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TILL-GEOCHEMISTRY SAMPLING AND QUATERNARY MAPPING IN SOUTH-CENTRAL NEWFOUNDLAND, GREAT BURNT LAKE (NTS 12A/08), NORTHERN COLD SPRING POND (NTS 12A/01), AND BURNT HILL (NTS 2D/05) MAP AREAS

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ABSTRACT

Systematic surficial mapping and sampling were carried out during the summer of 2016 in the Great Burnt Lake, northern Cold Spring Pond and Burnt Hill map areas. The purpose of this study was twofold; to collect till samples in an area of sparse bedrock exposure containing a variety of base- and precious-metal occurrences, and to map and characterize the glacial landscape of NTS map area 12A/08. Six hundred and twenty samples were taken using helicopter support within the study area, and on roads west of the Bay d'Espoir highway. Preliminary observations of landforms and striations suggest that ice stagnation and meltwater erosion occurred in the west, and an active south- to southeast-flowing ice sheet in the east. Observations of coarse fractions in till also confirm this south and southeast dispersal. Results of this study will be used to assist in mineral exploration and prospecting throughout the area.

INTRODUCTION

Quaternary mapping, and till-geochemistry sampling in the Great Burnt Lake, northern Cold Spring Pond and Burnt Hill (respectively, NTS map areas 12A/08, 12A/01 and 2D/05) are part of the regional surficial mapping program of the Geological Survey of Newfoundland and Labrador (GSNL). The objective is to delineate prospective areas for exploration using till geochemistry, to determine ice-movement directions and facilitate boulder tracing, and to map surficial deposits and features to aid in reconstructing paleo-ice environments. Much of the area is covered by surficial deposits, and scant bedrock outcrops. The map areas consist of ophiolitic and volcanic units that host occurrences of base metals and gold, and results of this survey are expected to provide information relating to the underlying bedrock and mineral occurrences.

LOCATION AND PHYSIOGRAPHY

The Great Burnt Lake (NTS map area 12A/08), northern Cold Spring Pond (NTS map area 12A/01) and Burnt Hill (NTS map area 02D/05) areas are located south of the Trans-Canada Highway (TCH), northeast of Meelpaeg and north of Jeddore lakes (Figure 1). Route 360 (the Bay d'Espoir highway) bounds the study area to the east. Great Burnt Lake, Crooked Lake and Island Pond Lake occupy the western lowlands; west of the Jamieson Hills in the centre of the study area. Hummocks, wetlands and ridges characterize the area east of the Jamieson Hills, rising to a plateau on the northeast corner of the study area near the Northwest Gander River. Wetlands and ridges are common south of the river; Partridgeberry Hills and Burnt Hills form the highlands south of the study area.

BEDROCK GEOLOGY

The description of the bedrock geology has been derived from earlier work by Colman-Sadd and Swinden (1982, 1984a, b), Colman-Sadd (1985), Swinden (1988), McNicoll *et al.* (2006) and Sandeman *et al.* (2012, 2013). The study area is located in the Central Mobile Belt overlapping both the Dunnage and Gander zones.

The elliptical Mount Cormack Subzone underlies a large part of the study area and includes quartzite and semi-pelitic schist of the Spruce Brook Formation, which has been intruded by the Through Hill Granite; Colman-Sadd and Swinden (1982, 1984a, b), Colman-Sadd (1985), Swinden (1988), and Sandeman *et al.* (2012, 2013).These are variably metamorphosed to lower and upper amphibolite facies (Colman-Sadd, 1985). Ophiolitic rocks of the Pipestone Pond complex (Figure 2) in the Jamieson Hills (Colman-Sadd and Swinden, 1984a, b; Swinden, 1988) and the Coy Pond complex (Figure 2) near the northwest Gander River (Colman-Sadd and Swinden, 1982; Sandeman *et al.*,

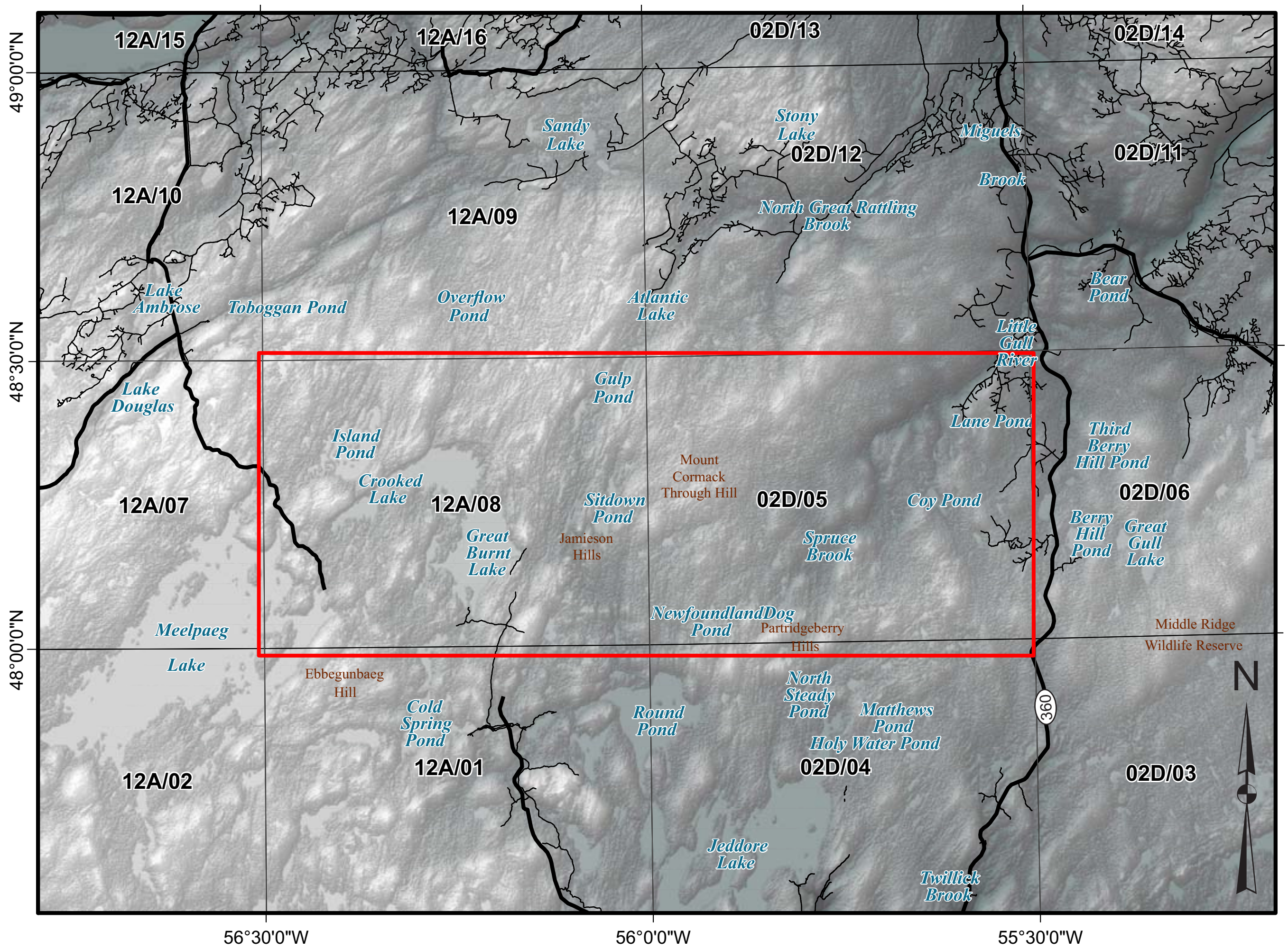


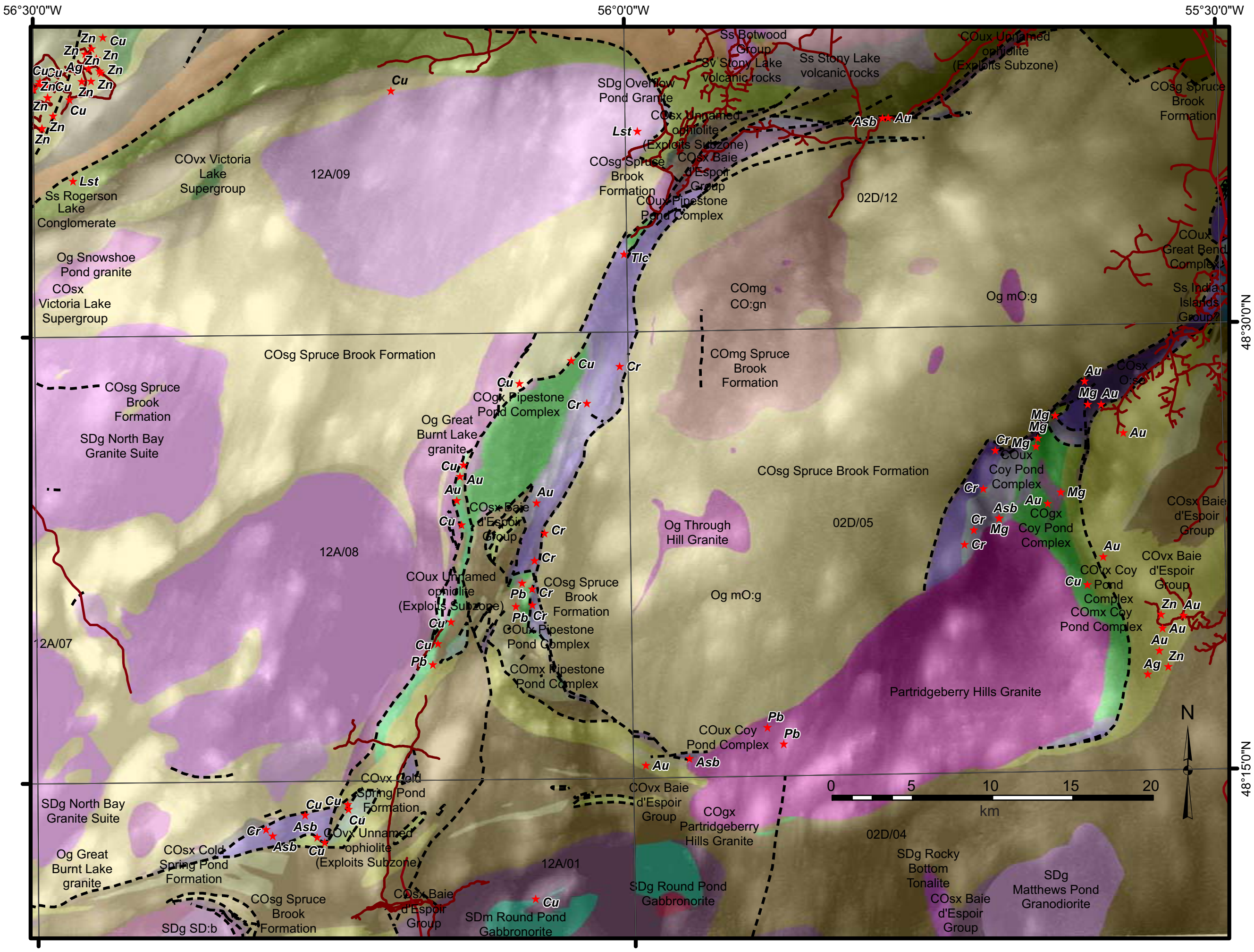
Figure 1. *Location map of Great Burnt Lake (NTS map area 12A/08), northern Cold Spring Pond (NTS map area 12A/01) and Burnt Hill (NTS map area 2D/05) in central Newfoundland. Route 360 (Bay d'Espoir highway) is located to the east of the study area. Red box denotes study area.*

2013) surround the Mount Cormack Subzone, predominantly outcropping on the western and eastern margins. Clastic sedimentary, volcaniclastic and intermediate to felsic volcanic rocks of the North Steady Pond Formation, Baie d'Espoir Group are exposed to the east of the Coy Pond complex (Figure 2; Colman-Sadd and Swinden, 1984a, b; Sandeman *et al.*, 2013) and to the south of the Mount Cormack Subzone and Pipestone Pond complex (Colman Sadd and Swinden, 1984a, b; Sandeman *et al.*, 2013). Basalt, conglomerate and greywacke of the Cold Spring Pond formation (Figure 2) outcrop to the west of the Mount Cormack Subzone. The Silurian North Bay Granite Suite (Figure 2) intrudes the Spruce Brook Formation to the west in the Great Burnt Lake (12A/08, Colman-Sadd and Swinden, 1984a, b; Colman-Sadd, 1985). Bedrock structures predominantly trend northeast to southwest (Colman Sadd and Swinden, 1984a, b).

MINERALIZATION

Descriptions and interpretations of mineralization in NTS map areas 12A/08 and 2D/05 are detailed in Colman-Sadd and Swinden (1982) and by Sandeman *et al.* (2012, 2013). Most mineral occurrences are in the Coy Pond and Pipestone Pond ophiolite complexes, and in the rocks of the North Steady Pond Formation and the Cold Spring Pond formation; individual occurrences are labelled in Figure 2, and Table 1 summarizes some of the more developed prospects.

The Coy Pond and Pipestone Pond ophiolite complexes host numerous chromite occurrences, where chromite typically forms disseminations in the Pipestone Pond complex, and lenses in parts of the Coy Pond complex (Colman-Sadd and Swinden, 1982). The Coy Pond complex is also host to gold mineralization in association with arsenopyrite, notably at the



LEGEND

POST-ORDOVICIAN OVERLAP SEQUENCES

- **Sv** — Bimodal to mainly felsic subaerial volcanic rocks; includes unseparated sedimentary rocks of mainly fluviatile and lacustrine facies *[Stony Lake volcanic rocks]*.
- **Ss** — Shallow-marine and non-marine siliciclastic sedimentary rocks, including sandstone, shale and conglomerate *[Botwood Group, Rogerson Lake Conglomerate]*.

DUNNAGE ZONE

Stratified rocks

Late Ordovician and Early Silurian

- **COsx** — Marine siliciclastic sedimentary rocks, including slate, shale, argillite, siltstone, sandstone, conglomerate, and minor unseparated carbonate, volcanic and intrusive rocks, and schist gneiss and migmatite *[Victoria Lake Supergroup, Baie d"Espoir Group - OY?]*
- **COvx** — Submarine mafic, intermediate and felsic volcanic rocks, including mafic volcanic rocks of ophiolote complexes; includes unseparated intrusive, sedimentary and metamorphic rocks *[Victoria Lake Supergroup, Davidsville Group, Baie d'Espoir Group, Cold Spring Pond formation]*

Intrusive rocks

Cambrian and Ordovician

- **COgx** — Granitoid intrusions, including trondhjemite of ophiolite complexes *[Partridgeberry Hills Granite]*
- **COmx** — Mafic intrusions, including unseparated granitoid rocks, and gabbro, diabase and trondhjemite of ophiolite complexes *[Pipestone Pond complex, Coy Pond complex]*
- **COux** — Ultramafic rocks of ophiolite complexes *[Pipestone Pond complex, Coy Pond complex]*

POST-ORDOVICIAN INTRUSIVE ROCKS

Silurian and Devonian

- **SDm** — Gabbro and diorite intrusions, including minor ultramafic phases *[Round Pond gabbronite, Long Pond diorite, Steel Pond gabbro]*
- **SDg** — Posttectonic gabbro-syenite-granite-peralkaline granite suites and minor unseparated volcanic rocks (northwest of Red Indian Line); granitoid suites, varying from pretectonic to syntectonic, relative to mis-Paleozoic orogenies (southeast of Red Indian Line) *[North Bay Granite Suite, Matthews Pond granodiorite, Missing Island Grandiorite, Overflow Pond Granite]*

GANDER ZONE

Stratified rocks

Cambrian(?) and Ordovician

- **COsg** — Quartzite, psammite, semipelite and pelite. including minor black slate, conglomerate, limestone, mafic and felsic volcanic rocks, and unseparated migmatitic rocks *[Spruce Brook Formation]*
- **COmg** — Migmatitic schist, gneiss, and minor amphibolite, derived in whole, or in part from Cambrian(?) and Ordovician protoliths *[Spruce Brook Formation]*

Intrusive rocks

Ordovician

- **Og** — Granite intrusions *[Through Hill Granite, Great Burnt Lake granite, Ebbegunbaeg Hill granite, Snowshoe Pond granite]*

Mount Cormack Subzone

SYMBOLS

Mineral Occurrence ★   Fault   Road

Figure 2. *Bedrock map and legend of Great Burnt Lake (12A/08) and Burnt Hill (2D/05) map areas in central Newfoundland (Colman-Sadd* et al.*, 2000).*

Table 1. Prospects in the Great Burnt Lake and Burnt Hill NTS map areas (Stapleton *et al.*, 2014). showings and indications are not listed

Deposit Name	MODS Reference	Major Commodity	Commodity	Stratigraphic Unit	Status
South Pond Gold #2	012A/08/Au002	Au	Cu	Cold Spring Pond Formation	Prospect
Reid Porphyry Zone	002D/05/Au006	Au		Coy Pond complex	Prospect
South Pond Gold #1	012A/08/Au001	Au	Cu	Cold Spring Pond Formation, Baie d'Espoir Group	Prospect
Mystery Pond Zone – Katie Property	002D/05/Au005	Au	Ag, Cu, Pb, Zn, W	North Steady Pond Formation, Baie d'Espoir Group	Prospect
Black Bart VMS System – Katie Property	002D/05/Zn001	Zn	Pb, Au, Ag	North Steady Pond Formation, Baie d'Espoir Group	Prospect
Tall Tree Zone – Katie Property	002D/05/Zn002	Zn	Au	North Steady Pond Formation, Baie d'Espoir Group	Prospect
Great Burnt Lake Deposit	012A/08/Cu001	Cu		Cold Spring Pond Formation, Baie d'Espoir Group	Developed Prospect
Chrome Pond	012A/08/Cr001	Cr	Fe, Mb, Pt, Tlc	Pipestone Pond complex	Prospect
Red Rocks Steady No. 1	002D/05/Asb002	Asb	Mg	Coy Pond complex	Prospect
Mosquito Hill	002D/05/Au008	Au	Cu	North Steady Pond Formation, Baie d'Espoir Group	Developed Prospect
End Zone	012A/08/Cu006	Cu		Cold Spring Pond Formation, North Salmon Dam Basalt	Prospect
South Pond Copper	012A/08/Cu002	Cu	Au	Baie d'Espoir Group	Developed Prospect
Bruce Pond – Katie Property	002D/05/Au004	Au		North Steady Pond Formation, Baie d'Espoir Group	Prospect
The MacDonald Zone – Katie Property	002D/05/Au003	Au	Ag, Zn, Cu, Pb	North Steady Pond Formation, Baie d'Espoir Group	Prospect

Reid deposit (Sandeman *et al.*, 2012), and has an inferred resource of 5.99 million tonnes averaging 0.558 g/t Au (Golden Dory Resources, Press Release, September 28, 2010).

The Cold Spring Pond formation, of uncertain stratigraphic affinity, hosts volcanogenic massive sulphide mineralization at the Great Burnt Lake deposit. Mineralization occurs as a tabular, conformable, massive pyrrhotite and chalcopyrite body, and a recent 43-101-compliant resource estimate by Pavey Ark Minerals Inc. returned 441 000 tonnes at 2.50% Cu (Swinden and Collins, 1982; Puritch and Barry, 2015). Additional mineralization occurs in a similar stratigraphic setting approximately 10 km to the north at the South Pond deposit, where disseminations and blebs of chalcopyrite in semi-massive zones of pyrrhotite occur in association with elevated gold mineralization of uncertain genesis (Puritch and Barry, 2015; J. Hinchey, personal communication, 2016).

The North Steady Pond Formation also hosts precious- and base-metal mineralization. The Mosquito Hill deposit contains gold mineralization in association with arsenopyrite (Sandeman *et al.*, 2013). A recent 43-101-compliant resource calculation returned 11.18 million tonnes averaging 0.546 g/t Au (grams per tonne gold) for 196 257 ounces gold (Giroux and Froude, 2010). The VMS mineralization occurs at the Katie property (south of the Mosquito Hill and Reid deposits) where mineralized outcrop samples have returned grades of 17% combined Zn, Pb and Cu (J. Hinchey, personal communication, 2016), and trenching has returned 10.7% Zn, 0.38% Pb, 0.196% Cu, 33.4g/t Ag, 1.13g/t Au over 1.26 m (Altius Minerals, January 2017 website-altiusminerals.com/projects/katie-vms). The formation also hosts numerous other base- and precious-metal occurrences (Figure 2).

REGIONAL GLACIAL HISTORY

The glacial history of Newfoundland is summarized in a number of papers; the following is a brief description of concepts covered by some of these papers with relevance to the study area.

Murray (1955) and Grant (1974) postulated the existence of isolated ice caps in Newfoundland during the Late Wisconsinan. Later work by Grant (1989) and Shaw *et al.* (2006) confirmed the existence and general location of the ice caps, and described a deglaciation sequence in Newfoundland starting from an east–west central divide. Systematic 1:250 000 and 1:50 000 surficial mapping of the Province (Vanderveer and Sparkes, 1982; Sparkes 1985; Proudfoot *et al.*, 1988, 1990; Liverman and Taylor, 1990; St Croix and Taylor, 1991; Taylor, 1994; Klassen, 1994a, b; Klassen and Murton, 1996; Batterson, 1999, 2003; Taylor, 2001b) resulted in the creation of the striation database. This database allowed for further refinement of both the relative timing and location of ice caps, and ice-flow movement across the Province. In 2003, the release of digital Shuttle Radar Topography Mission data (http://srtm.csi.cgiar.org/) allowed for the interpretation of large-scale landforms, and the more accurate identification of ice-flow patterns (Liverman *et al.*, 2006).

LOCAL GLACIAL HISTORY

Howley (1881) was the first to note the desolate boulder-strewn landscape that characterizes terrain around Great Burnt Lake in his observations of geology west of Pipestone Pond (Howley, 1881, page 240). Jenness (1960) noted that the study area consisted primarily of deposits produced by melting ice; including kettle lakes north of Burnt Hill, and mapped the study area as an inner drift zone of discontinuous end moraine separated from irregular deposits of the outer drift zone. Grant (1974) and Shaw *et al.* (2006; Figure 3A, B) proposed that discrete ice centres resulting from the disintegration of the Newfoundland Ice Cap in the Late Wisconsinan remained in place, including those over Red Indian Lake Basin and Meelpaeg Lake. Subsequent systematic mapping and sampling in central Newfoundland has:

- Refined the locations of the Meelpaeg and Topsails ice centres, including a timeline of deglaciation (St. Croix and Taylor, 1991; Taylor, 1994; Klassen 1994a; Smith, 2009; Organ, 2014, 2015).

- Identified southward flow in the Burnt Lake and Burnt Hill map areas from an ice divide north of the study area (Proudfoot *et al.*, 1988, 1990; St. Croix and Taylor, 1991), and

- Located areas of ice stagnation around Meelpaeg and Sandy lakes (Smith, 2009, 2012, 2013) and south of the Burnt Hill map sheet (Proudfoot *et al.*, 1990).

An age date north of Meelpaeg Lake (GSC-4186) suggests that this area was ice free sometime after 9300 years BP (McNeely and McCuaig, 1991; Taylor, 2001a). Detailed

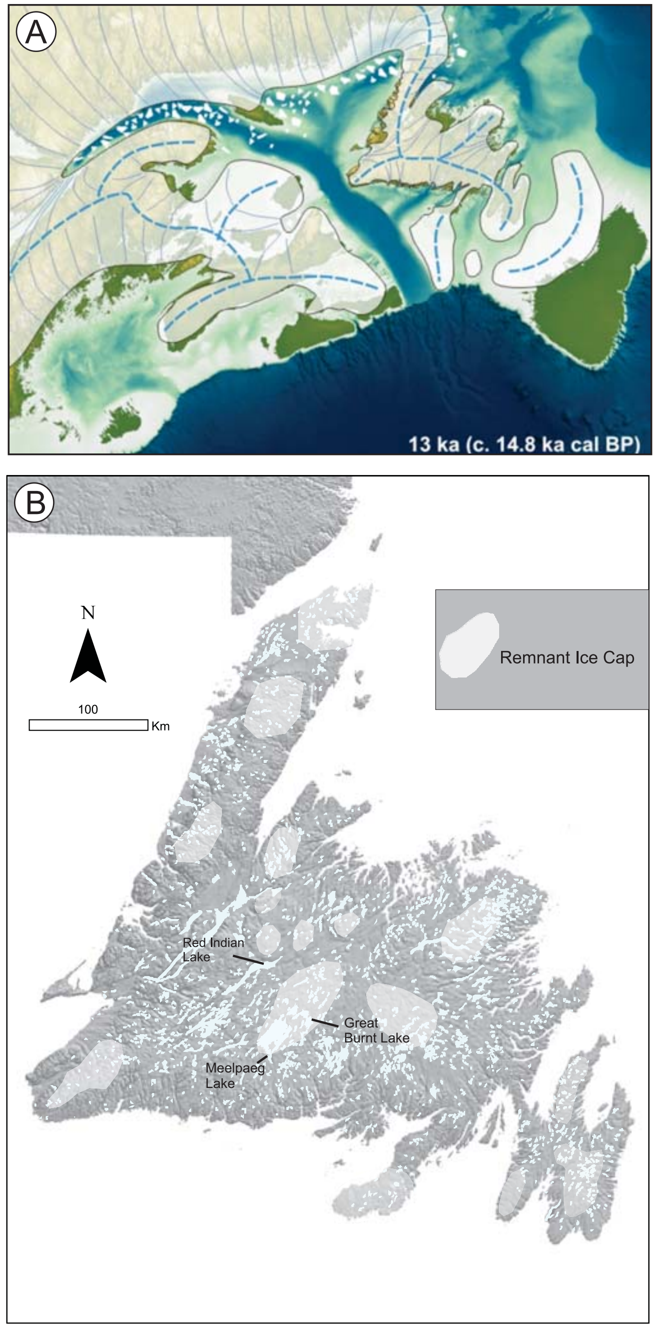


Figure 3. *A) Deglacial model of Newfoundland 12 000 years ago (Shaw* et al.*, 2006) indicating a large east–west arcuate ice divide across the Province; B) Remnant ice centres from Smith (2012); after Grant (1974). Systematic regional mapping (Sparkes, 1985; Klassen, 1994a, b; St. Croix and Taylor, 1991; Taylor, 1994; Batterson and Taylor, 2008) identified an ice divide between Snowshoe Pond and Lake Ambrose, with remnant ice centered on the Topsails and Meelpaeg Lake. Detailed mapping by Smith (2012) concluded that remnant ice in the Red Indian Lake basin consisted of three discrete ice caps in the Topsails, with active southeast retreat of ice to Meelpaeg Lake.*

work by Smith (2012) on glacial Lake Shanadithit, concluded that the Red Indian Lake Basin must have been ice-free with discrete ice cap remnants on the Topsails with ice retreat south to Meelpaeg Lake (Figure 3B), where it disintegrated in situ.

ICE-FLOW INDICATORS

Compiled striation measurements from central Newfoundland show divergent flow vectors to the north and northeast outlining an north–south ice divide (Proudfoot *et al.*, 1988, 1990; St. Croix and Taylor, 1990, 1991; Taylor, 2001b; Brushett, 2015; Figure 4). The study area lies south of this proposed divide, with the western portion located in hummocky terrain identified by Smith (2012) and north of an ice divide running through Red Indian Lake to Meelpaeg Lake (Klassen, 1994a; Proudfoot *et al.*, 1988, 1990; Taylor, 1994; Batterson and Taylor, 2008; Smith, 2009–2013; Figure 4). Most of the individual striation observations in the NTS map areas (Proudfoot *et al.*, 1988, 1990; St. Croix and Taylor, 1991; Taylor, 1994, 2001b) indicate one event and southward flow. Directly north of Lane Pond there are two flow directions recorded; these striation measurements are related to later northeast flow and southward flow from the divide (St. Croix and Taylor, 1990; Figure 4, location A). Southeast and southwest striations are recorded near Gulp Pond (St.

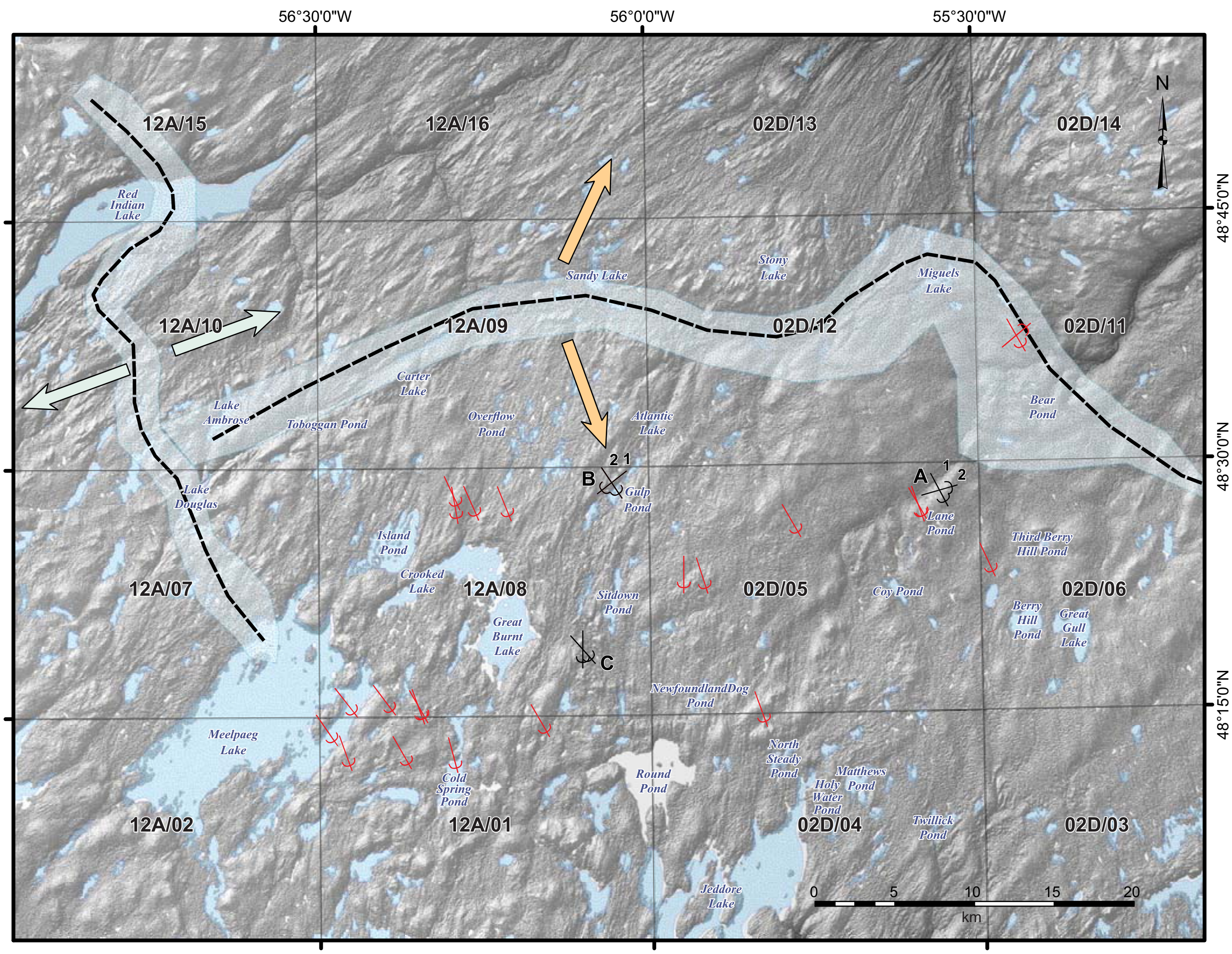


Figure 4. *Simplified ice-flow diagram of dominant flow events in the study area showing divergent flow from two proposed ice divides; blue arrows based on striation measurements by Sparkes (1985); Klassen (1991a); Proudfoot* et al. *(1988, 1990); St. Croix and Taylor (1991); Taylor (1994); Batterson and Taylor (2008) and Smith (2009–2013); orange arrows based on striation measurements from St. Croix and Taylor (1991); Taylor (1994) and Brushett (2015). Striation measurements discussed in the preceding text are plotted in black; striation measurements from this study are plotted in red. No age relationship is inferred between the two divides, and other ice-flow events around the study areas are omitted for simplicity. Data are plotted over 1 arc second SRTM digital terrain model (DTM). The DTM has been pan-sharpened using the ESRI Image analysis tool. A, B, and C are sites where ice-flow striations were collected.*

Croix and Taylor, *op. cit.*; Figure 4, location B) with an initial southeast flow and a later southwest flow indicated. Slightly divergent south and southwest striations are recorded east of Great Burnt Lake and southwest of Sitdown Pond (St Croix and Taylor, *op. cit.*; Figure 4, location C). No relative ages were assigned to the different measurements; the directions were recorded on top of a steep hill and may represent ice-flow deviation around a topographic high.

GLACIAL DISPERSAL

Brushett and Amor (2016) collected eight bulk till samples from 12 sites along the apparent dispersion train from the Pipestone Pond complex; and determined that chromite grains in the <2 mm fraction were transported at least 45 km down ice (south) from source. Results from this study also confirm the presence of a previously identified gold-grain dispersal train (Clarke, 1990) with gold grains dispersed 25 km south from the Pipestone Pond gold occurrence.

CURRENT WORK

SAMPLE METHODS

Sample sites in NTS map areas 12A/08, 12A/01 and 02D/05 (Figure 5) were accessed by helicopter. Till samples were collected from the C and BC horizons, in 552 test-pits, using a predetermined 4 km^2 sampling grid. Sixty-eight samples were taken at 1 km intervals near Route 360 where sites were accessed by a network of forest resource roads. Bedrock samples were taken at selected sites, where alteration was present or bedrock units were distinct. Duplicate samples were collected once at every 15–20 sites having a maximum distance of 3 m between the two sample pits. Care was taken to wipe down sample implements to avoid cross contamination. Site observations (including striation measurements, clast composition, clast angularity and clast percentages) were recorded using handheld computers and notebooks. The samples were placed in Kraft paper bags,

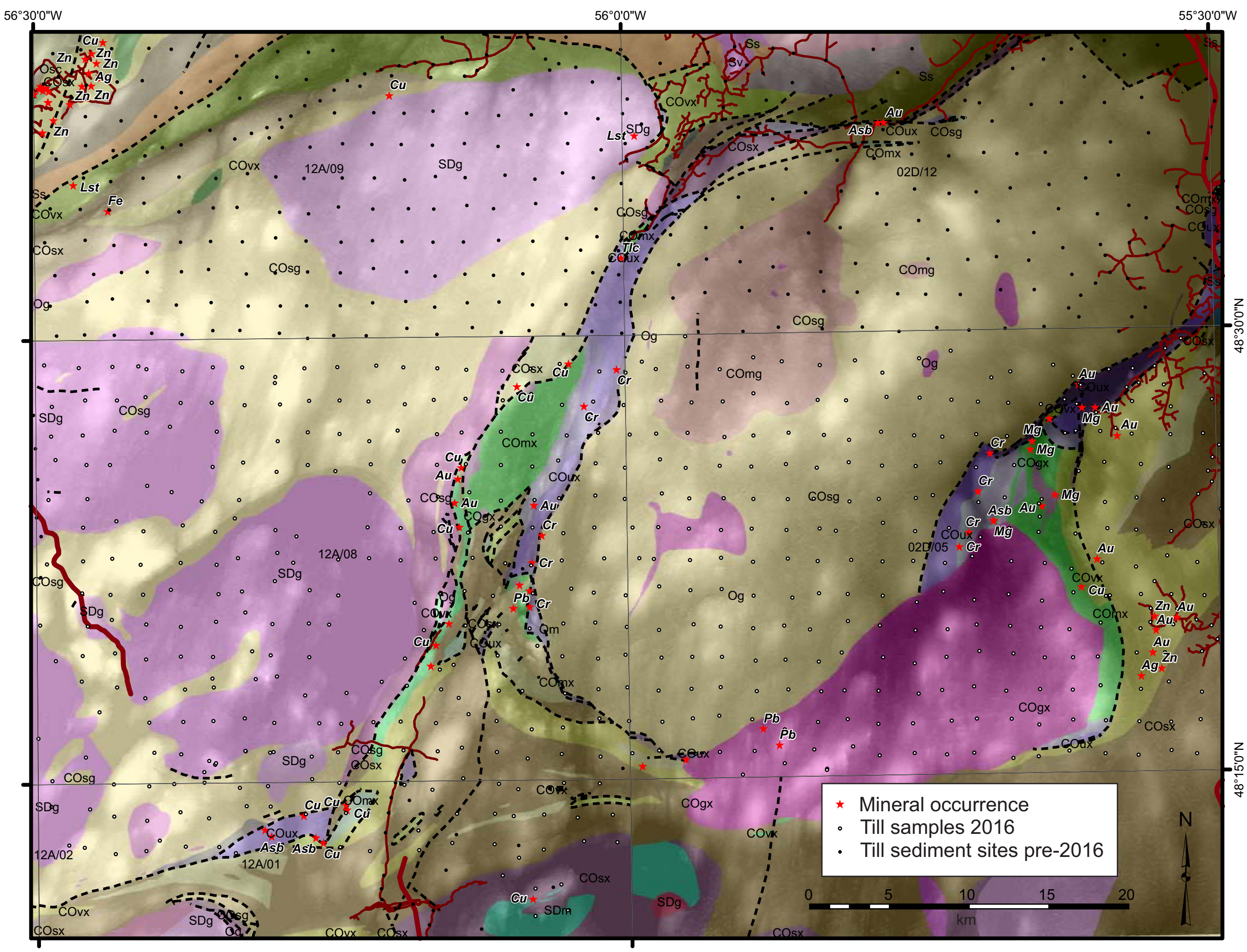


Figure 5. *Sample distribution (black circles) for NTS map areas 12A/08, 12A/01 and 2D/06. Black dots, samples collected before 2016.*

and carefully transported to the GSNL Laboratory in St. John's, where they were air-dried in ovens at 60°C and dry-sieved through 180 μm stainless-steel sieves in preparation for analysis. These results are expected later in 2017 and will be released in an Open File report.

RESULTS AND DISCUSSION

ICE-FLOW OBSERVATIONS

Ice-flow indicators were observed at several sites with 14 new striation measurements obtained from polished bedrock and quartz veins. New striation measurements agree with previous south-southeast ice-flow direction.

GLACIAL LANDFORMS

Boulder fields and sandy till deposits dominate the west. This area is dotted by shallow lakes underlain by slightly concave granite units. Extensive boulder fields and eroded till are observed north of Island Pond and Crooked Lake and where large angular (~2 m diameter) boulders dot the shorelines of the lakes. Isolated eskers and sandy hummocks converge northeast of Meelpaeg Lake (Plate 1A). Hummocky till surrounds isolated rock outcrop, till veneer and rock cover through most of the Great Burnt Lake map area. East of Great Burnt Lake, till-covered rock ridges skirt the Pipestone Pond complex and farther east, till blanket is interspersed with hummocky ridges. Till blanket (~5 m) covers the plateau to the northeast and incised channels cut through till from northwest to southeast (Plate 1B). Southeast of the plateau, wetlands and fluted southeast-trending till ridges characterize the landscape. In the south central study area, ribbed northeast–southwest-trending ridges surround isolated rock covered ridges.

TILL COMPOSITION AND CLAST DISPERSAL

Till composition consists of a silty sand matrix having 15–20% clasts and sandier tills collected above the North Bay Granite to the west. Pits excavated in glacial material, above mapped granitic units on the western portion of the study area, have boulders on the surface and cobbles in the A and B horizons. Low ridges underlain by sediments of the Spruce Brook Formation between the shallow lakes contain thicker and siltier till. Deformation till (Dreimanis, 1988) consisting of monomict, sheared flaggy clasts and minor fine sand are mapped on a ridge directly southeast of Great Burnt Lake. Siltier tills are observed on the Partridgeberry Hills Granite and hills northwest and northeast of Northwest Gander River toward Route 360. Average clast diameters, from all till sites, are 2–3 cm, and the clasts are subangular having striated and planed surfaces. Granitic, metasedimentary and volcanic clasts are noted in material near their probable bedrock sources.

PRELIMINARY OBSERVATIONS

Clast Dispersal

Observations of dominant clast types in till test-pits are plotted in Figure 6 as dot symbols over mapped bedrock. Volcanic rocks (green dots) are a good indicator of glacial flow directions as the clasts have a distinctive appearance and the units occur as a discrete layer surrounding the Mount Cormack Subzone. Few volcanic clasts are located south of the Pipestone Pond complex. Numerous volcanic clasts are recorded southeast of the Coy Pond complex as there are far more samples due to denser (1 km) sample spacing on forest roads to the east. Volcanic clasts near the Coy Pond complex are noted to the northwest of mapped volcanic bedrock units.

Plate 1. *A) Hummocky, boulder strewn terrain in 12A/08 north of Meelpaeg Lake; B) Till blanket north and south of the Northwest Gander River in 2D/05. Photo courtesy of Brant Gaetz.*

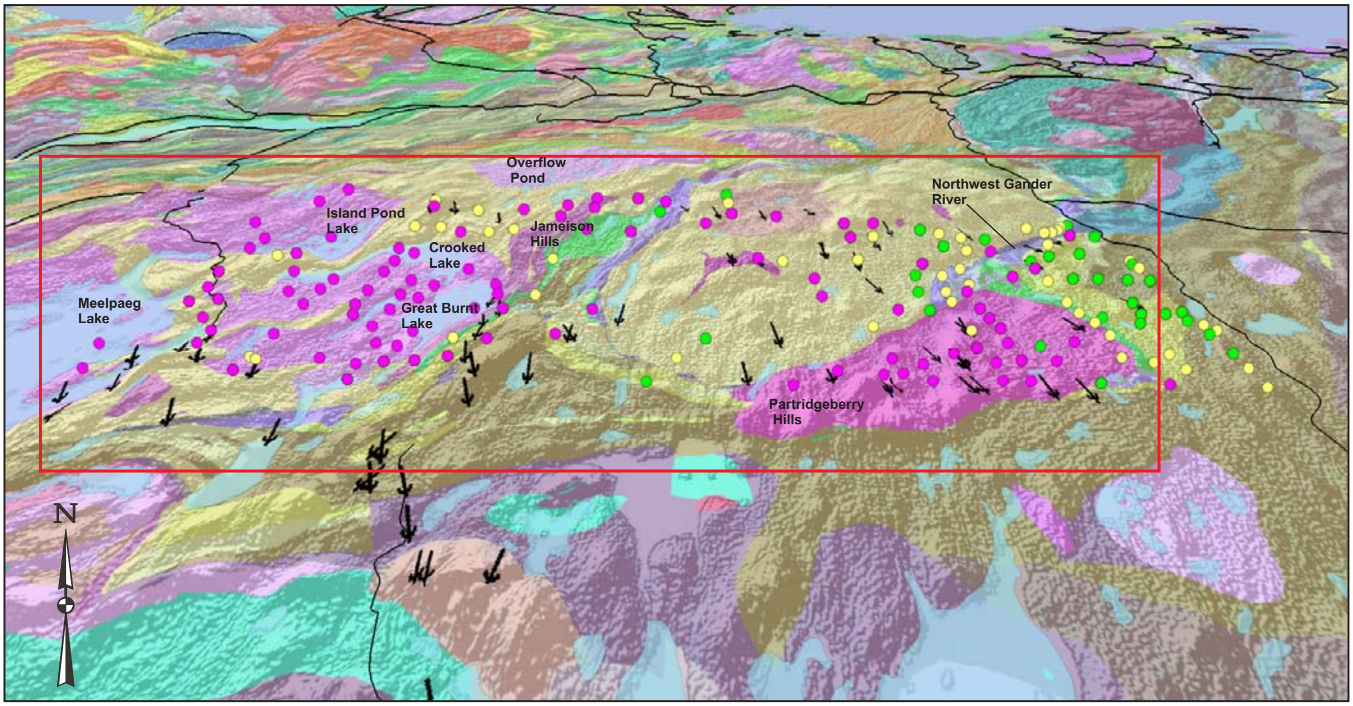


Figure 6. *Volcanic (green), granitic (pink) and sedimentary (yellow) clast types over Great Burnt Lake and Burnt Hill map sheets. Bedrock geology (Colman-Sadd* et al.*, 1990) and striations from the database (Taylor, 2001b) are draped over filtered SRTM topography (as discussed in Figure 4) in ESRI's ArcGlobe program with an elevation exaggeration of 20x. Observed dispersal directions are to the south and southeast with some variation.*

This may indicate: a) flow to the northwest, b) an undocumented or buried volcanic unit, or c) misidentification of clast material. Misidentification of clasts is unlikely due to the distinct appearance of the rock, and striation measurements (Proudfoot *et al.*, 1990; Taylor, 2001b) support southward flow in this area; thus, the occurrence of volcanic clasts may indicate an unmapped volcanic unit.

Granites (pink dots) are dispersed throughout a large portion of the survey area. This observation is not surprising, as there are abundant granitic sources (pink units) and the rock is resistant to comminution (*i.e.*, mechanical disintegration by glaciers; Dreimanis and Vagners, 1971; McClenaghan and Kjarsgaard, 2001). Observations indicate that most or all the clasts are granitic in test-pits located above the North Bay and Partridgeberry Hill granites. Granitic material is noted in tills above the Partridgeberry Hills Granite (Figure 6), 2–4 km southeast of the mapped contact and metasediments of the Mount Cormack Subzone to the north. The lack of observed granitic clasts near the contact of the two units could suggest that an active ice sheet entrained granitic material at the contact and transported it to the southeast. In contrast, granitic material was noted in tills to the north of Crooked Lake at the mapped contact between the North Bay Granite to the south and Mount Cormack Subzone sediments to the north; and inferred southeastward dispersal toward the southern contact of the units. It is not clear whether the clasts northwest of Crooked Lake were transported southeast from granites near Island Pond Lake, or deposited in situ as the ice disintegrated. However, the abundance of boulders and the sandy till in the same test-pits suggest a stagnant environment.

Metasedimentary clasts (yellow dots) were observed above mapped bedrock units of quartzite and pelites of variable metamorphic grade. The lower to upper amphibolite-facies metasediments (Colman-Sadd and Swinden, 1984a) of the Mount Cormack Subzone exhibit differing rock competencies; hence, glacial comminution and entrainment rates are variable. Therefore, variably metamorphosed clasts of the Mount Cormack Subzone are not suitable to identify ice-flow direction.

DISCUSSION

Extensive low-lying terrain, underlain by North Bay Granite (pink units to the west underlying Meelpaeg and Great Burnt lakes; Figures 2 and 6), covers the area south of the proposed ice divide (Figure 4) in NTS map area 12A/09 near Overflow Pond (Figure 1), east of Snowshoe Pond (NTS map area 12A/09), west of the Jamieson Hills and south toward the southern end of Meelpaeg Lake. The depressions are obvious in SRTM imagery (Figures 4 and 6) with lowland shallow lakes over North Bay Granite and isolated ridges located above metasedimentary rocks of the Spruce Brook formation. The mechanism of formation of these depressions is not clear; it would be expected that granites intruding the Spruce Brook formation would be more resistant to glacial erosion and would form topographic highs relative to the surrounding sediments. Glacial tills above the granites appear to have been preferentially eroded by water, as observed by the low silt content in thin till layers and the cobble content of the horizons in the overlying sediment. Large sandy moraine deposits and eroded eskers northeast of Meelpaeg Lake suggest the deposits were derived from stagnating ice. Thus, material deposited by this ice may have been englacial and distally sourced. Southeast-oriented striations in exposed bedrock north of Crooked Lake, southeast of Great Burnt Lake and northeast and northwest of Meelpaeg Lake (Figure 4) and observations of deformation till southeast of Great Burnt Lake suggest ice was active here with southeast-directed flow. Alternating lineated and hummocky landforms on the Burnt Hill map area are interpreted as an active ice-flow environment (Proudfoot *et al.*, 1990); with locally sourced glacial tills.

SUMMARY

Preliminary results of mapping and sampling on the Great Burnt Lake and Burnt Hill map areas are summarized below:

- A large portion of the Great Burnt Lake map area is covered by tills deposited in a stagnant ice environment. An active ice environment perhaps existed east of Great Burnt Lake through most of Burnt Hill.
- Observed dispersal patterns on the eastern portion of the Great Burnt Lake and the Burnt Hill map areas are consistent with mapped glacial flow directions. Geochemical results in 2017 should clarify glacial dispersal directions.
- Aerial photograph interpretation will determine the extent, nature and provenance of landforms in the Great Burnt Lake area.

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