GS2017-2

Reconnaissance work at Reekie Lake in the Munro Lake greenstone belt, Superior province, central Manitoba (part of NTS 63L11)

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In Brief:
- Scheelite mineralization was investigated as a potential analog to the Monument Bay Au-W deposit
- A crustal-scale fault defines the contact between supracrustal and plutonic rocks
- Disseminated scheelite is associated with pervasive calcsilicate alteration and elevated Cu, Mo, Hg and Au

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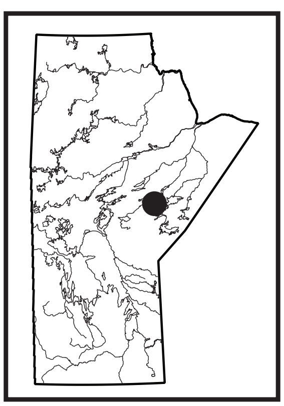

Summary

A one-week reconnaissance was conducted in the Reekie Lake area in July 2017 to assess the potential for a 1:50 000 scale mapping project and evaluate reports of disseminated scheelite mineralization. Reekie Lake is located along the southern margin of the Munro Lake belt, where granodioritic rocks of the Bayly Lake complex are in sheared contact with volcanogenic rocks of the Hayes River group along a splay of the Stull-Wunnummin fault. Hayes River group rocks along the northern shore of Reekie Lake consist largely of pillowed and massive basalt, and gabbro intrusions. The southern shore is underlain by protomylonitic granodiorite–tonalite of the Bayly Lake complex and mafic sandstone of the Hayes River group. The sandstone contains minor beds of felsic and intermediate tuff, feldspathic wacke, conglomerate and gabbro. Peridotite is exposed in an isolated cluster of low reefs at the east end of the lake. All units display a strong S_1 foliation.

Several generations of quartz veins and a population of quartz-carbonate veins are present at Reekie Lake. At the west end of the lake, a pervasive zone of calcsilicate alteration is associated with disseminated scheelite and chalcopyrite mineralization that has yielded elevated values of Cu, Mo, W, Hg and Au. The alteration could be part of a larger zone of intense carbonate alteration reported to occur along the fault zone that defines the south margin of the greenstone belt.

Introduction

Reekie Lake is located approximately 40 km south of Oxford House and 45 km west of Gods Lake Narrows. It lies along the southern margin of the Munro Lake greenstone belt. The first recorded exploration in the area was by Gods Lake Gold Mines Ltd. from 1935 to 1945 (Barry, 1962). Airborne electromagnetic surveys were conducted over the area by Inco Ltd. in 1958 (Assessment Files 90005 and 93901, Manitoba Growth, Enterprise and Trade, Winnipeg), followed by ground surveys and diamond-drilling by Falconbridge Nickel Mines Ltd. in 1968 (Assessment File 92005), which identified several ultramafic bodies on Vivian and Reekie lakes. McGregor and Petak (1977) investigated sparsely disseminated scheelite and base-metal mineralization in skarn alteration at the west end of Reekie Lake. Noranda Exploration Company Ltd. conducted reconnaissance and detailed mapping, and rock and humus sampling in the Reekie Lake area during the summers of 1990 and 1991, and recognized the presence of a 6.8 km long zone of intense carbonate alteration along the southern margin of the greenstone belt (Assessment File 93901). Gold mineralization was identified in carbonate-altered peridotite at the eastern end of Reekie Lake and in quartz-carbonate–altered intermediate to felsic tuff 700 m north of the western end of the lake. Greater than 10% of the samples collected by Noranda yielded Au values of >100 ppb.

This report summarizes the preliminary results of a one-week reconnaissance, in July of 2017, of the Reekie Lake area. The reconnaissance was undertaken to evaluate the potential for a 1:50 000 scale mapping project of the Munro Lake belt, which was last mapped in 1972 (Elbers and Gilbert, 1972), and to evaluate the disseminated scheelite mineralization for Au potential and possible similarities to Au-W mineralization in the Monument Bay deposit (Yamana Gold Inc.), approximately 140 km to the east along strike (McCracken and Thibault, 2014).

Geology of the Munro Lake belt

The Munro Lake greenstone belt is located in the Island Lake domain of the North Caribou terrane (Figure GS2017-2-1; Stott et al., 2010). The main portion of the belt stretches from Colen Lakes in the west to Touchwood Lake in the east. It is approximately 29 km long with a maximum width of 6.5 km. The belt is bordered to the north and south by tonalitic to granodioritic rocks of the Bayly Lake complex. The western end of the belt is truncated by a porphyritic granite pluton north of Colen Lakes. The eastern end of the belt narrows considerably (to approximately 200 m)

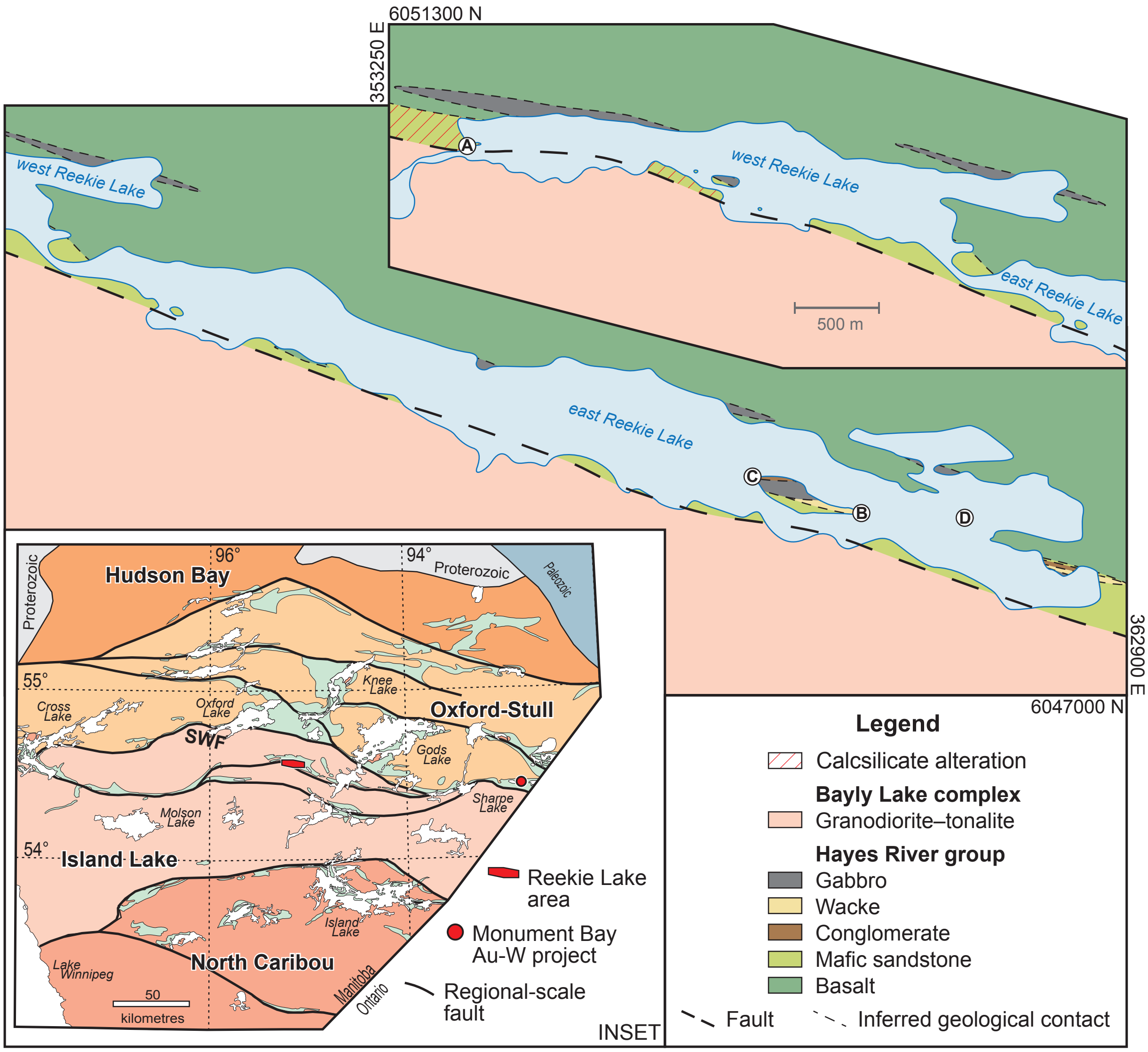

Figure GS2017-2-1: *Simplified geology of the Reekie Lake area. The east and west basins of Reekie Lake are referred to as 'east' and 'west' Reekie Lake for ease of reference. The limits of calcsilicate alteration are from McGregor and Petak (1977). Inset map is modified from Anderson et al. (2013). Abbreviation: SWF, Stull-Wunnummin fault. Co-ordinates are in NAD 83, zone 15.*

at Touchwood Lake and appears to coalesce with the Webber Lake belt at Sharpe Lake to form part of the Stull–Kistigan lakes belt, which hosts the Monument Bay deposit (Marten, 1992; Corkery et al., 1999; McCracken and Thibault, 2014). The contact between the Bayly Lake complex and supracrustal rocks at the southern margin of the belt coincides with a crustal-scale shear zone, which appears to be a splay of the Stull-Wunnummin fault.

The Munro Lake belt was mapped and described by Barry (1961), Elbers and Gilbert (1972) and Marten (1992). It is underlain by rocks of the Hayes River group, which consists of interlayered basalt, andesite, dacite, tuff and volcanogenic sediments, and related mafic intrusions. In the Munro and Reekie lakes area, the belt is divided into northern, central and southern suites of volcanic rocks (each <2.5 km wide), separated by two intervening suites of sedimentary rocks (each <1.8 km wide). The sedimentary rocks consist largely of greywacke and argillite with narrow beds of polymictic conglomerate. The overall geometry of the belt is considered to be a syncline, with the sedimentary rocks overlying an older suite of volcanic rocks, and a younger suite of volcanic rocks situated at the core of the structure. All rocks in the belt exhibit a moderate to strong S_1 foliation. Later F_2 folding resulted in the present synclinal structure. No axial-planar S_2 was developed (Elbers and Gilbert, 1972). Rocks in the Munro Lake belt are characterized by metamorphic assemblages of lower- to middle-amphibolite facies.

Reekie Lake geology

Reekie Lake occurs along the southern margin of the Munro Lake belt, where largely mafic to andesitic volcanic rocks of the Hayes River group are in sheared contact with tonalitic to granodioritic rocks of the Bayly Lake complex along a splay of the Stull-Wunnummin fault (Figure GS2017-2-1). All units described have been metamorphosed to amphibolite-facies conditions; however, the ‘meta’ prefix has been omitted for brevity. Due to high strain, it is generally not possible to define the nature of contacts between units. The east and west basins of Reekie Lake are referred to as ‘east’ and ‘west’ Reekie Lake, respectively, for ease of reference (following McGregor and Petak, 1977).

Bayly Lake complex

A large granodiorite–tonalite intrusion, exposed along the southern shore of Reekie Lake, marks the southern boundary of the Munro Lake belt. The intrusion varies from grey to white to pinkish grey, and is medium to coarse grained and protomylonitic (Figure GS2017-2-2). Although dominantly granodiorite, it commonly grades into tonalite with <10% K-feldspar. Biotite is the most abundant mafic mineral at 5–10%. Potassium feldspar and plagioclase form porphyroclasts/augen <2 cm across, which are locally asymmetric, consistent with dextral shear. Attenuated mafic enclaves <5 cm thick can be continuous over several metres. The granodiorite is intruded by granitic pegmatite dikes that vary from transposed and protomylonitic to crosscutting and lower strain with a quartz fabric that is subparallel to the mylonitic foliation. Trains of coarse K-feldspar augen could represent sheared and disrupted pegmatite dikes. The contact between the granodiorite and the supracrustal rocks to the north was not observed and underlies either low ground or the lake; it is assumed to be a structural contact. The attenuated mafic enclaves could be interpreted as xenoliths of supracrustal rocks, suggesting an intrusive contact; however, no granodiorite or tonalite dikes were observed to intrude the supracrustal rocks. The mafic enclaves could also represent tectonically entrained material, xenoliths of mafic rock unrelated to the supracrustal rocks, or mafic autoliths. Hence, the age of the granodiorite relative to the supracrustal rocks is uncertain.

Figure GS2017-2-2: *Sheared tonalite of the Bayly Lake complex.*

Hayes River group

Basalt

Basalt and gabbro are the dominant rock types along the north shores of Reekie Lake. The basalt weathers dark grey-green to buff and is dark green to black on fresh surfaces. It is fine to medium grained and strongly foliated to mylonitic, and varies from relatively homogeneous to discontinuously banded. Veinlets of carbonate are common and most apparent on fresh surfaces. Recognizable pillows are rare and strongly attenuated (20:1 elongation); however, local plagioclase-rich layers (<1 cm thick) with hornblende-rich margins likely represent transposed pillow selvages (Figure GS2017-2-3a). Local pods of epidosite <20 cm thick are present in the pillowed flows, and sparse pods of carbonate could represent interpillow material. Epidote lenses <2 mm wide and quartz lenses <4 mm wide locally make up 7–10% of the unit and likely represent attenuated amygdules (Figure GS2017-2-3a). Outcrops of high-strain, fine-grained amphibolite are common, and may represent either tectonized basalt or gabbro. Gabbro intrusions, ranging from several centimetres to tens of metres, are common within the basalt.

Mafic sandstone and associated rocks

Mafic sandstone is the dominant supracrustal rock exposed along the south shoreline of Reekie Lake. It is green-grey, fine to medium grained and typically pebbly and poorly sorted (Figure GS2017-2-3b). It is usually strongly foliated and crudely layered; however, fine-grained, laminated and apparently well-sorted layers are locally present. The sand matrix appears basaltic in composition and contains <15% basaltic to pyroxenitic pebbles <5 cm across. Sparse intermediate pebbles are present, along with rare felsic pebbles and plagioclase clasts <1 cm thick (Figure GS2017-2-3b). Clasts are typically elongate (>7:1) and locally boudinaged. Local lenses of quartz <5 mm thick are likely attenuated quartz veins. Local crystal-rich beds <5 m thick contain 20–30% rounded to blocky plagioclase grains (<3 mm; Figure GS2017-2-3c). Discrete grains of hornblende up to 2 mm can be present in minor amounts. Because of the high strain, it is uncertain if the rounding of grains is primary or tectonic. The mafic sandstone contains local layers of felsic and intermediate tuff <4 m thick, and intrusions of gabbro <5 m thick. Sparse layers of feldspathic wacke <1 m thick can also be present. A 3 m wide silicate-facies iron formation occurs at a contact between mafic sandstone and felsic tuff at west Reekie Lake (Figure GS2017-2-1, location A). Beds of tuff and wacke appear to become more common toward the contact with granodiorite–tonalite.

The felsic tuff varies from buff to creamy white on weathered surfaces and is light grey when fresh (Figure GS2017-2-3d). It is fine grained, strongly foliated to mylonitic, and laminated to layered at a scale of <2 cm. Bands of this siliceous rock occasionally contain discrete plagioclase grains (<2 mm) as either phenocrysts or clasts. These grains can constitute up to 7% of the rock. Local light and dark lenses could be attenuated lapilli (Figure GS2017-2-3d), suggesting interstratified lapilli tuff beds. This unit is interpreted as a felsic tuff, but it could also represent a fine-

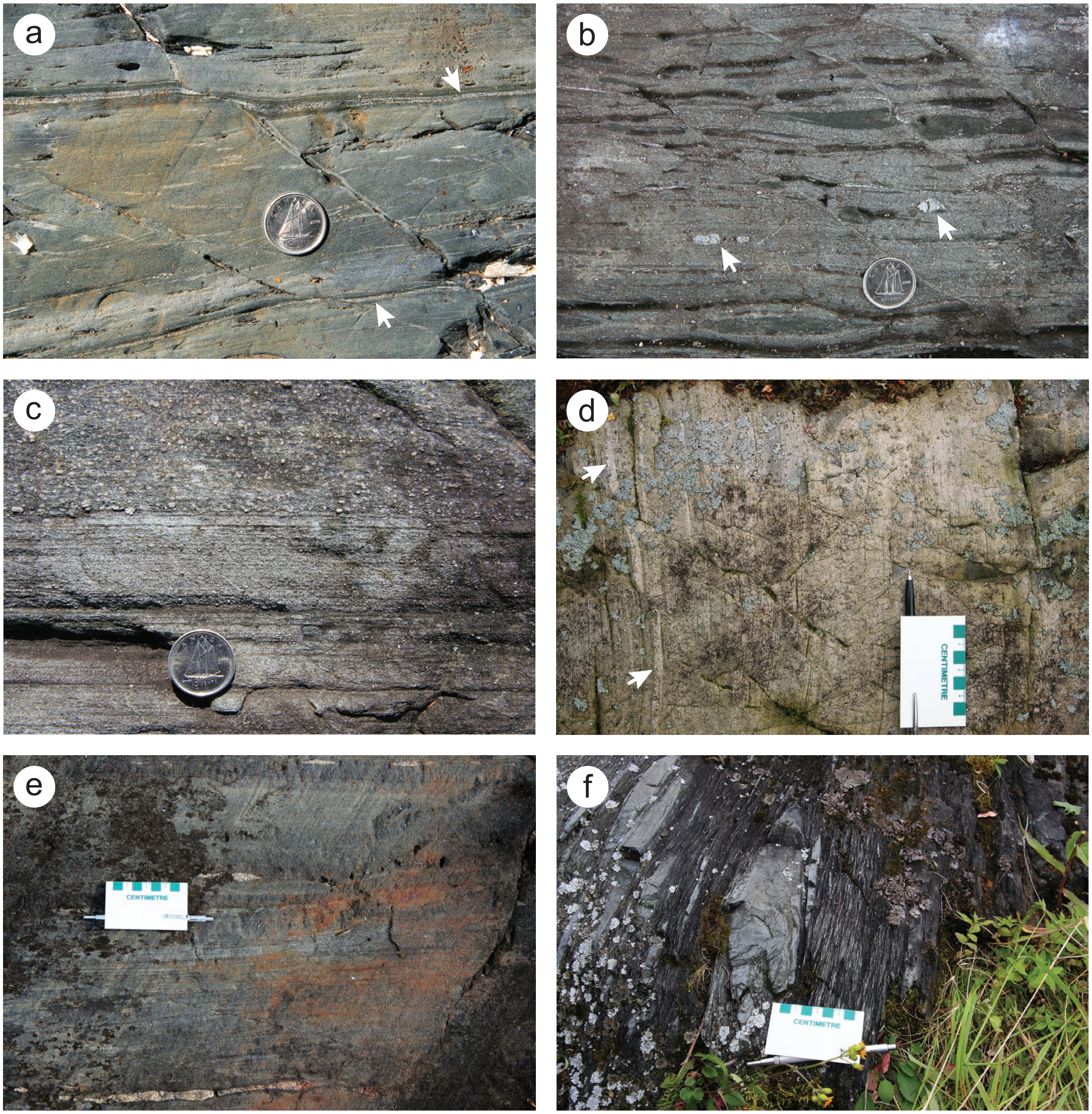

Figure GS2017-2-3: *Outcrop photographs of Hayes River group rocks at Reekie Lake:* ***a)*** *pillowed, amygdaloidal basalt; attenuated amygdules are present above and to either side of coin, and arrows indicate attenuated pillow selvages;* ***b)*** *mafic, pebbly sandstone, arrows indicating coarse plagioclase clasts;* ***c)*** *crystal-rich bed in mafic sandstone (top of image);* ***d)*** *felsic tuff with possible attenuated lapilli (arrows);* ***e)*** *locally sulphidic feldspathic wacke;* ***f)*** *altered conglomerate from location D (Figure GS2017-2-1), with an attenuated and folded pebble immediately above and left of scale card.*

grained felsic sandstone or arkosic arenite. The intermediate tuff is similar to the previously described felsic tuff but is grey to buff on the weathered surface with a less siliceous appearance and no readily apparent phenocrysts or clasts.

The feldspathic wacke is typically light grey, fine grained, strongly foliated and layered to laminated (Figure GS2017-2-3e). Beds (<15 cm thick) vary from massive to internally laminated. Local beds contain granules and pebbles <2 cm across. The pebbles are dominantly intermediate with sparse mafic clasts. Locally graded beds along the south shore of east Reekie Lake fine toward the south. At location B (Figure GS2017-2-1), the wacke is sulphidic and locally contains up to 15% pyrrhotite (Figure GS2017-2-3e). Conglomerate is locally associated with the feldspathic wacke and may grade into pebbly sand beds. Outcrops of conglomerate are highly strained (pebble elongation up to 30:1) and locally altered. At location C (Figure

GS2017-2-1), the conglomerate is light green, strongly foliated to mylonitic, and poorly sorted (Figure GS2017-2-3f). Pebbles are <15 cm thick and dominantly intermediate with lesser felsic and quartz clasts. The pebbles are supported by an altered phyllonitic matrix.

Gabbro

Gabbro to diabase intrusions, ranging from tens of centimetres to tens of metres wide, intrude all of the previously described units. The gabbro is dark green to grey-green on weathered surfaces and dark grey on fresh surfaces. It is medium to coarse grained and foliated to strongly foliated. Although generally homogeneous at outcrop scale, local intrusions contain plagioclase-rich layers <3 cm thick. Some intrusions are porphyritic, with 10–15% plagioclase phenocrysts (<3 mm) or glomerocrysts (<5 mm). Local pyroxenitic enclaves are <3 cm thick. Rare intrusions contain coarse-grained pods, which could represent fractionated segregations.

Peridotite

Outcrops of serpentinized peridotite occur as a cluster of low reefs at location D (Figure GS2017-2-1). The peridotite is light green to white, medium grained, foliated and strongly magnetic, and contains local carbonate veins up to 2 cm wide. The relationship between the peridotite and other rocks is unknown because of the isolated nature of these outcrops; however, a narrow band (<35 cm thick) of ultramafic schist, possibly representing sheared and altered peridotite, occurs along strike to the east within an outcrop of basalt.

Structure

The main penetrative fabric at Reekie Lake is the S_1 foliation, which is defined by attenuated bedding and primary layering. The S_1 foliation strikes west-northwest and is subvertical to steeply north dipping. The foliation is intense and appears mylonitic in many outcrops, with kinematic indicators suggesting dextral and possibly normal shear. This fabric appears to be related to a dextral shear zone that occurs at the contact between the supracrustal rocks and the granodiorite–tonalite to the south. Pebbles in the conglomerate at location C define a gently west-plunging stretching lineation. Local pebbles are also folded about an axis of the same orientation (Figure GS2017-2-3f). Local east-southeast-striking dextral S_2 shear bands with subvertical to steeply south-dipping orientations occur throughout the area. Sparse, conjugate, sinistral S_2 shear bands were also observed and generally strike southwest with steep northwest dips (Figure GS2017-2-4a). Hornblende

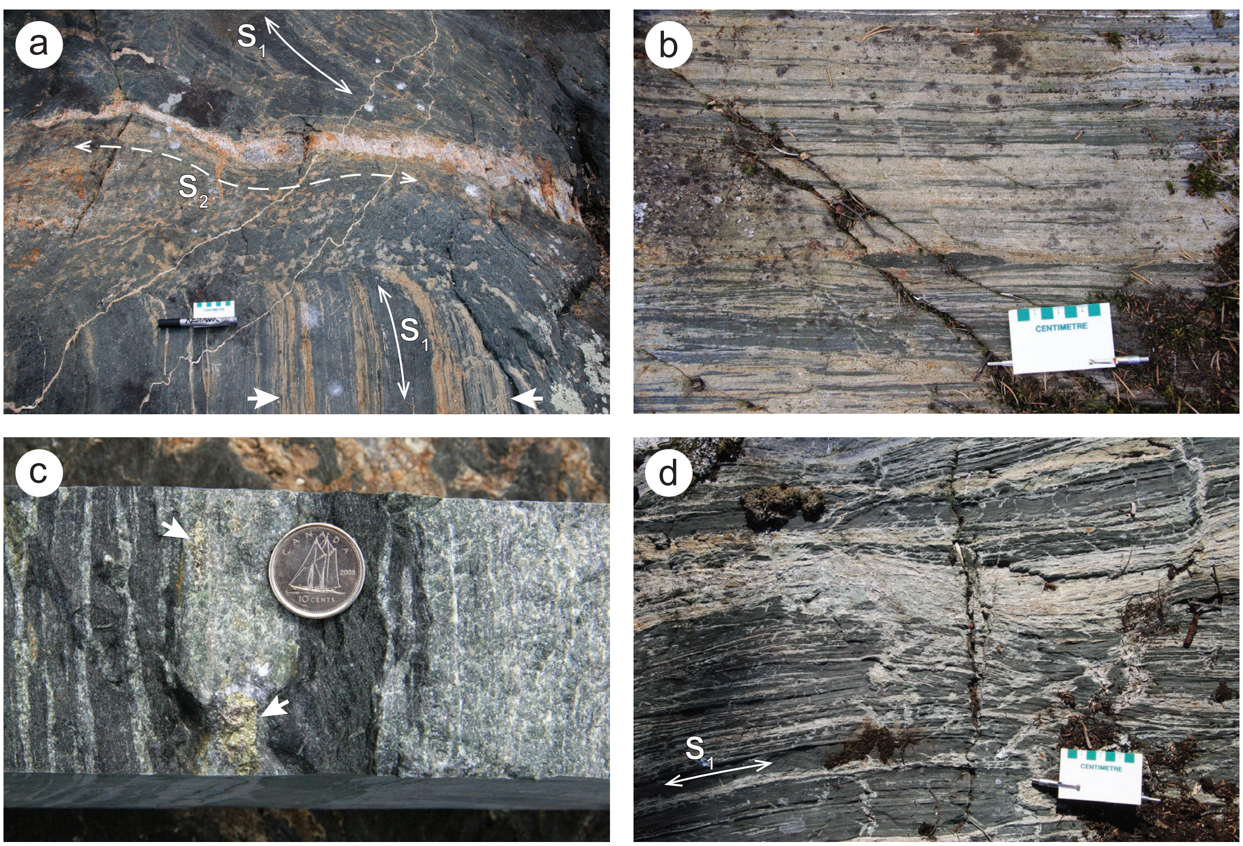

Figure GS2017-2-4: *Outcrop photographs of veins, alteration and structures from location A (Figure GS2017-2-1) at west Reekie Lake:* ***a)*** *sinistral S_2 shear structure with subparallel quartz vein transecting the S_1 regional foliation; calcsilicate alteration (arrows) appears to be largely controlled by the S_1 fabric;* ***b)*** *pervasive calcsilicate alteration of mafic sandstone along the S_1 foliation;* ***c)*** *blebs of chalcopyrite±pyrrhotite (arrows) hosted in calcsilicate alteration; photo is from the bottom of a saw-cut slab;* ***d)*** *possible fracture-controlled veins with haloes of calcsilicate alteration; the veins crosscut the S_1 fabric.*

typically defines both S_1 and S_2 fabrics, suggesting that amphibolite-facies conditions prevailed during D_1 and D_2. An S_3 foliation was observed in a weakly foliated pegmatite dike intruding protomylonitic tonalite. This later foliation is subparallel to S_1, and it is possible that the dike merely intruded late during D_1 deformation. Alternatively, it could be axial planar to the regional synclinal structure, which would make it an F_3 structure.

Veins and alteration

Homogeneous white quartz veins <60 cm thick are ubiquitous in the Reekie Lake area and likely represent several generations of vein emplacement. The most abundant suite of veins is parallel to subparallel to S_1 and characterized by pinch-and-swell structures, and likely formed prior to or during D_1 deformation. Occasional quartz veins occur within S_2 shear structures, contain ductile deformation fabrics and may have been emplaced during or subsequent to D_2 deformation (Figure GS2017-2-4a). The latest quartz veins crosscut all fabrics and were emplaced along brittle fractures. Quartz-carbonate veins occur locally within the basalt and gabbro, and are typically subparallel to S_1. The veins are typically <15 cm thick and appear foliated to weakly foliated. The carbonate typically appears to be dominated by Fe carbonate. The quartz-carbonate veins are interpreted to be relatively late in the deformational history.

Pervasive calcsilicate alteration, with local lenses of quartz and carbonate <3 mm wide, forms a 90 m by 1400 m zone at west Reekie Lake (Figure GS2017-2-1, location A) that is hosted in mafic sandstone. The alteration occurs as light green, fine- to medium-grained, diffuse bands <15 cm thick that parallel the strong S_1 foliation and make up <30% of outcrops (Figure GS2017-2-4a, b). Trace amounts of scheelite occur as finely disseminated grains and local lenses <2 mm thick, and chalcopyrite±pyrrhotite form blebs <2 cm across (Figure GS2017-2-4c). The strong structural control suggests that the alteration occurred prior to, or during, D_1; however, the alteration locally occurs as haloes to discordant fracture-controlled veins (Figure GS2017-2-4d), which suggests a protracted event.

Economic considerations

A zone of disseminated scheelite and chalcopyrite mineralization was reported by McGregor and Petak (1977) at west Reekie Lake (Figure GS2017-2-1, location A). The mineralization was described as hosted in carbonate-quartz skarn alteration. Although the zone was evaluated for W and base metals, its potential for precious metals was not tested. The zone of alteration occurs along a splay of the Stull-Wunnummin fault, which is similar to the setting of the Monument Bay Au-W deposit roughly 140 km to the east (Figure GS2017-2-1). At Monument Bay, Au mineralization is associated with coarse-grained scheelite in discrete vein systems hosted in felsic intrusive and intermediate volcanic rocks along a splay of the Stull-Wunnummin fault (McCracken and Thibault, 2014).

The style of mineralization at Reekie Lake varies considerably from that at Monument Bay. At Reekie Lake, the mineralization occurs within a zone of pervasive calcsilicate alteration, hosted in mafic sandstone with local layers of felsic tuff and silicate-facies iron formation. Although previously described as carbonate-quartz skarn mineralization, little carbonate is present, although it is possible that decarbonation occurred during regional metamorphism. The alteration appears to occur along strike with a 6.8 km long zone of intense carbonate alteration described by Noranda geologists (Assessment File 93901).

The alteration is unlikely to be skarn related to the granodiorite–tonalite of the Bayly Lake complex to the south, as previously suggested by McGregor and Petak (1977). The granodiorite has a strong S_1 protomylonitic fabric, whereas the calcsilicate alteration is characterized by local discordant veins that crosscut the S_1 fabric. Although no economic mineralization was identified, all samples from this zone yielded elevated assay values: two samples of altered mafic sandstone yielded up to 630 ppm Cu, 32 ppm Mo and 100 ppb Hg; a sample of altered felsic tuff yielded 262 ppm W and 1010 ppb Hg; and a sample of iron formation yielded 205 ppb Au (Couëslan, unpublished data). An occurrence of scheelite was also reported by Noranda at location C in east Reekie Lake (Figure GS2017-2-1; Assessment File 93901), which suggests similar mineralization over a strike length of 7.5 km.

Reefs of serpentinized peridotite and the presence of unexposed ultramafic rocks (Assessment File 92005) suggest there is at least notional potential for magmatic nickel-sulphide deposits in the Reekie Lake area. A potential source for crustal sulphide was identified in a band of sulphidic wacke (location B, Figure GS2017-2-1) west of the peridotite reefs; however, drilling by Falconbridge in the late 1960s failed to intersect sulphide mineralization in any of the targets.

Acknowledgments

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