditions. However, it has been suggested that submarine turbidity currents could form similar rocks. The pebbles cut and depress the laminae beneath them (Photo 13), and the superior laminae are attenuated, indicating that the pebbles were dropped into position prior to the consolidation of the inferior laminae and to the deposition of the superior. In the Precambrian, ice-rafting seems to have been the most logical means of transportation for the pebbles. In thin section the graded bedding of the laminae is clearly revealed. Large pieces of quartz and feldspar or small rock fragments show the same relationship microscopically as the boulders and pebbles do megascopically. The weathered surface of the rock is faintly etched, and the rock disintegrates forming pencils and flakes.

After conglomerate, quartzite is the commonest rock type. Again there is considerable variation in lithology and in composition.

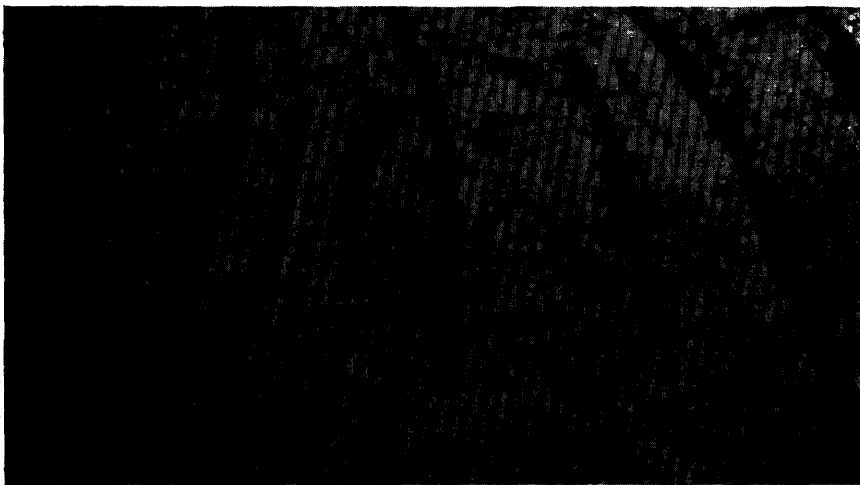
The most frequent type is a fine- to medium-grained, red-weathering, grey to pink, impure feldspathic quartzite with conchoidal to subconchoidal fracture. The outer quarter-inch of the rock is frequently leached, and in the next quarter-inch the red colour is intensified owing to the redeposited iron. Bedding is well developed, and where the dips are intermediate, as in the greater part of Cobden township, a dip-and-scarp topography is formed. In the Lauzon Lake area, where the dips are steep and the quartzite is interbedded with shale (Photo 14) and, locally, with conglomerate, the quartzite beds stand up as ribs. The

Photo 13



Gowganda Formation: Interbedded laminated conglomerate and quartzite; west end Cataract Lake. Note flame structure at base of quartzite, micro-crossbedding in quartzite, load casting at base of conglomerate, and relationship of laminae to pebbles in conglomerate.

Photo 14



Interbedded shale and quartzite, Gowganda Formation; east of Algoma, Long township.

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colour of the rock is apparently a reflection of the hematite enclosed in the plagioclase feldspar grains and in the interstitial dust. In thin section, sodic plagioclase is the dominant feldspar, and in several sections microcline is lacking; accessory minerals are zircon, magnetite, apatite, muscovite, and chlorite. Where quartzite has been more strongly metamorphosed, close to large diabase bodies, the hematite may coat joint planes or appear in quartz-specularite veinlets. More rarely, patches of limonite, with or without associated pyrite, are scattered through the rock. Features such as crossbedding, graded bedding, ripple-marks, and mud-cracks are not characteristic of the quartzites of the Gowganda Formation. However, near highway No. 557, halfway from the junction with highway No. 555, and the Blind River crossing, groove casts have been observed at the base of quartzite beds overlying argillite. Similar features and ripple-marks, micro-crossbedding, and graded bedding have been observed in the excellent exposure at Whitefish Falls (Photo 13).

South of the southwest end of Lake of the Mountains, the dominant rock type is a well-bedded, fine- to medium-grained, white-weathering, white to grey, impure quartzite. This quartzite was mapped by Collins as Missassagi quartzite, but the field relationships clearly show that it is within the Gowganda Formation. Similar quartzite is found elsewhere in the map-area, particularly in the lower part of the formation, and it is extensively developed in parts of the Iron Bridge map-area (Robertson 1963b, pp. 31-33). The chief difference between this quartzite and the typical pink quartzite lies in the relative lack of disseminated hematite dust in the feldspar and the matrix. The outer weathered skin develops a porcellaneous texture.

Occasionally, and particularly in the northern part of Cobden township (continuous with beds in Thompson township), medium- to coarse-grained gritty arkose is developed at the expense of quartzite. These arkoses consist of angular to subangular, moderately sorted microcline, plagioclase, and quartz grains set in a silica cement with very little matrix; in hand specimen the rock resembles a medium-grained granite. Accessory minerals are magnetite, chlorite and, rarely, muscovite and zircon. Hematite is present both in the feldspar grains and the matrix. Crossbedding and graded bedding are rather more characteristic of these arkose beds than of the typical pink quartzite.

Greywacke, similar to the matrix of the boulder greywacke conglomerates and of the boulder conglomerates, is a common rock type, but no further description is required. Conglomerate may be traced laterally into greywacke sometimes within a few feet.

Argillaceous quartzites and siltstones may be regarded as rock types intermediate between the quartzites and the argillaceous rocks.

Shales and argillites are well developed in the upper parts of the Gowganda Formation in the Dean Lake area to the west, and south of Lauzon Lake to the east of the present map-area. Such rocks interbedded with quartzite and conglomerate are an important part of the formation in the eastern part of Striker township. Where the interbeds of quartzite and shale are both thin, or where the quartzite is thin relative to shale, the quartzite beds may be distorted or even disrupted. This may be due to slumpage in the partially consolidated sediments, but near the Murray Fault it may be due to the differing competencies of these rock types during tectonic stress. Ripple-marks and, rarely, mud-cracks have been observed in these argillaceous rocks, indicating shallow-water deposition.

Graded bedding is common and may be due to either seasonal, cyclical, or turbidity-current deposition.

Shales and argillites may pass laterally into siltstones and quartzites or into greywackes and conglomerates. Some shales have a few scattered pebbles.

From the foregoing it will be seen that the Gowganda Formation, which underlies much of the southwestern part of the map-area, is a complex of many differing rock types; some of these are definitely water laid, some of them probably accumulated under cyclical conditions suggestive of freezing and thawing or of turbidity currents, and some may represent glacial deposits. (The last may also be explained on the basis of mud flows.)

LORRAIN FORMATION

Normally the Gowganda Formation is overlain conformably by quartzite with interbedded quartz jasper conglomerate of the Lorrain Formation. Locally, as in the Dunlop Lake and Mace Lake areas (Robertson 1963a, p. 36) of the Quirke syncline due north of the present map-area, the basal members are well-bedded, crossbedded arkose with scattered quartz pebbles and fragments. Neither type of sequence has been found *in situ*, but erratics of conglomeratic quartzite are common in the drift and in the boulder beaches along Lake Huron.

KEWEENAWAN

The youngest rocks in the map-area are intrusive quartz diabase, gabbro differentiated to diorite, and rarely lamprophyre. These rocks are generally correlated with the Nipissing diabase. Only one small dike of olivine diabase, commonly regarded as the last stage of Keweenawan igneous activity, has been recognized in the map-area. There is no evidence within the map-area for a post-Huronian (Killarney) granite (Robertson 1960, Chap. VI). With the advent of radioactive age-determination it has become apparent that there was a wide time gap between the intrusion of the Nipissing-type diabase and that of the olivine diabase, and that the Killarney-Grenville orogenesis took place in the interval. Recent determinations (Rb/Sr) on Nipissing gabbro from the Blind River area indicate a probable age of $2,170 \pm 200$ million years (Van Schmus *et al.* 1963). More and more geologists now use the term Nipissing diabase for the quartz diabase and gabbro and use Keweenawan only for the late olivine diabase (*cf.* Hawley 1962, pp. 6, 7). In conformity with both classical and recent usage in the Blind River area, the term Keweenawan is used here for all post-Huronian intrusive rocks in the map-area. Diabase and allied rock types occur either as dikes or as large irregular sill-like bodies. In the present map-area, sill-like bodies are not as well developed as in the Iron Bridge area to the west (Robertson 1963b, map 2012), but dikes are numerous.

The dikes are vertical or nearly vertical (Photos 7, 15) and are typically 50-150 feet wide, although in the map-area several dikes attain a width of at least 1,000 feet, and some can be traced for 12 miles across the map-area.

Dikes tend to strike either slightly south of east, or northwest. Dikes striking north or northeast, found elsewhere in the Blind River region, are not well developed in the present map-area.

The easterly set, i.e. that parallel to both the Murray Fault and the regional fold axes, is the best developed. The northwest set is well-developed, but the

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others are not. Except that the wide dikes, which show some differentiation from margin to core, tend to occur in the east-striking group, there is no great difference between the dikes of the different groups. Age relationships between the dikes of the differing trends, where observed, are not consistent. In the area south of the Murray Fault to the southwest of Blind River, the dikes anastomize, filling fractures of differing trends. Forking of dikes has been observed, particularly in the more competent rocks such as granite, throughout the Blind River–Elliot Lake area (Robertson 1960; 1961; 1962; 1963a; 1963b). Thereofe, it is concluded that

Photo 15



Aerial view, showing Keweenaw diabase dikes cutting well-bedded Upper Mississagi Quartzite; south shore of northwest arm Lauzon Lake, Striker township.

the diabase dikes were intruded simultaneously into a set of pre-existing fractures.

A large gabbroic intrusion forms the high ground half-way between Matinenda and Chiblow lakes. This has apparently cut out the outcrop of the Middle Mississagi Argillite. Occasional small baked argillite inclusions have been found within the gabbro. To the south, this body swings east forming a ridge along the southernmost arm of Matinenda Lake and the north shores of Emerald and Peak lakes, passing out of the map-area, just east of Peak Lake. To the north of the map-area, the body again swings east in Townships 167 and 161 (Robertson 1963a, map 2026). It thus conforms in general to the structural trends of the Chiblow anticline.

The top of a differentiated sill-like intrusion lies near the east boundary of Striker township north of Lauzon Lake. The uppermost few feet consist of a granitic rock—granophyre or, as it is commonly known, “red rock.” The rest of the body exposed in the map-area is a medium- to coarse-grained dioritic gabbro.

Both dike and sill rocks show chilled margins—these may be either sharp and unaltered, or strongly sheared with development of chlorite and veinlets of quartz, calcite, and occasional minor amounts of pyrite and chalcopyrite. The chilled marginal phases grade rapidly into medium- to coarse-grained diabase with lath-like feldspar crystals, which in turn, grade into coarse-grained gabbro. The diabase-gabbro is made up of calcic labradorite (cores *c.* An₇₀), diallagic augite with or without pigeonite, and minor quartz or micropegmatite. The pyroxenes may be fresh but are normally moderately to strongly uralitized. The accessories include magnetite, apatite, pyrite, pyrrhotite, and chalcopyrite.

In the coarser gabbroic rock, the uralitized pyroxene is replaced by a blue-green pleochroic hornblende. Large plates of chlorite may also be present. Red-brown, strongly pleochroic biotite becomes a characteristic accessory mineral and may be visible in the hand specimen. There is an increase in the amount of micropegmatite and free quartz present. The plagioclase is markedly zoned bytownite to andesine (An₈₀-An₃₃); the zoning may be continuous normal or, more frequently, broken normal, or it may be oscillatory. The accessory minerals are titaniferous magnetite (partially altered to leucoxene), red-brown biotite, sphene, apatite, chlorite (penninite), and zircon, and the sulphides, pyrite, pyrrhotite, and chalcopyrite.

In the large sill-like bodies, and in the wide dikes, the gabbro grades into a syenitic diorite characterized by a development of patches, up to several feet across, of quartz, plagioclase, and euhedral acicular hornblende crystals—the latter are blue-green in colour, may be up to an inch in length, and frequently show twinning. In vuggy patches simple quartz crystals line the cavities. Accessory minerals in the syenitic diorite include sphene, biotite, titaniferous magnetite, epidote, zircon, and the sulphides.

As noted (p. 42), there is only one occurrence within the map-area of "red rock" or granophyre. This is a fine- to medium-grained rock consisting of quartz, feldspar, and chloritized amphibole. In the hand specimen it closely resembles a granite. In thin section, the characteristic feature is the presence of quartz, oligoclase-albite, and orthoclase in micrographic intergrowth. These minerals may also occur as discrete entities. A characteristic accessory is red-brown biotite intergrown with magnetite. Sphene, apatite, and zircon may also be present. The red colour of the rock is due largely to the hematite dust in the plagioclase feldspar.

The larger masses of dioritic gabbro and the wider dikes are cut by thin dikes up to 2 feet wide. These dikes consist of fine-grained diabase and probably represent undifferentiated magma, which had been intruded into fractures in the gabbro.

Elsewhere in the Blind River area there are rare surface exposures or drillhole intersections of medium-grained, biotite-rich lamprophyre either in the gabbroic bodies or in the country rocks close to such bodies. Lamprophyre has not been recognized in the present map-area, but this is probably due to lack of outcrop rather than to absence of the rock type.

Locally, near large diabase or gabbro bodies, the country rock takes on a bright pink colour due to the formation of albite. Quartz-albite-epidote or quartz-carbonate-sulphide veins and stringers may be found in or near the border phases of gabbro or diabase. In particular, granite, quartzite, and arkose may become brick-red. Argillite and greywacke may be strongly indurated and al-

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bitized. It is clear that the diabase was the source for soda-rich hydrothermal fluids, which were able to migrate outwards. Elsewhere, but to a lesser extent, the country rocks may be chloritized. Similar features have been noted throughout the Blind River-Elliot Lake region.

Inclusions of the country rock are not common. Where present, they are usually restricted to the border phases. Some inclusions, particularly those of granite and quartzite, may be sharp and angular, and apart from albitization show little sign of interaction with the magma. Other inclusions, particularly of argillite and greywacke, are rounded and have vague boundaries, indicating that some assimilation has taken place; these inclusions are often surrounded by a thin rim of acicular amphibole crystals, the crystals being perpendicular to the contact of the inclusion and the gabbro. The large dikes in or near the Murray Fault, in the vicinity of the town of Blind River, have inclusions of quartzite up to 6 feet across. These have been described in some detail by Collins (1925, pp. 80-82). Although the boundaries of these inclusions are sharp, they have obviously been corroded, and there is a development of one or more surrounding amphibole rims. Collins suggested that there were all gradations between the unaltered inclusions and the irregular syenitic gabbro patches. It was further suggested that the "red rock" formed by differentiation of the assimilated material. However, numerous inclusions are restricted to the wide diabase dikes found in an area of pre-diabase tectonic disturbance. It is probable that the development of the syenitic patches and the "red rock" can be explained by the classical concept of differentiation *in situ* advanced by Bowen for similar rocks in the Gowganda area (Bowen 1910, pp. 658-74).

In central Scarfe township, on an outcrop east of the bend in the Clear Lake road about $\frac{1}{2}$ mile west of Pike Lake, there are exposures of a 5-foot wide, north-trending, breccia zone in Upper Mississagi quartzite (Photo 16). The breccia consists of rounded to angular blocks of feldspathic quartzite, which may have a maximum dimension of up to 6 feet, surrounded by a chloritic quartzose matrix, which passes locally into a more massive basic rock, possibly diabase. The blocks are albitized near the margin. A similar occurrence is poorly exposed on the north side of highway No. 557, east of the junction with the Clear Lake road. These breccias are reminiscent of the breccias found in the Sudbury area. At several localities elsewhere in the Blind River region, the author has seen similar breccia exposed on top of an outcrop, whereas at the base or in a cliff face a diabase dike is exposed. Thus it is believed that these breccias in the Blind River area were formed above diabase intrusions while the magma was being introduced.

Within the map-area there is no clear-cut relationship between the dikes and the sills. Locally, where the basal contacts of sills are visible, dike-like apophyses may be observed. These could represent fractures in the underlying rock filled from above, or they could be part of a feeder system. The east-striking diabase body between Blind River and Lauzon Bay of Lauzon Lake consistently shows a near-vertical contact on the south side, but on the north side sill-like contacts are locally seen. As already noted, late dikelets are present in some sectors of the differentiated gabbroic bodies, but these have not been observed to cut across the contact of the gabbro and the country rock. Elsewhere in the Blind River-Elliot Lake area, notably in the Whiskey Lake sector (Robertson 1962, p. 45), there is some evidence that dikes tend to be later than sills.

The structural significance of the distribution of diabase is discussed on pages 51-52.

Thus the greater part of the "Keweenaw" (as used in this report) was a period of hypabyssal basic intrusions. Some of these formed as sill-like bodies strongly differentiated from gabbro to granophyre ("red rock"), with lamprophyric segregations and albitic and chloritic end-stage hydrothermal fluids, which invaded and altered the country rock. Other bodies, possibly later in age, were intruded as diabase to quartz diabase dikes showing marked structural control.

Photo 16



Intrusion breccia: Partially albitized Upper Mississagi Quartzite surrounded by chloritic diabase; near Clear Lake road, central Scarfe township.

Olivine diabase has been mapped at only one locality, as a thin, northwest-striking dike, in the southeast corner of Mack township, between Magog Lake and Intersect Lake. The chief minerals are labradorite, augite, and magnesium-rich olivine; the main accessory is magnetite. The weathered surface shows an excellent diabase texture and is rusty brown with a marked tendency to spheroidal weathering. Olivine diabase observed elsewhere in the region (map 2032, back pocket) has a northwest strike and cuts the Nipissing-type gabbro.

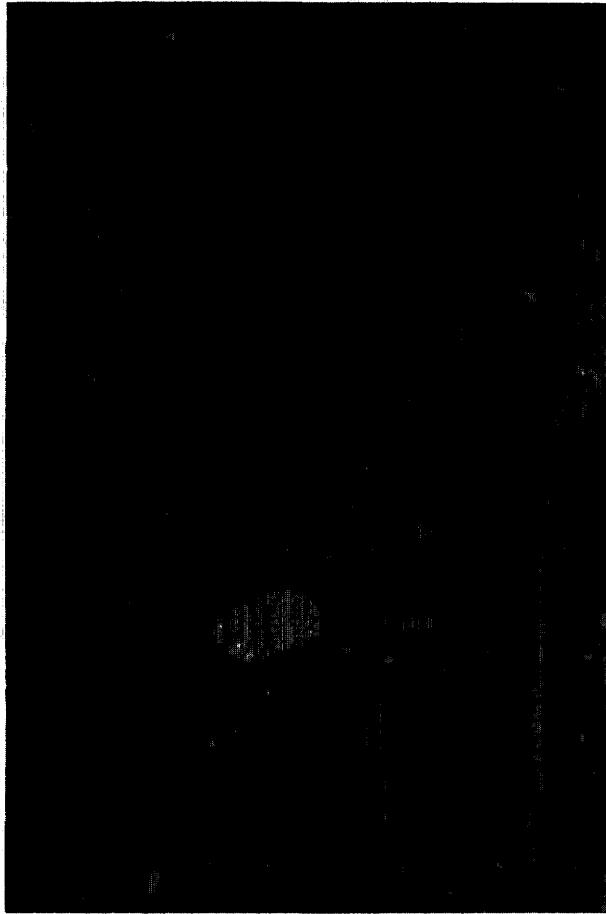
POST-PRECAMBRIAN

After the close of the Proterozoic, the area was eroded and reduced to a peneplane. In lower Paleozoic time shelf-sea deposits, now preserved on Manitoulin Island to the south and in the Hudson Bay depression to the north, probably extended over the area. The nearest exposure of Ordovician limestone is on Mississagi Island about 4 miles off shore from the mouth of the Mississagi River (Frarey 1961a). Occasional slabs of flaggy fossiliferous limestone are found on the beaches of Lake Huron; it is assumed that these have been ice-rafted from the south.

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The region was exposed and eroded throughout the greater part of post-Devonian time, with intermittent rejuvenation. The present topography was probably developed essentially between the Laramide revolution and the dawn of the Pleistocene.

Photo 17



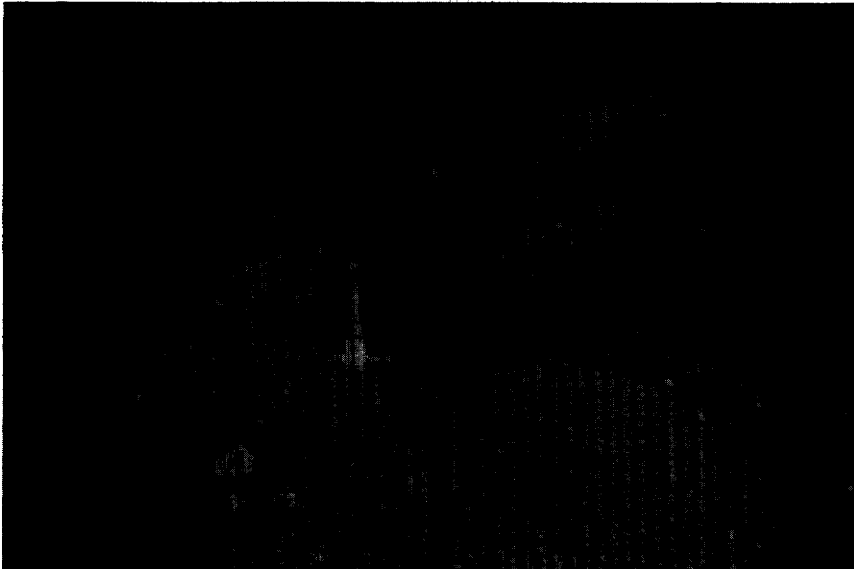
Glacial pavement on sparse boulder conglomerate Gowganda Formation; Whitefish Falls, west end of Cataract Lake, Cobden township.

During the Pleistocene the area was glaciated; the soil, which had formed, was removed. Outcrops were scoured and polished (Photo 17). Striae and chatter marks indicate that the principal direction of ice-flow was $S.15^{\circ}W$. On retreat of the ice, the till, glaciofluvial sands, clays, gravels, and occasional erratics were deposited within the area. This material occupies the low ground between the outcrops. In addition to rock types found within the map-area, there are large numbers of boulders of porcellaneous white quartzite with or without well-rounded quartz, chert, and jasper pebbles—the well-known Lorrain Quartzite.

Porphyritic diabase, with large yellow plagioclase phenocrysts, and gneiss boulders are also fairly common.

Extensive sand and gravel deposits underlie much of the southern part of Striker township; the Cobden, Pahpashcah, and Mississagi Valleys in Cobden township; and the Mississagi-Blind River delta. Mixed farming has been attempted in these areas, but most of the farms have been abandoned, except in east-central Cobden and west-central Striker where better soils developed containing more clay. Large gravel pits have been opened near highway No. 17 in Striker township, and the material has been used for highway construction and

Photo 18



Pleistocene crossbedded gravel; northwest of junction of highways Nos. 555 and 557, Cobden township.

maintenance. The sands and gravels are well-bedded, and on fresh faces cross-bedding is well displayed (Photo 18). Occasional large boulders are found. The stratified sand, gravel, and clay deposits may represent material dropped in post-glacial Lake Huron and (or) adjacent ice-dammed lakes. Along the present shore of North Channel of Lake Huron, raised beaches, filled-in lagoons, and progressive bars characteristic of an emergent coast can be identified on the ground as well as from air photographs. A former strand line can be traced along much of the south shore of Lake of the Mountains.

There is ample sand and gravel within the map-area to meet the requirements of the Department of Highways and local construction.

STRUCTURAL GEOLOGY

In addition to the main post-Huronian disturbance of the area, there is stratigraphic evidence to indicate earlier periods of tectonic disturbance. Although it has been possible to recognize locally small folds or faults as belonging to

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one or other of these earlier disturbances, observations are too limited to permit even a guess at the regional causative forces. The discussion here will, therefore, be limited to the post-Huronian structural elements listed below:

- 1) The major fold—the Chiblow anticline.
- 2) Minor folds.
- 3) Joints.
- 4) Faults.
- 5) Fractures filled by diabase intrusions.

The major structural features of the map-area are the Chiblow anticline, the axial plane of which lies close to the north edge of the map-area, and the Murray Fault system, which passes through the southern parts of Cobden and Striker townships following the Mississagi River–Blind River–Lauzon Lake depression.

1. Chiblow Anticline

The axial plane of the Chiblow anticline, the southern portion of the Blind River reverse-S structure, strikes slightly south of east across the northern parts of Scarfe and Mack townships, in the vicinity of Chiblow, Matinenda, and Pear lakes. On the west shores of Chiblow Lake (Robertson 1963b, map 2012), exposure of reliable marker beds and horizons permits reasonable determination of the fold. However, within the present map-area, the lack of definite markers makes determination less accurate.

The axis of the fold plunges west at between 1 and 8 degrees. The configuration of the axis of the Chiblow anticline is thus similar to that for the Quirke syncline to the north (Robertson 1960, pp. 157–58).

The greater part of the map-area lies on the south limb of the fold. Dips are gentle to moderate throughout the greater part of the map-area, becoming steep only as the Murray Fault is approached. In the axial-plane area there is apparently no significant difference in the dip values on the north and south limbs of the fold.

Three possible modes of origin for the major fold pattern of the Blind River region have been suggested. These are:

A compression normal to the axial planes of the folds.

Compaction folding over pre-existing Archean topography.

A northwest-southeast, right-hand shear couple associated with north-side -east movement on the Murray Fault.

The compaction hypothesis was developed prior to the extensive drilling and exploration, which has shown that the post-Huronian fold structures are transverse to the principal basement surface structures. From a regional study of bedding-plane lineations, small-scale folds, dragfolds, jointing, cleavage, faulting, and the distribution of fractures filled by diabase, the author (Robertson 1960, Chap. IV) has concluded that compression perpendicular to the axial planes of the major folds is the most likely mode of formation.

2. Minor Folds

Folds of relatively minor amplitude are common but poorly defined throughout the area. They generally represent corrugations and crumplings congruent with the main fold, and they were apparently not studied during the original field work. Near the Murray Fault such folding becomes more intense.

The Bruce Limestone (Photo 11) and, more rarely, some of the argillaceous rocks in the Gowganda Formation show dragfolding. In the Bruce Limestone, this dragfolding is normally congruent to the main fold, but other directions and plunges occur, possibly as the result of plastic flow. Some authorities (Pienaar 1958; C.I.M.M. 1957) have suggested that the small-scale folding within the Bruce Limestone is the result of penecontemporaneous slumpage, but the author has not found widespread evidence to support this view.

Data on minor folds and dragfolds collected by the author elsewhere in the Blind River camp indicate that the major folds were formed by lateral compression.

3. Joints

During the original field work, no quantitative data on jointing was collected. However, using data gathered throughout the Blind River area, the following generalizations can be made concerning joints:

1) In sedimentary rocks there is a system of joints developed parallel to and perpendicular to the bedding. These formed as a result of contraction during consolidation but may have been accentuated during later tectonic disturbances.

2) In diabase dikes and sills the best developed joints are perpendicular to and parallel to the walls of the intrusion and are cooling fractures. Those joints perpendicular to the wall often fall into a polygonal or hexagonal pattern. However, within the present map-area tectonic joints are found in diabase, indicating that the diabase was stressed after consolidation.

3) Joints and small-scale faults are well developed, particularly in the more competent rocks close to faults or diabase intrusions.

4) The whole area is characterized by vertical or near-vertical joints and small-scale faults, which often show as linears on air photographs. These fractures may be grouped by strike as follows: (1) slightly east of north, (2) northeast, (3) in an arc from east to east-southeast, and (4) southeast. Group (1) is perpendicular to, and Group (3) is essentially parallel to, the axial plane of the Chiblow anticline and to the Murray Fault. Right-hand and left-hand strike separations have been observed on both the northeast and southeast systems; however, the northeast system is characterized by left-hand strike separation, and the southeast system by right-hand strike separation. These observations suggest that the main tectonic influence in the area was a compression trending slightly east of north and slightly west of south.

4. Faults

Several faults enter or are entirely contained within the map-area. Faults were mapped largely on the basis of linears visible on the air photographs, together with evidence found in the field such as apparent displacement of outcrop, shearing and shattering of the adjacent rocks, and the presence of small-scale faults in the adjacent rocks. Normally, owing to the similarity of the rock types on opposite sides of a suspected fault, it is not possible to define the nature of a suspected fault.

All the faults postulated within the map-area are steep-dipping. It is apparent that the Murray Fault, which crosses the southern part of the area, is a

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reverse fault probably older than the Nipissing-type "Keweenaw" diabase in age. The Lake of the Mountains fault, which strikes northeast through Cobden, Striker, and Mack townships, is a strike-slip fault much later than the other structural features of the area.

The postulated faults within the map-area fall into the following five groups on the basis of strike-direction: (1) east to east-southeast, (2) northwest, (3) north, (4) northeast, and (5) late northeast.

1) East-Striking Faults

The east-striking group, which is the best developed, includes the Murray Fault and a number of closely related faults, which are steeply south-dipping reverse faults. Faults of this strike are found throughout the whole map-area, and are probably axial-plane faults formed at the same time as the Chiblow anticline. Both pre- and post-diabase faults have been identified. Many of the fractures filled by diabase are probably faults of this group.

Murray Fault

The Murray Fault strikes in an easterly direction across the southern parts of Cobden and Striker townships. The Mississagi River, the Blind River, and the southern arms of Lauzon Lake are oriented parallel to the fault. A wide zone of shattered or schistose rocks, such as that found near Spragge (O.D.M. Maps 1961, No. P.131), is not exposed. The development of a valley along the fault is, however, an indication that such a zone exists within the present map-area.

Between Blind River and the west boundary of the map-area, a wide diabase dike follows the fault zone and was apparently intruded after the main movements. Similar relationships are found east of Spragge. Close to the west boundary of the map-area, the Murray Fault is cut by the Lake of the Mountains fault, which is a northeast-striking, right-hand, strike-slip fault with a displacement of about $\frac{1}{2}$ mile. From stratigraphic evidence within the map-area and the area to the west (Robertson 1963b, map 2012) the vertical displacement of the Murray Fault is estimated at 6,000 feet (north side down), a figure similar to those obtained by Murray (Logan 1863), Collins (1925), and by Ginn (1961) near Espanola. Within the present map-area the country to the south of the Murray Fault is crossed by a number of east-striking faults, which also dip steeply south. The apparent displacement on these faults is south side up. Some have become the locus of intrusion for wide diabase dikes.

Close to the Murray Fault, Abraham obtained both S- and Z- dragfolds and suggested that several movements with different strike-slip components had taken place (Abraham 1957, p. 62). Bedding-plane lineations observed near Dean Lake (Robertson 1963b, p. 45) and near Spragge (O.D.M. Maps 1961, No. P.131) indicate that in these localities at least some of the movement was true dip slip. Aeromagnetic surveys in the vicinity of Spragge (O.D.M. Maps 1954) show anomalies displaced to the east on the north side of the fault. A similar north-side-east net slip was suggested by Ginn in the Espanola area.

2) Northwest-Striking Faults

Northwest-striking faults are well developed throughout the map-area. The majority of these are right-hand strike-slip faults and post-diabase in age.

3) North-Striking Faults

The north-striking faults are poorly developed. They strike at approximately right angles to the Murray Fault and the major fold structure. They may be associated with quartz-filled breccia zones.

4) Northeast-Striking Faults

Northeast-striking faults are not well developed but are found throughout the area. The majority of them, where identification has been possible, are left-hand strike-slip faults, post-diabase in age.

5) Late Northeast-Striking Fault

There is only one definite late northeast-striking fault. This is the Lake of the Mountains fault. This is a right-hand strike-slip fault, clearly later than either the diabase intrusions or the subsequent faults.

Lake of the Mountains Fault

The Lake of the Mountains fault strikes northeast through the map-area from Heather, on the Canadian Pacific railway track at the west margin of the map-area, to Lake of the Mountains and Magog Lake. The fault may be traced farther northeast to McGiverin Lake in McGiverin township (O.D.M. Maps 1960, No. P.70), whence it swings east through Esten township (O.D.M. Maps 1961, No. P.131) to Bellows Lake in Deagle township. In the Lake of the Mountains-Lake Magog area, the fault has a right-hand strike displacement of approximately $\frac{3}{4}$ mile, as measured on both the flat-lying Huronian sedimentary rocks and the steeply-dipping Keweenawan diabase intrusions. The true slip is, therefore, probably very close to strike-slip. To the southwest, the displacement lessens and in the Mississagi Bay area is probably from $\frac{1}{4}$ to $\frac{1}{2}$ mile (Robertson 1963b, map 2012). In the Frenchmans Bay-Heather area, the Lake of the Mountains fault displaces the Murray Fault. Wherever the Lake of the Mountains Fault has been mapped it has proved younger than other faults or than diabase of the Nipissing type.

Summary

The faults thus fall into the same strike groups as have been observed throughout the Blind River-Elliot Lake area (Robertson 1960; 1961; 1962; 1963a). The east-east-southeast group is the best developed, especially in the axial zone of the Chiblow anticline. The northeast- and northwest-striking faults are only poorly developed. In the Quirke syncline, where compression is characteristic of the axial area, the northwest faults are well developed, the axial-plane group moderately so, and the northeast group poorly developed. On a regional basis, the distribution and nature of the faults and of the fractures filled by diabase (with the exception of the Lake of the Mountains fault) suggests that they are a series of conjugate fracture systems formed to accommodate a pulsating compression oriented east of north-west of south (Robertson 1960).

5. Fractures Filled by Diabase Intrusions

The petrology and distribution of the diabase intrusions have already been discussed (page 41 *et. seq.*).

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Large, differentiated, irregular, sill-like gabbro bodies occur in a zone across Gladstone and Patton townships (Robertson 1963b, map 2012), which terminates in western Cobden township. A second zone occurs in the Matinenda Lake area of the townships of Mack, Scarfe, Township 167, and Township 161. These zones conform in a general way to the strike of the sedimentary rocks as traced round the Chiblow anticline. In the Blind River reverse-S structure, it is clear that the gabbro bodies are best developed in the lower members of the Huronian near the base of the Quirke syncline, and in the upper members of the Huronian near the nose of the Chiblow anticline, i.e., these bodies have been intruded into the naturally occurring dilatant areas of the folds. Probably such intrusion took place during a lull in the compressive forces. The bodies were able to crystallize and differentiate *in situ*; end-stage fluids carrying copper mineralization migrated upwards, and quartz-sulphide-carbonate-specularite veins were deposited in suitable traps close to the upper contacts of the intrusions.

The dikes may be either: (1) feeders or apophyses of the sills; or (2) later in age than the sills. Evidence within the map-area is not sufficient to clarify this point.

The dikes trend either east to east-southeast, or northwest. There is no apparent lithological difference between the dikes of the different directions. Cutting relations are obscure and when found are conflicting. More often dikes are seen to fork—each branch following a different strike-direction. It is, therefore, concluded, as for the rest of the Blind River area, that the diabase dikes formed at essentially the same time from the same magma and that they intruded a conjugate set of fractures. The best developed of these fractures were parallel to the axial plane of the Chiblow anticline and to the Murray Fault and were probably axial-plane cleavage fractures, which “gaped” on temporary release of the compressive forces. In normal folding, the northwest and northeast fractures would represent conjugate shear fractures, the acute angle between which would define the direction of maximum compression. (Within the present map-area, the northwest shear direction was developed to the exclusion of the northeast.)

Diabase dikes parallel to the Murray Fault are strongly developed in the Mississagi formations south of the fault. This strong structural control of diabase close to the fault, and the fact that to the east the fault zone is apparently obliterated by diabase intrusions, indicate that the diabase was intruded after the major movement on the fault had taken place.

Summary of Geological History

The geological and structural history of the Blind River area may be summarized as follows.

The oldest group consists of interbedded volcanic, pyroclastic, and sedimentary rocks (Keewatin (?) and Sudbury Group). These rocks were severely folded, metamorphosed, and intruded by granite and now appear as the host rocks in migmatite or as inclusions in granites. The granite consists of elongate elliptical bodies of red, massive, potash-rich, quartz monzonite with few inclusions, surrounded by grey to pink migmatitic to massive granodiorite to granite with numerous inclusions. Exposures within the map-area are of the latter type only.

The area was then reduced to a peneplane, with a locally preserved regolith, which probably formed under reducing conditions. Over greenstone areas valleys

and depressions formed; however, there is no indication of such features within the map-area.

Early in Huronian time, the region became one of deposition; rivers draining the land areas to the north and northwest deposited clastic sediments in a basin, which gradually encroached northwards. In the valleys and other depressions in the pre-Huronian peneplane that are found elsewhere in the Blind River area, uraniferous oligomictic conglomerates were laid down.

The Bruce Group formed in a period of shallow-water deposition intermittently interrupted so that there was a series of cycles each grading from a relatively-coarse basal member to a fine-grained upper member. Possibly much of this sedimentation took place in a cold climate. At the same time, more argillaceous, and, locally, calcareous sediments were being laid down in the Grenville geosyncline to the south and east (Quirke and Collins 1930). Facies variation from north to south within the map-area suggests that deeper water lay to the south and may indicate that part of the Grenville geosyncline underlay the site of present Lake Huron.

A more prolonged period of interruption of sedimentation separates the Bruce Group from the Cobalt Group. Folding and erosion took place during this interval, and several formations at the top of the Bruce Group found elsewhere in the area are missing within the map-area.

During Cobalt time, a heterogeneous assemblage of conglomerate, quartzite, greywacke, and shale was deposited, probably under a subtemperate climate. Some rocks are definitely water laid, some formed under seasonal freezing and thawing, and some may be of glacial origin. Younger quartzites and conglomerates, extensively developed to the north and northwest, are not found within the map-area, though the area of deposition probably extended thus far.

The area was then subjected to a north-south compression. The Chiblow anticline formed, with the south limb broken by the Murray Fault. Steeply dipping faults, joints, and fractures filled by later diabase dikes were formed and were best developed along east-southeast and northwest trends; northeast and north trends are also found but are poorly developed. Gabbro sills show a general conformity to the predictable dilatant areas of the fold. Small copper deposits are apparently genetically related to the gabbro, though the locus of deposition is controlled primarily by structural features.

Analysis of the structural features, in conjunction with a study of these features throughout the Blind River area, suggests that the area was subjected to a north-south pulsating compression. The Nipissing-type diabase was intruded during a lull in the intensity of the compressive forces. The Murray Fault may be one of a series of faults marking the boundary of the Grenville geosyncline.

Only one late olivine diabase dike has been found within the map-area. This strikes northwest, as do all other late olivine diabase dikes mapped in the Blind River area.

During glaciation the countryside was scoured by glaciers from slightly east of north. On retreat of the ice, glaciofluvial debris was deposited throughout the area. In general this is only preserved in the low ground between outcrops. However, in the southern parts of the map-area more extensive stratified sand, gravel, and clay deposits were probably laid down in post-glacial Lake Huron and smaller ice- or debris-dammed lakes.

ECONOMIC GEOLOGY

The map-area has been intensively prospected, particularly for copper and, in the period 1953-56, for uranium. In 1962 small quantities of copper ore were removed from an open pit in northwestern Cobden township. Of the industrial materials, both limestone and gravel are found; the limestone is too impure for use in the uranium mills, and the gravel is used by the Ontario Department of Highways and the local construction industry.

Uranium

The geology and the origin of the Blind River-Elliot Lake uranium deposits have been described in detail by several authors. The known ore-deposits of the region are found in pyritiferous, oligomictic conglomerate at, or near, the base of the Lower Mississagi Formation. Extensive exploration for such conglomerate (largely by diamond-drilling) was carried out in Mack and Striker townships and, to a lesser extent, in the northeastern part of Scarfe township. Active exploration ceased in 1956. The results were negative, and all ground originally staked for uranium had lapsed prior to the 1960 field season. Details of drilling are given under the property descriptions.

Sulphides

As indicated in the lithological descriptions of the various rock types found within the map-area, all types may contain disseminated sulphides, chiefly pyrite, but also minor chalcopyrite and pyrrhotite. Chalcopyrite tends to be localized by favourable structures at, or near, the contacts of the Nipissing diabase intrusions. Copper prospects were first recorded in 1906 (Corkhill 1907). In 1907, Cobden Copper Company Limited was formed to explore the northwestern part of Cobden township. In 1907 the company was reported as having a producing property, but no statistics were given (Gibson 1908, p. 21).

Following the conversion, in 1960, of the mill at the Pronto uranium mine to the production of copper concentrate, there was a marked increase in prospecting activity throughout the North Shore of Lake Huron. Within the present map-area this led to the discovery of showings in Blind River (Photo 20) immediately south of Chiblow Lake, and at the northwest end of Plump Lake, both in Scarfe township. The showings in northwestern Cobden township were re-examined, and one of these, that on the Goulding farm, was open-pitted during the summer of 1962 (Photo 19). Production was halted in July 1962.

Gravel

The areas between the outcrops of bedrock are underlain by unconsolidated material of glacial and glaciofluvial origin. The bulk of this consists of boulders, gravel, and sand. Locally, varved or massive clays are found. Extensive sand and gravel deposits occur in the southern part of Striker township; pits have been opened in these, and the material is used by the Department of Highways and the local construction industry. Large quantities of fill were obtained from this source during reconstruction of highway No. 17, in 1961.

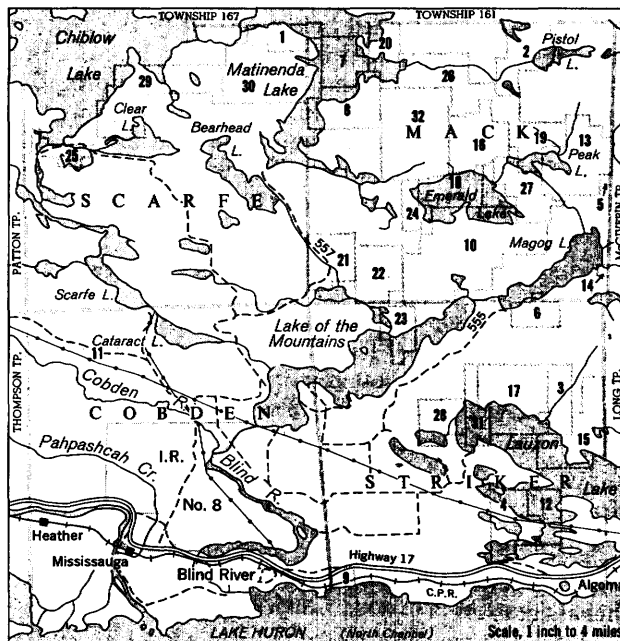


Figure 4 — Sketch map showing approximate location of properties.

PROPERTIES

- | | |
|---|---|
| 1 — Abconore Uranium Mines Limited. | 19 — Pickering Metal Mines Limited (Pear Lake Option). |
| 2 — Algom Uranium Mines Limited (Pistol Lake Group). | 20 — Power Mining Corporation (Matinenda Group). |
| 3 — Algoma Ore Properties Limited. | 21 — Power Mining Corporation (West Group, Mack Township). |
| 4 — Argoma Uranium Mines Limited. | 22 — Power Mining Corporation (East Group Option, Mack Township). |
| 5 — Bowsinque Mines Limited. | 23 — Power Mining Corporation (Two Mountains Group Option, Striker Township). |
| 6 — Bunker Hill Extension Mines Limited. | 24 — Red Bark Mines Limited. |
| 7 — Caulkins, D. P. | 25 — St. Onge Showing. |
| 8 — Duvex Oils and Mines Limited. | 26 — Talvey Metal Mines Limited (Matinenda Group). |
| 9 — Elliott, G. E. | 27 — Talvey Metal Mines Limited (Emerald Lake - Peak Lake Group). |
| 10 — Gimby, J. E. (later optioned to Harico Mining and Development Company Limited and taken over by Talvey Metal Mines Limited). | 28 — Taman Uranium Mines Limited. |
| 11 — Goulding Prospect. | 29 — Temple Gold Mines Limited. |
| 12 — Lake Lauzon Mines Limited. | 30 — United Metals. |
| 13 — Magoma Mines Limited. | 31 — Virginia Mining Corporation. |
| 14 — Matachewan Canadian Gold Limited. | 32 — Zenmac Metal Mines Limited. |
| 15 — New Kelore Mines Limited. | |
| 16 — Norgold Mines Limited. | |
| 17 — Old Smokey. | |
| 18 — Pickering Metal Mines Limited (Emerald Lake Option). | |

Scarfe, Mack, Cobden, Striker Townships

Description of Properties

Figure 4 is a location map showing the approximate position and extent of the individual properties discussed below. Most of the material used for this section of the report is that obtained in 1954-55 by E. M. Abraham (formerly geologist with the Ontario Department of Mines), or information submitted by mining companies to the Department in order to obtain work credits. Many companies or individuals who were active in the area are no longer in business, and many records have not been preserved. Bracketed numbers following property names refer to numbered locations on Figure 4.

ABCONORE URANIUM MINES LIMITED—(1)

This company's holding lay in the northeast corner of Scarfe township and is best reached via Matinenda Lake. The property is underlain by Lower Mississagi Quartzite capped, near the west boundary, by Middle Mississagi Conglomerate. In 1955 three drillholes were located as follows:

Hole No. 1—On the shore of Matinenda Lake about 200 feet east of the Scarfe-Mack townships boundary.

Hole No. 2—1,850 feet south-southwest of No. 1.

Hole No. 3—Approximately 100 feet south of No. 2.

The following summary logs are derived from data collected by E. M. Abraham and his assistants:

HOLE No. 1
Elevation: 6 feet above Matinenda Lake.

Footage	Description
0-846	Lower Mississagi arkosic quartzite. Numerous quartz pebbles.
750-758	
846-860	Lamprophyre?
860-880	Granite.
880	End of hole.

HOLE No. 2
Elevation: 160 feet above Matinenda Lake.

This hole was collared in diabase and was abandoned while still in the diabase.

HOLE No. 3
Elevation: 125 feet above Matinenda Lake.

Footage	Description
0-4	Casing.
4-581	Lower Mississagi quartzite.
581-582.5	Shear zone.
582.5-987.5	Lower Mississagi arkosic quartzite (scattered pebble bands up to 3 inches).
987.5-994	Transition zone.
994-1,012	Granite.
1,012	End of hole.

ALGOM URANIUM MINES LIMITED—(2)¹

This company held a group of 49 surveyed claims in Township 161 and Mack township. The part lying within Mack township comprises 21 claims in the vicinity of Pistol, Pear, and Norse lakes. The whole property was known as the Pistol Lake Property. The group may be reached from either Pistol Lake in Mack township or from Bakers Bay of Matinenda Lake in Township 161, or via the disused lumber road running through Mack township. Outcrops within the property are poor. Granite with numerous inclusions is exposed at Pistol and Pear lakes and Lower Mississagi arkosic quartzite is exposed near Norse Lake.

The company carried out both geological and geophysical surveys. Thirteen drillholes, all located in Township 161, were completed to basement. Only traces of oligomictic conglomerate were found, and the claims were allowed to lapse in 1958.

ALGOMA ORE PROPERTIES LIMITED—(3)²

This company held 17 claims to the north of Lauzon Lake, in the northeast corner of Striker township. The property is best reached from Lauzon Lake.

The eastern part of the property is underlain by a differentiated gabbroic body and the western part by well-bedded, greenish, arkosic, Lower Mississagi quartzite. The gabbro body is apparently sill-like and plunges gently westward. The quartzite dips gently to the west in the northern part of the property and to the southwest in the southern part.

In 1955 a drillhole was located in the northeastern part of the property. The summary log, which follows, is derived from the company log made available by company officials.

HOLE No. 1
Elevation: 65 feet above Lauzon Lake.
Plunge at collar: vertical.

Footage	Description
0-3.....	Casing.
3-25.....	Lower Mississagi quartzite.
25-35.....	Diabase.
35-121.....	Lower Mississagi quartzite.
121-634.....	Quartz diorite.
634-636.5.....	Lower Mississagi quartzite.
636.5-641.....	Diabase.
641-842.....	Lower Mississagi quartzite, occasional argillite parting.
842-1,201.5.....	Lower Mississagi arkosic quartzite, occasional argillite parting.
1,201.5-1,365.....	Granite.
1,365.....	End of hole.

ARGOMA URANIUM MINES LIMITED—(4)

This company's holding comprised 22 claims in Striker township, to the west of the narrows in Lauzon Lake and forming the north half of lot 5, concession I; lot 5, concession II; parts of lot 4, concession II; and part of lot 6, concession III.

¹Merged June 1960 to form Rio Algom Mines Limited.

²Now Algoma Ore Properties, Division of Algoma Steel Corp. Ltd.

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Between October and December 1956, three holes were drilled on the south shore of the bay of Lauzon Lake lying north of the Ontario Hydro-Electric Power Commission transmission line.

Summary logs derived from company logs submitted for assessment credit are given below.

HOLE No. 1
Dip at collar: vertical.

Footage	Description
0-8.....	Casing.
8-1,041.....	Upper Mississagi quartzite, conglomerate, and siltstone.
1,041.....	End of hole.

HOLE No. 2
Dip at collar: vertical.

Footage	Description
0-5.....	Casing.
5-35.....	Upper Mississagi conglomerate.
35-429.....	Upper Mississagi quartzite, thin argillite beds.
429.....	End of hole.

HOLE No. 3
Dip at collar: vertical.

Footage	Description
0-3.....	Casing.
3-325.....	Upper Mississagi quartzite.
325.....	End of hole.

BOWSIQUE MINES LIMITED—(5)

This company held a group of 19 claims in McGiverin township and one claim in Mack township, to the east of the southeast end of Peak Lake. The property is best reached from either Peak Lake or McGiverin Lake.

The claim in Mack township (S.S.M. 26345) is underlain by Lower Mississagi arkosic quartzites. In 1954 the company carried out a radioactivity survey on the group. On the Mack claim, readings of up to six times background with an average of 2-3 times background were obtained. Readings in the southern part of the claim were slightly higher than those in the northern part (O.D.M. Files 63.595).

BUNKER HILL EXTENSION MINES LIMITED—(6)

This company held a 90-percent interest in nine claims in Mack and Striker townships to the south of Magog Lake. The property may be reached from Magog Lake or by a tractor road, which crosses the property.

In the Spring of 1955, diamond-drillholes were drilled at the following locations:

Hole B.1—On the north side of the above-mentioned tractor road, about 30 chains east-southeast of the southwest corner of Magog Lake.

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Hole B.2—12 chains due east of the intersection of the above-mentioned tractor road and the Mack-Striker townships boundary.

Hole B.3—20 chains east of Hole B.1.

Hole B.4—On the south shore of Magog Lake on a bearing of N.8°W. from Hole. B.3.

Hole B.5—About 25 chains southwest of Hole B.1.

The following logs are summarized from data collected by E. M. Abraham and assistants:

HOLE B.1

Elevation: 155 feet above Magog Lake.

Dip at collar: vertical.

Footage	Description
0-361	Lower Mississagi feldspathic quartzite.
361	End of hole.

HOLE B.2

Elevation: 210 feet above Magog Lake.

Dip at collar: vertical.

Footage	Description
0-5	Casing.
5-213	Lower Mississagi feldspathic quartzite.
213-223	Diabase.
223-772	Granite.
772	End of hole.

HOLE B.3

Elevation: 170 feet above Magog Lake.

Dip at collar: vertical.

Footage	Description
0-4	Casing.
4-586	Lower Mississagi feldspathic quartzite.
586-596	Transition zone.
596-637	Granite.
637	End of hole.

HOLE B.4

Elevation: 10 feet above Magog Lake.

Dip at collar: vertical.

Footage	Description
0-16	Casing.
16-375	Lower Mississagi feldspathic quartzite.
375-406	Shear zone.
406-410	Diabase (sheared).
410-425	Transition zone.
425-454	Granite.
454	End of hole.

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HOLE B.5
Elevation: 45 feet above Magog Lake.
Dip at collar: vertical.

Footage	Description
0-75.....	Casing.
75-87.....	Transition zone.
87-225.....	Granite.
225.....	End of hole.

CAULKINS, D. P.—(7)

This property takes in the greater part of Matinenda Lake lying in north-west Mack township.

Between January and March 1955, two diamond-drillholes, both drilled from ice, were put down. The following summary logs are derived from logs supplied by W. D. Sutherland, Geological Engineer, Blind River.

HOLE No. 1 (southerly hole).
Dip at collar: vertical.

Footage	Description
0.0-90.0.....	Water.
90.0-108.0.....	Mud and gravel.
108.0-635.0.....	Lower Mississagi quartzite.
635.0-637.0.....	Transition zone.
637.0-680.0.....	Granite.
680.0.....	End of hole.

HOLE No. 2 (northerly hole).
Dip at collar: vertical.
Dip at 800 feet: 88°.

Footage	Description
0.0-90.0.....	Water.
90.0-169.0.....	Mud and boulders.
169.0-792.0.....	Lower Mississagi quartzite, occasional thin, radioactive, pebble band.
792.0-801.0.....	Transition zone.
801.0-836.0.....	Granite.
836.0.....	End of hole.

Pebble bands with radioactivity more than 3 times background were intersected as follows:

Footage	Radioactivity
	× background
659.5-661.0.....	4
678.0-681.0.....	4
689.4-690.0.....	4

DUVEX OILS AND MINES LIMITED—(8)

This company's holding comprised 27 claims in Mack township to the east of the main arm of Matinenda Lake and southwest of Camp Bay. The property is best reached from Matinenda Lake. The group is underlain by Lower Mississagi feldspathic quartzite cut by diabase dikes.

In the spring of 1955 four drillholes were located as follows:

Hole No. 1—500 feet south of the south shore of Camp Bay near the northeast corner of the property.

Hole No. 2—4,000 feet south of Hole No. 1.

Hole No. 3—2,650 feet southwest of Hole No. 2.

Hole No. 4—3,000 feet west of Hole No. 3 and 200 feet east of the east shore of the main arm of Matinenda Lake.

The following logs are summarized from data collected by E. M. Abraham and assistants:

HOLE No. 1
Elevation: 50 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-5.....	Casing.
5-534.....	Lower Mississagi quartzite, occasional pebble conglomerate.
534-596.....	Diabase.
596-625.....	Granite.
626.....	End of hole.

HOLE No. 2
Elevation: 125 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-6.....	Casing.
6-663.....	Lower Mississagi quartzite. Occasional pebble conglomerate.
540-630.....	Pure white quartzite.
630-663.....	Transition zone.
663-672.....	Granite.
672-715.....	Granite.
715.....	End of hole.

HOLE No. 3
Elevation: 160 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-5.....	Casing.
5-677.....	Lower Mississagi quartzite, occasional argillite, conglomerate.
677-850.....	Diabase.
850.....	End of hole.

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HOLE No. 4
Elevation: 15 feet above Matinenda Lake.
Plunge at collar: vertical.

Footage	Description
0-5.....	Casing.
5-261.....	Lower Mississagi quartzite.
261-531.....	Diabase.
531-678.....	Lower Mississagi quartzite.
678-738.....	Diabase (strongly fractured).
738.....	End of hole.

ELLIOTT, G. E.—(9)

George E. Elliott held four claims (S.S.M. 34501-34504 inclusive) in the southwest corner of Striker township. The property is crossed by both the Canadian Pacific railway and highway No. 17. The shore of the North Channel of Lake Huron lies about 600 feet north of the south boundary of the property.

In February 1955 fourteen drillholes, totalling 210 feet, were put down in an area just north of the Canadian Pacific right-of-way and about 300 feet from the east boundary of the property. Nothing of economic importance was recorded on the summary logs submitted for assessment credit. In March and April, 1955, a further sixteen holes, totalling 402 feet, were drilled about 150 feet west of the first group. Again nothing of economic importance was recorded on the logs submitted for assessment credit.

GIMBY, J. E.—(10)

In 1953, J. E. Gimby of Sault Ste. Marie acquired a group of 38 claims lying between Emerald and Black lakes in central Mack township. The property lies in concessions I, II, and III. The property may be reached from either Emerald Lake or the northeast end of Lake of the Mountains. The greater part of the property is underlain by Upper Mississagi quartzite. Middle Mississagi conglomerate and argillite are exposed near the north and east boundaries and in a north-trending valley in the centre of the property. The basal part of the argillite is strongly sheared, and there are numerous quartz veins. There is some indication of radioactivity associated with the argillite.

In the summer of 1953 two test pits were dug on the argillite. In one of these, at the west end of Black Lake, sheared argillite with quartz veins was found to be slightly radioactive. During November and December, 1953, five drillholes, totalling 243 feet, were put down. A conglomerate bed, 8 feet thick, intersected in these holes represents the Middle Mississagi conglomerate, which is exposed northeast of Black Lake. Nothing of economic importance is recorded in the summary logs submitted for assessment credit.

In 1954 the property was optioned to Harico Mining and Development Company (*see p. 65*) and was finally taken over by Talvey Metal Mines Limited (*see p. 77*).

GOULDING PROSPECT—(11)

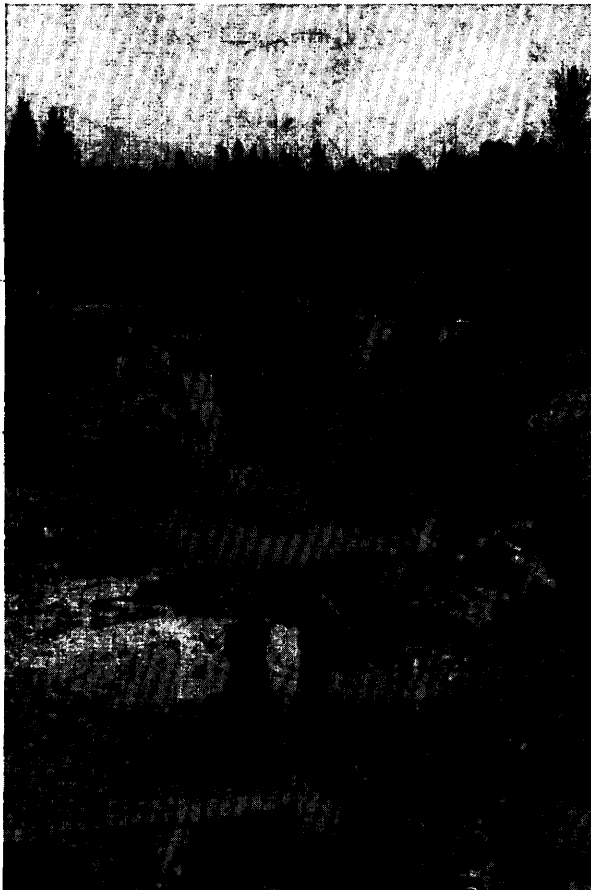
In 1955, E. M. Abraham found old pits in east-striking, chalcopryite-bearing quartz veins on the farm of William Goulding. They strike east-west in the north half of lot 10, concession V, Cobden township. The showing is believed to be one

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of those investigated by the Cobden Copper Company Limited (Corkhill 1907: Gibson 1908) in the period 1906-1907.

Following the conversion in 1960 of the mill at Pronto Uranium Mine to the production of copper concentrate, the attention of Messrs. J. St. Onge and

Photo 19



Open trench, Goulding Showing; lot 10, concession V,
Cobden township.

P. Faubert of Elliot Lake was brought to the property. In September 1961 an agreement was reached between St. Onge and Goulding permitting the former to carry out development work on the property with a view to establishing the feasibility of mining operations.

Holes were put down as follows:

HOLES DRILLED ON GOULDING PROPERTY

Hole	Dip	Bearing	Intersection
F. 1.....	-30°	N.	6 ft. quartz
F. 2.....	-30°	N.40°W.	1.43 percent cu./3.0 ft.
F. 3.....	-90°	—	2.34 percent cu./15 ft.

Following further surface exploration and drilling (details of which are not available) J. St. Onge and associates leased Mr. Goulding's farm on a royalty basis for one year starting 9 April 1962. In addition some 14 claims were staked by St. Onge and associates in the vicinity of the farm, in lots 9, 10, and 11 of concessions V and VI, Cobden township.

Surface stripping was carried out and a trench was blasted along the vein (see Figure 5 and Photo 19). A scraper operated by compressed air was used to haul the broken rock to a loading dump. The rock was trucked to Pronto Mine in Long township.

The following data on shipments is published by permission of J. St. Onge and of P. Young, manager of the Pronto Division of Rio Algom Mines Limited.

SHIPMENTS OF ORE FROM GOULDING PROPERTY

Period	Shipped	Copper Average Grade
May 1962	dry tons 263.3	percent 1.45
June 1962	222.5	1.34

The grade of individual truck-loads ranged from 1.01 percent copper to 1.46 percent copper and one load of hand-sorted ore assayed 2.10 percent copper. These grades were too low to permit economic mining and trucking, and therefore operation of the property was terminated at the end of June 1962.

On the expiry of the lease in April 1963 an option to renew the lease for a further one year period was not exercised, and all rights to the property reverted to Mr. Goulding.¹

HARICO MINING AND DEVELOPMENT COMPANY LIMITED

(See also Gimby, J. E. —(10))

In May and June, 1954, this company held an option on the ground already discussed under J. E. Gimby (p. 62) and later held by Talvey Metal Mines Limited (p. 77).

This company confirmed that the argillite was slightly radioactive. A grab sample from highly sheared argillite at the test pit at the west end of Black Lake (p. 62) contained 0.24 percent U₃O₈ (O.D.M. Files 63A.183). A test pit was dug in argillite due south of the headland on Emerald Lake. Three drillholes, totalling 53.4 feet were put down. No information of economic importance is given on the logs submitted for assessment credit.

LAKE LAUZON MINES LIMITED—(12)

The property consists of 10 claims (S.S.M. 25121-26 and S.S.M. 25131-34, inclusive) comprising lot 3 and the northeast quarter of lot 4, concession II, Striker township. The property, largely underlain by water, is in the vicinity of the narrows of Lauzon Lake; the only dry land is an island and parts of four head-

¹G. D. Cameron, barrister and solicitor, Blind River. Personal communication, June 1963.

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lands. The property is best reached by boat from Algoma or by the Ontario Hydro-Electric Power Commission transmission line.

From north to south the property is underlain by the following formations striking east and dipping south (the dip increasing from 20° in the north to 60° in the south): Upper Mississagi Formation including both conglomeratic and calcareous quartzite phases; Bruce Formation; Bruce Limestone member of the Espanola Formation; and the basal beds of the Gowganda Formation.

In the spring of 1955, a scintillometer survey was conducted on ice over the property, except for the two southernmost claims S.S.M. 25133-4. This survey failed to reveal any radioactivity anomalies (company report in O.D.M. Files 63.578).

In May 1955, a drillhole was collared on a headland in the northeast corner of the property. In July 1955, drilling was stopped at 955.4 feet. Drilling was restarted in June 1957 and terminated in August 1957.

The following log is summarized from the company logs submitted for assessment credit:

Elevation: 15 feet above Lauzon Lake.
Plunge at collar: 88°S.

Footage.....	Description ⁽¹⁾
0-3.....	Casing.
3-800.....	Grey-reddish quartzite.
800-1,550.....	Grey-reddish quartzite, argillite, conglomerate.
1,550-2,000.....	Grey-greenish, quartzite, occasional argillite.
2,000.....	End of hole.

⁽¹⁾It is not possible to assign, with confidence, boundaries to the Middle Mississagi Formation from the information provided.

MAGOMA MINES LIMITED—(13)

Magoma Mines Limited held a group of 31 claims in the Peak Lake area of east-central Mack township. The northern part of the property is underlain by the Algoman granite complex and by the large diabase intrusion striking east-west along the north shore of Peak Lake; the southern part is underlain by well-bedded Lower Mississagi arkosic quartzite cut by minor diabase intrusions.

In the period May-July, 1955, six drillholes were put down on the property, located as follows:

Hole M.1—1,000 feet west of the island in the southeast bay of Peak Lake.

Hole M.2—Southeast corner of the southeast bay of Peak Lake.

Hole M.3—1,400 feet east-southeast of M.2.

Hole M.4—750 feet southeast of M.3.

Hole M.5—200 feet southwest of M.4.

Hole M.6—700 feet south-southeast of M.1.

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The following logs are from the company logs submitted for assessment credit and from data collected by E. M. Abraham:

HOLE M.1

Elevation: 2 feet below Peak Lake.
Dip at collar: 80° on bearing N.14°E.

Footage	Description
0-5	Casing.
5-267	Lower Mississagi quartzite.
267-271	Diorite?
271-405	Lower Mississagi quartzite.
405-408	Diorite.
408-570 ¹ / ₁₂	Lower Mississagi quartzite.
568 ¹⁰ / ₁₂ -569 ¹ / ₁₂	Conglomerate, 0.02 percent U ₃ O ₈ .
570 ¹ / ₁₂ -578	Diabase.
578-725	Granite.
725	End of hole.

HOLE M.2

Elevation: 1 foot above Peak Lake.
Dip at collar: 80° on bearing N.30°E.

Footage	Description
0-9	Casing.
9-498 ¹ / ₂	Lower Mississagi quartzite.
498 ¹ / ₂ -531	Transition zone.
531-725	Granite with inclusions of greenstone, greywacke.
725	End of hole.

HOLE M.3

Elevation: 20 feet above Peak Lake.
Dip at collar: 80° on bearing N.25°E.

Footage	Description
0-7	Casing.
7-228	Lower Mississagi quartzite.
228-235 ¹ / ₂	Diabase.
235 ¹ / ₂ -419	Lower Mississagi quartzite.
419-422 ¹ / ₈	Transition zone.
422 ¹ / ₈ -436	Granite with inclusions.
436	End of hole.

HOLE M.4

Elevation: 15 feet above Peak Lake.
Dip at collar: 80° on bearing N.17°E.

Footage	Description
0-2	Casing.
2-376	Lower Mississagi quartzite.
376-385 ³ / ₄	Diorite.
385 ³ / ₄ -419	Granite with inclusions.
419	End of hole.

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HOLE M.5
Elevation: 15 feet above Peak Lake.
Dip at collar: vertical.

Footage	Description
0-15.....	Casing.
15-495.....	Lower Mississagi quartzite.
495-503.....	Transition zone.
503-542.....	Granite.
542.....	End of hole.

HOLE M.6
Elevation: same as Peak Lake.
Dip at collar: 80° on bearing N.30°E.

Footage	Description
0-3.....	Casing.
3-173½.....	Lower Mississagi quartzite.
173½-175.....	Fault breccia.
175-574½.....	Lower Mississagi quartzite.
574½-598.....	Transition zone.
598.....	End of hole.

MATACHEWAN CANADIAN GOLD LIMITED—(14)

This company held 25 claims in southeast McGiverin township to the east of Magog Lake. One claim (S.S.M. 25065) extended to the northeast end of Magog Lake in Mack township.

The property is best reached either via Magog Lake or by the tractor road near the south shore. Claim S.S.M. 25065 is underlain by granite, regolith, and the basal beds of the Lower Mississagi Formation. Geological mapping and a scintillometer survey were carried out in October and November 1954 (company reports in O.D.M. Files 63.586). Nothing of economic significance was revealed in that part of the property lying within Mack township.

NEW KELORE MINES LIMITED—(15)

This company held 27 claims in the northern Lauzon Lake sector of east-central Striker township. The property is best reached by boat from either Algoma or the west end of the north arm of Lauzon Lake. The area is underlain by interbedded quartzite, siltstone, and argillite of the Middle Mississagi Formation.

Regional airborne scintillometer surveys indicated low radioactivity anomalies on that part of the property lying north of Lauzon Lake (geophysical surveys submitted for assessment credit by Pronto Uranium Mines Limited, O.D.M. Maps 1954).

During January 1955, a scintillometer survey was carried out. This revealed eight moderate radioactive anomalies lying in three zones striking parallel to the local structure (company report in O.D.M. Files 63.582).

In May 1955, geological mapping was carried out on the property. This indicated that the radioactive zones coincided with the outcrops of siltstone and greywacke (company report in O.D.M. Files 63.582).

In order to test the siltstone argillite beds a drilling program was undertaken. Nine holes (from seven collars) were indicated by Abraham between the prominent headland on the north shore of Lauzon Lake and the Striker-Long townships boundary. The total length of these holes was 2,714 feet, and all were stopped within the Middle Mississagi Formation. No indication of economically significant radioactive material was reported (data from E. M. Abraham).

NORGOLD MINES LIMITED—(16)

In 1954, this company explored a group of 26 claims, known as the Honsberger option, lying to the north of Emerald Lake in central Mack township. The property is best reached by tractor road from the east end of the southeast arm of Matinenda Lake.

The northern part of the property is underlain by well-bedded arkosic Lower Mississagi quartzite dipping gently west, and the southern part by the massive diabase body on the north shore of Emerald Lake.

Four drillholes were put down in 1954. They were located as follows:

Hole M.1—about 4,000 feet north of the northernmost part of Emerald Lake.

Hole M.2—1,250 feet north of M.1.

Hole M.3—150 feet south of M.2.

Hole M.4—250 feet west of M.2 and M.3.

The following logs are summarized from company logs submitted for assessment credit. Elevations were taken by E. M. Abraham's assistants using a hand-barometer.

HOLE M.1
Elevation: 390 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-1.5.....	Casing.
1.5-214.0.....	Lower Mississagi quartzite.
214.0-298.5.....	Diabase.
298.5.....	End of hole.

HOLE M.2
Elevation: 438 feet above Matinenda Lake.
Dip at collar: 80° due N.

Footage	Description
0-4.5.....	Casing.
4.5-386.0.....	Lower Mississagi quartzite with occasional non-radioactive pebble band.
386.0-389.5.....	Lamprophyre.
389.5-404.0.....	Granite and diorite.
404.0.....	End of hole.

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HOLE M.3
Elevation: 438 feet above Matinenda Lake.
Dip at collar: 45°S.

Footage	Description
0.0-4.5.....	Casing.
4.5-8.5.....	Diabase.
8.5-62.5.....	Lower Mississagi quartzite.
62.5-96.0.....	Shatter zone ⁽¹⁾ quartz-carbonate veins.
96.0-100.0.....	Lower Mississagi quartzite.
100.0.....	End of hole.

⁽¹⁾Further west this zone is represented by a diabase dike.

HOLE M.4
Elevation: not determined.
Dip at collar: 45°S.

Footage	Description
0.0-4.5.....	Casing.
4.5-28.5.....	Lower Mississagi quartzite, occasional non-radioactive pebble band.
28.5-102.0.....	Diabase.
42.0-51.0.....	Fractured.
102.0-203.0.....	Lower Mississagi quartzite.
203.0.....	End of hole.

OLD SMOKEY—(17)

In 1955 a drillhole was collared on the first headland east from the west end of the north arm of Lauzon Lake. The log given here is summarized from data collected by E. M. Abraham and filed under the name Old Smokey. This hole is on ground formerly held by Fitzpatrick Uranium Mines Limited, which company is now defunct.

This property lies near the west end of the north arm of Lauzon Lake and is best reached by road and tractor road or via Lauzon Lake. The area is underlain by interbedded quartzite, siltstone, and argillite of the Middle Mississagi Formation.

HOLE No. 1
Elevation: 4 feet above Lauzon Lake.

Footage	Description
0-607.....	Middle Mississagi quartzite, siltstone, and argillite.
607-1,182.....	Lower Mississagi feldspathic quartzite.
1,182.....	End of log.

PICKERING METAL MINES LIMITED—(18, 19)

Pickering Metal Mines Limited (name was changed in March 1954, from Pickering Uranium Mines Limited) held options on two properties, both in Mack township. The larger property (No. 18 on map) covered the west half of Emerald Lake, and the smaller property was to the southwest of Pear Lake.

Emerald Lake Group (18)

This group is almost entirely underlain by water. The Middle Mississagi conglomerate and argillite probably lie near the southern and western margins of the property. Two holes were drilled: No. 1 from ice in the northern part of Emerald Lake, and No. 2 from the prominent headland on the south shore of the lake.

The following logs are summarized from data collected by E. M. Abraham:

HOLE No. 1
Elevation: Lake level.
Dip at collar: vertical.

Footage	Description
0-95.....	Water.
95-108.....	Mud and silt.
108-526.....	Lower Mississagi quartzite.
526.....	End of hole.

HOLE No. 2
Elevation: 35 feet above Emerald Lake.
Dip at collar: vertical.

Footage	Description
0-3.....	Casing.
3-714.....	Lower Mississagi quartzite.
714-740.5.....	Lower Mississagi argillite, quartzite.
740.5-1,207.....	Lower Mississagi quartzite.
1,207.....	End of hole.

Pear Lake Group (19)

The greater part of the property is underlain by well-bedded arkosic Lower Mississagi quartzite dipping gently west; the northeastern part is underlain by the Algonian granite complex. One drillhole was put down, and a summary log, from data collected by E. M. Abraham, is given below:

Elevation: 270 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-5.....	Casing.
5-105.....	Lower Mississagi quartzite with occasional pebble bands.
105-119.....	Transition zone.
119-160.....	Granite (partly gneissic).
160.....	End of hole.

POWER MINING CORPORATION—(20, 21, 22, 23)¹

The properties held by this company were located as follows:

- 1) 15 claims, to the north of Camp Bay, Matinenda Lake in northwest Mack Township and the adjacent part of Township 161. (The Matinenda Group.)
- (20)

¹Name changed in 1956 from Power Uranium Co. Ltd.

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2) 18 claims, north of Skull Lake in the southwest corner of Mack township. (West group, Mack township, also known as Heron Group.) (21)

3) An option on 19 claims to the northeast of Skull Lake adjoining the West Group. (East Group, Mack township.) (22)

4) An option on 12 claims in the northwest corner of Striker township lying between the south boundary of the East Group, Mack township, and the north shore of Lake of the Mountains. (The Two Mountains Group.) (23)

In 1955, an electromagnetic survey and a geological survey were carried out on all properties in order to locate the masses of diabase to be avoided in planning a drilling program (company maps and report in O.D.M. Files 63A.249).

Group 1—The Matinenda Group—(20)

The Matinenda Group lies to the north of Camp Bay, Matinenda Lake, and surrounds the east end of Brundage Bay. It is best reached from Matinenda Lake. The property is underlain by well-bedded Lower Mississagi arkosic quartzite, which dips gently west.

Three diamond-drillholes were located as follows:

Hole No. 1—West-central part of the headland separating Brundage Bay and Camp Bay.

Hole No. 2—East shore of Brundage Bay, 450 feet south of the Mack-Township 161 boundary.

Hole No. 3—Northeast corner of the prominent bay half-way along the north shore of Camp Bay.

The summary logs that follow are derived from data collected by E. M. Abraham and assistants.

HOLE No. 1
Elevation: 2 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-8.5.....	Casing.
8.5-636.5.....	Lower Mississagi quartzite, occasional pebble bands, basal beds well sorted.
636.5-641.5.....	Quartz diorite. [Basement]
641.5.....	End of hole.

HOLE No. 2
Elevation: 8 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-3.....	Casing.
3-416.....	Lower Mississagi quartzite, no pebble bands, basal beds not well sorted.
416-419.....	Transition zone.
419-460.....	Variable granite and inclusions.
460.....	End of hole.

HOLE No. 3
 Elevation: 10 feet above Matinenda Lake.
 Dip at collar: vertical.

Footage	Description
0-2.....	Casing.
2-566.....	Lower Mississagi quartzite, scattered pebble bands.
566-567.5.....	Transition zone to granite.
567.5.....	End of hole.

A 1-foot pyritiferous pebble band at 493 feet contained 0.030 percent U_3O_8 .¹

**Groups 2-4—West Group, Mack Township—(21); East Group,
 Mack Township—(22); Two Mountains Group, Striker
 Township—(23)**

The greater part of the area is underlain by well-bedded, grey Upper Mississagi quartzite characterized by scattered quartz-chert-jasper pebble bands. The southern part of Groups 2 and 3 and the northern part of Group 4 are crossed by a large east-striking diabase intrusion. Two prominent hills are the "mountains" from which Lake of the Mountains and the Two Mountains Group take their names.

Between June and September, 1955, a deep diamond-drillhole was put down from the headland on the north shore of Lake of the Mountains east of the creek from Skull Lake.

The summary log, which follows, is derived from data collected by E. M. Abraham and assistants:

Elevation: 15 feet above Lake of the Mountains.
 Dip: at collar }
 at 1,200 feet } vertical
 at 1,780 feet }
 at 2,000 feet }

Footage	Description
0-5.....	Casing.
5-656.....	Upper Mississagi quartzite.
656-731.....	Middle Mississagi argillite.
731-745.....	Middle Mississagi siltstone [may represent conglomerate].
745-2,014.....	Lower Mississagi quartzite.
2,014-2,019.....	Badly shattered lost core.
2,019-2,029.....	Trap rock. [Basement]
2,029.....	End of hole.

The core was logged with a geiger counter, but no significant departures from the background reading were obtained.

RED BARK MINES LIMITED—(24)

This company's holding comprised 14 claims at the west end of Emerald Lake, in the southwest quarter of Mack township. The property is best reached from Emerald Lake but can be reached via the portage from the east end of the

¹F. Q. Barnes, Geological Engineer, Blind River.

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southeast arm of Matinenda Lake, or via the disused lumber road running through Mack township.

In 1954, a geological survey was made of the property. The following is from a company report on file with the Ontario Department of Mines (O.D.M. Files 63A.188):

The property of Red Bark Mines Limited is underlain by the Mississagi quartzite series which has been intruded by dykes and sills of diabase. The quartzite beds are for the most part thick and massive. The attitude of bedding where measurable indicates that the property lies along the south limb of an east-west striking anticline. Jointing is prominent in places.

Northwest striking diabase dykes are prominent across the central part of the property Smaller dykes of similar material outcrop at the south end of the property.

The north end of the property is underlain by a large diabase sill.

A number of quartz veins striking parallel to the diabase intrusions are found on the property. These are not mineralized. (O.D.M. Files 63A.188.)

Photo 20



Blind River, south of Chiblow Lake, Scarfe township. The St. Onge discoveries are in river bed, between right-hand pier of dam and rock in river bed, central foreground.
Note gentle folding in Bruce Formation, left-hand bank.

ST. ONGE, J.—(25)

In the fall of 1960, during a period of low water, copper mineralization was found in the bed of Blind River immediately south of the dam at Chiblow Lake in the northwest sector of Scarfe township (Photo 20). Subsequent exploration revealed quartz veins, with occasional lenses of massive sulphide, over a distance of 300 feet south from the dam. A total of 34 claims, covering the vicinity of the showing and Plump Lake, were acquired by J. St. Onge, E. Dumas, P. A. Faubert, and D. St. Onge. The discovery showing became known as either the St. Onge showing or the Chiblow showing. A second showing was discovered at the northwest end of Plump Lake.

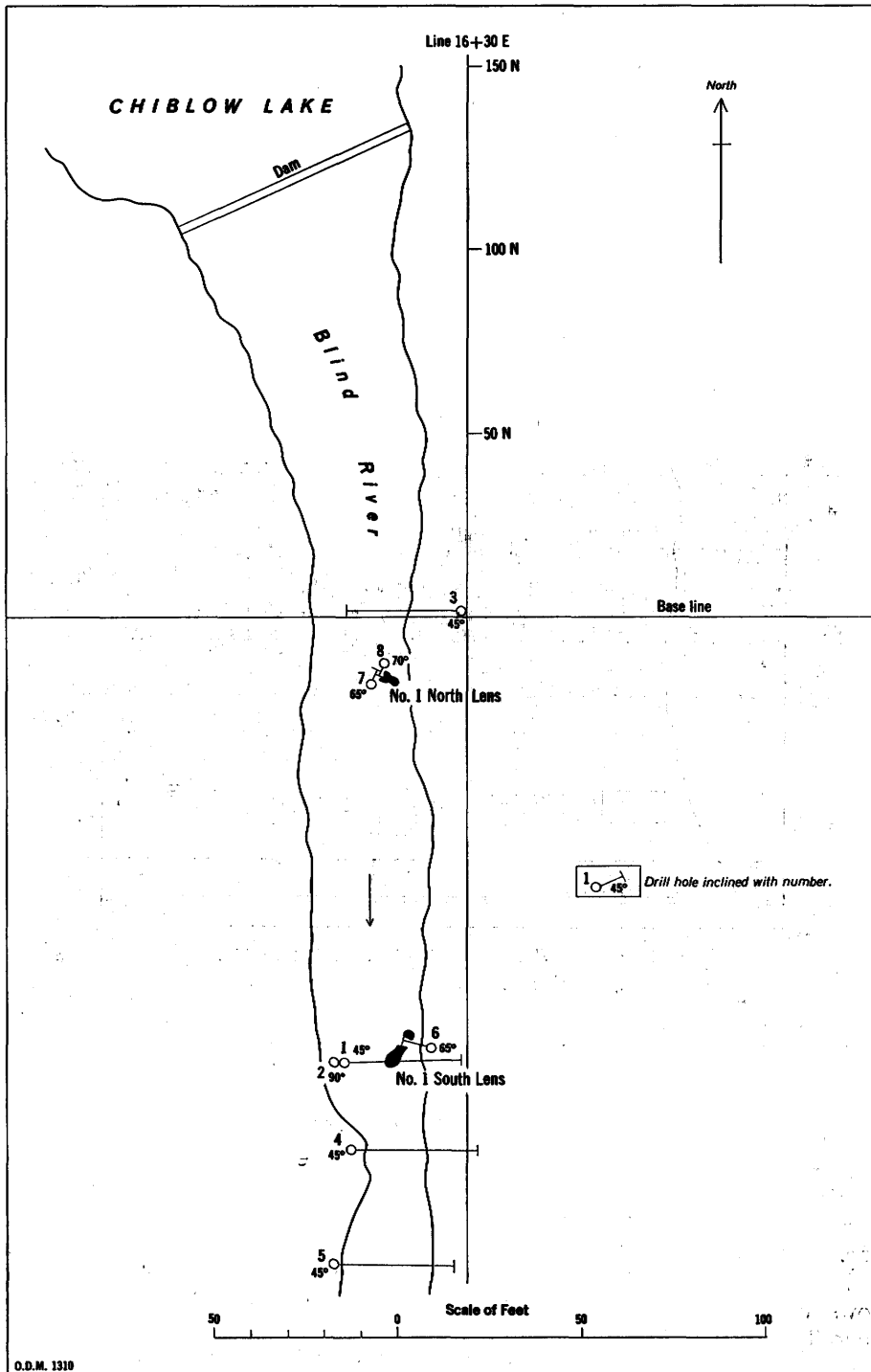


Figure 6 — Chiblow showing, Scarfe township.

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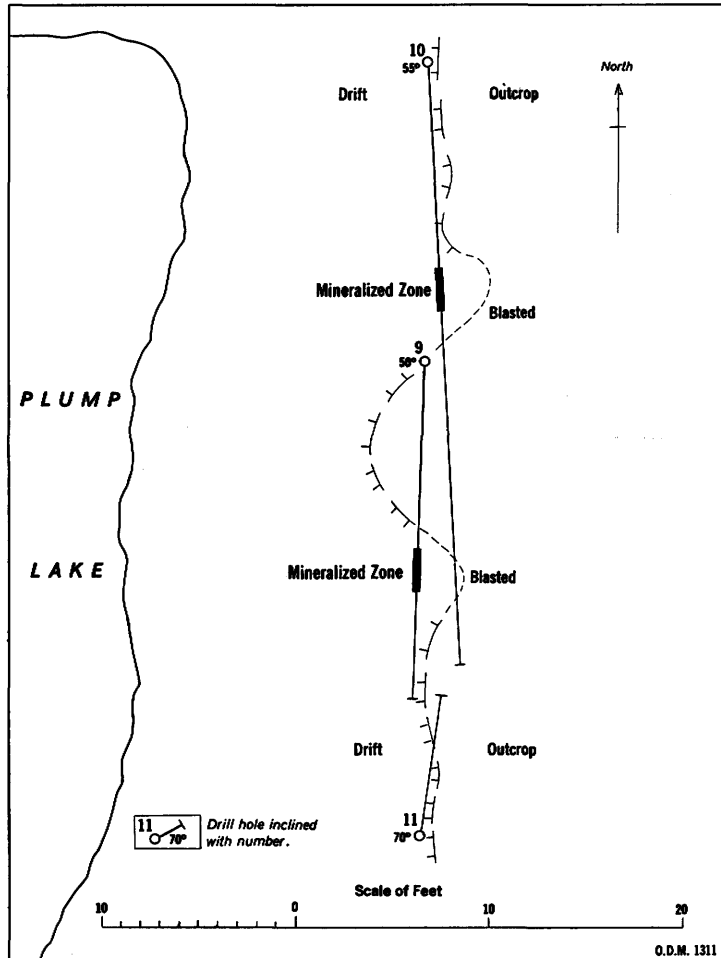


Figure 7 — Plump Lake showing, Scarfe township.

The property is best reached by plane to Chiblow or Plump lakes. The service road to the Chiblow dam is passable by ordinary vehicles to the east end of Plump Lake, beyond which four-wheel drive is necessary.

In the cliffs on the west shore of Plump Lake, the Bruce Conglomerate lies unconformably on the Upper Mississagi Formation; both dip gently southwest. The territory between Plump Lake and the Blind River is underlain by the Bruce Conglomerate. The Bruce Limestone is exposed on the east bank of the river south of the showing. The river flows in a deep gorge cut along a possible fault zone. Outcrops in the river bed show a quartzitic phase of the Bruce Formation cut by quartz veins and stringers (Photo 20). The cliff on the west of the gorge shows conglomerate, flagstone, and quartzite of the Bruce Formation dipping in a generally westerly direction. Superimposed on this regional dip are a series of low-amplitude folds plunging west. Shear zones, with or without quartz veins, lie close to the axial zones of the anticlinal folds. Farther to the west the Bruce

Limestone is again exposed dipping west. The western part of the group is underlain by conglomerate, argillite, and quartzite of the Gowganda Formation. A large, east-striking, diabase intrusion lies just north of the Chiblow dam. Typical rocks and an ore-bearing sample are illustrated in Photo 9.

In the spring of 1961, McIntyre Porcupine Mines Limited held an option on the property. Surface exploration, both geological and geophysical, and some packsack drilling were carried out.

Company officials described the showings as follows:¹

Chiblow Showing

Massive pyrite, pyrrhotite, and chalcopyrite, in small relatively flat lenses, as at the No. 1 showing, where test-pitting and diamond-drilling showed the south pod to strike south-southwest and to be 6-8 feet long, 3-4 feet wide, and 1-2 feet thick, and the north lens to strike east-west, and to be 2-3 feet long, 10-12 inches wide and 8-10 inches thick. Alteration consists of moderate silicification and chloritization.

A pit approximately 19 by 4 by 4 feet blasted on this showing (south lens of above) indicated the pod, while not fully exposed, to be 6-8 feet long, 3-4 feet wide, and 1-2 feet thick. Strike is approximately north-south and the dip is flat.

Six holes were drilled under, or along strike of this showing. This work located only traces of pyrite and pyrrhotite mineralization, and gave little or no evidence of the presence of the postulated north-south fault. [The location of the holes is shown in Figure 6.]

Two short holes were drilled and blasted under these sulphides (north pod of above). These showed the lens to strike east-west, dip vertically, and to be 2-3 feet long, 10-12 inches wide, and 8-10 inches thick.

Two short holes were put down under this showing to test for sulphides 5-10 feet below the surface. Only fine-grained, scattered pyrite was intersected. [The location of these holes is shown in Figure 6.]

Plump Lake Showing

Finely disseminated pyrite, and chalcopyrite, in a small, tight, east-west striking, vertically dipping, shear zone, as at the No. 2 showing, where diamond-drilling located sulphide mineralization, but not in economic amounts. Alteration consists of chloritization only.

Three holes drilled under the surface showing located only minor amounts of pyrite and pyrrhotite with traces of chalcopyrite. [The location of the holes is shown in Figure 7.]

McIntyre Porcupine Mines Limited allowed the option to expire, and the property was returned to the St. Onge-Faubert ownership.

TALVEY METAL MINES LIMITED—(26, 10, 27)

This company held three claim groups, all within Mack township. The first, Matinenda Group (26), comprised 18 claims to the east and southeast of the east end of Camp Bay of Matinenda Lake. The second group (10) consisted of 40 claims lying between Emerald Lake and the south boundary of Mack township; the bulk of this property was held by J. E. Gimby (*see* p. 62) and was also explored by Harico Mining and Development Company Limited (*see* p. 65). The third group (27) was made up of 17 claims covering the area between Emerald and Peak lakes.

Group 1—Matinenda Group—(26)

The first group is best reached via Matinenda Lake. In 1955, the company carried out geological mapping and a scintillometer survey on the group. The results are contained in Department files (O.D.M. Files 63A.245).

The property is underlain by well-bedded, gently west-dipping, greenish, arkosic Lower Mississagi quartzite, cut by east- and northwest-trending diabase

¹Excerpts from report to McIntyre Porcupine Mines Ltd., made available by J. St. Onge.

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dikes. The aeromagnetic map for Mack township (O.D.M. Maps 1954) shows a radioactivity anomaly to the southeast of Camp Bay. Ground scintillometer survey showed that part of the property to the south of Camp Bay to have a slightly higher level of radioactivity (2-4 times background) than that part to the east and southeast (1-2½ times background) (O.D.M. Files 63A.245).

During the summer of 1955, a drillhole was put down at the east end of Camp Bay. The following log is summarized from data collected by E. M. Abraham:

Elevation: 10 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-5.....	Casing.
5-469.....	Lower Mississagi feldspathic quartzite.
368-372.....	Abundant quartz, chert pebbles.
372-424.....	Pebble bands, common.
469-472.....	Transition zone.
472-525.....	Andesite.
525.....	End of hole.

Group 2—Emerald Lake—South Boundary of Mack Township—(10)

The general geology and early development work on this group have been discussed under J. E. Gimby (p. 62) and Harico Mining and Development Company Limited (p. 65).

In 1955, Talvey carried out geological mapping and a ground scintillometer survey (O.D.M. Files 63A.253). Taking diabase as background it was found that the Middle Mississagi argillite showed the greatest radioactivity with an average value of about four times background.

Group 3—Emerald Lake—Peak Lake Group—(27)

This group is best reached from Emerald Lake.

In 1955, Talvey carried out a geological survey and a ground scintillometer survey. The property is underlain by Lower Mississagi quartzite and feldspathic quartzite. A persistent argillite bed can be traced through the eastern part of the group. Several diabase dikes striking west-northwest cross the property.

The ground scintillometer survey indicated that the quartzite had a characteristic radioactivity of approximately twice background.

No further development work was undertaken.

TAMAN URANIUM MINES LIMITED—(28)

This company's holding comprised 12 claims at the west end of the northwest arm of Lauzon Lake, Striker township. The property may be reached either by water or by road.

Geological Report No. 20

The group is underlain by well-bedded Upper Mississagi quartzites striking northwest and dipping 10° - 20° SW. The quartzites are cut by diabase dikes. The boundary of the Upper and Middle Mississagi formations lies close to the northeast corner of the property.

In 1954, a deep drillhole was put down from the shore of Lauzon Lake in the northeast corner of the group.

The following log is summarized from the company log submitted for assessment credit:

Elevation: 10 feet above Lauzon Lake.
Dip: at collar, 85° on bearing N. 55° E.
at 500 feet, 85° .
at 1,000 feet, 84° .

Footage	Description
0.0-4.0	Casing.
4.0-307.0	Upper Mississagi quartzite.
307.0-1,121.0	Middle Mississagi interbedded quartzite and argillite.
1,121.0	End of hole.

TEMPLE GOLD MINES LIMITED—(29)

This company held 36 claims between Chiblow, Clear, and Bearhead lakes in north-central Scarfe township. The property is best reached from Bearhead or Chiblow lakes.

The greater part of the group is underlain by grey Upper Mississagi quartzite dipping gently west. The southwest corner is underlain by the large west-striking diabase intrusion to the north of Clear Lake. The eastern part of the property is underlain by the western part of the north-striking diabase intrusion forming the high ground west of Matinenda Lake. A number of westerly- and northwesterly-striking diabase dikes cross the property.

In 1955, two drillholes were put down. No. 1 was collared on the west bank of the small lake in the northeastern part of the property. No. 2 was collared about 925 feet east of the southeasternmost bay of Chiblow Lake.

The following logs are summarized from company logs and data collected by E. M. Abraham:

HOLE No. 1
Elevation not given.
Dip: at collar, 45° ; bearing not given.
at 250 feet, 52° .

Footage	Description
0.0-6.0	Casing.
6.0-206.0	Upper Mississagi quartzite.
206.0-208.6	Diabase.
208.6-228.8	Upper Mississagi quartzite.
228.8-257.0	Diabase.
257.0	End of hole.

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HOLE No. 2
 Elevation: 45 feet above Chiblow Lake.
 Dip: at collar, vertical.
 at 860 feet, 87°

Footage	Description
0-4.....	Casing.
4-492.5.....	Upper Mississagi quartzite.
492.5-532.....	Breccia zone, quartz and diabase injections.
532-769.....	Upper Mississagi quartzite.
769-1,166.....	Middle Mississagi argillite.
1,166-1,323.5.....	Middle Mississagi conglomerate.
1,323.5-2,174.....	Lower Mississagi quartzite.
2,063-2,074.....	Breccia zone with quartz veins.
2,174.0-2,267.0.....	Lower Mississagi quartzite with scattered pebbles, no significant radioactivity.
2,267.0-2,301.0.....	Granite.
2,301.0.....	End of hole.

UNITED METALS—(30)

The property held by this company lies to the west of Matinenda Lake, in the northeast corner of Scarfe township and the adjacent parts of Mack township. The property is best reached via Matinenda Lake.

The west half of the property is underlain by the large diabase intrusion west of Matinenda Lake, and the east half by Middle Mississagi conglomerate forming a capping over Lower Mississagi quartzite.

One diamond-drillhole was put down in the northeast corner of the property just southeast of the three holes on the adjacent Abconore property (page 55). The following log is summarized from data collected by E. M. Abraham:

Elevation: 50 feet above Matinenda Lake.
 Dip at collar: vertical.

Footage	Description
0-2.6.....	Casing.
2.6-128.....	Lower Mississagi quartzite.
128-132.....	Quartz veins with pyrite.
132-871.....	Lower Mississagi arkosic quartzite.
565-568.....	Quartz veins.
573-586.....	Quartz veins with sulphides.
653-655.....	Quartz veins.
767-833.....	Numerous small pebble bands.
807-808.....	Quartz veins with sulphides.
868-869.....	Fractured.
871-917.....	Lower Mississagi quartzite, well-washed.
915-917.....	Quartz veins.
917-922.....	Transition zone.
922-946.5.....	Granite.
946.5.....	End of hole.

VIRGINIA MINING CORPORATION—(31)¹

This company held a group of 10 claims near the west end of the northwest arm of Lauzon Lake. The southern part of the property is underlain by the lake, and the northern part by interbedded quartzite, argillite, and siltstone of the Middle Mississagi Formation.

In 1955, a drillhole was sunk on the northern part of the property. The following log is summarized from data collected by E. M. Abraham and assistants:

Elevation: 60 feet above Lauzon Lake.
Dip at collar: vertical.

Footage	Description
0-2.....	Casing.
2-468.....	Middle Mississagi quartzite, siltstone, and argillite.
468-799.....	Lower Mississagi quartzite.
469-783.....	Much broken core, quartz veins, chlorite coated fractures.
799-882.....	Diabase.
882-1,394.....	Lower Mississagi arkosic quartzite.
1,393.....	Six-inch leached pyritiferous pebble band.
1,394-1,428.5.....	Granite.
1,428.5.....	End of hole.

ZENMAC METAL MINES LIMITED—(32)

This company held several claim groups within the map-area. These were optioned in 1954 to Stancan Uranium Corporation.²

The only group for which assessment work has been filed lies in Mack township, northeast of the east end of the southeast arm of Matinenda Lake, and southeast of the east end of Camp Bay. The group is best reached by tractor road from the east end of the southeast arm of Matinenda Lake. The area is also reached via the lumber road leading to Pistol Lake.

The property is underlain by well-bedded arkosic Lower Mississagi quartzite, dipping gently west to southwest and cut by several east- and northwest-trending diabase dikes. A large diabase intrusion lies close to the south boundary of the property.

In the period November 1953-January 1954, four drillholes were put down by Zenmac Metal Mines Limited. These were located as follows:

Hole No. 1-1—1,650 feet east-northeast of the east end of the southeast bay of Matinenda Lake.

Hole No. 1-2—1,000 feet northeast of hole No. 1-1.

Hole No. 1-3—2,100 feet east-northeast of hole No. 1-2.

Hole No. 1-4—450 feet east of hole No. 1-3.

¹Name changed, September 1954, from Belleville Gold Mines Limited.

²Name changed in 1960 to Stanward Corporation.

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The following logs are derived from company logs submitted for assessment credit:

HOLE No. 1-1
Elevation: 260 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-5.....	Casing.
5-369.....	Lower Mississagi quartzite.
369-370.....	Diabase.
370-584.....	Lower Mississagi quartzite.
584-598.....	Lower Mississagi conglomerate.
598-612.....	Granite.
612.....	End of hole.

HOLE No. 1-2
Elevation: 280 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-3.....	Casing.
3-551.....	Lower Mississagi quartzite with occasional non-radioactive conglomerate bed.
551-554.5.....	Granite.
554.5-556.....	Diabase.
556-565.....	Granite.
565.....	End of hole.

HOLE No. 1-3
Elevation: 220 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-2.5.....	Casing.
2.5-395.....	Lower Mississagi quartzite.
395-501.....	Diabase.
501.....	End of hole.

HOLE No. 1-4
Elevation: 165 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-1.....	Casing.
1-82.....	Lower Mississagi quartzite.
82-246.....	Diabase.
246.....	End of hole.

After the property was taken over by Stancan in 1955, three further drillholes were put down. These were located as follows:

Hole Z-1-1—3,600 feet southeast of the southeast corner of Camp Bay.

Hole Z-1-2—2,400 feet south of hole No. Z-1-1.

Hole Z-1-3—2,650 feet south of hole No. Z-1-2 and 5,800 feet northeast of the southeast bay of Matinenda Lake.

The following logs are derived from those provided by D. S. Robertson, company geologist:

HOLE Z-1-1
Elevation: 55 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-233.....	Lower Mississagi quartzite.
233-23.....	Diabase with epidote veins.
236-342.5.....	Lower Mississagi quartzite.
342.5-1,164.....	Diabase.
1,164.....	End of hole.

HOLE Z-1-2
Elevation: 100 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-446.....	Lower Mississagi quartzite.
439-446.....	Fractured and altered quartzite.
446-672.....	Diabase.
672.....	End of hole.

HOLE Z-1-3
Elevation: 125 feet above Matinenda Lake.
Dip at collar: vertical.

Footage	Description
0-197.....	Lower Mississagi quartzite.
197-650.....	Diabase.
650.....	End of hole.

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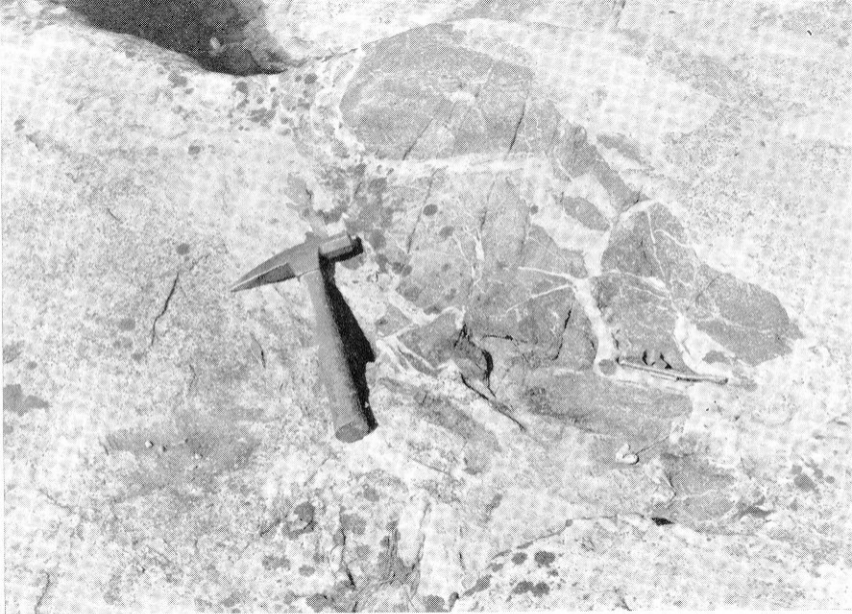
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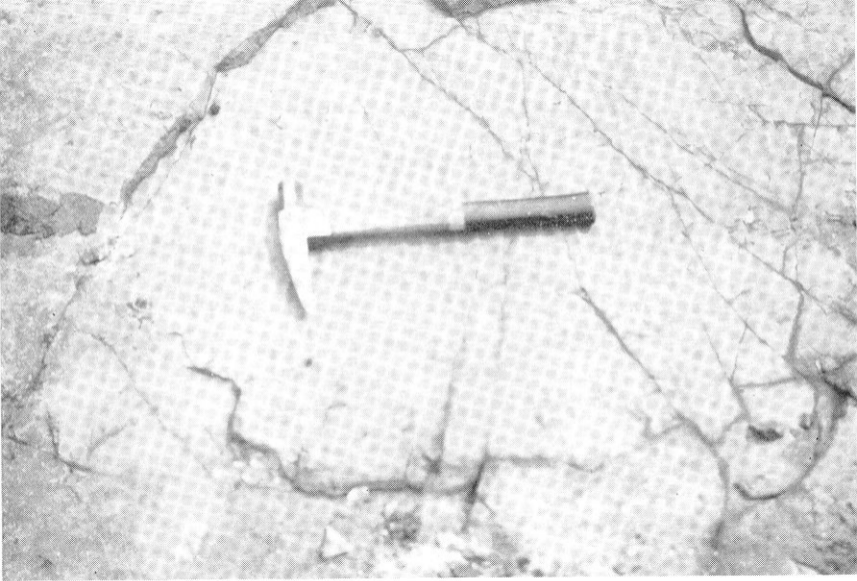
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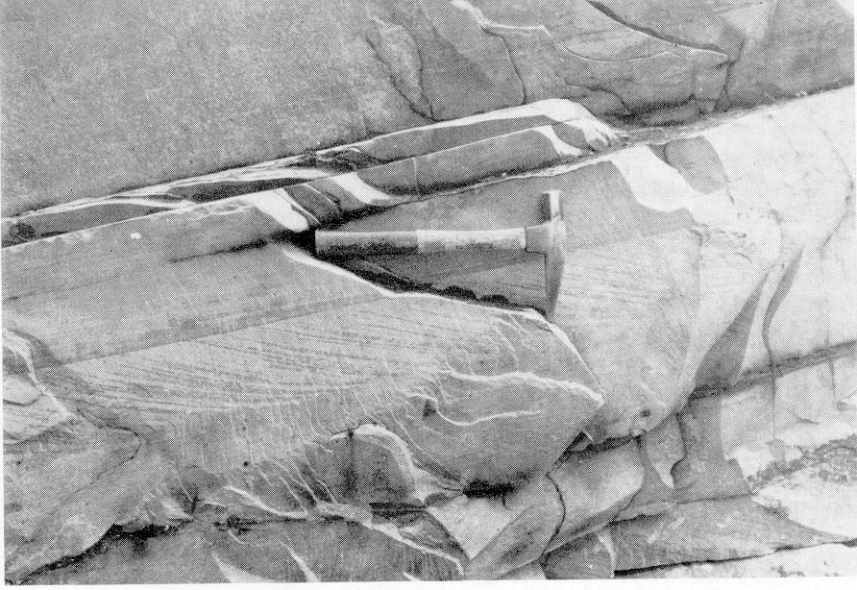
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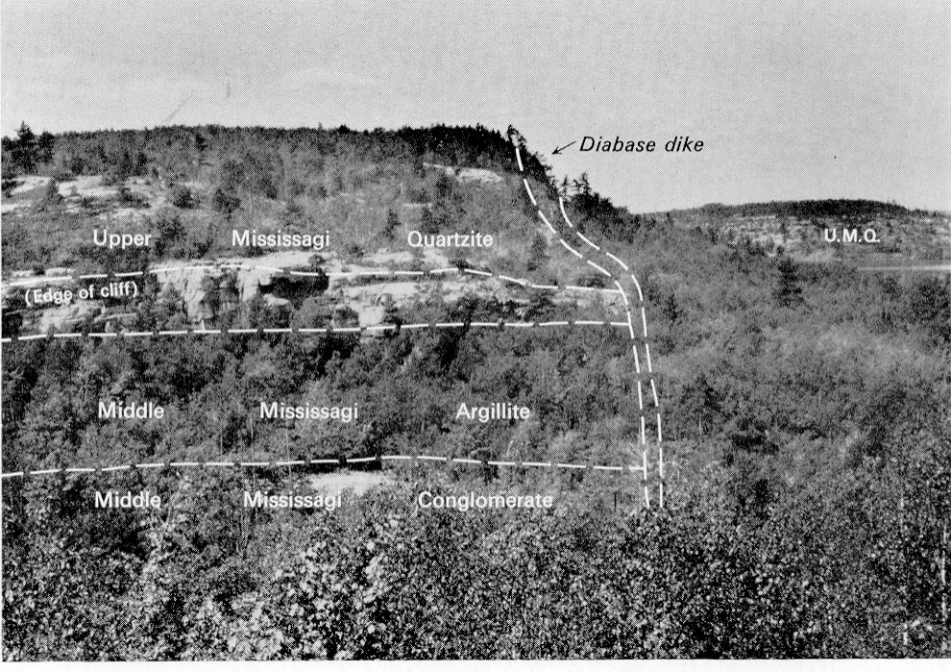












Diabase dike

Upper

Mississagi

Quartzite

U.M.O.

(Edge of cliff)

Middle

Mississagi

Argillite

Middle

Mississagi

Conglomerate

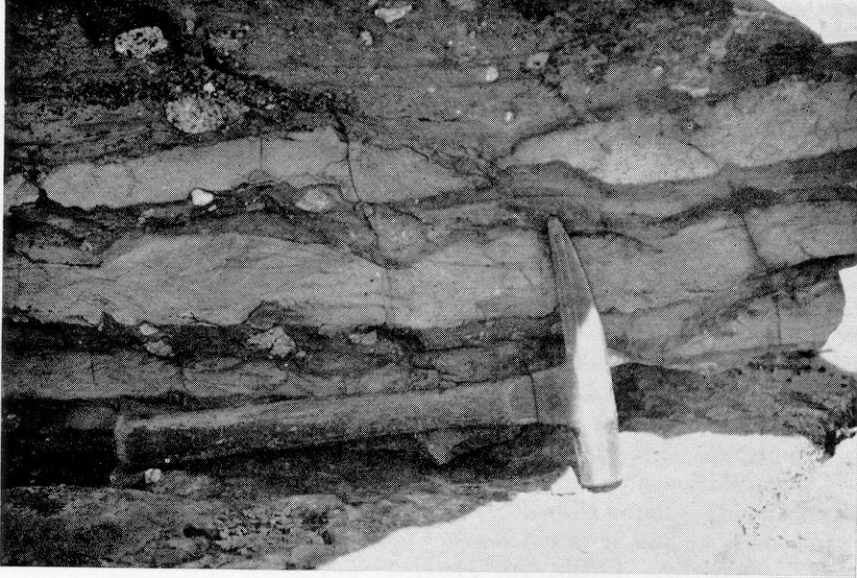
















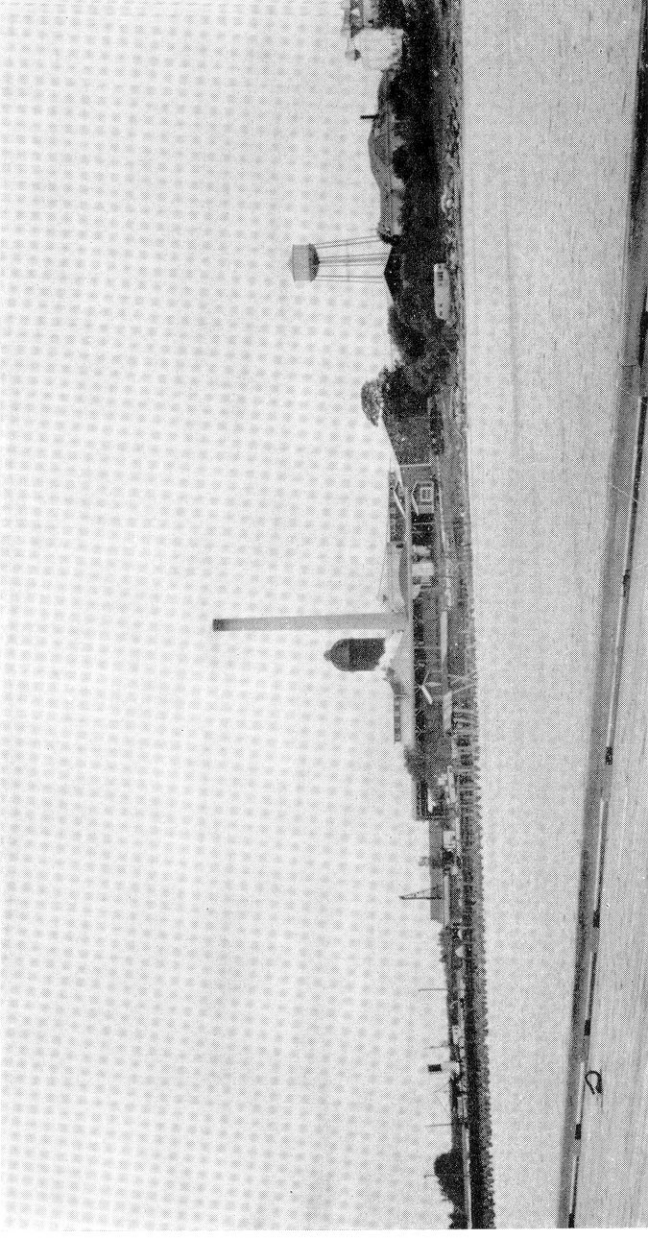


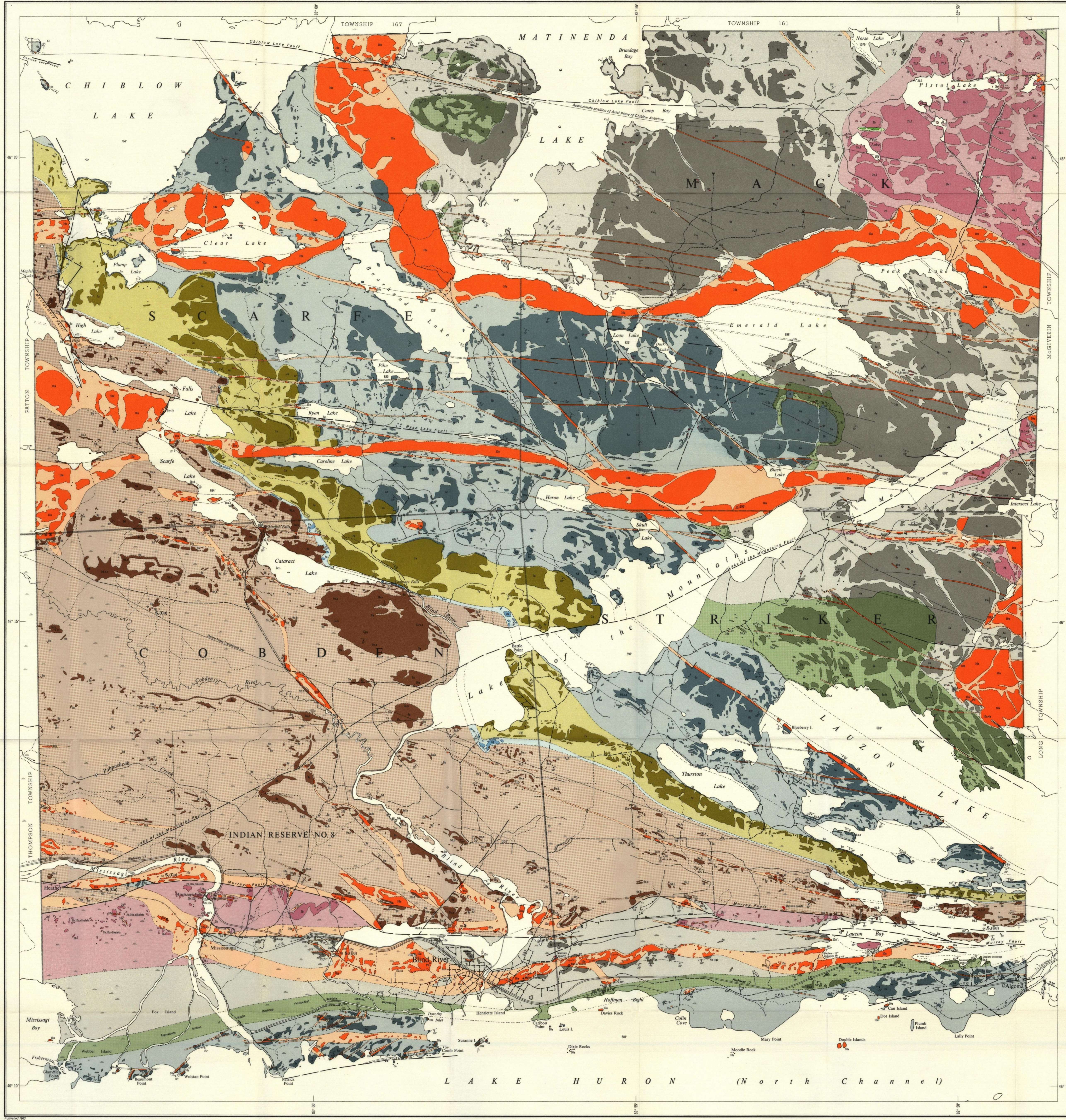
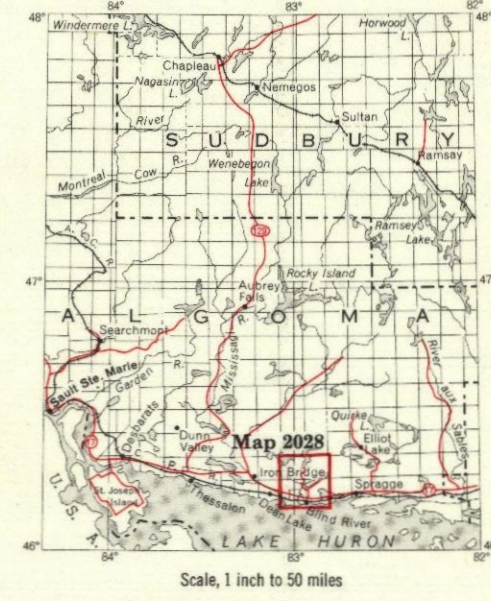












- SYMBOLS**
- Glacial striae.
 - Small rock outcrop.
 - Boundary of rock outcrop.
 - Geological boundary, defined.
 - Geological boundary, assumed.
 - Strike and dip, direction of top unknown.
 - Strike and vertical dip, direction of top unknown.
 - Strike and dip, top in direction of arrow.
 - Direction (arrow) in which inclined beds face as indicated by gradation in grain size.
 - Direction (arrow) in which inclined beds face as indicated by cross bedding.
 - Direction (arrow) in which overturned beds face as indicated by cross bedding.
 - Synclinal axis.
 - Anticlinal axis.
 - Direction of plunge of fold axis, crest line or trough line.
 - Strike and dip of schistosity.
 - Strike and dip of schistosity, dip unknown.
 - Strike and dip of gneissosity.
 - Fault, defined.
 - Fault, indicated or assumed.
 - Fault, defined, arrows indicate horizontal movement.
 - Gravel or sand pit.
 - Drillhole, not completed to basement.
 - Drillhole, completed to basement; title or no unaltered quartz pebbles conglomerate.
 - Quartz veins.
 - Network of quartz veins.
 - Sulphide mineralisation, (copper).
 - Triangulation station.
 - Altitude in feet above mean sea level.
 - Marsh or swamp.
 - River, creek, stream. Arrow indicates direction of flow.
 - Railway.
 - Highway.
 - Motor road with secondary highway number.
 - Wagon road.
 - Trail.
 - Township boundary, approximate location.
 - Indian Reserve boundary, approximate location.

- LEGEND**
- CENOZOIC**
- RECENT***
- Recent deposits.
- PLEISTOCENE***
- Pleistocene deposits.
- PRECAMBRIAN**
- PROTEROZOIC**
- KEEWATIN**
- Keweenaw.
- INTRUSIVE CONTACT**
- Olivine diorite.
 - Diorite, gabbro, and diorite cut by silic acid and basic dikes.
 - Granite.
- INTRUSIVE CONTACT**
- HURONIAN**
- COBALT GROUP**
- GOVANDA FORMATION**
- Polymictic conglomerate with or without interbedded quartzite, argillite, bitulite, gneiss, etc.
 - Felsitic quartzite with or without interbedded conglomerate, argillite, siliceous gneiss, etc.
 - Gneiss with or without interbedded conglomerate, argillite, siliceous quartzite, etc.
 - Argillite, siliceous, with or without interbedded quartzite, gneiss, conglomerate, etc.
- UNCONFORMITY**
- BRUCE GROUP**
- ESPANOLA FORMATION****
- Bruce Limestone.
- CONFORMABLE CONTACT**
- BRUCE FORMATION**
- Polymictic conglomerate with occasional lenses of quartzite and gneiss.
 - Felsitic quartzite, argillite, bitulite, gneiss, etc.
 - Gneiss with or without interbedded conglomerate, argillite, siliceous quartzite, etc.
 - Polymictic conglomerate, etc.
- CONFORMABLE CONTACT**
- UPPER MISSISSAGI FORMATION**
- Felsitic quartzite, argillite, bitulite, gneiss, etc.
 - Gneiss with or without interbedded conglomerate, argillite, siliceous quartzite, etc.
 - Polymictic conglomerate, etc.
- CONFORMABLE CONTACT**
- MIDDLE MISSISSAGI FORMATION**
- Gneiss with or without interbedded conglomerate, argillite, siliceous quartzite, etc.
 - Polymictic conglomerate, etc.
- CONFORMABLE CONTACT**
- LOWER MISSISSAGI FORMATION**
- Felsitic quartzite, argillite, bitulite, gneiss, etc.
 - Polymictic conglomerate, etc.
- UNCONFORMITY**
- ARCHEAN**
- Granite, gneiss, etc.
- ALGOMAN**
- Granite, gneiss, etc.
- INTRUSIVE CONTACT**
- KEEWATIN?**
- Undifferentiated meta-volcanics and metasediments (as inclusions in granite).

*The Recent and Pleistocene deposits are not differentiated on this map. They occur in areas not mapped as bedrock.

**The upper members of the Espanola Formation were removed by the Govanda intrusion.

Bedrock geology, outcrops and inferred extensions of each rock unit are shown respectively in deep and light shades of the same color. Where in places a formation is too narrow to show color and must be represented in black, a short black bar appears in the appropriate block.

SOURCES OF INFORMATION

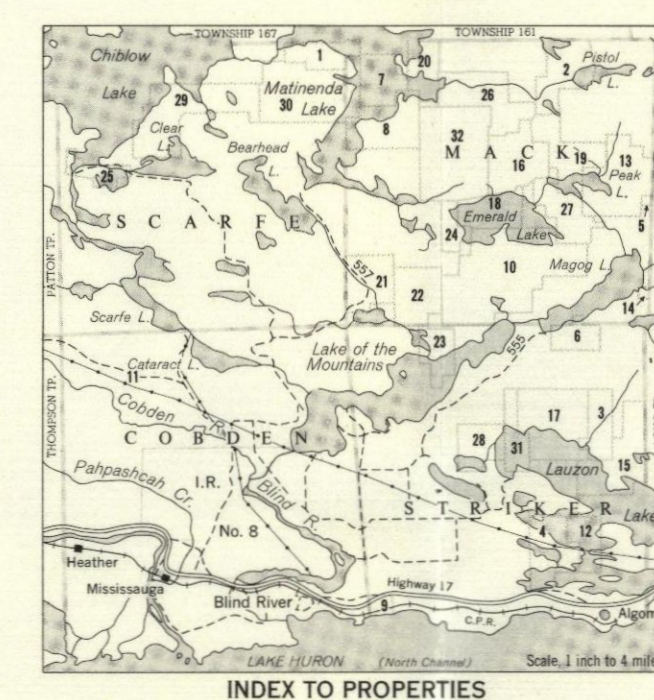
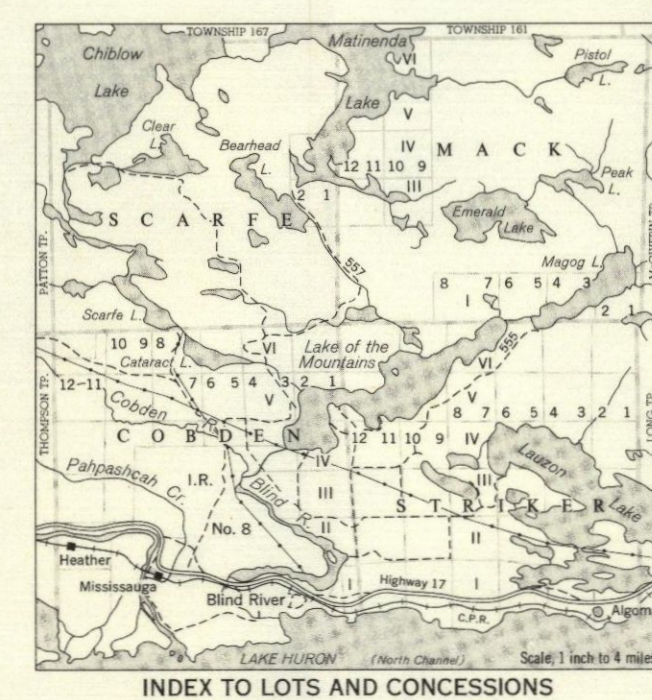
Geology by E. M. Alvarado and assistants, 1954, 1955, and by J. Robertson and assistants, 1956. Geological maps and plans of mining companies.

Cartography by R. B. Robinson, Ontario Department of Mines, 1952.

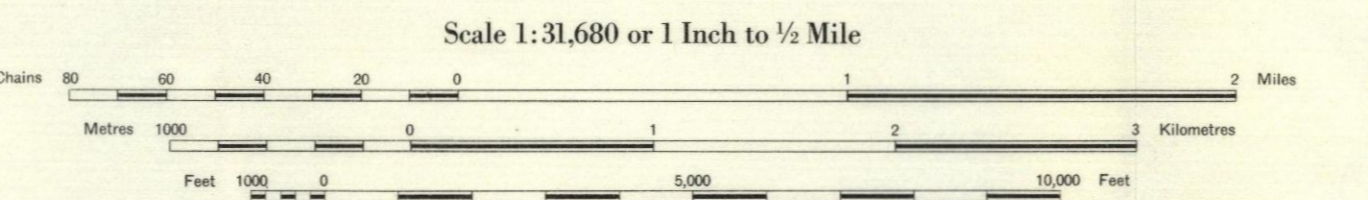
Base map derived from maps of the National Topographic Survey and the Survey of Canada. Additional information from Canadian Indian Affairs Branch, the Algonquin Park, and other sources. Boundaries on the Property Map are approximate only and not related to.

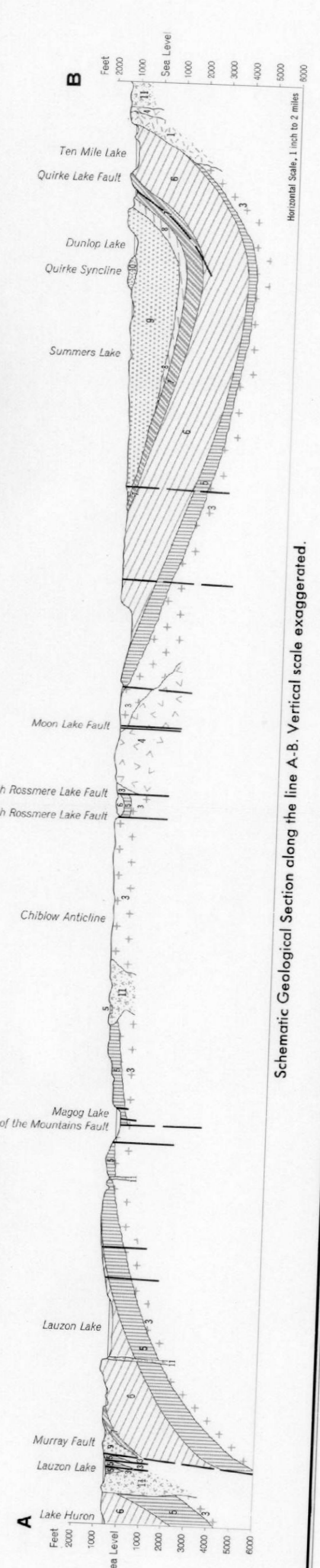
The magnetic declination in this area was approximately 6° W., 1965.

- LIST OF PROPERTIES**
1. Algonquin Uranium Mines Limited.
 2. Algonquin Uranium Mines Limited.
 3. Algonquin Uranium Mines Limited.
 4. Algonquin Uranium Mines Limited.
 5. Algonquin Uranium Mines Limited.
 6. Algonquin Uranium Mines Limited.
 7. Algonquin Uranium Mines Limited.
 8. Algonquin Uranium Mines Limited.
 9. Algonquin Uranium Mines Limited.
 10. Algonquin Uranium Mines Limited.
 11. Algonquin Uranium Mines Limited.
 12. Algonquin Uranium Mines Limited.
 13. Algonquin Uranium Mines Limited.
 14. Algonquin Uranium Mines Limited.
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 28. Algonquin Uranium Mines Limited.
 29. Algonquin Uranium Mines Limited.
 30. Algonquin Uranium Mines Limited.

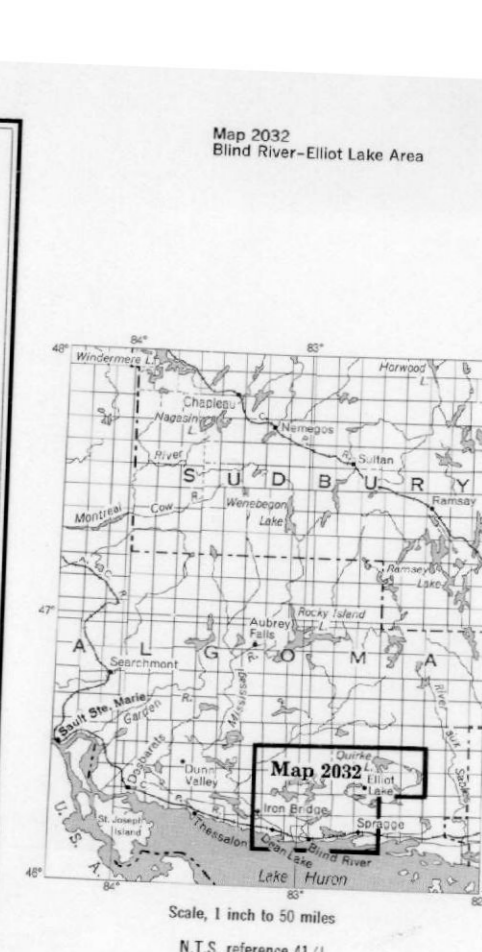
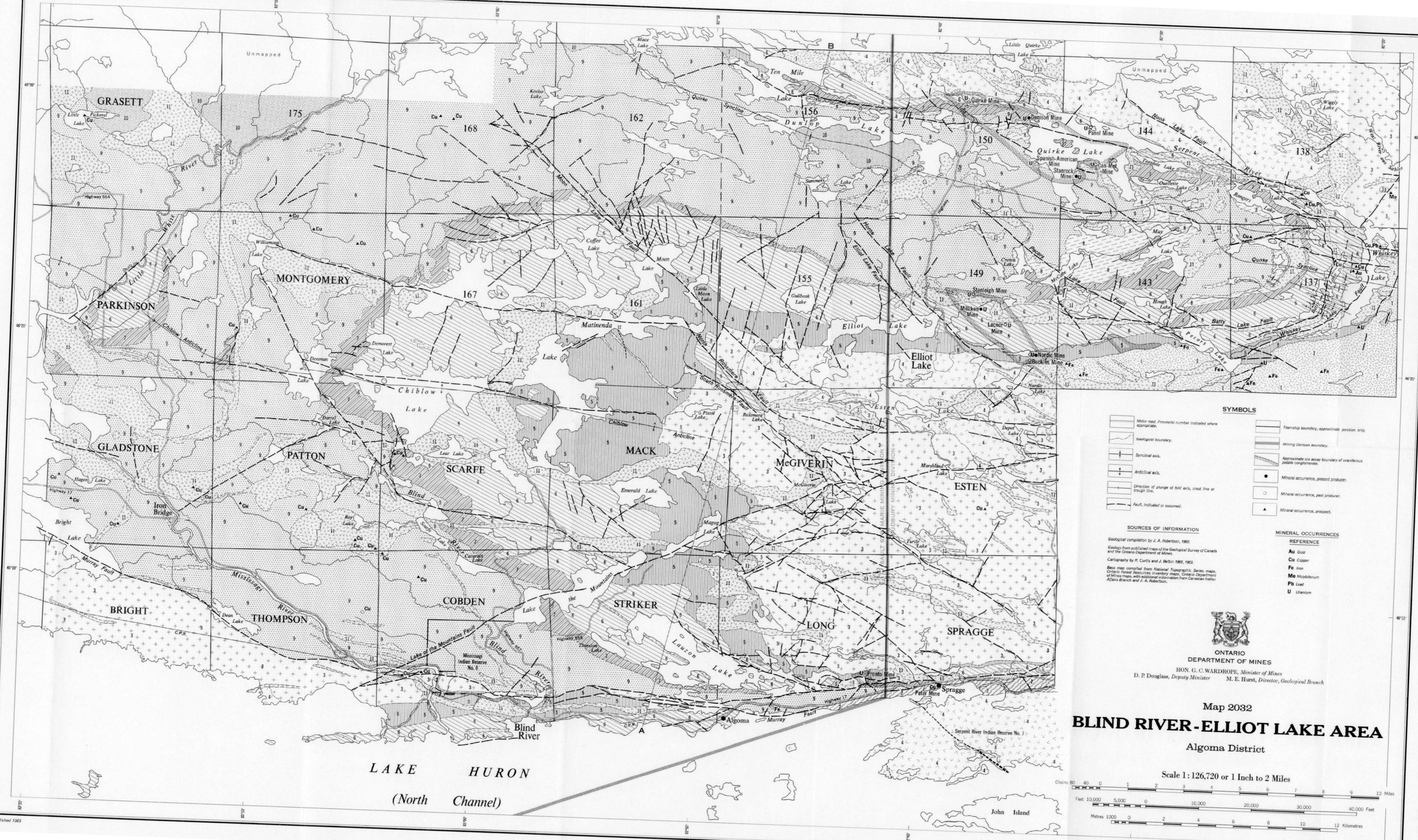


Map 2028
SCARFE, MACK, COBDEN, AND STRIKER TOWNSHIPS
 ALGOMA DISTRICT





Schematic Geological Section along the line A-B. Vertical scale exaggerated.



- SYMBOLS**
- Motor road. Provincial number indicated where appropriate.
 - Geological boundary.
 - Synclinal axis.
 - Anticlinal axis.
 - Direction of plunge of fold axis, crest line or trough line.
 - Fault, indicated or assumed.
 - Township boundary, approximate position only.
 - Mining Division boundary.
 - Approximate ore assay boundary of unclassified possible conglomerates.
 - Mineral occurrence, present producer.
 - Mineral occurrence, past producer.
 - Mineral occurrence, prospect.

- SOURCES OF INFORMATION**
- Geological compilation by J. A. Robertson, 1962.
 Geology from published maps of the Geological Survey of Canada and the Ontario Department of Mines.
 Cartography by R. Curtis and J. Belin, 1962, 1963.
- Base map compiled from National Topographic Series maps, Ontario Forest Resources Inventory maps, Ontario Department of Mines maps, with additional information from Canadian Indian Affairs Branch and J. A. Robertson.

- MINERAL OCCURRENCES REFERENCE**
- Au Gold
 - Cu Copper
 - Fe Iron
 - Mo Molybdenum
 - Pb Lead
 - U Uranium

ONTARIO DEPARTMENT OF MINES
 HON. G. C. WARDROPE, Minister of Mines
 D. P. Douglass, Deputy Minister M. E. Hurst, Director, Geological Branch

Map 2032
BLIND RIVER-ELLIOT LAKE AREA
 Algoma District

Scale 1:126,720 or 1 Inch to 2 Miles

Chains 80 0 1 2 3 4 5 6 7 8 9 10 Miles
 Feet 10,000 5,000 0 10,000 20,000 30,000 40,000 Feet
 Metres 1000 0 2 4 6 8 10 12 Kilometres

- LEGEND**
- CENOZOIC**
RECENT AND PLEISTOCENE*
 Sand and gravel, and clay.
- GREAT UNCONFORMITY**
- PRECAMBRIAN**
PROTEROZOIC
KEWEENAWAN
 Olivine diabase.
 Quartz diabase.**
- INTRUSIVE CONTACT**
- HURONIAN**
COBALT GROUP
 Gairn Formation: Quartzite.
 Givens Formation: Conglomerate, quartzite.
- UNCONFORMITY**
- BRUCE GROUP**
 Serpent Formation: Quartzite.
 Bruce and Estabrook Formations: Conglomerate, limestone, ironstone.
 Middle and Upper Missisquoi Formations: Conglomerate, quartzite, quartzite.
 Lower Missisquoi Formation: Quartzite, conglomerate.
- GREAT UNCONFORMITY**
- ARCHEAN**
ALGOMA GRANITE
 Massive red granitic rocks.
 Intrusive contact †
 Gneiss to massive, grey to pink, granitic rocks.
 Intrusive contact
SUDBURY GROUP
 Spragge Formation*** and basic intrusions: Schists, quartzite, Magnetite.
 Relationship unknown
KEEWATIN (†) GROUP
 Metavolcanics and metasediments.
- *These deposits are not shown on this map.
 **Quartzite diabase is widely termed Missisquoi diabase or Post Huronian diabase and the term Keweenaw is then restricted to the olivine diabase. Only the large diabase bodies are shown.
 ***These rocks here named Spragge Formation have previously been correlated with the Mackinac Formation.