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NEW GEOLOGICAL MAPPING OF THE HOLLINGER LAKE AREA (NTS 23J/16), CENTRAL LABRADOR TROUGH

J.P. Butler
Regional Geology Section

ABSTRACT

New, 1:50 000-scale geological mapping is presented for the Hollinger Lake area (NTS 23J/16), central Labrador Trough. The area is underlain by Paleoproterozoic supracrustal rocks of the Kaniapiskau Supergroup that were formed along the eastern margin of the Superior Craton, and later deformed, during ca. *1.8 Ga Trans-Hudsonian collision. The map area is divided into four distinct lithotectonic zones, separated by regional-scale faults. In the southwest, the Schefferville Zone comprises sedimentary and minor volcanic rocks of the Swampy Bay, Attikamagen, and Ferriman groups, deformed into a series of tight southeast-plunging folds. The Howse and Hurst zones are underlain by shales and siltstones of the Swampy Bay and Ferriman groups, respectively, intruded by gabbro of the Montagnais Sills. In the northeast, the Retty Zone comprises volcanic and volcaniclastic rocks of the Doublet Group. These four zones appear to have each experienced folding and associated cleavage development contemporaneous with sub-greenschist- to greenschist-facies regional metamorphism, followed by juxtaposition along inferred southwest-verging thrust faults. The interpreted pattern of deformation and metamorphism is consistent with southwest-directed shortening and burial in the foreland of the New Québec Orogen. Notable mineralization within the Hollinger Lake area includes locally enriched iron formation, base-metal sulphide mineralization within shale, and disseminated sulphides within the gabbro sills.*

INTRODUCTION

The Labrador Trough is an approximately 150-km-wide belt of deformed Paleoproterozoic rocks extending southeastward from Ungava Bay through Québec and Labrador (Figure 1). Its bedrock geology is dominated by the Kaniapiskau Supergroup (Figure 2), a *ca.* 2.17–1.87-Ga (Rohon *et al.*, 1993; Machado *et al.*, 1997) supracrustal sequence deposited along the eastern margin of the Superior Craton and later deformed during the Trans-Hudson orogeny.

During July and August of 2017, helicopter-supported 1:50 000-scale mapping was carried out within the south-central part of the Labrador Trough, near Hollinger Lake (NTS map area 23J/16). The goals of this project are to: 1) update the geology of the Hollinger Lake map area; 2) sample key geological units with the aim of providing new geochemical and geochronological data to test existing correlations and regional tectonic models; and 3) assess the economic potential of the map area.

This report details the preliminary results of this project, including a summary of the main lithological units that underlie the area, and suggestions for future work.

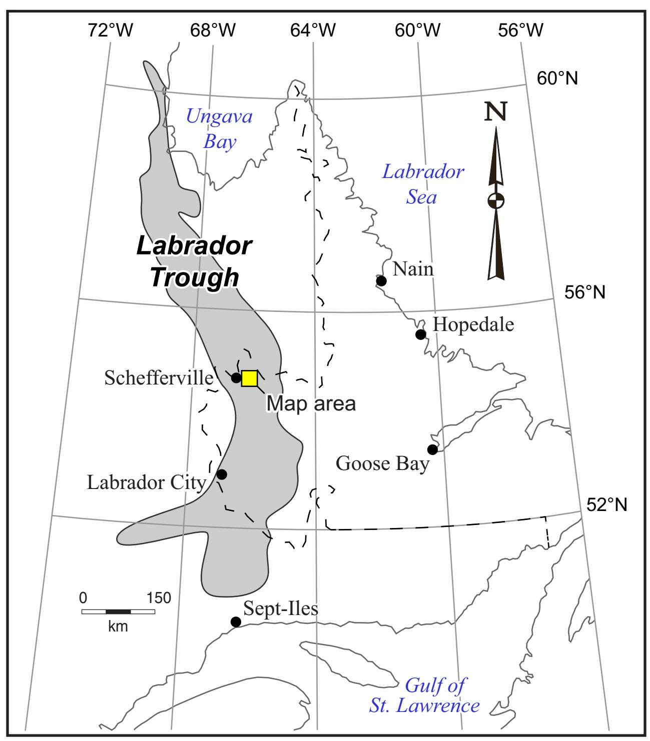

Figure 1. *Simplified map of eastern Canada showing the location of the Labrador Trough in Québec and Labrador (adapted from Rivers and Wardle, 1979).*

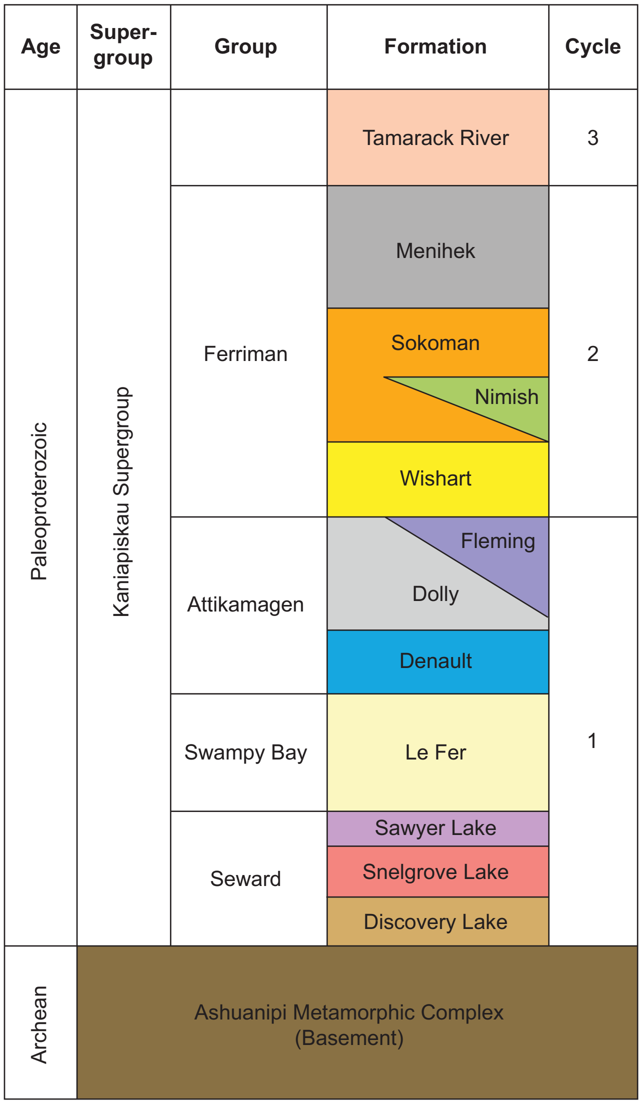

Figure 2. *Simplified stratigraphy of the Kaniapiskau Supergroup (adapted from Conliffe, 2017). The Doublet Group, not shown, is part of a separate tectonic terrane that is considered time correlative with the Ferriman Group (Clark and Wares, 2005).*

LOCATION, ACCESS, AND PHYSIOGRAPHY

The map area is located approximately 30 km east of Schefferville, Québec (Figure 1), and is accessible only by helicopter. Topographically, the area is relatively flat, where broad, low-lying areas separate small northwest-trending ridges and lakes (Plate 1). The largest, Attikamagen Lake, covers most of the northwestern part of the map area. Between the lakes, lie dense spruce forests punctuated by swamps and clearings of caribou moss. Bedrock exposure is poor throughout most of the study area except for the ridges, which typically comprise more weather-resistant rock types, such as iron formation or gabbro.

PREVIOUS WORK

Mapping in the Hollinger Lake area began in the 1950s with detailed surveys by the Labrador Mining and Exploration Company (Bloomer, 1954; Hoag, 1971). These efforts were followed by regional, 1:50 000-scale mapping by the Geological Survey of Newfoundland and Labrador in the late 1970s (Doherty, 1979; Wardle, 1979). Wardle (1982) later assimilated all existing data into a 1:100 000-scale regional compilation of the south-central Labrador Trough. This previous work has proven relatively accurate, and the geological units presented here are much like those described by Doherty (1979).

REGIONAL GEOLOGICAL BACKGROUND

REGIONAL STRATIGRAPHY

The Labrador Trough is part of the Circum-Superior Belt (Baragar and Scoates, 1981), which in the Mesoproterozoic formed a continuous ring of sedimentary and volcanic successions bordering the Superior Craton. The stratigraphy of the trough has been described in detail by several authors (*e.g.*, Wardle and Bailey, 1981; Clark and Wares, 2005 and references therein) and only a general summary is provided here.

The western-central part of the trough is underlain by rocks of the Kaniapiskau Supergroup (Figure 2), a sequence of supracrustal rocks that lies unconformably on Archean Superior basement. Sedimentary successions within the Kaniapiskau Supergroup are divided into three cycles of deposition. In Cycle 1 (Seward to Attikamagen groups), terrestrial rocks grade upward into shallow-marine and finally passive-margin sedimentary rocks, a transition interpreted tectonically to represent rifting and formation of the

Plate 1. *View of the Hollinger Lake map area showing characteristic topography. Ridge in foreground is glomeroporphyritic gabbro of the Montagnais Sills.*

Superior passive margin (Wardle and Bailey, 1981). Rifting is constrained to have begun before 2169 ± 4 Ma, the zircon age from a gabbro sill intruding the Seward Group at the base of Cycle 1 (Rohon *et al.*, 1993). The stratigraphically higher Cycle 1 Swampy Bay Group is dated at 2142 +4/-2 Ma (Clark, 1984). The uppermost parts of Cycle 1, the Swampy Bay and Attikamagen groups, underlie much of the study area.

Cycle 2 rocks, constituting the Ferriman Group, record a second transgressive sequence within which shallow-marine sedimentary rocks give way to deeper water turbidites and locally basalts (Clark and Wares, 2005). In the eastern part of the trough, Cycle 2 includes volcanic and volcaniclastic rocks of the Doublet Group, which are considered coeval with deposition of the Ferriman Group. The tectonic significance of Cycle 2 remains unclear, with proposed depositional settings ranging from a foredeep basin related to subduction beneath the Core Zone (Hoffman, 1988), to a marginal pull-apart rift basin (Skulski *et al.*, 1993), or back-arc basin (Rohon *et al.*, 1993). The timing of Cycle 2 deposition is constrained by an age of 1880 ± 2 Ma for a carbonatitic dyke interpreted as contemporaneous with deposition of the Sokoman Formation (Ferriman Group) (Chevé and Machado, 1988). Findlay *et al.* (1995) reported a similar age of 1878 ± 1 Ma for felsic volcanic rocks of the Nimish Formation, which are intercalated with the Sokoman Formation. A substantial part of the study area is underlain by rocks of Cycle 2 Ferriman Group.

Throughout the central part of the Labrador Trough, Cycles 1 and 2 are intruded by voluminous mafic–ultramafic sills, collectively referred to as the Montagnais Sills, which are contemporaneous and interpreted as co-magmatic with Cycle 2 volcanic rocks (Findlay *et al.*, 1995). Like Cycle 2 sedimentation, the tectonic significance of this magmatism remains controversial, having been ascribed to rifting of the lithosphere in a forearc setting (*e.g.*, Hoffman, 1990) or alternatively to impingement of a mantle plume beneath the Superior Craton (Ciborowski *et al.*, 2017). The timing of intrusion of the Montagnais Sills is constrained by an age of 1884 ± 2 Ma for a glomeroporphyritic gabbro sill, cutting turbidites of the Menihek Formation, which overlie the Sokoman Formation. Machado *et al.* (1997) obtained a younger age of 1874 ± 3 Ma for a glomeroporphyritic gabbro sill at the top of the Hellancourt Formation, in the middle of Cycle 2; this suggests that the Montagnais Sills may represent a long-lived intrusive event or alternatively, they may encompass more than one mafic intrusive event.

Cycle 2 rocks are unconformably overlain by synorogenic molasse deposits of Cycle 3, inferred to represent collision of the Superior Craton with the Core Zone during the Trans-Hudson orogeny (Hoffman, 1988; Clark and Wares, 2005), but which do not outcrop in the study area.

TECTONIC HISTORY

The Labrador Trough constitutes the foreland of the New Québec Orogen, the southeasternmost arm of the broader Trans-Hudson orogenic system formed by *ca.* 1.8 Ga collision of the Superior Craton with the southeastern Churchill Province (specifically the Core Zone) (Clark and Wares, 2005). Structurally, the western–central trough exhibits features typical of a foreland fold and thrust belt. Stratigraphic repetition is common, owing to numerous high-angle, foreland-verging thrust faults (*e.g.*, Wardle, 1982). Folds range from open to nearly isoclinal, have shallow plunges, and are typically overturned to the west, producing a similar southwest-verging pattern to that of the thrust faults. Because of this deformation, rocks of the Labrador Trough are divided into a series of distinct lithotectonic zones separated by thrust faults. From west to east these include the Tamarack, Schefferville, Howse, Hurst, and Retty zones (Clark and Wares, 2005). The present study area transects the last four of these, and delineation of these zones within the study area is discussed below.

Metamorphism related to Hudsonian collision is low grade throughout the western–central part of the trough, including the tectonic zones described above, generally reaching prehnite–pumpellyite to greenschist facies. Metamorphic grade increases northeastward across the orogen, where rocks of the Rachel-Laporte Zone, a lithotectonic zone of debatable provenance (Corrigan *et al.*, 2016; Henrique-Pinto *et al.*, 2017), reach amphibolite to granulite facies (*see* references in Clark and Wares, 2005).

The timing of deformation and metamorphism related to Trans-Hudsonian orogenesis is best constrained in the far hinterland of the orogen, where upper-amphibolite- to granulite-facies metamorphism in the Rachel-Laporte Zone has been dated at pre-1845 to 1829 Ma, with posttectonic pegmatite intrusion between 1793 and 1769 Ma (Machado *et al.*, 1989; Machado, 1990). In the western–central trough, the sole constraint on the timing of deformation comes from the undeformed monzonitic Nachicapau Lake intrusion, which gave an age of 1813 ± 4 Ma (Machado *et al.*, 1997), providing a lower bound for the cessation of foreland folding and thrusting.

GEOLOGY OF THE HOLLINGER LAKE AREA (NTS 23J/16)

LITHOTECTONIC ZONES

The geology of the Hollinger Lake area (Figure 3) is divided into four lithotectonic zones correlative with the zones described above. From southwest to northeast these include: the Schefferville Zone, the Howse Zone, the Hurst Zone and the Retty Zone. Recognition of these zones with-

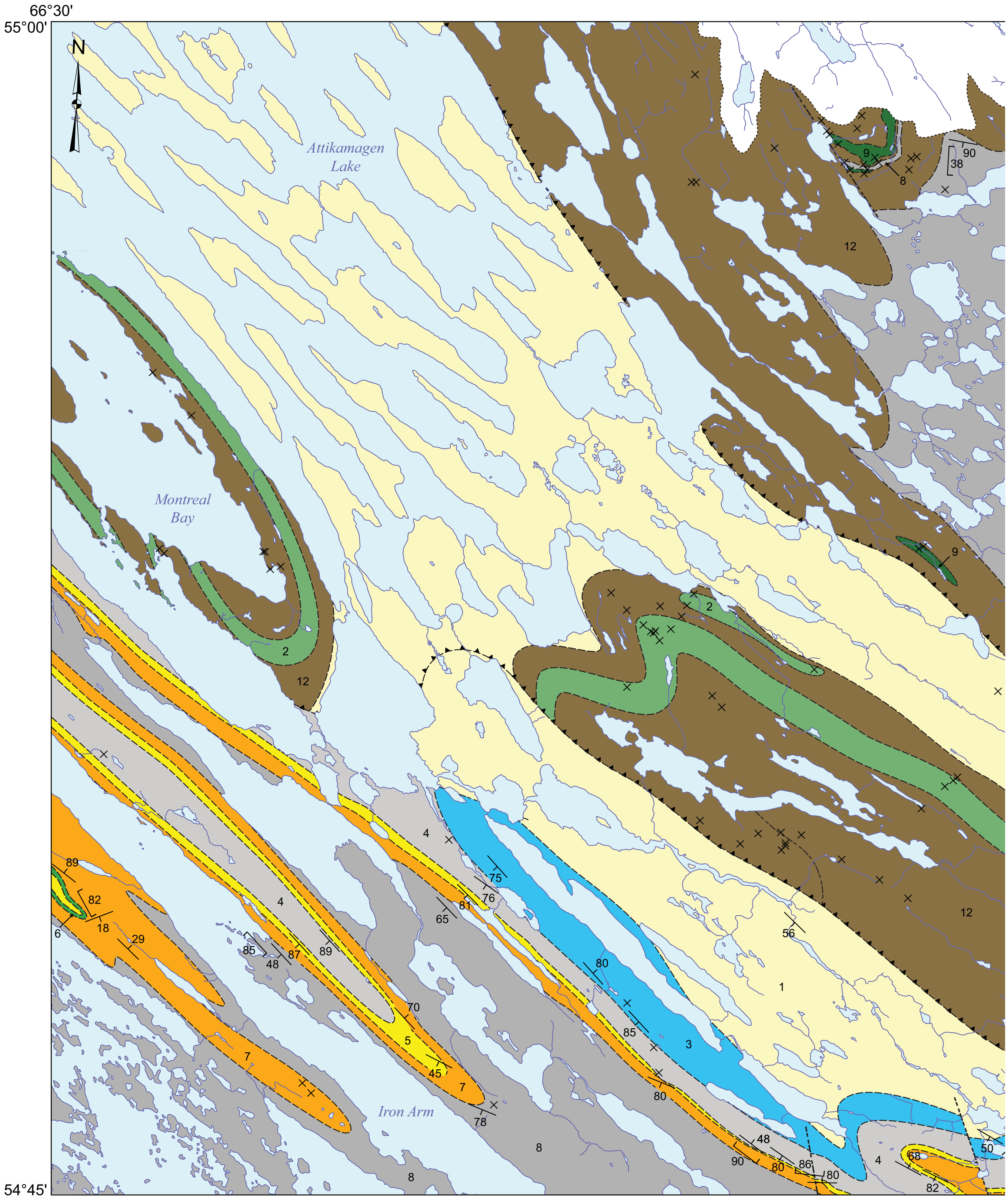

Figure 3. *Preliminary geological map of the Hollinger Lake area (NTS 23J/16).*

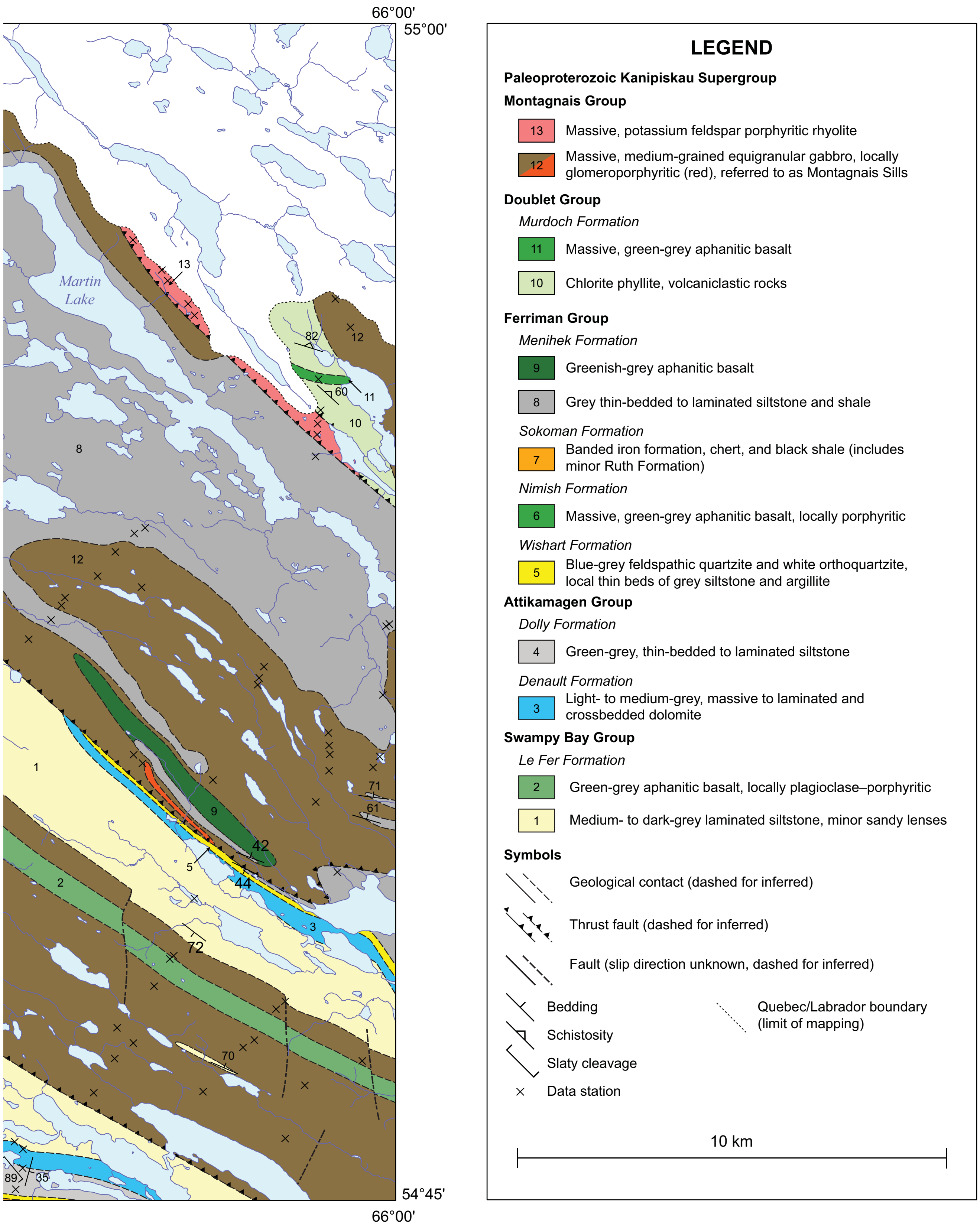

Figure 3. *Continued.*

in the map area is based on changes in structural style, including truncation of regional-scale structural features by faults inferred from aeromagnetic data (Figure 4), and by changes in the principal lithological units.

Schefferville Zone

The Schefferville Zone encompasses the southwestern end of the map area (Figure 4). On the preliminary map (Figure 3), it is characterized by a series of regional-scale southeast-plunging folds involving rocks of the Le Fer Formation (Swampy Bay Group), and the overlying Attikamagen and Ferriman groups. These folds are readily apparent in the aeromagnetic data where strong positive magnetic anomalies correspond to the distribution of the iron-rich Sokoman Formation.

Howse Zone

The Howse Zone lies to the northeast of the Schefferville Zone (Figure 4) and extends from the southeastern corner of the map area northwestward to beneath Attikamagen Lake. On the preliminary map (Figure 3), it is dominated by rocks of the Le Fer Formation, including siltstone and basalt, intruded by gabbro of the Montagnais Sills. Two major folds, the Montreal Bay anticline and the Laura Lake anticline, can be seen in the aeromagnetic data (Figure 4) and correspond to gabbro intercalated with basalt. A prominent magnetic high follows the southern part of the Laura Lake anticline, and corresponds to gabbro. The Howse Zone is separated from the Schefferville Zone by the Ferrum River Fault, an inferred thrust fault which, although not observed by the present author due to poor exposure, is apparent in the truncation of the Laura Lake and Montreal Bay anticlines.

Hurst Zone

The Hurst Zone lies to the northeast of the Howse Zone and is separated from it by the Chassin Fault (Figure 4). On the preliminary map, the Hurst Zone is underlain by siltstone and minor basalt of the Menihek Formation, intruded

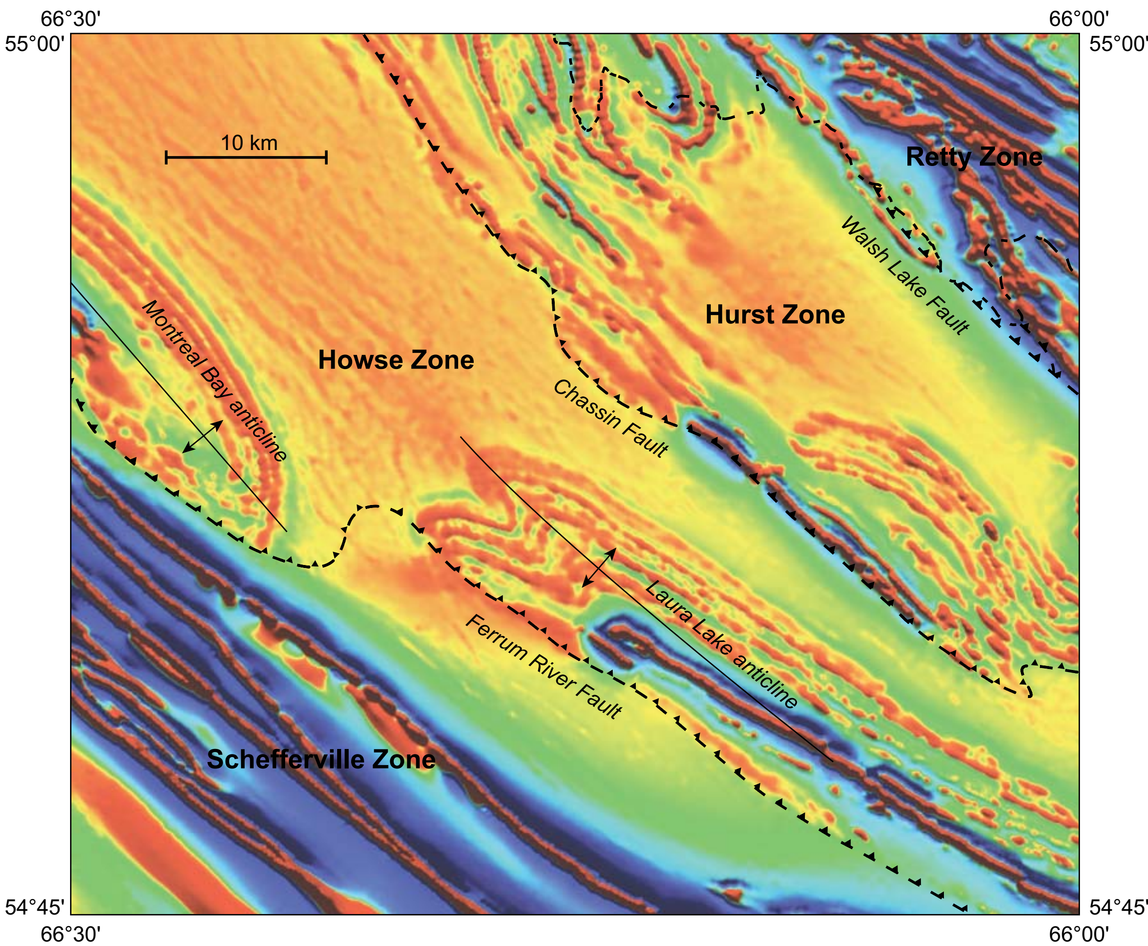

Figure 4. *First vertical derivative of aeromagnetic data for the Hollinger Lake area showing inferred tectonic zone boundaries and regional-scale folds referred to in text. Saw-tooth dashed lines represent inferred thrust faults (Wardle, 1982). Dashed line shows provincial boundary.*

by voluminous gabbro sills, the latter defining several-km-wavelength folds in the aeromagnetic data.

Retty Zone

The Retty Zone is separated from the Hurst Zone by the Walsh Lake Fault, and marks a distinct break in both lithology, aeromagnetic signature, and metamorphic grade. It is dominated by greenschist-facies metavolcanic rocks of the Murdoch Formation. The latter constitute the only exposures of the Doublet Group within the study area.

LITHOLOGICAL UNITS

The following is a description of lithological units within the Hollinger Lake map area (NTS 23J/16). All units described here are shown on the accompanying map (Figure 3). Most of these units have been described previously (Doherty, 1979), although their distribution has changed from previous maps (*e.g.*, Wardle, 1982).

Swampy Bay Group

Le Fer Formation (Unit 1)

The Le Fer Formation, part of the Cycle 1 Swampy Bay Group, represents the lowest stratigraphic level of the Kaniapiskau Supergroup exposed in the map area. It comprises medium- to dark-grey laminated shales and siltstones having a well-developed cleavage (Plate 2A). Minor sandy lenses appear locally. The combination of grain size and the presence of graded bedding suggest a possible turbidite origin for this unit, although based on its finely laminated character deposition probably occurred in a relatively low-energy (*i.e.*, distal) environment. The unit is very poorly exposed, and scattered outcrops combined with the regional aeromagnetic signature suggest that the Le Fer Formation underlies much of Schefferville and Howse zones. In the Schefferville Zone, the Le Fer Formation is bounded at its top (to the south) by the conformably overlying Denault Formation, whereas its north end lies in contact with a sequence of gabbro sills (Montagnais Sills; *see* below) along the Ferrum River Fault. In the Howse Zone, the Le Fer Formation is inferred to underlie all of the area extending beneath Attikamagen Lake and southeastward.

Le Fer Formation Basalt (Unit 2)

Basalts are found associated with gabbro sequences that intrude the Le Fer Formation in two places within the Howse Zone; in the west, as part of the Montreal Bay anticline, and in the central/eastern part of the area within the Laura Lake anticline. In both exposures, the original contacts between the basalt flows and Le Fer Formation are not exposed. The basalts are massive, aphanitic, and grey-green (Plate 2B). In many instances, networks of sub-cm-scale chlorite-filled fractures permeate the outcrop. Porphyritic textures are found in some outcrops, characterized by <0.5-cm-scale plagioclase phenocrysts; however, they are rare. Doherty (1979) described pillow textures from this unit; these were not observed during the present survey. Flow tops with calcite-filled amygdules appear very locally; however, the internal structure of the flows is typically impossible to discern. Distinguishing between separate flows is thus difficult, but given the thickness of the unit (up to 1 km thick) it quite likely comprises multiple flows.

Attikamagen Group

Denault Formation (Unit 3)

The Denault Formation is poorly exposed throughout the entire map area, cropping out in two small belts within the Schefferville and Howse zones, where it varies in thickness from approximately 50 m to 2 km. Its contact with the underlying Le Fer Formation was not observed, but is inferred to be conformable (Doherty, 1979). The Denault Formation comprises beige-weathering, light- to medium-grey dolomite varying from massive to laminated and cross-laminated (Plate 2C). Doherty (1979) described stromatolitic horizons, cherts, and dolomite breccias from this unit; these features were not observed during the present study, likely owing to the lack of exposure.

Dolly Formation (Unit 4)

The Dolly Formation is limited in exposure to the Schefferville Zone, where it forms an approximately 1-km-thick package separating the underlying Denault Formation from the Wishart Formation. The contact between it and the underlying Denault Formation was not observed, but is assumed to be conformable. The unit is characterized by light- to dark-greenish-grey siltstones having a well-developed cleavage (Plate 2D). Bedding ranges in thickness from fine laminations to cm-scale beds.

Ferriman Group

Wishart Formation (Unit 5)

The Wishart Formation, representing the onset of Cycle 2 transgression, disconformably overlies the Dolly Formation in the Schefferville Zone where it forms an approximately 100-m-thick section, and also in the Howse Zone, where the Dolly Formation is absent. Lithologically, it is characterized by bluish-grey feldspathic quartzites (Plate 2E) to white orthoquartzites, with thin interbeds of grey siltstone and argillite, the proportion of which (relative to quartzite)

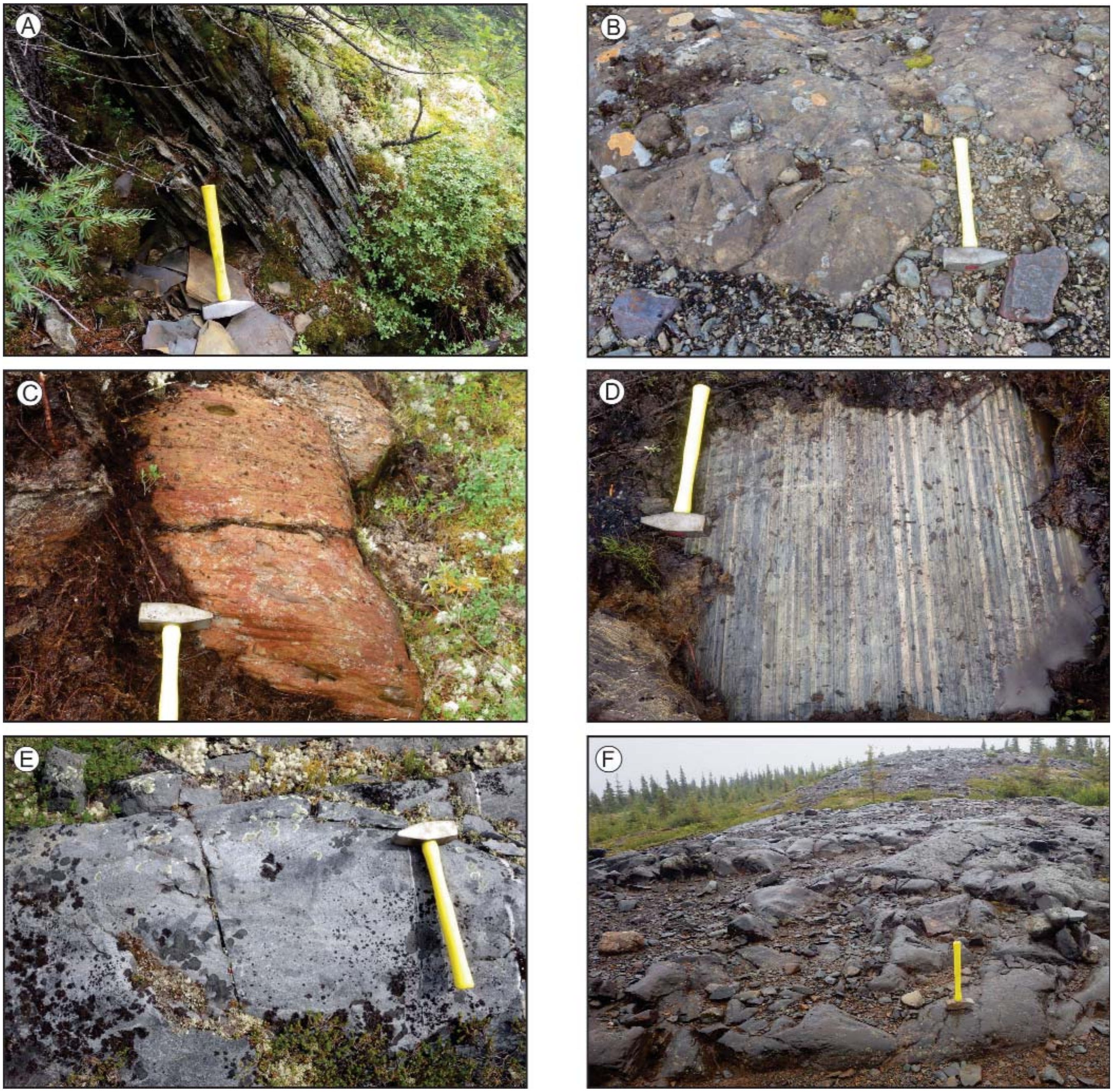

Plate 2. *Representative photographs of key rock types from the Hollinger Lake map area (hammer for scale). A) Siltstone/shale of the Le Fer Formation; B) Massive aphanitic basalt of the Le Fer Formation; C) Laminated and crosslaminated dolomite of the Denault Formation; D) Laminated siltstone of the Dolly Formation; E) Crossbedded quartzite of the Wishart Formation; F) Massive aphanitic basalt of the Nimish Formation.*

varies along strike. Quartzite beds typically vary from 10 cm to 1 m in thickness. Hummocky crossbedding is common within the Wishart Formation, suggesting a shallow-marine origin. Additional features, including black-banded chert horizons and thin lenses of quartz-K-feldspar granule conglomerate may also be present locally (Doherty, 1979).

Nimish Formation (Unit 6)

The Nimish Formation basalt outcrops as an approximately 50-m-thick sequence in the extreme west of the Schefferville Zone, where it separates the Wishart Formation from the overlying Sokoman Formation. It is aphanitic, massive, and locally porphyritic, with a distinct greenish hue reflecting abundant olivine (Plate 2F).

Sokoman Formation (Unit 7)

The Sokoman Formation outcrops in the Schefferville Zone as a thin, 10- to 50-m-thick belt, and corresponds to a prominent anomaly on the regional aeromagnetic map where it defines a series of tight folds. Weathering resistant, it forms most of the topographic ridges in the Schefferville Zone. Following Doherty (1979), the Sokoman Formation is divided into a lower, middle, and upper formation. The lower iron formation comprises silicate and minor silicate–carbonate facies iron formation characterized by dark-green and brown-laminated chert, respectively (Doherty, 1979). The middle iron formation, the most commonly exposed part of the section within the map area, is banded iron formation typified by alternating bluish-grey hematite-rich and red jasper-rich bands, typically on the order of 5 to 10 cm in thickness (Plate 3A). The upper iron formation is composed of carbonate cherts (Doherty, 1979), but was not observed in the map area.

At the base of the Sokoman Formation lies the Ruth Formation, a thin (typically <25-m-thick) package of sulphide-rich (mostly pyrite), black siltstones and shales, interlayered with discontinuous 5- to 10-cm-thick white chert beds. Owing to its thinness, the Ruth Formation has been grouped together with the Sokoman Formation on the accompanying map.

Menihek Formation (Unit 8)

The Menihek Formation marks the final stage of Cycle 2 deposition, and represents the highest stratigraphic level exposed in the map area within the Ferriman Group. It is inferred to underlie much of the Schefferville and Hurst zones; however, like the lithologically similar Le Fer Formation it is very poorly exposed, and only a handful of outcrops were observed. Where exposed, the Menihek Formation comprises dark-grey to black-laminated siltstones and shales that have a well-developed slaty cleavage (Plate 3B), as well as minor bluish-grey chert, greywacke, and carbonaceous siltstone (Doherty, 1979). In the Hurst Zone, the Menihek Formation is intruded by gabbro sills, and in this zone, the Menihek Formation typically outcrops as gossanous, sulphide-rich siltstone and argillite.

Menihek Formation Basalt (Unit 9)

Aphanitic, equigranular, massive basalt is found locally within the Hurst Zone. It is typically intercalated with gabbro, and is assumed to be associated with deposition of the Menihek Formation. Lacking obvious structures such as pillows or vesicles, the basalt is often difficult to distinguish from fine-grained gabbro (*e.g.*, diabase or chilled sill margins), and some previously mapped sections of basalt (Wardle, 1982) have been reinterpreted here as gabbro. Although not observed within the map area, a reconnaissance trip to the adjacent (to the south) map area revealed spectacular pillow structures in basalts associated with the Menihek Formation.

Doublet Group

Murdoch Formation (Unit 10)

North of the Walsh Lake Fault, within the Retty Zone, lie sedimentary and metabasic volcanic/volcaniclastic rocks of the Murdoch Formation. The dominant lithology is a light-green chlorite phyllite, along with subordinate volcaniclastic rocks. A strong metamorphic fabric is present throughout, defined by a crenulated schistosity and (in volcaniclastic rocks) by the alignment of flattened volcanic clasts (Plate 3C).

Murdoch Formation Basalt (Unit 11)

Aphanitic, massive green-grey basalts are locally intercalated with the volcaniclastic rocks of the Murdoch Formation.

Montagnais Group

Montagnais Group/Sills (Unit 12)

Throughout much of the Howse and Hurst zones, sedimentary rocks of the Kaniapiskau Supergroup are intruded by pretectonic gabbro sills assigned to the Montagnais Sills (Doherty, 1979). The gabbro is typically medium grained, massive, and equigranular (Plate 3D). It is locally porphyritic, with sub-cm-scale hornblende phenocrysts. Chilled margins are locally found adjacent to the enclosing sedimentary rocks. Individual sill thicknesses are difficult to estimate, owing to the lack of exposure, but based on the distribution of chilled margins probably vary from 10 to 100 m thick. Glomeroporphyritic gabbro, containing large (>1 cm) plagioclase phenocrysts, outcrops locally within the Hurst Zone and is included in this unit (Plate 3E). Reconnaissance work in the adjacent map area suggests this glomeroporphyritic variety of gabbro is more abundant toward the northeast.

Rhyolite (Unit 13)

Rhyolite outcrops within a fault-bounded wedge separating the Hurst and Retty zones just north of Martin Lake,

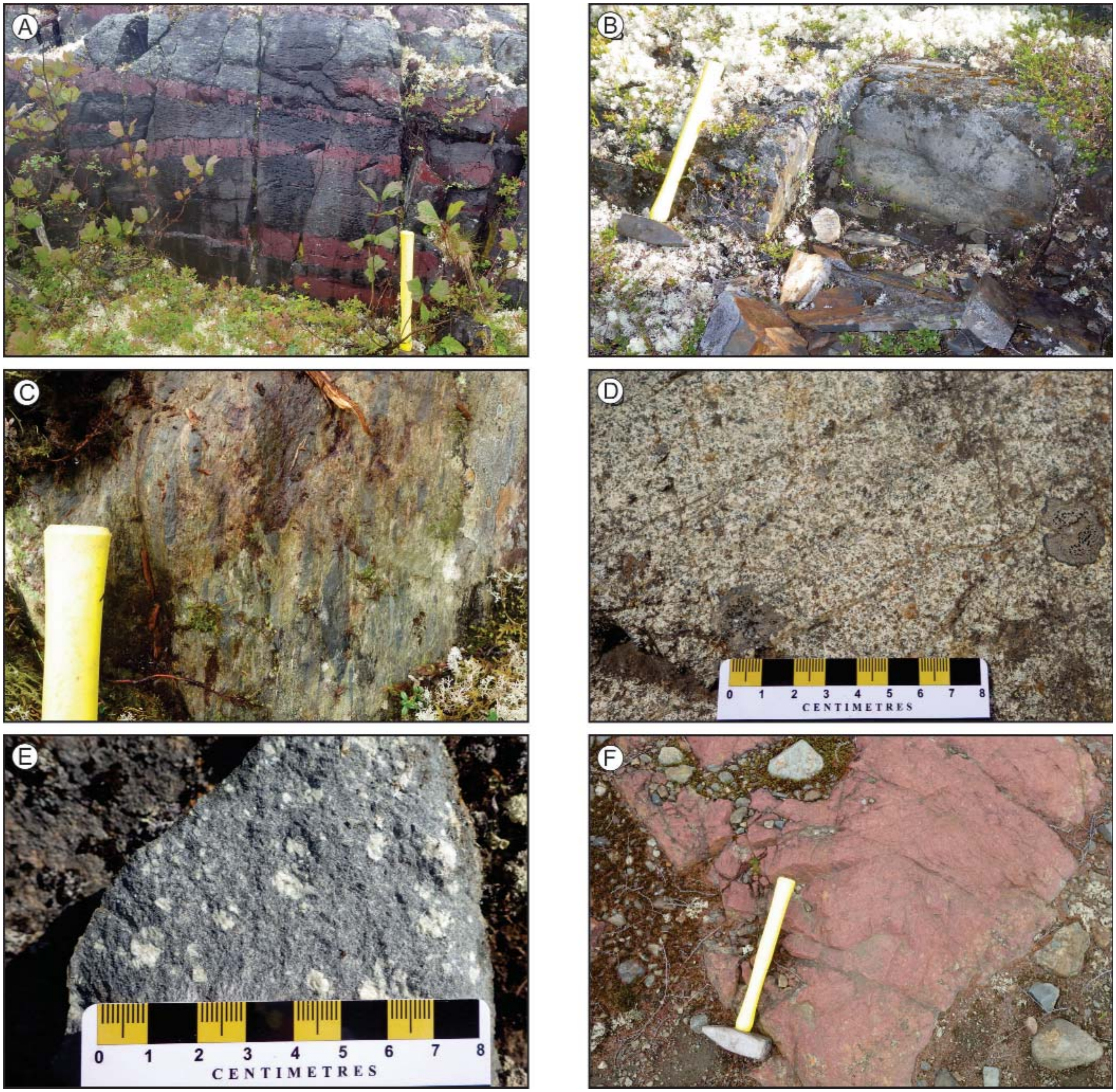

Plate 3. *Representative photographs of key rock types from the Hollinger Lake map area (hammer for scale). A) Banded iron formation of the Sokoman Formation showing alternating bluish-grey hematite-rich and red jasper layers; B) Cleaved laminated siltstones of the Menihek Formation; C) Deformed volcaniclastic rocks of the Murdoch Formation; D) Medium-grained equigranular gabbro of the Montagnais Sills; E) Medium-grained glomeroporphyritic gabbro of the Montagnais Sills showing cm-scale plagioclase agglomerations; F) K-feldspar porphyritic rhyolite.*

in the northeastern corner of the map area. The rhyolite is massive, with no evidence of internal flow banding, and porphyritic, with abundant 0.5- to 1-cm-potassium feldspar phenocrysts (Plate 3F). Doherty (1979) interpreted this unit as co-magmatic with the Montagnais Sills, although the rhyolite has not been dated.

STRUCTURE AND METAMORPHISM

The geological structure of the study area (Figure 5) is consistent with southwest-directed shortening related to development of a foreland fold-and-thrust belt during Trans-Hudsonian collision. In the Schefferville Zone, sedimentary

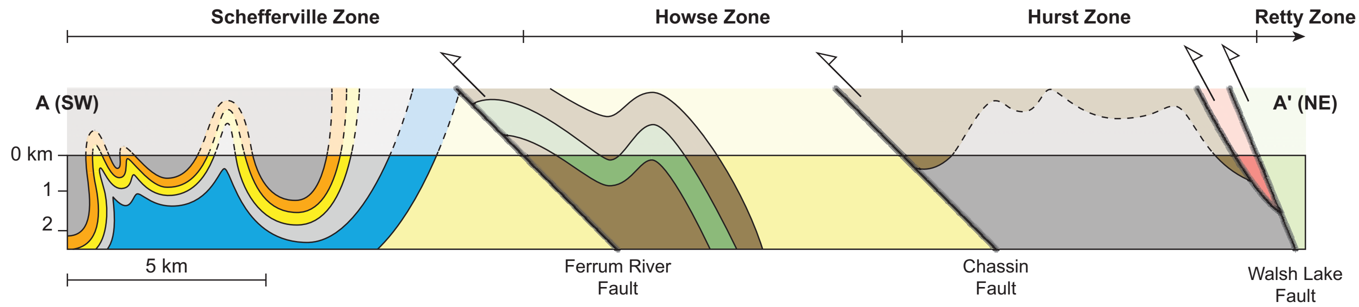

Figure 5. *Cross-section through the Hollinger Lake map area.* See *Figure 3 for legend.*

rocks are moderate to steeply dipping, and exhibit an axial-planar cleavage associated with tight, southeast-plunging folds visible in the map pattern and aeromagnetic data. Outcrop-scale parasitic folds are found locally, but are rare. In the Howse and Hurst zones, a similar slaty cleavage is exhibited by the limited exposures of the Le Fer and Attikamagen formations. The gabbro sills that dominate these zones, in contrast, lack an internal fabric; folding is only apparent in the map pattern and aeromagnetic data. Within the Retty Zone, phyllite of the Murdoch Formation exhibits a crenulated schistosity defined by chlorite. The latter parallels the regional trend of bedding/cleavage, and is inferred to represent the same stage of deformation observed in the more southern zones, with the crenulations possibly representing a second deformation event not present elsewhere.

Regional-scale folding was followed by juxtaposition of the tectonic zones along faults inferred from the aeromagnetic data. Recognition of these faults in the field was not possible, owing to the lack of exposure, and thus the transport direction was not determined; however, previous work (Wardle, 1982) suggests they are southwest-verging, high-angle thrust faults. Both folding and later faulting affect the Montagnais Sills, and therefore probably postdate *ca.* 1870 Ma. No posttectonic units were identified in the study area.

Metamorphic grade appears to be low throughout the study area, ranging from prehnite–pumpellyite facies within the Schefferville to Hurst zones, to greenschist facies in the Retty Zone. Preliminary petrographic analysis shows that gabbro sills from within the Howse and Hurst zones are strongly overprinted, with olivine and pyroxenes in many cases overprinted by abundant chlorite, prehnite, and pumpellyite. However, further work is required to fully characterize the grade and distribution of metamorphism within the area.

MINERALIZATION

The Hollinger Lake area has been the focus of intermittent exploration activity since the 1940s (Swinden and Santaguida, 1993 and references therein), and remains a prospective target for iron ore (Gan *et al.*, 2012) and base-metal sulphide mineralization (Labonté and Kieley, 2009).

In the Schefferville Zone, altered iron formation characterized by abundant secondary hematite and white, cherty veinlets, was observed locally, suggesting that the Sokoman Formation in the map area has potential for localized enrichment to “direct shipping” grade ore. However, no sizeable areas of alteration were discovered. In addition, several pyrite-bearing quartz veins were sampled within the Ruth Formation (Plate 4A).

In the Howse Zone, considerable attention has been paid to potential base-metal sulphide mineralization (*e.g.*, chalcopyrite) associated with sulphide-rich shales and carbonaceous argillites of the Menihek Formation (Swinden and Santaguida, 1993; Labonté and Kieley, 2009). Several new gossan zones from within this unit were documented and sampled during the 2017 field season (Plate 4B, C).

Mineralization associated with the Montagnais Sills (Howse and Hurst zones) is typically limited to fine-grained, disseminated sulphides (typically pyrite) within the gabbro. However, locally the gabbro is cut by quartz veins containing pyrite, chalcopyrite and locally malachite (Plate 4D), and thus may provide a valuable future target for base–precious-metal mineralization.

CONCLUSIONS

The Hollinger Lake area is underlain by supracrustal rocks of the Kaniapiskau Supergroup, which formed during Paleoproterozoic rifting and the later drift of the Superior Craton. Two cycles of sedimentation, and minor associated basaltic volcanism, are recognized in the field area. In Cycle 1, passive margin turbidites and basalt of the Le Fer Formation give way to dolomite and siltstone of the Denault and Dolly formations, respectively. In Cycle 2, quartzite of the Wishart Formation is overlain by iron formation of the Sokoman Formation and turbidites and associated basalts of the Menihek Formation. The entire sedimentary–volcanic

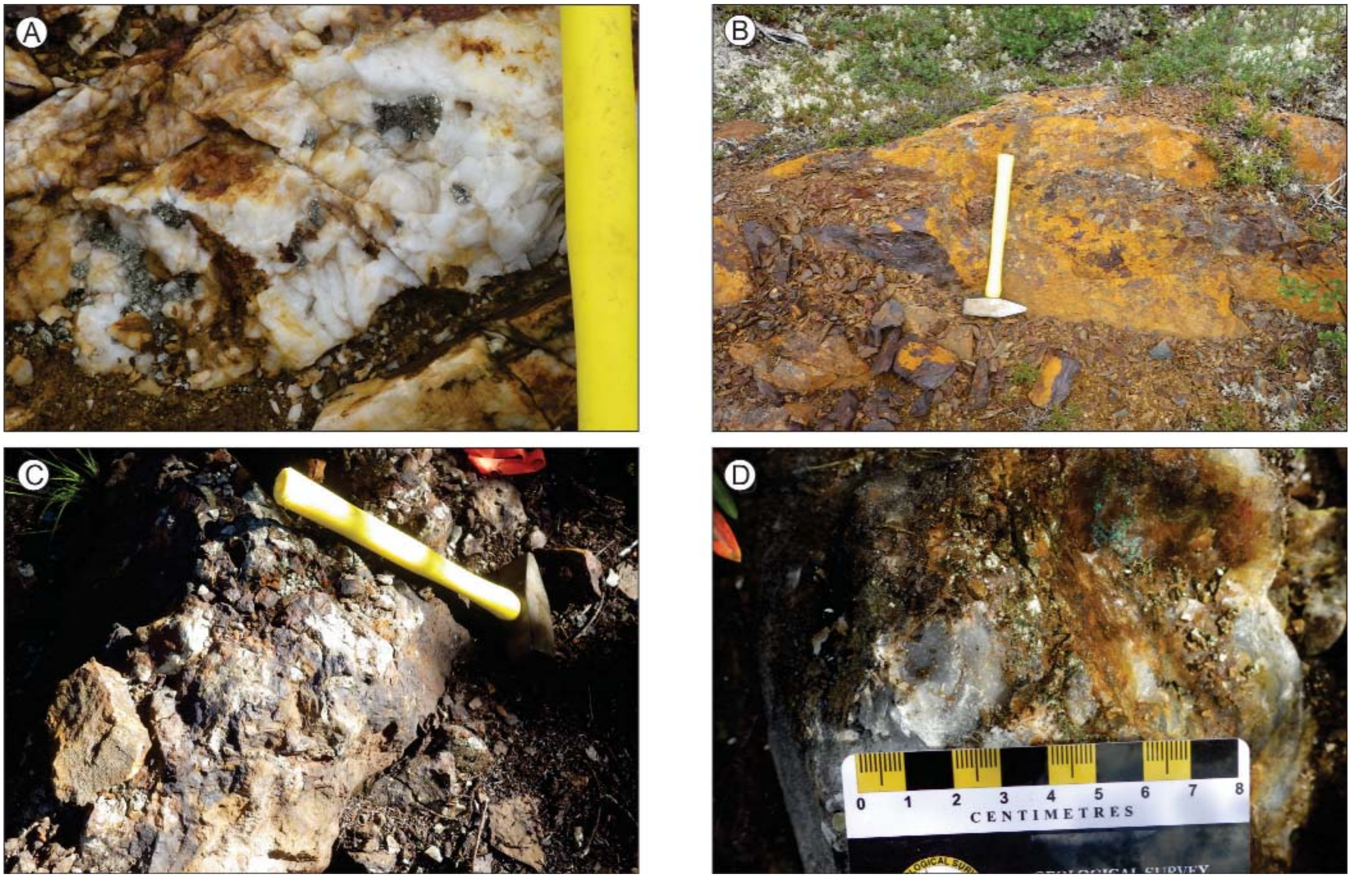

Plate 4. *Examples of mineralization from the Hollinger Lake area. A) Pyrite in quartz vein from the Ruth Formation; B) Gossanous zone developed in siltstones of the Menihek Formation; C) Sulphide-rich argillite from the Menihek Formation; D) Pyrite, chalcopyrite, and malachite-bearing quartz vein intruding gabbro of the Montagnais Sills.*

sequence is intruded by the *ca.* 1880–1870 Ma Montagnais Sills. Each of these units experienced deformation during subsequent Trans-Hudsonian orogenesis, resulting in the formation of open to tight, shallowly southeast-plunging folds and the development of an associated axial-planar cleavage. Subsequent transport along inferred southwest-verging thrust faults led to the juxtaposition of distinct litho-tectonic zones. Metamorphic grade in the map area remained low during this deformation, probably not exceeding greenschist facies, consistent with shallow burial in the foreland of the New Québec Orogen. Future work will include the use of radiometric dating and whole-rock geochemistry to provide greater insight into the tectonic setting in which these rocks were formed, in particular the source of the voluminous mafic magmatism evident in the Montagnais Sills and its significance with respect to lithospheric-scale tectonics.

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