Provisional nomenclature of the volcanic rocks in the Buchans area, central Newfoundland

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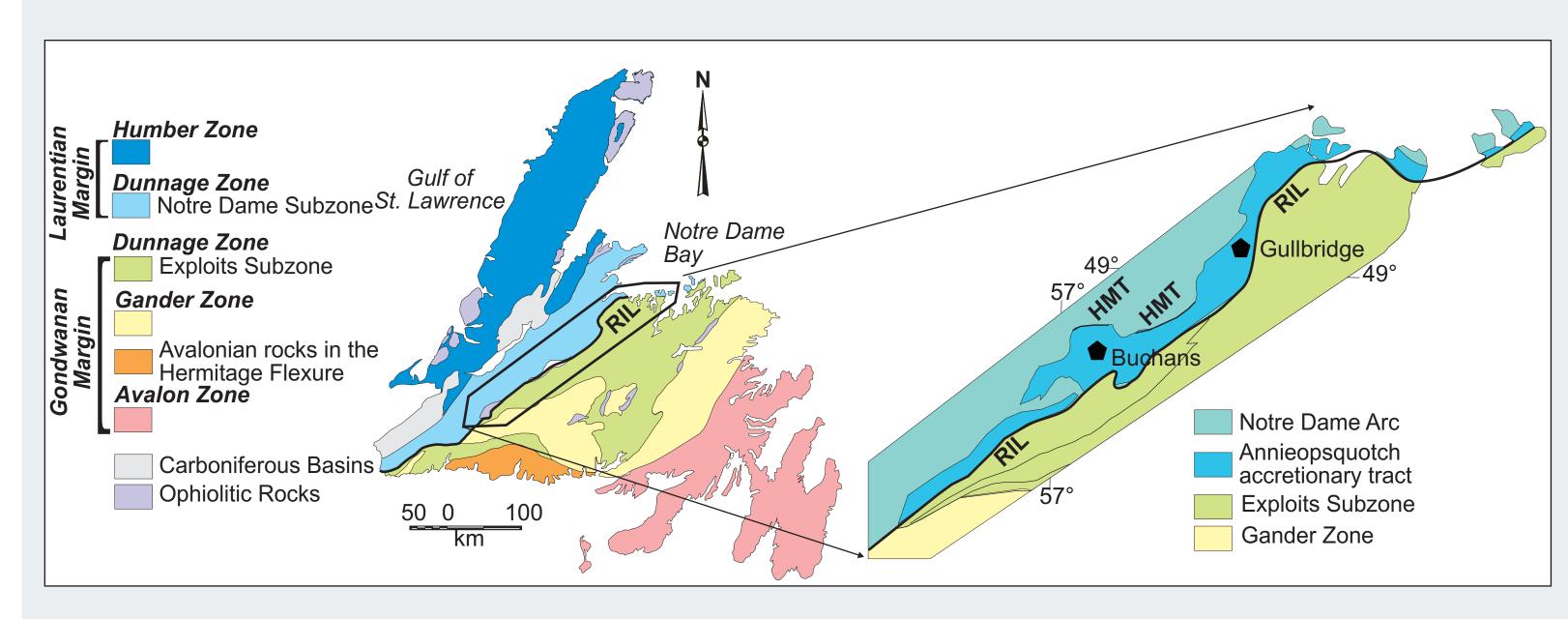
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Introduction

The Buchans - Robert's Arm belt comprises an imbricated peri-Laurentian continental arc sequence that hosts the world-class Buchans VMS ore bodies. The Buchans mining camp produced 16.2 million tonnes of ore at an average grade of 14.5% Zn, 7.6% Pb, 1.3% Cu, 126 g/t Ag and 1.37 g/t Au. The ore was predominantly mined from five main orebodies thought to represent a single stratigraphic horizon within the Buchans Group (Thurlow and Swanson, 1987). Re-evaluation of the Buchans - Robert's Arm belt tectonostratigrapy suggests it is a composite terrane comprising several tectonically juxtaposed, unrelated units with a complex structural history.

In this contribution, the stratigraphy proposed by Thurlow and Swanson (1987) is provisionally revised. The definition of the Ski Hill Formation is expanded to include some Lundberg Hill Formation rocks. The definition of Buchans River Formation is also expanded and now includes some Sandy Lake Formation rocks. The definition of the Sandy Lake Formation is revised to be consistent with its type locality. Lundberg Hill Formation is abandoned as a stratigraphic term. Several new lithostratigraphic units are proposed. These include Harry's River ophiolite complex, Mary March Brook formation and Ken's Brook formation. Other units are included in the previously defined Red Indian Lake Group (Zagorevski et al., 2006; Rogers et al., 2005).



Revised Nomenclature

SPRINGDALE GROUP

Ken's Brook formation – Commonly red-weathering subareal flow-banded to massive rhyolite and commendite associated with coeval mafic sills and tuffaceous sediments (c. 426 Ma).

HARRY'S RIVER ophiolite complex

Tholeiitic BAB-like pillow basalt, sheeted diabase, massive diabase and gabbro. Highly strained and metamorphosed to amphibolite facies below the Hungry Mountain Thrust (ca. 473-468 Ma on the basis of correlation with the Lloyds River Ophiolite Complex).

BUCHANS GROUP (The following units do not have any stratigraphic linkages with the type localities of the Buchans Group nor Robert's Arm Group. They appear to be correlative to some tracts in the Gullbridge area: see O'Brien, 2009 and 2008)

Mary March Brook formation – Bimodal tholeiitic sequence comprising massive to flow-banded, aphyric to quartz and feldspar-phyric, locally columnar jointed rhyolite and associated pyroclastic rocks interlayered with pillowed to brecciated mafic volcanic rocks. Type locality occurs to the east of and along the shores of Mary March Brook (ca. 462 Ma and older: Zagorevski and Rogers, 2008, 2009).

Woodman's Brook member – colourful volcanic and sedimentary derived breccia that includes jasper, chert, siliceous black siltstone, basalt, rhyolite and dacite blocks in a locally soft-sediment deformed gritty sedimentary matrix. Associated with blue-grey dacite tuff and domes that locally form peperitic contacts with sediment and rare limestone. The Woodman's Brook Member is well exposed along the Middle Branch Brook; however, the name is derived from Woodman's Brook breccias from exploration diamond drill cores in the Woodman's Brook area.

Seal Pond member – quartz-megacrystic rhyolite. Type locality occurs to the east of Seal Pond (c. 462 Ma). May have been previously mapped as the "prominent quartz rhyolite".

BUCHANS GROUP

Buchans River Formation - Predominantly massive to flow banded (ca. 465 Ma Clementine rhyolite) and locally columnar jointed (ca. 465 Ma Oriental rhyolite) calc-alkaline rhyodacite to rhyolite and related pyroclastic rocks. Also includes blue-grey calc-alkaline dacite and related tuffaceous rocks (ca. 463 Ma MacLean dacite), granitoid-bearing conglomerate, volcanogenic conglomerate, sandstone, and turbiditic wacke. These rocks are locally associated with Ba-Pb-Zn-Cu bearing exhalative VMS (transported orebodies) and stockwork Cu-rich mineralization (e.g., Lucky Strike). Type locality occurs along the Buchans River near the "Discovery" outcrop. The revised formation includes some c. 463 Ma rocks previously assigned to the Sandy Lake Formation as those are either indistinguishable from Buchans River Formation or do not form mappable units. Basalt structurally underlying the "footwall arkose" remains unnamed (Tilley's

Ski Hill Formation - Predominantly calc-alkaline mafic breccia (Ski Hill) with minor sedimentary and felsic pyroclastic rocks underlain by mafic tuff, chert, jasperite, turbiditic sedimentary rocks (previously Lundberg Hill Formation) and minor limestone. Type locality is "Ski" Hill immediately north of the Lucky Strike Glory Hole.

Sandy Lake Formation - Calc-alkaline pillow basalt, massive basalt, basaltic breccia and mafic tuff, quartz-phyric rhyolite ("prominent quartz dacite/rhyolite") with subordinate jasperite, felsic tuff and minor sedimentary rocks including limestone. Contained in a thrust sheet structurally overlying Buchans River Formation and Ski Hill Formation. Type locality occurs along the western shore of Sandy Lake and in DDH along the southeastern shore of Sandy Lake.

Wiley's Brook complex - Defined by the quartz-phyric pink-weathering biotite and locally hornblende-bearing granodiorite (c. 467 Ma). Appears to be associated with felsic volcanic and pyroclastic rocks. Type locality is on Wiley's Brook.

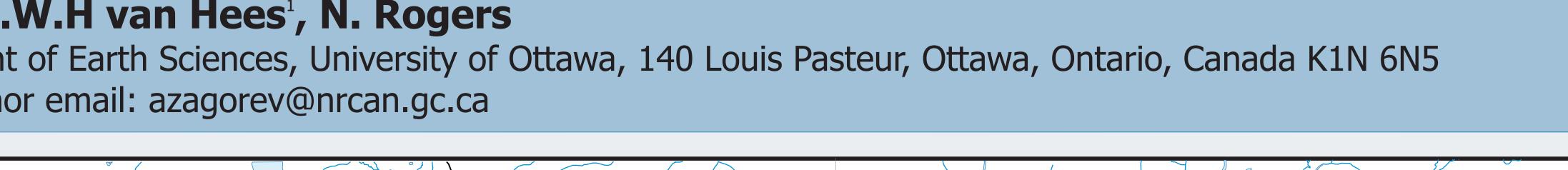
RED INDIAN LAKE GROUP (follows Zagorevski et al., 2006 and Rogers et al., 2005)

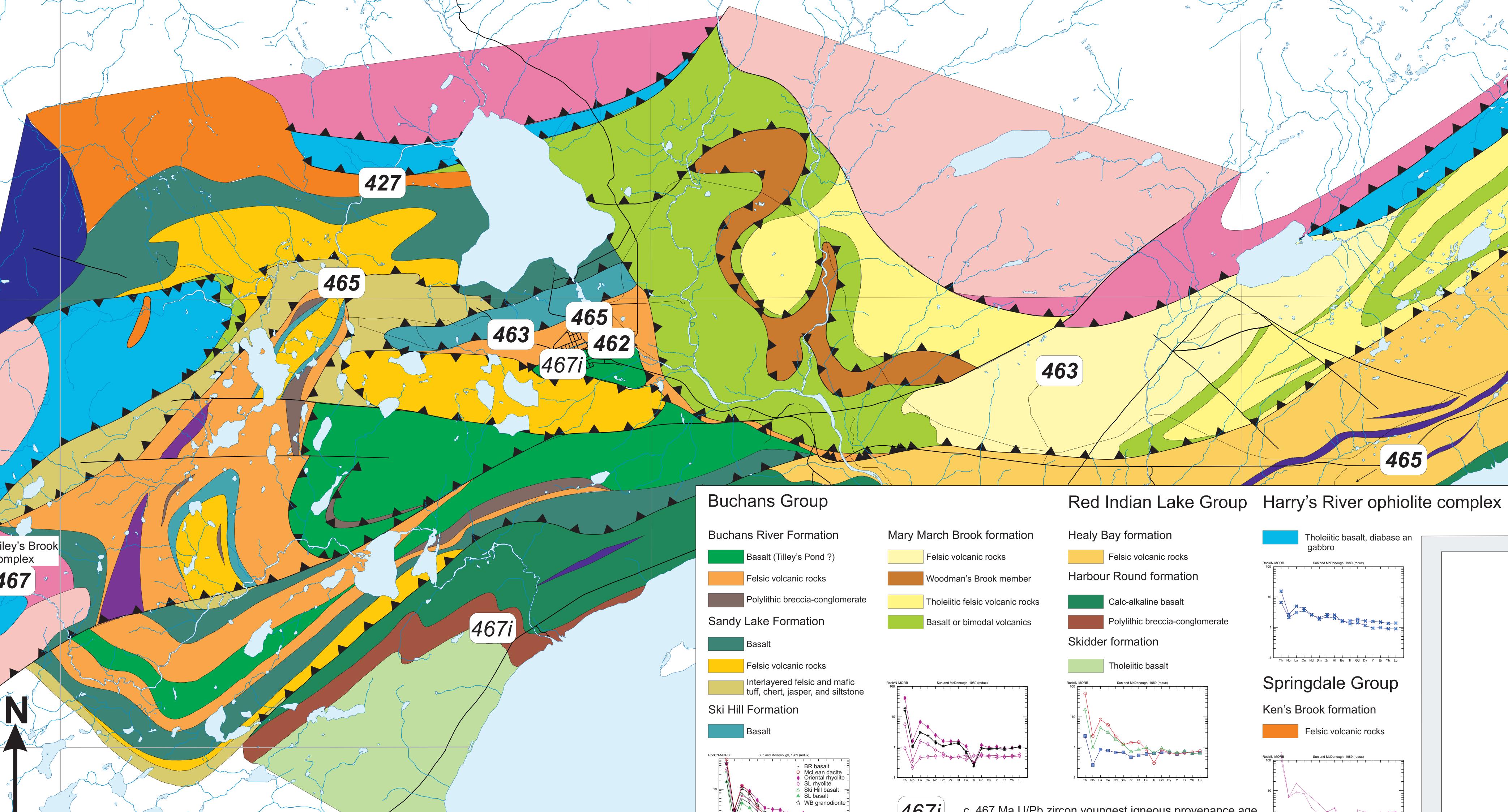
Healy Bay Formation – Felsic tuffs and rhyolite hosting Connel Option prospect Harbour Round Formation - Calc-alkaline mafic volcanic rocks hosting Mary March prospect Skidder Formation – Tholeiitic mafic volcanic rocks hosting Skidder prospect

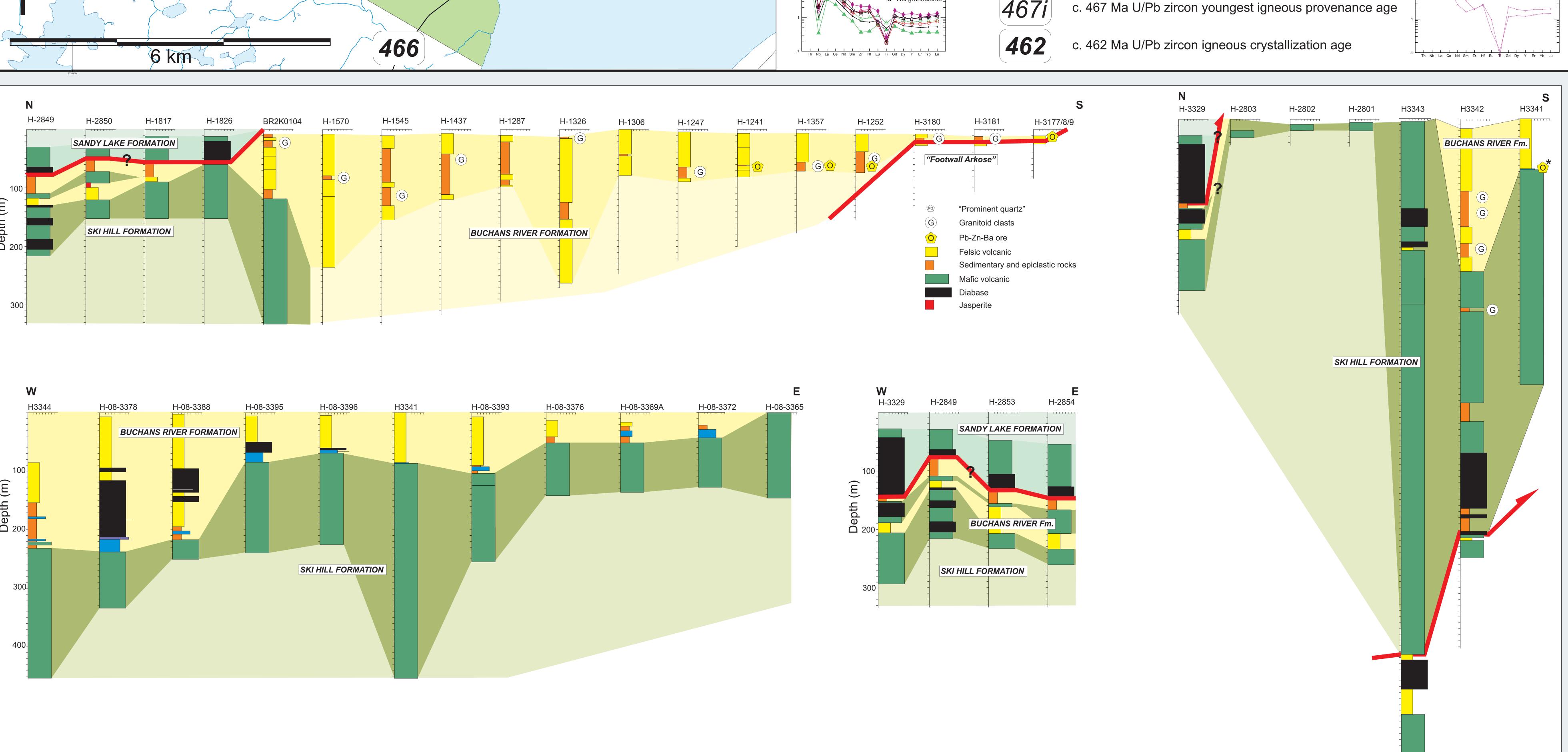
ABANDONED STRATIGRAPHIC TERMINOLOGY

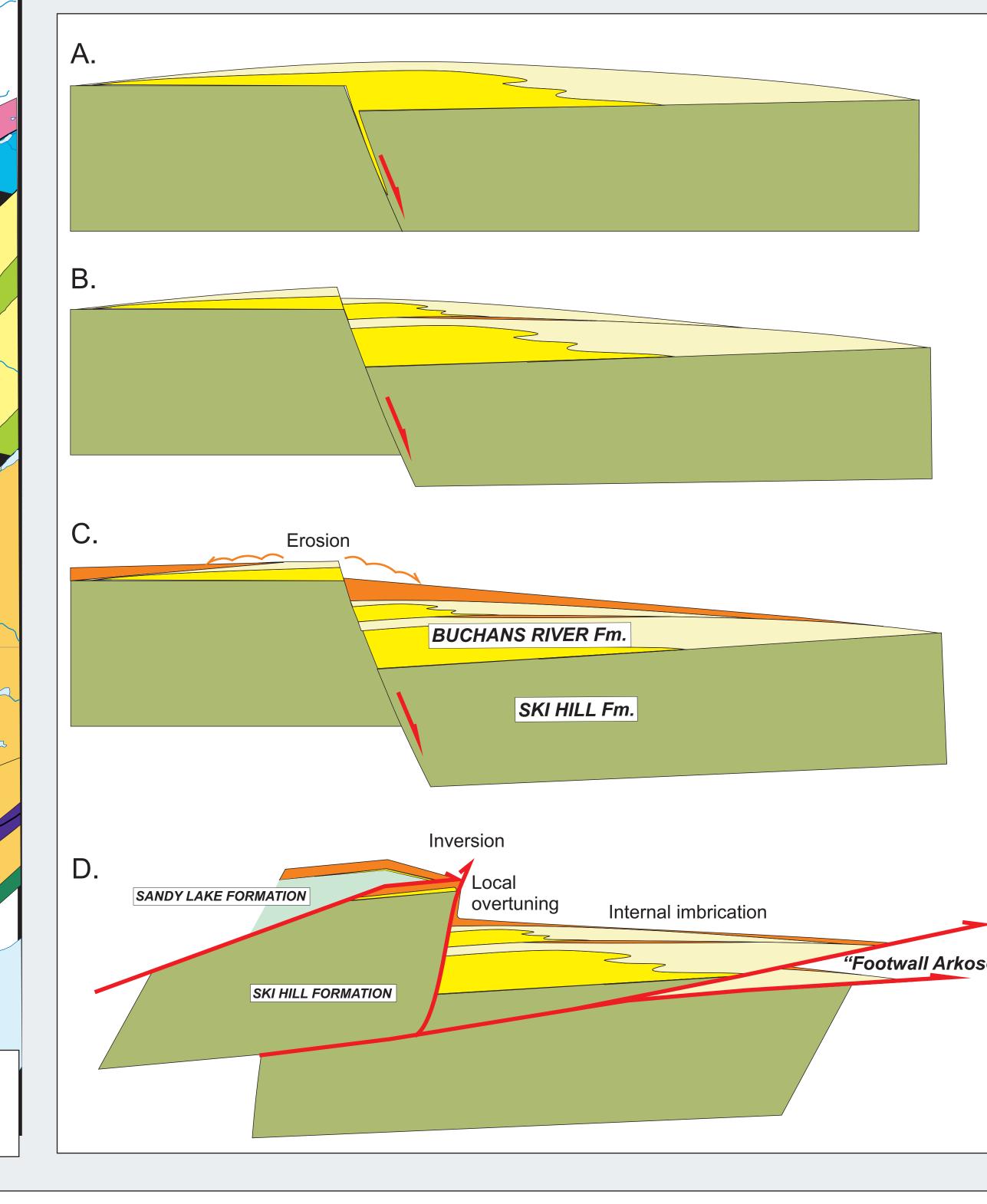
Lundberg Hill Formation – There is no geographic feature called Lundberg Hill. Feeder granodiorite – Renamed to Wiley's Brook granodiorite to conform to the type locality and to remove any genetic implications from the nomenclature.

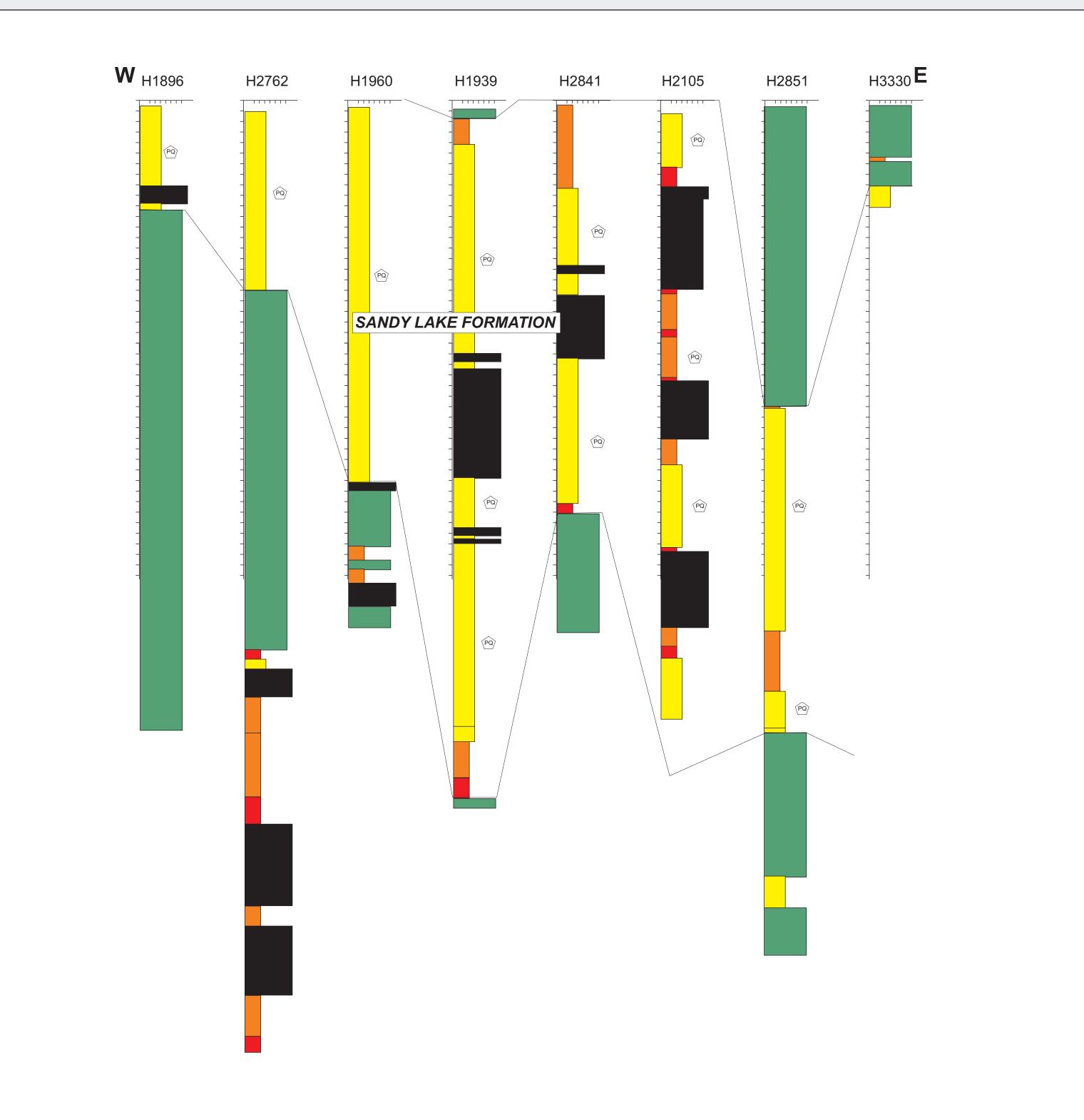
Footwall arkose (informal) – Re-assigned from the Sandy Lake Formation to the Buchans River Formation and to the Healy Bay Formation where it occurs below the Powerline Thrust. Prominent quartz rhyolite/dacite (informal) – this a distinctive but non-unique rhyolite that occurs in several distinct structural panels including tholeiitic Mary March Brook formation and calc-alkaline Buchans River and Healy Bay formations.











Discussion

The presence of multiple tectono-stratigraphic units in the Buchans area provides an exciting opportunity for exploration in multiple adjacent VMS-prospective terranes that include the Mary March Brook formation, Buchans Group and Red Indian Lake Group. Each unit is distinguished by its own stratigraphy and geochemistry; hence, the exploration strategy has to be catered to individual terranes. The terranes form a thrust stack (cf. Thurlow et al., 1992) with Mary March Brook formation occupying the highest structural level and Red Indian Lake Group at the lowest structural level. The stacking and internal imbrication of the units indicates that mineral potential is open at depth. The stratigraphies of the Mary March Brook formation and Red Indian Lake Group have been previously discussed (Zagorevski and Rogers, 2008, 2009 and Zagorevski et al., 2006 respectively). The following discussion concentrates on the Buchans Group.

Relogging and examination of historical diamond drill hole logs has revealed significant thickness variation in the Buchans River Formation. The Buchans River Formation rhyolite flows and epiclasticsedimentary rocks thicken dramatically south of Ski Hill. This variation is attributed to existence and preservation of a syn-volcanic extensional fault system that controlled the primary distribution of the volcanosedimentary units. Such faults have been suggested but not identified by several previous researchers (e.g., Kirkham and Thurlow, 1987). Subsequent tectonism resulted in structural inversion and reactivation of the fault fault system as a steep reverse fault, accompanied by structural imbrication of the Buchans River Formation (cf. Calon and Greene, 1987).

The redefinition of the Sandy Lake Formation mainly results from the re-interpretation of historical diamond drill hole logs. The Sandy Lake Formation pillow basalts lie either above sheared Buchans River Formation or above a diabase. Considering that Silurian diabase dykes commonly intrude along Ordovician thrusts, the occurrence of sheared rocks and diabase along the contact between the Buchans River and Sandy Lake formations is interpreted to represent a thrust. Since the type locality of the Sandy Lake Formation occupies the highest structural level in the Buchans Group, it must represent either a structural repetition of the Ski Hill Formation or the stratigraphic base of the Ski Hill Formation.