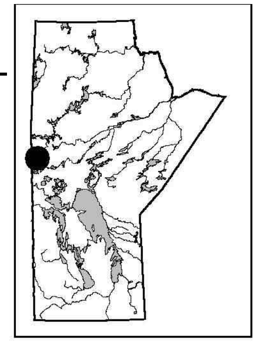
GS-2 GEOLOGY OF THE WABISHKOK LAKE AREA (PARTS OF NTS 63K/13NE AND /14NW)

by H. P. Gilbert



Gilbert, H.P. 2001: Geology of the Wabishkok Lake area (parts of NTS 63K/13NE and /14NW); *in* Report of Activities 2001, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 18-27.

SUMMARY

- The volcanic section in the Wabishkok Lake area is dominated by pillowed basalt, derived gneiss and intercalated gabbro, interpreted as arc-type rocks. Massive to fragmental felsic volcanic rocks and minor mafic volcanic breccia units occur within the volcanic section in the east part of the map area.
- Regional foliation in the Wabishkok Lake area is interpreted as a product of an early deformation event (F_1). Other structural features associated with the first deformation are not preserved; thus, the configuration of early fold structures and the extent of any structural repetition are not known. Northeast-plunging F_2 folds are distinguished from shallower, east-plunging lineations associated with the F_3 Wabishkok Lake antiform, which is delineated by the regional S_1 foliation pattern. This major fold structure, the hinge line of which extends through an early pluton in the centre of the map area ('Pistol Lake granodiorite'), trends east-northeast, roughly parallel to the margin of the greenstone belt. The F_3 deformation caused partial dispersion of F_2 minor fold attitudes. Late F_4 brittle deformation resulted in minor faulting and localized tectonic breccia.
- Most occurrences of surficial mineralization occur within basalt, but one of the most significant economic prospects in the Wabishkok Lake area is associated with felsic volcanic rocks. Rhyolite at Blueberry Lake, in the east part of the map area, contains several massive pyrite-pyrrhotite (± chalcopyrite) layers up to 1.5 m thick; assay data indicate moderate Zn and Au contents. A massive to fragmental rhyolite unit between Wabishkok and Kotyk lakes, which is possibly part of the same formation, contains sporadic gossan domains derived from pyritic mineralization. Electromagnetic conductors locally intersect the margins of the latter rhyolite unit, which occurs within a gabbro sill. In basaltic rocks, rusty weathering zones with sulphide mineralization are locally associated with minor felsic porphyry intrusions and silicic alteration. The mineralization occurs both within mafic flows and at basalt-gabbro contacts. Recent exploration has focused on a gold-bearing, sulphide-oxide–facies iron formation in the gabbroic terrane between Wabishkok Lake and Lac Aimée.

INTRODUCTION

A four-week geological mapping program was conducted in June in the Wabishkok Lake area, on the north flank of the Flin Flon greenstone belt (Fig. GS-2-1). This project was designed to extend detailed (1:20 000 scale) map coverage north from the Lac Aimée–Naosap Lake area (Gilbert, 1997, 1999), in order to

- investigate the regional structure, geochemistry and tectonic affinity of the volcanic rocks in the Wabishkok Lake area;
- investigate the age and origin of major intrusive units; and
- investigate all mineral showings and assess their economic potential.

Mapping was conducted from a base on Wabishkok Lake, accessible to four-wheel drive vehicles via a rough logging road at kilometre 34 on the road to Sherridon. Comprehensive map coverage was achieved in the volcanic terrane in the vicinity of Wabishkok Lake, as far as Blueberry Lake in the east, and north to within 0.5 km of the volcanic rock–sedimentary gneiss contact south of Kisseynew Lake (Fig. GS-2-1, -2). Preliminary results indicate that the area contains arc-type volcanic components, intruded by early gabbroic and granitoid intrusions. The map area is located in the Wabishkok Lake fault block, which is the northernmost component of the Amisk collage in this part of the Flin Flon greenstone belt (Gilbert, 1999). The Amisk collage (1.92–1.87 Ga; Lucas et al., 1996) is a Paleoproterozoic accretionary complex that contains diverse volcanic rock suites; these have been compared to various modern analogues, such as intra-oceanic arc basalt and MORB-like rocks of arc-rift and/or ocean-floor origin (Stern et al., 1995a, 1995b; Syme et al., 1996; Gilbert, 1996).

Supracrustal rocks in the Wabishkok Lake area consist almost entirely of basaltic flows, intercalated with associated intrusive units (Table GS-2-1). Rhyolite is only a minor component of the volcanic sequence, and volcanic fragmental rocks are rare. No sedimentary rocks have been recognized, although iron-formation in the terrane between Wabishkok Lake and Lac Aimée may extend into the south part of the map area. Limited data in the south part of the Wabishkok Lake fault block, north of Lac Aimée, indicate the basalt in that area is tholeiitic (Gilbert, 1999). Field data from the volcanic sequence in the tholeiitic Wabishkok Lake area are consistent with an arc-volcanic affinity; geochemical data to confirm the origin of these rocks is expected to be available before the end of this year.

STRUCTURE

The first tectonic event that affected rocks in the Wabishkok Lake area was crustal-scale faulting that accompanied 1.88–1.87 Ma tectonic accretion of the Amisk collage (Lucas et al., 1996), when the Wabishkok Lake fault block was juxtaposed against strata of the Kisseynew sedimentary basin immediately to the north (Fig. GS-2-1). The contact between

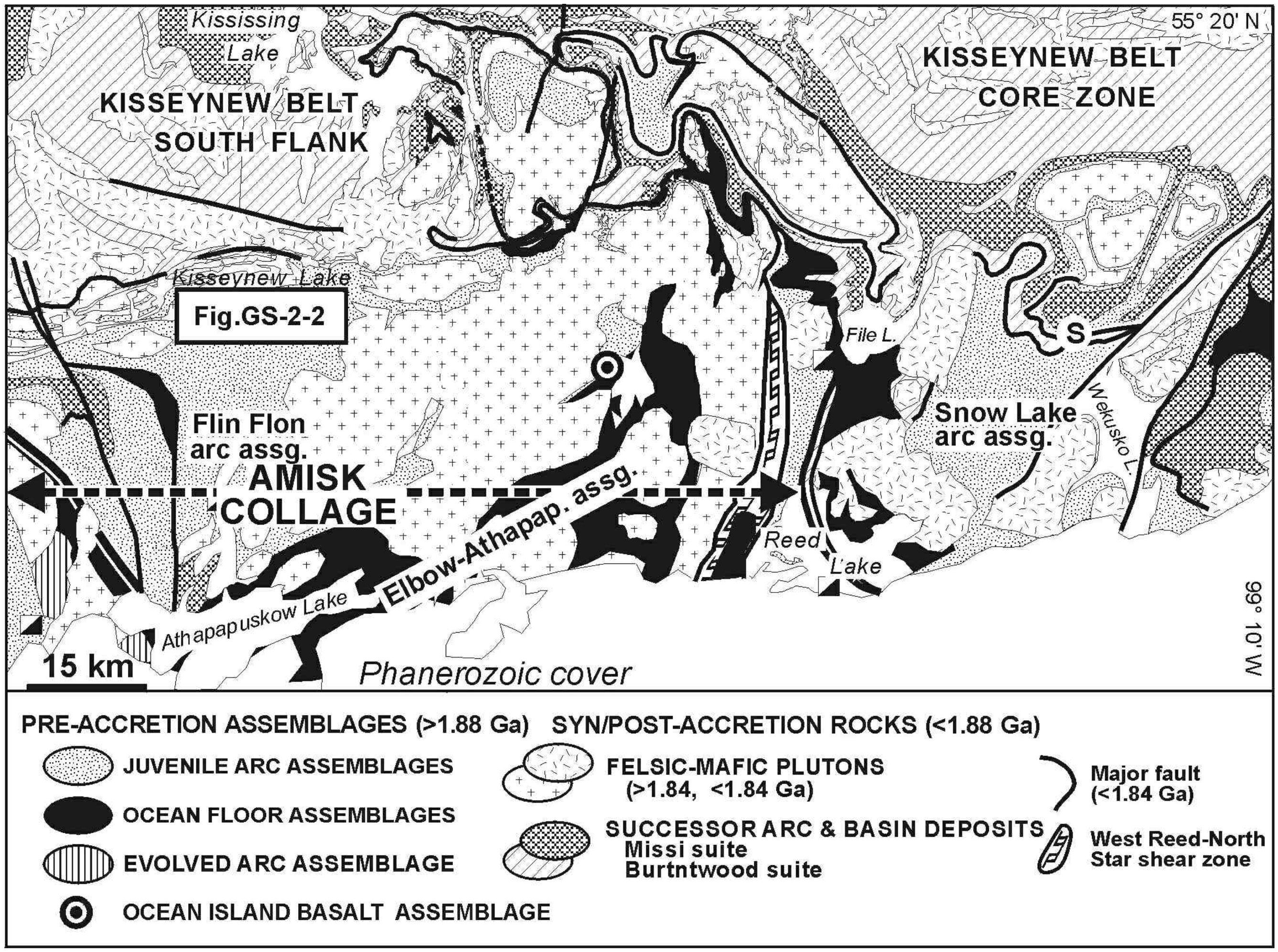


Figure GS-2-1: Simplified geology of the Flin Flon greenstone belt, showing the major tectonostratigraphic assemblages and location of the Wabishkok Lake area.

Wabishkok Lake area volcanic rocks and the metasedimentary gneiss to the north has been interpreted as faulted to locally stratigraphically conformable, suggesting that the margin of the greenstone belt locally represents a facies transition between volcanic rocks to the south and turbidite-type, epiclastic deposits in the Kisseynew basin to the north (Zwanzig and Schledewitz, 1992). Thus, in contrast to many of the components of the Amisk collage that were tectonically transported during the accretionary event, the Wabishkok Lake fault block may not have been affected significantly by such transport, and probably occupies approximately the same site as the volcanic edifices from which it is derived.

Four deformation phases postdate tectonic accretion in the Wabishkok Lake area. The structural history is defined by features such as minor folds, lineations and faults that affect the regional foliation, which is interpreted as a product of the earliest deformation phase (F_1). The regional S_1 foliation is assumed to have been associated with major folds, but the attitudes of the hypothetical F_1 structures are unknown because planar features such as bedding or flow layering, which may have contained F_1 minor folds, are not preserved in the map area. The F_2 deformation resulted in northeast-plunging minor folds (mainly Z-asymmetrical) that range from open flexures to tight similar folds, locally associated with axial-planar, strain-slip cleavage (Fig. GS-2-3). These structures are distinguished from east-trending, shallowly plunging F_3 folds (and various concordant ‘B’ lineations) that are associated with the Wabishkok Lake antiform (Fig. GS-2-4). Mineral lineations and micro-crenulations (L_3) are most conspicuous in the core of this major fold, at the eastern end of Wabishkok Lake (Fig. GS-2-5). A plot of all S_1 foliations in that area, where the F_3 fold closure is defined by the trace of the regional foliation, indicates that the shallow, easterly plunge of the major fold axis approximates the average of all F_3 lineations and minor fold axes in the map area (Fig. GS-2-4, -6). The east-northeast trend of the shallowly plunging Wabishkok Lake antiform is roughly coincident with the volcanic rock–metasedimentary gneiss contact at the north margin of the greenstone belt, which apparently represented a significant influence on the attitude of the fold. The last deformation phase (F_4) consisted of localized brecciation, shearing and faulting, generally at a high angle to the regional foliation. This brittle deformation was commonly accompanied by retrogressive metamorphism, characterized by epidote-chlorite-quartz mineral assemblages (Fig. GS-2-7).

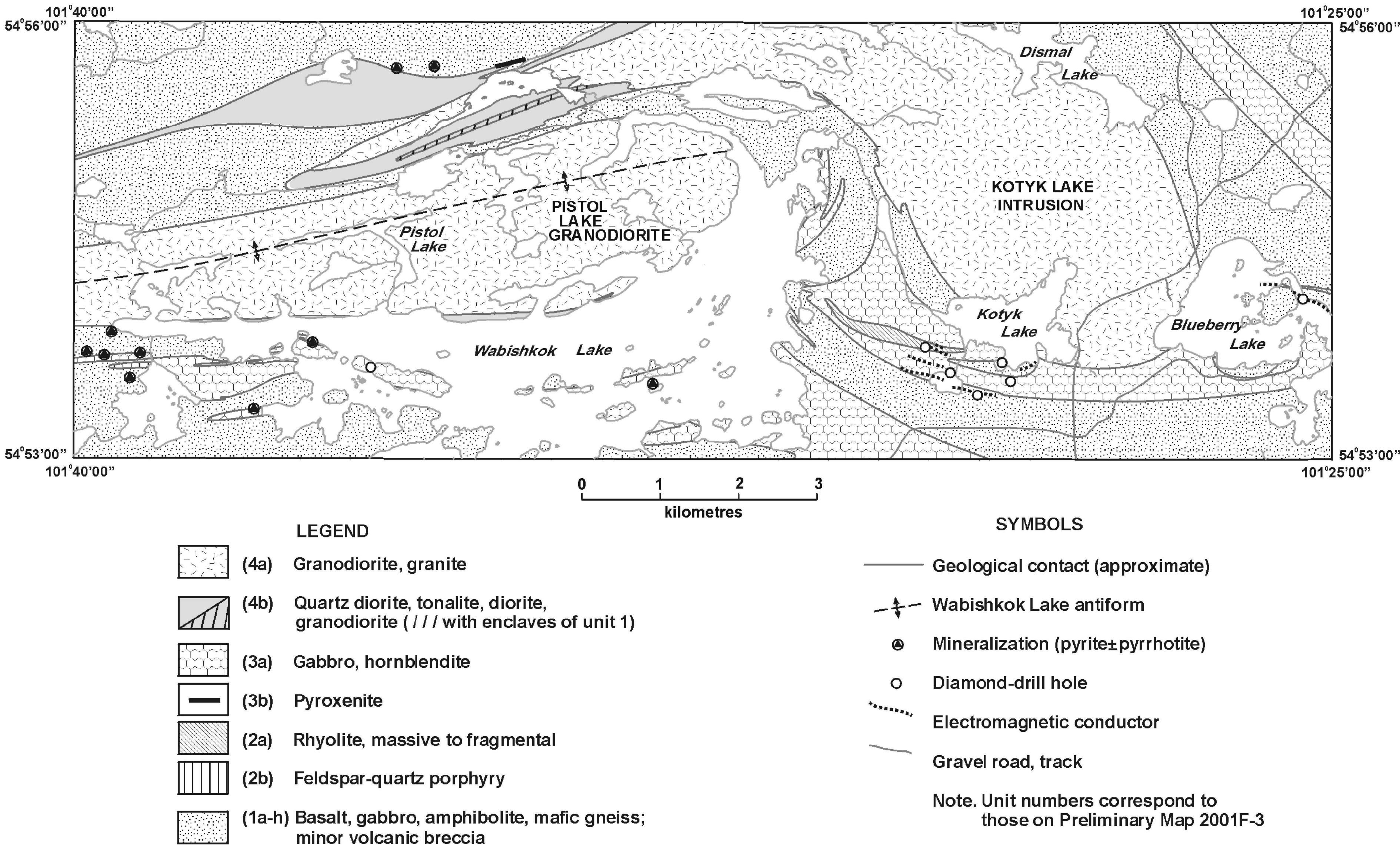


Figure GS-2-2: Generalized geology of the Wabishkok Lake area.

Table GS-2-1: Geological map units in the Wabishkok Lake area.

INTRUSIVE ROCKS		
Granodiorite, granite, quartz diorite, tonalite, minor diorite (4)		
	(4a)	Granodiorite, granite, minor pegmatite and aplite
	(4b)	Quartz diorite, tonalite, minor diorite and granodiorite
Gabbro, pyroxenite (3)		
	(3a)	Gabbro, minor hornblendite
	(3b)	Pyroxenite
VOLCANIC ROCKS		
Rhyolite, felsic porphyry (2)		
	(2a)	Rhyolite, massive to fragmental
	(2b)	Feldspar-quartz porphyry
Basalt, related intrusive rocks and derived gneiss (1)		
	(1a)	Aphyric basalt and derived gneissic rocks; related gabbro
	(1b)	Gabbro (synvolcanic)
	(1c)	Aphyric and pyroxene-phyric pillowed basalt
	(1d)	Monolithic volcanic breccia
	(1e)	Heterolithic volcanic breccia

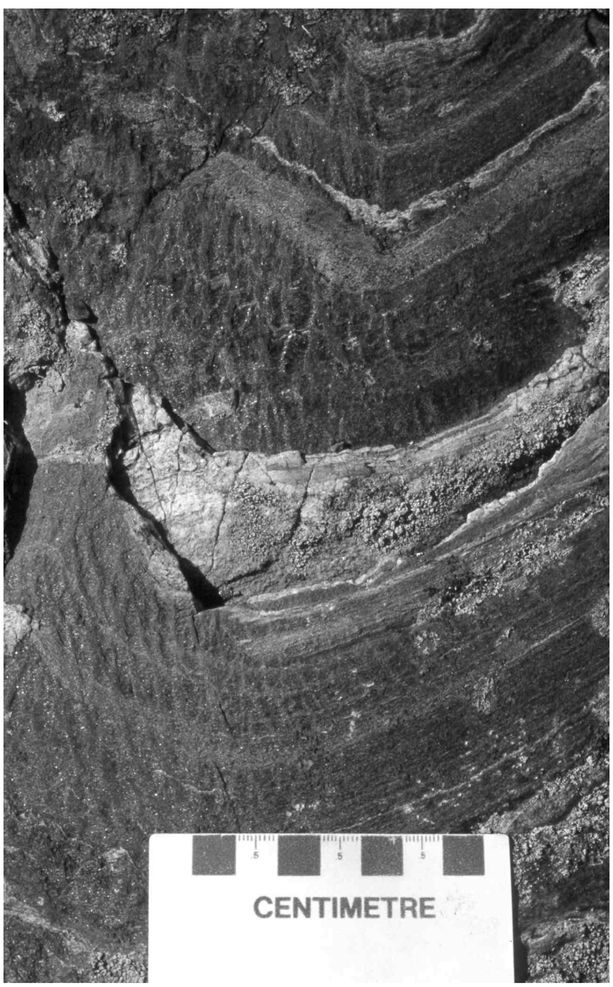


Figure GS-2-3: F_2 fold and associated axial-planar strain-slip cleavage at the eastern end of Wabishkok Lake.

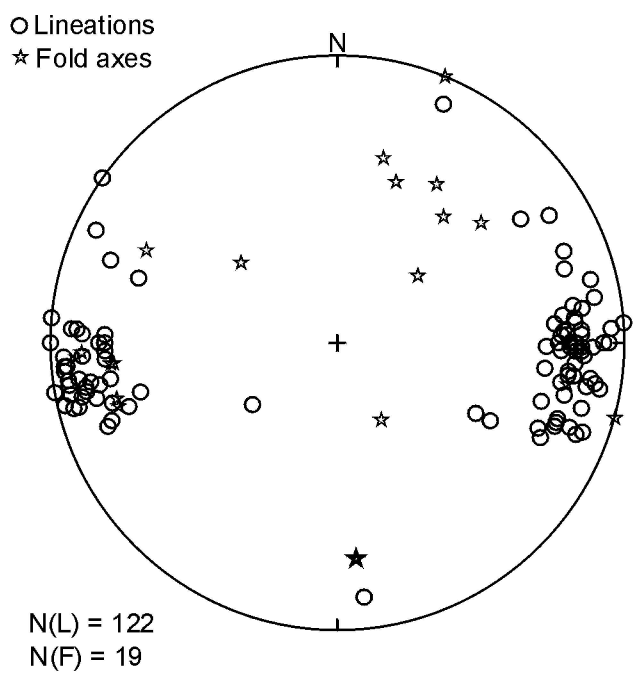


Figure GS-2-4: Lower-hemisphere stereographic plot of minor folds and lineations in the Wabishkok Lake area.

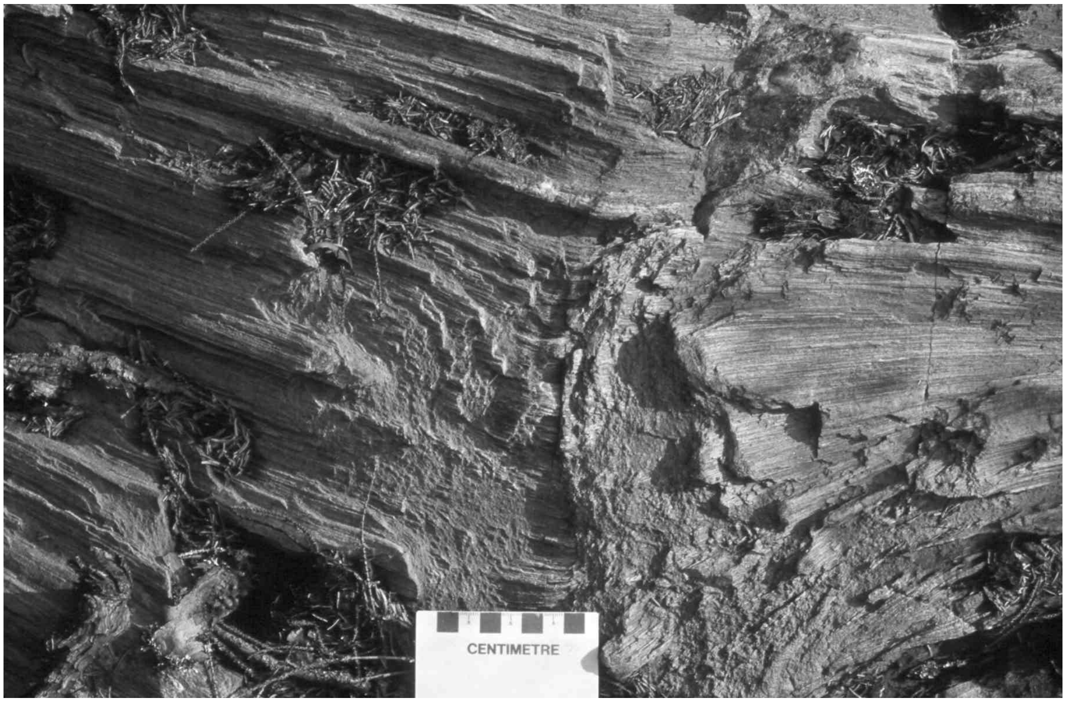


Figure GS-2-5: L_3 lineation in amphibolitic gneiss, slightly deformed by an F_4 fault at the eastern end of Wabishkok Lake.

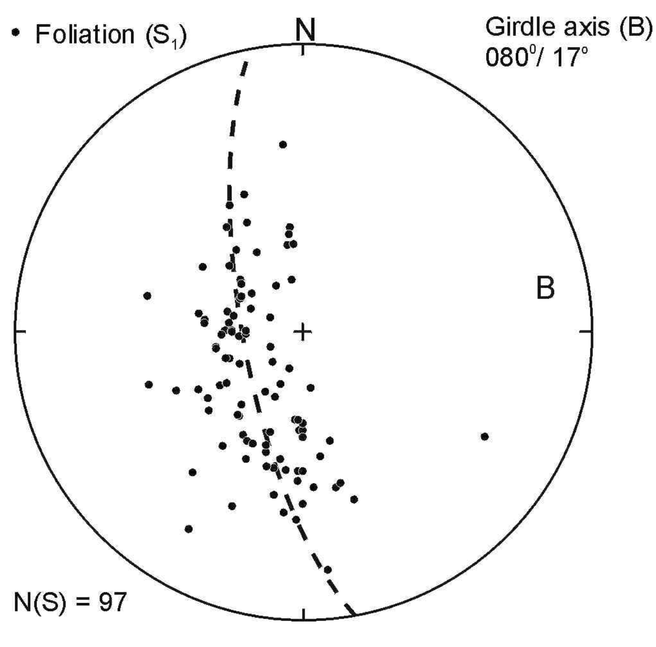


Figure GS-2-6: Lower-hemisphere stereographic plot of S_1 foliation in the eastern Wabishkok Lake area.

Figure GS-2-7: Late (F_4) tectonic breccia with massive epidote matrix in gabbro close to the western end of Wabishkok Lake.

STRATIGRAPHY

Aphyric Basalt and Derived Gneissic Rocks; Related Gabbro (1a)[1]

Aphyric basalt, amphibolite, derived gneiss and schist (1a) constitute over 90% of supracrustal rocks in the Wabishkok Lake area. The mafic volcanic rocks occur in a uniform stratigraphic sequence devoid of sedimentary intercalations, although rare interflow units of autoclastic breccia (up to 0.4 m thick) are locally preserved. Pillow structure is present in only a minority of units, although pillows occur in all parts of the volcanic section. North-facing pillow tops were recognized at several places in the southwest corner of the map area, where pillowed flows are best preserved. At that locality, moderately flattened pillows are typically 0.5 to 2 m long and characterized by 1 to 5 mm long amygdules of quartz±feldspar, or rare carbonate. The flows weather medium to dark gray-green and have dark chloritic selvages that are locally cored by saussuritized plagioclase. Several occurrences of 'mattress' pillows (up to 5 m long) also occur in the section. Some pillows contain conspicuous, large quartz amygdules (up to 8 by 1.5 cm) toward their margins and large open vugs in pillow cores. Radial pipe-amygdules occur in several units.

Minor epidotic alteration occurs sporadically throughout the Wabishkok Lake basalt. In the southwest part of the map area, epidotization is locally pervasive in concordant zones up to 10 m wide. Several ages of epidotization are recognized, including early, syngenetic (sea-floor) alteration and subsequent introduction of epidote in concordant veins and younger joint sets. Tectonic breccia associated with late, brittle deformation (F_4) is characterized by a massive epidote matrix (Fig. GS-2-7). Conformable pyritized zones (0.2 to 0.5 m wide) occur locally, within or at the margins of basaltic flows. The mineralized zones, which contain up to 5% disseminated to stringer pyrite (±pyrrhotite and traces of base metals), are commonly associated with silicic alteration and are locally strongly sheared. Silicification and mineralization are locally spatially related to concordant units of felsic porphyry (2b) within the basaltic section. Amphibolitic gneiss and schist occur in strongly attenuated zones toward the margins of the volcanic terrane, and also in localized areas adjacent to altered, epidotized basalt domains or mineralized zones. The mafic gneiss commonly displays a thinly laminated, dynamometamorphic fabric, with concordant epidotic layers (2–10 mm) derived from altered domains and selvages in pillowed flows, and subordinate quartzofeldspathic stringers. Elsewhere, the lamination is very fine (0.5–2 mm) and defined by grey- to green-weathered tones that reflect subtle differences in mafic mineral content. The metamorphic rocks are locally porphyroblastic, with subhedral hornblende or elongate anthophyllite prisms that indicate at least a lower amphibolite grade of metamorphism. Disseminated garnets and richly garnetiferous zones (up to 30 cm wide) within amphibolitic gneiss were also noted at a few localities.

Gabbro, Synvolcanic (1b)

Synvolcanic mafic sills (1–40 m wide), intercalated with the Wabishkok Lake basalt, are generally massive to moderately foliated and locally display chilled margins. The intrusive rocks consist of mesocratic to melanocratic gabbro that contains up to 80% amphibole. At one locality, a 3 m wide gabbroic feeder dyke that truncates a volcanic flow terminates in pillowed basalt, with which it is lithologically gradational. Synvolcanic gabbro sills are texturally gradational with the massive, central parts of some flows, and the origin of some units (i.e., intrusive versus extrusive) cannot be ascertained.

Aphyric and Pyroxene-Phyric Pillowed Basalt (1c)

West-southwest-facing mafic volcanic flows of subunit 1c at Blueberry Lake are lithologically and stratigraphically distinct from basalt elsewhere in the Wabishkok Lake area. Only two localities are known for this unit, which is at least 40 m thick and consists of two distinct flows, both characterized by small, relatively undeformed amygdaloidal pillows (generally <1 m across) with thick (3 cm) selvages. Pillow cores are epidotized and display a densely packed, plagioclase-amygdaloidal texture. At the southeastern locality, hornblende pseudomorphs after pyroxene constitute up to 25% of the rock, whereas the flow at the northwestern locality is aphyric; the two flows are approximately on strike. The pillowed basalt is assumed to be stratigraphically conformable with adjacent volcanic breccia (1d), but the contact between these map units is not exposed.

Monolithic Volcanic Breccia (1d)

Basaltic breccia of probable autoclastic origin (1d) occurs on an islet in the centre of Blueberry Lake. The breccia unit is at least 2 m thick and contains exclusively mafic clasts that range widely in amygdaloidal texture; quartz amygdules constitute 10 to 50% of clasts by volume (Fig. GS-2-8). The fragments are angular to irregular in shape, locally with cuspate margins. Remnants of chloritic rims on some clasts are similar to small, dark green tabular fragments in the monolithic breccia, which may be derived from the spalled surface of a cooling flow. Basaltic flow-breccia of similar origin occurs locally within the mafic volcanic section in the southwest part of the map area, but those interflow breccia units are invariably deformed and epidotized, and original features are poorly preserved.

[1] Numbers in parentheses throughout this report refer to map units in Table GS-2-1 and on Preliminary Map 2001F-3.

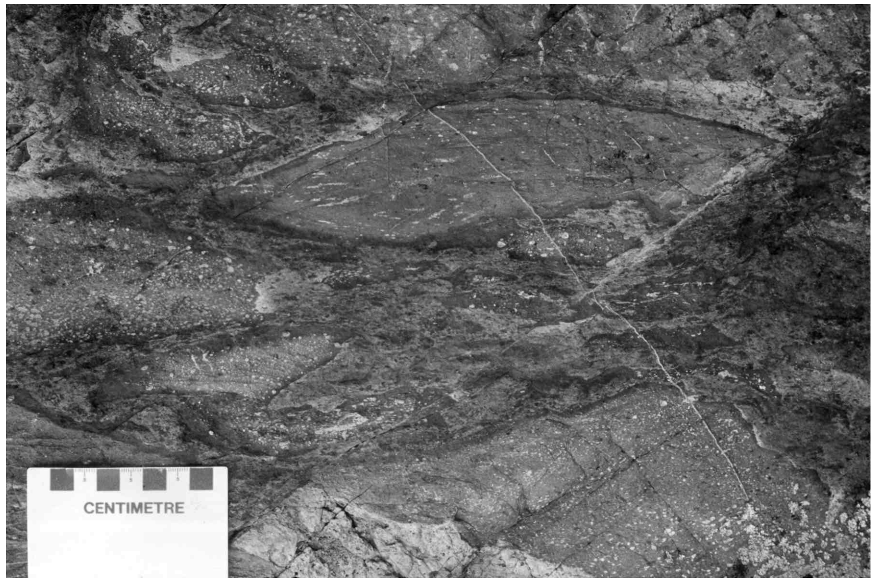


Figure GS-2-8: Monolithic basalt flow-breccia with amygdaloidal fragments (1d) at Blueberry Lake.

Heterolithic Volcanic Breccia (1e)

An isolated outcrop of heterolithic volcanic breccia occurs in the central part of Blueberry Lake, adjacent to the inferred mafic flow-breccia unit (1d). The heterolithic breccia, which is provisionally interpreted as part of a debris flow, consists of unsorted, 1 to 2 m thick, coarse fragmental layers intercalated with minor lapilli-tuff beds over an outcrop width of 8 m. The breccia is mostly undeformed and contains cobbles and small blocks of basalt and subordinate felsic clasts. Mafic fragments display widely variable aphyric to plagioclase-phyric and amygdaloidal textures. The fragments are angular to highly irregular in shape, and occur in a tuffaceous matrix (Fig. GS-2-9).

Rhyolite, Massive to Fragmental (2a)

A lensoid unit of porphyritic rhyolite, up to 160 m thick and approximately 1.6 km along strike, occurs within the gabbro sill west of Kotyk Lake. The rhyolite appears to be largely massive, but contains subordinate primary fragmental zones that suggest the unit is an extrusive lava flow. Localized chilled margins at the gabbro-rhyolite contact support the interpretation that the felsic unit is a skialithic enclave within the mafic intrusion.

White- to pale grey-weathering rhyolite contains small (approx. 1 mm) phenocrysts of plagioclase (up to 15% of the rock) and subordinate quartz (up to 5%). The strongly foliated felsic unit is characterized by diffuse, pale grey streaks and localized iron-stained domains up to 0.6 m wide. Possible spherulitic texture was observed at one locality. A fragmental zone, over 10 m wide and close to the south margin of the rhyolite, contains grey-weathering, angular to irregularly shaped clasts up to 8 cm across. The fragments typically constitute 25 to 40% of the rock and are inferred to be autoclastic in origin. Breccia with more densely packed fragments (up to 70% of the rock) is interpreted as a transitional rock type between massive rhyolite and the marginal breccia facies (Fig. GS-2-10).

Feldspar-Quartz Porphyry (2b)

Homogeneous felsic porphyry with sparse plagioclase (±quartz) phenocrysts occurs in several concordant units, up to 65 m thick, within the basaltic section in the southwest corner of the map area. The moderately to strongly foliated porphyry is very fine grained to aphanitic, and generally highly silicic; weathered surfaces are white, with localized,

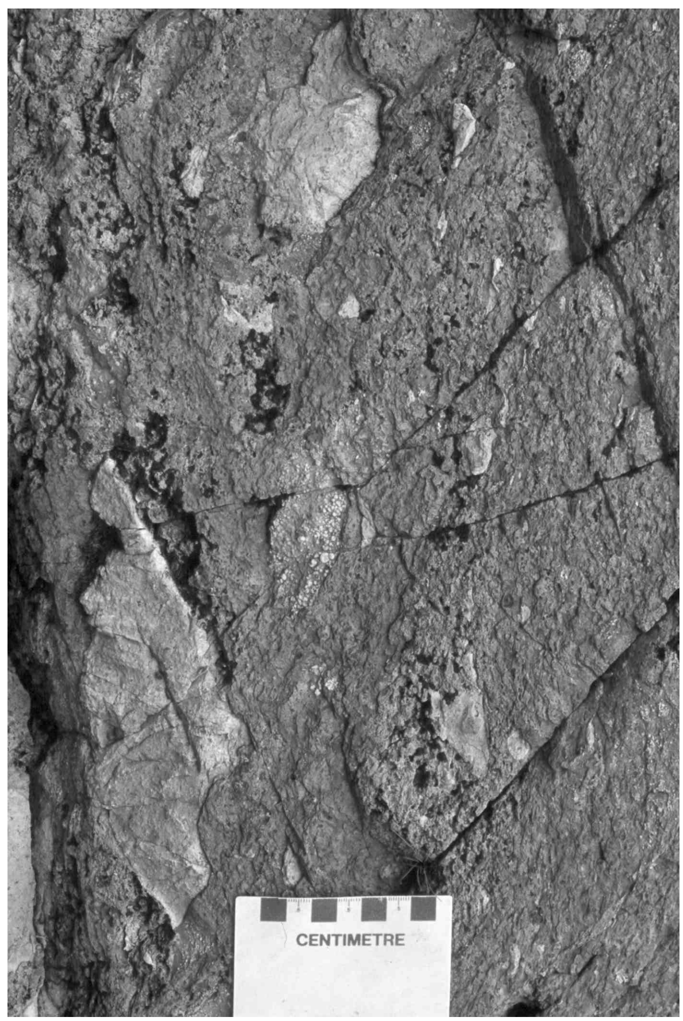


Figure GS-2-9: Heterolithic volcanic breccia of inferred debris-flow origin (1e) at Blueberry Lake.

Figure GS-2-10: Fragmental rhyolite (2a) with densely packed, subangular to irregularly shaped clasts, west of Kotyk Lake.

diffuse, pale grey to beige streaks. The rocks locally contain minor garnet porphyroblasts (up to 5%), and display sporadic iron-stained domains. Contacts between the porphyry intrusions and volcanic rocks are typically sharp and planar; however, at one locality, contiguous amphibolite (1a) contains thin felsic veins derived from the porphyry.

The origin of subunit 2b is uncertain; the porphyry is most likely either associated with the (predominantly basaltic) volcanic sequence or related to later granitoid plutonism. Subunit 2b is provisionally interpreted as volcanic related, because the felsic porphyry is lithologically similar to massive phases in rhyolite (2a), which has been established as an extrusive unit, probably similar in age to mafic volcanic rocks (1); furthermore, the porphyry intrusions are not spatially related to any major granitoid intrusion.

Gabbro, Minor Hornblendite (3a)

Large gabbro intrusions (3a) are widely distributed and equal in abundance to mafic volcanic rocks in the Wabishkok Lake area. These units are not intimately intercalated with mafic flows, in contrast to the synvolcanic mafic sills (1b). However, the two gabbroic types are lithologically similar, with hypidiomorphic, interlocking green hornblende and plagioclase crystals, or local 'spotted' texture due to equant, subhedral to ovoid amphibole. Both gabbroic units are generally massive, except for minor foliated to sheared zones close to the margins of the intrusions.

The major gabbroic sill (3a) that extends through a chain of islands in the central part of Wabishkok Lake is 0.25 to 1 km in width and is continuous with the North Aimée Gabbro southeast of Wabishkok Lake (Gilbert, 1999). The latter intrusion is interpreted as postvolcanic because it apparently truncates an inferred major fault between the Wabishkok Lake and Animus Lake blocks; limited geochemical data indicate that the intrusion is derived from a MORB-type magmatic source. The gabbro sill that extends northwest from Kotyk Lake to the east end of Wabishkok Lake is lithologically similar to the intrusion in the central part of the lake, but is locally more mafic (melanocratic to hornblenditic, with 65–95% amphibole).

Pyroxenite (3b)

A massive pyroxenite lens, approximately 20 m thick and over 70 m along strike, is emplaced within basalt (1a) in the north part of the map area. This ultramafic lens is located very close to the mafic volcanic–quartz diorite contact north of Wabishkok Lake (Fig. GS-2-2). Massive, coarse- to very coarse grained pyroxenite contains subhedral pyroxene crystals up to 1 cm long, variously altered to amphibole. Minor, finer grained zones occur at the south margin of the lens; brown mica (?phlogopite) constitutes up to 5% of the rock. The moderate to bright apple-green weathering colour of the pyroxenite contrasts with the darker grey-green tones of contiguous basalt; contacts with the basalt are not exposed. The pyroxenite intrusion, which is apparently unique in the map area, is provisionally interpreted as a tectonically emplaced, primitive fraction of the magma from which gabbro of subunit 3a is derived.

Granodiorite, Granite, Minor Pegmatite and Aplite (4a)

Two granodioritic to granitic plutons (4a) together occupy at least one-third of the map area. The Pistol Lake granodiorite is an early, pear-shaped stock located in the core of the F_3 Wabishkok Lake antiform, in the west-central part of the map area (Fig. GS-2-2). The pervasive S_1 foliation within the pluton is deformed by the major fold, the hinge line of which extends east-northeast through the intrusion. A second granitoid pluton with similar texture and composition ('Kotyk Lake intrusion'), which extends northwest from Kotyk Lake and wraps around the antiformal fold closure in the area northeast of Wabishkok

Lake, is interpreted as coeval with the Pistol Lake granodiorite.

The Pistol Lake intrusion consists of moderately to strongly foliated, biotite-bearing granodiorite and granite. The granitoid rocks contain incipient quartz eyes (2–8 mm) that are commonly lineated parallel to the shallowly plunging axis of the Wabishkok Lake antiform. Potassium metasomatism has resulted in irregular to ovoid K-feldspar aggregates (3–10 mm) and localized concordant K-feldspar–rich zones (2–25 cm wide). The white- to pink-weathering granodiorite is locally intruded by red aplite and pegmatite dykes, assumed to be a late magmatic phase of the granodiorite. Quartz-eye granodiorite to quartz monzonite southwest of Dismal Lake (Kotyk Lake intrusion; Fig. GS-2-2) contains ovoid to lenticular quartz aggregates (0.5–1.2 cm) and subhedral K-feldspar crystals (0.5–1.5 cm) that each constitute up to 40% of the rock. Biotite and subordinate hornblende constitute 5 to 8% of the rock, which is moderately foliated. Based on previous mapping (Bateman and Harrison, 1945), this intrusion is apparently continuous with quartz dioritic to granodioritic rocks (4b) in the area immediately north of Wabishkok Lake.

Quartz Diorite, Tonalite, Minor Diorite and Granodiorite (4b)

White-weathering quartz dioritic to tonalitic rocks (4b) occur in the west part of the Kotyk Lake intrusion, in the area north of Wabishkok Lake. At that locality, the south part of the map unit consists of quartz dioritic and tonalitic rocks that contain minor enclaves of partially assimilated mafic volcanic strata and associated gneisses (Preliminary Map 2001F-3); in contrast, the north part of the unit consists of homogeneous granodiorite (4a). The quartz diorite is texturally similar to the granodiorite, except for the absence of K-feldspar. Quartz diorite (4b) also occurs at the south margin of the Pistol Lake granodiorite (4a), where the contact between the two granitoid units is approximately coincident with the north shore of central Wabishkok Lake. Up to 80 m of hornblende quartz diorite to diorite (4b) are exposed at the lakeshore in the area southeast of Pistol Lake. The medium- to coarse-grained rocks are strongly foliated, with hypidiomorphic plagioclase and prominent euhedral hornblende that is locally porphyroblastic. Massive, pink aplitic veins and thin dykes (<0.5 m thick) are characteristic of the unit, and constitute up to 40% of some outcrops. Remnants of fine-grained amphibolitic gneiss derived from basalt (1a) occur at several shoreline outcrops along the contact between units 4a and 4b. A 3 m wide cataclastic zone that contains a highly sheared quartz intrusion at the south margin of the Pistol Lake granodiorite suggests that the contact between the two granitoid units is locally faulted.

ECONOMIC GEOLOGY

Most mineral showings in the Wabishkok Lake area are located within mafic volcanic rocks. The mineralization consists of localized accumulations of pyrite (± minor pyrrhotite) and occurs both within basaltic units and at contacts between flows and synvolcanic gabbroic sills. The mineralized zones are typically partly silicified and, in some cases, contain minor felsitic intrusions. Most mineral showings are located in the southwest corner of the map area, where various stratigraphic settings are distinguished (Fig. GS-2-2; Table GS-2-2). Diamond drilling at a basalt/gabbro contact was carried out in 1951 by Hudson Bay Exploration and Development Co. Ltd., to test a conductor at the south margin of the major gabbro sill south of Kotyk Lake (Fig. GS-2-2). The drill intersected several massive-sulphide layers in basalt adjacent to the mafic sill. The layers are up to 0.75 m thick and consist largely of pyrite and pyrrhotite, with minor chalcopyrite.

Table GS-2-2: Setting of mineralization at three localities in the southwest part of the Wabishkok Lake area.

Location	Host rock	Mineralization
Within a few metres of the amphibolite-granodiorite contact at the north margin of the mafic volcanic terrane, at the western end of Wabishkok Lake	Highly sheared, silicified gneiss (0.5 m thick) within gneissic amphibolite	Pyrite, disseminated and in fine stringers, constitutes approximately 5% of the rock
Approximately 0.6 km south of the north margin of the mafic volcanic terrane.	Silicified basalt in a mafic volcanic section, adjacent to a feldspar porphyry dyke; the basalt contains subordinate gabbro interlayers and is extensively epidotized and silicified over an 80 m wide zone	Disseminated pyrite
At the margin of mafic volcanic enclaves, within the major gabbro sill that extends through the centre of Wabishkok Lake; two mineralized localities and a diamond-drill hole site occur approximately on strike over a distance of 3.5 km, along a horizon through the central part of the gabbro sill	Partly silicified basalt, associated with minor felsitic intrusive units	Pyrite±arsenopyrite (disseminated and in fine stringers) constitutes up to 5% of the host rock. The mineralization occurs in 1-3 m wide, rusty-weathering zones

One of the most significant economic prospects in the Wabishkok Lake area occurs within felsic volcanic rocks at Blueberry Lake, close to the east margin of the map area (Fig. GS-2-2). Diamond drilling of an electromagnetic (EM) anomaly at that locality intersected massive sulphide layers up to 1.5 m thick, which contain 0.16% Cu, 0.98% Zn and 34 g/t Au (Assessment File 90485, Manitoba Industry, Trade and Mines, Winnipeg). The area was subsequently investigated by geological mapping and a humus geochemical survey (Assessment File 93337, Manitoba Industry, Trade and Mines, Winnipeg). Sulphide mineralization is hosted by highly deformed felsic volcanic rock units up to 50 m thick, associated with gabbroic sills within the mainly basaltic volcanic sequence east of Blueberry Lake (Preliminary Map 2001F-3). Five kilometres west of the Blueberry Lake mineral locality, a 160 m thick unit of rhyolite (2a) occurs within a gabbro intrusion southwest of Kotyk Lake (Fig. GS-2-2). The lensoid rhyolite unit contains localized iron-stained domains due to minor accumulations of pyrite. Two EM conductors are, in part, coincident with felsic volcanic–gabbro contacts at the north and south margins of the rhyolite unit (Preliminary Map 2001F-3).

The most recent exploration in the Wabishkok Lake area focused on the potential for gold mineralization in a sulphide-oxide–facies iron-formation that extends along strike for up to 7 km in the area between Lac Aimée and Wabishkok Lake (Gilbert, 1997; Assessment Files 93347, 94471 and 94472, Manitoba Industry, Trade and Mines, Winnipeg). Moderate amounts of Au (up to 4.1 g/t [0.12 oz/ton]) and minor Cu, Ni and Zn occur in pyrite-bearing chert laminae, and within veins of quartz and feldspar porphyry that are associated with the magnetiferous sedimentary formation (Gilbert, 1986, 1997).

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REFERENCES

Bateman, J.D. and Harrison, J.M. 1945: Mikanagan Lake; Geological Survey of Canada, Map 832A, scale 1:63 360.

Gilbert, H.P. 1986: Geological investigations in the Tartan Lake–Lac Aimée area; *in* Report of Field Activities 1986, Manitoba Energy and Mines, Minerals Division, p. 43–48.

Gilbert, H.P. 1996: Geochemistry of mafic volcanic rocks in the Tartan–Embury–Mikanagan Lakes area (abstract); Geological Association of Canada–Mineralogical Association of Canada, Joint Annual Meeting 1996, Winnipeg, Manitoba, Program with Abstracts, p. A36.

Gilbert, H.P. 1997: Geology of the Lac Aimée–Naosap Lake area (NTS 63K/13SE and 63K/14SW); *in* Report of Activities 1997, Manitoba Energy and Mines, Geological Services, p. 84–98.

Gilbert, H.P. 1999: Geochemistry of Paleoproterozoic volcanic rocks in the Lac Aimée–Naosap Lake area, Flin Flon Belt (parts of NTS 63K/13SE and 63K/14SW); Manitoba Energy and Mines, Geological Services, Open File Report OF99-1, 21 p.

Lucas, S.B., Stern, R.A., Syme, E.C., Reilly, B.A. and Thomas, D.J. 1996:Intraoceanic tectonics and the development of continental crust: 1.92–1.84 Ga evolution of the Flin Flon Belt, Canada; Geological Society of America Bulletin, v. 108, p. 602–629.

Stern, R.A., Syme, E.C. and Lucas, S.B. 1995a: Geochemistry of 1.9 Ga MORB- and OIB-like basalts from the Amisk collage, Flin Flon belt, Canada: evidence for an intra-oceanic origin; Geochimica et Cosmochimica Acta, v. 59, p. 3131–3154.

Stern, R.A., Syme, E.C., Bailes, A.H. and Lucas, S.B. 1995b: Paleoproterozoic (1.90–1.86 Ga) arc volcanism in the Flin Flon Belt, Trans-Hudson Orogen, Canada; Contributions to Mineralogy and Petrology, v. 119, p.117–141.

Syme, E.C., Bailes, A.H., Stern, R.A. and Lucas, S.B. 1996: Geochemical characteristics of 1.9 Ga tectonostratigraphic assemblages and tectonic setting of massive sulphide deposits in the Paleoproterozoic Flin Flon Belt, Canada; *in* Trace Element Geochemistry of Volcanic Rocks: Applications for Massive Sulphide Exploration, (ed.) D.A. Wyman; Geological Association of Canada, Short Course Notes, v. 12, p. 279–327.

Zwanzig, H.V. and Schledewitz, D.C.P. 1992: Geology of the Kississing–Batty Lakes area: interim report; Manitoba Energy and Mines, Geological Services, Open File Report OF92-2, 87 p.