GEOLOGICAL SURVEY OF CANADA

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W.J. Davis, R.G. Berman and A. MacKinnon

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

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DIGITAL DATA

Appendix I containing the U-Pb analytical results is included as a digital data file in Microsoft Excel 2003 format.

Introduction

The Geo-Mapping Frontiers project was initiated in 2011 within the Geomapping for Energy and Minerals (GEM) 2008-2013 program to improve the geological understanding of some of the more remote and poorly understood regions of Canada's north. The Chantrey area, mostly within the Kitikmeot region of western Nunavut (parts of NTS million sheets 76 , 66, and 56), was one of the areas targeted (Figure 1). As part of this project U-Pb zircon geochronological investigations were carried out on archival samples originally collected as part of regional mapping projects of the Geological Survey of Canada in the 1950's and 1960's (Heywood, 1961; Fraser, 1964). The samples were archived at the GSC facility in Ottawa and geological information for the samples, with the exception of sample descriptions and lithology names, is derived from the original field and traverse notes.

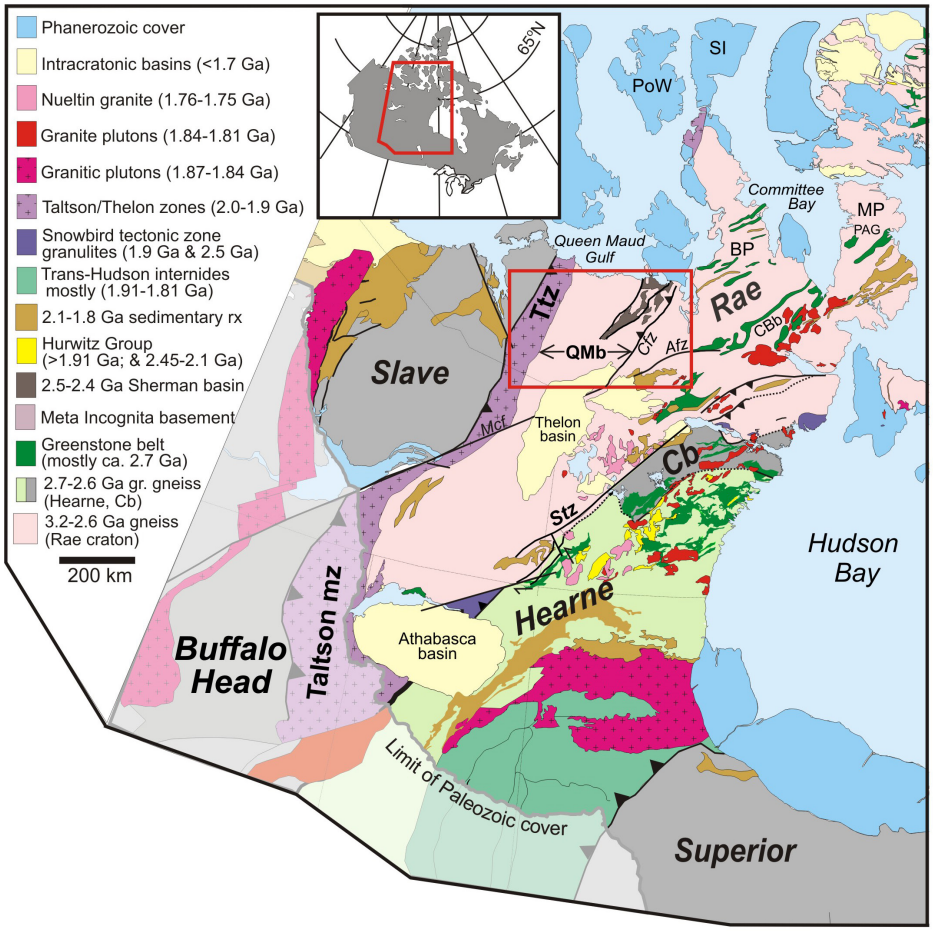

Figure 1 Regional geological map of northwest Laurentia. Area of Figure 2 highlighted by red box. Abbreviations: Afz = Amer fault zone, BP = Boothia Peninsula, Cb = Chesterfield block, Cfz = Chesterfiled fault zone, Mcf = Macdonald fault, MP = Melville Penisula, PAG - Prince Albert Group, PoW = Prince of Wales Island, QMb = Queen Maud block, SI = Somerset Island, Stz = Snowbird tectonic zone, Ttz = Thelon tectonic zone.

This report presents U-Pb ages of zircon for ten samples that comprise a roughly east-west transect across the Thelon tectonic zone, Queen Maud block, and adjacent Rae craton (Hoffman, 1988). The locations of samples are shown in Figure 2 and a summary of age results is presented in Table 1. Sample information and the interpretation of the U-Pb data are presented for each individual sample in following sections. The U-Pb analytical data are presented in Appendix 1.

Regional Geological Setting

Thelon tectonic zone:

Thelon tectonic zone (Ttz; Figure 1) comprises a series of pronounced, NNE-striking magnetic anomalies that extend ~500 km from the MacDonald fault to Queen Maud Gulf, and appear to continue to Prince of Wales and western Somerset Island. The similarities in magnetic fabrics and age of plutonic rocks suggest that the Ttz may have continuity with the Taltson magmatic zone

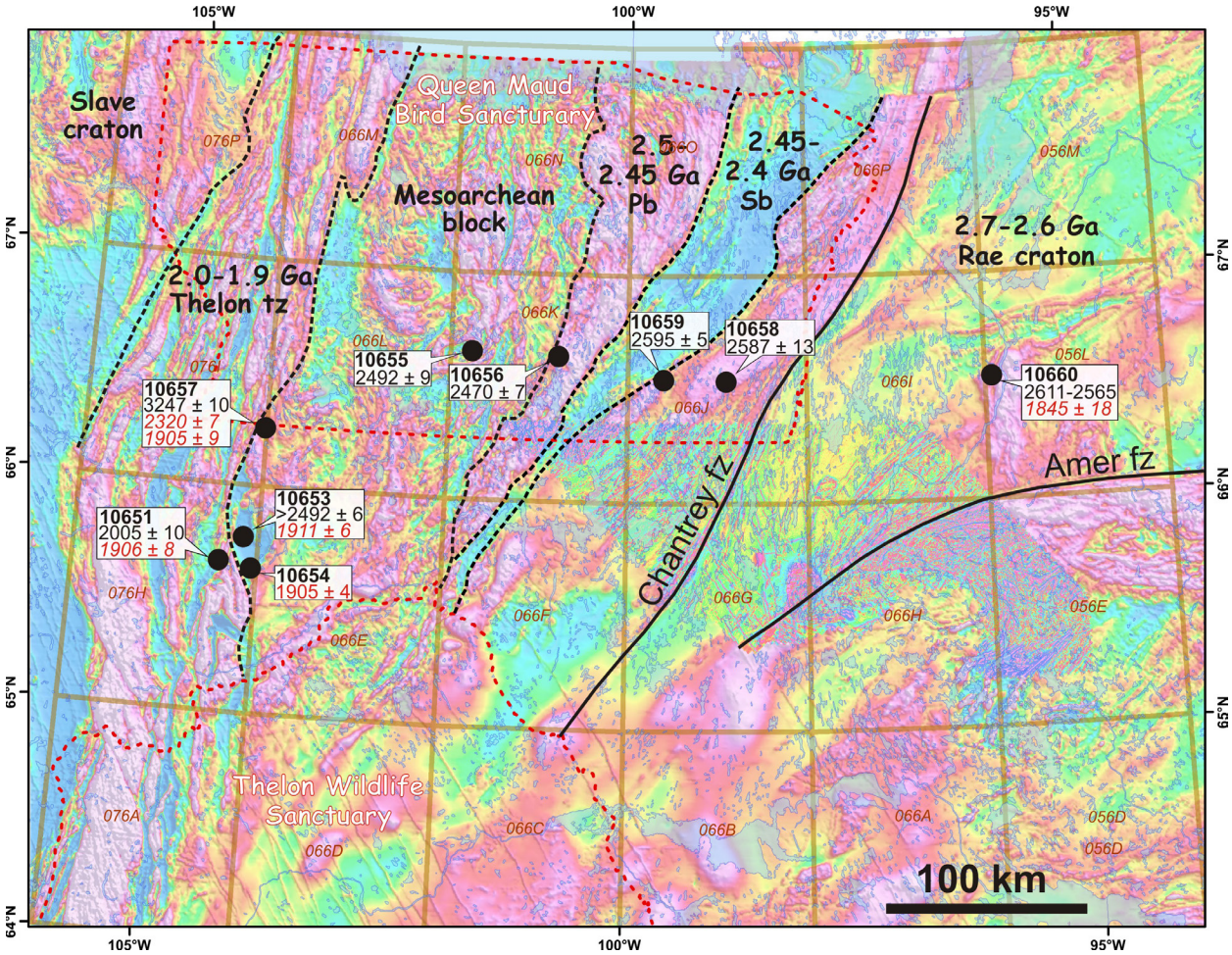

Figure 2. Regional aeromagnetic map showing locations of samples in this study and boundaries of principal tectonic domains discussed in text. Ages are indicated below lab number, regular font = igneous age, red italic font = metamorphic age. Ages and errors are rounded values from Table 1. See Table 1 for sample details. Abbreviations: Pb = plutonic belt, Sb = Sherman basin, fz = fault zone, tz = tectonic zone.

south of the MacDonald fault (Hoffman, 1988). The Thelon zone has been postulated to represent a continental arc built on the western flank of Rae craton and subsequently intensely deformed during collision of the Slave craton (Hoffman, 1988). An alternative model based on compositions of plutonic rocks proposes that this zone formed an intracontinental mountain belt far removed from an active plate boundary (Chacko et al., 2000; Schultz et al., 2007).

Geochronological data for the Ttz are available from three widely separated areas: a southern region between the MacDonald fault and 65°N (van Breemen et al, 1987a, van Breemen and Henderson, 1988, James et al., 1988, Henderson and van Breemen, 1992), a central region between 66 °N and 67°N (van Breemen et al., 1987b; Frith and van Breemen, 1990) that in part coincides with the western part of the Chantrey transect, and a single outcrop along the coast of Queen Maud Gulf (Tersmette, 2012). Geochronological data in each area document high-grade metamorphism and/or granitoid plutonism at 2.01-2.00 Ga. In the southern region, syn-tectonic plutonism occurred at 1957 +9/-5 (James et al., 1988) and 1920 ± 4 Ma (van Breemen et al, 1987a). In the central region, K-feldspar megacrystic granite crystallized at 1994 +6/-4 Ma (Frith and van Breemen, 1990), massive to weakly foliated clinopyroxene granodiorite at 1978 ± 2 Ma (Frith and van Breemen, 1990), and syntectonic, S-type granite was emplaced at 1908 ± 2 Ma (van Breemen et al., 1987) during granulite-facies metamorphism dated at 1906 ± 2 Ma (Roddick and van Breemen, 1994).

Queen Maud block (QMb):

The Queen Maud block (Heywood and Schau, 1978) or uplift (Hoffman, 1988), was distinguished by Heywood and Schau (1978) on the basis of its high metamorphic grade relative to adjacent areas (Committee and Armit blocks) of the northern Churchill province. Originally defined to extend north of the MacDonald fault and east to the Chantrey fault zone (Heywood and Schau, 1978), Schultz et al. (2007) suggested that the eastern boundary shift further west to a prominent magnetic lineament interpreted to reflect the eastern limit of a newly discovered ca. 2.5 Ga plutonic belt. The northern limit is unconstrained as the Precambrian geology is concealed beneath water or Paleozoic rocks of the Arctic islands. It may extend to northern Boothia Peninsula based on correlation of magnetic fabrics.

The geology of the area is very poorly known with no systematic mapping accomplished since the initial helicopter surveys in the 1950's and 1960's. A number of K-Ar ages were reported in the 1960's which gave Paleoproterozic metamorphic cooling ages but little information on the age of the rocks. A small number of Nd isotopic analyses of archival samples by Theriault et al. (1994) identified significant 3.6-3.1 Ga crustal signatures in the southwestern part of the QMb, and Schultz (2007) report Nd model ages of 2.8-3.1 Ga for rocks in the northeastern part of the block. Recent U-Pb geochronological work based on geological transects in the eastern and northern part of the block is published by Schultz et al. (2007) and Tersmette (2012), respectively.

Hoffman (1988) interpreted the Queen Maud block as the exhumed part of a tectonic plateau developed behind the Thelon tectonic zone as a consequence of Himalayan-style, ca. 1.97 Ga collision of the Slave and Rae provinces. This model was challenged by Schultz et al. (2007) and Tersmette (2012) who identified a significant 2.5–2.3 Ga plutono-metamorphic history in the area, indicating that much of the high-grade metamorphism predates the Thelon orogeny and instead

forms part of the Arrowsmith orogen that developed on the western margin of the Rae (Berman et al. 2005, Berman et al. 2012). A major area of commonly orthopyroxene-magnetite-bearing, 2.52–2.45 Ga plutonic rocks corresponds to a NNE-striking magnetic high (Pb on Figure 2) (Schultz et al., 2007; Tersmette, 2012). To the east, this belt abuts a pronounced magnetic low associated with the Sherman group supracrustal rocks (Sb on Figure 2), which are considered to have been deposited in a rift basin after 2.45 Ga (youngest detrital zircon) and before ca. 2.39 Ga, the time of metamorphic monazite growth (Schultz et al., 2007). Tersmette (2012) refers to the plutonic belt and Sherman group as the Paalliq belt. His geochronological data indicate that the region to the west of the plutonic belt and east of the Ttz, dubbed the Perry River belt, consists dominantly of ca. 3.2-3.1 Ga granitoid gneiss intruded by 2.7 Ga plutons.

Rae Craton:

The Rae craton west of Hudson Bay is dominated by Neoarchean supracrustal and granitoid rocks with lesser Mesoarchean basement gneiss. With the notable exception of the ca. 2.97 Ga Prince Albert group on Melville Peninsula (Frisch, 1983; Wodicka et al., 2011), supracrustal belts are dominantly Neoarchean and include quartzite-komatiite supracrustal rocks of the 2.72-2.68 Ga Committee Bay belt (Skulski et al., 2003) and Woodburn Lake groups (Fraser, 1988, Zaleski et al, 2000). The most voluminous component of the extensive granitoid domains is a suite of ca. 2.62 – 2.58 Ga plutons of dominantly monzogranitic composition (Skulski et al., 2003; Hinchey et al., 2011 and references therein). Metamorphosed remnants of what is thought to have been an extensive ca. 2.1–1.9 Ga Palaeoproterozoic sedimentary cover include the Amer, Ketyet River, Montressor, Chantrey, and Penrhyn groups (Rainbird et al., 2010 and references therein). A northeast-striking foliation is characteristic of the region and is demonstrated to be a Paleoproterozoic fabric (Berman et al., 2005; 2012). Indentation of the Slave craton (Henderson et al., 1990) is considered to have driven dextral latest movement in the Chantrey fault zone (Hoffman, 1989; Frisch, 2000) and the Amer fault zone (Tella, 1994).

Summary of Results

A more complete geological synthesis of the area is ongoing and will follow this report. The main geological highlights resulting from this study are summarized below.

- The 3247 ± 10 Ma age for a sample of granitoid gneiss (10657) in the western part of the QMb significantly extends to the south the Mesoarchean crustal block identified along the Arctic coast by Tersmette (2012).

- Three granitoid samples (10659, 10658, 10660) yielded ca. 2580-2595 Ma crystallization ages, extending the regional distribution of this widespread plutonic event in the Rae further west than previously known.

- Two samples of plutonic rocks (10656, 10655) yielded ages of 2470 and 2492 Ma, further highlighting the regional significance of the 2.51-2.47 Ga plutonic event in the QMb. One sample (10656) is from the prominent magnetic high previously associated with these rocks by Schulz et al. (2007), whereas a second sample (10655) occurs to the west indicating

that plutonic rocks of this age are not limited to the previously identified eastern domain (Figure 2).

- Significant zircon recrystallization at 2320 ± 7 Ma in sample 10657, located in the westernmost part of the QMb, further highlights the regional significance of 2.3-2.4 Ga metamorphism related to the Arrowsmith Orogeny within the QMb.

- A 2005 ± 5 Ma crystallization age for a hornblende granodiorite (10651) provides additional evidence that this age represents the dominant time of plutonism along much of the Thelon tectonic zone in this area.

- Significant 1.91 Ga metamorphic recrystallization of zircon is documented in three samples (10651, 10653, and 10657) from within and from areas to the east of the Thelon tectonic zone. A fourth sample of leucogranite (10654) has a crystallization age of 1905 ± 4 Ma. The full extent of this regional metamorphic event remains to be discovered.

Analytical Methods

Samples were processed by electropulse disaggregation using a Spark2 (CNT-MC Inc.) instrument at Overburden Drilling in Ottawa. followed by sieving, and density separation using heavy liquids at the Geochronology facility, GSC, Ottawa. Zircon were separated based on magnetic properties using a Frantz Isodynamic separator. SHRIMP analytical procedures followed those described by Stern (1997), with standards and U-Pb calibration methods following Stern and Amelin (2003). Details regarding the procedure, or any deviations from it, are noted in the section relating to specific samples. Briefly, zircons were cast in 2.5 cm diameter epoxy mounts (along with fragments of the GSC laboratory standard zircon (z6266, with $^{206}Pb/^{238}U$ age = 559 Ma). The mid-sections of the zircons were exposed using 9, 6, and 1 μm diamond compound, and the internal features of the zircons (such as zoning, structures, alteration, etc.) were characterized in back-scattered electron mode (BSE) utilizing a Zeiss Evo 50 scanning electron microscope. The count rates at eleven masses including background were sequentially measured with a single electron multiplier. Off-line data processing was accomplished using SQUID2 (version 2.22.08.04.30, rev. 30 Apr 2008). The 1σ external errors of $^{206}Pb/^{238}U$ ratios reported in the data table incorporate the error in calibrating the standard. Common Pb correction utilized the Pb composition of the surface blank (Stern, 1997). Yb and Hf concentration data were calculated using sensitivity factors derived from standard 6222 with values of 229 and 8200 ppm respectively. Details of the analytical session, including spot size, number of scans, calibration error and the application of any intra-element fractionation corrections are given with the samples. Isoplot v. 3.00 (Ludwig, 2003) was used to generate concordia plots and calculate regression ages and weighted means. The error ellipses on the concordia diagrams and the weighted mean errors are reported at 2σ.

Table 1. Location information and summary of U-Pb age results for samples from this study.

Lab #	Sample	Rock Type	Rock Description	UTM Zone	East	North	NTS Million	NTS 250	NTS 50	Age (Ma)	Error (Ma)	Age Material	Age Method	Age Qualifier	Age Interpretation
10651	55-CD-159	Plutonic	hornblende-bearing granitic gneiss	13	527562	7283614	76	H	9	1906.0	10.0	Zircon	U/Pb	Direct	Metamorphic
10651	55-CD-159	Plutonic	hornblende-bearing granitic gneiss	13	527562	7283614	76	H	9	2004.8	5.3	Zircon	U/Pb	Direct	Igneous Crystallization
10652	55-EA-261A	Sedimentary	Ms-Bt metapsammite	13	543235	7279776	76	H	9	1940.0	-	Zircon	U/Pb	Maximum Estimate	Depositional
10653	55-EA-261B	Plutonic	Peraluminous granite	13	543235	7279776	76	H	9	1911.5	5.6	Zircon	U/Pb	Estimate	Metamorphic
10653	55-EA-261B	Plutonic	Peraluminous granite	13	543235	7279776	76	H	9	2492.0	6.0	Zircon	U/Pb	Minimum Estimate	Igneous Crystallization
10654	55-EA-265	Plutonic	Garnetiferous leucogranite	13	537970	7294180	76	H	16	1905.1	4.4	Zircon	U/Pb	Direct	Igneous Crystallization
10655	62-FD-080	Plutonic	Hbl-opx granite gneiss	14	379618	7395318	66	K	12	2492.3	8.5	Zircon	U/Pb	Direct	Igneous Crystallization
10656	62-FD-084	Plutonic	Hornblende-biotite tonalite	14	421151	7392854	66	K	10	2469.9	6.9	Zircon	U/Pb	Direct	Igneous Crystallization
10657	62-FD-125	Plutonic	Granitic gneiss	13	544022	7349672	76	I	8	1904.6	8.8	Zircon	U/Pb	Direct	Metamorphic
10657	62-FD-125	Plutonic	Granitic gneiss	13	544022	7349672	76	I	8	2320.0	7.0	Zircon	U/Pb	Direct	Metamorphic
10657	62-FD-125	Plutonic	Granitic gneiss	13	544022	7349672	76	I	8	3247.0	10.0	Zircon	U/Pb	Estimate	Igneous Crystallization
10658	60-HF-272	Plutonic	Hornblende-biotite granite	14	504469	7379630	66	J	10	2587.0	13.0	Zircon	U/Pb	Direct	Igneous Crystallization
10659	60-HF-275A	Plutonic	Foliated granite	14	472212	7380277	66	J	12	2594.8	4.7	Zircon	U/Pb	Maximum Estimate	Igneous Crystallization
10660	60-HF-010	Plutonic	Orthopyroxene tonalite	15	370464	7382550	56	L	12	1845.0	18.0	Zircon	U/Pb	Direct	Metamorphic
10660	60-HF-010	Plutonic	Orthopyroxene tonalite	15	370464	7382550	56	L	12	2565.0	13.0	Zircon	U/Pb	Minimum Estimate	Igneous Crystallization
10660	60-HF-010	Plutonic	Orthopyroxene tonalite	15	370464	7382550	56	L	12	2611.0	35.0	Zircon	U/Pb	Maximum Estimate	Igneous Crystallization

UTM coordinates in NAD 27 projection

Sample Descriptions and Analytical Results

10651: Hornblende-magnetite granodiorite gneiss

Sample Number: 55-CD-159 **Geochronology Lab Number:** 10651

Location

Lat and Long NAD27	65° 40’ 29.6”N 104°24’1.3”W
UTM NAD 27	Zone 13 E527562 N7283614
Map Sheet 76H	

Geological Domain: Thelon tectonic zone

Sampling History

Sampled in 1955 by B.G. Craig. Collected from GSC archives April 2012.

Sample Preparation

Sample size: hand sample.
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) followed by Frantz™ Magnetic Separator. Zircon were hand picked from the NONMAG @ MAX 10°ss and mounted on an epoxy puck (IP642).

Sample Description

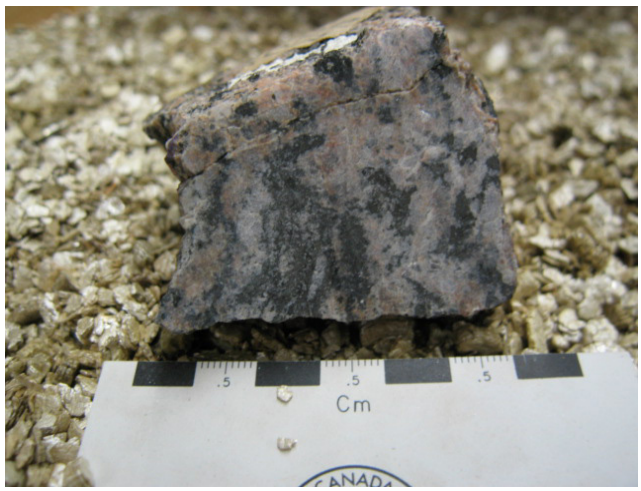

Figure 10651-1. Photograph of hand sample

The sample location corresponds to the western edge of a regionally extensive magnetic high that thins and becomes discontinuous ~9 km north of this location. This hornblende-magnetite granodiorite gneiss was collected from a small outcrop in an area with scant bedrock exposed. The rock has a weakly developed gneissosity with bands of hornblende and magnetite imperfectly segregated from aggregates of quartz, plagioclase, and K-feldspar (Figure 10651-1). Preferred shape fabric is largely absent, except for rare quartz and larger K-feldspar grains that are elongate parallel to the gneissosity. Within leucocratic layers, feldspar and quartz grains up to 5 mm in diameter are commonly surrounded by a fine-grained quartz-rich matrix. Magnetite grains up to 1 mm in diameter occur as inclusions in hornblende

and in the matrix along with minor ilmenite and pyrite. Biotite forms sparse isolated grains, but more commonly rims on magnetite and hornblende.

Zircon Description

The zircons recovered are of moderate overall quality and are prismatic stubby to elongate crystals (aspect ratio of 2-3:1). The grains are clear, colourless to light brown, and highly fractured. They range in size from 50 µm to 200 µm. Unidentified mineral inclusions are present in some grains (Figure 10651-2).

Figure 10651-2 Transmitted light image of zircon for sample 10651

In secondary electron microscope (SEM) backscatter electron (BSE) imaging the grains exhibit diffuse oscillatory zoning that is variably developed (Figure 10651-3B and 3C). Many grains contain brighter, relatively higher uranium interiors with darker, non-zoned outer rims. The contact between the zones is not generally sharp and the darker outer zones are interpreted as areas of recrystallization as opposed to new zircon growth.

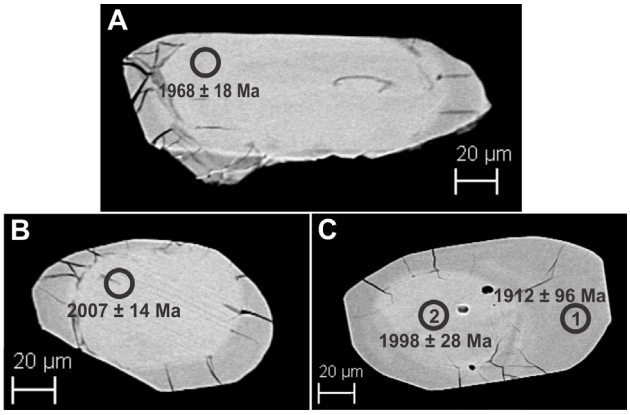

Figure 10651-3 SEM BSE images of representative zircons from sample 10651
A) Grain 25, B) Grain 42,C) Grain 31.

Analytical details

Date analyzed	June 19-20, 2012.
Mount Number	642
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.1%
External error in Pb/U ratio	0.31%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	100 um
Spot size	~20 um
Primary Beam Intensity	4- 10 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	No

Results and Age Interpretation

A total of 17 analyses were made on 12 individual grains. The analyses generally overlap the concordia curve and define two age populations which correspond to the two types of zircon domains described above. Eight analyses of the brighter interior domains yield a weighted mean age of = 2004.8 ± 5.3 Ma (0 of 8 rej. MSWD = 0.61, probability = 0.75). These analyses have U concentrations ranging from 240 to 620 ppm and Th/U ratios of 0.33-0.7. The darker outer parts of the zircon yield a younger weighted mean age of 1906 ± 10 Ma (0 of 8 rej. MSWD = 0.46, probability = 0.87). These analyses have lower U contents of 60-190 ppm. A single concordant analyses (white) has an intermediate age of 1968 Ma which could reflect overlapping of the two domains by the beam or incomplete Pb-loss from the area analyzed. The older age of 2004.8 ± 5.3 Ma is interpreted as the time of igneous crystallization of the rock, whereas the 1906 ± 10 Ma age is interpreted to reflect recrystallization of zircon during a younger metamorphic event.

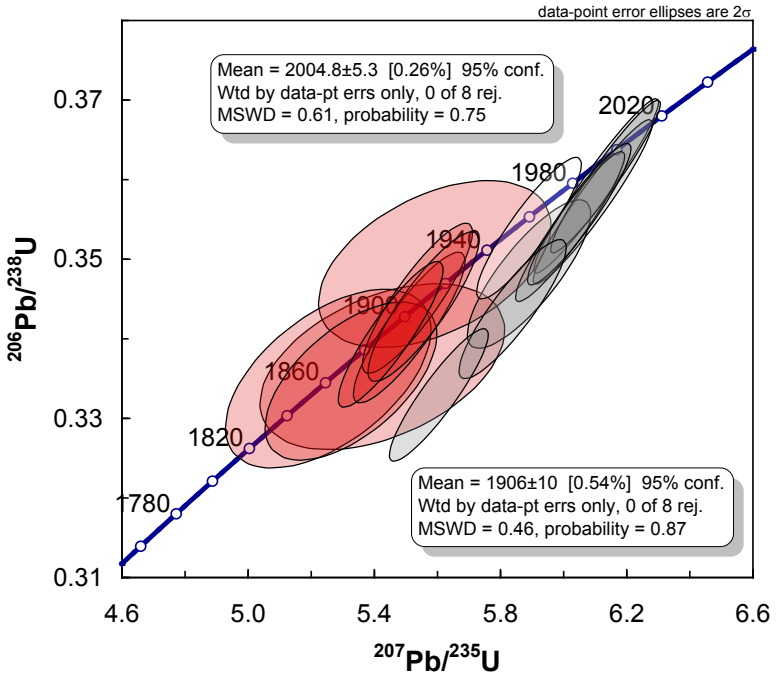

Figure 10651-4 U-Pb Concordia diagram for sample 10651. Red ellipses represent analyses of darker outer domains, grey ellipses represent analyses of interior brighter domains.

10652: Ms-Bt Metapsammite

Sample Number: 55-EA-261A **Geochronology Lab Number:** 10652

Location

Lat and Long NAD27	65°38’19.5”N 104°3’38.4”W
UTM NAD27	Zone 13 E543235 N7279776
Map Sheet 76H	

Geological Domain: Queen Maud block

Sampling History

Sampled in 1955 by K.E. Eade. Collected from GSC Archives March 2012.

Sample Preparation

Sample size: hand sample.
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircon were hand picked from the MAG @ 1.0A and the NONMAG @ 1.0A fractions and mounted on an epoxy puck IP642.

Sample Description

The sample location is near the southern end of a 20 x 35 km magnetic low on the west side of Queen Maud block. This sample was originally descriped as a highly strained granitic gneiss but has been reinterpreted to be of metasedimentary origin. The outcrop consists of strongly foliated (065/40°) metapsammite, interpreted to have been intruded by a massive plutonic rock (z10653). The fine-grained metapsammite consists of mm-scale quartzofeldspathic bands alternating with bands rich in muscovite and biotite blades that are aligned parallel to the layering. The grain size is generally < 0.1 mm, except for some attenuated, foliation-parallel quartz crystals within leucocratic layers. Accessory minerals are monazite (abundant), apatite, and zircon.

Figure 10652-1 Photograph of sample z10652

Zircon Description

The zircon recovered are ovoid stubby to subhedral prismatic crystals (aspect ratio of 1-3:1). The grains are generally of poor quality, moderately turbid, light brown with some red-orange iron staining and show minor fracturing. Grain size ranges from 50 µm to 200 µm. Unidentified inclusions are present in some grains (Figure 10652- 2A and 2B).

In SEM BSE images the grains exhibit a high degree of alteration. Many grains show brighter zircon interiors with dark alteration around the margins. Occasionally the alteration develops as embayments into the grain interior (Figure 10652- 3A). Little internal zonation is revealed under BSE but faint oscillatory zoning is evident is some grains (Figure 10652- 3B). In some cases, well developed oscillatory zoning can be seen along with radial fracturing of rims due to metamictizaton (Figure 10652- 3C).

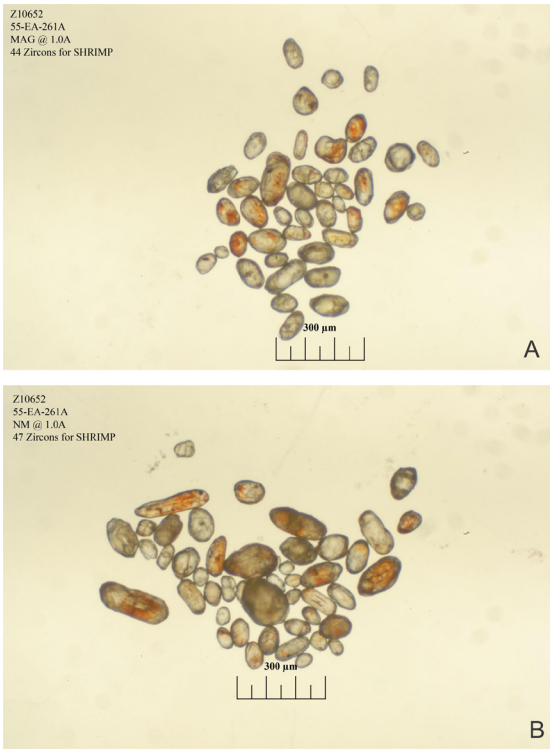

Figure 10652- 2 Transmitted light images of zircon A) Mag @ 1.0A fraction B) Non-mag @ 1.0A fraction

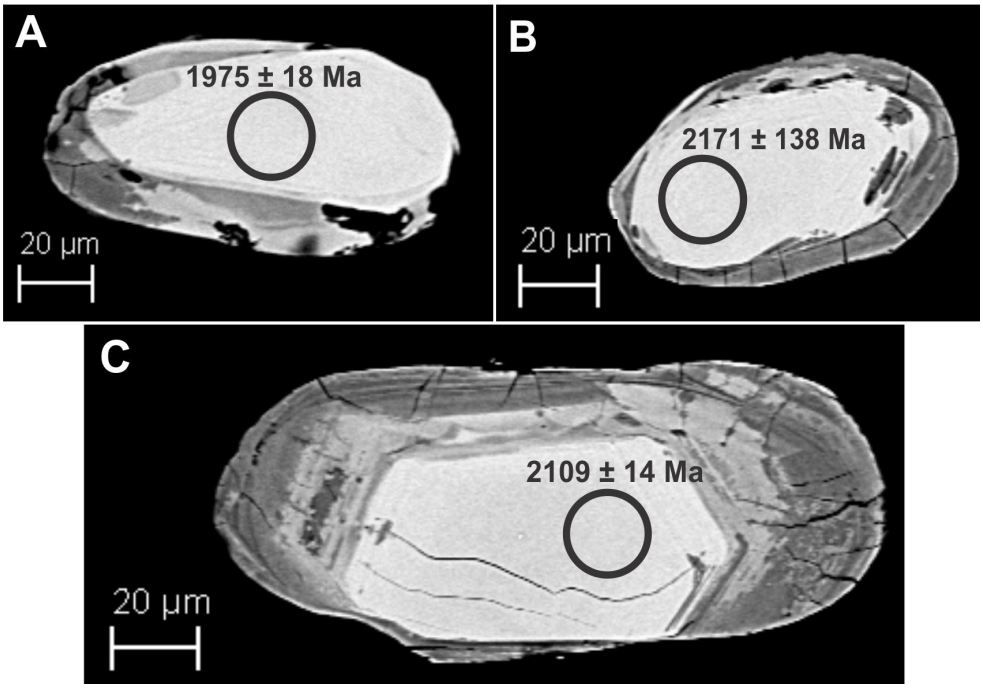

Figure 10652-3 SEM BSE images of representative zircon A) Grain 25 B) Grain 22 C) Grain 34

Analytical Details

Date analyzed	June 19-20, 2012.
Mount Number	642
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.1%
External error in Pb/U ratio	0.31%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	100 um
Spot size	~20 um
Primary Beam Intensity	4- 10 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	No

Results and Age Interpretation

A total of 12 analyses were made on 12 individual grains. The analyses have a range of $^{207}Pb/^{206}Pb$ ages from about 2500 Ma to 1940 Ma (Figure 10652- 4). The $^{207}Pb/^{206}Pb$ model age does not correlate with a particular zircon texture or grain type. The sample is dominated by zircon with Paleoproterozoic ages and assuming that the zircon represent detrital material then this rock is Paleoproterozoic, with a maximum age given by the youngest concordant result at 2.0 Ga. However it is known that zircon from rocks in this area have experienced high-grade metamorphism at ~1.9 Ga which caused extensive Pb-loss from zircon at that time. Therefore, it remains possible that the metasedimentary rock is older and zircon lost Pb during a metamorphic recrystallization at or after ~1.94 Ga.

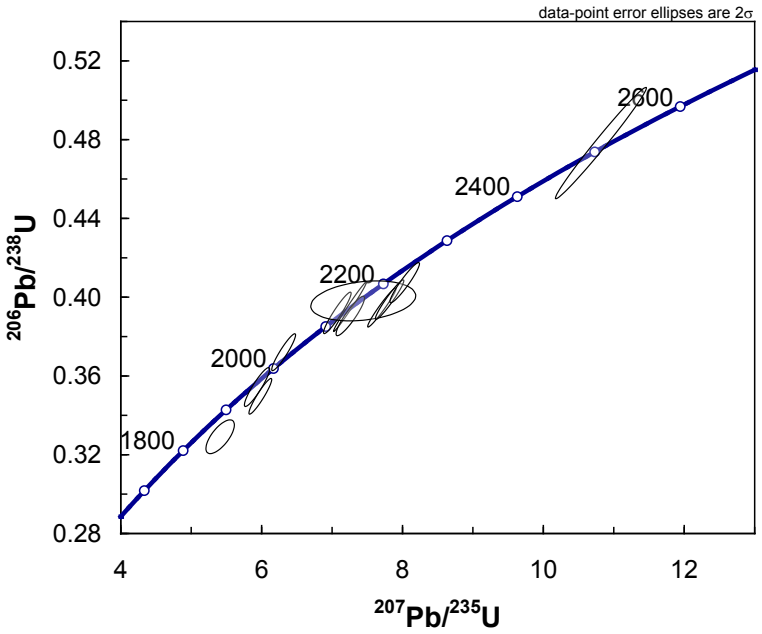

Figure 10652- 4 U-Pb Concordia diagram for sample 10652. Error ellipses are 2σ.

10653: Peraluminous Granite

Sample Number: 55-EA-261B **Geochronology Lab Number:** 10653

Location

Lat and Long NAD27	65° 38’ 19.5”N 104° 3’ 38.4”W
UTM NAD 27	Zone 13 E543235 N7279776
Map Sheet 76H	

Geological Domain: Queen Maud block

Sampling History

Sampled in 1955 by K.E. Eade. Collected from GSC archives April 2012.

Sample Preparation

Sample size: hand sample.
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircon were hand picked from the NONMAG @ MAX 10°ss and the MAG @ MAX 10°ss fractions and mounted on an epoxy puck (IP642) for SHRIMP analysis.

Sample Description

The sample location is near the southern end of a 20 x 35 km magnetic low on the west side of Queen Maud block. At this sample location, a strongly foliated metapsammite (z10652) was interpreted to be intruded by a more massive-looking plutonic rock (z10653, this sample). The sample is a well-foliated peraluminous granite, with the foliation defined by highly attenuated quartz and K-feldspar crystals (up to 1 x 6 mm in size) surrounded by a fine-grained, recrystallized quartzofeldspathic matrix. Aluminous phases include anhedral, fractured garnet, prismatic sillimanite, and highly embayed Fe-rich spinel that is commonly rimmed by sillimanite . Ilmenite is common, and rutile is present.

Figure 10653-1 Photograph of sample 10653.

Zircon Description

The zircon recovered from this sample is of poor quality, and includes equant to prismatic crystals (aspect ratio of 1-2:1) with rounded terminations. The grains show a low to high turbidity and are colourless to light brown in colour. They range in size from 50 µm to 250 µm. Moderate fracturing and unidentified inclusions are present in some of the grains (Figure 10653-2).

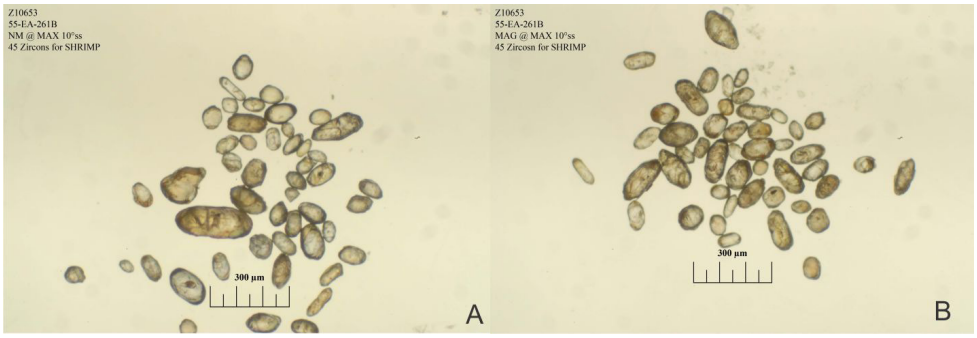

Figure 10653-2 Transmitted light image of pre-mounted zircons from sample 10653

In SEM BSE images the grains generally exhibit bright interiors with either flat, homogenous texture (Figure 10653-3A) or oscillatory zoning (Figure 10653-3B). All grains have darker altered rims (Figure 10653-3A and 3B).

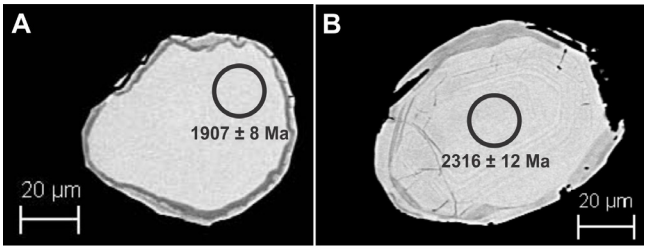

Figure 10653-3 SEM BSE images of representative zircons from sample 10653 A) Grain 4 B) Grain 5.

Analytical details

Date analyzed	June 20, 2012.
Mount Number	642
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.1%
External error in Pb/U ratio	0.31%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	100 um
Spot size	~20 um
Primary Beam Intensity	4- 10 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value applied	No

Results and Age Interpetation

A total of 14 analyses were made on 14 individual grains in the sample. The $^{207}Pb/^{206}Pb$ model ages range from 2492 Ma to about 1907 Ma. Uranium content is high and variable with values from 130 to 5600 ppm. Th/U ratios are variable (0.01-0.6). The three youngest analyses have

amongst the highest uranium contents (>900 ppm) but a consistent correlation of U and age is not observed. The younger analyses also tend to have higher Hf contents (>13000 ppm). The highest U content (5600 ppm) was determined from a darker zone that is altered and contains significant common Pb. The two youngest analyses have ages at 1911.5 ± 5.6 Ma. These analyses are from grains that have flat homogenous textures in BSE (e.g. grain 4; Figure 10653-3) which may indicate recrystallization as zircon with older apparent ages typically exhibit remnants of faint oscillatory zoning. The younger ages at ~1.91 Ga are interpreted to reflect metamorphic recrystallization of older zircon, and the spread in ages reflects variable degrees of Pb-loss. A 1.91 Ga metamorphic event is well documented regionally supporting this interpretation. The crystallization age of the rock is not determined but is likely to be older than 2.5 Ga.

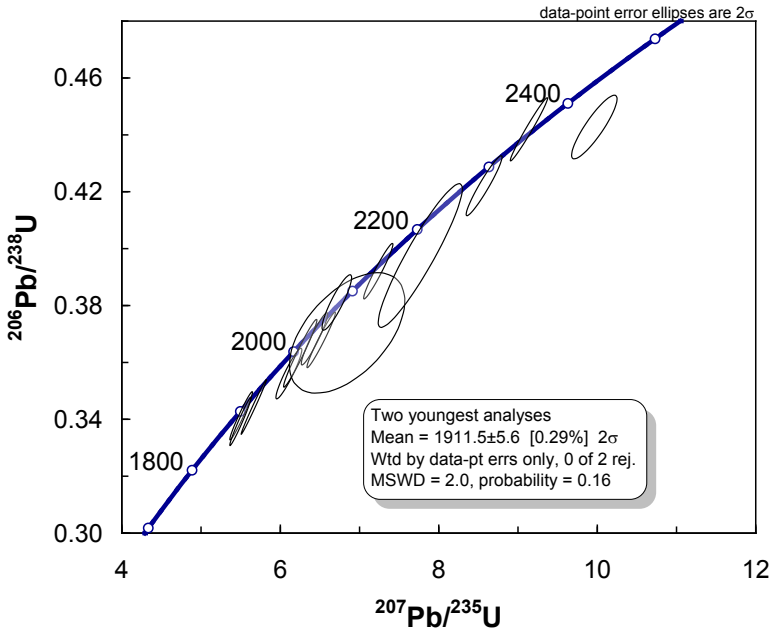

Figure 10653-4 U-Pb Concordia diagram for sample 10653.

10654: Garnetiferous Leucogranite

Sample Number: 55-EA-265 **Geochronology Lab Number:** 10654

Location

Lat and Long NAD27	65°46'7"N 104°10'15.3"W
UTM NAD 27	Zone 13 E537970 N7294180
Map Sheet 76H	

Geological Domain: Queen Maud block

Sampling History

Sampled in 1955 by K.E. Eade. Collected from the GSC archives in March, 2012

Sample Preparation

Sample size: hand sample
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircons were hand picked from the NONMAG @ MAX 10°ss fraction and mounted on an epoxy puck (IP642) for SHRIMP analysis.

Sample Description

The sample was collected from an area of abundant outcrop within a well-defined 20 x 35 km magnetic low on the west side of Queen Maud block. The outcrop contains massive to weakly foliated (005/90) garnet leucogranite interspersed with pink granitic gneiss. The leucogranite sample contains ~5 % equant, < 3 mm-diameter garnet grains that commonly have fractures filled with very fine-grained biotite needles. A moderate shape fabric is displayed by larger quartz grains set in a fine-grained matrix. Zircon and monazite form large grains up to 0.2 x 0.4 mm in size.

Figure 10654-1 Photograph of sample 10654.

Zircon Description

The zircon recovered from this sample are of moderate quality and consist of euhedral, stubby to elongate crystals (aspect ratio of 1.5-3:1). Some rounded equant grains were also present. The grains are clear and colourless to light brown showing minimal fracturing and very few inclusions (Figure 10654-2).

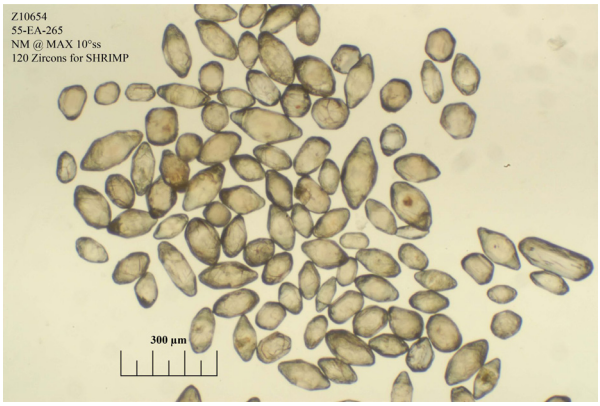

Figure 10654-2 Transmitted light images of zircon from sample 10654.

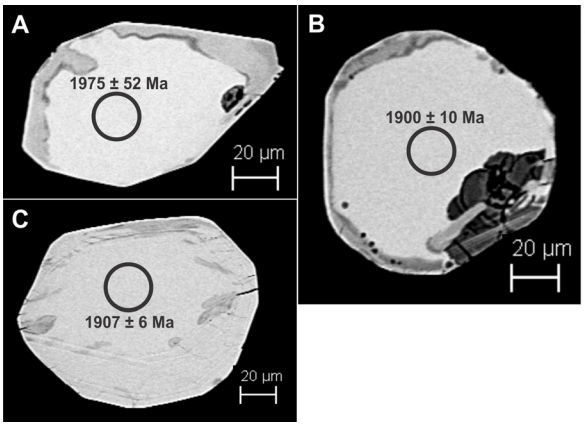

Figure 10654-3 SEM BSE images of representative zircons from sample 10655 A) Grain 7 B) Grain 23 C) Grain 60

The SEM BSE images reveal bright interiors and darker altered margins. Some grains appear to be highly altered around the perimeter (Figure 2A and 2B) and occasionally penetrating into grain interios (Figure 2A). Oscillatory zoning of the margins is sometimes present but weakly defined (Figure 2C).

Analytical details

Date analyzed	June 19-20, 2012.
Mount Number	642
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.1%
External error in Pb/U ratio	0.31%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	100 um
Spot size	~20 um
Primary Beam Intensity	4- 10 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	No

Results and Age Interpretation

Ten analyses of high uranium zircon yield a single age population with a weighted mean $^{207}Pb/^{206}Pb$ age of 1905.1 ± 4.4 (MSWD = 2.6, probability = 0.006). The zircon are enriched in uranium with contents of 500-1800 ppm and Th/U ratios of 0.1 to 0.2. The grains show evidence of sector and oscillatory zoning and the age is interpreted as the crystallization age of the rock.

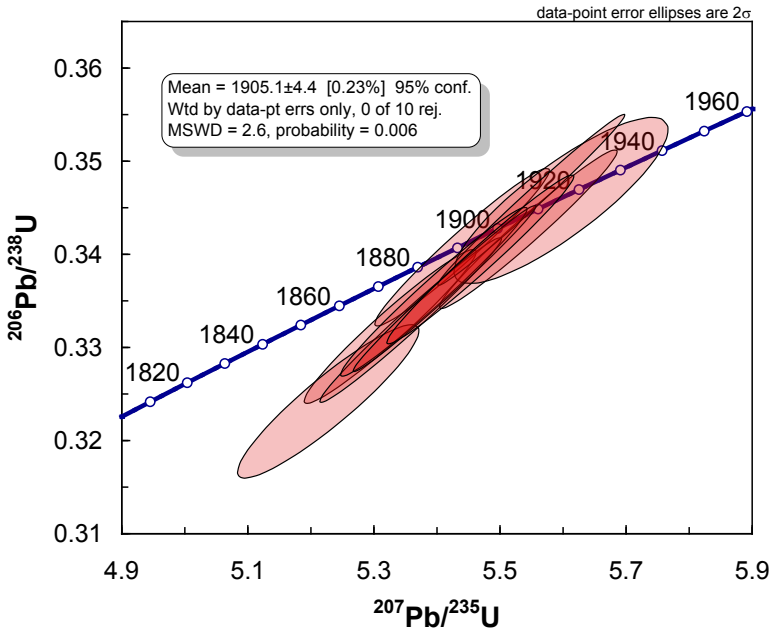

Figure 10654-4 U-Pb Concordia diagram for sample 10654.

10655: Hornblende-orthopyroxene Granite Gneiss

Sample Number: 62-FD-080 **Geochronology Lab Number:** 10655

Location

Lat and Long NAD27	66°39'16.6"N 101°43'22.5"W
UTM NAD 27	Zone 14 E379618 N7395318
Map Sheet 66K	

Geological Domain: Queen Maud block

Sampling History

Sampled in 1955 by J. A. Fraser. Collected from GSC archives April 2012.

Sample Preparation

Sample size: hand sample
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircon were hand picked from the NONMAG @ MAX 10°ss and mounted on an epoxy puck (IP642) for SHRIMP analysis.

Sample Description

The location where this sample was collected corresponds to a ~8 km-long magnetic high that is oriented approximately parallel to the 335/30° foliation measured in outcrop, at a high angle to the magnetic fabric immediately to the west. In this medium-grained (< 1 mm) sample, aggregates of equant to somewhat elongate grains of hornblende occur with sparse orthopyroxene, ilmenite, and magnetite. Whereas orthopyroxene commonly rims magnetite, a consistent reaction relationship between hornblende and orthopyroxene is not evident. The leucocratic component of the rock consists of irregular, equant grains of K-feldspar, plagioclase, and lesser quartz, suggesting post-tectonic recrystallization.

Figure 10655-1 Transmitted light images of zircon from sample 10655

Zircon Description

The zircon recoverd from this sample is of good to excellent quality, well faceted to subhedral, prismatic to elongate crystals (aspect ratio of 2-3:1). The grains are clear and colourless with some iron staining, minor fracturing and fluid and mineral inclusions.

The SEM BSE images reveal irregular zoning with darker interiors and brighter margins. Grain interiors exhibit faint oscillatory and sometimes sector zoning (Figure 10655-3B). The brighter margins are flat and homogenous (Figure 10655-3A). The contacts between the interior and exterior areas are generally faded, irregular and tend to follow the zone boundaries.

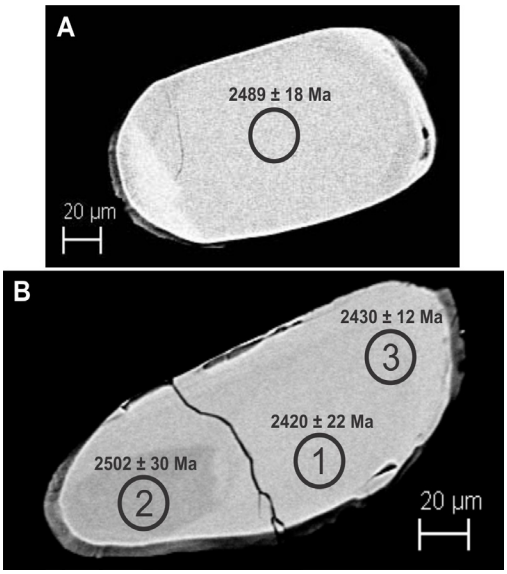

Figure 10655-2 BSE SEM images and individual ages for grains 34 (A) and 65 (B)

Analytical details

Date analyzed	June 19-20, 2012.
Mount Number	642
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.1%
External error in Pb/U ratio	0.31%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	100 um
Spot size	~20 um
Primary Beam Intensity	4- 10 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	No

Results and Age Interpretation

Twenty-seven analyses were made on nineteen grains targeting the dark grain interiors as well as the brighter grain margins. Thirteen of the analyses of grain interiors (red ellipses in Figure 10655-3) define a concordant cluster with a weighted mean age of 2492.3 ± 8.5 Ma (MSWD = 1.4, probability = 0.17) which is interpreted as the crystallization age of the rock (red ellipses Figure 10655-3). Nine analyses of the brighter zones have younger ages between 2430 and 2380 Ma and have higher Hf contents and lower Th/U ratios. These zones are interpreted to represent recrystallized areas of the older zircon. The analyses do not define a coherent age population and the timing of the recrystallization is undetermined. It could be as old as 2380 Ma or as young as 1900 Ma as the younger analyses plot along a reference discordia to a lower intercept of ~1900

Ma which may reflect partial Pb-loss at that time. A 2380 Ma age is consistent with estimates for high-grade metamorphism in some parts of the QMb (Schultz et al. 2007).

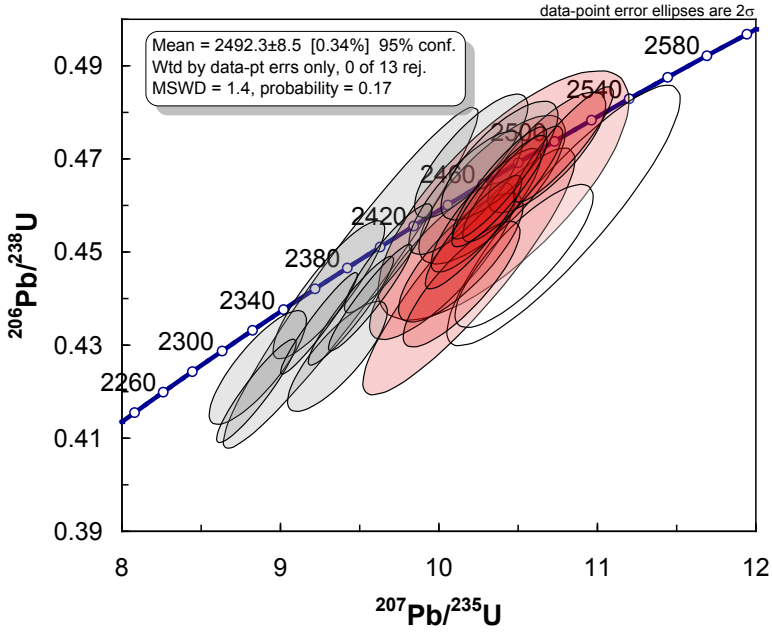

Figure 10655-3 U-Pb Concordia diagram for sample 10655. Red ellipses are analyses of grain interiors.

10656: Hornblende-Biotite Tonalite

Sample Number: 62-FD-084 **Geochronology Lab Number:** 10656

Location

Lat and Long NAD27	66°38’45.5”N 100°46’57.4”W
UTM NAD 27	Zone 14 E421151 N7392854
Map Sheet 66K	

Geological Domain: Queen Maud block

Sampling History

Sampled in 1962 by J. A. Fraser and collected from GSC archives April 2012.

Sample Preparation

Sample size: hand sample
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircons were hand picked from the NONMAG @ MAX 10°ss and mounted on an epoxy puck (IP646) for SHRIMP analysis.

Sample Description

This sample location corresponds to the west flank of a strong, regionally extensive, NNE-striking magnetic high on the east side of Queen Maud block, just north of Armark Lake. A 155/55° foliation was measured in the outcrop. In this sample randomly oriented, phenocrysts of plagioclase up to 5 mm in length are set in a finer grained (< 1 mm) matrix of quartz, plagioclase, hornblende, and biotite. A weak foliation is defined by most biotite and some elongate hornblende grains. Where biotite appears to have formed from hornblende breakdown, it defines a second fabric at a high angle to the first. Apatite is abundant, allanite occurs as inclusions in hornblende, and magnetite is sparse.

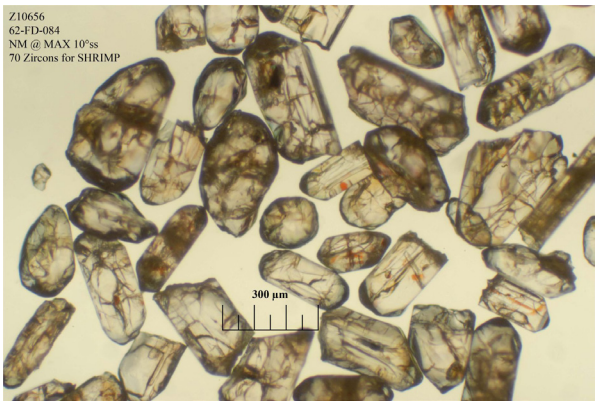

Figure 10656-1 Transmitted light image of zircon from sample 10656

Zircon Description

The zircon recovered is of poor to moderate quality, well faceted to subhedral, stubby to prismatic crystals (aspect ratio of 1.5-2:1) (Figure 10656-1). The grains are clear to moderately turbid and colourless to light brown. Some inclusions are present and most grains are highly fractured. They range in size from 100 µm to 400 µm in the long dimension.

In SEM BSE imaging the grains generally exhibit concentric to irregular zoning (Figure 10656-2a, b). Some grains have brighter interiors surrounded by darker margins (Figure 10656-2C).

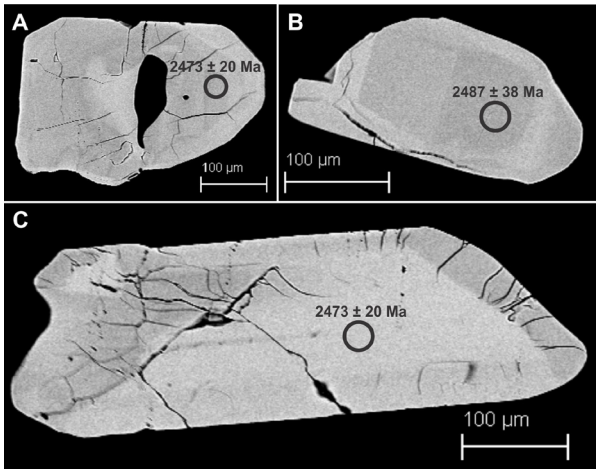

Figure 10656-2 SEM BSE images of representative zircons from sample 10656 A) Grain 5, B) Grain 38, C) Grain 7.

Analytical details

Date analyzed	June 27, 2012
Mount Number	646
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.36%
External error in Pb/U ratio	: 0.34%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	100 um
Spot size	~20 um
Primary Beam Intensity	7-8 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	No

Results and Age Interpretation

A total of 21 analyses were completed on 20 grains. Uranium contents vary from 120 to 700 ppm with Th/U ratios of 0.4-1.1. A single age population is defined with a weighted mean $^{207}Pb/^{206}Pb$ age of 2469.9 ± 6.9 Ma (MSWD = 2.0, probability = 0.005, 20 of 21). There is some excess scatter in the data as indicated by the low probability of fit, which may be due to minor Pb-loss. The age is interpreted as the time of crystallization of the granite (Figure 10656-3).

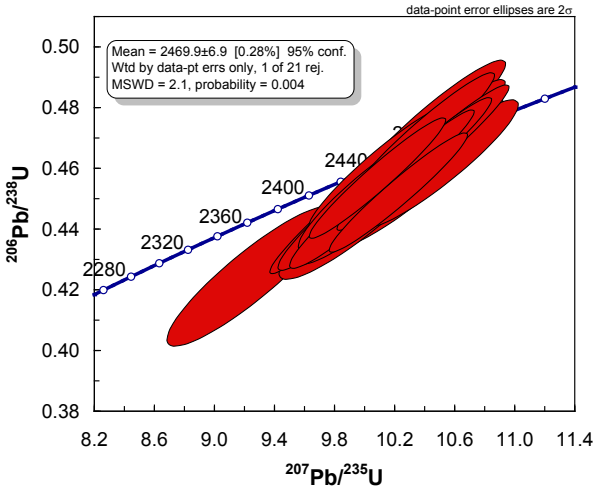

Figure 10656-3 U-Pb Concordia diagram.

10657: Feldspar porphyroclastic Granitic Gneiss

Sample Number: 62-FD-125 **Geochronology Lab Number:** 10657

Location

Lat and Long NAD27	66°15'56.2"N 104°1'11.5"W
UTM NAD 27	Zone13 E544022 N7349672
Map Sheet 76I	

Geological Domain: Queen Maud block

Sampling History

Sampled in 1962 by J. A. Fraser. Collected from GSC archives April 2012.

Sample Preparation

Sample size: hand sample
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircons were hand picked from the NONMAG @ MAX 10°ss and mounted on an epoxy puck (IP647) for SHRIMP analysis.

Sample Description

This sample locality from the west side of QMb corresponds to the north-striking, west flank of a region that appears from its magnetic fabric to have been complexly folded. A 355/55° foliation was measured in outcrop. This granite gneiss is characterized by K-feldspar and plagioclase porphyroclasts up to 7 mm in length that are enveloped by fine-grained biotite, feldspars, and attenuated quartz that define a crenulated, strong foliation. Abundant epidote forms texturally early crystals in places folded around plagioglase porphyroclasts, as well as late crystals that have overgrown foliation-defining biotite. Accessory phases include apatite, titanite, magnetite, pyrite, and pyrrhotite.

Zircon Description

Zircon recovered from this rock is of poor to moderate quality. Grain morphology is dominated by well faceted subequant to elongate prismatic crystals (aspect ratio of 2-3:1). The grains are clear to highly turbid and light brown to dark brown in colour. Many grains exhibit extensive metamictization. Some unidentified inclusions are present and most grains are extensively fractured. They range in size from 50 to 400 μm in the long dimension (Figure 10657-1).

In SEM BSE imaging the zircons display highly variable textures. A significant population preserves well defined oscillatory zoning which is in places recrystallized to a homogenous, brighter zircon (Figure 10657-2A). Many grains show extensive zones of recrystallization that appear as irregular brighter BSE zones (Figure 10657-2B). These zones may be confined to the outer rim of crystals, or penetrate irregularly throughout the grain interior.

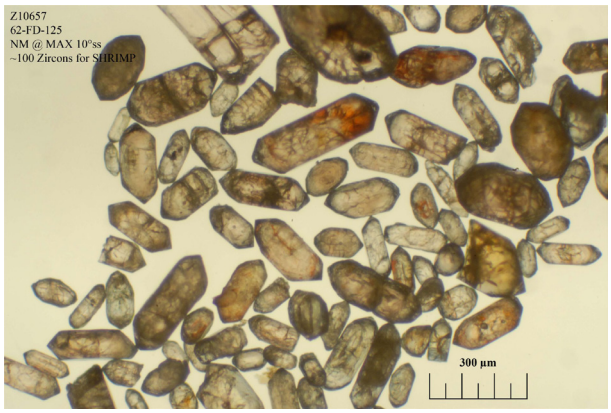

Figure 10657-1 Transmitted light image of pre-mount zircons from sample 10657.

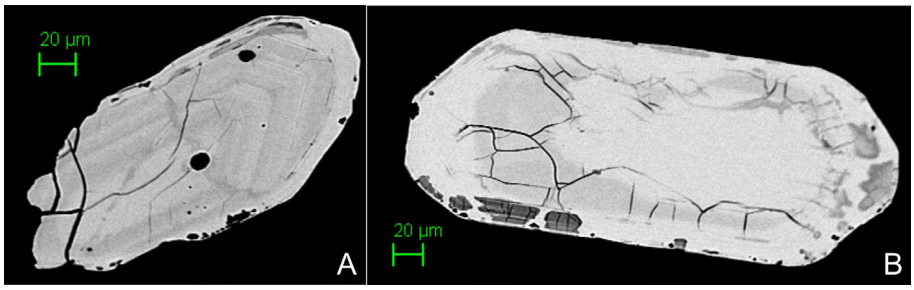

Figure 10657-2 SEM BSE images of representative zircon from sample 10657

Analytical details

Date analyzed	June 28-29, 2012
Mount Number	647
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.25%
External error in Pb/U ratio	0.30%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	100 um
Spot size	~20 um
Primary Beam Intensity	6-8 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	No

Results and Age Interpretation

Thirty-two analyses were made on twenty individual crystals. Three principal age groupings were determined (Figure 10657-3): 1) zircon with Archean ages from 2.75 Ga to 3.25 Ga; 2) a group of zircon of variable composition with ages between 2.31 and 2.39 Ga; and 3) zircon with ages between 1.90 and 1.95 Ga. None of the three groups define a single age population. The

Archean zircons typically preserve oscillatory zoning and occur as individual crystals or as cores within partially recrystallized grains. The U-Pb data for these analyses spread along a reference discordia from 3247 ± 10 Ma, the weighted mean age of the two oldest analyses, to ~2350 Ma, a time of extensive zircon recrystallization and partial Pb-loss. The 3247 ± 10 Ma age is the preferred estimate for the original crystallization age of the sample with the other Archean grains recording variable amounts of Paleoproterozoic Pb-loss. Fifteen analyses of zircon have ages between 2392 ± 10 Ma and 2305 ± 10 Ma. These analyses include zircon with variable textures and a wide range in Th/U composition between 0.01 and 1.4. The eleven youngest of these analyses have relatively high Th/U ratios (>0.1) and define an age of 2320 ± 7 Ma (MSWD = 2.4, probability = 0.008). The four older analyses have lower Th/U ratios, recrystallized textures and ages of ca. 2370-2390 Ma. The data argue for episodic metamorphic recrystallization during this interval. A second metamorphic episode is recorded by the five youngest analyses is dated at 1904.6 ± 8.8 Ma (MSWD = 1.2, probability = 0.30). As with the ~2.3 Ga metamorphic event, the data do not define a single age population pointing to inheritance and/or protracted metamorphic recrystallization over the interval 1970 -1905 Ma.

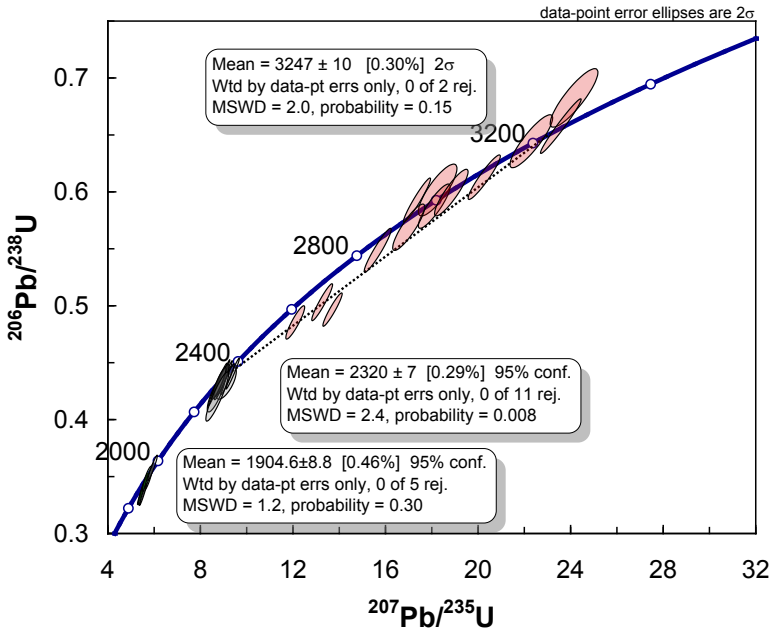

Figure 10657-3 Concordia diagram for sample 10657. Dashed line is reference discordia between 3.25 and 2.35 Ga. Mean ages are $^{207}Pb/^{206}Pb$ ages.

10658: Hornblende-biotite Granite

Sample Number: 60-HF-272 **Geochronology Lab Number:** 10658

Location

Lat and Long NAD27	66°32'14.7"N 98°53'57.9"W
UTM NAD 27	Zone 14 E504469 N7379630
Map Sheet 66J	

Geological Domain: Queen Maud blcok

Sampling History

Sampled in 1960 by W.W. Heywood. Collected from GSC archives April 2012.

Sample Preparation

Sample size: hand sample
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircon were hand picked from the NONMAG @ MAX 10°ss and mounted on an epoxy puck (IP647) for SHRIMP analysis.

Sample Description

The location of this sample corresponds to a pronounced magnetic high more than 20 x 180 km in size and striking northeast on the east side of the Sherman basin. This medium-grained (< 2 mm) granite has a moderately developed foliation defined by thin bands of hornblende and biotite and a weak shape fabric in feldspar and quartz crystals. Magnetite forms anhedral, interstitial grains less than 0.1 mm in size. Accessory minerals include titanite, apatite, epidote, and pyrite.

Zircon Description

Zircon is of poor to moderate quality, well faceted to subhedral and prismatic to elongate crystals (aspect ratio of 2-3:1). The grains are highly fractured, clear to somewhat turbid and colourless to light brown. They range in size from 50 μm to 400 μm in long dimension (Figure 10658-1).

In SEM BSE imaging the grains display bright interiors with concentric zoning typical of magmatic crystallization (Figure 10658-2A, B, C). Radial fracturing of outer margins from metamictization is present in some grains (Figure 10658-2A). There is no evidence for extensive recrystallization.

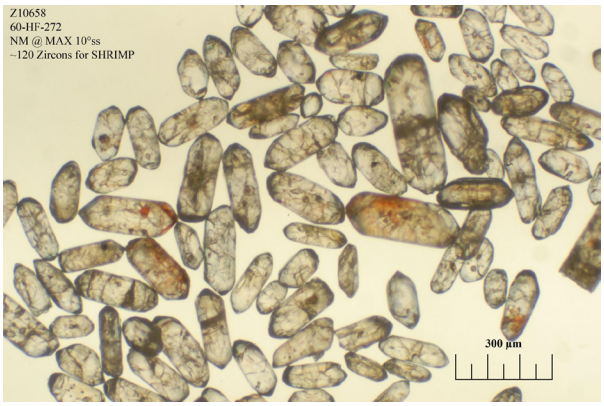

Figure 10658-1 Transmitted light image of zircon from sample 10658.

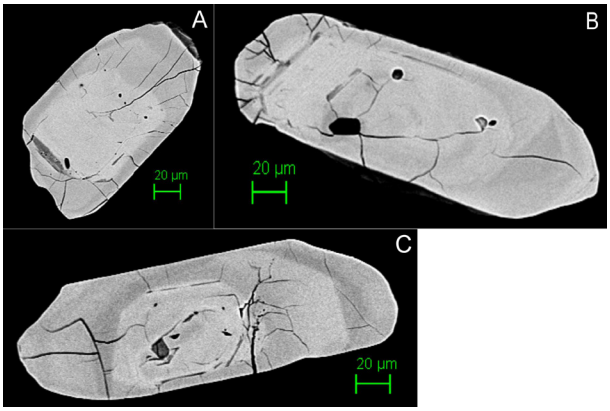

Figure 10658-2 SEM BSE images of representative zircons from sample 10658.

Analytical details

Date analyzed	June 28-29, 2012
Mount Number	647
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.25%
External error in Pb/U ratio	0.30%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	100 um
Spot size	~20 um
Primary Beam Intensity	6-8 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	No

Results and Age Interpretation

A total of thirteen analyses yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2594 ± 13 Ma (MSWD = 3.3 probability = 0). The population exhibits excess scatter. Three analyses have slightly older ages of ~2.62 Ga and may represent xenocrysts (Figure 10658-3). Excluding these three analyses yields a weighted mean age of 2581 ± 12 Ma (MSWD = 1.5, probability = 0.14). The Tukey biweight means age is 2587 ± 13 Ma, overlaps the weighted mean ages. As this method is more resistant to outliers it is taken as the preferred age of the rock.

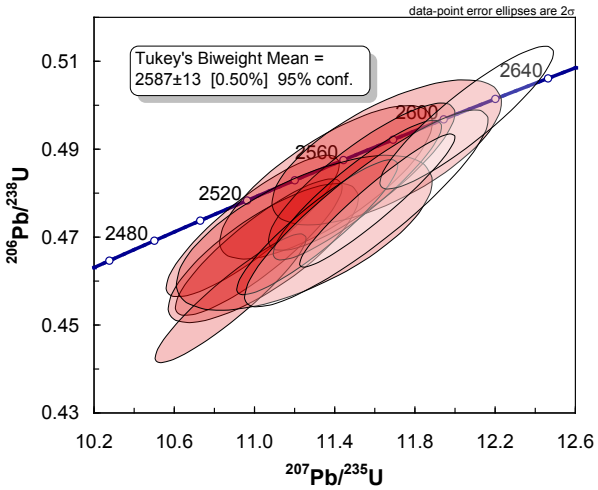

Figure 10658- 3 U-Pb Concordia diagram for sample 10658.

10659: Foliated Granite

Sample Number: 60-HF-275A **Geochronology Lab Number:** 10659

Location

Lat and Long NAD27	66°32'31.2"N 99°37'31.9"W
UTM NAD 27	Zone 14 E472212 N7380277
Map Sheet 66J	

Geological Domain: Queen Maud block

Sampling History

Sampled in 1960 by W.W. Heywood. Collected from GSC archives April 2012

Sample Preparation

Sample size: hand sample
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircon were hand picked from the NONMAG @ MAX10°ss and mounted on an epoxy puck (IP648) for SHRIMP analysis.

Sample Description

This sample is located near the northern edge of a small, but pronounced magnetic high that is truncated by the eastern boundary of the Sherman basin. This strongly foliated granite has feldspar crystal up to 2 mm in diameter surrounded by a finer-grained matrix in which many feldspars grains, but particularly quartz crystals show a strong shape fabric. Fine-grained biotite blades are generally aligned with the foliation, as is the more abundant chlorite. Epidote forms small crystals at a high angle to the foliation, suggesting post-tectonic greenschist-facies metamorphism that involved biotite and plagioclase breakdown to chlorite and sericite, respectively. Magnetite is abundant, with grains up to 0.3 mm long aligned with the foliation. Accessory minerals include sparse titanite, apatite, and ilmenite.

Figure 10659-1Transmitted light image of zircon from sample 10659.

Zircon Description

The selected zircons are of poor quality, subhedral and prismatic to elongate crystals (aspect ratio of 2-3:1). They are turbid and light brown to dark brown in colour. Their size

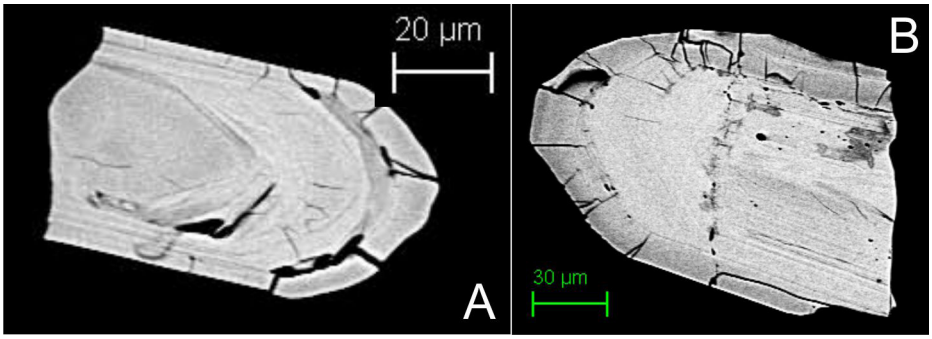

Figure 10659-2 SEM BSE images of representative zircons from sample 10659.

ranges from 50 x 100 µm to 100 x 300 µm (Figure 10659-1). Unidentified inclusions are present in some grains.

The SEM BSE images reveal that almost all of the zircon population displays oscillatory zoning. Most of the grains are partially metamict and most grains were not suitable for analyses. Some grain show distinct core rim relationships.

Analytical details

Date analyzed	July 12, 2012
Mount Number	648
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.0%
External error in Pb/U ratio	0.24%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	70 um
Spot size	~15 um
Primary Beam Intensity	2.3-2.5 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	1.0029

Results and Age Interpretation

Twenty-four analyses of twenty-three grains yield a range of concordant ages from 2955 to 2478 Ma. Uranium content is high and variable from 170 to 1700 ppm with variable Th/U ratios from 0.01 to 0.78. There is no clear correlation of age with composition. The two youngest analyses are slightly reversely discordant. The data do not define a dominant age population. The two oldest analyses represent core material, although in both cases the surrounding zircon was too altered to afford analysis. Distinct age groups cluster at 2705 Ma, 2638 Ma, and 2595 Ma, with three analyses having younger ages to 2478 Ma (Figure 10659-3, 4). It is unclear how to interpret the data. It is possible that the igneous age is given by the zircon population at 2594.8 ± 4.7 Ma, in which case the older analyses would represent inherited material with the younger analyses reflecting some Pb-loss

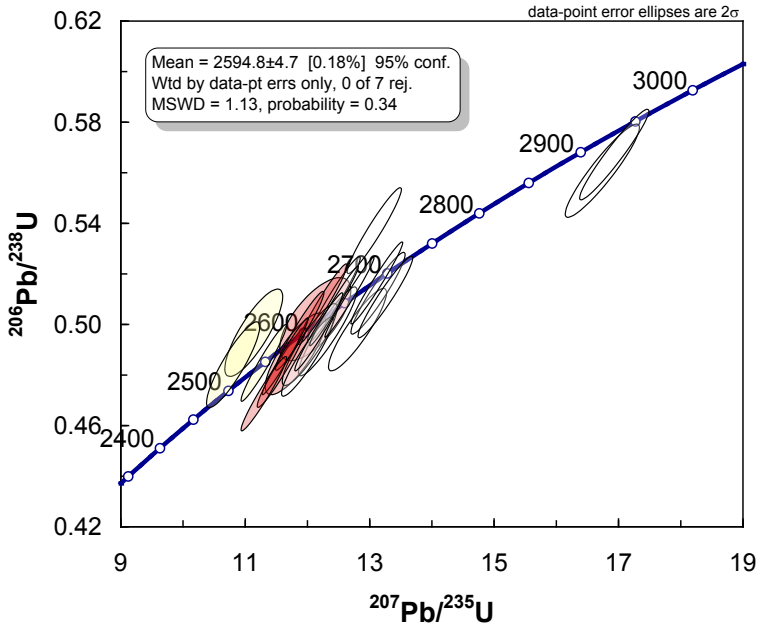

Figure 10659-3 Concordia diagram for sample 10659. Red ellipses identify a group of seven analyses used to calculate a maximum igneous crystallization age. Yellow elleipses are two analyses of younger zircon of uncertain significance.

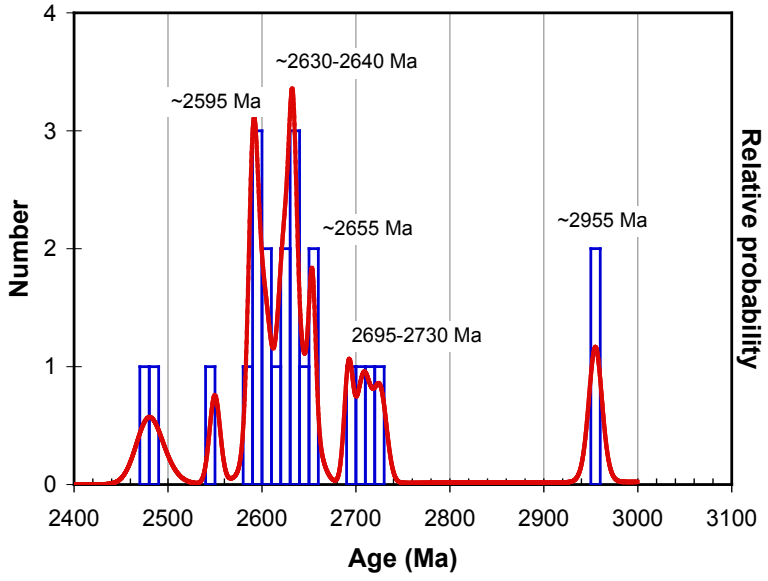

Figure 10659-4 Probability density plot (red) with histogram (blue) showing range of ages and principal modes.

10660: Orthopyroxene-bearing Tonalite

Sample Number: 60-HF-010 **Geochronology Lab Number:** 10660

Location

Lat and Long NAD27	66°32'11.4"N 95°54'58.2"W
UTM NAD 27	Zone 15 E370464 N7382550
Map Sheet 56L	

Geological Domain: Rae craton
Sampling History

Sampled in 1960 by W.W. Heywood. Collected from GSC archives April 2012.

Sample Preparation

Sample size: hand sample
Electronic pulse disaggregation (EPD) at Overburden Drilling Management Inc., Ottawa. Heavy liquid separation in Methyl Iodide (MI) heavy liquids followed by Frantz™ Magnetic Separator. Zircon were hand picked from the NONMAG @ 0.5A and mounted on an epoxy puck (IP648) for SHRIMP analysis.

Sample Description

The location of this sample is near the north end of a distinct, ~30 x 60 km magnetic high that extends north of the Amer shear zone. At the sample location, well foliated (020/90) granitic gneiss was noted to have a lighter colour and lower mafic content than typical of this general region. The sample consists largely of medium-grained (< 2 mm) plagioclase and quartz, which commonly form elongate crystals (aspect ratio up to 4:1), and sparse K-feldspar. Anhedral, mostly embayed crystals of orthopyroxene less than 0.1 mm in length may be partly rimmed by fine-grained biotite. Ilmenite forms irregular, interstitial grains less than 0.2 mm in size.

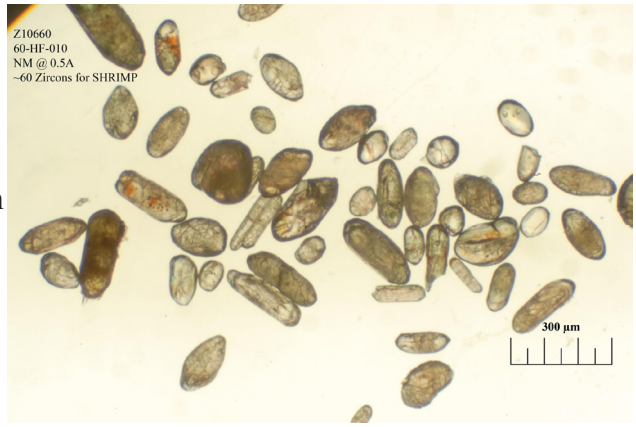

Figure 10660-1 Transmitted light image of pre-mounted zircons from sample 10660.

Zircon Description

Very few zircon (~60) were recovered from this sample and they are of exceptionally poor quality. Zircon are subhedral to

rounded and form subequant to elongate prismatic crystals (aspect ratio of 1.5-3:1). The grains are mostly turbid and dark brown in colour. A subset are clearer and colourless. Grain size ranges from 50 x 100 µm to 100 x 300 µm (Figure 10660-1).

The SEM BSE images show extensive alteration of the crystals with only minor remnants of primary zircon preserved. Alteration is persistent in patches throughout the grains as well as extensive fracturing. Often zircon cores are extensively altered with numerous inclusions or porosity (Figure 10660-2C). The rims around the high uranium cores exhibit radial fracturing. Faint oscillatory zoning is visible in outer margins of the grains indicating an igneous origin (Figure 10660-2A, 2B and 2C).

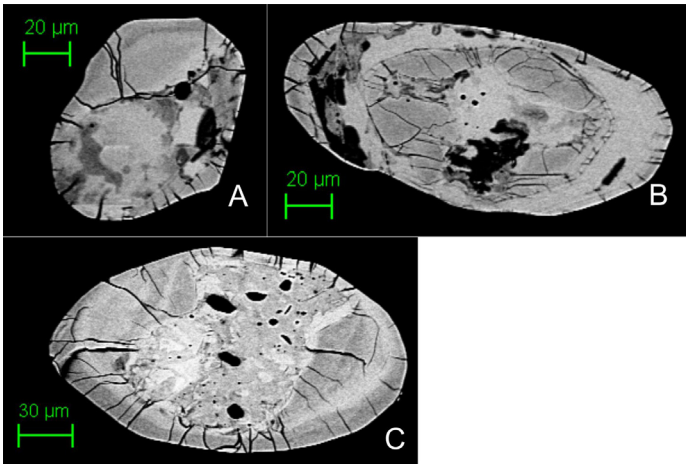

Figure 10660-2 SEM BSE images of representative zircons from sample 10660

Analytical details

Date analyzed	July 12, 2012
Mount Number	648
Primary Calibration standard	6266
Error in Pb/U ratio from calibration	1.0%
External error in Pb/U ratio	0.24%
Data reduction software used	SQUID 2.22.08.04.30, rev. 30 Apr 2008
Kohler aperture	70 um
Spot size	~15 um
Primary Beam Intensity	2.3-2.5 nA
Raster time	1.5 minutes
Scans per analysis	5
Secondary Standard	1242
Mass Fractionation value	1.0029

Results and Age Interpretation

Zircon were of extremely poor quality and only a small number of analyses were accomplished. The majority of the analyses have Neoarchean ages ranging from 2.46 to 2.695 Ga (Figure 10660-3). Two grains have Paleoproterozoic ages for which three analyses yield a weighted

mean $^{207}Pb/^{206}Pb$ age of 1845 ± 18 Ma (MSWD = 0.49, probability = 0.69). The Archean zircon yield an ambiguous age interpretation. One analyses has a discordant $^{207}Pb/^{206}Pb$ age of 2695 Ma that is 100 Ma older than the next oldest analyses and is considered to be an inherited crystal. A group of five analyses, less than 4% discordant, yield a weighted mean $^{207}Pb/^{206}Pb$ age 2565 ± 13 Ma (MSWD = 2.9, probability = 0.022). A sixth, discordant analyses has an age that falls within this group but demonstrates recent Pb-loss. The low probability of fit indicates excess scatter in the data which may indicate small amounts of Pb-loss in one or more of these grains. Paleoproterozoic Pb-loss is indicated by analyses 15.1 with a discordant age of 2461 Ma. Regression of the data excluding the inherited and discordant analyses yields an upper intercept age of 2611 ± 35 Ma (MSWD = 1.16; grains 6.2 and 18.1 excluded) with a lower intercept anchored at 1845 ± 18 Ma (Figure 3). The 2565 ± 13 Ma age is considered a minimum estimate of the crystallization of the rock, whereas the 2611 ± 35 Ma age represents a maximum age estimate. The 1845 ± 18 Ma age is interpreted as a time of metamorphism of the rock

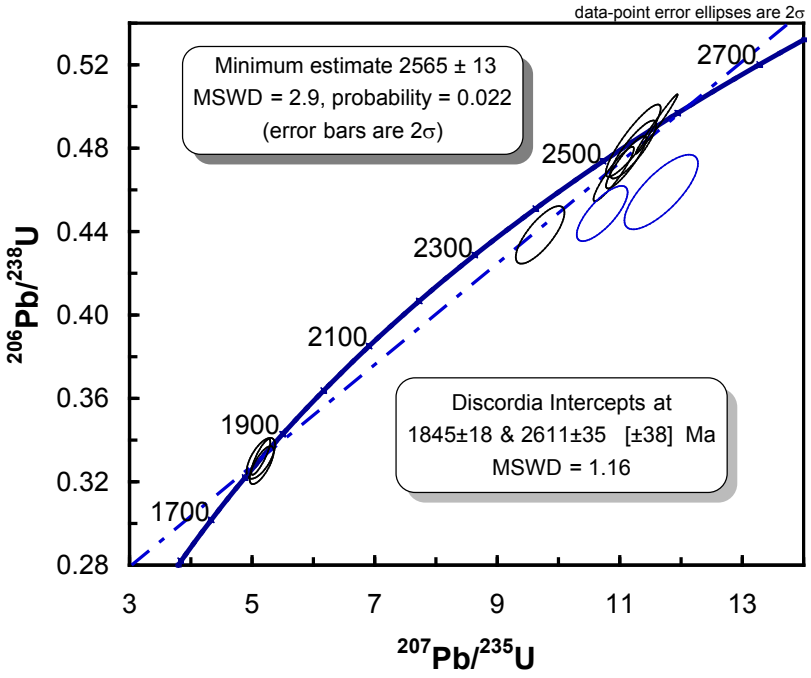

Figure 10660-3 U-Pb Concordia diagram for sample 10660. Blue ellipses demonstrate recent Pb-loss and were excluded from the regression analyses.

Acknowledgements

Ann Thériault, Angelique Magee and Michele Coyne are thanked for their help discovering the samples within the GSC sample archive facility. Beth Hillary provided support in managing information relating to original data and notes. John Percival spearheaded the effort to organize the archive samples and provided support as project leader. Sally Pehrsson provided considerable input on sample selection and geological discussion. Ray Chung and Ron Christie expertly prepared zircon separates. Julie Peressini guided the sample grain selection and generally moved things through the process. Pat Hunt is thanked for her skill in acquiring the SEM images and Tom Pestaj and Nicole Rayner for their support preparing ion probe mounts as well as SHRIMP lab operations. A review of this report by Nicole Rayner greatly improved the clarity of this manuscript.

References

Berman, R.G., Sanborn-Barrie, M., Stern, R.A., and Carson, C.J. 2005. Tectonometamorphism at ca. 2.35 and 1.85 ga in the Rae domain, western Churchill province, Nunavut, Canada: Insights from structural, metamorphic and in situ geochronological analysis of the southwestern committee bay belt. Canadian Mineralogist, **43**: 409-442.

Berman, R.G., Pehrsson, S., Davis, W.J., Ryan, J.J., Qui, H., and Ashton, K.E. 2012. The Arrowsmith orogeny: Geochronological and thermobarometric constraints on its extent and tectonic setting in the Rae craton, with implications for pre-Nuna supercontinent reconstruction. Precambrian Research, (dx.doi.org/10.1016/j.precamres.2012.10.015).

Chacko, T., De, S.K., Creaser, R.A., and Muehlenbachs, K. 2000. Tectonic setting of the Taltson magmatic zone at 1.9-2.0 Ga: A granitoid-based perspective. Canadian Journal of Earth Sciences, **37**: 1597-1609.

Fraser, J.A. 1988. Geology of the Woodburn lake map area, District of Keewatin. Geological Survey of Canada, Paper, **87-11**: 1-12.

Fraser, J.A. 1964. Geological notes on northeastern District of Mackenzie, Northwest Territories. Geological Survey of Canada, Paper, **63-40**.

Frisch, T. 2000. Precambrian geology of Ian Calder lake, Cape Barclay, and part of Darby lake map areas, south-central Nunavut. Geological Survey of Canada, Bulletin, **542**: 1-51.

Frisch, T. 1983. Precambrian geology of the Prince Albert hills, western Melville peninsula, Northwest Territories. Geological Survey of Canada, Bulletin, **346**: 1-70.

Frith, R.A. and van Breemen, O. 1990. U-Pb zircon age from the himag plutonic suite, Thelon tectonic zone, Churchill structural province, Northwest Territories. Geological Survey of Canada, Paper, **89-2**: 49-54.

Henderson, J.B. and Thériault, R.J. 1994. U-Pb zircon evidence for circa 3.1 ga crust south of the McDonald fault, northwestern Canadian Shield, Northwest Territories. Geological Survey of Canada, Current Research, **1994-F**: 43-47.

Henderson, J.B. and van Breemen, O. 1992. U - Pb zircon ages from an Archean orthogneiss and a Proterozoic metasedimentary gneiss of the Thelon tectonic zone, District of Mackenzie, Northwest Territories. Geological Survey of Canada, Paper, **91-2**: 25-33.

Henderson, J.B., McGrath, P.H., Theriault, R.J., and Van Breemen, O. 1990. Intracratonic indentation of the B Slave province into the early Proterozoic Thelon tectonic zone of the Churchill province, northwestern Canadian Shield. Canadian Journal of Earth Sciences, **27**: 1699-1713.

Heywood, W.W. 1961. Geological notes, northern District of Keewatin. Geological Survey of Canada, Paper, **61-18**.

Heywood, W.W. and Schau, M. 1978. A subdivision of the northern Churchill structural province. Geological Survey of Canada, Paper, **78-1A**: 139-143.

Hinchey, A.M., Davis, W.J., Ryan, J.J., and Nadeau, L. 2011. NeoArchean high-potassium granites of the Boothia mainland area, Rae domain, Churchill Province: U-Pb zircon and Sm-Nd whole rock isotopic constraints. Canadian Journal of Earth Sciences, **48**: 247-279.

Hoffman, P.F. 1989. Precambrian geology and tectonic history of North America. The Decade of North American Geology Project, Volume **A**: 447-512.

Hoffman, P.F. 1988. United plates of America, the birth of a craton: Early Proterozoic assembly and growth of Laurentia. Annual Review of Earth and Planetary Sciences, **16**: 543-603.

James, D.T., van Breemen, O., and Loveridge, W.D. 1988. Early Proterozoic U-Pb zircon ages for granitoid rocks from the Moraine lake transect, Thelon tectonic zone, District of Mackenzie. Geological Survey of Canada, Paper, **88-2**: 67-72.

Ludwig, K.R., 2003. Using Isoplot/Ex, version 3, A geochronological toolkit for Microsoft Excel: Berkeley Geochronology Center. Special Publications, **4**, 70 p.

Rainbird, R.H., Davis, W.J., Pehrsson, S.J., Wodicka, N., Rayner, N., and Skulski, T. 2010. Early Paleoproterozoic supracrustal assemblages of the Rae domain, Nunavut, Canada: Intracratonic basin development during supercontinent break-up and assembly. Precambrian Research, **181**: 167-186.

Roddick, J.C. and van Breemen, O. 1994. U-Pb zircon dating: A comparison of ion microprobe and single grain conventional analyses. Geological Survey of Canada, Current Research, **1994-F**: 1-9.

Schultz, M.E.J. 2007, The Queen Maud block, Nunavut – Genesis of a large felsic igneous province in the earliest Paleoproterozoic and implications for Laurentian geotectonic models, Unpublished M.Sc. Thesis, University of Alberta, 71 p.

Schultz, M.E.J., Chacko, T., Heaman, L.M., Sandeman, H.A., Simonetti, A., and Creaser, R.A. 2007. Queen Maud block: A newly recognizedPpaleoproterozoic (2.4-2.5 Ga) terrane in northwest Laurentia. Geology, **35**: 707-710

Skulski, T., Sandeman, H., Sanborn-Barrie, M., MacHattie, T., Young, M., Carson, C., Berman, R.G., Brown, J., Rayner, N., Panagapko, D., Byrne, D., and Deyell, C. 2003. Bedrock

geology of the Ellice Hills map area and new constraints on the regional geology of the Committee Bay area, Nunavut. Geological Survey of Canada, Current Research (Online), **2003-C22**: 1-11.

Stern, R.A. 1997. The GSC sensitive high resolution ion microprobe (SHRIMP): Analytical techniques of zircon U-Th-Pb age determinations and performance evaluation. Geological Survey of Canada, Current Research, **1997-F**: 1-31.

Stern, R.A. and Amelin, Y. 2003. Assessment of errors in SIMS zircon U-Pb geochronology using a natural zircon standard and NIST SRM 610 glass. Chemical Geology, **197**: 111-142.

Tella, S. 1994. Geology, Amer Lake (66H), Deep Rose Lake (66G) and parts of Pelly Lake (66F); Geological Survey of Canada, Report Number 2969. scale 1:250000

Thériault, R.J., Henderson, J.B., and Roscoe, S.M. 1994. Nd isotopic evidence for early to mid-Archean crust from high grade gneisses in the Queen Maud block and south of the McDonald fault, western Churchill province, Northwest Territories. Geological Survey of Canada, Current Research, **1994-F**: 37-42.

Tersmette, D.B. 2012. Geology, geochronology, thermobarometry, and tectonic evolution of the Queen Maud block, Churchill craton, Nunavut, Canada. MSc., University of Alberta.

van Breemen, O. and Henderson, J.B. 1988. U-Pb zircon and monazite ages from the eastern Slave province and Thelon tectonic zone, artillery lake area, N.W.T. Geological Survey of Canada, Paper, **88-2**: 73-83.

van Breemen, O., Henderson, J.B., Loveridge, W.D., and Thompson, P.H. 1987a. U - pb zircon and monazite geochronology and zircon morphology of granulites and granite from the Thelon tectonic zone, Healey lake and Artillery lake map areas, N.W.T. Geological Survey of Canada, Paper, **87-1A**: 783-801.

van Breemen, O., Thompson, P.H., Hunt, P.A., and Culshaw, N. 1987b. U - Pb zircon monazite geochronology from the northern Thelon tectonic zone, District of Mackenzie. Geological Survey of Canada, Paper, **87-2**: 81-93.

Wodicka, N., Corrigan, D., Nadeau, L. and Erdmann, S., 2011. New U-Pb geochronological results from Melville Peninsula: unravelling the Archean and Early Paleoproterozoic magmatic history of the north-central Rae craton. Geol. Assn. Canada - Mineral. Assn. Canada Abst. 36.

Zaleski, E., Pehrsson, S., Duke, N., Davis, W.J., L'Heureux, R., Greiner, E., and Kerswill, J.A. 2000. Quartzite sequences and their relationships, Woodburn lake group, western Churchill province, Nunavut. Geological Survey of Canada, Current Research (Online), **2000-C7**: 1-10.

TABLE 1: U/PB Analytical Data

Spot name	U (ppm)	Th (ppm)	Y (ppm)	Hf (ppm)	Th/U	$^{206}Pb^*$ (ppm)	$^{204}Pb/^{206}Pb$	% ±	$f(206)^{204}$ %	$^{208*}Pb/^{206*}Pb$	±	$^{207*}Pb/^{235}U$	±	$^{206*}Pb/^{238}U$	±	Corr Coeff	$^{207*}Pb/^{206*}Pb$	±	Apparent Ages (Ma) $^{206}Pb/^{238}U$	±	Apparent Ages (Ma) $^{207}Pb/^{206}Pb$	±	Disc. (%)
Sample #: 55-CD-159 IP642																							
10651-19.1	99	138	170	11174	1.39	30	1.9E-04	91	0.334	0.1047	0.0025	5.587	0.151	0.3489	0.0043	0.4608	0.1162	0.0028	1929	21	1898	43	-2
10651-22.1	74	59	174	11681	0.79	21	2.7E-04	39	0.473	0.0998	0.0017	5.320	0.111	0.3339	0.0041	0.5894	0.1155	0.0020	1857	20	1888	30	1.9
10651-24.1	59	42	174	11618	0.71	17	3.7E-04	38	0.645	0.0983	0.0021	5.250	0.134	0.3343	0.0047	0.5476	0.1139	0.0024	1859	23	1863	38	0.2
10651-25.1	419	189	213	10953	0.45	127	1.3E-05	121	0.022	0.0987	0.0005	5.887	0.068	0.3535	0.0037	0.8995	0.1208	0.0006	1951	18	1968	9	1.0
10651-30.2	601	432	406	10713	0.72	171	4.9E-05	39	0.084	0.0997	0.0005	5.601	0.064	0.3321	0.0034	0.9080	0.1223	0.0006	1849	17	1990	8	8.2
10651-31.1	80	62	160	11409	0.77	23	9.8E-05	207	0.169	0.0997	0.0026	5.421	0.158	0.3358	0.0043	0.4412	0.1171	0.0031	1866	21	1912	46	2.8
10651-31.2	226	118	178	10375	0.52	67	-8.3E-06	40	-0.014	0.1036	0.0008	5.888	0.080	0.3476	0.0039	0.8154	0.1228	0.0010	1923	18	1998	14	4.3
10651-32.1	382	145	163	11265	0.38	113	6.2E-05	29	0.108	0.1035	0.0006	5.836	0.069	0.3432	0.0036	0.8862	0.1233	0.0007	1902	17	2005	10	5.9
10651-38.1	131	110	159	11341	0.84	38	3.7E-05	51	0.065	0.1028	0.0006	5.507	0.072	0.3408	0.0039	0.8795	0.1172	0.0007	1890	19	1914	11	1.4
10651-42.1	604	348	325	10863	0.58	184	3.6E-05	31	0.063	0.1084	0.0005	6.047	0.068	0.3553	0.0037	0.9278	0.1234	0.0005	1960	18	2007	7	2.7
10651-45.1	108	82	183	11613	0.76	32	-1.5E-05	34	-0.027	0.1025	0.0006	5.532	0.071	0.3445	0.0039	0.8791	0.1165	0.0007	1908	19	1903	11	0.3
10651-45.2	239	75	123	11262	0.32	73	-6.0E-06	47	-0.010	0.1056	0.0004	6.089	0.077	0.3568	0.0043	0.9505	0.1238	0.0005	1967	20	2011	7	2.5
10651-48.1	191	169	145	11471	0.88	56	1.3E-05	191	0.023	0.1026	0.0006	5.449	0.068	0.3399	0.0038	0.8893	0.1163	0.0007	1886	18	1899	10	0.8
10651-50.1	261	91	143	11279	0.35	79	8.2E-06	93	0.014	0.1081	0.0004	6.017	0.071	0.3537	0.0039	0.9400	0.1234	0.0005	1952	19	2006	7	3.1
10651-58.1	112	86	140	11201	0.77	33	-4.6E-05	48	-0.079	0.1047	0.0007	5.551	0.072	0.3434	0.0039	0.8711	0.1172	0.0007	1903	19	1915	11	0.7
10651-58.2	345	142	167	11350	0.41	106	3.5E-05	40	0.061	0.1057	0.0004	6.101	0.081	0.3589	0.0045	0.9591	0.1233	0.0005	1977	22	2004	7	1.6
10651-65.1	341	161	236	10883	0.47	105	2.8E-05	34	0.048	0.1058	0.0004	6.129	0.071	0.3600	0.0040	0.9541	0.1235	0.0004	1982	19	2007	6	1.4
Sample #: 55-EA-261A IP642																							
10652-22.1	365	44	619	12062	0.12	125	5.0E-06	91	0.009	0.1280	0.0051	7.432	0.304	0.3977	0.0041	0.2551	0.1355	0.0054	2158	19	2171	67	0.7
10652-25.1	368	105	268	13354	0.29	112	3.7E-05	30	0.064	0.1062	0.0005	5.918	0.074	0.3540	0.0040	0.9158	0.1213	0.0006	1954	19	1975	9	1.2
10652-34.1	325	47	446	12647	0.14	109	2.3E-05	44	0.040	0.1161	0.0004	7.063	0.082	0.3916	0.0043	0.9451	0.1308	0.0005	2130	20	2109	7	-1
10652-40.1	525	40	38	10672	0.08	168	1.1E-05	28	0.019	0.1166	0.0005	6.296	0.069	0.3718	0.0038	0.9328	0.1228	0.0005	2038	18	1998	7	-2
10652-42.1	572	241	301	11023	0.42	196	9.3E-06	44	0.016	0.1214	0.0004	7.805	0.083	0.3983	0.0041	0.9574	0.1421	0.0004	2161	19	2253	5	4.8
10652-46.1	356	85	300	10397	0.24	146	3.7E-05	28	0.064	0.1391	0.0005	10.818	0.264	0.4778	0.0115	0.9882	0.1642	0.0006	2518	50	2500	6	-1
10652-62.1	460	33	248	13436	0.07	154	1.5E-05	106	0.025	0.1148	0.0006	7.249	0.084	0.3900	0.0041	0.9064	0.1348	0.0007	2123	19	2162	8	2.1
10652-63.1	160	134	60	9507	0.84	45	3.1E-04	19	0.542	0.1044	0.0011	5.393	0.083	0.3287	0.0035	0.6966	0.1190	0.0013	1832	17	1941	20	6.5
10652-64.1	354	146	170	11256	0.41	106	8.8E-06	66	0.015	0.1031	0.0004	5.964	0.067	0.3494	0.0037	0.9355	0.1238	0.0005	1932	18	2012	7	4.6
10652-66.1	1235	419	444	13376	0.34	419	4.0E-06	144	0.007	0.1170	0.0002	7.245	0.096	0.3947	0.0052	0.9887	0.1331	0.0003	2145	24	2139	3	0.3
10652-70.1	661	218	242	11657	0.33	224	9.5E-06	31	0.016	0.1233	0.0003	7.698	0.082	0.3944	0.0041	0.9689	0.1416	0.0004	2143	19	2247	5	5.4
10652-72.1	444	38	432	13246	0.08	155	2.1E-06	708	0.004	0.1207	0.0004	8.024	0.087	0.4070	0.0042	0.9416	0.1430	0.0005	2201	19	2264	6	3.2
Sample #: 55-EA-261B IP642																							
10653-12.1	347	147	290	10629	0.42	110	3.5E-07	1720	0.001	0.1102	0.0004	6.421	0.070	0.3680	0.0038	0.9438	0.1265	0.0005	2020	18	2050	6	1.7
10653-14.1	666	263	327	10189	0.40	210	4.9E-06	160	0.008	0.1119	0.0003	6.503	0.073	0.3676	0.0040	0.9731	0.1283	0.0003	2018	19	2075	5	3.2
10653-17.1	5617	68	489	14233	0.01	1660	2.7E-05	10	0.046	0.1352	0.0002	5.652	0.065	0.3441	0.0039	0.9930	0.1191	0.0002	1906	19	1943	2	2.2
10653-19.1	978	199	194	15532	0.20	371	1.3E-05	29	0.022	0.1262	0.0003	9.137	0.096	0.4416	0.0045	0.9819	0.1501	0.0003	2358	20	2347	3	-1
10653-26.1	159	89	148	9517	0.56	60	1.5E-05	95	0.025	0.1279	0.0007	9.968	0.117	0.4423	0.0046	0.8837	0.1634	0.0009	2361	21	2492	9	6.2
10653-32.1	954	254	44	14454	0.27	278	1.2E-05	36	0.021	0.1030	0.0002	5.481	0.057	0.3390	0.0034	0.9792	0.1173	0.0002	1882	17	1915	4	2.0
10653-34.1	256	149	287	9639	0.58	78	-1.1E-05	37	-0.019	0.1085	0.0004	6.092	0.067	0.3558	0.0037	0.9357	0.1242	0.0005	1962	17	2017	7	3.2
10653-35.1	792	136	280	11009	0.17	267	1.3E-05	35	0.022	0.1176	0.0003	7.228	0.076	0.3918	0.0040	0.9645	0.1338	0.0004	2131	18	2148	5	1.0
10653-4.1	1277	284	45	16248	0.22	374	-5.7E-06	59	-0.010	0.1031	0.0002	5.490	0.057	0.3410	0.0034	0.9743	0.1168	0.0003	1892	17	1907	4	0.9
10653-41.1	789	38	144	14704	0.05	246	9.2E-06	65	0.016	0.1072	0.0003	6.240	0.086	0.3630	0.0049	0.9754	0.1247	0.0004	1996	23	2024	5	1.6
10653-5.1	480	241	391	10037	0.50	174	3.6E-05	32	0.062	0.1214	0.0004	8.572	0.092	0.4217	0.0043	0.9525	0.1474	0.0005	2268	20	2316	6	2.4
10653-71.1	129	46	150	11754	0.35	41	3.3E-05	39	0.057	0.1140	0.0042	6.829	0.299	0.3701	0.0086	0.5323	0.1338	0.0050	2030	41	2149	63	6.5
10653-72.1	421	100	313	11522	0.24	144	2.7E-05	28	0.047	0.1138	0.0012	7.762	0.217	0.3973	0.0103	0.9282	0.1417	0.0015	2157	48	2248	18	4.8
10653-83.1	176	73	181	9174	0.42	58	5.7E-05	49	0.099	0.1179	0.0006	6.703	0.078	0.3807	0.0040	0.8978	0.1277	0.0007	2080	19	2066	9	-1

Sample #: 62-FD-080			**IP642**																				
10654-11.1	973	118	151	13683	0.12	219	4.3E-04	59	0.750	0.1178	0.0042	4.144	0.166	0.2620	0.0049	0.4665	0.1147	0.0041	1500	25	1875	63	22.4
10654-14.1	483	80	61	13142	0.17	135	4.6E-05	35	0.079	0.0930	0.0004	5.226	0.059	0.3241	0.0034	0.9191	0.1169	0.0005	1810	16	1910	8	6.0
10654-15.1	740	108	168	14528	0.15	181	7.5E-04	93	1.308	0.1058	0.0093	4.459	0.408	0.2853	0.0072	0.2743	0.1134	0.0100	1618	36	1854	151	14.4
10654-20.1	597	83	148	13578	0.14	177	1.8E-05	40	0.032	0.0983	0.0006	5.597	0.069	0.3457	0.0036	0.8506	0.1174	0.0008	1914	17	1918	12	0.2
10654-23.1	896	164	165	12002	0.18	256	1.5E-05	32	0.027	0.0933	0.0002	5.325	0.056	0.3322	0.0034	0.9672	0.1163	0.0003	1849	16	1900	5	3.1
10654-42.1	952	134	97	12129	0.14	279	9.1E-06	106	0.016	0.1029	0.0003	5.439	0.057	0.3407	0.0034	0.9709	0.1158	0.0003	1890	17	1892	4	0.1
10654-45.1	1768	226	210	12079	0.13	520	-1.8E-07	1972	0.000	0.1045	0.0002	5.545	0.058	0.3426	0.0035	0.9773	0.1174	0.0003	1899	17	1917	4	1.1
10654-48.1	1343	189	184	11693	0.14	384	1.0E-05	32	0.018	0.1078	0.0002	5.357	0.059	0.3328	0.0036	0.9851	0.1167	0.0002	1852	17	1907	3	3.3
10654-51.1	1766	158	189	12999	0.09	525	3.0E-06	63	0.005	0.1012	0.0001	5.549	0.061	0.3457	0.0037	0.9909	0.1164	0.0002	1914	18	1902	3	-1
10654-54.1	869	126	97	12032	0.14	251	2.0E-05	26	0.035	0.0997	0.0002	5.394	0.061	0.3359	0.0037	0.9802	0.1165	0.0003	1867	18	1903	4	2.2
10654-6.1	786	103	124	14174	0.13	205	1.2E-03	21	2.013	0.1927	0.0068	4.833	0.194	0.3037	0.0057	0.4642	0.1154	0.0041	1710	28	1886	63	10.6
10654-60.1	1729	354	247	11563	0.20	499	7.6E-07	51	0.001	0.1007	0.0002	5.411	0.059	0.3362	0.0036	0.9896	0.1167	0.0002	1869	18	1907	3	2.3
10654-7.1	1776	252	297	13138	0.14	449	1.4E-04	17	0.240	0.1142	0.0017	4.924	0.107	0.2945	0.0047	0.7296	0.1213	0.0018	1664	23	1975	26	17.9
10654-74.1	971	114	104	12075	0.12	283	8.2E-06	39	0.014	0.1010	0.0002	5.468	0.061	0.3394	0.0037	0.9815	0.1169	0.0002	1884	18	1909	4	1.5
Sample #: 55-EA-265			**IP642**																				
10655-1.1	41	39	132	9530	0.96	16	-5.4E-05	88	-0.094	0.1575	0.0020	10.788	0.302	0.4577	0.0114	0.8922	0.1710	0.0022	2429	50	2567	21	6.4
10655-1.1.2	37	35	104	7421	0.93	15	2.4E-04	39	0.409	0.1361	0.0016	10.335	0.189	0.4631	0.0065	0.7668	0.1618	0.0019	2453	29	2475	20	1.1
10655-10.1	167	77	164	13843	0.46	66	4.3E-05	79	0.074	0.1229	0.0009	10.295	0.142	0.4587	0.0054	0.8579	0.1628	0.0012	2434	24	2485	12	2.4
10655-12.1	108	102	252	11039	0.95	41	1.5E-04	36	0.257	0.1230	0.0010	10.139	0.151	0.4429	0.0055	0.8352	0.1660	0.0014	2364	25	2518	14	7.3
10655-15.1	88	114	313	10069	1.30	34	1.4E-04	41	0.235	0.1414	0.0014	10.136	0.161	0.4486	0.0057	0.7953	0.1639	0.0016	2389	25	2496	16	5.1
10655-17.1	67	81	265	9892	1.20	26	2.2E-04	33	0.376	0.1327	0.0013	10.536	0.178	0.4489	0.0063	0.8258	0.1702	0.0016	2391	28	2560	16	7.9
10655-17.1.2	63	68	207	9415	1.09	23	6.2E-05	45	0.108	0.1267	0.0010	9.355	0.129	0.4274	0.0048	0.8182	0.1588	0.0013	2294	22	2442	13	7.2
10655-17.2	59	67	223	9704	1.14	23	1.9E-04	22	0.331	0.1341	0.0013	9.436	0.330	0.4443	0.0149	0.9620	0.1540	0.0015	2370	67	2391	16	1.1
10655-19.1	51	48	159	9930	0.94	20	1.5E-04	37	0.260	0.1328	0.0014	10.021	0.189	0.4478	0.0069	0.8169	0.1623	0.0018	2386	31	2480	18	4.5
10655-3.1	142	144	304	11028	1.02	55	1.6E-05	135	0.027	0.1340	0.0007	10.216	0.125	0.4541	0.0050	0.8961	0.1632	0.0009	2413	22	2489	9	3.6
10655-34.2	67	62	186	10261	0.92	27	2.3E-05	328	0.040	0.1286	0.0011	10.682	0.152	0.4712	0.0053	0.7868	0.1644	0.0014	2489	23	2502	15	0.6
10655-34.3	310	68	53	12241	0.22	117	5.3E-05	29	0.091	0.1273	0.0005	9.562	0.107	0.4400	0.0047	0.9429	0.1576	0.0006	2351	21	2430	6	3.9
10655-35.2	725	95	59	12091	0.13	271	8.0E-06	85	0.014	0.1235	0.0004	9.238	0.099	0.4346	0.0045	0.9567	0.1542	0.0005	2326	20	2393	5	3.3
10655-37.1	62	45	151	10385	0.73	24	1.4E-04	30	0.240	0.1334	0.0015	10.186	0.274	0.4456	0.0108	0.9022	0.1658	0.0019	2376	48	2515	19	6.6
10655-38.1	60	61	193	10425	1.02	24	3.6E-04	60	0.632	0.1351	0.0027	10.407	0.324	0.4619	0.0109	0.7583	0.1634	0.0033	2448	48	2491	34	2.1
10655-39.1	121	140	294	10301	1.15	46	5.7E-05	71	0.098	0.1229	0.0009	9.299	0.145	0.4417	0.0060	0.8788	0.1527	0.0011	2358	27	2376	13	0.9
10655-42.1	88	118	302	9696	1.34	36	1.5E-06	1087	0.003	0.1314	0.0007	10.788	0.129	0.4729	0.0051	0.8970	0.1655	0.0009	2496	22	2512	9	0.8
10655-45.1	84	101	272	9685	1.20	34	3.8E-05	56	0.066	0.1288	0.0011	10.203	0.146	0.4704	0.0054	0.8049	0.1573	0.0013	2485	24	2427	14	-3
10655-45.2	233	193	103	11415	0.83	84	2.9E-05	56	0.050	0.1244	0.0005	8.840	0.103	0.4200	0.0045	0.9253	0.1527	0.0007	2260	21	2376	8	5.8
10655-45.3	84	92	250	9845	1.09	33	4.3E-05	24	0.075	0.1318	0.0011	10.167	0.147	0.4625	0.0054	0.8092	0.1594	0.0014	2451	24	2450	14	0.0
10655-46.1	67	50	140	10489	0.75	27	8.4E-05	43	0.145	0.1273	0.0012	10.379	0.151	0.4694	0.0052	0.7647	0.1604	0.0015	2481	23	2459	16	-1
10655-46.2	213	48	50	12002	0.23	80	1.7E-05	47	0.029	0.1362	0.0006	9.440	0.110	0.4372	0.0048	0.9375	0.1566	0.0006	2338	21	2419	7	4.0
10655-47.1	104	69	148	11679	0.66	42	6.0E-05	38	0.105	0.1392	0.0007	10.380	0.122	0.4646	0.0049	0.9019	0.1620	0.0008	2460	22	2477	9	0.8
10655-48.1	107	102	250	10563	0.95	43	7.5E-06	483	0.013	0.1342	0.0007	10.379	0.123	0.4629	0.0049	0.8905	0.1626	0.0009	2452	22	2483	9	1.5
10655-6.1	289	49	52	11724	0.17	111	1.7E-05	39	0.029	0.1305	0.0007	9.676	0.114	0.4484	0.0048	0.9048	0.1565	0.0008	2388	21	2418	8	1.5
10655-7.1	82	89	171	10475	1.08	30	1.4E-04	21	0.243	0.1279	0.0010	8.848	0.125	0.4250	0.0050	0.8270	0.1510	0.0012	2283	23	2357	14	3.7
10655-7.2	105	126	298	10160	1.20	42	2.9E-05	52	0.051	0.1349	0.0008	10.464	0.130	0.4644	0.0051	0.8785	0.1634	0.0010	2459	22	2491	10	1.6
Sample #: 62-FD-084			**IP646**																				
10656-10.1	403	306	276	11628	0.76	147	2.0E-04	38	0.347	0.1181	0.0012	9.245	0.225	0.4249	0.0093	0.9031	0.1578	0.0016	2283	42	2432	18	7.3
10656-13.1	934	1001	580	9386	1.07	372	1.0E-04	27	0.178	0.1367	0.0007	10.381	0.188	0.4636	0.0081	0.9632	0.1624	0.0008	2455	36	2481	8	1.2
10656-16.1	250	188	317	9788	0.75	96	3.7E-05	24	0.064	0.1266	0.0007	9.969	0.189	0.4472	0.0080	0.9501	0.1617	0.0010	2383	36	2473	10	4.4
10656-17.1	124	43	105	12843	0.35	49	-6.1E-05	53	-0.107	0.1327	0.0010	10.503	0.210	0.4618	0.0085	0.9223	0.1650	0.0013	2447	38	2507	13	2.9
10656-22.1	300	235	296	9768	0.78	117	4.4E-05	120	0.076	0.1283	0.0009	10.138	0.196	0.4544	0.0082	0.9298	0.1618	0.0012	2415	36	2475	12	2.9
10656-23.1	189	102	149	11241	0.54	75	1.0E-32	100	0.000	0.1280	0.0009	10.109	0.195	0.4602	0.0083	0.9378	0.1593	0.0011	2440	37	2448	11	0.4

10656-25.1	180	61	108	13256	0.34	69	5.4E-05	24	0.094	0.1360	0.0008	9.910	0.196	0.4475	0.0084	0.9497	0.1606	0.0010	2384	38	2462	10	3.8
10656-26.1	131	79	153	9557	0.60	51	3.1E-05	41	0.054	0.1305	0.0010	10.046	0.197	0.4533	0.0082	0.9232	0.1607	0.0012	2410	36	2463	13	2.6
10656-27.1	324	257	388	9414	0.79	127	1.0E-05	132	0.018	0.1341	0.0007	10.088	0.184	0.4571	0.0080	0.9633	0.1601	0.0008	2427	36	2456	8	1.5
10656-28.1	366	317	452	9468	0.87	142	2.9E-05	29	0.051	0.1287	0.0006	10.227	0.187	0.4523	0.0080	0.9633	0.1640	0.0008	2405	35	2497	8	4.4
10656-29.1	133	74	157	10942	0.55	51	6.2E-05	31	0.107	0.1401	0.0013	9.966	0.216	0.4453	0.0088	0.9049	0.1623	0.0015	2374	39	2480	16	5.1
10656-29.2	224	174	311	10311	0.78	91	1.0E-32	100	0.000	0.1335	0.0009	10.442	0.202	0.4745	0.0086	0.9408	0.1596	0.0010	2503	38	2452	11	-3
10656-3.1	351	278	383	9753	0.79	138	2.2E-05	95	0.039	0.1331	0.0006	10.273	0.186	0.4597	0.0080	0.9682	0.1621	0.0007	2438	36	2478	8	1.9
10656-35.1	158	86	177	11801	0.54	63	4.8E-05	57	0.083	0.1323	0.0010	10.239	0.208	0.4622	0.0087	0.9241	0.1607	0.0012	2449	38	2463	13	0.7
10656-38.1	133	51	103	12260	0.38	52	4.8E-05	99	0.083	0.1303	0.0015	10.202	0.230	0.4541	0.0089	0.8693	0.1630	0.0018	2413	40	2487	19	3.5
10656-4.1	269	227	348	9325	0.84	109	6.5E-05	38	0.113	0.1302	0.0007	10.394	0.191	0.4712	0.0083	0.9563	0.1600	0.0009	2489	36	2456	9	-2
10656-42.1	450	388	496	9867	0.86	173	1.0E-32	100	0.000	0.1314	0.0007	9.874	0.203	0.4476	0.0089	0.9691	0.1600	0.0008	2385	40	2455	9	3.4
10656-46.1	185	97	160	11692	0.53	71	9.1E-05	44	0.158	0.1407	0.0012	10.037	0.206	0.4493	0.0084	0.9101	0.1620	0.0014	2392	37	2477	14	4.1
10656-5.1	184	81	139	12531	0.44	73	3.9E-05	57	0.068	0.1353	0.0008	10.314	0.193	0.4628	0.0082	0.9467	0.1616	0.0010	2452	36	2473	10	1.0
10656-6.1	487	464	520	9351	0.95	195	3.8E-06	41	0.007	0.1295	0.0007	10.491	0.190	0.4675	0.0081	0.9608	0.1628	0.0008	2473	36	2485	8	0.6
10656-7.1	730	671	432	9082	0.92	294	2.5E-05	37	0.043	0.1333	0.0008	10.453	0.195	0.4690	0.0083	0.9459	0.1617	0.0010	2479	36	2473	10	0.3
Sample #: 62-FD-125			**IP647**																				
10657-102.1	112	134	176	11160	1.20	40	3.5E-05	138	0.060	0.1295	0.0013	8.680	0.201	0.4197	0.0088	0.9072	0.1500	0.0015	2259	40	2346	17	4.4
10657-13.1	215	92	187	12071	0.43	80	-3.9E-06	487	-0.007	0.1310	0.0006	8.852	0.128	0.4313	0.0059	0.9424	0.1489	0.0007	2311	26	2333	8	1.1
10657-14.1	131	156	131	11021	1.19	49	1.7E-05	55	0.030	0.1231	0.0007	8.754	0.126	0.4313	0.0057	0.9127	0.1472	0.0009	2312	26	2313	10	0.1
10657-14.2	228	114	152	12988	0.50	85	5.1E-07	1719	0.001	0.1277	0.0006	8.805	0.120	0.4316	0.0056	0.9434	0.1480	0.0007	2313	25	2322	8	0.5
10657-15.1	379	371	295	8394	0.98	116	1.0E-32	100	0.000	0.1038	0.0004	5.870	0.079	0.3570	0.0046	0.9562	0.1192	0.0005	1968	22	1945	7	-1
10657-18.1	709	119	180	11650	0.17	213	1.1E-05	25	0.018	0.1070	0.0003	5.719	0.079	0.3502	0.0047	0.9755	0.1184	0.0004	1936	22	1933	5	0.2
10657-20.1	207	122	167	10399	0.59	97	4.6E-05	112	0.080	0.1560	0.0008	15.639	0.238	0.5481	0.0079	0.9462	0.2070	0.0010	2817	33	2882	8	2.8
10657-20.2	998	182	189	12103	0.18	293	1.4E-05	66	0.025	0.1043	0.0003	5.475	0.071	0.3415	0.0043	0.9750	0.1163	0.0003	1894	21	1900	5	0.4
10657-25.1	826	207	288	13465	0.25	303	3.9E-06	58	0.007	0.1223	0.0004	8.614	0.128	0.4267	0.0062	0.9792	0.1464	0.0004	2291	28	2305	5	0.7
10657-30.1	212	79	224	10215	0.37	119	-9.8E-06	64	-0.017	0.1745	0.0006	23.579	0.358	0.6567	0.0097	0.9769	0.2604	0.0008	3254	38	3249	5	0.2
10657-32.1	198	89	158	9980	0.45	85	4.1E-05	73	0.072	0.1361	0.0006	13.225	0.183	0.5023	0.0066	0.9455	0.1909	0.0009	2624	28	2750	7	5.6
10657-32.2	150	11	153	11538	0.07	45	-2.2E-05	220	-0.038	0.1210	0.0011	5.658	0.090	0.3476	0.0046	0.8293	0.1181	0.0010	1923	22	1927	16	0.2
10657-33.1	893	122	102	10491	0.14	332	6.9E-05	20	0.119	0.1283	0.0004	8.871	0.116	0.4330	0.0055	0.9720	0.1486	0.0005	2319	25	2330	5	0.5
10657-36.1	1468	500	414	13284	0.34	553	2.3E-05	28	0.040	0.1241	0.0003	8.953	0.115	0.4385	0.0055	0.9845	0.1481	0.0003	2344	25	2324	4	-1
10657-37.1	596	308	175	12545	0.52	223	4.3E-05	26	0.074	0.1244	0.0004	8.816	0.115	0.4355	0.0055	0.9745	0.1468	0.0004	2331	25	2309	5	-1
10657-42.1	183	1	108	12236	0.01	68	1.7E-04	32	0.293	0.1616	0.0024	9.057	0.181	0.4317	0.0059	0.6776	0.1522	0.0022	2313	26	2370	25	2.9
10657-42.2	1035	116	149	13381	0.11	298	1.1E-05	21	0.019	0.1012	0.0003	5.379	0.069	0.3353	0.0042	0.9763	0.1163	0.0003	1864	20	1901	5	2.2
10657-55.1	61	28	156	8749	0.45	31	1.2E-04	31	0.207	0.1658	0.0012	18.832	0.293	0.5986	0.0083	0.8940	0.2282	0.0016	3024	34	3039	11	0.6
10657-59.1	1113	9	49	14849	0.01	421	1.5E-05	15	0.027	0.1299	0.0004	9.346	0.122	0.4398	0.0056	0.9752	0.1541	0.0004	2350	25	2392	5	2.1
10657-6.1	660	51	163	10182	0.08	248	1.5E-05	37	0.026	0.1280	0.0003	9.053	0.117	0.4375	0.0056	0.9813	0.1501	0.0004	2340	25	2347	4	0.4
10657-6.2	111	114	112	10653	1.02	41	4.1E-05	61	0.070	0.1290	0.0009	8.864	0.132	0.4336	0.0057	0.8931	0.1482	0.0010	2322	26	2326	11	0.2
10657-62.1	1140	124	170	13085	0.11	334	1.7E-05	30	0.029	0.0976	0.0003	5.507	0.072	0.3416	0.0043	0.9705	0.1169	0.0004	1894	21	1910	6	0.9
10657-64.1	107	11	50	10171	0.11	39	1.1E-04	40	0.186	0.1307	0.0014	8.638	0.162	0.4223	0.0066	0.8327	0.1484	0.0015	2271	30	2327	18	2.9
10657-7.1	23	11	131	10511	0.50	12	-1.2E-04	35	-0.200	0.1536	0.0016	18.246	0.340	0.6008	0.0093	0.8300	0.2203	0.0023	3033	37	2983	17	-2
10657-72.1	251	148	197	10805	0.59	132	5.4E-05	21	0.094	0.1754	0.0008	20.266	0.282	0.6119	0.0080	0.9400	0.2402	0.0011	3078	32	3121	8	1.8
10657-73.1	42	19	241	8462	0.46	25	3.1E-04	34	0.535	0.1712	0.0015	24.145	0.425	0.6815	0.0104	0.8691	0.2570	0.0022	3350	40	3228	14	-5
10657-74.1	345	130	432	12639	0.38	175	5.2E-05	36	0.089	0.1718	0.0007	17.353	0.241	0.5919	0.0079	0.9590	0.2126	0.0008	2997	32	2926	6	-3
10657-8.1	387	233	305	12083	0.60	144	-1.4E-05	39	-0.024	0.1231	0.0004	8.843	0.119	0.4338	0.0057	0.9712	0.1479	0.0005	2323	26	2321	5	0.1
10657-83.1	623	50	236	11128	0.08	233	3.0E-05	60	0.052	0.1368	0.0005	9.132	0.122	0.4349	0.0056	0.9573	0.1523	0.0006	2328	25	2372	7	2.2
10657-87.1	55	22	110	8950	0.41	30	8.0E-05	26	0.139	0.1841	0.0015	22.306	0.375	0.6434	0.0095	0.8772	0.2514	0.0020	3203	37	3194	13	0.3
10657-9.1	48	20	100	8118	0.41	24	1.6E-04	37	0.284	0.1579	0.0013	16.973	0.283	0.5679	0.0083	0.8764	0.2168	0.0017	2899	34	2957	13	2.4
10657-90.1	146	85	329	8969	0.58	73	5.2E-05	176	0.090	0.1621	0.0012	18.093	0.278	0.5866	0.0079	0.8817	0.2237	0.0016	2976	32	3007	12	1.3
Sample #: 60-HF-272			**IP647**																				
10658-1.1	321	162	238	9830	0.50	132	3.7E-05	38	0.064	0.1260	0.0006	11.610	0.159	0.4781	0.0062	0.9467	0.1761	0.0008	2519	27	2616	7	4.5
10658-3.1	293	85	174	12436	0.29	115	3.6E-05	78	0.062	0.1281	0.0007	10.875	0.154	0.4559	0.0060	0.9239	0.1730	0.0009	2422	26	2587	9	7.6

10658-36.1	147	54	144	11349	0.37	62	4.2E-04	23	0.736	0.1633	0.0024	11.655	0.234	0.4891	0.0067	0.6859	0.1728	0.0025	2567	29	2585	24	0.9
10658-36.2	82	31	123	11070	0.38	33	7.2E-04	26	1.253	0.1645	0.0029	11.244	0.261	0.4709	0.0072	0.6579	0.1732	0.0030	2487	32	2589	29	4.7
10658-37.1	305	196	403	10242	0.64	130	1.1E-04	36	0.192	0.1416	0.0009	12.056	0.177	0.4970	0.0066	0.9061	0.1759	0.0011	2601	28	2615	10	0.6
10658-49.1	256	84	253	11204	0.33	103	1.4E-04	36	0.244	0.1283	0.0010	11.017	0.170	0.4676	0.0063	0.8763	0.1709	0.0013	2473	28	2566	12	4.4
10658-49.2	276	92	239	11394	0.33	112	6.4E-05	42	0.110	0.1452	0.0009	11.310	0.164	0.4721	0.0063	0.9146	0.1737	0.0010	2493	27	2594	10	4.7
10658-5.1	150	52	123	11601	0.34	60	3.7E-04	29	0.639	0.1275	0.0014	11.040	0.194	0.4662	0.0065	0.7891	0.1717	0.0019	2467	28	2575	18	5.0
10658-57.1	252	104	206	11172	0.41	104	3.3E-05	29	0.057	0.1285	0.0008	11.509	0.171	0.4805	0.0065	0.9052	0.1737	0.0011	2530	28	2594	11	3.0
10658-60.1	122	48	216	9974	0.39	51	6.8E-05	26	0.117	0.1348	0.0011	11.531	0.190	0.4836	0.0068	0.8584	0.1730	0.0015	2543	30	2586	14	2.0
10658-64.1	148	61	204	9591	0.42	61	5.1E-04	23	0.887	0.1438	0.0017	11.353	0.217	0.4823	0.0071	0.7725	0.1707	0.0021	2537	31	2565	20	1.3
10658-9.1	140	61	161	10197	0.43	57	8.4E-05	35	0.146	0.1356	0.0011	10.986	0.176	0.4724	0.0066	0.8663	0.1687	0.0014	2494	29	2544	13	2.4
10658-93.1	198	78	243	10258	0.39	81	4.1E-04	19	0.718	0.1496	0.0014	11.554	0.248	0.4764	0.0091	0.8934	0.1759	0.0017	2511	40	2615	16	4.8
Sample #: 60-HF-272			**IP648**																				
10659-01.1	289	132	460	9498	0.46	121	1.0E-32	100	0.000	0.1417	0.0007	12.024	0.168	0.4880	0.0063	0.9286	0.1787	0.0009	2562	27	2641	9	3.6
10659-03.1	424	48	185	12638	0.11	207	1.0E-32	100	0.000	0.1541	0.0006	16.938	0.227	0.5674	0.0073	0.9577	0.2165	0.0008	2897	30	2955	6	2.4
10659-04.1	955	11	568	15419	0.01	408	1.0E-32	100	0.000	0.1391	0.0004	12.206	0.158	0.4978	0.0063	0.9739	0.1778	0.0005	2604	27	2633	5	1.3
10659-07.1	1688	427	788	13535	0.25	741	5.4E-06	35	0.009	0.1478	0.0003	12.697	0.161	0.5113	0.0064	0.9857	0.1801	0.0004	2662	27	2654	4	0.4
10659-08.1	172	53	336	13144	0.30	72	5.4E-05	29	0.094	0.1424	0.0011	10.839	0.173	0.4848	0.0068	0.8845	0.1621	0.0012	2548	30	2478	13	-3
10659-14.1	377	153	474	11542	0.41	163	1.5E-03	11	2.618	0.2020	0.0028	12.154	0.232	0.5027	0.0066	0.6910	0.1753	0.0024	2626	28	2609	23	-1
10659-22.1	178	62	254	10701	0.35	76	4.4E-05	33	0.076	0.1374	0.0013	11.168	0.191	0.4974	0.0070	0.8237	0.1628	0.0016	2603	30	2485	16	-6
10659-23.1	201	60	98	11844	0.30	86	3.2E-05	76	0.056	0.1399	0.0009	12.828	0.189	0.4986	0.0066	0.8966	0.1866	0.0012	2608	28	2712	11	4.7
10659-26.1	1044	348	518	9483	0.33	463	4.6E-06	34	0.008	0.1456	0.0004	13.137	0.171	0.5169	0.0066	0.9774	0.1843	0.0005	2686	28	2692	5	0.3
10659-30.1	644	42	340	14683	0.06	268	1.0E-32	100	0.000	0.1693	0.0006	11.607	0.159	0.4838	0.0064	0.9638	0.1740	0.0006	2544	28	2597	6	2.5
10659-32.1	470	255	355	10611	0.54	207	1.6E-05	35	0.027	0.1415	0.0006	13.271	0.178	0.5114	0.0065	0.9547	0.1882	0.0007	2663	28	2727	7	2.9
10659-43.1	230	175	268	11551	0.76	111	6.7E-05	40	0.116	0.1591	0.0009	16.748	0.242	0.5610	0.0075	0.9266	0.2165	0.0012	2871	31	2955	9	3.5
10659-43.2	1211	35	476	15347	0.03	508	1.4E-05	24	0.025	0.1386	0.0004	11.670	0.150	0.4882	0.0062	0.9791	0.1734	0.0005	2563	27	2591	4	1.3
10659-46.1	173	77	477	8962	0.45	73	2.6E-05	34	0.045	0.1460	0.0010	12.067	0.179	0.4927	0.0066	0.8982	0.1776	0.0012	2582	28	2631	11	2.3
10659-47.1	844	32	516	15242	0.04	361	4.2E-04	15	0.731	0.3964	0.0024	12.352	0.193	0.4979	0.0072	0.9216	0.1799	0.0011	2605	31	2652	10	2.2
10659-48.1	389	192	292	9707	0.49	172	1.0E-32	100	0.000	0.1489	0.0007	13.156	0.178	0.5129	0.0066	0.9461	0.1860	0.0008	2669	28	2707	7	1.7
10659-50.1	722	54	251	14618	0.08	316	1.5E-05	38	0.027	0.1422	0.0005	12.264	0.161	0.5086	0.0065	0.9675	0.1749	0.0006	2651	28	2605	6	-2
10659-56.1	1483	41	919	15745	0.03	647	7.5E-06	25	0.013	0.1639	0.0004	12.455	0.159	0.5079	0.0064	0.9839	0.1778	0.0004	2648	27	2633	4	-1
10659-58.1	595	95	461	13393	0.16	261	1.6E-05	37	0.028	0.1475	0.0005	12.445	0.174	0.5103	0.0069	0.9653	0.1769	0.0006	2658	29	2624	6	-2
10659-59.1	652	52	327	14381	0.08	279	1.0E-32	100	0.000	0.1525	0.0005	11.902	0.158	0.4981	0.0064	0.9631	0.1733	0.0006	2606	27	2590	6	-1
10659-64.1	733	39	365	14447	0.05	298	8.8E-06	88	0.015	0.1292	0.0004	11.324	0.148	0.4734	0.0060	0.9652	0.1735	0.0006	2499	26	2591	6	4.3
10659-72.1	177	18	121	10638	0.10	74	4.4E-04	23	0.771	0.1957	0.0020	11.840	0.198	0.4892	0.0066	0.8017	0.1755	0.0018	2567	28	2611	17	2.0
10659-74.1	767	35	333	14484	0.05	320	1.9E-05	42	0.032	0.1344	0.0004	11.329	0.149	0.4856	0.0062	0.9671	0.1692	0.0006	2552	27	2550	6	0.1
10659-79.1	563	126	622	12411	0.22	260	2.0E-05	38	0.035	0.1535	0.0006	13.097	0.175	0.5375	0.0069	0.9580	0.1767	0.0007	2773	29	2623	6	-7
Sample #: 60-HF-010			**IP648**																				
10660-12.1	1981	93	619	13728	0.05	836	1.0E-32	100	0.000	0.1424	0.0003	11.602	0.139	0.4913	0.0058	0.9869	0.1713	0.0003	2576	25	2570	3	0.3
10660-14.1	623	29	595	13501	0.05	250	-1.7E-05	139	-0.030	0.1612	0.0008	10.901	0.135	0.4674	0.0053	0.9247	0.1691	0.0008	2472	23	2549	8	3.6
10660-15.1	161	11	422	13882	0.07	61	9.6E-05	34	0.166	0.1598	0.0017	9.700	0.162	0.4383	0.0056	0.7703	0.1605	0.0017	2343	25	2461	18	5.7
10660-18.1	70	0	533	13281	0.00	28	1.0E-04	86	0.177	0.1479	0.0020	11.676	0.245	0.4586	0.0073	0.7604	0.1847	0.0025	2433	32	2695	22	11.6
10660-18.2	2	0	205	9021	0.01	1	8.4E-03	40	14.585	4.4933	2.2937	6.093	3.170	0.3927	0.0394	0.1930	0.1125	0.0574	2135	180	1840	717	-19
10660-21.1	415	12	243	14357	0.03	169	2.8E-05	30	0.049	0.1750	0.0009	11.105	0.134	0.4730	0.0051	0.8986	0.1703	0.0009	2497	22	2560	9	3.0
10660-24.1	536	14	77	18396	0.03	153	3.8E-05	40	0.065	0.1032	0.0007	5.141	0.064	0.3319	0.0035	0.8492	0.1124	0.0007	1847	17	1838	12	-1
10660-24.2	123	12	68	16869	0.10	35	6.8E-05	48	0.119	0.1164	0.0016	5.143	0.095	0.3312	0.0040	0.6559	0.1126	0.0016	1844	19	1842	25	0.1
10660-25.1	220	14	494	15149	0.06	91	1.0E-32	100	0.000	0.1588	0.0011	11.219	0.183	0.4835	0.0071	0.8972	0.1683	0.0012	2542	31	2541	12	0.1
10660-6.1	260	24	747	12729	0.09	107	3.2E-05	41	0.055	0.1283	0.0009	11.221	0.153	0.4791	0.0057	0.8692	0.1699	0.0011	2524	25	2556	11	1.5
10660-6.2	122	10	456	13225	0.08	47	1.2E-04	40	0.201	0.1268	0.0013	10.713	0.170	0.4483	0.0054	0.7626	0.1733	0.0018	2388	24	2590	17	9.3
10660-7.1	2	0	51	9827	0.11	1	1.0E-32	100	0.000	0.0000	0.0000	16.112	1.613	0.6304	0.0376	0.5962	0.1854	0.0149	3151	147	2702	127	-21
10660-9.1	199	21	261	13626	0.11	56	4.1E-05	49	0.071	0.1146	0.0012	5.157	0.080	0.3279	0.0037	0.7286	0.1141	0.0012	1828	18	1865	19	2.3

Notes (see Stern, 1997):

Spot name follows the convention x-y.z; where x = sample number, y = grain number and z = spot number. Multiple analyses in an individual spot are labelled as x-y.z.z

Uncertainties reported at 1s (absolute) except 204/206 ratio in % and are calculated by numerical propagation of all known sources of error

Uncertainty in compositional data is estimated at ~5% 1s

$f206^{204}$ refers to mole fraction of total 206Pb that is due to common Pb, calculated using the 204Pb-method; common Pb composition used is the surface blank (4/6: 0.05770; 7/6: 0.89500; 8/6: 2.13840)

* refers to radiogenic Pb (corrected for common Pb)

Discordance relative to origin = 100 * (1-(206Pb/238U age)/(207Pb/206Pb age))

Calibration standard 6266; U = 910 ppm; Age = 559 Ma; 206Pb/238U = 0.09059

Error in 206Pb/238U calibration and instrumental mass fractination values: see information provided with each sample in text

Th/U calibration: F = 0.03900*UO + 0.85600