GEOLOGICAL SURVEY OF CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

PRELIMINARY SERIES

SHEET 41

LEGEND

PALAEOZOIC

14	Limestone, sandstone, shale, siltstone

PROTEROZOIC

12 13	13. Granophyre, granophyric diabase 12. Diabase, gabbro, minor granophyre

HURONIAN

COBALT GROUP (8-11)

11	White quartzite, minor argillite
10	Variegated siltstone, interbedded chert, subordinate quartzite
9	LORRAIN FORMATION: undifferentiated arkose, quartzite, quartzite breccia, siltstone; 9a, pink to buff-weathering arkose, arkosic quartzite, and siltstone, commonly spotted; poorly bedded; minor argillite; 9b, purple siltstone and quartzite; 9c, mainly red, pink, and buff-coloured, well crossbedded pebbly quartzite; some white quartzite and pebble conglomerate; 9d, jasper conglomerate zone; white quartzite with prominent jasper-rich pebble conglomerate interbeds; 9e, dominantly white quartzite, numerous pebbly interbeds
8	GOWGANDA FORMATION: greywacke, arkose, siltstone, argillite, commonly conglomeratic, polymictic conglomerate; subordinate grey and pink-weathering impure quartzite; 8a, argillite

BRUCE GROUP (2-7)

7	SERPENT FORMATION: mainly fine-grained feldspathic quartzite; some coarser-grained quartzite, conglomerate, and siltstone
6	ESPANOLA SILTSTONE: siltstone, siltstone breccia, conglomeratic siltstone, conglomerate, fine-grained quartzite, limestone; 6a, limestone
5	BRUCE LIMESTONE: thin-bedded limestone, minor siltstone
4	BRUCE CONGLOMERATE: greywacke conglomerate, conglomeratic greywacke
2	MISSISSAGI FORMATION: feldspathic quartzite; minor argillite and conglomerate; 2a, polymictic conglomerate
3	THESSALON FORMATION: 3a, basalt, commonly amygdaloidal; 3b, rhyolite; 3c, quartzite

ARCHAEAN

1	Granite, granitic gneiss

Drift-covered area

Rock outcrop, area of rock outcrop

Geological boundary (approximate or assumed)

Bedding (inclined)

Schistosity, gneissosity, cleavage (inclined, vertical)

Fault, shear zone (approximate, assumed)

Glacial striae (direction of ice-movement known)

Tectonic breccia

Quarry (inactive)

Mineral showing or occurrence (copper, Cu; iron, Fe; radioactive substance, Ra)

Mine workings, inactive (copper, Cu; iron, Fe; gold, Au)

1. Algomont Mine
2. Bruce Mines; 2a, Copper Bay Section; 2b, Wellington Section; 2c, Taylor Section; 2d, Bruce Section
3. Havilah Mine
4. Rainbow Mine
5. Rock Lake Mine
6. Stobie Mine

Geology by M. J. Frarey, 1961

Cartography by the Geological Survey of Canada, 1962

Main highway

Other roads

Cart track

Trail

Railway

Township boundary

Post Office

Intermittent stream

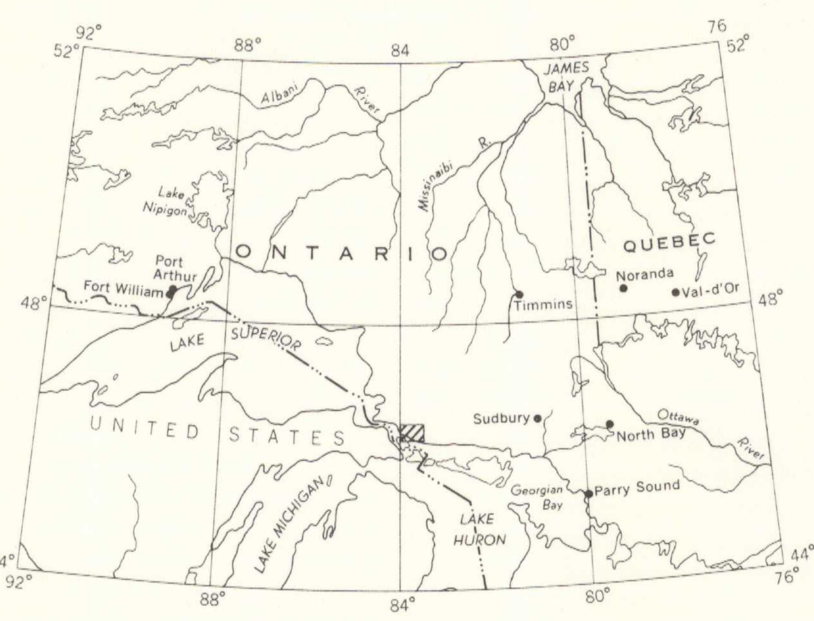
Marsh

Sand or gravel pit

Height in feet above mean sea-level

Base-map by the Army Survey Establishment, R. C. E., Department of National Defence, 1953-58

Approximate magnetic declination, 04° 51' West, increasing 0.2' annually



INDEX MAP

Adjoins Map 23-1959, "Echo Lake"

PUBLISHED, 1962
COPIES OF THIS MAP MAY BE OBTAINED FROM THE DIRECTOR, GEOLOGICAL SURVEY OF CANADA OTTAWA

PRINTED BY THE SURVEYS AND MAPPING BRANCH

MAP 32-1962
GEOLOGY
BRUCE MINES
ONTARIO

Scale: One Inch to One Mile = $\frac{1}{63,360}$

Miles

1 ½ 0 1 2 3

DESCRIPTIVE NOTES

Most of the map-area is underlain by Precambrian rocks, dominated by Huronian sediments and later diabasic intrusions. It is part of the "original Huronian area" first mapped by Murray[1] and partly described in Collins' classical study[2].

Granite and granitic gneiss (1) are confined to the northeastern corner of the map-area. They are pink- to buff-weathering, mostly medium-grained rocks, low in mafic minerals, similar to granitic pre-Huronian rocks of nearby areas[3 4 5]

The map-area appears to contain the most complete Huronian section in the region. The Bruce Group (2-7) occurs along Lake Huron in the southeastern part of the map-area and again in the north-central part. The Mississagi Formation (2) consists mainly of grey- to white-weathering, fine- to coarse-grained feldspathic quartzite, with numerous interbeds of quartzose and feldspathic grit, and conglomerate containing pebbles of black chert and subordinate jasper. West of Nesterville, some 700 feet of argillaceous sediments underlying quartzite were reported from drilling, but these beds were not seen on surface. Polymictic conglomerate (2a) carrying granitic and volcanic fragments was seen near Madill Lake near the northern edge of the area, and also intermittently northeast of Thessalon. Maximum exposed thickness of the formation appears to be about 2,500 feet. The Thessalon Formation (3) includes both the rocks near Thessalon originally named by Collins[2] and similar rocks in Aberdeen township at the northern edge of the map-area, whose extension was previously mapped[3] but not correlated. It consists dominantly of massive basic flows (3a), featureless except for numerous amygdaloidal layers. Chert-like laminations appear in the rhyolite (3b) east of Thessalon. In both areas, intercalations of quartzite, grit, and quartz-pebble conglomerate occur. The Bruce Conglomerate (4), exposed only at a few places because of overburden, consists of various fragments, chiefly grey granite and quartz, up to boulder size, scattered in a dark, quartzose matrix, and is probably not more than 150 feet thick. The Bruce Limestone (5) is an assemblage of thinly laminated, grey, cream-coloured, and brownish beds totalling possibly 150 feet. It is well exposed at Bowker Point and westward along Lake Huron, and also about a mile east of Ophir. The Espanola siltstone (6) was seen only near Bruce Mines, in particular along Lake Huron at Green Bay and on islands southeast of the village. It consists mainly of soft, dark grey to brownish-weathering, commonly delicately laminated, ripple-marked siltstone, with thin interbeds of fine-grained quartzite. The formation is marked by small-scale deformation features and by sedimentary breccia near the base. An interesting conglomeratic facies occurs on the islands southeast of Bruce Mines; it ranges from a material resembling Gowganda 'tillite'—siltstone with scattered pebbles, almost exclusively of pink granite—to conglomerate with numerous pink granite boulders and other debris. The latter was formerly mapped on Larry Island as Bruce Conglomerate[2]. The Espanola limestone member (6a) was seen only at and near Green Bay, where siltstone is overlain by thin-bedded, grey, possibly dolomitic limestone, which is not more than 100 feet thick and weathers to a deep brown corrugated surface. The Espanola Formation is estimated to be about 500 feet thick. The Serpent Quartzite (7) consists mainly of up to 600 feet of fine-grained, feldspathic, greenish to dull-white-weathering quartzite. Near Ophir, a few feet of polymictic conglomerate forms the base, and at Green Bay, conglomerate beds characterized by pink granite debris are interbedded with quartzite. On Fremlin Island, and on the nearest mainland to the west, the quartzite also contains scattered pink granitic fragments near the top of the formation. A small quartzite dyke is exposed in this vicinity.

The Cobalt Group (8-11) appears to overlie the Bruce Group with an erosional unconformity of variable magnitude. Normally it rests on the Serpent Formation with no angular discordance and contains little debris from the Bruce strata, although near Green Bay the basal conglomerate appears to include detached blocks of Serpent quartzite. However, in Rose, Galbraith, and Haughton townships in the northeastern part of the map-area, Cobalt rocks rest concordantly on the Mississagi Formation, and in the northern part of Rose township a sharp bevelling of the Bruce strata is indicated, although interpretation is hampered by lack of outcrop. The Gowganda Formation (8) consists of an irregularly interbedded assemblage of sediments up to at least 3,000 feet thick. It consists mostly of variably conglomeratic arkose, greywacke, and argillite, commonly referred to collectively as 'tillite'. The latter two types contain numerous thin lenticular intercalations of pink-weathering, mostly fine grained, impure quartzite or siltstone. These commonly are deformed or ruptured, evidently by pre-consolidation flow. Argillite commonly displays excellent bedding or lamination, but distinctly-varve-like sequences are evidently lacking. Laminated, non-conglomeratic argillite-siltstone (8a) makes up the uppermost 400 feet or so of the formation. Close-packed beach-type conglomerate forms the base on the west shore of Green Bay, grading abruptly into 'tillite'-type conglomeratic greywacke. About 250 feet of greyish impure quartzite, with some argillite, occurs apparently locally, in the middle of the formation near the western edge of Plummer Additional township, south of the Canadian Pacific Railway. The massive-bedded basal Lorrain unit (9a), which can be further divided locally, is about 1,500 feet thick in west-central Rose township, evidently thinning northwestward. West of Desbarats however, it appears to approximate that figure. Markings believed to be possible worm trails occur in this member about 1 1/2 miles northeast of Desbarats. The succeeding fine-grained purple member (9b) was only seen in the Desbarats district, where it attains a maximum thickness of about 350 feet. The coarse-grained, red, purple, and buff beds (9c) overlying unit 9b are strikingly cross-bedded. They total as much as 2,000 feet in thickness. The jasper-conglomerate zone (9d), flanked by unit 9c, is generally not well exposed, and has a variable jasper content. Where jasper-rich, it has an attractive appearance, particularly where pale green, peach-coloured or black chert pebbles also occur. The jasper-conglomerate zone has indefinite boundaries (generalized on the map) but where best defined it appears to be as much as 850 feet thick. The uppermost white quartzite member (9e) presents a monotonous succession, commonly about 2,000 feet thick, of massive, medium- to coarse-grained beds, commonly separated by a few inches of grit or pebble-conglomerate. This member forms prominent white hills between Gordon and Ottertail Lakes. Northeast of the Murray Fault, the Lorrain Formation is as much as about 6,800 feet thick. Restricted areas of Lorrain rocks about 1 1/2 miles north of Bruce Station, and also just north of Cloudslee, are interesting for their content of tectonic breccia. Two or more types of quartzite, possibly including some from the Bruce Group, occur in the breccia, as do fragments of the Gowganda Formation in the occurrences north of Bruce Station.

Soft, buff-coloured, grey, creamy and reddish siltstone forms most of the overlying formation (10), and chert intercalations a few inches thick are common. Just east of Plummer it includes limestone beds a few inches thick. The formation in many places is schistose or otherwise deformed. Around McCarroll Lake, it is approximately 1,200 feet thick. Near the north end of Diamond Lake it passes through a thin transitional zone into the succeeding white quartzite (11). This unit resembles the upper member of the Lorrain Formation, which aspect, together with the many sheared contacts in the area north and northeast of Desbarats Lake, creates some difficulty in identifying certain areas of white quartzite.

The larger diabasic masses (12) appear to be subconcordant. The diabase dykes are nearly vertical, and some cut the larger bodies (12). In some cases, diabase intrusions mark the positions of faults. Granophyre (13) is intergradational with diabase.

The Palaeozoic strata of St. Joseph Island are almost entirely concealed by overburden. They are believed to be mainly of Middle Ordovician age.

The strata northeast of the Murray Fault form a homocline dipping moderately to the southwest, modified by a few minor flexures trending northwestward to westward, notably in Meredith, Galbraith, Haughton and Plummer townships. The rest of the Huronian terrain is occupied by a faulted, westerly plunging anticline. The Murray Fault and a number of subparallel breaks south of it are apparently south-dipping thrusts. In the west half of the map-area the Murray Fault branches and enters a zone of parallel faults and is difficult to define. Almost all of this zone between Desbarats Lake and McCarroll Lake is strongly deformed. Movement on the northwest-trending fault along the Canadian Pacific Railway may have been essentially vertical. Around Desbarats Lake, sub-rectilinear fractures, some filled by diabase, possibly involved minor movements. The diabase body crossing Rock Lake marks an east-west fault involving right-hand displacement.

Quartz-carbonate veins bearing pyrite, chalcopyrite, bornite, and specularite are numerous. Those in diabase include the historic workings at Bruce Mines, operated between 1848 and 1921[6 7], the former Algomont Mine in the northwest corner of Rose township, and various prospects scattered over the area. At the former Havilah Mine in Galbraith township, veins in diabase carried sufficient gold to encourage several attempts at production[2 6]. An apparently small sulphide deposit in diabase in Tarbutt township just east of Loyal Lake includes cobalt mineralization. Most other vein deposits occur in Gowganda strata. The vein deposits generally appear to be restricted in size and grade. About 2 miles northwest of Desbarats, disseminated pyrite and chalcopyrite follow certain beds in the basal member of the Lorrain Formation[7]. Hematite-rich veins, chiefly in Lorrain white quartzite, were formerly prospected[2], but are of little present economic interest. Northwest of Leeburn, in Aberdeen and Aberdeen Additional townships, hematite concentrations that may be of sedimentary origin occur in basal Lorrain beds; a limited amount of work was done here in 1961. Radioactive quartz-pebble conglomerate has been reported in Aberdeen township about 3 miles north of Ophir, and in West Thessalon township about 3 miles northeast of Thessalon. Radioactive veins in diabase also occur just west of Desbarats Lake and, reportedly, on the northeast shore of that lake. Diabase was formerly quarried for road metal at Bruce Mines and on St. Joseph Island. Jasper conglomerate was mined in 1961 not far north of the area, near Echo Lake, for the manufacture of terrazzo; possible sources of this material exist in the map-area.

[1]Murray, A.: Geol. Surv., Canada, Rept. Prog. 1858, pp. 67-100 (1859).
[2]Collins, W. H.: North Shore of Lake Huron; Geol. Surv., Canada, Mem. 143 (1925).
[3]Frarey, M. J.: Echo Lake, District of Algoma, Ontario; Geol. Surv., Canada, Map 23-1959 (1959).
[4]Frarey, M. J.: Wakwekobi Lake, District of Algoma, Ontario; Geol. Surv., Canada, Map 6-1961 (1961).
[5]Frarey, M. J.: Dean Lake, District of Algoma, Ontario; Geol. Surv., Canada, Map 5-1961 (1961).
[6]Knight, C. W.: Ont. Bur. Mines, Ann. Rept. vol. 24, pt. 1, pp. 230-235 (1915).
[7]Thomson, J. E., and others: Copper, Nickel, Lead, and Zinc Deposits in Ontario; Ont. Dept. Mines, Metal Resources Circ. No. 2 (1957).

MAP 32-1962
BRUCE MINES
ONTARIO
SHEET 41