Energy, Mines and Resources, Canada — Energie, Mines et Ressources, Canada

DESCRIPTIVE NOTES

The Elbow Lake map area (NTS 63K/15) comprises 865 km2, bounded by latitudes 54° 45' and 55° 00' and longitudes 101° 00' and 100° 30'. It is located within the Early Proterozoic Flin Flon metavolcanic belt, 65 km east of Flin Flon and 40 km west of Snow Lake. The geological context of this area has been outlined by Syme (1991; 1992). The area was burnt in the summer of 1989, an event which greatly improved the quality and quantity of bedrock exposure. This map is a follow-up to the cooperative Elbow Lake project in which detailed (1:15 840) geological mapping was divided between Manitoba Energy and Mines (supracrustal rocks: Syme, 1992) and the Geological Survey of Canada (granitoid rocks: Whalen, 1992) (Syme and Whalen, 1992). Upon completion of the cooperative Elbow Lake project area, mapping of granitoid rocks within the remainder of NTS 63K/15 was carried out at 1:50 000 scale during 1992 and 1993. In this map, the geology of the area covered in the cooperative Elbow Lake project, has been greatly simplified, in particular the supracrustal rocks, major mafic intrusions and minor intrusions mapped by E. Syme, Manitoba Energy and Mines.

Supracrustal rocks in the area belong to the Amisk Group (**unit 1**) and consist mainly of mafic metavolcanic rocks and related high level intrusions. Within the area he has mapped, Syme (1992; pers. com. 1993) has subdivided these rocks into sequences with arc, back-arc and ocean island basalt affinity (**units 1a, b,** and **c**). Elsewhere in the map area, the Amisk Group is undivided (**unit 1d**). In the eastern portion of the map area, the supracrustal rocks were compiled from McGlynn (1959). In the northwestern portion of the sheet, data was compiled from Schledewitz (1992b; 1993 pers. com.). Detailed descriptions of the supracrustal rocks are given by Syme (1991, 1992) and Schledewitz (1992a).

Gneissic supracrustal rocks of possible Amisk Group affinity (**unit 2**) are exposed in the northeast portion of the map area. In large part **unit 2** was compiled from McGlynn (1959). Adjacent to the Gants Lake batholith (**unit 9**), this unit is a heterogeneous mixture of equal portions of migmatitic paragneiss and amphibolite, considered to represent a deformed and metamorphosed supracrustal package. The presence of a major proportion of probable metavolcanic rocks suggest an affinity with the Amisk Group.

Numerous small, high level intrusions into the Amisk Group were mapped along with the supracrustal rocks by Syme (1991;1992). In this map, these have been grouped into two units; a felsic to intermediate group (**unit 3a**) and a mafic to intermediate group (**unit 3b**). Each group contains intrusive phases of diverse relative ages, some of which may be equivalent to phases of the major mafic/ultramafic and granitoid intrusions. A similar variety of minor intrusions is probably present within the undivided Amisk Group (**unit 1d**) elsewhere in the map area.

A number of large mafic/ultramafic intrusions (**unit 4**) occur within the map area. The Long Bay, East Claw Lake and Elbow/Claw Lake gabbro complexes (**units 4a, 4b** and **4c**), mapped and described by Syme (1991; 1992), include a spectrum of mafic lithologies such as layered and massive gabbro units. In this map, these complexes compiled from Syme and Whalen (1992) are not subdivided. The other group of major mafic intrusions (**unit 4d**) was mainly compiled from McGlynn (1959). The name, Josland gabbro complex, was adopted from equivalent rocks described in the adjacent File Lake sheet (NTS 63K/16) by Bailes (1980). The major mafic intrusions have been interpreted as relatively early (syn- to slightly post-volcanic) intrusions (Bailes, 1980; Syme, 1991; 1992).

The East Elbow Lake, Elbow Lake, Webb Lake, and Rail Lake intrusions (**units 5** through **8**) are quartz phyric to quartz megacrystic tonalitic intrusive rocks which may belong to an early (>1860Ma), potassium-poor intrusive suite. Lithologically similar plutons near Flin Flon (Cliff Lake) and Snow Lake (Sneath Lake and Richard Lake) have been interpreted as being subvolcanic bodies which are genetically related to massive sulphide mineralization (Gordon et al., 1990).

The East Elbow Lake stock (**unit 5a**) is an oval intrusion which covers an area of 10 km^2 just east of the northeast corner of Elbow Lake. Preliminary U-Pb results from this body indicate it is pre-Missi in age (1864+/-3 Ma; Whalen and Hunt, unpublished data). This intrusion consists of white weathering, coarse- grained quartz megacrystic (1-2.5 cm), biotite-hornblende tonalite which locally contains euhedral biotite books. Foliation is generally weak and orientated east to northeast. Similar quartz megacrystic to quartz phyric tonalite sills (**units 5b** and **5c**) occur within and northwest of Claw Lake.

The Elbow Lake tonalite (**unit 6**) covers an area of 250 km^2, only about 25% of which is located within the map-area. Portions of the Elbow Lake pluton outside the map-area have been described by Baldwin (1980) and Hunt (1970). Unit 6 is generally quartz phyric rather than quartz megacrystic. Preliminary U-Pb zircon results from this pluton suggest that it is pre-Missi in age (1869+20/-7 Ma; Hunt and Whalen, unpublished data). A remarkable feature of the mapped portion of this large intrusion is a lack of distinctive compositional or textural phases. However, there is some variation at the outcrop scale in the size and abundance of euhedral biotite phenocrysts and in the degree and nature of alteration. Also, the northeastern portion of the pluton contains more prominent quartz phenocrysts or eyes. Within the central portion of this pluton, there are areas of potassic alteration spatially associated with healed vein stockworks. These veins have 1-3 cm selvages containing pink feldspar and large euhedralsecondary biotite books. Also, the foliation in these areas is arently because alteration has overgrown or obscured the original foliation.

The name Webb Lake plutonic complex (**unit 7**) is used to refer to a texturally diverse group of mainly tonalitic plutonic rocks covering an area of about 35 km^2 near Webb Lake. Portions of this complex mapped by Schlediwitz (1992a) and Syme and Whalen (1992) were previously included within the Echo Lake and Webb Creek plutons. Phases resemble the Elbow Lake tonalite (**unit 6**), in being quartz phyric (**units 7b** to **7e**) or biotite phyric (**unit 7f**) rather than quartz megacrystic and in being affected by similar hydrothermal alteration. In general, this complex appears to preserve a higher level of exposure than seen in the Elbow Lake tonalite, with **units 7b** and **7c** probably representing a subvolcanic roof zone. Textural and compositional diversity within these high level units has been mapped in detail and described by Schledewitz (1992a and 1992b).

The Rail Lake pluton (**unit 8**) is a small (18 km^2) ovoid body in the southeastern portion of the map area. One phase (**unit 8a**) is quartz megacrystic (1 to 2.5 cm), another (**unit 8b**) is biotite megacrystic (1 to 3 cm) and a third phase (**unit 8c**) is quartz phyric, similar to portions of **unit 6** and unit **7**.

The Gants Lake batholith (**unit 9**) is an elongate, north-south trending body which extends for over 54 km from beneath the Shield margin to within the Kisseynew belt. Of the 550 km^2 it occupies, over 60% is located in the map area. McGlynn (1959) described this batholith as consisting simply of gneissic biotite granodiorite. However, remapping, indicates this to be a composite batholith which contains the oldest (>1870 Ma) granitoid rocks in the map area and intrusive phases which are equivalent in age to the younger (<1850 Ma) zoned plutons (**units 12** to **14**). A sharp difference in metamorphic grade and penetrative deformation exists across this batholith. In the northeast it consists of orthogneisses (**units 9a** to **9d**) bounded further east by heterogeneous paragneisses and amphibolites (**units 2** and **1d**). This is in marked contrast to its western side where slightly to moderately foliated homogeneous plutonic phases intrude easily recognizable metavolcanic lithologies. Further work, in particular U-Pb dating, is required to resolve whether this batholith stitches a major tectonic boundary or whether it may juxtapose equivalent rocks of contrasting erosional levels.

Compositionally banded to migmatitic gneisses exposed on the northeastern side of the Gants Lake batholith have been roughly subdivided into various mappable components. This includes a number of coarse grained amphibole-garnet gabbro bodies (**unit 9a**) which have sheared contacts with their host gneisses. A major phase, grey tonalitic to quartz dioritic gneiss containing abundant sheets of earlier deformed tonalitic to mafic orthogneisses (**unit 9b**), is particularly well exposed on the shores of Gants Lake. Just northeast of here, there is an area consisting mainly of K-feldspar phyric migmatitic granodioritic gneiss (9c). Extensions of **unit 9b** further to the northeast are based on airphoto interpretation and compilation from McGlynn (1959). To the west, the easily identifiable older orthogneiss component in **unit 9b** decreases and the abundance of foliation parallel sheets of younger biotite granodiorite and granite increases (**unit 9d**). The younger component in **unit 9d** is probably equivalent to **units 9f** and **9h**. Further west there is an area (**unit 9e**) in which outcrop scale rafts of older orthogneisses (probably equivalent to **units 9b** and **9c**) are included within less deformed granodiorite to granite (equivalent to **units 9f** to **9h**). The older plutonic rafts frequently preserve foliation directions which contrast with that of their younger host rocks. Due to their compositional similarly, it is only in areas of good exposure that the two ages of granodiorite can be separated. The central portion of the Gants Lake batholith consists of a number of fine to coarse grained, biotite+/-amphibole granodioritic phases (**units 9f** to **9h**). Unit 9f is characterized by a 'sugary' recrystallized gneissic texture which is lacking in **unit 9e**. Unit 9h is texturally and compositionally more variable than **units 9e** and **9f**. Exposures of **unit 9h** in the southern part of the batholith are homogeneous finer grained equivalent of **unit 9g**. The more northern exposures of this unit can be gneissic and include compositionally banded portions. It is thought that the south to north contrasts in **units 9f** to **9h** reflect a progressive northward metamorphic and local tectonic overprinting rather than the presence of different ages of granodiorites.

The northwestern portion of the Gants Lake batholith consists of a group of probably comagmatic phases (**unit 9i** to **9m**). The U-Pb age of 1871+/-3 Ma obtained from granodiorite **unit 9j** (Hunt and Whalen, unpublished data) indicates that these phases are among the oldest in the map area. A body of diverse mafic intrusive rocks (**unit 9i**) exhibits both contacts which suggest it is comagmatic with the host granodiorite (**unit 9j**) and others which suggest that the gabbro is older. Unit 9j consists of slightly to well-foliated, buff, coarse-grained, plagioclase porphyritic (1-2 cm), biotite-hornblende granodiorite. Adjacent to this units' contact with Unit 1, there is a narrow sheet of strongly foliated to mylonitic, dark pink, aplitic to pegmatitic, biotite granite (**unit 9k**). This phase was probably intruded at the contact between **unit 1** and **unit 9j**. The northwestern edge of the batholith includes a couple of more mafic phases (**units 9l** and **9m**) considered to be comagmatic with the main granodiorite phase (**unit 9j**). Portions of **unit 9j** adjacent to **units 1** and **9h** grade to feldspar augen schist and its contacts with **units 9h** and **9g** are believed to be faults. Where exposed, this contact consists of a 100 m wide zone of ribbon mylonites, including sheets of tectonized mafic supracrustal rocks. This mylonite zone has been traced southward within the batholith east of Claw Lake where it appears to be truncated by phases of a younger intrusive suite (**units 9n** to **9s**). It is possible that the narrow elongate wedge of **unit 9j**, east of Claw Lake may have tectonically emplaced from the northwest, rather than being intruded into its present location.

The southern end of the Gants Lake batholith consists of an ovoid, bimodal intrusion (**units 9n** through **9s**), only the northern half of which lies within the map area. The eastern part of this body consists of poorly exposed fine to coarse grained gabbroic to dioritic rocks (**units 9o** and **9n**). On its west side, adjacent to Claw Lake, there is a heterogeneous mixture of gneissic to massive, fine- to medium-grained, gabbroic to tonalitic intrusive and basaltic volcanic rocks (**unit 9p**). This agmatite zone is cut by numerous dykes of equigranular to quartz-eye porphyritic tonalite to granodiorite related to **unit 9s**. To the east, similar mafic intrusive rocks, without the volcanic lithologies, form irregularly spaced, north-south orientated screens (**unit 9q**) within a major granodiorite to granite phase (**unit 9s**). The northern end of the intrusion consists of an area of quartz diorite to tonalite (**unit 9r**) that is texturally similar to **unit 9s**. Contact relationships between **units 9n** to **9s** suggest comagmatic intrusion of mafic and felsic magmas with hybridization to produce intermediate compositions (**unit 9r**). A sample of granodiorite unit 9s yielded a poorly defined U-Pb zircon age of 1845+27/-12 Ma, compatible with all phases at this end of the batholith being contemporaneous with the various zoned plutons in the map area (**units 12** through **14**).

A couple of small (1 to 2 km^2) ovoid, only slightly foliated biotite phyric (**unit 9t**) and quartz phyric granite bodies intrude well foliated portions of **unit 9g** and **9d** just southwest of Gants Lake. Their relationship to other intrusive phases is unknown.

The North Star Lake pluton (**unit 10**) is a small (10 km2) intrusion exposed on the west side of North Star Lake. Contacts of this pluton were compiled from Norquay et al. (1991). Unit 10a, a strongly foliated, medium to coarse grained quartz and plagioclase phyric biotite granodiorite to tonalite, and **unit 10b**, a very fine to fine grained biotite felsic aplite, may be metamorphosed equivalents of phases 9g and 9h of the Gants Lake batholith. If so, there is marked increase in metamorphism and deformation east of this batholith, comparable to the contrast described above between **units 9g** and **9f**.

The composite Echo Lake pluton (**unit 11**) covers an area of about 48 km^2 on the northwest side of the map-area. In the northwestern portion of this pluton, there is a massive and apparently undeformed oval plug (**unit 11e**), that may be equivalent in age (1847 Ma; Gordon et al., 1990) to plutons such as the Lynx Lake pluton south of Flin Flon, which postdate regional D2 deformation. Sharp contacts have been observed between this massive, feldspar-amphibole porphyritic granodiorite (**unit 11e**) and well-foliated, coarse-grained, hornblende-biotite granodiorite (**unit 11d**). Matrix grain size in **unit 11e** varies from very fine-grained near margins to medium-grained in its interior. Textures exhibited by this unit, together with the presence of cross-cutting amygdaloidal mafic dykes, suggest that it was intruded at a relatively high-level. Minor areas of equigranular, coarse-grained, hornblende-biotite granite occur at a number of localities near the edge of **unit 11e**. The older, tectonically foliated portion of the Echo Lake pluton has been subdivided into a number of compositional variants which become more felsic and more lithologically homogeneous toward the interior of the pluton. The most eastern **unit 11b** exhibits textural variation from fine- to coarse- grained and compositional variation from melagabbro to diorite and quartz diorite. Included in this unit are areas of diorite which contain a high portion (10 to 40%) of pyroxenitic inclusions. Coarse- grained pyroxenite occurs both as bands or schlieren and as massive zones (**unit 11a**). It is thought that some of the abrupt compositional and textural variations in this unit could be due to left-lateral faulting and shearing with displacements varying from a few meters to a number of kilometres. There is a close textural resemblance between the two more western phases. The split into two units is based on quartz content and the fact that the diorite to quartz diorite **unit 11c** commonly contains mafic (basaltic or gabbroic) inclusions. In contrast, such inclusions are less common in the quartz diorite to granodiorite **unit 11d** and biotite is more abundant than hornblende. Various compositional and textural types of dykes are most common in the eastern portion of this pluton and include grey to beige feldspar-quartz rhyolite porphyry, dark pink granitic aplite and basaltic to diabasic dykes. Due to later deformation, these dykes generally can not be followed for any distance along strike. In contrast, only one generation of amygdaloidal basaltic dykes cuts the western massive granodiorite **unit 11e**. These dykes can often be followed for up to 500 meters.

The Gauthier Lake, Norris Lake and Big Rat Lake plutons (**units 12** through **14**) are composite, compositionally zoned, generally unaltered and only slightly deformed. This relatively late suite of intrusions are probably all of similar age to the Big Rat Lake pluton from which an U-Pb age of 1845+/-3 Ma was obtained (Whalen and Hunt, unpublished data).

The Gauthier Lake pluton (**unit 12**), an ovoid body covering an area of about 30 km^2 in the north central portion of the map area, is zoned from a monzodiorite or quartz monzonite rim (**unit 12a**), through granodiorite (Unit 12b) to a granite core (**unit12c**). All internal contacts appear to be gradational. Contacts are displaced by late north-south trending, narrow, fault zones. Evidence for a vertical movement component on these faults is given by the presence of high-level porphyritic textures and stockwork quartz veins with sericitic alteration within the central portion of the granite core to this pluton.

The oval Norris Lake pluton (**unit 13**), covers an area of 24 km2 at the east-central edge of the map area. The western half of this intrusion, which lies in the map area, is zoned from a mafic inclusion-rich dioritic rim (**unit 13a**), through quartz diorite and granodiorite (**units 13b and 13c**) to minor areas of late granite (**unit 13d**). Contacts between 13a to 13c are gradation, whereas **unit 13d** intrudes **unit 13c**.

The Big Rat Lake pluton (**unit 14**) covers an area of about 32 km^2 on the southwest side of the map-area. Granitic **units 14f** and **14g** cut more mafic phases (**units 14a** to **14e**) and appear not to be cut by dykes which intrude the more mafic phases. This suggests that there could be an age gap between granitic and dioritic to granodioritic phases. The older, more mafic phases appear to be consanguineous components of a pluton which is zoned from a granodioritic rim to a dioritic core. The medium to dark pink, foliated biotite granite of **units 14f** and **14g** is remarkably uniform in composition, lacks mafic enclaves and is only cut by some probably comagmatic granitic aplite dykes. Based on consistent variations in grain size, it has been subdivided into fine- to medium- (14g) and medium- to coarse-grained (14f) portions. The eastern margin of **unit 14f** is more biotite-rich, quartz-poor and hornblende-bearing. This zone, which is also characterized by the presence of ovoid to stretched (4 to 50 cm) fine-grained, hornblende-biotite granodiorite inclusions, may reflect marginal contamination or assimilation of older quartz diorite to granodiorite. Sharp intrusive contacts were observed between **unit 14f** and older **unit 14c**. Two gradational textural subtypes of a relatively compositionally homogeneous granodiorite form the outer zones of the northeastern portion of this pluton.The outer, coarser grained, more equigranular phase (**unit 14e**) is variably foliated and sheared such that it is difficult to distinguish primary feldspar phyric texture from feldspar-augen texture. There is a gradation from coarse-grained, equigranular **unit 14e** through subporphyritic to porphyritic **unit 14d** from the margin inward. As no intrusive contacts were observed between these granodiorite units and other phases of this pluton, contacts are thought to be gradational. Other subunits in the northeast portion of this pluton are uniformly medium-grained equigranular but compositionally variable. There is variation from more felsic (quartz diorite to granodiorite)(**unit 14c**) to more mafic (quartz diorite to diorite)(**unit 14b**) towards the core. Mapped boundaries, based on field estimates of quartz and mafic mineral content, are apparently gradational over short distances rather than intrusive. Areas of hybrid intrusive rocks (**unit 14a**) consist of mainly rounded mafic igneous inclusions (5 cm to >3 m) in a matrix of diorite to quartz diorite. Inclusions form about 40 to 60% of this subunit and include mafic metavolcanic rocks, which were deformed prior to their incorporation, and cognate mafic intrusive rocks. Various dykes including basalt to diabase, grey granodioritic feldspar-hornblende porphyry and composite basalt - dacite dykes are common cutting the **units 14a** to **14e** north of Separation Creek. The presence of a right-lateral fault in Separation Creek, is indicated by offsets in approximately north-south trending intrusive boundaries. Compositional contrasts between phases across this creek could be due to some normal displacement on this fault.

Tectonites in major shear zones and faults zones (**unit 15**) include the products of both brittle and ductile deformation. These rocks, compiled from Syme and Whalen (1992) and described by Syme (1992), occur within the major north-south Elbow Lake and Claw Bay shear zones.

In general, the vastly improved quality of outcrop resulting from the 1989 burn greatly facilitates prospecting for mineral deposits in the Elbow Lake sheet. The setting of gold mineralization and potential for VMS deposits in the map area has been reviewed by Syme (1991 and 1992) and Schledewitz (1991). Gold occurrences in the Elbow Lake area are epigenetic and localized within intense deformation zones within and adjacent to the Elbow Lake shear zone. Though known gold showings occur mainly within supracrustal units, granitoid units may be equally good hosts. The burn has provided extensive new exposures of plutonic rocks cut by quartz and sulphide-bearing veins, major faults and shear zones. In contrast to the supracrustal rocks, which have been intensely prospected since the early 1930's, such zones in granitoid rocks generally bear no evidence of having been prospected. Though such zones are frequently not exposed, mapped displacements of or juxtapositioning of plutonic phases indicate the location of major faults and shear zones.

Comparison to mineralization in the Phantom Lake stock, west of Flin Flon (Galley and Franklin, 1989; Thomas, 1990) and the Star Lake pluton in the La Ronge belt (Poulsen et al., 1986), suggests that Elbow Lake area plutons also have potential for late magmatic - hydrothermal gold and porphyry-type mineralization. Portions of the Webb Lake complex (**units 7b, 7c** and **7d**) probably represent a subvolcanic roof zone. Texturally diverse very fine to fine grained intrusive phases in these units are cut by sulphide-bearing quartz vein systems which have potential for gold mineralization (Schledewitz, 1993 pers. com.). The presence of late magmatic, fracture-controlled, potassic alteration in portions of the Elbow Lake tonalite (**unit 6**) make it a possible target for gold prospecting. A couple of the younger zoned plutons contain areas of fracture-related alteration with associated sulphides. The larger fault bounded block on the east side of the granite core (**unit 12c**) to the Gauthier Lake pluton has outcrop scale areas of quartz vein related sericitic alteration. This block of **unit 12c** exhibits porphyritic textures absent in adjacent portions of this phase, suggesting that it may represent a down faulted higher level zone of the pluton. Within the core of the Norris Lake pluton (**unit 13**) there are a number of small late bodies of granite (**unit 13d**). Exposures of granodiorite **unit 13c** adjacent to **unit 13d** are cut by stockworks of sulphide-bearing veins which die out within the granite, suggesting a genetic tie between veins and granite. The map area contains a number of both early (**units 3a, 4** and **9a**) and late (**units 9o, 9p** and **11a**) mafic to ultramafic intrusions. The potential of these bodies for nickel and platinum group metals merits evaluation. For example, at the northeast edge of the Gants Lake batholith, an extensive gossan zone was noted within a 5 km^2 body of gabbro (**unit 9a**) at its contact with granodioritic gneisses (**unit 9c**).

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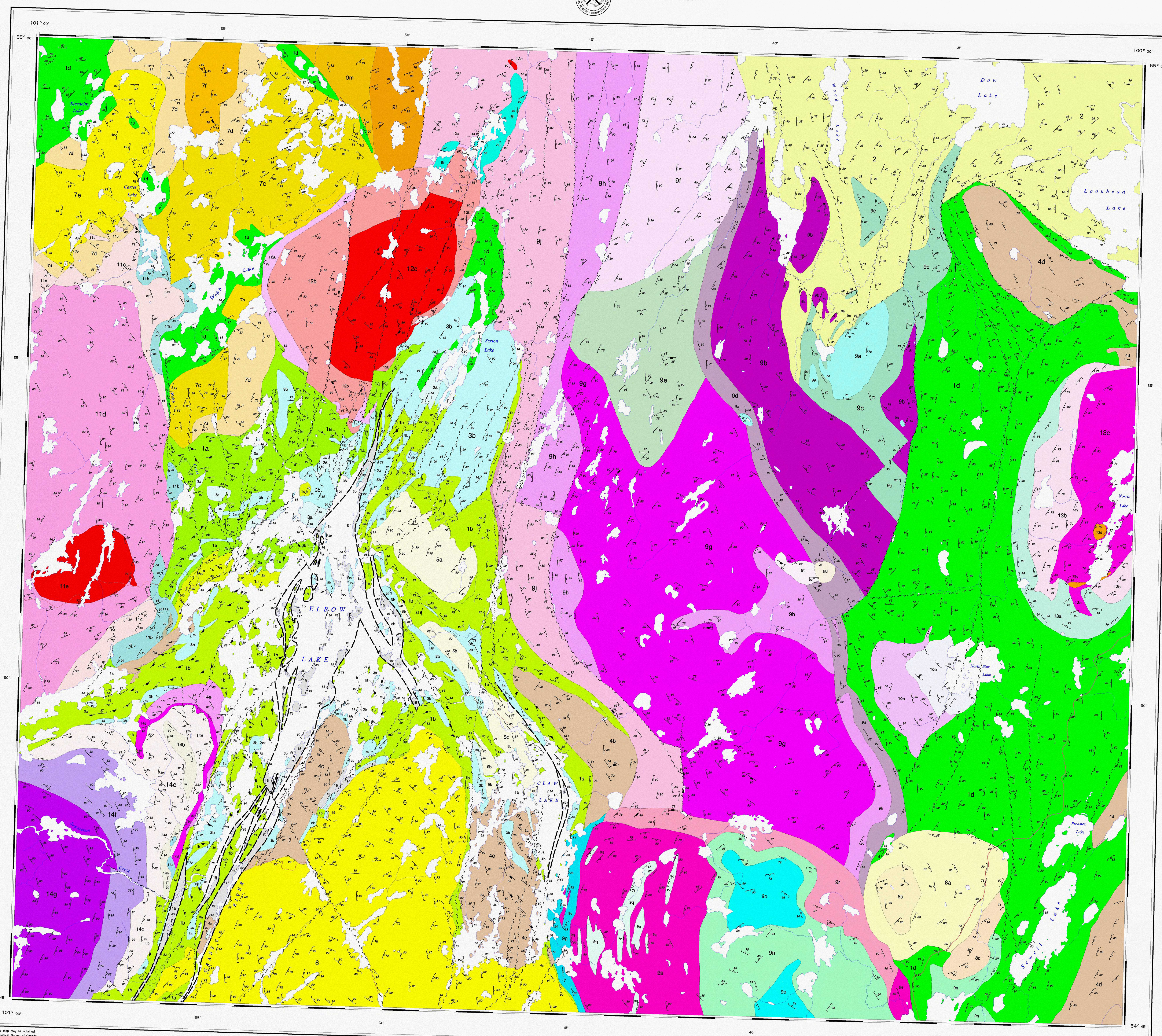

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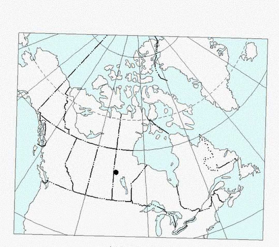

LOCATION MAP

Geology by J.B. Whalen 1991-93 assisted by M. O'Keefe 1992 and D. Morrison 1993; geology of supracrustal rocks by E. Syme 1990-92 compiled in digital form from Syme and Whalen (1992); additional information compiled from McGlynn (1959), Schledewitz (1992) and Norquay et al. (1991)

Digital map compilation by K. Baker, Geological Survey of Canada

Digital cartography by R.L. Allard, Geological Survey of Canada

Any revisions or additional information known to the user would by welcomed by the Geological Survey of Canada

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GEOLOGY

ELBOW LAKE

MANITOBA

Scale 1:50 000 - Échelle 1/50 000

Kilometres 1 0 1 2 3 4 Kilomètres

Transverse Mercator Projection
CM 100°45', Scale Factor 1
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Mean magnetic declination 1993, 9° 53' East, decreasing 9.9' annually. Readings vary from 9° 35' Esat in the SE corner to 10° 11' in the NW corner of the map

Coordinated through the auspices of the NATMAP Sheild Margin Project

Contribution to Canada-Manitoba Partnership Agreement on Mineral Development (1990-1995), a subsidiary agreement under the Canada-Manitoba Economic and Regional Development Agreeement

63N/4	63N/3	63N/2	63N/1
63K/13	63K/14	63K/15 OF 2709	63K/16
63K/12	63K/11	63K/10	63K/9

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE

LEGEND

15 Tectonites in shear zones and faults. Brittle deformation in shear zones; includes fault breccia, mylonite, diorite, and mafic and felsic phyllonites

BIG RAT LAKE PLUTON
Subunits 14a to 14e are similar in age and older than subunits 14f to 14g; contacts are gradational within 14a - 14e and 14f - 14g

14a Heterogeneous "hybrid" intrusive rocks: unit 14b with abundant (>40%) mafic igneous plutonic and volcanic inclusions

14b Grey, foliated, medium grained, equigranular, hornblende-biotite diorite to quartz diorite

14c Beige to grey, foliated, medium grained, equigranular, hornblende-biotite quartz diorite to granodiorite

14d Medium pink, foliated, medium grained, porphyritic, hornblende-biotite granodiorite (1845 +/- 3 Ma; Hunt and Whalen, unpublished data)

14e Dark pink to red, foliated, coarse grained, equigranular to subporphyritic, hornblende-biotite granodiorite

14f Dark pink, foliated, equigranular, fine to medium grained, biotite +/- hornblende granite (intrudes 14c)

14g Dark pink, foliated, equigranular, medium to coarse grained, biotite granite

NORRIS LAKE PLUTON
Subunits 13a to 13d are similar in age with gradational contacts between 13a to 13c; 13d intrudes 13b and 13c; phases of this pluton are lithologically similar to units 14a to 14e

13a Grey, foliated, fine to medium grained, equigranular, hornblende +/- biotite diorite to quartz diorite containing common rafts and inclusions of fine to coarse grained mafic plutonic rocks including pyroxenite, gabbro and quartz gabbro

13b Grey to pink, foliated, medium grained, equigranular, hornblende-biotite quartz diorite to granodiorite

13c Pink, foliated, medium grained, equigranular, hornblende-biotite granodiorite

13d Pink, foliated, fine to medium grained, equigranular, biotite-hornblende granite

GAUTHIER LAKE PLUTON
Subunits 12a to 12c are similar in age with gradational contacts

12a Beige to grey, foliated, fine to coarse grained, equigranular, hornblende-biotite monzodiorite to quartz monzonite

12b Pink to grey, foliated, medium to coarse grained, equigranular, hornblende-biotite granodiorite

12c Pink, foliated, medium to coarse grained, K-feldspar phyric, biotite-hornblende granite to granodiorite

ECHO LAKE PLUTON
Subunits 11b to 11d have gradational contact and are similar in age; subunit 11b intrudes 11a and subunit 11e intrudes 11d

11a Black, massive, coarse grained, pyroxenite and melagabbro

11b Grey to black, foliated, medium to coarse grained, equigranular, hornblende +/- biotite gabbro to quartz diorite with abundant (>30%) mafic plutonic inclusions, including pyroxenite (intrudes 11a)

11c Grey to beige, foliated, medium to coarse grained, equigranular, hornblende +/- biotite diorite to quartz diorite

11d Pink to grey, foliated, medium to coarse grained, equigranular, hornblende-biotite granodiorite to quartz diorite

11e Grey, massive, feldspar porphyritic, hornblende-biotite, granodiorite; minor equigranular coarse grained granite adjacent to unit 11d (intrudes 11d)

NORTH STAR LAKE PLUTON
Subunits 10a and 10b are similar in age and maybe equivalent to units 9g and 9h, respectively

10a Grey to beige, well foliated, medium to coarse grained, quartz phyric biotite granodiorite

10b Dark grey to pink, well foliated, very fine to fine grained, equigranular, biotite granodiorite (intrudes 10a)

GANTS LAKE BATHOLITH
Phases within this batholith range in age from 1845 (subunit 9s) to 1871 Ma (subunit 9j) or older (subunits 9a to 9h); subunits within the following groupings are thought to be of similar age: 9f to 9h; 9i to 9m; 9n to 9s; 9t to 9u

9a Black, medium to coarse grained, foliated, equigranular, hornblende-pyroxene +/- garnet gabbro

9b Grey, medium to coarse grained, equigranular, biotite-hornblende, tonalitic to quartz dioritic gneiss with abundant (>30%) rafts of older compositionally-banded garnet-bearing tonalitic and amphibolitic gneisses

9c Pink to grey, fine to coarse grained, equigranular to K-feldspar phyric, biotite-hornblende granodioritic gneiss

9d As subunit 9b with abundant dykes and sheets of younger fine to medium grained, biotite granodiorite to granite and granitic pegmatite equivalent to subunits 9g and 9h

9e Heterogenous sheeted mixture of older, foliated to gneissic, medium to coarse grained, biotite tonalite to granite (probably equivalent to subunits 9b and 9c) and younger, massive to foliated, fine to coarse grained, biotite granodiorite to granite (equivalent to subunits 9f and 9h)

9f Pink to beige, medium to coarse grained, gneissic, quartz porphyritic, biotite granite to granodiorite (maybe equvalent to subunit 9g)

9g Medium to coarse grained, biotite granite to granodiorite

9h Grey to pink, foliated, fine to medium grained, equigranular to plagioclase phyric, biotite +/- hornblende granodiorite to granite; includes compositionally banded gneissic portions with a sugary recrystallized texture

9i Mafic intrusive complex; includes diabase, medium grained hornblende diorite, coarse to very coarse grained equigranular hornblende gabbro and minor pyroxenite

9j Grey to beige, coarse grained, plagioclase phyric to equigranular, hornblende-biotite granodiorite to quartz diorite (1871 +/- 3 Ma; Hunt and Whalen, unpublished data)

9k Pink, foliated to mylonitic, leucocratic granite pegmatite and/or aplite

9l Grey, medium grained, equigranular to plagioclase phyric, hornblende-biotite quartz diorite to granodiorite

9m Grey, foliated, fine to coarse grained, equigranular, hornblende-biotite quartz diorite to diorite

9n Grey to black, slightly foliated to massive, equigranular, very fine to medium grained, hornblende gabbro to quartz diotite

9o Black, massive to slightly foliated, medium to coarse grained, hornblende-biotite gabbro to diorite

9p Heterogeneous "hybrid" intrusive rocks; mixture of foliated, fine to medium grained, hornblende-biotite diorite to quartz diorite and mafic volcanic rocks in a matrix of, and cut by dykes of, medium to coarse grained, dark pink granodiorite to quartz diorite equivalent to subunit 9s

9q Grey to black, massive to foliated, fine to coarse grained, hornblende-biotite diorite to quartz diorite; cuspated, pillowed contacts with subunit 9a suggest comagmatic intrusion

9r Grey to beige, coarse grained, equigranular, hornblende-biotite quartz diorite to tonalite

9s Dark pink to grey, coarse grained, foliated, hornblende-biotite granodiorite to granite; includes quartz phyric portions and dykes (1845+27/-12 Ma; Hunt and Whalen, unpublished data)

9t Beige, massive to slightly foliated, coarse grained, biotite phyric granite

9u Beige, massive to slightly foliated, coarse-grained, quartz phyric biotite granite

RAIL LAKE PLUTON
Subunits 8a to 8c are thought to be similar in age

8a Pink to beige, foliated, coarse to very coarse grained, quartz megacrystic hornblende-biotite tonalite

8b Beige, foliated, coarse to very coarse grained, biotite megacrystic tonalite (intrudes 8a)

8c Beige, foliated, fine to medium grained, quartz phyric biotite-hornblende tonalite (intrudes 8a)

WEBB LAKE PLUTONIC COMPLEX
Subunits 7b to 7f are similar in age and lithologically similar to Elbow Lake tonalite (unit 6); contacts are both gradational and intrusive; subuits 7b and 7c are interpreted as high level roof zone equivalents of 7e and 7f; subunit 7d is intruded by unit 11c

7a Grey, fine grained, foliated, plagioclase phyric, biotite-hornblende quartz diorite

7b Beige to pink, slightly to strongly foliated, very fine to medium grained, quartz phyric biotite leucotonalite porphyry containing abundant (>30%) mafic to felsic supracrustal inclusions

7c Beige to pink, slightly to strongly foliated, very fine to medium grained, quartz phyric biotite leucotonalite porphyry with areas of abundant (>30%) comagmatic, fine grained, hornblende-biotite diorite inclusions

7d Pink, foliated, fine to medium grained, quartz phyric, biotite-hornblende tonalite to quartz diorite

7e Pink to grey, foliated, medium to coarse grained, quartz phyric, biotite-hornblende tonalite to quartz diorite

7f Pink to grey, foliated, medium to coarse grained, biotite phyric, biotite-hornblende tonalite

ELBOW LAKE TONALITE

6 Beige to pink, medium to coarse grained, equigranular to quartz-biotite megacrystic, biotite-hornblende tonalite (1869+20/-7 Ma; Hunt and Whalen, unpublished data)

EAST ELBOW LAKE TONALITE STOCK AND RELATED SILLS

5 5a: Beige, coarse grained, quartz megacrystic, biotite-hornblende tonalite (1864+/-3 Ma; Hunt and Whalen, unpublished data)
5b: Beige, equigranular to weakly quartz megacrystic biotite-hornblende tonalite; minor quartz diorite
5c: Beige to greenish, fine to medium grained, equigranular to quartz phyric, biotite-hornblende tonalite, locally gneissic; diabase dykes; local intrusions; locally contains an older grey-green phase and a younger leucocratic phase

MAJOR MAFIC/ULTRAMAFIC INTRUSIONS

4a 4a: Long Lake gabbro complex
4b: East Claw Lake gabbro complex
4c: Elbow Lake/Claw Lake gabbro complex
4d: Josland gabbro complex

MINOR INTRUSIONS

3a Felsic to intermediate intrusions: quartz porphyry, fine grained leucotonalite, rhyolite, quartz diorite

3b Mafic to intermediate intrusions: diabase, gabbro diorite, pyroxenite, mafic agmatite

GNEISSIC SUPRACRUSTAL ROCKS OF POSSIBLE AMISK AFFINITY

2 Mixture of compositionally banded amphibolitic gneiss and granodioritic migmatite and paragneiss cut by abundant dykes and sheets of tonalitic to granodioritic orthogneisses (equivalent to units 9b and 9c)

AMISK GROUP
Mainly mafic, with minor felsic, volcanic and volcanoclastic rocks, minor sedimentary rocks and high-level intrusive rocks

1a Arc assemblage

1b Ocean floor assemblage

1c Ocean island basalt assemblage

1d Undivided

Geological contact (observed, inferred)
Bedding, top known (inclined) 80
Bedding, top unknown (inclined) 80
Pillows, top known (inclined,overturned) 35 60
Pillows, top unknown (inclined) 80
Flow contact, top known (inclined) 80
Flow contact, top unknown (inclined) 80
Foliation, inclined (generation unknown, 1st, 2nd) 90 75 85
Igneous layering, top known (inclined,overturned) 85 60
Igneous layering, top unknown (inclined) 80
Lineation, generation unknown (inclined) 35
Fault, sense unknown (outcrop scale) 80
Fault
Shear zone, sense unknown (inclined) 80
Narrow shears and shear zones
Boundary of shear zones

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