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TECTONIC PROVINCES OF LABRADOR: AN UPDATED LITHODEMIC AND TECTONIC SYNTHESIS

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ABSTRACT

Labrador preserves a composite record of continental evolution spanning nearly four billion years, including Archean craton formation, Paleoproterozoic orogenesis, widespread Mesoproterozoic magmatism and basin development, as well as Grenvillian orogenesis. Despite extensive mapping and regional synthesis, geological interpretation has been complicated by inconsistent and legacy use of tectonic, stratigraphic and lithodemic terminology, much of which predates modern geochronological, isotopic and geophysical constraints and limits comparability with adjacent regions. This contribution provides an updated synthesis of the tectonic provinces of Labrador and introduces targeted updates to long-standing lithotectonic and lithodemic terminology. Rock units are classified using the Cooperative Lithodemic and Stratigraphic System (CLASS), under which strongly metamorphosed crust is organized as complexes, lithodemes and assemblages, and tectonic terms are reserved exclusively for deformation events. This framework is applied consistently across all major geological provinces of Labrador, including the Nain, Superior, Southeastern Churchill, Makkovik and Grenville provinces. This report includes an updated synthesis of province-scale tectonic divisions, redefinition of several long-used but inconsistently applied terms, refinement of lithotectonic domains in the Southeastern Churchill Province, and a unified treatment of Mesoproterozoic anorthosite–mangerite–charnockite–granite (AMCG), peralkaline volcano-sedimentary and rift-related successions that crosscut multiple provinces. The revised framework provides a coherent basis for geological mapping, mineral exploration and regional correlation across Labrador and adjacent regions of Québec and Greenland.

INTRODUCTION

This report presents a revised geological framework for Labrador that integrates recent advances in geochronology, regional geophysics and geological mapping to improve consistency in lithotectonic subdivision and terminology. Labrador preserves a complex Precambrian record spanning Archean crustal formation, Paleoproterozoic orogenesis, Mesoproterozoic magmatism and basin development, and Grenvillian orogenesis and plays a critical role in understanding the assembly of northeastern Laurentia. The primary objective of this contribution is to provide a province-wide synthesis of Labrador's tectonic framework and to formalize necessary updates to legacy lithodemic and domain terminology, in light of contemporary datasets.

Much of the tectonic and domain terminology used in Labrador was established during regional mapping campaigns of the 1970s–1990s, prior to the widespread availability of modern U–Pb geochronology, isotope datasets and high-resolution aeromagnetic coverage. During this period, tectonic events, structural zones and lithologically defined crustal blocks were commonly conflated, particularly in high-grade and polycyclic terranes where stratigraphic relationships are obscured by deformation and metamorphism. As a result, terms such as orogen, zone and domain were typically applied interchangeably, reflecting data limitations and interpretive frameworks of the time rather than discrete lithotectonic entities.

Recent advances in geochronology, geophysics and cross-border synthesis now permit a more rigorous distinction between tectonic processes and the rock units that record them. These datasets demonstrate that many long-used regionally applicable terms no longer adequately reflect crustal architecture, the timing of magmatic and metamorphic events, or correlations with adjacent regions in Québec and Greenland. Accordingly, there is a need to standardize nomenclature, clarify domain boundaries and distinguish tectonic overprint from lithological identity using a consistent lithodemic framework.

In this synthesis, a clear distinction is made between suture zones, reactivated lithospheric boundaries and intracrustal shear zones, as these terms have been inconsistently applied in previous regional frameworks. A suture zone is used here in its strict sense to denote the site of closure of a former ocean basin and collision between crustal blocks with demonstrably distinct pre-collisional histories, typically supported by evidence such as oceanic or marginal-basin lithologies, sharp isotopic or geochronological discontinuities, contrasting pressure–temperature–time paths, or unequivocal subduction polarity indicators (Dewey, 1970). Recent synthesis of the Southeastern Churchill Province (SECP) emphasizes that many long-recognized crustal-scale shear zones record Paleoproterozoic reactivation of older lithospheric heterogeneities and Archean inheritance, rather than suturing of exotic terranes *sensu stricto* (Godet and Lafrance, 2025). Accordingly, not all domain boundaries presented are interpreted as sutures. Instead, lithotectonic domain boundaries are defined as map-scale surfaces separating crustal regions that differ in dominant age, lithologic assemblage, tectonomagmatic evolution or degree of Paleoproterozoic and younger reworking. These boundaries may coincide with major shear zones, but their classification reflects crustal affinity and tectonic history rather than the presence or absence of ocean closure. This distinction allows the SECP to be subdivided in a manner that preserves genuine collisional boundaries where supported by evidence, while avoiding over-interpretation of intracontinental shear zones as sutures.

Labrador and adjacent Québec preserve largely a composite Archean–Mesoproterozoic record involving the Archean Nain and Superior provinces, the Archean to Paleoproterozoic Southeastern Churchill and Makkovik provinces and the Mesoproterozoic Grenville Province (Figure 1). In this report, an updated tectonic–domain framework is presented that: a) applies the 2024 Cooperative Lithodemic And Stratigraphic System (CLASS; Maxeiner *et al.*, 2024) to strongly metamorphosed and polycyclic crustal units; b) formalizes the definition of the Torngat Domain and distinguishes it from the Torngat orogenic event; c) replaces legacy "Core Zone" terminology with a set of discrete central SECP domains consistent with updated Québec-side subdivisions; and d) supersedes older New Québec Orogen zone classification with a foreland–parautochthon–hinterland framework.

Volcano-sedimentary successions in Labrador occur across a wide range of tectonic settings and ages and display variable relationships with province boundaries. In this synthesis, such units are treated as lithodemic successions rather than tectonic subdivisions. Successions that are genetically and spatially tied to a single tectonic province are described within the relevant province sections, whereas successions that occur along province margins, postdate major orogenic events, or span multiple provinces are summarized separately under the Cover and Post-Orogenic Units section. This approach avoids conflation of supracrustal deposition with tectonic architecture whilst retaining the stratigraphic and tectonic significance of individual groups.

GEOLOGICAL FRAMEWORK BY PROVINCE

NAIN PROVINCE (NORTH ATLANTIC CRATON)

The Archean Nain Province represents the Labrador segment of the North Atlantic Craton (NAC), extending through Greenland to northwestern Scotland (Bridgwater *et al.*, 1973). The Labrador segment of the NAC comprises two Archean crustal blocks (Figure 1): a) the northern 3.9–2.5 Ga Saglek Block (Schiøtte *et al.*, 1989a, b); and b) the southern 3.3–2.5 Ga Hopedale Block (*see* review in Hinchey *et al.*, 2024). These two blocks exhibit distinct Paleo- and Neoarchean tectonomagmatic histories (*see* review in Connelly and Ryan, 1996). The boundary between the Hopedale and Saglek blocks is inferred to occur along a poorly defined, north-northeast-trending high-strain zone, and interpreted to have been active as late as *ca.* 2.56 Ga (Connelly and Ryan, 1996). However, recent work in the Hopedale Block suggests that the collision occurred earlier, between 2.73 and 2.70 Ga (Hinchey *et al.*, 2024) and may have been east–west directed (Hinchey *et al.*, *this volume*). Accordingly, the established nomenclature for the Nain Province and its constituent crustal blocks is retained in this synthesis, as it remains robust and compatible with current datasets. Along the North Atlantic Craton margin, several Paleoproterozoic supracrustal successions, including the Ramah, Snyder, Mugford and Ingrid groups, record continental-margin sedimentation and volcanism and are retained here as lithodemic successions rather than domain-defining units (Figure 1). They are described separately under the Cover and Post-Orogenic Units section.

Saglek Block

The Saglek Block (Figure 1) is dominated by Eoarchean to Paleoarchean tonalite–trondhjemite–granodiorite (TTG) orthogneisses interleaved with supracrustal belts and intruded by younger granitoids (*see* review in Ryan and Martineau, 2012; Kusiak *et al.*, 2018). The oldest rocks are the >3.8 Ga Nulliak assemblage, preserved as belts and enclaves of mafic–ultramafic rocks, iron formation,

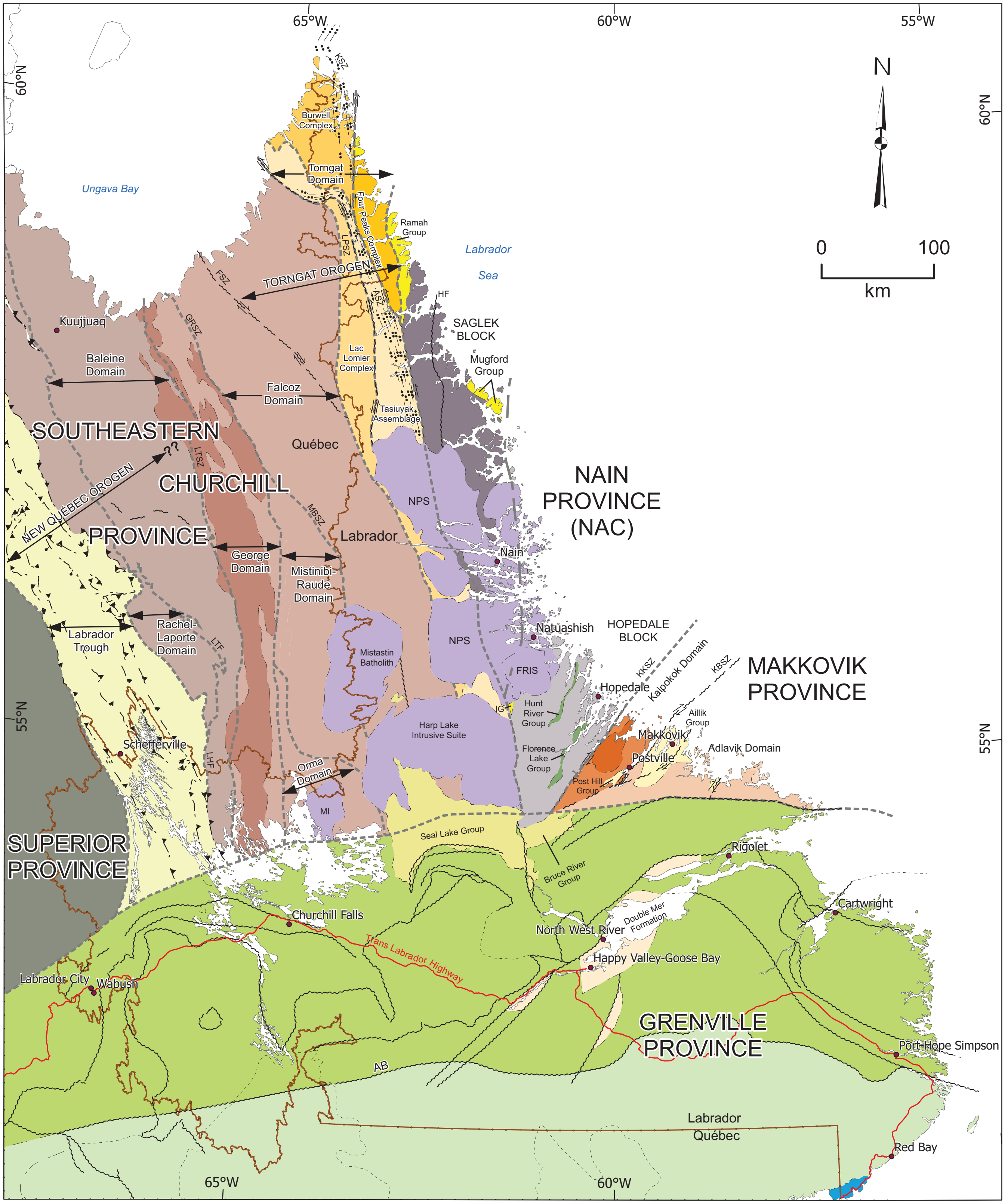

Figure 1. *Caption and Legend on following page.*

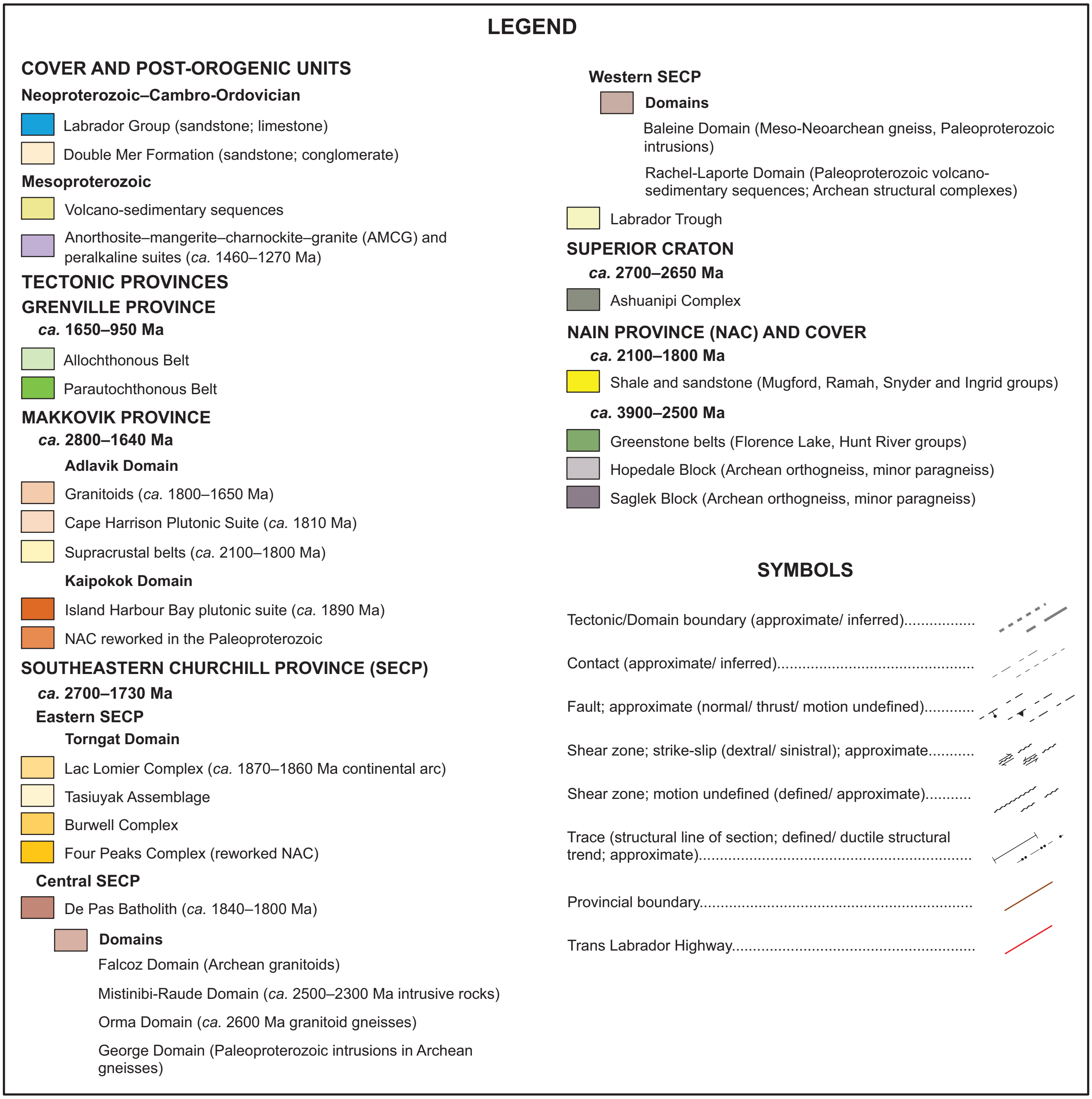

Figure 1. *Revised lithotectonic subdivisions of eastern Québec and Labrador. ASZ–Abloviak Shear Zone, AB–Allochthon Boundary, FRIS–Flowers River Igneous Suite, FSZ–Falcoz Shear Zone, GRSZ–George River Shear Zone, HF–Handy Fault, IG–Ingrid Group, KSZ–Kormaktovik Shear Zone, KKSZ–Kanairiktok Shear Zone, KBSZ–Kaipokok Bay Shear Zone, LHF–Lac Herodier Fault, LPSZ–Lac Pilliamet Shear Zone, LTSZ–Lac Tudor Shear Zone, LTF–Lac Turcotte Fault, MBSZ–Moonbase Shear Zone, MI–Michikamau Intrusion, NPS–Nain Plutonic Suite.*

calc-silicate rocks and pelitic gneiss within the orthogneiss (Bridgwater *et al.*, 1975; Collerson and Bridgwater, 1979). The TTG orthogneisses are divided into: a) the Uivak I gneiss, an early, grey tonalitic–granodioritic gneiss emplaced >3.6 Ga (Kusiak *et al.*, 2018; Sałacińska *et al.*, 2019); and b) the Maidmonts gneiss (formerly Uivak II), an iron-rich augen granodioritic to ferrodioritic gneiss with protolith ages of *ca.* 3.6–3.3 Ga (Collerson, 1983; Sałacińska *et al.*, 2019). Xenoliths of banded Uivak I gneiss enclosed within the Maidmonts augen gneiss demonstrate that the former underwent ductile deformation prior to the emplacement of the latter (Collerson and Bridgwater, 1979). Enclaves within Uivak I gneiss have been interpreted as >3.9 Ga Nanok/Iqualuk gneisses (Komiya *et al.*, 2015), although this remains debated (*see* Whitehouse *et al.*, 2019). The Maidmonts augen gneiss is pervasively foliated and lineated, is less extensive than Uivak I, and occurs mainly along coastal exposures (Collerson and Bridgwater, 1979; Ryan *et al.*, 1984).

The younger Upernavik supracrustal assemblage comprises amphibolite, quartz–biotite paragneiss, semipelite, calc-silicate gneiss and minor marble, interlayered with both Uivak I and Maidmonts gneisses (Bridgwater *et al.*, 1975). It is distinguished from the Nulliak assemblage by its sediment-dominated character and lack of iron formation (Sałacińska *et al.*, 2019). Detrital zircon data indicate deposition after *ca.* 3.3 Ga and metamorphism at *ca.* 2.8–2.7 Ga (Connelly and Ryan, 1996; Kusiak *et al.*, 2018). Younger granitoid magmatism includes the *ca.* 3.25 Ga Lister gneiss, a felsic orthogneiss distinct in age and isotopic composition from Uivak I (Schiøtte *et al.*, 1989a, b; Schiøtte and Bridgwater, 1990), and a broadly coeval granitoid on Parkavik Island, south of Hebron Fiord, that is intruded by a *ca.* 3.0 Ga leucogranite sheet (Schiøtte and Bridgwater, 1990). These bodies document prolonged Archean crustal differentiation and partial melting, comparable to the Itsaq Gneiss Complex in Greenland (Nutman *et al.*, 2014; Vezinet *et al.*, 2019).

The Saglek Block preserves multiple high-temperature metamorphic events. Uivak I experienced early metamorphism and migmatization prior to the *ca.* 3.6–3.3 Ga Maidmonts augen gneiss emplacement. Later granulite- to upper-amphibolite-facies metamorphism at *ca.* 2.7 Ga produced the pervasive gneissosity, followed by a *ca.* 2.5 Ga metamorphic and magmatic event associated with post-tectonic granites (Baadsgaard *et al.*, 1979; Collerson, 1983; Wendt and Collerson, 1999; Kusiak *et al.*, 2018; Dunkley *et al.*, 2019).

Hopedale Block

The Hopedale Block (Figure 1) preserves a polyphase magmatic and metamorphic Archean history between *ca.* 3.26 and 2.55 Ga. Its oldest crust is the 3.262–3.245 Ga Maggo Gneiss, a composite TTG orthogneiss suite that engulfs rafts of older supracrustal rocks, some of which may predate 3.26 Ga (Rayner, 2022; Hinchey *et al.*, 2024). These early crustal components record the initial stabilization of the block and provide the basement onto which younger intrusive and volcanic sequences were built. New U–Pb data further indicate that multiple supracrustal belts previously grouped as “Weekes Amphibolite” include components older than the Maggo Gneiss (>3.262 Ga), underscoring a more complex early evolution than previously recognized (Sandeman *et al.*, 2023; Hinchey *et al.*, 2024).

Between 3.141 and 3.105 Ga, the block underwent widespread plutonism and volcanism, including emplacement of multiple tonalitic–granodioritic intrusions and deposition of the Hunt River Group at *ca.* 3.105 Ga (James *et al.*, 2002; Rayner, 2022; Hinchey *et al.*, 2024). A second major pulse of magmatism and sedimentation followed between 3.032 and 2.953 Ga, including an unnamed 3.03–3.01 Ga plutonic suite and deposition of the Florence Lake Group (James *et al.*, 2002; Diekrup *et al.*, 2023; Hinchey *et al.*, 2024). Newly recognized volcano-sedimentary rocks older than *ca.* 3.124 Ga suggests an unrecognized older belt that preceded the Florence Lake Group or, the group represents a long-lived volcanic system (Hinchey *et al.*, 2024).

From 2.892 to 2.796 Ga, the block was intruded by the Kanairiktok Intrusive Suite (KIS), a tonalite–granodiorite suite now interpreted as a continental magmatic arc, possibly marking the onset of modern-style, subduction-driven plate tectonics in the region (Loveridge *et al.*, 1987; Rayner, 2022; Hinchey *et al.*, 2024). Regional metamorphism from *ca.* 2.846 to 2.796 Ga, recorded by zircon and titanite overgrowths, overprinted most Archean units and is spatially widespread across the block. This event was followed by a second 2.732–2.70 Ga magmatic and metamorphic pulse, expressed across the Hopedale Block, which is regarded as the best candidate for recording the Saglek–Hopedale collision *ca.* 2.7 Ga (Hinchey *et al.*, 2024).

The final Archean event is documented in the emplacement of the Aucoin Plutonic Suite (2.578–2.545 Ga), locally accompanied by a *ca.* 2.55 Ga metamorphic overprint (Sandeman and McNicoll, 2015; Hinchey *et al.*, 2024). Although spatially restricted, these late intrusions and metamorphic rims suggest continued tectonothermal activity after amalgamation of the Saglek and Hopedale blocks. The Hopedale Block, therefore, records a protracted and multistage tectonomagmatic evolution from early Paleoarchean crust formation, through Meso- to Neoarchean arc magmatism and collision, to late Archean reworking, similar but distinct from the evolutionary history preserved in the Saglek Block.

SUPERIOR PROVINCE

In Labrador, the Archean Superior Province (Figure 1) is represented exclusively by the Ashuanipi Complex, which forms the easternmost exposed subprovince of the Superior Province. The established nomenclature for the Superior Province and its Labrador expression is retained in this synthesis, as existing terminology remains consistent with current geological, geochronological and geophysical constraints.

Ashuanipi Complex

The Ashuanipi Complex is a large, granulite-facies, sedimentary-magmatic terrane forming the easternmost subprovince of the Archean Superior Province. Apart from new geological mapping and new geochemical data from the northern Ashuanipi Complex (van Nostrand and Bradford, 2014; van Nostrand *et al.*, 2016; van Nostrand, 2017), little research in the Labradorian Superior Province has been conducted since the bedrock mapping in the 1980s (Percival, 1987, 1991a, 1993; Percival and Girard, 1988). In western Labrador, the Ashuanipi Complex consists of older migmatitic paragneiss interleaved with pre-tectonic TTG, quartz diorite, diorite and mafic–ultramafic intrusions of the Desliens igneous suite (Percival, 1993). These rocks were variably deformed and extensively melted during high-grade metamorphism. The eastern margin is unconformably overlain by Proterozoic siliciclastic rocks of the Labrador Trough (Percival, 1993).

Only one U–Pb zircon age-constraint for the Ashuanipi Complex occurs in Labrador (2.723 ± 0.006 Ga) from a quartz diorite unit of the Desliens igneous suite (Percival *et al.*, 2003). Earlier geochronological studies that attempted to date the Desliens igneous suite did not produce definitive crystallization ages (Percival *et al.*, 1992). The remainder of the published geochronological constraints are from samples within Québec. Detrital zircons from metasedimentary gneiss range from 3.4 to 2.7 Ga and provide a maximum deposition age (Mortensen and Percival, 1987). The Desliens igneous suite intruded between *ca.* 2.72 and 2.68 Ga, followed immediately by high-grade metamorphism at *ca.* 2.68–2.65 Ga, during which the regional S_1 migmatitic fabric and syn- to late-metamorphic garnet ± orthopyroxene diatexites were formed (Mortensen and Percival, 1987; Percival and Girard, 1988; Percival, 1991a, b). Post-peak metamorphic cooling occurred between 2.65 and 2.63 Ga, accompanied by intrusion of *ca.* 2.65 Ga pegmatites and leucogranite, and followed by a 2.65–2.60 Ga thermal overprint (Percival, 1991a; Chevè and Brouillette, 1992). The complex is strongly migmatized: metatexite and diatexite are volumetrically dominant. Peak metamorphic conditions were estimated at ~700–800°C and 5–6.5 kbar (Percival, 1991a). Overall, the Ashuanipi Complex preserves a deeply exhumed section of late Archean crust recording sedimentation, magmatism, extensive partial melting, high-grade metamorphism and late thermal overprinting between 3.4 and 2.6 Ga.

SOUTHEASTERN CHURCHILL PROVINCE (SECP)

Review

The Southeastern Churchill Province (SECP) of Labrador and northern Québec (Figure 1) is a reworked Archean–Paleoproterozoic region forming part of the eastern Trans-Hudson Orogen (Wardle *et al.*, 2002; Butler *et al.*, 2025a). It records a protracted tectonic history from Mesoarchean crustal development through Paleoproterozoic convergence and terminal collision between the Superior and North Atlantic cratons at *ca.* 1.90–1.80 Ga, followed by exhumation by *ca.* 1.73 Ga (Wardle *et al.*, 2002; Godet *et al.*, 2020a; Charette *et al.*, 2021; Butler, 2023, 2024; Butler *et al.*, 2025a, b). The province comprises multiple lithotectonic domains separated by crustal-scale shear zones that collectively document the assembly of northeastern Laurentia (Figure 1).

Recent high-precision U–Pb geochronology, new aeromagnetic datasets and updated Ministère des Ressources Naturelles et des Forêts mapping demonstrate that several long-used SECP subdivisions no longer adequately reflect crustal architecture or tectonic history. In particular, new syntheses highlight the importance of early Paleoarchean inheritance and show that much of the Archean crust previously interpreted as discrete blocks forms part of a larger Meso- to Neoarchean continental nucleus, newly defined as the Koksoak Domain and likely influences Paleoproterozoic tectonic processes and endowment (Lafrance and Godet, 2024; Butler *et al.*, 2025b; Godet and Lafrance, 2025).

Historically, the SECP was divided into the Torngat Orogen to the east, the Core Zone in the centre, and the New Québec Orogen (NQO) to the west (Wardle *et al.*, 2002). However, these schemes employ tectonic terms as map-scale units, even though the associated deformation and metamorphic effects extend well beyond their mapped limits. In this report, the SECP is therefore subdivided using a lithodemic framework consistent with the classification system of Maxeiner *et al.* (2024), in which tectonic terms (New Québec Orogen, Torngat Orogen) are reserved strictly for Paleoproterozoic deformation events, and crustal elements are defined as lithotectonic domains.

Within this framework, the SECP is subdivided into three first-order groupings based on tectonic position and crustal affinity: a) the western SECP, comprising foreland, parautochthonous and hinterland domains related to development of the New Québec Orogen; b) the central SECP, consisting of composite Paleoproterozoic arc-related and Archean basement domains, and c) the eastern SECP, representing the North Atlantic Craton margin and defined here as the Torngat Domain (Figure 1). Several Paleoproterozoic volcano-sedimentary successions preserved within the SECP, including the Ramah and Ingrid groups, are treated in this report as lithodemic units within their respective domains and are described separately under Cover and Post-Orogenic Units.

WESTERN SECP: FORELAND AND HINTERLAND DOMAINS OF THE NEW QUÉBEC OROGENY

The western SECP consists of foreland–parautochthonous–hinterland system formed during the *ca.* 1.83–1.80 Ga New Québec orogeny along the eastern margin of the Superior Craton (James *et al.*, 2002; Van der Leeden *et al.*, 1990; Wardle *et al.*, 2002). In this report, New Québec Orogen is used strictly as a tectonic descriptor (for the orogenic event). The crustal elements traditionally grouped under the New Québec Orogen are instead described as lithotectonic domains comprising the Labrador Trough (composite, variably parautochthonous passive margin to foreland basin), the Rachel–Laporte Domain (parautochthonous belt), and the Baleine Domain (hinterland Archean basement; Clark and Wares, 2005; Lafrance and Godet, 2024; Butler *et al.*, 2025a; Godet and Lafrance, 2025).

Labrador Trough (Passive Margin to Foreland Basin Domain)

The Labrador Trough (Figure 1) represents a Paleoproterozoic composite continental-margin to foreland basin developed along the eastern passive margin of the Superior Craton during development of the Manikewan Ocean basin (Wardle *et al.*, 2002; Clark and Wares, 2005; Butler *et al.*, 2025a). The supracrustal succession was deposited between *ca.* 2.17 and 1.81 Ga (Clark and Wares, 2005) and comprises thick sequences of siliciclastic sedimentary rocks, iron-formations and subordinate volcanic rocks (Kaniapiskau Supergroup, Clark and Wares, 2005). Mafic sills and dykes intruding supracrustal rocks of the Kaniapiskau Supergroup record Paleoproterozoic magmatic activity associated with basin development (*e.g.*, Rohon *et al.*, 1993; Butler, 2020). Stratigraphic architecture records progressive basin deepening and subsidence prior to convergence, followed by development of a foreland basin and then burial and deformation during Paleoproterozoic collision.

During the New Québec orogeny, the Labrador Trough was deformed into a west-verging fold-and-thrust belt and metamorphosed from greenschist to lower amphibolite facies while accommodating dextral transpression between the Superior craton and the various accreting domains to the east (Wardle, 1982). Its western boundary with the Superior Craton is generally concordant, although locally disrupted by thrust faults such as the Maraude Fault (Konstantinovskaya *et al.*, 2019) while eastern parts are deformed into a series of allochthons. Farther east, the Trough transitions into higher-grade rocks of the Rachel–Laporte Domain across a series of *en-echelon* thrusts and high-strain zones that accommodated crustal shortening and hinterland(west)-directed transport (Wardle, 1982; Wardle *et al.*, 2002). Structural synthesis demonstrates that deformation reflects dextral oblique convergence and pronounced strain partitioning, including syn-convergent extensional structures, with along-strike variations in exhumation attributed to heterogeneous shortening and erosion rather than discrete lithotectonic blocks (Konstantinovskaya *et al.*, 2019).

Rachel–Laporte Domain (Parautochthonous Belt)

The Rachel–Laporte Domain forms the parautochthonous belt of the western SECP and represents the transitional zone between the foreland Labrador Trough and hinterland Archean basement farther east. The domain is dominated by amphibolite-facies metasedimentary paragneisses of the Laporte Supersuite (<1.84 Ga), which constitutes a regionally extensive Paleoproterozoic supracrustal package (Henrique-Pinto *et al.*, 2017). To adhere to the CLASS lithodemic classification system, we propose that this unit be renamed the Laporte Superassemblage, reflecting its supracrustal, paragneiss-dominated character rather than an intrusive suite. Detrital zircon populations indicate derivation primarily from Paleoproterozoic arc crust of the central SECP, including sources coeval with the De Pas Batholith (*ca.* 1.84–1.81 Ga), consistent with deposition in a continental forearc to collisional pro-foreland setting (Charette, 2016; Henrique-Pinto *et al.*, 2017). Local exposures of Archean gneiss provide evidence for significant crustal stacking, tectonic inversion of stratigraphy and progressive crustal thickening during Paleoproterozoic shortening (Wardle *et al.*, 2002). Structurally, the Rachel–Laporte Domain records similar deformation style as recorded in the Labrador Trough and resulted in an apparent continuous Barrovian sequence (Godet *et al.*, 2020a) linking basin inversion to mid-crustal metamorphism within the parautochthonous orogenic wedge.

Baleine Domain (Hinterland Archean Basement)

The Baleine Domain (Figure 1) comprises predominantly reworked Archean gneisses intruded by Paleoproterozoic granitoids and represents the hinterland basement domain of the western SECP (Lafrance *et al.*, 2020). In Labrador, it corresponds to the McKenzie River Domain of James and Dunning (2000) and incorporates the Kuujjuaq Domain in Québec (Wardle *et al.*, 2002); together, these areas define a continuous Archean crustal block. The domain preserves variable Paleoproterozoic reworking but retains a strong Archean lithologic and isotopic signature (Lafrance *et al.*, 2020).

The Baleine Domain consists of two subdomains (northern and southern) separated by the Morel Fault (Lafrance *et al.*, 2020). The northern subdomain is composed of predominantly Meso- to Neoarchean (*ca.* 2.9–2.7 Ga) tonalitic gneiss, migmatite, anatectic granite, mafic to intermediate intrusive complexes and associated volcano-sedimentary sequences (Godet and Lafrance, 2025). The southern subdomain includes strongly migmatitized supracrustal units, potassic intrusive suites and anatectic granites similar to those of the northern subdomain (Lafrance and Godet, 2024; Butler *et al.*, 2025b). A metamorphosed potassic intrusion, the Champdoré Suite, intruded the Baleine Domain and is broadly synchronous with the De Pas Batholith. The McKenzie River Domain of James and Dunning (2000) was incorporated into the Baleine Domain, reflecting shared Archean basement characteristics and Paleoproterozoic reworking. The Baleine Domain is interpreted as being part of the Koksoak Domain, the larger Meso- to Neoarchean continental nucleus of the SECP. In the revised framework adopted here, the Baleine Domain represents the hinterland against which foreland and parautochthonous elements of the New Québec orogeny were shortened and stacked during Paleoproterozoic convergence.

CENTRAL SECP: COMPOSITE ARC AND BASEMENT DOMAINS

The central SECP comprises a composite Paleoproterozoic arc-related crustal assemblage and Archean basement domains that record variable degrees of Paleoproterozoic reworking. This section includes parts of the informal “Core Zone” terminology used in earlier syntheses. Domains included are the George, Mistinibi–Raude, Orma and Falcoz. The George and Falcoz domains, together with the Baleine Domain to the west, constitute the Archean Koksoak Domain, interpreted as representing the cratonic nucleus of the SECP (Godet and Lafrance, 2025).

George Domain

The George Domain (Figure 1) is dominated by the Paleoproterozoic De Pas Batholith (*ca.* 1.84–1.81 Ga), a large calc-alkaline intrusive complex widely interpreted as a continental arc (Van der Leeden *et al.*, 1990; Martelain *et al.*, 1998; James and Dunning, 2000) or syn-collisional batholith (Wardle *et al.*, 2002), emplaced into the eastern margin of the Superior Craton and its cover. Archean gneisses and Neoarchean volcano-sedimentary rocks suggest a 2.69–2.62 Ga failed continental rift in the core of the Koksoak Domain (Godet and Lafrance, 2025) and record significant Paleoproterozoic crustal thickening and reworking (Lafrance and Godet, 2024).

The domain is bound by major mylonitic shear zones, including the Lac Tudor shear zone to the west and the George River shear zone to the east, which accommodated large-scale juxtaposition of Archean basement and Paleoproterozoic arc crust. Plutons of the De Pas Batholith cut the Lac Tudor shear zone. In this framework, the bounding shear zones are interpreted as Paleoproterozoic reactivated lithospheric-scale structures that accommodated intracontinental strain partitioning during arc construction and subsequent transpression, rather than suture zones marking closure of an intervening ocean basin (Godet and Lafrance, 2025).

Mistinibi–Raude Domain

The Mistinibi–Raude Domain (Figure 1) comprises a distinctive assemblage of late Archean to early Paleoproterozoic igneous and metamorphic rocks that differs markedly from adjacent domains in age, lithology and tectonometamorphic history. The domain is characterized by *ca.* 2.57–2.32 Ga granitoid and volcanic rocks, variably metamorphosed at granulite-facies conditions at *ca.* 2.1 Ga (Godet *et al.*, 2020b), and lacks the pervasive *ca.* 1.90–1.80 Ga deformation and metamorphism that typifies much of the central SECP (Corrigan *et al.*, 2018; Charette *et al.*, 2019). Minor remnants of Paleoproterozoic supracrustal rocks, including the Hutte Sauvage Group, are locally preserved within the Mistinibi–Raude Domain and are interpreted to record early Paleoproterozoic volcano-sedimentary activity broadly coeval with domain-scale granitoid magmatism (Godet *et al.*, 2020b).

Structural and geochronological data indicate that the Mistinibi–Raude Domain escaped Trans-Hudson orogenesis, suggesting either tectonic isolation during Paleoproterozoic convergence or incorporation as a non-reactive restitic crustal block (Godet *et al.*, 2020b). In the revised framework adopted here, the Mistinibi–Raude Domain is retained as a discrete lithotectonic domain that preserves an anomalous crustal history within the SECP and provides important constraints on the pre-Trans-Hudson configuration of northeastern Laurentia. The Mistinibi–Raude Domain is bounded by Paleoproterozoic shear zones that reflect intracontinental reactivation and strain localization, rather than by suture zones recording closure of an intervening ocean basin (Godet *et al.*, 2020b).

Orma Domain

The Orma Domain (Figure 1) is a small but geologically distinct Archean crustal block exposed in southeastern SECP, structurally isolated from adjacent Paleoproterozoic domains by major shear zones. It is dominated by Neoarchean orthopyroxene-bearing granitoids and associated high-grade gneisses that record crystallization at *ca.* 2.63–2.57 Ga and high-temperature metamorphism at *ca.* 2.58–2.57 Ga (James *et al.*, 2003). James *et al.* (2003) demonstrated that the Orma Domain lacks the extensive Paleoproterozoic supracrustal assemblage and apparently escaped the Trans-Hudson orogeny like the Mistinibi–Raude Domain. Instead, the Orma Domain represents a fragment of Archean lower crustal basement that was tectonically juxtaposed against Paleoproterozoic rocks during later deformation.

Recent syntheses have proposed grouping the Orma Domain with the Mistinibi–Raude Domain based on present-day structural proximity and shared lack of Paleoproterozoic deformation (Corrigan *et al.*, 2018; Charette *et al.*, 2019; Godet and Lafrance, 2025). This report follows the interpretation of James *et al.* (2003) and retains the Orma Domain as a separate lithotectonic entity, on the basis of its distinct Archean age, lithologic character and tectonothermal evolution. It is bounded by Paleoproterozoic shear zones but is internally Archean, making it a unique crustal fragment within the SECP.

Falcoz Domain

The Falcoz Domain (Figure 1) is a composite Archean–Paleoproterozoic lithotectonic domain forming the easternmost Archean block of the central SECP. It comprises western and eastern subdomains which display contrasting lithologic assemblages and metamorphic grades and are separated by the Blumath Shear Zone (Lafrance and Vanier, 2022). The western Falcoz subdomain is dominated by Mesoarchean to Neoarchean tonalitic to granodioritic orthogneiss of TTG affinity, which represents some of the oldest crust preserved in the SECP (*ca.* 3.0–2.85 Ga; Butler *et al.*, 2025b). Godet and Lafrance (2025) proposed that the western Falcoz and the northern Baleine subdomains were initially part of the same entity, the Koksoak Domain, and partially rifted away at *ca.* 2.69–2.62 Ga. These rocks underwent repeated granitoid intrusion during the Neoarchean, followed by Paleoproterozoic metamorphism and deformation. The eastern Falcoz subdomain contains a greater abundance of orthopyroxene-bearing tonalite gneiss, reflecting deeper crustal levels and higher metamorphic conditions than the western subdomain.

Geochronological data indicate that the Falcoz Domain records multiple episodes of Archean magmatism (*ca.* 3.0–2.6 Ga), followed by significant Paleoproterozoic reworking at *ca.* 1.9–1.8 Ga (Lafrance and Vanier, 2022). The Blumath Shear Zone separates the western and eastern Falcoz subdomains and marks a major structural boundary within the central SECP. The domains juxtaposed across the structure display contrasting Archean lithologic assemblages and crustal histories (*e.g.*, Butler *et al.*, 2025b; Lafrance and Vanier, 2022). In the framework of Godet and Lafrance (2025), the Blumath Shear Zone is interpreted as a reactivated intracontinental lithospheric boundary that localized Paleoproterozoic strain between crustal levels with contrasting Archean architecture, rather than as a suture zone marking ocean closure for which diagnostic evidence such as ophiolites, subduction-related mélanges, high-pressure metamorphism and juvenile arc geochemistry is absent. The Falcoz Domain thus represents a structurally heterogeneous segment of inherited Archean crust that acted as a rigid buttress during Paleoproterozoic transpression, linking central SECP arc domains to the reworked margin of the North Atlantic Craton.

EASTERN SECP: TORNGAT DOMAIN

Torngat Domain

The units situated between the Falcoz Domain of the SECP and the NAC are redefined here as the composite lithotectonic Torngat Domain (Figure 1). This domain is distinct from the Torngat Orogen, which is retained strictly as the name for the *ca.* 1.90–1.73 Ga orogenic event. The Torngat Domain preserves Archean inheritance and intense Paleoproterozoic tectonometamorphic reworking along the craton margin and comprises four principal lithodemic units: the Lac Lomier Complex, Tasiuyak Assemblage, Burwell Complex and Four Peaks Complex.

Lac Lomier Complex

The Lac Lomier Complex (LLC, Figure 1) is a *ca.* 1.87–1.84 Ga Paleoproterozoic gneiss complex forming the western margin of the Torngat Domain (Ermanovics and Van Kranendonk, 1998). The complex is dominated by *ca.* 1.87 Ga tonalitic to granodioritic orthogneiss and metaplutonic rocks metamorphosed at granulite-facies conditions that are commonly migmatitic, the bulk crystallization of anatectic melt being interpreted at 1.845 Ga (Charette *et al.*, 2021). The LLC is interpreted as a continental arc emplaced along the western margin of the North Atlantic Craton and subsequently highly strained and pervasively reworked during the Torngat Orogen transpressional deformation. New mapping and aeromagnetic data indicate that the LLC extends significantly farther south than previously recognized (Wardle *et al.*, 1997), forming a continuous high-grade belt that extends beneath the Harp Lake Intrusive Suite (Hinchey *et al.*, 2024; Scorsolini *et al.*, 2025).

Tasiuyak Assemblage

The name Tasiuyak Assemblage (Figure 1; formerly referred to as the Tasiuyak paragneiss, Tasiuyak gneiss or Tasiuyak Complex in earlier literature) comprises a regionally extensive package of metatexite to diatexite migmatite derived predominantly from aluminous sedimentary protoliths (Wardle, 1983; Ermanovics and Van Kranendonk, 1998). It is characterized by remarkably homogeneous, straight-layered gneiss consisting of alternating bands of garnet–sillimanite–biotite–graphite semipelitic to pelitic gneiss and garnetiferous leucogranite, the latter comprising approximately 50–80% of the rock volume and locally forming kilometre-scale segregations (Ermanovics and Van Kranendonk, 1998). Atypical but recurrent lithologic variants include magnesium-rich, cordierite-bearing gneiss and silica-poor, spinel-bearing assemblages (Wardle, 1983). Much of the eastern part of the unit was subsequently mylonitized within the regional-scale Abloviak shear zone (Wardle *et al.*, 2002). Detrital zircon data are limited but indicate a predominantly Paleoproterozoic population between 2.06 and 1.94 Ga (Scott, 1995, 1998; Scott and Machado, 1995), constraining deposition to younger than 1.94 Ga and older than *ca.* 1.895 Ga, the age of plutons that intrude the unit (Scott 1998). The short duration between deposition and metamorphism is consistent with sedimentation along an active continental margin.

Burwell Complex

The Burwell Complex (Figure 1) comprises a heterogeneous suite of Paleoproterozoic plutonic, volcanic and metasedimentary rocks bounded by the Abloviak shear zone to the west and the Komaktorvik shear zone to the east. Lithologies include diorite–tonalite–granite (DTG) suite plutons, subordinate quartz diorite and gabbro, mid-ocean-ridge-basalt (MORB)-type mafic gneiss and amphibolite, paragneiss and calc-silicate units, and local granulite-facies (charnokitic) orthogneiss; rafts of anorthositic gneiss occur locally (Van Kranendonk, 1996). Metamorphic grade ranges from amphibolite to granulite facies, with variable Torngat Orogen-age deformation and local anatexis, particularly toward the bounding shear zones (Van Kranendonk, 1996). These rocks are interpreted to represent a tilted crustal section through a *ca.* 1.91–1.88 Ga Andean-type continental magmatic arc developed along the margin of the North Atlantic Craton (Van Kranendonk, 1996). The DTG suite constitutes the principal arc component, whereas interlayered MORB-type mafic gneiss and amphibolite are interpreted as remnants of a marginal or back-arc basin incorporated during arc accretion.

Four Peaks Complex

The Four Peaks Complex (Figure 1) comprises predominantly orthopyroxene-bearing tonalitic to granodioritic orthogneiss and migmatite, with subordinate mafic orthogneiss and amphibolite, and local supracrustal enclaves of paragneiss (Van Kranendonk and Wardle, 1996). Archean felsic and mafic orthogneisses form the dominant lithologies and are intruded by Paleoproterozoic mafic dykes, including members of the Avayalik dyke suite (Van Kranendonk *et al.*, 1993). Metamorphic grade ranges from upper amphibolite to granulite facies, and deformation is generally moderate within the interior of the complex but increases markedly toward its margins adjacent to the Komaktorvik shear zone. Geochronological data indicate that the Four Peaks Complex represents reworked Archean crust of North Atlantic Craton affinity that experienced high-temperature Paleoproterozoic metamorphism during the Torngat Orogen (Connelly, 2001). The garnet–clinopyroxene–orthopyroxene assemblages preserved in much of the complex record near-peak metamorphic conditions and show limited evidence for syn- or post-peak deformation, consistent with burial beneath a hot continental arc followed by rapid exhumation, with strain localized primarily along major shear-zone boundaries (Van Kranendonk, 1996; Connelly, 2001).

MAKKOVIK PROVINCE

The Makkovik Province represents a late Paleoproterozoic orogen that forms part of Laurentia and occurs along the southern margin of the Nain Province. It records prolonged crustal growth, reworking, and magmatism associated with Paleoproterozoic convergence and assembly of the Nuna supercontinent between *ca.* 1.90 and 1.80 Ga (Ketchum *et al.*, 2002; Hinchey *et al.*, 2020, 2023). The province is commonly interpreted as an accretionary belt formed through protracted terrane amalgamation and reworking of the southern NAC margin.

Despite shallower present-day exposure levels, the Makkovik Province is widely regarded as the Labrador counterpart of the Ketilidian Orogen of southern Greenland, reflecting a shared Paleoproterozoic tectonic evolution along the margin of Laurentia (Hinchey, 2021a, b; Vestergaard *et al.*, 2024). Traditional subdivision of the province into the Kaipokok, Aillik and Cape Harrison domains was based on correlation with Ketilidian structural zones (Kerr *et al.*, 1996). Recent mapping, lithogeochemical, geochronological, and isotopic studies, however, support merging the Aillik and Cape Harrison domains into a single Adlavik Domain, reflecting their shared lithologic and tectonomagmatic history (Hinchey, 2021c).

Kaipokok Domain

The Kaipokok Domain (Figure 1) represents the reworked southern margin of the North Atlantic Craton and forms the foreland domain of the Makkovik Province. It is dominated by Archean gneisses overlain locally by Paleoproterozoic cover sequences, including supracrustal rocks interpreted to record passive-margin to early extensional settings. The Archean gneisses are interpreted as reworked NAC (Ketchum *et al.*, 2002). Paleoproterozoic supracrustal successions associated with the Kaipokok Domain include the Post Hill Group (>2.1 Ga) and the assumed equivalent Moran Lake Group, which record early Paleoproterozoic sedimentation and volcanism linked to arc and basin development within the Makkovik Province (Ketchum *et al.*, 2001, 2002). Following arc–continent collision, establishment of a continental-margin arc above a cratonward-dipping subduction zone led to emplacement of calc-alkaline granitoids within the Kaipokok Domain. These intrusions comprise the *ca.* 1.89–1.87 Ga Island Harbour Bay Plutonic Suite, along with subordinate younger intrusive phases (Barr *et al.*, 2007; Hinchey *et al.*, 2022). In the context of Ketilidian correlations, the Kaipokok Domain is equivalent to the northern external domain of the orogen and provides the foreland against which Paleoproterozoic arc-related crust was accreted and deformed.

Adlavik Domain

The Adlavik Domain (Figure 1) comprises a composite Paleoproterozoic arc–back-arc system and forms the internal domain of the Makkovik Province. It includes Paleoproterozoic metasedimentary and metavolcanic rocks of the Aillik Group, coeval granitoids of the Measles Point Granite Suite and multiple intrusive suites emplaced at *ca.* 1.80 Ga, *ca.* 1.72 Ga and *ca.* 1.65–1.64 Ga (Kerr *et al.*, 1996; Hinchey *et al.*, 2020, 2023; Vestergaard *et al.*, 2025); representing a prolonged period of magmatic and tectonic activity during Paleoproterozoic convergence and subsequent post-collisional reorganization. The Aillik Group records deposition of thick volcano-sedimentary successions in a rifted arc to extensional arc setting between *ca.* 1.88 and 1.84 Ga and reaches a minimum preserved stratigraphic thickness of approximately 15 km (Ketchum *et al.*, 2002; Hinchey *et al.*, 2020; Hinchey, 2021b). Two principal successions are recognized: a western succession dominated by siliciclastic sedimentary rocks with subordinate felsic volcanic rocks, and an eastern succession dominated by felsic volcanic rocks with lesser mafic lavas and volcaniclastic deposits. Metamorphic grade in the Adlavik Domain attained upper greenschist to lower amphibolite facies.

A younger magmatic phase at *ca.* 1.81–1.80 Ga marks a late- to post-collisional stage following Nuna assembly and accretion of the Cape Harrison arc or microcontinental fragment (Ketchum *et al.*, 2002; Hinchey *et al.*, 2023). It produced the felsic Cape Harrison Plutonic Suite that is interpreted to reflect slab rollback and mantle upwelling during post-orogenic reorganization. Syn- to posttectonic granitoids and reworked orthogneiss of this suite overprint earlier Paleoproterozoic structures within the Adlavik Domain.

GRENVILLE PROVINCE

In Labrador, the Grenville Province represents a reworked Laurentian continental margin constructed through Paleoproterozoic Labradorian orogenesis, extensively modified during Mesoproterozoic active-margin evolution (*ca.* 1.50–1.35 Ga), and variably overprinted during Grenvillian collision and associated magmatism between *ca.* 1090 and 985 Ma (Gower, 2019; Indares, 2024). Earlier syntheses subdivided this region into a series of terranes and blocks (*e.g.*, Hawke River, Groswater Bay, Lake Melville, Wilson Lake, Churchill Falls and Lac Joseph terranes), largely on the basis of contrasts in lithology, metamorphic grade and structural level (Gower *et al.*, 1991b, 2008a). These differences are now understood to reflect variations in crustal age, composition, and Grenvillian strain localization within Laurentian crust, rather than discrete tectonostratigraphic entities (Indares *et al.*, 2022; Indares 2024).

The Grenville Province in Labrador records late Mesoproterozoic reworking of pre-Grenvillian Laurentian crust during prolonged active-margin evolution and subsequent continental collision. The Labrador segment is dominated by Paleoproterozoic to Mesoproterozoic crust that underwent heterogeneous Grenvillian deformation and metamorphism and is structurally organized into parautochthonous and allochthonous levels separated by the Allochthonous Boundary, previously termed the Allochthon Boundary Thrust (Gower *et al.*, 2008a, b; Indares, 2024). Pre-Grenvillian crustal development exerted a first-order control on Grenvillian architecture and includes widespread *ca.* 1.50–1.35 Ga continental-arc, back-arc and inboard extensional magmatism, that is well preserved in eastern Labrador within units historically assigned to the Pinware terrane and the Wakeham–La Romaine volcano-sedimentary and plutonic assemblages (Gower *et al.*, 2008a, b; Rivers and Murphy, 2012; Indares, 2024). These rocks record the construction of an Andean-style active margin along southeastern Laurentia prior to Grenvillian shortening and high-grade metamorphism.

Grenvillian reworking imposed strong structural and metamorphic overprints, locally reaching granulite facies, but did not uniformly obliterate Mesoproterozoic magmatic and tectonic signatures. As a result, pre-Grenvillian crustal architecture is heterogeneously preserved across the

Grenville Province in Labrador. Tectonic terminology related to the Grenville Orogen is retained strictly for deformation events, whereas crustal blocks and intrusive suites are described as lithotectonic domains and lithodemic units, providing a consistent basis for mapping, interpretation, and comparison with adjacent provinces. Accordingly, the Labradorian Grenville Province is best described using two complementary levels of subdivision: a) Structural–metamorphic level, distinguishing parautochthonous and allochthonous belts separated by the Allochthon Boundary; b) Crustal-age domains, comprising Paleoproterozoic Labradorian basement (*ca.* 1.75–1.65 Ga) and Mesoproterozoic active-margin crust (*ca.* 1.50–1.35 Ga); and c) Grenvillian tectonometamorphic and magmatic overprint, including widespread anorthosite–mangerite–charnockite–granite (AMCG)/anorthosite magmatism (~1.1–1.0 Ga; Indares, 2024). This approach reconciles older Labrador-focused syntheses with contemporary Grenville-wide models and avoids retention of legacy terrane nomenclature that is no longer supported by geochronologic or isotopic data. Mesoproterozoic supracrustal successions, including the Bruce River, Petscapiskau and Blueberry Lake groups, are preserved within the Grenville Province and are treated here as cover sequences, described in the Cover and Post-Orogenic Units section.

Labradorian Basement Domain (*ca.* 1.75–1.65 Ga)

The Labradorian Basement Domain comprises Paleoproterozoic Laurentian crust formed between *ca.* 1.75 and 1.65 Ga and represents the oldest crustal component of the Grenville Province in Labrador (Gower *et al.*, 1992; Indares *et al.*, 2022; Indares, 2024). This basement comprises high-grade orthogneiss, paragneiss and associated plutonic rocks that record amphibolite- to granulite-facies metamorphism and penetrative deformation predating Mesoproterozoic magmatism. Labradorian crust forms the basement onto which younger Mesoproterozoic plutons and supracrustal sequences were emplaced, particularly in southeastern Labrador. Although strongly reworked during parts of the Grenvillian orogenesis, Labradorian domains locally preserve Paleoproterozoic isotopic signatures and structural fabrics, particularly within the parautochthonous belt (Gower *et al.*, 1992; Indares, 2024). Recognition of Labradorian basement is critical, as it demonstrates that much of the Grenville Province in Labrador represents reworked Laurentian crust, rather than juvenile additions during Grenvillian time.

Mesoproterozoic Active-margin Domain (*ca.* 1.50–1.35 Ga)

The Mesoproterozoic Active-margin Domain comprises crust formed during prolonged continental-margin magmatism and sedimentation along southeastern Laurentia between *ca.* 1.50 and 1.35 Ga (Rivers, 2015; Gower, 2019). In Labrador, this interval is dominated by magmatism and sedimentation in the 1.51–1.45 Ga range, with more limited younger Mesoproterozoic additions (Gower, 1996). This domain includes calc-alkaline tonalite to granite plutons, ferroan and alkali-calcic granitoids, and associated volcano-sedimentary successions interpreted to record arc, back-arc and inboard extensional environments (Gower *et al.*, 1991a; Rivers *et al.*, 2012). Geochemical and isotopic data indicate mixed juvenile and reworked Laurentian sources, consistent with Andean-type continental-margin evolution rather than oceanic terrane accretion (Dickin, 2000; Dickin and Strong, 2019; Swanson-Hysell *et al.*, 2023). This Mesoproterozoic architecture exerted a first-order control on subsequent Grenvillian strain localization, metamorphic grade, and magmatic focusing (Rivers, 2008).

Grenvillian Structural–Metamorphic Domains (*ca.* 1090–985 Ma Parautochthonous and Allochthonous Belts)

Grenvillian deformation imposed a province-scale structural architecture defined by the parautochthonous and allochthonous belts, separated by the Allochthon Boundary (Gower, 1996; Rivers, 1997, 2008). This boundary marks a fundamental transition in strain intensity and metamorphic grade. The parautochthonous belt comprises Laurentian crust that experienced limited tectonic transport and moderate Grenvillian metamorphism, commonly preserving pre-Grenvillian fabrics and isotopic systems. The allochthonous belt consists of Laurentian crust that was strongly reworked, transported and metamorphosed during Grenvillian collision, commonly reaching upper-amphibolite to granulite facies. This subdivision is structural and metamorphic, not tectonostratigraphic, and is consistent with Québec lexicon terminology.

In Labrador, Grenvillian deformation initiated as early as *ca.* 1090 Ma in high-strain zones and continued through the Ottawan phase (*ca.* 1090–1020 Ma) into the Rigolet phase (*ca.* 1010–985 Ma; Gower, 1996; Rivers and Murphy, 2012; Indares, 2024). Deformation styles include: a) northwest-directed thrusting toward the Laurentian foreland; b) dextral transpression and strike-slip partitioning in eastern sectors; and c) crustal thickening, partial melting and exhumation of deep crustal levels (Gower, 1996; Rivers, 2008). The spatial variability in timing and intensity of Grenvillian deformation reflects inheritance from the 1.50–1.45 Ga active-margin architecture, rather than juxtaposition of unrelated crustal blocks (Rivers, 2008; Gower, 2019).

Crosscutting Mesoproterozoic Magmatic Suites (*ca.* 1.10–0.98 Ga)

A prominent feature of the Labrador segment of the Grenville Province is widespread AMCG and anorthosite magmatism, emplaced broadly between *ca.* 1.10 and 0.98 Ga (Gower *et al.*, 1992; Rivers, 2008; Indares, 2024). These intrusions are treated in this synthesis as crosscutting lithodemic units rather than as defining elements of tectonic domains. These suites transect both Labradorian basement and Mesoproterozoic active-margin domains and are spatially associated with major Grenvillian deformation corridors. Their distribution reflects exploitation of inherited lithospheric weaknesses established during earlier tectonic events. This treatment is consistent with the approach adopted elsewhere in the report for Mesoproterozoic magmatism that spans multiple provinces.

COVER AND POST-OROGENIC UNITS

Paleoproterozoic Volcano-sedimentary Sequences

The Paleoproterozoic volcano-sedimentary successions summarized here are regionally significant supracrustal units whose distribution and timing transcend province boundaries.

Ramah Group

The Ramah Group (Figure 1) is a Paleoproterozoic supracrustal succession unconformably overlying Archean basement of the Nain Province, preserved as a laterally continuous belt between Nachvak and Saglek bays along the North Atlantic Craton margin (Morgan, 1975; Knight and Morgan, 1981). The succession reaches a composite thickness of approximately 1.7 km and is subdivided into six formations (Rowsell Harbour, Reddick Bight, Nullataktok, Warspite, Typhoon Peak and Cameron Brook), defining an upward transition from a shallow-water siliciclastic shelf assemblage to deeper-water basinal deposits separated by a regional sequence boundary (Wilton *et al.*, 1994; Archibald, 1995). Basin deepening is recorded by the appearance of graphitic and pyritic shale and chert in the Nullataktok Formation, locally associated with laterally persistent pyrite-rich horizons (Wilton *et al.*, 1994). The Ramah Group was deformed and metamorphosed during Torngat orogenesis, with metamorphic grade and structural intensity increasing toward the thrust-bounded western margin of the belt (Morgan, 1975; Knight and Morgan, 1981).

Snyder Group

The Snyder Group is a thin Paleoproterozoic sedimentary succession preserved on Snyder Island and adjacent mainland in the northern Nain Province, where it unconformably overlies Archean basement (Speer, 1976). The group is approximately 240 m thick, expanding locally to ~355 m where intruded by <1.81 Ga plutonic rocks, and comprises five conformable units, including basal quartzite, iron formation, quartzite–marble, graphitic- and sulfide-bearing siltstone and an upper quartzite unit (Barton Jr. and Barton, 1975; Speer, 1976). The presence of iron formation and graphite-bearing sedimentary rocks indicates deposition in a shallow-marine to restricted-basin environment along the early Paleoproterozoic craton margin (Speer, 1976). Structural and metamorphic features within the Snyder Group are dominated by contact metamorphism and deformation associated with emplacement of the Kiglapait intrusion rather than regionally penetrative Torngat deformation (Speer, 1982). The Snyder Group is bracketed between 2.6–1.84 Ga based on Rb–Sr isotopic constraints from the Snyder breccia, with subsequent Mesoproterozoic plutonism contributing to thermal overprinting (Barton Jr. and Barton, 1975). Despite its limited thickness and areal extent, the Snyder Group provides an important record of early Paleoproterozoic platformal sedimentation along the North Atlantic Craton margin prior to widespread Torngat deformation and subsequent Mesoproterozoic magmatic overprinting.

Mugford Group

The Mugford Group (Figure 1) is a Paleoproterozoic volcano-sedimentary succession deposited on Archean basement along the North Atlantic Craton margin and preserves a stratigraphic transition from siliciclastic and chemical sedimentation to voluminous mafic volcanism (Hamilton, 1994; Smyth, 1976). The group is commonly subdivided into five formations, including the Sunday Run Formation (~30 m; crossbedded sandstone, conglomerate, laminite and dolostone), Cod Island Formation (~200 m; black shale, chert, argillite and sandstone), Calm Cove Formation (~375 m; basaltic flows and breccias), Shark Gut Formation (~40 m; argillite and tuff) and Finger Hill Formation (~600 m; volcanic breccia and tuff intruded by diabase sills (Smyth, 1976; Wilton, 1994). Basal shale- and chert-dominated units, particularly within the Cod Island Formation, record euxinic basin conditions and have been highlighted as favourable horizons for SEDEX-style base-metal mineralization (Wilton, 1994). Field relationships indicate that the Mugford Group overlies block-faulted basement, with variable stratigraphic thicknesses consistent with syn-depositional extensional tectonics (Smyth, 1976). Geochemical syntheses characterize Mugford mafic volcanic rocks as rift- or plateau-type basalts, supporting the interpretation of deposition in an extensional intracontinental to marginal basin setting during the Paleoproterozoic (Hamilton, 1994).

Ingrid Group

The Ingrid Group (Figure 1) is an isolated Paleoproterozoic volcano-sedimentary succession preserved along the boundary between the SECP and the North

Atlantic Craton and represents one of the youngest Paleoproterozoic supracrustal packages in the region (Ermanovics, 1981; Hinchey *et al.*, 2025). The group comprises sandstone to siltstone, upward-coarsening polymictic conglomerate, basalt with subordinate andesite, rhyolite and felsic tuff, collectively recording deposition in a volcanically active basin setting (Ermanovics, 1993; Hinchey *et al.*, 2025). Metamorphic grade is generally lower-greenschist facies, and deformation is attributed to late-stage Torngat orogenesis rather than syn-depositional tectonism (Hinchey *et al.*, 2025). The eastern contact of the Ingrid Group is faulted against Archean orthogneiss, whereas the western contact is not exposed but has been interpreted as a thrust placing the Ingrid Group structurally above gneiss assigned to the SECP (Hinchey *et al.*, 2025). With an interpreted depositional age of *ca.* 1.81 Ga, the Ingrid Group records post-orogenic supracrustal deposition associated with transtension following major Paleoproterozoic deformation along the craton margin (Hinchey *et al.*, 2025).

Additional Paleoproterozoic sedimentary successions include the Lake Harbour Group, a partially migmatized metasedimentary package that is only sparsely and discontinuously preserved in northern Labrador (Scott *et al.*, 2002) and is distinct from the Paleoproterozoic successions described above. This unit is referred to as the Lake Harbour Suite in recent Québec stratigraphic compilations (Lafrance and Vanier, 2022); however, this nomenclature is not consistent with the lithodemic and stratigraphic classification scheme of Maxeiner *et al.* (2024). Owing to its limited occurrence in Labrador, the Lake Harbour Group is not discussed further in this synthesis.

Mesoproterozoic Volcano-sedimentary Sequences

The Mesoproterozoic volcano-sedimentary successions described below are grouped together to emphasize shared age and depositional character rather than affiliation with individual tectonic provinces.

Bruce River Group

The Bruce River Group (Figure 1) is a Mesoproterozoic supracrustal succession consisting of variably metamorphosed sedimentary and volcanic rocks interpreted to record pre-Grenvillian basin development and volcanism. The group comprises a heterogeneous assemblage of siliciclastic sedimentary rocks, volcanic units and minor chemical sediments that were subsequently deformed and metamorphosed during Grenvillian orogenesis. Most units of the Bruce River Group are interpreted to be *ca.* 1.665 to 1.645 Ga (Schärer and Gower, 1988; Sparkes, 2017). However, the Heggart Lake Formation, traditionally included within the Bruce River Group, has yielded an imprecise U–Pb zircon age of *ca.* 1.85 Ga from a drillhole sample (Sparkes *et al.*, 2016). This suggests that the Heggart Lake Formation is either an older package or that the dated sample was not part of the formation. This age distinction indicates that the Bruce River Group, as currently defined, likely incorporates supracrustal components of differing ages that were juxtaposed during later deformation; therefore, the group needs to be redefined.

Blueberry Lake Group

The Blueberry Lake Group is a Mesoproterozoic volcano-sedimentary succession dominated by siliciclastic sedimentary rocks with subordinate volcanic and volcaniclastic units (Gower *et al.*, 1986; Gower, 1996), exposed in central Labrador south of the Grenville Front, where it forms a Grenvillian-metamorphosed supracrustal package structurally overlying Laurentian basement within the interior of the Grenville Province. Available U–Pb zircon geochronological constraints indicate that the Blueberry Lake Group is *ca.* 1.54 Ga (Brooks *et al.*, 1981). Lithologic associations and structural relationships suggest deposition in an extensional to active margin setting developed along the southeastern Laurentian margin prior to Grenvillian orogenesis. The Blueberry Lake Group thus represents an early Mesoproterozoic supracrustal record of margin-proximal basin development along southeastern Laurentia prior to Grenvillian convergence.

Petscapiskau Group

The Petscapiskau Group comprises a volcano-sedimentary assemblage dominated by siliciclastic sedimentary rocks with minor volcanic components and occurs in central Labrador, within the Orma Domain of the SECP, where it is preserved as a discontinuous supracrustal package interleaved with Archean basement gneisses (Brooks *et al.*, 1981). It is interpreted as part of a regionally developed Mesoproterozoic supracrustal succession (Emslie, 1970). Based on lithologic character, stratigraphic position and regional associations, the Petscapiskau Group is interpreted to be correlative with the Bruce River Group (James *et al.*, 2003). Although detailed geochronological constraints remain limited, existing data support correlation with Mesoproterozoic active-margin or intracontinental basin successions rather than Paleoproterozoic foreland or arc-related sequences (James *et al.*, 2003).

Seal Lake Group

The Seal Lake Group is a Mesoproterozoic volcano-sedimentary succession exposed in central Labrador (van

Nostrand and Macfarlane, 2011; van Nostrand *et al.*, 2013). The group is regionally extensive and overlaps the Grenville Province, the SECP and the Nain Province, and therefore does not correspond to a single tectonic province (Wardle *et al.*, 1997). The group was deformed during the Grenville orogeny (Gower *et al.*, 1980). Geochronological constraints from felsic volcanic units and crosscutting intrusions indicate that the Seal Lake Group was deposited between *ca.* 1.270 and *ca.* 1.225 (Cadman *et al.*, 1994; Romer *et al.*, 1995), synchronous with the final stages of AMCG magmatism elsewhere in Labrador. The Seal Lake Group is interpreted to have formed in an extensional intracratonic to marginal basin setting, likely related to lithospheric thinning associated with Mesoproterozoic mantle upwelling and widespread anorthosite-related magmatism (Roscoe and Emslie, 1973). The Siamarnekh Formation, interpreted as a likely correlative of the basal formation of the Seal Lake Group based on lithology, stratigraphic position and available geochronological constraints (Spencer *et al.*, 2015), is preserved approximately 250 km to the north.

Mesoproterozoic Igneous Suites (*ca.* 1.47–1.27 Ga)

Michikamau Intrusion

The Michikamau Intrusion (MI, Figure 1) is a regionally extensive Mesoproterozoic AMCG complex emplaced at *ca.* 1.47–1.40 Ga within central Labrador and adjacent Québec (Emslie, 1965, 1970). It intrudes the SECP and represents one of the earliest expressions of Mesoproterozoic AMCG magmatism in Labrador. The intrusion forms a laterally extensive, layered mafic–anorthositic body recording large-volume magma emplacement within stabilized continental lithosphere and is dominated by anorthosite with associated troctolite, leucotroctolite, norite and layered gabbro, and locally, more evolved dioritic to syenitic phases (Emslie, 1965). The Michikamau Intrusion hosts orthomagmatic Ni–Cu–Co sulphide mineralization. From a tectonic perspective, it demonstrates that AMCG magmatism extended well into previously accreted Paleoproterozoic lithosphere and was not restricted to craton margins.

Harp Lake Intrusive Suite

The Harp Lake Intrusive Suite (HLIS, Figure 1) forms a Mesoproterozoic AMCG suite within central Labrador and intrudes Paleoproterozoic crust of the SECP. The suite comprises a volumetrically dominant massif of coarse-grained anorthosite and related plagioclase-rich cumulate rocks (including leuconorite, leucogabbro and leucotroctolite), flanked and intruded by a diverse assemblage of mafic to felsic plutonic rocks (Emslie, 1980). These include marginal gabbroic and troctolitic bodies, iron-rich dioritic intrusions and dykes, and large quartz monzonite to monzonitic plutons. Minor late-stage granitic intrusions represent the most evolved components of the suite. The coexistence of anorthositic cumulates, iron-rich dioritic intermediate rocks and voluminous felsic plutons reflects repeated magma recharge, differentiation and local magma mingling. Available geochronological data, although poorly constrained, indicate emplacement broadly contemporaneous with other Mesoproterozoic AMCG intrusions in Labrador, with the HLIS intruding at *ca.* 1.45 Ga (Emslie, 1980). The HLIS is host to poorly documented magmatic sulphide mineralization and is interpreted to represent a deeply eroded, mid-crustal expression of intracontinental AMCG magmatism (Emslie, 1980).

Mistastin Batholith

The Mistastin Batholith (Figure 1) is a large, composite Mesoproterozoic AMCG intrusion emplaced between *ca.* 1.439 and 1.423 Ga (Emslie *et al.*, 1980; Emslie and Hunt, 1990). It intrudes the SECP and consists mostly of intermediate potassic plutonic rocks containing K-feldspar phenocrysts that typically preserve a rapakivi texture. These rocks are associated with lesser amounts of monzonite, quartz syenite, granite, anorthosite, leucogabbronorite and leucogabbro. All lithologies are massive and contemporaneous and appear comagmatic (Emslie *et al.*, 1980). Mineral assemblages commonly include fayalite, orthopyroxene and clinopyroxene, consistent with reduced, iron-rich magmatic conditions typical of AMCG systems (Emslie *et al.*, 1980). The batholith hosts rare earth mineralization (Kerr and Hamilton, 2014). The Mistastin Batholith is interpreted as an anorogenic to extension-related intrusion (Emslie *et al.*, 1980).

Nain Plutonic Suite

The Nain Plutonic Suite (NPS, Figure 1) comprises numerous plutons that formed between *ca.* 1.36 and 1.29 Ga (Ryan, 2000) and covering an area of approximately 18 500 km^2, straddling the boundary of the NAC and the SECP. The most abundant lithologies of the NPS are anorthosite (including leuconorite and leucotroctolite), granitic rocks (ranging from granite to monzonite, quartz monzonite and syenite), iron-rich diorite and troctolite (Ryan, 2000). Collectively these rocks record prolonged, episodic Mesoproterozoic magmatism.

Geochronological constraints indicate that the NPS records multiple magma pulses spanning several tens of millions of years. Zircon antecrysts with U–Pb ages of *ca.* 1370 Ma occur within the *ca.* 1340 Ma Pearly Gates anorthosite, demonstrating inheritance from earlier magmatic events (Tettelaar, 2004). Anorthositic plutons were emplaced episodically until at least *ca.* 1295 Ma (Hamilton, 1997). Silicic magmatism is recorded by U–Pb zircon ages from granitic intrusions ranging from 1363 ± 3 Ma (Tettelaar,

2004) to 1292 ± 2 Ma (Ryan, 1991). Minor volumes of iron-rich dioritic to gabbronoritic magmatism are most common after *ca.* 1330 Ma and persist until *ca.* 1298 Ma (Ryan *et al.*, 2017). Troctolitic magmatism within the NPS includes both regionally extensive and economically significant intrusions. These include the Voisey's Bay intrusion, dated at 1333 ± 1 Ma, which hosts world-class Ni–Cu–Co mineralization (Amelin *et al.*, 1999; Evans-Lamswood *et al.*, 2000) and the Kiglapait layered intrusion, dated at 1307–1306 Ma (Yu and Morse, 1993; Hamilton, 1997), one of the largest and best-preserved mafic layered intrusions in the world. Additional mafic intrusions are documented in the Pants Lake area, where olivine gabbro and gabbro from drill core samples yield U–Pb zircon and baddeleyite ages between 1338 ± 2 Ma and 1322 ± 2 Ma (Smith, 2006; Kerr, 2012). Collectively, the Nain Plutonic Suite records a long-lived, compositionally diverse AMCG magmatic system.

Flowers River Igneous Suite

The Flowers River Igneous Suite (FRIS, Figure 1) is a Mesoproterozoic volcanic–plutonic complex that represents the peralkaline expression of late-stage Mesoproterozoic intracontinental magmatism. The suite comprises a series of high-level peralkaline granite plutons spatially associated with, and encircling, felsic volcanic rocks of the Nuiklavik volcanic assemblage, together defining a caldera-related magmatic system emplaced between *ca.* 1290 and 1270 Ma (Hill, 1991; Ducharme, 2020). Peralkaline granite plutons of the FRIS are typically hypersolvus, medium- to coarse-grained, and compositionally homogeneous, with mineral assemblages dominated by sodic amphibole and sodic pyroxene, and minor fayalitic olivine and aenigmatite (Hill, 1988). These plutons form a discontinuous ring around the Nuiklavik volcanic rocks and are interpreted as shallow-level felsic stocks emplaced beneath an active volcanic centre (Hill, 1991; Miller, 1994; Bonin *et al.*, 2020). The Nuiklavik volcanic rocks are dominantly subaerial rhyolite and associated pyroclastic deposits preserved within overlapping collapsed calderas. Structural and thermochronologic constraints suggest rapid post-emplacement uplift, exposing shallow crustal levels of the magmatic system (Hill, 1991).

Strange Lake Igneous Complex

The Strange Lake Igneous Complex is a Mesoproterozoic peralkaline A-type granitic intrusion emplaced at 1240 ± 2 Ma along the Québec–Labrador boundary (Miller *et al.*, 1997). It represents the youngest manifestation of Mesoproterozoic alkaline magmatism in the region and forms part of the evolved, peralkaline end-member of the regional AMCG–alkaline magmatic province. The complex is a roughly circular, high-level pluton dominated by peralkaline granite with hypersolvus (a single perthitic alkali feldspar) and transsolvus (two separate alkali feldspars – albite and microcline) facies (Siegel *et al.*, 2018). Mineral assemblages are characterized by sodic amphibole (arfvedsonite), sodic pyroxene, perthitic alkali feldspar and quartz, reflecting strongly alkaline, iron-rich magmatic conditions (Miller *et al.*, 1997). The intrusion hosts widespread pegmatitic and late-stage magmatic–hydrothermal features but preserves clear evidence of a dominantly magmatic origin. The Strange Lake Complex is commonly interpreted as a late, highly evolved derivative of Mesoproterozoic alkaline magmatism, potentially related to residual melts generated during prolonged fractionation of earlier AMCG-related magmatic systems (Miller *et al.*, 1997; Mohammadi *et al.*, 2025)

Neoproterozoic–Cambro-Ordovician Sedimentary Units

Double Mer Formation

The Double Mer Formation is a late Mesoproterozoic to early Neoproterozoic continental red-bed succession exposed in southeastern Labrador and forms a key supracrustal component of the Lake Melville rift system defined by Gower *et al.* (1986), which includes the Lake Melville graben and the Double Mer half-graben. The formation unconformably overlies the Grenvillian basement and records post-orogenic extensional basin development along the southeastern margin of Laurentia. The formation consists predominantly of arkosic sandstone, conglomerate, siltstone and shale, deposited in alluvial to fluvial environments (Gower *et al.*, 1986). Coarse clastic facies indicate proximal basement sources and active syn-sedimentary faulting, consistent with deposition during crustal extension rather than compressional tectonism. The unit is unmetamorphosed and only weakly deformed, preserving well-developed primary sedimentary structures. Although the Double Mer Formation lacks direct radiometric ages, stratigraphic relationships and paleomagnetic data constrain deposition to the latest Mesoproterozoic–Cambrian, postdating Grenvillian deformation and broadly overlapping the timing of late intracontinental extension recorded elsewhere along the Laurentian margin (Gower *et al.*, 1986). This is supported by U–Pb detrital geochronology of the formation that preserves predominantly 1.00 to 0.98 Ga zircons (Spencer *et al.*, 2015). The formation is in close spatial association with the Lake Melville rift system and links sedimentation to regional lithospheric stretching preceding the opening of the Iapetus Ocean (Gower *et al.*, 1986).

Labrador Group

Lower Paleozoic autochthonous sedimentary strata are preserved locally in southern Labrador and record early Paleozoic deposition along the Laurentian continental margin prior to Appalachian orogenesis (Cumming, 1983; Gower *et al.*, 1994). These strata unconformably overlie Precambrian basement and form part of the autochthonous margin succession. The Paleozoic component comprises the upper Labrador Group, of Early to Middle Cambrian age, including the Bradore and Forteau formations; the lower Labrador Group (Bateau and Lighthouse Cove formations) is Neoproterozoic and excluded from the Paleozoic succession (Cumming, 1983; Gower *et al.*, 1994).

The Bradore Formation consists mainly of sandstone with minor conglomerate deposited during initial marine transgression onto the Laurentian craton, recording a transition from fluvial to nearshore marine environments (Cumming, 1983). It is overlain by the Forteau Formation, composed of shallow-marine carbonate strata including limestone and dolostone with archaeocyathid-bearing reefal facies, documenting establishment of a Cambrian carbonate platform along the northeastern Laurentian margin (Cumming, 1983; Gower *et al.*, 1994). Deformation and metamorphism of the autochthonous succession is minimal, and primary sedimentary structures are widely preserved. These strata record the transition from Neoproterozoic rifting to Cambrian passive-margin sedimentation and provide a reference framework for early Paleozoic paleogeography and subsequent Appalachian deformation in Labrador.

CONCLUSIONS

Labrador records a long and complex history of continental evolution, yet the geological framework traditionally used to describe this history has evolved both episodically and spatially unevenly, with many long-standing regional terms reflecting legacy interpretations developed prior to the availability of modern geochronological, geophysical and isotopic datasets. As a result, inconsistencies in terminology and domain definition have increasingly hindered regional synthesis and interprovincial and international correlation. This report presents a province-scale synthesis of Labrador geology applying a revised tectonic and lithostratigraphic/lithodemic framework that clearly distinguishes tectonic events from the rock units that record them. Consistent use of the CLASS lithodemic classification provides a coherent basis for describing strongly metamorphosed and polycyclic crust, while established tectonic terminology is retained strictly for deformation and orogenic processes. These updates supersede earlier zone-based and orogen-centric subdivision schemes at the provincial scale and improve alignment with contemporary frameworks in Québec, Greenland, and the broader Laurentian margin.

Within the Southeastern Churchill Province, revised domain definitions and correlations reflect improved understanding of Archean inheritance and Paleoproterozoic reworking, while preserving the additional resolution afforded by remote and sparse Labrador exposures. Elsewhere, consistent treatment of the Nain, Makkovik and Grenville provinces clarifies internal crustal architecture and tectonic relationships. This approach also places Mesoproterozoic AMCG, peralkaline, volcano-sedimentary and rift-related units within a unified lithospheric context that transcends provincial boundaries. The framework presented here is intended as a stable reference for Labrador-wide geological mapping, geophysical synthesis, and mineral exploration.

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