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Permanent link: https://doi.org/10.4095/330237

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Recommended citation
Rayner, N.M., 2022. Report on U-Pb geochronology from the 2017–2020 GEM-2 activity "Saglek Block, Labrador: Geological Evolution and Mineral Potential"; Geological Survey of Canada, Open File 8901, 1 .zip file. https://doi.org/10.4095/330237

Publications in this series have not been edited; they are released as submitted by the author.

Description of Content

This report contains the U-Pb geochronological results for 17 rock samples from Labrador collected as part of the Geomapping for Energy and Minerals (GEM2) activity entitled ***Saglek Block, Labrador: Geological Evolution and Mineral Potential***. The purpose of this report is to release the existing data with the required sample and laboratory metadata along with a limited, preliminary interpretation so that this information is available for consideration by future researchers.

This report contains Excel spreadsheets, one corresponding to each sample, with the results for sensitive high-resolution ion microprobe (SHRIMP) analysis conducted at the Geological Survey of Canada. Each spreadsheet contains a worksheet containing the data and series of sheets including the concordia diagram and other pertinent plots for each sample. The scanning electron microscope zircon images annotated with the SHRIMP spot locations are included as separate Adobe pdf files. Details for each sample are given below and a summary of the interpreted ages is provided in Table 1 and also in an accompanying kml file to be viewed in Google Earth.

INTRODUCTION

The aim of this GEM2 activity was to gain a better understanding of the geological evolution of the North Atlantic Craton (NAC) in Labrador, as well as its potential for hosting base and precious metals deposits, REEs, U, and gem minerals. It involved targeted bedrock mapping, structural and metamorphic analysis, tectonostratigraphy of Proterozoic basins, U-Pb geochronology and tracer isotope studies, as well as analysis of surficial materials and glacial dynamics. The initial aim of the project, which is reflected in the activity name, was to target the Saglek Block and its Proterozoic cover sequences. For logistical and administrative reasons, the majority of the research was instead carried out in the adjacent Hopedale Block to the south which also ties it to the GEM2 Core Zone activity. The objective of a mapping and U-Pb geochronology sampling campaign in 2017-2018 was to provide improved constraints on crustal and tectonothermal evolution of the southern North Atlantic Craton and Core Zone. The data presented herein will be used to produce new 1:250,000 scale maps of NTS map sheets 013M and 013N.

A more detailed description of the regional geology can be found in Corrigan et al (2018) and references therein. Below is a brief synopsis of the map units discussed in this report and shown on Figure 1. The area of interest is located at the junction of four tectonic blocks bound by Archean to Paleoproterozoic orogens. These are the 2.8–3.3 Ga Hopedale Block, the 3.2–4.0 Ga Saglek Block, the 2.3–2.8 Ga Core Zone, and the 1.88–1.74 Ga Makkovik Province. No samples from the Makkovik Orogen are discussed in this paper. The Hopedale and Saglek Blocks together form the Nain Province, which is part of the larger North Atlantic Craton. The boundary between these blocks is assumed to be tectonic and Neoarchean in age, although its exact nature and location is uncertain (Figure 1). Some of the geochronology sampling focused on providing better constraints on the nature of this boundary.

The Hopedale Block hosts two distinct supracrustal belts dominated by mafic volcanic rocks; the 3.1 Ga Hunt River volcanic belt and the 3.0–2.98 Ga Florence Lake volcanic belt. The Maggo Gneiss has been interpreted to be basement to the Florence Lake and Hunt River belts, although in

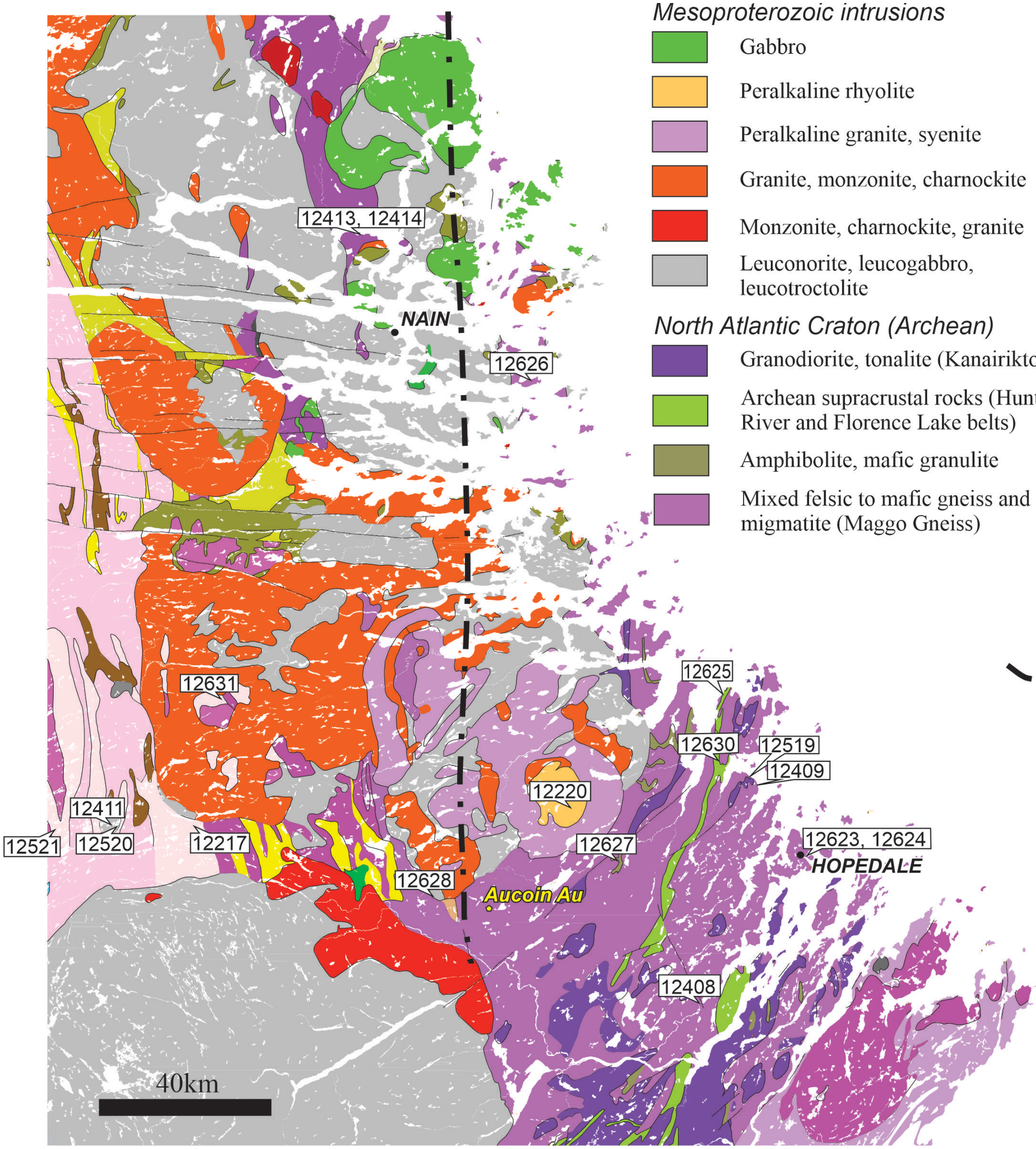

Figure 1. Geological map of the Saglek activity study area. Extracted from Wardle et al. 1997. Locations of the samples presented in the report are identified with their lab number.

Table 1. Summary of results

Lab #	Sample #	Rock Description	Location	Latitude	Longitude	Crystallization age	Other ages	Other age interpretation
12413	18CXAD0069B01	foliated monzogranite	Webb Bay	56.75558	-61.77764	3783±40 Ma	2711±12 Ma	Metamorphism
12414	18CXAD0069C01	quartzite	Webb Bay	56.75558	-61.77764		Detrital modes at 3.65-3.78 Ga, 2.81 Ga, 2.78 Ga Youngest detrital population at ca. 2.72-2.70 Ga	
12408	18CXAD0038B01	non-migmatitic granite gneiss	Adlatok Bay	55.16456	-60.60901	3262±5 Ma	2836±4 Ma (zircon); 2704±4 Ma (titanite)	Metamorphism
12519	18CXAD0041A01	gneissic granite	NW of Hopedale	55.61094	-60.40286	3258±10 Ma	2846±7 Ma	Metamorphism
12409	18CXAD0042A01	gneissic granite	NW of Hopedale	55.58688	-60.39541	3247±12 Ma	2833±9 Ma (zircon); ca. 2.7 Ga (titanite)	Metamorphism
12624	17CXA-D018A1	Foliated tonalite	Hopedale	55.459	-60.218	3141±6 Ma	2724±3 Ma	Metamorphism
12623	17CXA-D018B1	Granite melt injection in D018A gneiss	Hopedale	55.459	-60.218	2710±2 Ma	3.07-3.20 Ga	Inheritance
12625	17CXA-D017A1	Tonalite/tronjemite cutting Hunt R. assemblage	NW of Hopedale	55.8037	-60.4863	3124±3 Ma	2710±10 Ma	Cryptic overprint
12626	18CXA-D068A	granodiorite gneiss	Paul Island	56.451	-61.1873	3043±12 Ma	2833±26 Ma (low Th/U rims); 2497±9 Ma (high U rims)	Archean metamorphism Paleoproterozoic metamorphism
12627	18CXA-D056B	foliated granite cutting Weekes amphibolite	west of Hopedale	55.4596	-60.9554	2832±6 Ma		
12628	18CXA-D048A	granite gneiss	west of Ingrid Lake	55.37679	-61.5901	2848±7 Ma	2732±8 Ma	Metamorphism
12631	18CXA-D59A	deformed psammite	enclave in NPS	55.79589	-62.33345		Main detrital modes at 2.08, 2.03 and 2.0 Ga. Rare Archean detritus (2.65-2.96 Ga). Youngest detrital zircon 1994±15 Ma	
12411	18CXAD0053A01	gabbro-norite	far west of map area	55.53258	-62.72969	1917±4		
12521	18CXAD0055A01	foliated syenogranite	far west of map area	55.51666	-63.00589	1875±5 Ma	1827±7 Ma	Metamorphism
12520	18CXAD0052A01	monzogranite	far west of map area	55.52057	-62.71179	1918±6 Ma	1859±11 Ma	Metamorphism
12217	17CXAD014A01	foliated charnockite	far west of map area	55.5248	-62.438	1853±3 Ma	1828±3	Metamorphism or Pb-loss
12220	17CXAD011A02	quartz-feldspar porphyry	Flowers River	55.5543	-61.08501	1272±13 Ma		

some places Archean rocks interpreted to be part of Maggo Gneiss intrude the Florence Lake Belt. Thus there is complexity in correlation of Archean metaplutonic units and assessing what constitutes basement versus post-depositional intrusive rocks (e.g. Kanairiktok Suite) is one of the questions the dated units attempt to clarify.

The Core Zone is separated from the North Atlantic Craton by the ca. 1.87–1.85 Ga Torngat orogen. Previous mapping identified variably deformed and recrystallized felsic plutonic units classified as undifferentiated "gneiss" or "granitic gneiss". Samples of various lithologies, some of which were not previously recognized (see Corrigan et al. 2018 for details), were collected for geochronology in order to test correlations with the ca. 1.87–1.85 G Lac Lomier complex observed some 200km to the north.

The study area also contains voluminous Mesoproterozoic anorthosite-mangerite-charnockite-granite (AMCG) plutonic units including the Flowers River Complex, and the Nain Plutonic suite.

PROCEDURE

All samples were disaggregated using standard crushing/pulverizing techniques followed by density separation using the Wilfley table and heavy liquids. For SHRIMP analysis, zircon or titanite were selected after examination under a binocular microscope. The selected grains were cast in epoxy mounts IP895, IP937, IP950, IP956, IP962, IP974, IP983, IP984, and IP991. The mid-sections of the minerals were exposed through polishing with diamond compound, and internal features characterized in back-scattered electron mode (BSE) mode utilizing a Zeiss Evo 50 scanning electron microscope. Mount surfaces were evaporatively coated with 10 nm of high purity Au.

SHRIMP analytical procedures followed those described by Stern (1997). Fragments of the GSC primary zircon reference material (RM) 6266 ($^{206}Pb/^{238}U$ age = 559±02 Ma, Stern and Amelin 2003) and secondary zircon RM 1242 ($^{207}Pb/^{206}Pb$ age = 2679.7±0.2 Ma, Davis et al. 2019) were analyzed on the same mount and under the same conditions as the unknowns. Analyses were conducted using an O^{-} primary beam, with a spot size of either 16 µm or 12 µm at a beam current between 1–9 nA for zircon analysis and 16–17 nA for titanite analysis. The count rates of the isotopes of Hf, U, Th, and Pb as well as Hf and Yb for zircon were sequentially measured over five or six scans with a single electron multiplier. Off-line data processing was accomplished using Squid2.5 (Ludwig, 2009) software. Decay constants used follow the recommendations of Steiger and Jäger (1977). The 1σ external errors of $^{206}Pb/^{238}U$ ratios reported in the data table incorporate a ±0.8–1.3 error in calibrating the primary RM (see Stern and Amelin, 2003). Analyses of a secondary zircon RM 1242 were interspersed between the sample analyses to assess the requirement of an isotopic mass fractionation correction for the $^{207}Pb/^{206}Pb$ age. Intra-element mass fractionation corrections ranging between 1.000–1.005 were applied to the samples. Details of the analytical session (mount/session number, spot size, primary beam intensity) are recorded in the footnotes of the data tables as is the measured weighted mean $^{207}Pb/^{206}Pb$ age of RM 1242 for that session. Common Pb correction utilized the Pb composition of the surface blank (Stern, 1997). Isoplot v. 4.15 (Ludwig, 2012) was used to generate concordia plots and calculate weighted means. The error ellipses on the concordia diagrams, and the weighted mean errors in the text are reported at 95% confidence, unless otherwise noted. Errors reported in the data tables are given at the 1s confidence interval.

RESULTS

ARCHEAN BASEMENT – Saglek Block

Lab number 12413 (sample number 18CXAD0069B01): foliated monzogranite, Webb Bay

A septum of Archean gneisses between Mesoproterozoic Nain plutonic suite rocks were investigated in Webb Bay, an area previously interpreted as the boundary between the Saglek and Hopedale Blocks. A foliated monzogranite cuts a strongly deformed regional orthogneiss (Figure 2a) containing enclaves of amphibolite and metasedimentary rocks including quartzite. The grains of this sample are rounded and range from equant to elongate. Several grains exhibit pervasive fracturing through both rims and cores. Zoning varies from poorly developed sector zoning to well-developed oscillatory zoning. Thirty-three analyses of twenty-four zircon grains yielded a range of $^{207}Pb/^{206}Pb$ ages from 3723–2580 Ma. The oldest results, which are consistently from oscillatory zoned zircon fall along a discordia chord with an upper intercept of 3783±40 Ma (n=11, MSWD = 0.74). This is interpreted to represent the crystallization age of the monzogranite[1]. Sector zoned zircons yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2711±12 Ma (n = 11, MSWD = 1.4), which is interpreted to represent an episode of metamorphic zircon growth. The discordance recorded in the older grains, as well as non-reproducibility of replicate analyses on individual grains also point to extensive recrystallization, possibly during multiple metamorphic events. Thus the Eoarchean crystallization age is a minimum age for the strongly deformed regional orthogneiss that it cuts. This result extends the range of Saglek Block Eoarchean gneisses approximately 100km further south from their previously dated localities.

12414 (18CXAD0069C01): quartzite, Webb Bay

A unit of quartzite transposed with heterogeneous tonalite gneiss (Figure 2b) was also sampled in the Webb Bay area. The morphology of the zircons recovered from this sample is highly varied. Grains are generally small, equant and rounded, though smaller populations of elongate, euhedral zircons or fragments are present. Rounded grains predominantly exhibit unzoned, low-U cores surrounded by a thin high-U rim. Euhedral grains and fragments generally exhibit more complex patterns of zonation with faint oscillatory zoning or convolute zoning in cores. Rims are highly fractured, high-U and exhibit alteration textures along the fractures. Seventy-seven analyses were carried out on 63 grains, yielding a range of $^{207}Pb/^{206}Pb$ ages from 3826–2508 Ma. A probability-density plot of ages illustrates detrital modes at 3.65–3.78 Ga, 2.81 Ga, 2.78 Ga and a youngest detrital population at ca. 2.72–2.70 Ga. Analyses which comprise the older modes are derived from zircons with rounded, low-U cores. The younger modes are generally comprised of analyses from rounded, unzoned grains. As with the adjacent foliated monzogranite described above, non-reproducible replicate analyses are attributed to metamorphic resetting, making the determination of the youngest detrital zircon difficult. Only one grain (#102) yields a

[1] Note that this interpretation differs from that given in Rayner and Corrigan (2019) based on subsequent review of the zircon textures.

Figure 2. Field photographs, by N. Rayner unless otherwise noted. **a)** 12413/18CXAD0069B01- foliated monzogranite, Webb Bay. Hammer approx. 60 cm long; Photograph by D. Corrigan. NRCan photo 2022-273 **b)** 12414/18CXAD0069C01- quartzite, Webb Bay. Hammer approx. 60 cm long; Photograph by D. Corrigan. NRCan photo 2022-274 **c)** 12408/18CXAD0038B01 - non-migmatitic granite gneiss, Adlatok Bay. Hammer (30cm) beside block collected for geochronology. NRCan photo 2022-275 **d)** Overall outcrop aspect at Adlatok Bay showing Florence River mafic volcanics interbedded/intruded by felsic gneiss and pegmatite. Hammer is for scale is 30cm long. NRCan photo 2022-276 **e)** 12519/18CXAD0041A01 - gneissic granite, NW of Hopedale. Sampled unit in foreground, highly disrupted/altered Weekes amphibolite in the midground. Hammer approximately 60cm long; NRCan photo 2022-277 **f)** 12409/18CXAD0042A01 - gneiss granite NW of Hopedale. Geochronology sampling avoided pervasive pegmatite intrusions as much as possible. Scale card is 8cm across. NRCan photo 2022-278

Figure 2 cont'd. g) 12626/18CXAD0068A - granodiorite gneiss with rootless isoclinal folds flanked by pegmatite injections. Hammer (30cm) is laying on sampled unit; NRCan photo 2022-279 **h)** 12627/18CXAD0056B - foliated granite, W of Hopedale intruding Weekes amphibolite. Hammer for scale is 30cm long; NRCan photo 2022-280 **i)** 12628/18CXAD0048A - granite gneiss W of Ingrid Lake. Hammer for scale is 30cm long; NRCan photo 2022-281 **j)** 12631/18CXAD059A - deformed psammite . Hammer for scale is 30cm long is laying on sampled unit with leucosome above; NRCan photo 2022-282 **k)** 12521/18CXAD0055A01 - weakly foliated syenogranite; NRCan photo 2022-283 **l)** 12520/18CXAD0052A01 - weakly foliated monzogranite. NRCan photo 2022-284.

reproducible young age of 2655±28 Ma (n = 2, MSWD = 0.56) which may be the maximum age of deposition. More conservatively, it is constrained by the population of detrital zircon at ca. 2.72–2.70 Ga. While this sediment was inferred to be part of the older suite of gneisses, the contacts between them are strongly transposed. The quartzite is demonstrably younger than the cross-cutting granitoid phase and thus is not a part of an Eoarchean metasedimentary package.

ARCHEAN BASEMENT – Hopedale Block

<u>12408 (18CXAD0038B01):</u> non-migmatitic granite gneiss, Adlatok Bay

A sample of non-migmatic "Maggo gneiss" was collected to better constrain the age range of this extensive gneissic suite. At this location a granitoid gneiss was interpreted to cut the 3.0 Florence Lake mafic volcanic and sedimentary rocks (James et al. 1996) making the gneiss unit younger than 3.0 Ga and thus not a "Maggo" gneiss. When the site was revisited in 2018, the presence of both a migmatitic and non-migmatitic phase was noted (Figure 2c) but the relationship between the dated non-migmatitic unit and the rafts is obscured by extensive tectonic transposition as well as a pegmatitic phase at the margin of the raft and the "host" gneiss (Figure 2d). The zircons of this sample are predominantly sub-rounded prisms and fragments. The zircon cores are variable in morphology; several exhibit oscillatory or sector zoning in CL, while other appear unzoned and may feature extensive inclusions or resorbed core boundaries. Rims contain generally low concentrations of U (bright in CL). Thirty-six analyses were carried out on 22 zircons yielding a range of $^{207}Pb/^{206}Pb$ ages from 3271–2749 Ma forming two distinct clusters. The oldest cluster, consisting of analyses of zircon cores yield a weighted mean $^{207}Pb/^{206}Pb$ age of 3262±5 Ma (n = 7, MSWD = 1.03). Slightly younger analyses (down to ca. 3.1 Ga) fall along a discordia chord and are excluded from the calculation. A population of younger zircons which cluster on a concordia yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2836±4 Ma (n = 15, MSWD = 1.04). Two interpretations of these data are possible, 3262±5 Ma may be the igneous crystallization age and thus 2836±4 Ma is a migmatitic/metamorphic overprint, or the ca. 3.3 Ga zircons are inherited in a 2.8 Ga plutonic rock. The zircon textures do not provide an unambiguous solution as oscillatory zoned zircons are present in both age populations.

The metamorphic history of this sample was also investigated by SHRIMP using titanite. Titanite grains are predominantly unzoned, with the exception of high-U mottled textures observed in some grains along the grain edges. Fractures are common, but only minor inclusions are observed. Twenty-one analyses were carried out on 16 titanite grains, yielding a range of $^{207}Pb/^{206}Pb$ ages from 2823–2657 Ma. Thus it appears that titanite growth began at the time the youngest zircons crystallized. A weighted mean calculation of the youngest analyses yielded a $^{207}Pb/^{206}Pb$ age of 2704±4 Ma (n = 8, MSWD = 0.83) indicating a subsequent period of metamorphism not indicated by the zircon data.

Given the titanite data, along with a single, coherent oldest age population (which is inconsistent with inheritance of a metasedimentary component) the preferred interpretation of the zircon results are igneous crystallization at 3262±5 Ma, followed by 2836±4 Ma cryptic injection related to migmatization seen elsewhere in the Maggo gneisses. It is inferred that this ca. 2.8 Ga phase is what was interpreted by James et al. (1996) to cut the Florence Lake mafic volcanic rocks.

<u>12519 (18CXAD0041A01):</u> gneissic granite, NW of Hopedale

This sample was also collected to better characterize the Maggo gneiss. It is a foliated to gneissic granite with minimal melt segregations (Figure 2e). The zircons recovered from this sample range from slightly elongate to equant and are generally rounded/resorbed. Grains exhibit prominent zoning in CL, typically characterized by fine oscillatory zoning in their cores with darker (in CL), broad concentric zoning present along their outer edges. Twenty-nine analyses were carried out on 22 zircons and yielded a range of $^{207}Pb/^{206}Pb$ ages from 3281–2782 Ma. Two primary groups of ages are evident. The older population yields a weighted mean $^{207}Pb/^{206}Pb$ age of 3258±10 Ma (n = 11, MSWD = 1.6), which is interpreted as the igneous crystallization age, as these were recorded in oscillatory-zoned zircon cores. A younger population of primarily rim and grain exterior analyses yields a weighted mean $^{207}Pb/^{206}Pb$ age of 2846±7 Ma (n = 8, MSWD = 3.1). This is interpreted as the age of a metamorphic overprint consistent with their association with zircon rims and the low Th/U ratios of these analyses (0.01-0.13) in comparison to the older zircon core analyses (0.45-0.79).

<u>12409 (18CXAD0042A01):</u> gneissic granite, NW of Hopedale

This sample of migmatitic Maggo gneiss was collected at the presumed locality of the Finn (1989) 3.1 Ga (Rb-Sr) sample in order to try and constrain the oldest component of the Maggo gneiss (Figure 2f). The zircons recovered from this sample are small, rounded grains which often feature thin, fractured rims surrounding oscillatory zoned cores. Twenty-eight analyses were carried out on 25 zircons, yielding a range of $^{207}Pb/^{206}Pb$ ages from 3273–2789 Ma. The majority of the analyses cluster on concordia and yield a weighted mean $^{207}Pb/^{206}Pb$ age of 3247±12 Ma (n = 13, MSWD = 2.1), which is interpreted as the age of igneous crystallization. Five of the older analyses show significant discordance and are excluded from the calculation. A population of primarily zircon rim analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2833±9 Ma (n = 7, MSWD = 2.1). This is interpreted as the time of a metamorphic overprint due to the low Th/U of these rims (0.01-0.4).

Additional constraints on the metamorphic history of this sample is provided by SHRIMP analysis of titanite. In BSE images, the titanite is generally absent of internal features, with the exception of fracturing and alteration features in proximity to fractures in some grains. Twenty analyses were carried out on 18 titanite grains, yielding a range of $^{207}Pb/^{206}Pb$ ages from 2773-2631 Ma. A probability density plot of the titanite ages shows a significant peak at 2700 Ma, with sporadic older and younger analyses.

<u>12624 (17CXA-D018A1):</u> foliated tonalite, Hopedale

This sample of foliated tonalite was collected within the hamlet of Hopedale in order to characterize the extensive gneissic package in the area. The zircons recovered from this sample are primarily elongate with rounded terminations, or less frequently, rounded and equant grains. Low-U rims frequently truncate oscillatory zoned cores. Forty-one analyses were conducted on 39 zircons, and yield a range of $^{207}Pb/^{206}Pb$ ages from 3161-2700 Ma. There are two distinct age populations; a concordant subset of the older population yields a weighed mean $^{207}Pb/^{206}Pb$ age of

3141±6 Ma (n = 13, MSWD = 1.7), which is interpreted as the igneous crystallization age, as these data points were collected from faintly zoned cores. The younger population yields a weighted mean $^{207}Pb/^{206}Pb$ age of 2724±3 Ma (n = 20, MSWD = 1.06). These young ages are recorded from zircon rims which are characterized by low Th/U (0.09-0.01) and sector zoning and thus are interpreted as an age of metamorphism.

<u>12623 (17CXAD018B1):</u> granite vein, Hopedale

This granite is an injected phase into sample 17CXA-D018A1 described above and thus provides a lower age pin on the components of the gneiss complex in Hopedale. The zircons recovered from this sample are subhedral with thick, unzoned or sector zoned, high-U rims surrounding faintly oscillatory or straight-zoned cores. High-U unzoned/sector zoned grains are also observed but occur less frequently. Forty-seven analyses were carried out on 39 grains, yielding a range of $^{207}Pb/^{206}Pb$ ages from 3202-2695 Ma. Analyses yielding non-reproducible ages from 3202–3068 Ma are interpreted to be inherited zircons, as the analyses were taken from xenocrystic cores of zircon grains with overgrowths. A weighted mean calculation of the dominant unzoned/sector zoned zircon yields a $^{207}Pb/^{206}Pb$ age of 2710±2 Ma (n = 29, MSWD = 1.3) which is crystallization age of the injection granite. This age overlaps with that of the zircon rims in sample 17CXA-D018A although these rims are not characterized by the same low Th/U.

<u>12625 (17CXAD017A1):</u> tonalite/trondjemite, northwest of Hopedale

This sample of tonalite/trondjemite was collected along the coast northwest of Hopedale where it cuts deformed 3.1 Ga Hunt River (James et al. 2002) sedimentary rocks. The zircons recovered from this sample are primarily sub-hedral, elongate prisms or fragments. Grains generally exhibit complex oscillatory or sector zoning visible in BSE and CL, though some grains or rims are unzoned and high-U. Fractures and inclusions are common. Twenty-eight analyses were carried out on 28 zircon grains, yielding a range of $^{207}Pb/^{206}Pb$ ages from 3141–2532 Ma. The concordia diagram illustrates a concentration of ages at 3141–3098 Ma, with rare younger ages spanning 2710–2532 Ma. Analyses from this older population yield a weighted mean $^{207}Pb/^{206}Pb$ age of 3124±3 Ma (n = 23, MSWD = 1.15). This interpreted as an igneous crystallization age, as these data points were collected from primarily core analyses. Younger, non-reproducible ages derived from the unzoned grains and rims are interpreted to be a metamorphic overprint with a maximum age of 2710±10 Ma, the $^{207}Pb/^{206}Pb$ age of the oldest of the unzoned zircon (grain 19). The ca. 2.53 Ga results from other rims may reflect Pb-loss from 2.7 Ga zircon, or a separate zircon growth event. Crystallization at 3124±3 Ma is inconsistent with existing geological models of the area where the Hunt River volcanics are erupted at ca. 3.1 Ga and then not subject to deformation until 2.8–2.9 Ga. This result would imply that sedimentary rocks within the Hunt River belt were deposited and deformed prior to 3124 Ma. This calls into question either the cross-cutting field relationships observed or the correlation of the host rocks with the Hunt River volcanic belt. Metasedimentary rocks in the northern Hunt River volcanic belt are poorly exposed and contact relationships are uncertain.

12630 (18CXAD0016A02): olivine gabbro

This sample of a NE trending gabbro dyke did not yield any datable material.

<u>12626 (18CXAD0068A):</u> granodiorite gneiss, Paul Island

This sample of tonalite to granodiorite gneiss containing rootless isoclinal folds (Figure 2g) was collected east of Nain from a complex outcrop that also included mafic gneissic enclaves, extensive pegmatite injection and cross cutting aplite. The suture between the Saglek Block and the Hopedale Block has been proposed to run north/south through this area (Connelly and Ryan, 1996), thus an age of this sample could better constrain the boundary. Zircons recovered from this sample are complex. Oscillatory zoned zircon is present as entire grains or as cores. The oscillatory zoning is often truncated by CL-bright zircon exhibiting sector or convolute zoning. A third distinctive zircon type is unzoned and with a poor CL response indicating high U concentrations. This type of zircon is present as discrete grains or as rims, typically surrounding the low U, sector zoned zircon. Forty-nine analyses were carried out on 37 zircon grains, yielding a range of $^{207}Pb/^{206}Pb$ ages from 3080–2402 Ma spread along the concordia curve indicating a complex, multistage geologic history. By grouping this complex array according to zircon zoning type and chemistry it is possible to elucidate three events. The crystallization age of the granodiorite is interpreted to be 3043±12 Ma based on the Tukey's biweight mean of the $^{207}Pb/^{206}Pb$ age of oscillatory zoned zircon (n=10). Another 12 analyses of oscillatory zoned zircon were excluded from this calculation as they record younger ages that are inferred to the result of Pb-loss during subsequent metamorphic events. Sector zoned, low U (CL-bright) and distinctly low Th/U zircon rims yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2833±26 Ma (n=6 low MSWD = 0.54, probability = 0.75) which is interpreted as the time of an Archean metamorphic overprint. Unzoned, high U zircon rims yield a $^{207}Pb/^{206}Pb$ age of 2497±9 Ma (n=7 unzoned zircon, MSWD = 0.40, probability = 0.88) which is interpreted as recording an earliest Paleoproterozoic metamorphic overprint. The remaining analyses that fall between these three end members may be the result of mixing where the analytical spot straddles more than one age domain, or exhibit the effects Pb-loss from this polymetamorphic history.

Plutonism at 3.04 Ga has not previously been recognized in either the Hopedale or Saglek Blocks however 2.8–2.7 Ga is well known as an episode of granulite metamorphism in the Saglek Block and 2.5 Ga ages have been attributed to reworking of the suture between Hopedale and Saglek Blocks all the way up to Saglek Bay/Hebron Fjord (Kusiak et al 2018 and references therein).

<u>12627 (18CXAD0056B):</u> foliated granite, west of Hopedale

A sample of strongly foliated granite cuts a large exposure Weekes amphibolite west of Hopedale (Figure 2h). Zircon grains are typically prismatic, and oscillatory zoned. The inner parts of some grains have lower U (brighter in CL) than the outer parts but the zoning appears concentric and not truncated in most cases. The outer parts of the grains are commonly altered. Thirty-two analyses were carried out on 27 zircons yielding a range $^{207}Pb/^{206}Pb$ ages from 2853-2479 Ma. Many of the younger analyses are reversely discordant which is consistent with their very high U (1000-2400 ppm) and altered appearance. The oldest grains have lower U (typically 60-500ppm) and a subset of concordant analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2832±6 Ma (n = 9, MSWD = 2.1) which is interpreted as a crystallization age. The remaining younger, discordant (both normal and reverse) ages indicate a thermal and/or fluid overprint that lead to alteration, however the timing of this event cannot be constrained.

12628 (18CXAD0048A): granite gneiss, west of Ingrid Lake

This sample of granite gneiss (Figure 2i) was collected just west of the Ingrid Lake sedimentary assemblage, a zone thought to represent the suture between the Saglek Block (to the west) and the Hopedale Block (to the east) (Connelly and Ryan, 1996). Zircons recovered from this sample are characterized by fine oscillatory zoning. Some grains are mantled by broadly zoned (concentric or sector) zircon rims however the distinction between finely zoned and broadly zoned zircon can be ambiguous. Thirty-one analyses were carried out on 28 zircons, yielding a range of $^{207}Pb/^{206}Pb$ ages from 2877-2586 Ma. A cluster of the oldest, concordant analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2848±7 Ma (n = 10, MSWD = 1.6). These analyses are all from finely oscillatory-zoned zircon and thus this age is interpreted as the crystallization age of the granite protolith. A younger cluster of ages from broadly zoned rims yields a weighted mean $^{207}Pb/^{206}Pb$ age of 2732±8 Ma (n = 8, MSWD = 1.3) which is interpreted as the time of metamorphism. This granite gneiss is on the west side of what has been proposed as the suture between the Saglek and Hopedale Blocks. These ages are identical to ones observed further east in the Hopedale Block and thus does not support the presence of a suture as currently hypothesized.

PALEOPROTEROZOIC COVER SEQUENCES AND PLUTONISM

12631 (18CXAD059A): deformed psammite, enclave in Nain Plutonic suite

This sample of deformed psammite (Figure 2j) was taken from an area mapped as large Archean enclave in Nain Plutonic Suite (NPS) west of Hopedale (Wardle et al. 1997). The zircons recovered from this sample are large and rounded, with varied internal characteristics. Populations of grains with faint oscillatory zoning, sector zoning, banded zoning and unzoned interiors are all present. Inclusions and fractures are common throughout the suite of zircons recovered, with several also exhibiting alteration textures in rims or at the core-rim boundary of grains. Sixty-five analyses were carried out on 61 zircons, yielding a range of $^{207}Pb/^{206}Pb$ ages from 2968-1956 Ma. A probability density plot shows prominent modes at 2080 Ma, 2035 Ma and 2000 Ma as well as minor modes at 2.3 Ga and in the Archean up to 2.95 Ga. Replicate analyses of the youngest detrital zircon yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1994±15 Ma (n = 4, MSWD = 1.9). This age is interpreted as the age maximum age of deposition of the psammite, clearly indicating that this is not an Archean enclave with the NPS but instead is Paleoproterozoic. Sources for the extensive 2.0-2.1 Ga detritus are not well known in Labrador/eastern Quebec.

12411 (18CXAD0053A01): gabbro-norite, far west of map area

A sample of hornblende-orthopyroxene (retrogressed to clinopyroxene ± pargasite) gabbro was collected from a body with a high aeromagnetic signature, wrapped by the magnetic fabric of the surrounding rocks. The sampled unit is metamorphosed but not deformed. The zircons recovered from this sample are small, angular fragments. Most grains do not exhibit any patterns of zonation, with only rare instances of faint oscillatory zoning, or highly contrasting convolute domains visible in BSE (CL images are not available). Twenty-two analyses carried out on 22 zircons yield a range of $^{207}Pb/^{206}Pb$ ages from 1943–1894 Ma. These analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1917±4 Ma (n = 22, MSWD = 1.4). This is interpreted as the crystallization age of the gabbro norite.

<u>12521 (18CXAD0055A01)</u>: syenogranite

A weakly foliated syenogranite was collected from far west of map area (Figure 2k). Zircons recovered from this sample are large and sub-rounded, with oscillatory zoned cores surrounded by broadly zoned thin rims. Twenty-seven analyses were carried out on 18 zircons, yielding a range of $^{207}Pb/^{206}Pb$ ages from 2024–1823 Ma. A single analysis with an age of 2024 Ma is interpreted as inherited while the weighted mean $^{207}Pb/^{206}Pb$ age of the older cluster of zircons yields an age of 1875±5 Ma (n = 20, MSWD = 1.3). These were collected from the oscillatory zoned cores and are interpreted as the age of igneous crystallization. The ages comprising the younger, secondary mode yield a weighted mean $^{207}Pb/^{206}Pb$ age of 1827±7 Ma (n = 6, MSWD = 0.14), and is interpreted as a metamorphic overprint due to their broad/sector zoning and occurrence as rims.

<u>12520 (18CXAD0052A01):</u> monzogranite

A weakly foliated, equigranular monzogranite was collected from an area with low aeromagnetic signatures surrounding high-mag lenses in the far west of map area (Figure 2l). Zircons recovered from this sample are large and subhedral, exhibiting predominantly fine-scale zoning. Rarely, oscillatory zoned cores appear partially resorbed and are rimmed by low-U, unzoned overgrowths. Some grains exhibit alteration textures in their rims. Twenty-eight analyses were carried out on 21 zircon grains, yielding a range of $^{207}Pb/^{206}Pb$ ages from 1945–1843 Ma. A weighted mean of the oldest 17 analyses, all from oscillatory zoned zircon, yields a $^{207}Pb/^{206}Pb$ age of 1918±6 Ma (MSWD = 1.8) interpreted as the igneous crystallization age. The weighted mean $^{207}Pb/^{206}Pb$ age of 4 analyses of unzoned, low Th/U (0.03–0.11) rims is 1859±11 Ma (MSWD = 1.7) and is interpreted as a metamorphic overprint.

<u>12217 (17CXAD014A01):</u> foliated charnockite, far west of map area

Zircons recovered from this sample consist of rounded grains and angular fragments. Zircon cores are generally unzoned, with rare oscillatory zoning. Few zircons have distinct rims, which are highly fractured and feature alteration textures. Twenty-eight analyses were carried out on 25 zircons, yielding a range of $^{207}Pb/^{206}Pb$ ages from 2657–1816 Ma. Of these, the rare older analyses (2.66-2.5 Ga) are interpreted to be inherited. The remaining analyses are all from high U, unzoned zircon, often as rims, and appear to cluster on concordia in two subsets. The older group of analyses yields a weighted mean $^{207}Pb/^{206}Pb$ age of 1853±3 Ma (n = 9, MSWD = 0.64) interpreted as an igneous crystallization. A second group yields a slightly younger weighted mean $^{207}Pb/^{206}Pb$ age of 1828±3 Ma (n = 8, MSWD = 1.4). This might represent a discrete metamorphic event, or possibly Pb-loss from the ca. 1850 Ma zircon.

NEOPROTEROZOIC PLUTONISM

<u>12220 (17CXAD011A02):</u> quartz-feldspar porphyry, Flowers River

This sample of quartz-feldspar porphyry was collected from the Flowers River Igneous Suite. This complex comprises voluminous peralkaline granite ring intrusions and coeval volcanic rocks and intrudes the NPS. The zircons recovered from this sample are small, angular fragments, primarily without visible zonation in BSE. Twenty-two analyses were conducted on 22 zircons and recorded $^{207}Pb/^{206}Pb$ ages ranging from 1395–1227 Ma. These analyses yielded a weighted mean $^{206}Pb/^{238}Pb$ age of 1272.4±5.6 Ma (n = 22, MSWD = 1.18) interpreted as the crystallization age. As the measured uncertainty on the mean $^{206}Pb/^{238}Pb$ age is below the 1% long-term variability recognized through monitoring of reference materials, the crystallization age and uncertainty is best reported as 1272±13 Ma (age ± 1%).

ACKNOWLEDGEMENTS

D. Corrigan was the field party and project leader of the GEM2-Saglek activity under which these samples were collected. His geological observations and discussions at the outcrop underpin the interpretations in this report. The author is grateful for the support and assistance of the staff of the Geochronology Laboratories of the Geological Survey of Canada. In particular, R. Chung, G. Case, and T. Pestaj are thanked for their careful efforts and excellent work. M. Polivchuk provided the necessary high-quality scanning electron microscope images. Quinn Emon ably assisted with the preparation of the digital files herein. The manuscript benefitted from a thorough review by Alana Hinchey and Jeanne Percival.

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