GEOLOGICAL SURVEY OF CANADA COMMISSION GEOLOGIQUE DU CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES
MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES

GEOLOGY OF THE EAST BULL LAKE AREA RA-7

LEGEND

- 20 LATE PRECAMBRIAN DIABASE DYKES
- 19 PROTEROZOIC GRANITE
- 18 NIPISSING DIABASE
- 17 AMPHIBOLITE, DIABASE DYKES

HURONIAN SEDIMENTS

- 16a QUARTZITE, ARGILLITE
- 16b CONGLOMERATE
- 15 FELDSPAR PORPHYRY DYKES

EAST BULL LAKE GABBRO

- 14 DENDRITIC GABBRO
- 13 METAGABBRO
- 12 GABBRO
- 11a ANORTHOSITIC GABBRO
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- 11c NODULAR ANORTHOSITE GABBRO
- 10 ANORTHOSITE
- 9 GABBRO DYKES

PARISIEN LAKE SYENITE

- 8a COARSE GRAINED SYENITE
- 8b MIXED, COARSE AND MEDIUM GRAINED SYENITE
- 8c MEDIUM GRAINED SYENITE

INTERMEDIATE INTRUSIVES

- 7 DIORITE, QUARTZ DIORITE, DIORITE GNEISS
- 6 EARLY ARCHEAN GABBRO

EARLY ARCHEAN INTRUSIVES AND SUPRACRUSTALS

- 5a WACKE
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- 5c AGGLOMERATE
- 4 PORPHYROBLASTIC GRANITE
- 3 GRANODIORITE
- 3a FINE GRAINED GRANODIORITE
- 2 INTERMEDIATE METAVOLCANICS
- 1 MAFIC METAVOLCANICS

SYMBOLS

- GEOLOGICAL BOUNDARY
- DYKE BOUNDARY
- OUTLINE OF OUTCROP
- CATACLASTIC ZONE
- BEDDING (INCLINED, HORIZONTAL)
- LAYERING (VERTICAL, INCLINED, DIP UNKNOWN)
- FOLIATION (VERTICAL, INCLINED, DIP UNKNOWN)
- LINEATION (INCLINED)
- SHEARING (VERTICAL, INCLINED, DIP UNKNOWN)
- PILLOWS (TOPS)
- ROAD
- TRAIL
- BASE LINE
- BUILDING
- FIRE TOWER

METRES
1000 0 1000 2000

INDEX MAP

Regional Geology of the East Bull Lake Area

The East Bull Lake map-area is located about 35 km east-northeast of Elliot Lake, Ontario and about 26 km north-northwest of Massey, Ontario. Good access to the area is provided via highway 553 north from the Trans-Canada Highway.

The 198 km² map-area is located entirely within the Superior Structural Province. Supracrustal rocks of the Southern Structural Province occur south and immediately west of the map-area. The area is underlain by Archean metavolcanic and metasedimentary rocks, Archean granites (senso lato), Proterozoic sedimentary rocks and probable Proterozoic plutons, e.g., mafic intrusions, syenite and granite.

Steeply dipping metavolcanic and metasedimentary rocks occur in the south-western part of the map-area. Mafic metavolcanics (1) generally exhibit pillow or flow breccia textures. Intermediate metavolcanic rocks (2) contain lapilli and bomb fragments and occur as narrow belt like domains within mafic metavolcanics. Several small enclaves of wacke and conglomerate (5), composed of both meta-volcanic and granitoid clasts, are present but in general metasediments are rare within the map-area. Metavolcanic rocks were apparently intruded by medium to coarse-grained gabbro (6) prior to folding and metamorphism and subsequently intruded by diabase dykes and sills (17).

Granodiorite (3) underlies large parts of the map-area especially in the northwest and southeast corners. The granodiorite is generally medium grained, leucocratic with less than 10% biotite and exhibits a weak to moderate metamorphic foliation defined by the long axes of quartz grains and aligned biotite. Xenoliths of amphibolite occur throughout the granodiorite although in the southeastern area they are particularly large and abundant. These may be scattered roof pendants of remnant volvanic flows into which the granodiorite intruded.

Archean gabbro (6) occurs only in the western part of the map-area and intrudes the granodiorite and supracrustals. The rock is a medium to coarse grained gabbro with original clinopyroxene altered to amphibole.

Porphyroblastic granite (4) is beige to salmon pink, slightly foliated and contains undeformed porphyroblasts of subhedral to euhedral microcline, 1.0 to 10.0 cm long developed parallel to the foliation. The matrix is composed of quartz, plagioclase, microcline, biotite and subordinate hornblende. Porphyroblast content varies from about 10 to 20 per cent with local concentrations of 30 to 65 per cent. The foliation is defined by mafics, porphyroblasts and occasionally by the long axis of elongate quartz grains. Xenoliths of amphibolite are present, some with microcline porphyroblasts.

Intermediate intrusive rocks (7) occur in the northwestern part of the map-area. They are black weathering, medium grained dioritic rocks composed of plagioclase, hornblende and variable amounts of quartz.

The Parisien Lake Syenite (8) outcrops directly south of the main gabbro intrusion. It is elongate, extending approximately 13.5 km in an east-west direction and 3.25 km wide. The syenite is compositionally homogeneous consisting of well twinned potassium feldspar phenocrysts and interstitial amphibole and biotite. The matic mineral content is highly variable; it is generally less than 20% although this percentage is exceeded in some outcrops. The syenite has been separated into 3 units based on the grain size of microcline feldspar. Coarse grained syenite (8a) is porphyritic with phenocrysts ranging from 5 mm to 4.0 cm. Medium grained syenite (8c) is less porphyritic with grains from 1.0 to 5.0 mm. A mixed unit (8a) consists of outcrops containing coarse and medium grained varieties. Primary alignment of potassium feldspar occurs locally and varies considerably over short distances.

Three small, isolated bodies of medium grained syenite occur along the north boundary of the map-area immediately west of the Sauble River. These resemble the hornblende rich phase of medium grained syenite which occurs north of Renault Lake.

The East Bull Lake pluton (9, 10, 11, 12, 13, 14) occupies the central part of the map-area. It is elongate in an east-west direction, slightly more than 3 km wide with a minimum length of 13.5 km. The intrusion comprises various gabbroic rock units and two gabbro dykes which occur northwest and southeast of the main unit. Intrusive relationships with the surrounding rocks are rare although the gabbro appears to intrude the volcanic rocks to the south.

Gabbro dykes (9) strike 270° to 290°, apparently with steep dips, and vary from about 30 to 100 metres wide. These dykes have an aphanitic chill margin and a gabbro core. They are essentially plagioclase and pyroxene rocks in which pyroxene is partly altered to amphibole. Cross cutting relations between these dykes and others in the area are rare, however some relationships suggest that the diabase dykes are younger.

The outer margin on the eastern side of the intrusion is composed mainly of anorthosite (10). Minor amounts of gabbroic anorthosite or gabbro occur in some outcrops where the increase in pyroxene content results in segregated, poorly defined layers within the anorthosite. The unit is generally medium to coarse grained although pyroxene rich layers are finer grained.

Nodular anorthositic gabbro (11c) occurs only near the eastern map boundary. This unit is characterized by round to oval shaped, 3 cm to 10 cm nodules of anorthosite in a medium grained matrix of pyroxene gabbro.

A plagioclase rich gabbro unit, gabbroic anorthosite (11b) occurs within the outer margin of anorthosite (10). Plagioclase content ranges from 60 to 85 percent with subophitic textures developed.

Anorthositic gabbro (11a) is concentrated around East Bull Lake and is characterized by metre scale layers composed of thick gabbro layers and thinner anorthosite layers. Both units are medium grained. The layers exhibit variable strike and dip though horizontal and subhorizontal dips (<15°) are most common. Fractures within the gabbro layers are generally filled while fractures within the anorthosite layers are normally short (20 cm), perpendicular to layering and not filled.

A relatively fresh gabbro (12) occurs immediately west of Moon Lake. Ophitic and subophitic texture is commonly displayed and layering due to concentrations of medium and finer grained gabbro may be present.

Most of the western part of the intrusion is a medium grained, metagabbro (13). Primary pyroxene crystals are partly to completely converted to actinolitic amphibole and cummingtonite. These mafics commonly define a strong fabric with variable dips from subhorizontal to subvertical. The isolated gabbro lenses occurring in the northern part of the map-area also belong to this unit.

Dendritic gabbro (14) is located in the central region of the intrusion. It occurs as patchy areas in the central plateau west of Moon Lake and as an east-west linear band to the south. Amphibole dendrites of various sizes, though always coarse grained (greater than 1.0 cm) occur in a matrix of plagioclase. They are characteristically associated with potash feldspar which composes 5 to 25% of this rock unit. In some locales the dendrites and associated minerals are pegmatitic. Quartz may be present.

Two large feldspar porphyry dykes (15) intrude the Parisien Lake syenite. The dykes appear to contain unaltered pyroxene and crystal aggregates of saussuritized plagioclase up to 3 cm in diameter.

Huronian sediments (16) occur extensively in the northeastern map-area and sporadically in the southwest. In the northeast they form a sequence with a maximum thickness of 80 metres that grades upwards from a basal conglomerate to argillite and quartzite. The sequence unconformably overlies the metavolcanics in the southwest, the Archean porphyroblastic granite and possibly the East Bull Lake Gabbro. Outliers of quartzite and argillite occur in the volcanics (1, 2) and the porphyroblastic granite (4). Contacts with the Nipissing diabase are sharp and vertical with diabase apparently intruding the sediments.

The basal conglomerate consists of well rounded pebbles and boulders (1 cm to 1 m), of granite, with matic volcanics, and amphibolite supported in a black, mudstone matrix. The conglomerate grades into a grey, flat lying massive argillite which in turn grades into a buff white to green, massive to well bedded quartzite. The quartzite exhibits primary structures such as graded beds, high angle cross beds and ripple marks, all of which indicate that the unit is in its original position.

Amphibolite and diabase dykes (17) cut most rock units but are most apparent where they cut granodiorite, (3), granite (4), syenite (8) and the main gabbro body (9, 10, 11, 12, 13, 14).

The rocks are generally fine to medium grained (1-2 mm) with diabase texture. Compositions range from 30 to 40 per cent plagioclase and 40 to 50 per cent pyroxene altered to amphibole. The dykes are often characterized by the presence of minor disseminated sulphides, mainly pyrite. Some dykes contain olivine.

The strike of these dykes varies from 270° to 360°, although by far the most common orientation is from 300° to 320°. The dip can rarely be measured, most are apparently steep (70° to 90°) though some have moderate dips indicated by an arcuate strike. Diabase dykes in the volcanic rocks (1, 2) are shallow dipping and some form subhorizontal sheets. Dyke width is highly variable from less than a metre to 300 m though most range from 5.0 to 25.0 m. True dyke width is rarely seen since dykes generally occur along the edge of the outcrops. The dykes may be up to 8.0 km long. It is likely that several ages of amphibolite/diabase dyke intrusions are present. All dyke segments which are unlabelled on the map sheet belong to unit 17.

Nipissing diabase (18) occurs in the northeastern part of the map-area as high cliff bounded plateaus. The rock is mottled black and white, fine to medium grained with diabase texture. The basal parts of several large cliffs are gabbro that contain occasional thin anorthosite bands. It is composed of plagioclase, pyroxene altering to amphibole, and variable amounts of quartz.

Proterozoic granite (19) occurs southwest of Millen Lake and immediately west of the Sauble River in the northern part of the map-area. It is porphyritic with red laths of poikilitic microcline and plagioclase phenocrysts (0.3 to 5 cm long) in a medium grained, generally massive matrix of plagioclase, potassium feldspar, quartz, and less than 5% biotite and/or hornblende.

Late diabase dykes (20) occur in the northeast. In one locale this type of dyke is a topographic high visible on aerial photographs. In other locales it is a topographic low occurring along valley bottoms or in swamps. The dykes strike northwest with steep to vertical dips and cross cut the Archean granite (8), Proterozoic granite (19), Nipissing diabase (18) and Huronian quartzite (16). The dykes have a minimum width of 20 metres. The rock is rusty brown, highly weathered and porphyritic with laths of plagioclase in a diabase matrix of medium grained plagioclase, hornblende and quartz.

Late aplite dykes, not shown on the map, intrude the Parisien Lake syenite (8), porphyroblastic granite (4), and granodiorite (3). Felsic dykes, though present, are rare in the East Bull Lake pluton.

The map-area is transected by several fault zones, the most notable of which trends 115° across the map-area through Folson Lake. A smaller fault zone splays southeast from it at Whiskey Lake and trends about 130° to terminate south of Folson Lake. Other fault zones occur in southeastern and northeastern parts of the map-area. The faults in the northeast occur in the porphyritic granite and the Proterozoic granite. They are shorter than the Folson Lake Fault, and exhibit ductile shear, with mylonite or ultramylonite.

Crystalline rocks affected by the Folson Lake Fault such as the granodiorite (3) and East Bull Lake pluton exhibit cataclastic textures including randomly oriented fractures, angular breccia fragments and numerous microfaults. Quartz veining in all faulted rocks and red colouration of granodiorite are common features. Amphibolite commonly develops a schistose texture. Slickensides and mineral lineations are common within the fault zones though orientations vary greatly.

The Folson Lake Fault Zone exhibits an apparent dextral strike separation of about 3.2 km offsetting the western contact of the gabbro body from Sauble Lake on the north side of the fault to the western tip of Folson Lake on the south side. However the fault zone exhibits an apparent sinstral strike separation of about 1.0 km where it offsets the eastern contact of the gabbro body near Parisien Lake. These observations plus generally steep plunging mineral lineations within the fault zone seem to indicate that the fault zone has a significant dip slip displacement of south side down. Faults within southeastern parts of the map-area exhibit vertical mineral lineations indicating primarily dip-slip displacement.

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This Open File Report covers ongoing work done as part of the Nuclear Fuel Waste Management Program, and is intended for quick dissemination of the information. The information it contains may not yet have been evaluated rigorously, and any conclusions may be subject to modification in the light of further information.

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