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MARGINAL NOTES

INTRODUCTION

Synoptic, reconnaissance mapping of the Burleigh Falls area was carried out in 1980 at a scale of 1:50 000, as an extension of the structural and stratigraphic synthesis of the Bancroft uranium belt of the Grenville Province (Bright 1977, 1980, 1987). The Burleigh Falls area covers the southern part of the Bancroft uranium belt and lies directly south of the previously mapped Eels Lake area (Bright 1987), which straddles the middle and part of the northern section of this belt. The legend of the Burleigh Falls area map is lithological, except for the strata of the Grenville Supergroup which have been subdivided into three major lithostratigraphic groups. Because of the local diversity and rapid changes in subordinate lithologies between outcrop areas, only major boundaries between dominant lithological units, particularly within the lithostratigraphic groups, are shown on the map face. More detailed information on particular map segments can be found on published, detailed maps and reports in the references.

LOCATION AND ACCESS

The Burleigh Falls area, which covers about 1000 km^2 in the northeastern part of Peterborough County, lies approximately 45 km southwest of the town of Bancroft, and 150 km northeast of the City of Toronto. The map area is bounded by longitudes 78°00'W and 78°30'W, and by latitudes 44°30'N and 44°45'N. The village of Apsley lies just to the north of the northeastern corner of the area; the villages of Burleigh Falls and Buckhorn lie in the southern part of the area. Primary access from the east is via Highway 28 north from Peterborough through Burleigh Falls, northward across the eastern part of the area to Apsley. Access into the western part of the map area is via Highway 36 northeast from Lindsay to Bobcaygeon. East of Bobcaygeon, Highway 36 connects with Highway 507, approximately 8 km north of Buckhorn. The access into the central part of the map area, the region of the Burleigh gneiss dome, is limited to a system of canoe routes.

MINERAL EXPLORATION

Exploration in the area was originally sparked, during the latter part of the 19th century, by the discovery of corundum and mica in the alkalic syenite gneisses of the Bancroft region. Since that time, prospecting has been carried out at various localities on deposits of mica, feldspar, nepheline, iron, and corundum. Commercial development of nepheline syenite at Blue Mountain, near Nephton, commenced by open-pit mining methods in 1936. Nepheline syenite production from this area has continued uninterrupted to the present day. Output in 1980 was from two major producers: Indusmin Limited (in the map area) and Sobin Chemicals (Canada) Limited (just to the east of the map area).

Since the 1950s, most of the exploration has been concentrated on and near the numerous uranium deposits in the northern part of the area. Periods of peak activity occurred during the mid-1950s, the late 1960s, and the late 1970s. Production feasibility studies were carried out in the late 1970s by Rare Earth Resources Limited and Imperial Oil Limited on the Cavendish Uranium Deposit (Number 16), and by Camindex Mines Limited on the Zenmac-Loon Call Lake Uranium Deposit (Number 3). From 1974 to 1979, Insulite Development Corporation Incorporated tested a phlogopite-vermiculite deposit in deeply weathered zones in the marbles of southern Cavendish Township.

PREVIOUS WORK

The map area is included in earlier regional compilation maps by Adams and Barlow (1910) and Hewitt (1957). Recently, more detailed geological mapping in the eastern part of the area was carried out in Methuen Township by Hewitt (1961) and in Chandos Township by Shaw (1962). The northern part of the area, in particular Anstruther and Cavendish Townships, were later mapped during 1975 and 1976 by the Ontario Geological Survey (Bright 1981a, b, c, d). Parts of all the above mentioned areas were included in the reconnaissance synoptic mapping of the Eels Lake area (Bright 1987). Harvey Township in the southwestern part of the map area was mapped in detail by Morton (1983).

REGIONAL GEOLOGICAL SETTING

The Burleigh Falls area is underlain mainly by Precambrian rocks. Unsubdivided, flat-lying, Cambro-Ordovician arkosic grit, shale, siltstone, and sandstone of the Shadow Lake Formation and Ordovician limestone of the Gull River Formation (unit 24) cover the Precambrian succession in the southern part of the map area.

The Precambrian rocks are of Middle Proterozoic age, and lie along the southwestern exposed margin of the Central Metasedimentary Belt (CMB) of the Grenville Province, in southeastern Ontario (Wynne-Edwards 1972). The central part of the map area is traversed by the southern part of the Harvey-Cardiff Basement Arch, an 80 km long and approximately 25 km wide, north-northeast-trending structural feature in this part of the CMB. This arch-like structure is delineated by a linear series of five gneiss domes that were selective and repeated centres of basement uplift and closely related granitic, and locally, alkalic and mafic plutonism (Bright 1977, 1980, 1987). Two of these domes, within the arch, occur in the map area, and from south to north are the Burleigh Dome and the Anstruther Dome, respectively. Only the southern margin of the Anstruther Dome lies in the map area. A migmatite-gneiss complex that is considered to be basement to the Grenville Supergroup strata is exposed in the Burleigh Dome. The rocks in the area were subjected first to the Elzevirian Orogeny and later to the Grenville (Ottawan) Orogeny between 1240 and 1000 Ma (Stockwell 1982).

GENERAL GEOLOGY

The Precambrian rocks in the Burleigh Falls area can be divided into four main groups which, in order of interpreted decreasing age, are as follows:

1. rocks of the basement complex (unit 1)
2. supracrustal rocks of the Grenville Supergroup (units 2 to 15)
3. syntectonic to late tectonic metaplutonic rocks (units 16 to 20)
4. late to posttectonic intrusive rocks (units 21 to 23)

BASEMENT COMPLEX

In northwestern Harvey Township, a series of grey and pinkish grey granitic gneisses and related migmatites (unit 1), which the author has interpreted as basement to the overlying Grenville Supergroup quartzofeldspathic strata, are exposed north of the village of Buckhorn in the southwestern part of the 13 km wide, elliptical Burleigh Dome. During this reconnaissance mapping survey, the author did not examine these poorly accessible gneisses and migmatites which had recently been mapped by Morton (1983). During the present survey however, the author did examine at selective locations the various pink and buff coloured, layered quartzofeldspathic gneisses (units 2 and 3) surrounding this inferred basement complex in the central region of the Burleigh Dome. Prior to this survey, the author mapped, in detail, similar-looking metasedimentary gneisses flanking the basement migmatite-gneiss complex exposed in the central region of the Anstruther Dome, in the adjoining Eels Lake area to the north (Bright 1981c, 1981d, 1987).

The author's proposed basement migmatite-gneiss complex within the Burleigh Dome, in general, corresponds to the area which Morton (1983) designated as the "central migmatite zone" of his "Burleigh Gneiss Complex". Encircling this central migmatite zone and forming the margins of this complex, Morton describes a marginal zone of banded quartz-feldspar gneisses which the author has reinterpreted as metasedimentary gneisses belonging to the overlying Anstruther Lake Group of the Grenville Supergroup (Bright 1980, 1981c, 1981d, 1987).

GRENVILLE SUPERGROUP

Previous mapping by the author, in the Eels Lake area to the north of the map area (Bright 1987), provided the basis for lithostratigraphic subdivisions of the Grenville Supergroup in the Burleigh Falls area. In ascending stratigraphic order, these regional subdivisions are a) the Anstruther Lake Group (Bright 1977, 1980, 1987); b) the Hermon Group (Lumbers 1967); and c) the Mayo Group (Hewitt and James 1956). Within these three major subdivisions, most individual units still require more detailed study to be further stratigraphically subdivided; therefore, the order of the lithological subdivisions within these groups is tentative and does not imply age relationships.

The Anstruther Lake Group, the lowest exposed portion of the Grenville Supergroup in the Bancroft-Burleigh Falls region (Bright 1977, 1980, 1987), consists mainly of feldspathic, arenaceous metasediments (unit 2) with subordinate interbedded units of biotite-rich metasediments (unit 3). These metasediments are locally migmatitic, particularly near the inferred contact between the basement gneisses and the overlying supracrustal rocks in the south-central part of the Burleigh Dome. Migmatitic metasediments also occur along the fault-bounded eastern flank of this dome. In contrast, the feldspathic meta-arenites and interlayered metawackes within this group along the western and southwestern flanks of the dome are much less migmatitic. Primary bedding, in places graded bedding, and crosslaminations are locally preserved.

Hermon Group epiclastic and/or chemical metasediments (units 4 to 9) conformably overlie the feldspathic meta-arenites of the Anstruther Lake Group. The Hermon Group contains the following two main subdivisions: a) a lower sequence of predominantly, epiclastic metasediments with subordinate intercalated marble (units 4 to 9); and b) a thicker, upper sequence of mafic to felsic metavolcanics (units 10 and 11), containing minor intercalated epiclastic metasediments and marble. The boundary between this group and the underlying Anstruther Lake Group has been arbitrarily chosen where the Hermon Group marbles (unit 9) first appear, or in their absence, where units or interlayers of metawacke, para-amphibolite, or aluminous metapelite (units 5 to 7, respectively) become prominent (Bright 1977, 1980, 1987).

The metavolcanic succession, in the upper part of the Hermon Group to the west of the Burleigh Dome, differs from the metavolcanic succession to the east of this dome. In the western and northwestern part of the area, the tightly folded Cavendish-Harvey metavolcanics to the west of the dome are a tholeiitic mafic to felsic succession. Mafic flows, the lower part of this metavolcanic succession, predominate in Cavendish Township, whereas intermediate to felsic tuff, lapilli-tuff, and tuff-breccia, the upper part of the same succession, are most abundant in Harvey Township. An estimated, maximum, composite thickness of the Cavendish-Harvey mafic to felsic metavolcanic succession in central Harvey Township is about 1400 m. To the east of the dome, in the eastern part of the area, thinner, tightly folded successions of Hermon Group metavolcanics occur in the following two areas: a) the Loon Call Lake metavolcanics which occur along the northeastern and eastern flanks of the Burleigh Dome are predominantly a tholeiitic mafic to felsic metavolcanic suite; and b) the Stoney Lake metavolcanics, located in southern Burleigh and southwestern Methuen Townships, are mainly a calc-alkalic mafic to felsic metavolcanic suite. Intermediate to felsic tuffs and lapilli-tuffs, the upper part of the Stoney Lake metavolcanic succession, are exposed in many places along the northern shore and adjacent islands in Stoney Lake.

The Mayo Group, a predominantly carbonate metasedimentary sequence, conformably overlies the Hermon Group in the eastern part of the map area. In this region, the Mayo Group can be further subdivided into two formational units which, from bottom to top, are a) the Dungannon Formation (Hewitt and James 1956), consisting mainly of marble (unit 14) with minor intercalated epiclastic metasediments (units 12 and 13); and b) the Apsley Formation (Shaw 1962), consisting mainly of a turbidity-type metawacke-metamudstone-reworked tuff sequence (unit 15). Mayo Group marbles of the Dungannon Formation also occur to the west of the Burleigh Dome, in the northwestern corner of the area. Here however, these marbles occur only in fault-contact with the older Hermon Group strata.

The maximum, cumulative thickness of the Grenville Supergroup to the west of the Burleigh Dome is approximately 4000 m, whereas to the east of this dome, it has a thickness in excess of 4500 m.

SYNTECTONIC TO LATE TECTONIC METAPLUTONIC ROCKS

Mafic, alkalic, and several ages of granitic metaplutonic rocks form small plutons, stocks, sills, and dikes throughout the area. These rocks were emplaced at successive stages during the Elzevirian Orogeny (1240 to 1180 Ma) (Stockwell 1982). These rocks can be divided into four subgroups which, in order of decreasing age, are as follows:

1. metamorphosed mafic intrusive rocks (unit 16) which consist mainly of metagabbro, metadiorite, and ortho-amphibolite sills. In places within a single sill, these various mafic rocks appear to grade into, or are interlayered with, units of syenite gneiss (unit 18)
2. metamorphosed alkalic intrusive rocks which consist mainly of potassic syenite (unit 18), and to a lesser extent, nepheline-bearing syenite (unit 17). Both lithologies are present in the Blue Mountain nepheline syenite complex exposed along the southeastern boundary of the map area. Rocks from this complex yielded a whole rock Rb-Sr isochron age of 1258±41 Ma, which is interpreted as an initial age of crystallization (Krogh and Hurley 1968)
3. metamorphosed intermediate to felsic intrusive rocks (unit 19) which consist mainly of foliated to layered granodiorite, and in places, granite. Small plutons, stocks, sills, and numerous dikes of this metaplutonic suite are only shown to lie within, and to the west of, the Burleigh Dome, in the domain of the Harvey-Cardiff Basement Arch
4. metamorphosed felsic to intermediate intrusive rocks (unit 20) which consist mainly of massive, foliated, and lineated granite, and in places, granodiorite. This more massive-looking felsic suite forms small plutons, like the Methuen pluton, and numerous stocks, sills, and dikes only in that part of the Grenville Supergroup strata which is exposed to the east of the fault-bounded, eastern margin of the Burleigh Dome

The age relationship between these two, spatially separated granitic suites (units 19 and 20) is not known, however, both suites were recrystallized during the high rank metamorphism that accompanied the later Grenville (Ottawan) Orogeny (1140 to 1000 Ma) (Stockwell 1982). Both granitic suites are tentatively correlated with the larger Elzevir-Westemkoon trondhjemite-granodiorite plutonic complexes to the east of the map area, which yielded a U-Pb zircon age of 1226±25 Ma (Silver and Lumbers 1966) and a whole rock Rb-Sr isochron age of 1240±50 Ma (Bell and Blenkinsop 1980).

LATE TECTONIC TO POSTTECTONIC INTRUSIVE ROCKS

During the waning stages of the late, high rank Grenville (Ottawan) metamorphism, the following mafic to felsic plutonic rocks were successively emplaced: a) massive to weakly foliated granite to granodiorite stocks and dikes (unit 21); b) small mafic dikes (unit 22) of more than one age; and c) massive, unmetamorphosed, pegmatitic granite dikes, in places dike swarms (unit 23), which are particularly concentrated in the supracrustal rocks along the flanks of the Burleigh and Anstruther Domes.

METAMORPHISM AND STRUCTURAL GEOLOGY

The rocks of the basement complex and the Grenville Supergroup were subjected to at least two periods of regional metamorphism and accompanying granitic plutonism. The regional metamorphic grade attained by the older supracrustal and metaplutonic rocks during the earlier Elzevirian Orogeny is not certain, however, to the east of the area, upper greenschist to amphibolite facies mineral assemblages developed in the rocks of the Supergroup (Lumbers 1969). In the map area during the subsequent, higher rank, Grenville (Ottawan) metamorphism, the previously metamorphosed supracrustal rocks and many of the early mafic, alkalic, and intermediate to felsic plutonic rocks (units 16 to 20) were again metamorphosed under conditions ranging from middle to upper amphibolite facies.

The structure of the central part of the Burleigh Falls area is dominated by the 13 km wide, elliptical Burleigh Dome, which is the southern exposed end of the Harvey-Cardiff Basement Arch (Bright 1977, 1980, 1987). The development of this selective centre of basement uplift and granitic plutonism, as well as that of the adjacent Anstruther Dome just to the north of the map area, was probably initiated during the Elzevirian Orogeny. At this time, the relatively flat-lying Grenville Supergroup strata and interlayered mafic and alkalic sills (units 16 to 18), along the flanks of the rising domes, were deformed into a series of north- to northeast-trending regional folds that paralleled the trend of the developing arch. Local east-trending folds probably developed in the northern part of the area between the Burleigh and Anstruther Domes and locally around syntectonic to late tectonic granitic plutons (units 19 and 20) (emplaced at this time into the deformed strata of the Supergroup along the flanks of these domes). During the younger Grenville (Ottawan) Orogeny, the earlier northeast-trending structures were augmented during renewed basement uplift, granitic plutonism, and regional folding along and adjacent to the arch, particularly at selective loci such as the Burleigh and Anstruther Domes. The older Elzevirian folds were refolded into a new parallel series of regional north- to northeast-trending folds; refolded or new, east-trending folds synchronously developed between the uplifted domes. During successive or synchronous stages of this younger orogeny, the Harvey-Cardiff Basement Arch itself, and all major northeast-trending fold structures along the flanks of this arch, were overturned to the west-northwest during westerly directed, regional thrust faulting.

Another structural feature of note, to the east of the Burleigh Dome, is the Chandos Synclinorium (Bright 1987) in eastern Burleigh Township. The southern end of this 1.2 km wide, northeast-trending, and westerly-overturned synclinorium is the dominant structural element in the eastern part of the area. This synclinorium, which is not labelled on the map face, is fault-bounded against the Burleigh Dome on the west. Its eastern limb, along the eastern boundary of the map area, is marked by a linear series of syntectonic granitic plutons that includes the Methuen pluton. Similarily to the west of the Burleigh Dome, the northwestern part of the area is underlain by part of the eastern limb of another northeast-trending and westerly-overturned synclinorium (Bright 1987), most of which lies to the west of the map area in Galway Township.

A pervasive, southeast-plunging lineation, which is not always shown on the map face, is present in many of the supracrustal rocks and syntectonic to late tectonic plutonic rocks within, and to the west of, the Burleigh Dome, in the domain of the Harvey-Cardiff Basement Arch. This fabric probably developed during regional overturning and synchronous thrust faulting of the arch and its flanking synclinorium to the west. To the east of the fault-bounded eastern margin of the Burleigh Dome, a southeast-plunging lineation is locally developed in the rocks, however, this penetrative fabric decreases rapidly in intensity toward the eastern boundary of the map area.

All the bedrock, including the late tectonic pegmatitic granite dikes, are fractured, sheared, and offset by three regional fault systems. The trace of most of the faults shown on the accompanying map has been interpreted from a) major offsets in lithology and stratigraphy defined during field mapping; b) truncations or offsets of aeromagnetic trends; c) major lineaments observed on aerial photographs; and d) observation of cataclastic textures. The oldest fault system consists of east-northeast-trending thrust faults accompanied by shearing and cataclasis. This oldest fault system is offset by a younger system of north-northeast-trending faults, many of which dip 35° to 60° east. The youngest, third system is made up of steeply dipping faults that trend in a north to northwest direction.

ECONOMIC GEOLOGY

STRATABOUND IRON OXIDE AND IRON SULPHIDE DEPOSITS IN MARBLE

Small, stratabound deposits of disseminated to locally massive magnetite and/or hematite, pyrite, and pyrrhotite with minor base metal mineralization occur within marble sequences of the Hermon Group in the western part of the area. Deposits of this type were noted in the locations listed below. For more detailed descriptions and locations, the reader is referred to Bright (1981a, 1981b, 1981c, 1981d, 1987).

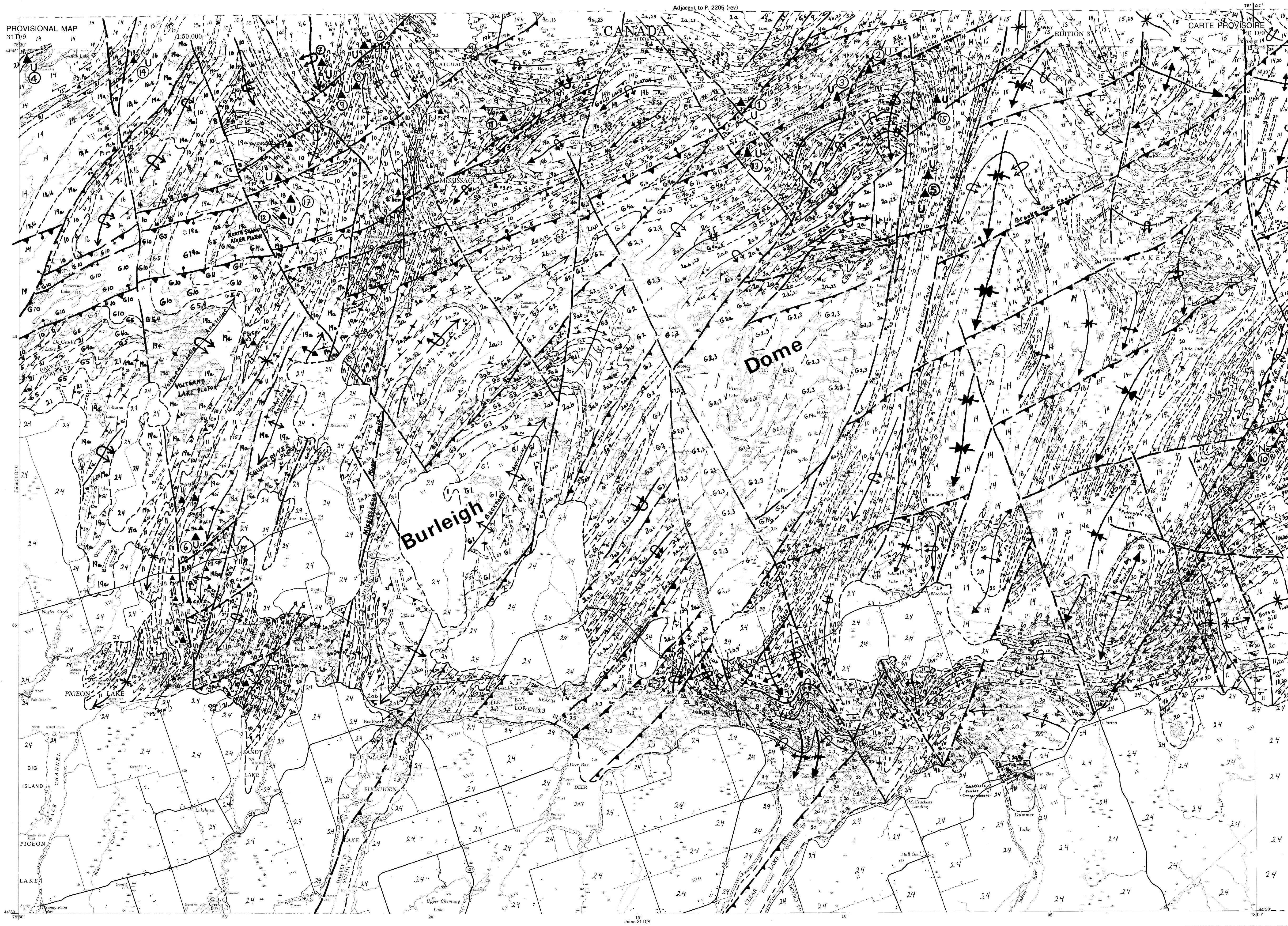
1. Along the west shore of Catchacoma Lake, massive layers of pyrite and pyrrhotite mineralization, up to 3.7 m thick, occur in the marble on the northern half of lot 18, concession IV and the southern half of lot 18, concession V, Cavendish Township.
2. West of Mississagua Lake, thin layers of massive hematite, in places hematite and magnetite, occur in marble on the northern half of lot 4, concession II, Cavendish Township.
3. Rusty pyritic schist layers containing minor pyrrhotite occur in marble along the eastern shore of Mississagua Lake in Cavendish Township and west of Udra Lake in Galway Township.
4. In central Harvey Township, between Sandy and Big Bald Lakes, disseminated pyrite and minor sphalerite mineralization is present in the marble near its contact with mafic metavolcanics.

SULPHIDE MINERALIZATION IN METAVOLCANICS

In Cavendish Township, minor disseminated pyrite and pyrrhotite and very minor chalcopyrite mineralization is present in the mafic metavolcanics, on lot 4, concession IV and lots 12 and 13, concession VI. Minor disseminated pyrite also occurs in intermediate to felsic metavolcanics north of Mountain Lake on lot 9, concession II, Cavendish Township.

In Harvey Township, Morton (1983) has reported minor zones of disseminated to stringer pyrite and minor chalcopyrite mineralization occurring at several widespread localities in the mafic to felsic metavolcanics, and associated minor intercalated chemical and clastic metasediments. For more exact locations of the following as well as other mineral deposits in Harvey Township mentioned later in this section, the reader should refer to Ontario Geological Survey Map 2475 (Morton 1983). In the mafic to intermediate metavolcanics, pyrite, and locally pyrrhotite, in places containing minor chalcopyrite (less than 0.5 percent), rare arsenopyrite and sphalerite mineralization form disseminations and amygdaloidal fillings within flows at the following localities: a) south of Little Bald Lake on lots 14 and 15, concession XII; b) north of Little Bald Lake on lot 16, concession XIII and lot 19, concession IX; and c) north of Highway 36 and west of the Squaw River on lot 30, concession IX and lot 27, concession XI, Harvey Township. Also in Harvey Township, the intermediate to felsic metavolcanics contain minor disseminated to stringer pyrite mineralization with minor chalcopyrite (less than 0.1 to 0.5 percent), and in places, rare sphalerite at the following localities (Morton 1983): a) south of Highway 36 and west of the Squaw River on lot 19, concession XII; and b) north of Highway 36 and west of the Squaw River on lot 30, concession IX and lot 24, concessions XI and XII.

Sulphide mineralization in interlayered minor units of clastic metasediments within the metavolcanic succession occur at the following localities in Harvey Township (Morton 1983): a) south of Little Bald Lake on lots 14 and 15, concession XI and lot 13, concession XII, disseminated pyrite blebs and streaks with minor chalcopyrite (and locally sphalerite) are present in rusty weathering muscovite-quartz-feldspar schist and gneiss; and b) north of Little Bald Lake on lots 18 and 19, pyrite and chalcopyrite mineralization occurs in muscovite and muscovite-biotite-quartz-feldspar schist and gneiss units within the intermediate to felsic metavolcanics. Similar rusty weathering, pyritic quartz-feldspar schist and gneiss units occur in the mafic metavolcanics northeast of Stoney Lake on lot 5, concession XI, Burleigh Township. This is the only significant sulphide occurrence in metavolcanics observed by the author in the eastern part of the area.



SULPHIDE MINERALIZATION IN FELSIC PLUTONIC ROCKS

In Harvey Township, Morton (1983) has reported several small sulphide deposits within local zones of fracturing, shearing, and brecciation in the cross faulted, southern part of the Squaw River granitic pluton at the following localities north and south of Highway 36: a) on lot 22, concession XI; b) on lot 20, concession IX; and c) lot 19, concession XII. The mineralization consists of quartz and quartz-feldspar veins, stringers, and fracture vein fillings, and in places calcite veins, containing disseminated pyrite, chalcopyrite, molybdenite, and locally, minor magnetite and bornite.

VERMICULITE

Vermiculite is used in the aggregate, refractory, insulation, and fireproofing industries. It is found as disseminations in pre-Pleistocene, deeply weathered zones (paleo-regoliths) in the phlogopitic marbles exposed between Catchacoma and Mississagua Lakes in Cavendish Township. Vermiculite-bearing sections of this marble, on the property of Insulite Development Corporation Incorporated (Number 11), are discontinuously exposed on the southern halves of lots 23 and 25, concession IV. Other showings occur on the southern half of lot 22, concession IV, and the northwestern quarter of lot 14, concession II, Cavendish Township.

URANIUM MINERALIZATION

Introduction

Within the Burleigh Falls area, uranium mineralization is associated with hybrid phases in the late tectonic, generally leucocratic, pegmatitic granite dikes (unit 23) that were emplaced throughout the entire region during the waning stages of the Grenville (Ottawan) Orogeny. Pegmatite-hosted uranium deposits occur mainly in the northern part of the map area. Here, these dikes, in places swarms of pegmatite dikes, in general concordantly intrude the tightly folded and cross folded amphibolite facies metavolcanics and mafic mineral-rich epiclastic metasediments of the Hermon Group, along and between the northern flanks of the Burleigh Dome and the adjacent, southern flank of the Anstruther Dome. These two domes at the southern end of the Harvey-Cardiff Basement Arch coincide with the southern end of the Bancroft uranium belt (Satterly 1957). In this southern part of the Bancroft uranium belt, exploration and development in the map area has outlined the following reserves: a) 406 000 tons with an average grade of 1.77 pounds U_3O_8 per ton in the Camindex Mines Limited (Zenmac-Loon Call Lake) Deposit (Number 3) in southeastern Anstruther Township; and b) 435 624 tons with an average grade of 1.92 pounds U_3O_8 per ton in the Rare Earth Resources (Cavendish) Deposit (Number 16) in central Cavendish Township (Robertson 1975).

Pegmatite-Hosted Uranium Deposits

The uranium mineralization, principally uranothorite and uraninite with minor thorite, allanite, and zircon (cyrtolite), occurs mainly as disseminations or fracture-vein fillings in locally altered phases of the leucocratic, pegmatitic granite dikes. The uranium-bearing hybrid pegmatites commonly exhibit irregular, contaminated border zones of granitic to syenitic composition. Many of these hybrid dikes contain partially assimilated inclusions of biotite gneiss, amphibolite, calc-silicate gneiss, and aluminous biotite schist and gneiss; hornblende and pyroxene-rich marble xenoliths are locally present. The uranium minerals, when present, are generally concentrated in the hybrid, commonly inclusion bearing, phases of the pegmatitic granite. Hybrid phases of the pegmatites that may contain uranium mineralization commonly exhibit some, or all of the following features: a) a red discolouration (hematization) of the feldspars and quartz; b) a secondary development of porphyroblastic hornblende, pyroxene, and biotite, as well as aggregates of smokey quartz; c) a late development of magnetite, iron sulphides, molybdenite, chalcopyrite, tourmaline, and in places fluorite and calcite, either as minor disseminated grains, irregular small patches, or fracture vein fillings in the pegmatite proper or in the immediately adjacent altered wall rocks; and d) a late stage shearing and fracturing along dike-wall rock contacts.

CONSIDERATIONS IN FUTURE EXPLORATIONS

BASE METAL MINERALIZATION

The Cavendish-Harvey mafic to felsic metavolcanic succession in the northwestern and western part of the map area has the highest potential for base metal mineralization. Within these metavolcanics, iron and base metal sulphide occurrences are more abundant in central Harvey Township than in southern Cavendish Township. The presence of a substantial volume of coarse, intermediate to felsic, fragmental rocks in southwestern Cavendish Township, indicates that a volcanic centre may have existed nearby and that sulphide mineralization might be associated with this centre of volcanic activity. Detailed geological and geophysical exploration therefore may lead to an economic discovery in the Cavendish-Harvey metavolcanic succession and possibly also in the similar metavolcanics on Stoney Lake in the southeastern part of the area.

URANIUM MINERALIZATION

Future exploration programs in the map area for uranium deposits or the reevaluation of known deposits should concentrate on pegmatitic granite dikes and dike swarms that intrude the amphibolite-grade metasediments and metavolcanics of the Hermon Group along the flanks of the Burleigh and Anstruther Domes. Late tectonic pegmatitic granite dikes are also abundant in the older Anstruther Lake Group meta-arenites (also in amphibolite facies) that mantle these domes, however, to date, no appreciable uranium mineralization has been found in the late pegmatites intruding these metasediments. Similarly, no pegmatite-hosted uranium deposits have been reported in the younger,similar metamorphic grade Mayo Group marbles that overlie the Hermon Group strata along the flanks and to the east of the Burleigh Dome.

Especially promising areas to explore are those areas underlain by Hermon Group epiclastic metasediments and metavolcanics along the flanks of the domes which are cut by pegmatite dikes that lie at, or in close proximity to, regional east- and north-trending faults. Late stage uranium remobilization and concentration, during posttectonic shearing and fracturing of the host and wall rocks, has been a major ore forming process (Satterly 1957; Hewitt 1957).

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PROPERTIES[a]

1. Blott, William [1977][b]
2. Camindex Mines Limited (Aubella Occurrence)
3. Camindex Mines Limited (Zenmac–Loon Call Lake Deposit)
4. Coballoy–Silver Crater Occurrence
5. Great Basin Metal Mines Limited [1969][b]
6. Imperial Oil Limited [1978][b]
7. Imperial Oil Limited (Assarco Occurrence)
8. Imperial Oil Limited (Cromwell Occurrence)
9. Imperial Oil Limited (Ganamede Occurrence)
10. Indusmin Limited
11. Insulite Development Corporation Incorporated
12. Louvicourt–Silanco Occurrence
13. Newkirk–Crab Lake Occurrence
14. Newkirk–Loom Lake Occurrence
15. Pole Star Occurrence
16. Rare Earth Resources Limited (Cavendish Deposit)
17. United Macfie Occurrence

[a]As of 1980.
[b]Date in square brackets indicates last year of active exploration.

ABBREVIATIONS

asp	Arsenopyrite
bn	Bornite
cp	Chalcopyrite
hem	Hematite
mo	Molybdenite
ne	Nepheline
py	Pyrite
po	Pyrrhotite
sp	Sphalerite
tour	Tourmaline
U	Uranium
verm	Vermiculite

SYMBOLS

- Bedding, top unknown; (inclined, vertical)
- Bedding, top indicated by arrow; (overturned)
- Bedding, top (arrow) from grain gradation; (inclined, unknown)
- Bedding top (arrow) from cross bedding;(inclined)
- Schistosity; (inclined)
- Gneissosity; (inclined, vertical)
- Foliation; (unknown, inclined, vertical)
- Lineation with plunge
- Geological boundary, observed
- Geological boundary, position interpreted
- Fault; (observed, assumed). Arrows indicate horizontal movement
- Thrust fault; spot indicated down throw side
- Plunge of fold axes; (Z-fold, S-fold, W-fold, U-fold) shape shown
- Anticline, syncline, with plunge direction
- Anticline; (defined, approximate)
- Antiform
- Syncline; (defined, approximate)
- Synform
- Anticline and syncline (overturned)
- Property occurrence
- Mineral occurrence
- Shaft

SOURCES OF INFORMATION

Base map derived from Map 31 D/9 (Burleigh Falls) of the National Topographic System.

ODM-GSC Aeromagnetic Map 103G, scale 1:50 000.

Compilation from published and unpublished maps of the Ontario Geological Survey, Ontario Ministry of Northern Development and Mines as per reference list.

Assessment Files Research Office, Ontario Geological Survey, Toronto.

Geology not tied to surveyed lines.

Magnetic declination approximately 11°W in 1980.

Metric conversion factor: 1 foot = 0.3048 m.

CREDITS

Geology by E.G. Bright and assistants, 1975 to 1980.
Geological compilation by E.G. Bright, 1980 to 1985.

Every possible effort has been made to ensure the accuracy of the information presented on this map; however, the Ontario Ministry of Northern Development and Mines does not assume any liability for errors that may occur. Users may wish to verify critical information; sources include both the references listed here, and information on file at the Resident Geologist's Office and the Mining Recorder's Office nearest the map area.

Issued 1988

Information from this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form:

Bright, E.G.
1988: Precambrian Geology of the Burleigh Falls Area, Peterborough County; Ontario Geological Survey, Map P.3096, Geological Series-Preliminary Map, scale 1:50 000. Geology 1975 to 1980.

Ontario
Ministry of Northern Development and Mines
Sean Conway, Minister of Mines

Mines and Minerals Division
Ontario Geological Survey

MAP P.3096
Geological Series—Preliminary Map

PRECAMBRIAN GEOLOGY
BURLEIGH FALLS AREA
PETERBOROUGH COUNTY

Scale 1:50 000

Mile 1 — 0 — 1 Mile
Metres 1000 — 0 — 1 Kilometre

NTS Reference: 31 D/9
ODM-GSC Aeromagnetic Map: 103G
OGS Geological Compilation Map: 2441

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Printed in Ontario, Canada

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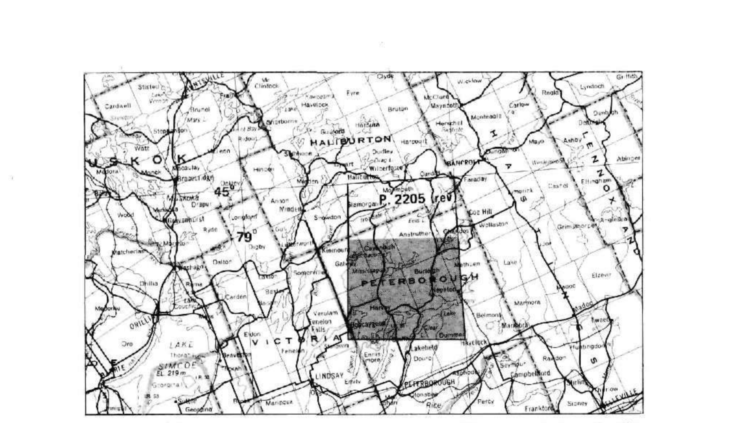

LOCATION MAP

Scale: 1:1 584 000 or 1 inch to 25 miles

LEGEND[a]

PHANEROZOIC
CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT[b]

Glaciofluvial deposits of sand, silt, and gravel; locally silty to sandy and stoney till; swamp and bog accumulations.

UNCONFORMITY

PALEOZOIC
CAMBRO-ORDOVICIAN AND MIDDLE ORDOVICIAN

24 Basal arkosic grit, shale, siltstone, and sandstone; lithographic limestone, fossiliferous limestone, bioclastic limestone, shale.

UNCONFORMITY

PRECAMBRIAN[c,d]
MIDDLE PROTEROZOIC
LATE TECTONIC TO POSTTECTONIC INTRUSIVE ROCKS
PEGMATITIC GRANITE DIKES[e]

23 Leucocratic granite, pegmatitic granite, granite pegmatite

INTRUSIVE CONTACT

LATE MAFIC INTRUSIVE ROCKS[e]

22 Massive to foliated, fine-grained amphibolite dikes; massive to weakly foliated gabbro, diabase; biotite lamprophyre

INTRUSIVE CONTACT

LATE GRANITIC INTRUSIVE ROCKS

21 Massive biotite granite, leucocratic granite, hornblende-biotite granite, granodiorite

INTRUSIVE CONTACT

SYNTECTONIC TO LATE TECTONIC MAFIC TO FELSIC INTRUSIVE ROCKS
METAMORPHOSED GRANITIC INTRUSIVE ROCKS
Metamorphosed Felsic to Intermediate Intrusive Rocks

20 Massive to foliated and lineated, in places layered, leucocratic granite, biotite granite, hornblende-biotite granodiorite; minor porphyritic biotite granite, hybrid granite gneiss

Metamorphosed Intermediate to Felsic Intrusive Rocks[e,f]

19
- 19a Foliated, in places layered, biotite granodiorite, hornblende-biotite granodiorite; minor quartz diorite
- 19b Foliated, in places layered, leucocratic granite, biotite granite; minor quartz monzonite, hybrid granite gneiss

INTRUSIVE CONTACT

METAMORPHOSED ALKALIC INTRUSIVE ROCKS
Potassic Syenite

18 Massive to foliated, in places layered, biotite syenite, biotite-hornblende syenite, leucocratic syenite; layered hornblende-rich syenite gneiss

INTRUSIVE CONTACT

Nepheline Syenite

17 Massive to foliated and lineated, in places layered, hornblende-nepheline syenite, biotite- and biotite-muscovite-nepheline syenite, muscovite- and muscovite-magnetite-nepheline syenite; minor nepheline syenite pegmatite dikes

INTRUSIVE CONTACT

METAMORPHOSED MAFIC INTRUSIVE ROCKS

16 Massive to foliated metagabbro; hornblende-plagioclase gneiss; massive to weakly foliated metadiorite, noritic metagabbro; minor amphibolite, metaperidotite dikes

INTRUSIVE CONTACT

METASEDIMENTARY AND METAVOLCANIC ROCKS[c,d]
GRENVILLE SUPERGROUP
MAYO GROUP
EPICLASTIC METASEDIMENTARY ROCKS
Apsley Formation
Siliceous Clastic Metasediments

15 Thinly interbedded metawacke, feldspathic meta-arenite, rusty weathering meta-arenite; minor metaconglomerate, metamudstone (biotite gneiss and schist), calcareous metamudstone (para-amphibolite); may, in part, be reworked tuffs

CONFORMABLE CONTACT

CHEMICAL AND EPICLASTIC METASEDIMENTARY ROCKS
Dungannon Formation
Carbonate Metasediments

14 Massive to foliated and layered, siliceous calcitic to dolomitic marble; locally minor, thinly interlayered para-amphibolite, calcsilicate gneiss, siliceous clastic metasediments (units 13, 12 respectively)

Amphibole-rich Metasediments

13 Foliated to layered para-amphibolite, biotite-hornblende- and hornblende-plagioclase gneiss, calc-silicate gneiss (calcareous metamudstones)

Siliceous Clastic Metasediments

12 Foliated to layered, in places interlayered, biotite-quartz-feldspar gneiss containing less than 10% biotite (feldspathic meta-arenite), and biotite-quartz-plagioclase gneiss, minor biotite schist (metawacke, metamudstone), rusty weathering quartzofeldspathic gneiss

CONFORMABLE CONTACT

HERMON GROUP
METAVOLCANIC ROCKS
Intermediate to Felsic Metavolcanics[f]

11 Foliated, in places layered, leucocratic quartzofeldspathic gneiss, biotite- and muscovite-biotite quartzofeldspathic gneiss (derived from flows or tuffs); intermediate to felsic tuff, lapilli-tuff, tuff-breccia, coarse-grained fragmental rocks, flows

Mafic to Intermediate Metavolcanics[f]

10 Foliated to layered amphibolite, hornblende-plagioclase gneiss, biotite-hornblende-quartz-plagioclase gneiss, (derived from flows or tuff); massive, amygdaloidal, porphyritic, and pillowed, mafic to intermediate flows; in places flow-breccias

CHEMICAL METASEDIMENTARY ROCKS
Carbonate Metasediments

9 Foliated to layered, siliceous calcitic to dolomitic marble; locally thinly interlayered para-*amphibolite, calc-silicate gneiss, biotite-rich and* feldspathic arenaceous metasediments (units 6, 5, 4a respectively); minor "quartzite" (meta-quartzarenite and/or recrystallized chert) interlayers

EPICLASTIC AND CHEMICAL METASEDIMENTARY ROCKS
Iron-rich Metasediments

8 Rusty weathering, quartzofeldspathic gneiss (feldspathic meta-arenite), muscovite-quartz-pyrite schist, pyritic feldspar-quartz-biotite schist; minor magnetite-bearing meta-ironstone

EPICLASTIC METASEDIMENTARY ROCKS
Aluminous Metamudstones

7 Garnet-sillimanite-biotite schist and gneiss, garnet-biotite schist, garnet-biotite-muscovite schist and gneiss

Amphibole-rich Metasediments[f]

6 Foliated to layered amphibolite, hornblende-plagioclase gneiss, calcsilicate gneiss (calcareous metamudstones)

Biotite-rich Metasediments[f]

5 Foliated to layered, in places migmatitic, biotite quartz-plagioclase gneiss (metawacke), hornblende-biotite- and biotite-hornblende-quartz-plagioclase gneiss (calcareous metawacke), biotite schist (metamudstone); minor interlayered feldspathic arenaceous metasediments

Feldspathic, Arenaceous Metasediments[f]

4
- 4a Foliated to layered, in places migmatitic, biotite-quartz-feldspar gneiss containing less than 10% biotite (feldspathic meta-arenite), muscovite-biotite-quartz-feldspar gneiss; minor interlayered biotite-rich metasediments
- 4b[g] *Thinly interbedded feldspathic meta-arenite,* rusty weathering feldspathic meta-arenite and metawacke; locally clast- to matrix-supported metaquartzarenite-pebble- and polymictic pebble metaconglomerate interbeds

CONFORMABLE CONTACT

ANSTRUTHER LAKE GROUP
EPICLASTIC METASEDIMENTARY ROCKS AND RELATED MIGMATITES
Biotite-rich Metasediments[f]

3 Unsubdivided
- 3a Foliated to layered, biotite-quartz-plagioclase gneiss, hornblende-biotite-quartz-plagioclase gneiss (metawacke); locally migmatitic varieties (unit 3b); minor biotite schist interlayers (metamudstone); in many places interlayered feldspathic arenaceous metasediments (unit 2a)
- 3b Migmatitic variety of unit 3a, with 5 to 20% granodioritic leucosome layers; minor phases of nebulitic and schlieren-like migmatite

Feldspathic Arenaceous Metasediments[f]

2 Unsubdivided
- 2a Foliated to layered, biotite-quartz-feldspar gneiss (feldspathic meta-arenite) containing less than 10% biotite; locally migmatitic varieties (unit 2b); minor interlayers of biotite-rich metasediments (unit 3a)
- 2b Migmatitic variety of unit 2a, with 5 to 10% granitic leucosome layers, lenses

UNCONFORMITY

BASEMENT MIGMATITE-GNEISS COMPLEX[f]

1 Foliated to layered, in places stromatitic, pinkish-grey migmatitic quartzofeldspathic gneiss; stromatitic, in places nebulitic and phlebitic, grey migmatitic mafic gneiss; minor massive to layered granodioritic gneiss (diatexite)

NOTES:
a) This is basically a field legend and may be changed as a result of subsequent laboratory investigations.
b) Not shown on map face.
c) The Precambrian legend is strictly lithological and no age relationship is inferred by the order of the units within the Mayo, Hermon, or Anstruther Lake Groups of the Grenville Supergroup.
d) Multiple codes are listed in order of decreasing outcrop abundance, e.g. 2ab, 3ab—2a is most abundant, 3b is least abundant.
e) Intrusive rocks emplaced during several stages.
f) The letter "G" preceding a rock code refers to a geophysically interpreted lithology from aeromagnetic map 103G (G.S.C.-1953), Burleigh Falls Sheet.
g) Unit 4b is restricted to areas along the southeastern shore of Stoney Lake, Dummer Township.