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Abstract: U-Pb SHRIMP, Sm-Nd isotopic and chemical analyses are presented for archived samples from the Tehery-Wager Bay area, a gneiss domain north of Chesterfield Inlet in Nunavut. Igneous crystallization ages of 2707 ± 8 Ma, 2699 ± 11 Ma, and 2701 ± 14 Ga were obtained, respectively, from a tonalitic biotite-hornblende gneiss, a foliated tonalite, and a foliated granodiorite. Five inherited zircons from the latter have ages in the range 2960 to 2906 Ma. These three intrusive rocks are coeval with, and therefore not basement to, the Woodburn Lake and Prince Albert groups. A younger age of 2584 ± 12 Ma was obtained from a foliated hornblende-biotite granodiorite, which corresponds to widespread plutonism in the Rae Province. Metamorphic zircon overgrowths from two samples yielded ages of 1865 ± 10 Ma and 1863 ± 14 Ma, respectively, which are interpreted in terms of regional metamorphism preceding the 1845 to 1795 Ma crustally derived Hudson granite intrusions.

Sm-Nd crystal separation ages (T_{DM}) for twelve samples range from 3.08 to 2.53 Ga and indicate the existence Mesoarchean crust in the area. Six of the T_{DM} ages are in the 2.83 to 2.72 Ga range, which also characterizes T_{DM} ages in much of the western Churchill Province. The majority of the samples feature LREE enrichment, HREE depletion, negative to slightly positive Eu/Eu* anomalies, and Nb depletion. Two samples with 2.56 Ga and 2.53 Ga T_{DM} ages have compositions that differ markedly from the main population in having positive Eu/Eu* anomalies and extreme HREE depletion.

Résumé : Les résultats d'analyses U-Pb à la microsonde SHRIMP, d'analyses isotopiques du couple Sm-Nd et d'analyses chimiques sont présentés pour des échantillons de la région de Tehery-Wager Bay, un domaine gneissique au nord de l'inlet Chesterfield. Des âges de cristallisation des roches ignées de 2707 ± 8 Ma, 2699 ± 11 Ma et 2701 ± 14 Ga ont respectivement été obtenus pour un gneiss tonalitique à biotite-hornblende, une tonalite foliée et une granodiorite foliée. Cinq cristaux de zircon hérité provenant du gneiss folié ont donné des âges de 2960 à 2906 Ma. Ces trois roches intrusives sont contemporaines des roches des groupes de Woodburn Lake et de Prince Albert et ne représentent donc pas leur substratum. Un âge plus récent de 2584 ± 12 Ma a été obtenu pour une granodiorite foliée à hornblende-biotite; il correspond à une période de plutonisme répandu dans la Province de Rae. Des accroissements secondaires de zircon d'origine métamorphique provenant de deux échantillons ont donné des âges de 1865 ± 10 Ma et 1863 ± 14 Ma, respectivement; ces âges représenteraient une période de métamorphisme régional qui a précédé les intrusions granitiques de Hudson (1845-1795 Ma) dérivées de la croûte.

Les âges Sm-Nd de séparation de la croûte (T_{DM}) établis pour douze échantillons varient de 3,08 à 2,53 Ga et indiquent l'existence de croûte mésoarchéenne dans la région. Six des âges T_{DM} se situent dans la plage de 2,83 à 2,72 Ga, dans laquelle se trouvent également les âges (T_{DM}) d'une bonne partie des roches de la Province de Churchill occidentale. La majorité des échantillons étaient enrichis en terres rares légères et appauvris en terres rares lourdes et en niobium, et présentaient des anomalies de Eu/Eu* négatives à légèrement positives. Deux des échantillons dont les âges T_{DM} étaient respectivement de 2,56 Ga et de 2,53 Ga avaient une composition nettement différente de celle de la population principale, car ils présentent des anomalies de Eu/Eu* positives et un appauvrissement extrême en terres rares lourdes.

INTRODUCTION

The western Churchill Province (WCP, Fig. 1) is a large, geologically complex region that witnessed repeated thermotectonic reworking from at least 2.7 Ga to 1.7 Ga (Stern and Berman, 2000; Sanborn-Barrie et al., 2001; Carson et al., 2004; Berman et al., 2005; Baldwin et al., 2006; Berman et al., in press). Neodymium isotope studies are proving useful in identifying crustal domains of different ages that are difficult to discern through mapping and U-Pb geochronology alone. Previous U-Pb zircon and Sm-Nd studies on orthogneisses and granitoid intrusions in the western Churchill Province have identified broad areas of crust with Neoarchean (ca. 2.7 Ga), late Mesoarchean (ca. 2.8 Ga), and early Mesoarchean to Paleoarchean (>3.0 Ga) Sm-Nd model ages. Regional Sm-Nd studies in the WCP north of 60° were made by Thériault et al. (1994), Dudas et al. (1991), Sandeman et al. (2004), Cousens (1999), and van Breemen et al. (2005). These studies, together with more localized data sets and previously unpublished data, are being compiled in map and database form by Geological Survey of Canada (GSC) scientists with the aim of: 1) determining the extent of Archean crustal domains, 2) clarifying tectonic models for the region, and 3) delineating metallotectonic domains. In this contribution to the Nd isotopic coverage of the WCP, we present new U-Pb SHRIMP (Sensitive High-Resolution Ion Micro Probe), Sm-Nd isotopic, and geochemical data for a selection of igneous rocks from an Archean domain of high-grade gneiss in Tehery-Wager Bay area, north of Chesterfield Inlet (Fig. 1). This area between latitudes 64 and 66° and longtitudes 90 and 94°, where little geochronological data and isotopic data are available, was the subject of a recent Remote Predictive Mapping project of the GSC (Panagapko et al., 2004), which produced new maps from remotely sensed and archival data to update reconnaissance maps created before the advent of regional aeromagnetic surveys.

GENERAL GEOLOGY

The WCP was divided by Hoffman (1988) into the Rae and Hearne provinces, separated by the Snowbird Tectonic Zone (Fig. 1). Both provinces are now being further subdivided, mainly on the basis of mean crustal ages and distinctive tectonothermal events (Skulski et al., 2002; Hanmer et al., 2004; Pehrsson et al., 2003; MacLachlan et al., 2005a, b; Davis et al., 2006; Berman et al., in press; van Breemen et al., in press).

The Tehery-Wager Bay map area is situated in the Rae province, just north of the Rae-Hearne boundary along Chesterfield Inlet (Fig. 1). Most of the Tehery-Wager Bay area has only been mapped at reconnaissance 1:1 000 000 scale (Operations Baker and Wager: Lord and Wright, 1967; Heywood, 1967; Heywood and Schau, 1978; Schau, 1983), although targeted studies were undertaken along the Wager and Daly Bay shorelines (Gordon, 1988; Henderson et al., 1991; Jefferson and Schau, 1992). This area is of interest owing to the presence of a series of granulite massifs along the northern shoreline of Chesterfield Inlet, which reflect, in part, rapid exhumation of lower crust at ca. 1.9 Ga (Gordon, 1988; Tella and Annesley, 1988; Sanborn-Barrie, 1994; Mills et al.,2007). Mesoarchean basement rocks are known to be present in the southwest corner of the region where Zaleski et al. (2001) identified 2.87 Ga granodiorite intruding banded mafic and felsic gneisses of unknown age. This basement constitutes the substrate to Archean supracrustal rocks of the Woodburn Lake Group that were deposited between 2.74 Ga and 2.63 Ga. To the north and east in the Committee Bay Belt, equivalent supracrustal rocks of the Prince Albert Group were deposited between 2.73 Ga and 2.69 Ga and widely intruded by plutons in the 2.61 to 2.58 Ga age range (Skulski et al., 2002, 2003a, b). At present, the Tehery-Wager Bay area is understood to consist mainly of strongly deformed, inferred Archean, granitic gneiss and foliated granitic rocks at amphibolite and higher metamorphic grade, and local Paleoproterozoic intrusions. Much of the area is the equivalent of the southeastern domain of the Committee Bay Belt, a zone dominated by granitic to tonalitic plutonic rocks that locally engulf supracrustal screens equivalent to the Prince Albert Group of the central domain (Skulski et al., 2002, 2003a, b). Paragneiss bodies, which are less abundant, are of both Archean and Proterozoic age (Panagapko et al., 2004).

Early Proterozoic (ca. 1.83 Ga) granite plutonism is represented by thin, shallowly dipping granitic sheets of the Hudson suite (van Breemen et al., 2005) that include the Ford Lake batholith surrounding Wager Bay (LeCheminant et al., 1987). The latter is related to a northeast-trending array of Proterozoic granite intrusions extending to the northeast (Skulski et al., 2002, 2003a). The area is interpreted to be transected by the 1.89 Ga or younger Chesterfield fault zone (Panagapko et al., 2004), a broad, northeast-trending zone of high strain separating high-pressure (7–12 kbar) mixed ortho- and paragneisses on the southeast from low-pressure (<5 kbar) metamorphosed equivalents of the Paleoproterozoic Ketyet River group to the northwest (Berman et al., 2002). These two metamorphic domains were reworked along the ca. 1.8 Ga east-west-trending Wager shear zone (Henderson et al., 1991), which separates the southern metamorphic domain from the Ford Lake batholith.

SAMPLE DESCRIPTIONS AND CHEMISTRY

Samples investigated in this study (Appendix I) were obtained from the archive collections of the Geological Survey of Canada and were restricted to those of adequate size, homogeneity, and absence of alteration. Locations are given in Appendix I and shown in Figure 1. Relatively silicic samples were selected with potential for having ^{147}Sm/^{144}Nd significantly different from that of depleted mantle, as these

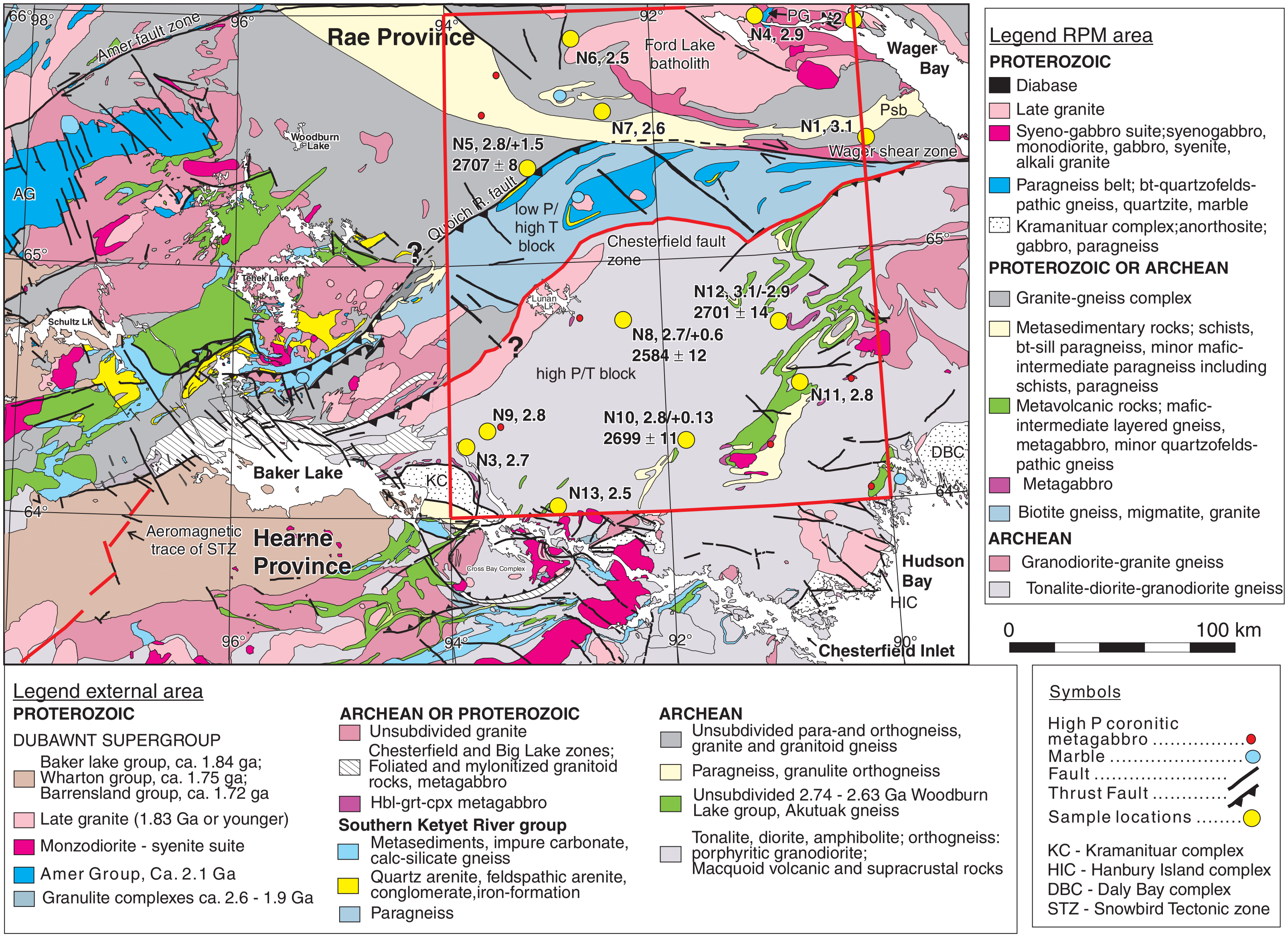

Figure 1. Regional geological map of the Western Churchill Province along Hudson Bay, showing Remote Predictive Mapping area bounded by red lines. Labels show sample numbers followed by depleted mantle Nd model ages (DePaolo, 1981) in Ga. For samples with U-Pb zircon ages, labels also show σ_{Nd} values and U-Pb age with uncertainty in Ma. The Archean tonalite-diorite-granodiorite gneiss is composed of the following units: granodioritic, tonalitic and dioritic orthogneiss; biotite granodiorite; hornblende tonalite; and massive to augen biotite granite.

yield steep intersections with the mantle evolution curve and meaningful Nd model ages. Model ages were not calculated for samples with $^{147}Sm/^{144}Nd > 0.15$ as these would be imprecise. Paragneiss samples were not included in this study as they give an average age of the source terrain and, in a limited number of analyses, may not be the best representatives of local crustal evolution.

Most of the samples were collected during mapping by Heywood and others (Heywood, 1967); sample N13 was collected during mapping of the Macquoid Lake area (Tella et al., 2001). These samples come from six regional map units, selected to cover the range of inferred unit ages. Samples N1 and N7 through N9 constitute gneissic to foliated members of a widespread biotite granitoid gneiss unit. Samples N2 to N5 are foliated to recrystallized granodiorite, tonalite, and granite from the dominant regional granodioritic orthogneiss unit. Sample N6 is a biotite granodiorite from the margin of the Ford Lake batholith. Sample 10 is a foliated, recrystallized hornblende-biotite tonalite from a regional tonalite to diorite gneiss unit. Sample N11 is a recrystallized, mafic-poor, biotite granite. Sample N12, interpreted to be from the oldest unit based on the reported occurrence of crosscutting mafic dykes and complex gneissosity, is a foliated biotite augen granodiorite.

Elemental analyses to aid in the characterization of the samples were obtained from the GSC laboratories where XRF (X-ray fluorescence), ICP-ES (inductively coupled plasma emission spectrometry) and ICP-MS (inductively coupled plasma mass spectrometry) methods were used (Table 1). Figure 2 shows the composition of the samples on a plot of total alkalis versus silica. Figure 3 shows a spider diagram of the distribution of MORB-normalized (Mean Ocean Ridge Basalt) trace elements and Figure 4 shows rare earth element (REE) distributions. As the samples are from diverse map units, their trace-element chemistry cannot be interpreted as coherent suites. Most samples, however, have variable but negative Eu/Eu* anomalies and overall they show high average REE concentrations, suggesting an evolved (dominantly granitoid) character for the local crust. Samples N7 and N13, both with young T_{DM} values (*see* below), show positive Eu/Eu* (Europium/Interpolated Europium) anomalies and strong heavy rare earth element (HREE) depletion, and may represent melts with garnet-bearing restites. The profiles for the HREE values for both samples are concave up. All samples except N13 show significant Nb depletion, which would be consistent with a hypothesis of subduction-related genesis in an arc setting.

U-PB SHRIMP AGES

Ages for zircons from four of the samples studied have been determined using the U-Pb SHRIMP microbeam method. These samples are N5, a biotite-hornblende tonalite to diorite gneiss; N8, a foliated hornblende-biotite monzonite; N10, a foliated, recrystallized, hornblende-biotite tonalite; and N12, a foliated granodiorite. Sample N5 was collected from a location between the Wager shear zone and the Chesterfield fault zone; samples N10, N12, and N8 were collected south of the Chesterfield fault zone (Figure 1).

Analytical method

Analytical procedures for U-Pb zircon analyses using the SHRIMP II at the Geological Survey of Canada followed those described by Stern (1997), with standards and U-Pb calibration methods by Stern and Amelin (2003). Zircons were cast in 2.5 cm diameter epoxy mounts (GSC #318) along with fragments of the GSC laboratory standard zircon (z6266, with $^{206}Pb/^{238}U$ age = 559 Ma). The internal features of the zircons were imaged using an electron microscope in backscattered electron (BSE) mode. Analyses were conducted using a $^{16}O^-$ primary beam. An approximately 20 µm diameter spot size was used for analysis, with a current beam current of approximately 3.5 nA. The 1σ external errors of Pb/U ratios incorporate a ±1.0% error in the standard calibration. Isoplot version 3.00 (Ludwig, 2003) was used to generate concordia plots and calculate weighted means. U-Pb analytical data are presented in Table 2 and displayed on concordia plots (Fig. 5).

Interpretation of results

Zircons from the biotite-hornblende gneiss sample N5 consist mostly of clear, rounded, stubby prisms, although some are round to oval in outline. Zoning is vague and cores are not clearly distinguishable from rims. Twelve U-Pb analyses were strongly clustered on the concordia, whereas three others were discordant and corresponded to younger ages (Fig. 5a). A regression analysis of all the data points yielded upper and lower intercept ages of 2742 ± 31 Ma and 1792 ± 320 Ma, respectively, with a mean square of weighted deviates (MSWD) of 1.04 and probability of fit (POF) of 0.40. These upper and lower intercept ages were interpreted in terms of a Neoarchean igneous precursor and Paleoproterozoic U-Pb disturbance. The upper intercept age was not considered reliable because the analytical uncertainties in SHRIMP analyses may mask recent Pb loss. A better estimate was obtained from the $^{207}Pb/^{206}Pb$ ages, excluding the youngest three that clearly showed Paleoproterozoic disturbance. Their weighted mean is 2707 ± 8 Ma corresponding to a MSWD of 0.97 and a POF of 0.48. Th/U ratios ranging from 0.3 to 0.8 are in the range of zircon from igneous rocks.

Zircons from foliated hornblende-biotite monzonite, N8, are subhedral prismatic with rounded outlines. Igneous zoning is well developed. There are also some unzoned rims and ovoid unzoned zircons. Rounding of the prisms is the result of metamorphic overgrowths as well corrosion of older igneous zircon. Nine concordant analyses from unzoned rims and unzoned ovoid zircon (Fig. 5b) yielded a weighted mean $^{207}Pb/^{206}Pb$ age of 1865 ± 10 Ma with a MSWD of 1.4 and a

Table 1. Major and trace elements compositions.

	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13
SiO_2	71.50	67.60	67.50	63.10	64.00	68.80	70.00	68.30	69.30	55.10	69.60	70.70	69.30
TiO_2	0.29	0.42	0.60	0.77	0.78	0.51	0.26	0.21	0.37	1.03	0.66	0.25	0.19
Al_2O_3	15.40	15.80	15.40	15.60	15.50	15.00	16.20	16.40	15.70	16.90	14.10	15.80	17.10
Fe_2O_3	1.33	1.84	2.02	2.38	2.67	1.70	0.71	0.96	1.47	2.52	1.56	0.88	1.00
FeO	0.6	1.4	1.6	2.9	3.0	0.9	0.8	1.3	1.2	5.2	1.3	1.1	0.9
MnO	0.01	0.05	0.06	0.12	0.09	0.04	0.03	0.03	0.03	0.14	0.06	0.02	0.02
MgO	0.46	1.00	1.17	2.18	2.00	0.52	0.65	0.66	0.87	3.90	0.48	0.72	0.57
CaO	2.69	3.99	2.91	4.73	5.27	1.56	2.46	3.20	2.73	7.45	2.03	3.37	3.74
Na_2O	4.60	5.80	4.30	4.80	4.70	3.40	4.90	4.10	4.30	4.80	3.30	5.10	5.60
K_2O	2.79	1.29	3.70	2.55	1.32	6.63	3.68	4.18	3.67	1.60	5.79	1.42	1.45
P_2O_5	0.10	0.14	0.20	0.35	0.21	0.16	0.11	0.13	0.10	0.42	0.27	0.12	0.05
H_2O	0.4	0.6	0.7	0.7	0.7	0.5	0.4	0.4	0.7	1.1	0.4	0.6	0.3
CO_2	BD	0.4	BD	0.2	0.2	0.2	BD	BD	BD	0.3	BD	BD	BD
total	100.17	100.33	100.16	100.38	100.44	99.92	100.20	99.87	100.44	100.46	99.55	100.08	100.22
Rb	93.00	53.00	57.00	162.00	44.00	322.00	120.00	154.00	79.00	57.00	187.00	55.00	30.00
Cs	1.60	0.67	0.49	7.10	0.66	1.90	1.70	1.40	1.10	0.95	0.82	1.20	0.39
Sr	313	369	445	469	475	355	595	279	409	805	290	565	633
Ba	730	216	1250	490	300	1930	945	1270	1140	588	1520	959	487
Ga	19.00	21.00	18.00	22.00	22.00	20.00	19.00	20.00	17.00	23.00	18.00	18.00	20.00
Tl	0.48	0.32	0.21	0.68	0.27	1.50	0.55	0.73	0.26	0.42	0.89	0.46	0.22
Sn	0.8	3.3	1.4	10.0	1.8	1.6	0.9	2.0	0.8	2.1	2.5	BD	BD
Pb	20	20	7	28	11	59	20	22	9	16	34	25	14
Y	6.10	47.00	30.00	44.00	19.00	29.00	4.00	16.00	17.00	28.00	60.00	5.40	1.40
Zr	349.0	222.0	317.0	459.0	142.0	641.0	245.0	291.0	195.0	294.0	464.0	243.0	133.0
Hf	11.00	6.10	7.90	12.00	3.50	18.00	6.10	8.80	4.20	6.10	12.00	5.40	3.20
Nb	7.90	21.00	18.00	37.00	13.00	19.00	7.40	9.40	13.00	10.00	24.00	2.10	2.40
Ta	0.40	2.90	0.72	2.60	0.51	1.40	0.51	0.46	0.87	0.44	1.30	0.05	0.07
La	33.0	34.0	71.0	133.0	34.0	317.0	38.0	81.0	45.0	55.0	161.0	27.0	15.0
Ce	75.0	66.0	157.0	252.0	68.0	722.0	72.0	161.0	97.0	122.0	349.0	49.0	23.0
Pr	6.30	8.50	20.00	29.00	8.30	64.00	6.80	18.00	9.80	16.00	38.00	5.10	2.20
Nd	19.0	34.0	68.0	101.0	31.0	192.0	21.0	58.0	33.0	60.0	130.0	17.0	6.7
Sm	2.70	9.80	11.00	18.00	5.80	24.00	2.30	8.90	5.50	10.00	21.00	2.80	0.85
Eu	1.00	1.30	2.10	2.90	1.60	2.00	0.94	1.20	1.20	2.70	3.60	1.10	0.76
Gd	1.80	10.00	7.50	13.00	4.70	11.00	1.30	5.60	3.90	7.50	15.00	2.00	0.54
Tb	0.21	1.60	0.97	1.50	0.62	1.20	0.14	0.65	0.52	0.94	1.90	0.21	0.06
Dy	1.00	9.50	5.10	7.60	3.30	5.70	0.66	2.90	2.90	4.90	11.00	1.00	0.24
Ho	0.19	1.70	0.96	1.30	0.61	0.98	0.12	0.50	0.55	0.91	2.00	0.19	0.04
Er	0.53	4.60	2.60	3.40	1.60	2.40	0.31	1.20	1.60	2.50	5.40	0.44	0.11
Tm	0.08	0.61	0.40	0.49	0.23	0.35	0.05	0.16	0.23	0.35	0.79	0.06	BD
Yb	0.56	3.50	2.60	3.00	1.40	2.20	0.34	1.00	1.60	2.30	5.10	0.35	0.12
Lu	0.11	0.45	0.40	0.48	0.22	0.35	0.07	0.18	0.26	0.37	0.80	0.07	0.02
Th	13.00	11.00	6.00	35.00	2.20	138.00	13.00	28.00	14.00	4.40	34.00	2.70	0.12
U	1.40	3.80	0.37	7.00	0.40	11.00	3.50	2.30	0.68	0.93	2.20	0.53	0.11
La/Sm	12.2	3.5	6.5	7.4	5.9	13.2	16.5	9.1	8.2	5.5	7.7	9.6	17.6
Gd/Yb	3.2	2.9	2.9	4.3	3.4	5.0	3.8	5.6	2.4	3.3	2.9	5.7	4.5
LaSm(n)	6.3	1.8	3.3	3.8	3.0	6.8	8.5	4.7	4.2	2.8	4.0	5.0	9.1
GdYb(n)	2.1	1.9	1.9	2.9	2.2	3.3	2.5	3.7	1.6	2.1	1.9	3.8	3.0

(n) denotes normalized to sample S10
Analyses by GSC Ottawa analytical chemistry services, using XRF (method XRF-100) and ICP (methods ICP-ES-110 and ICP-MS-100 and -110)

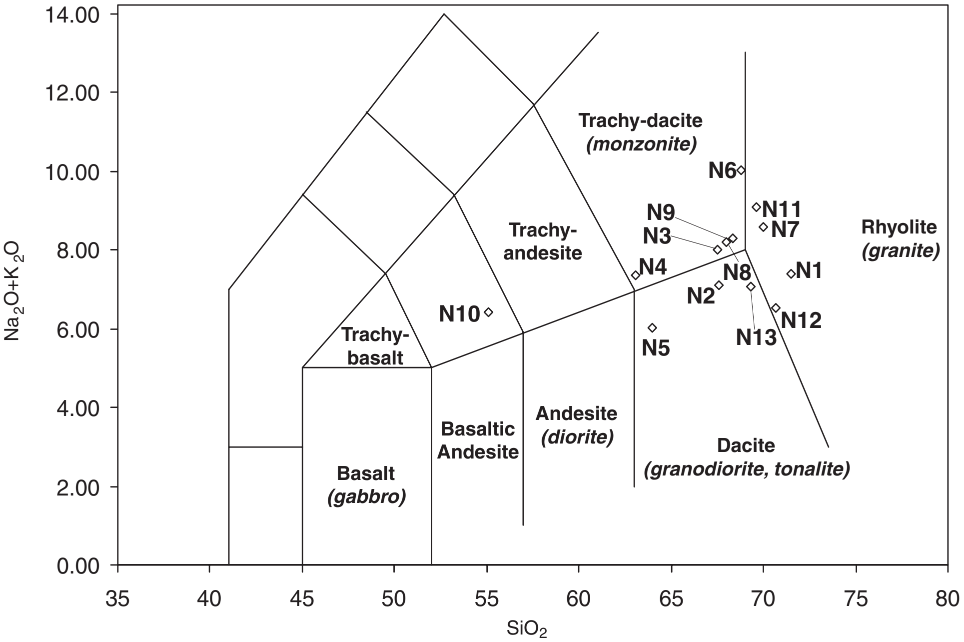

Figure 2. Total alkalis-silica diagram (Le Bas et al., 1986) for all samples in this study.

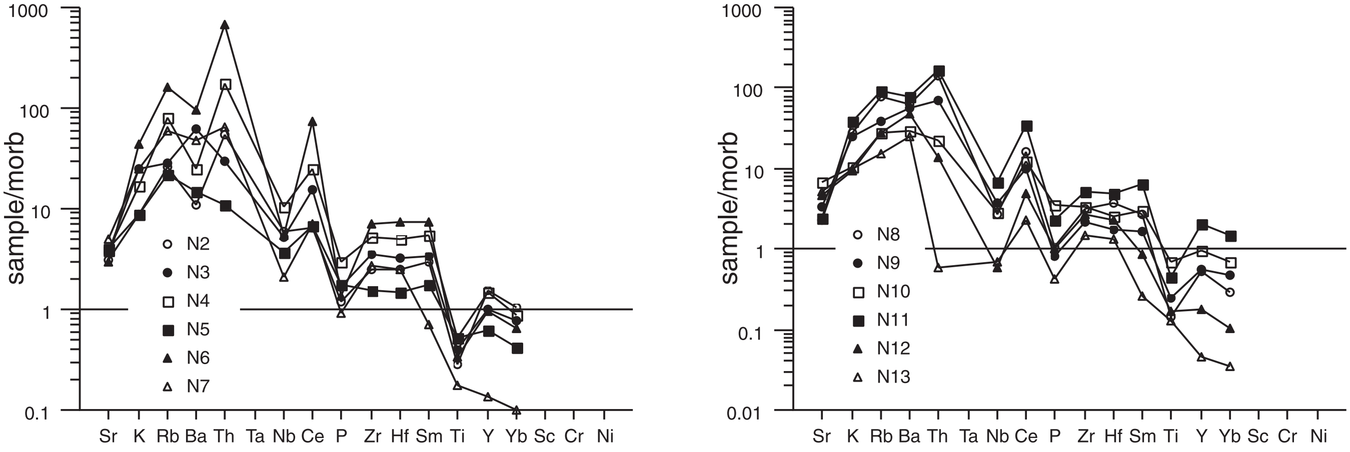

Figure 3. Rare earth elements normalized to chondrites (normalization after Wheatley and Rock, 1988).

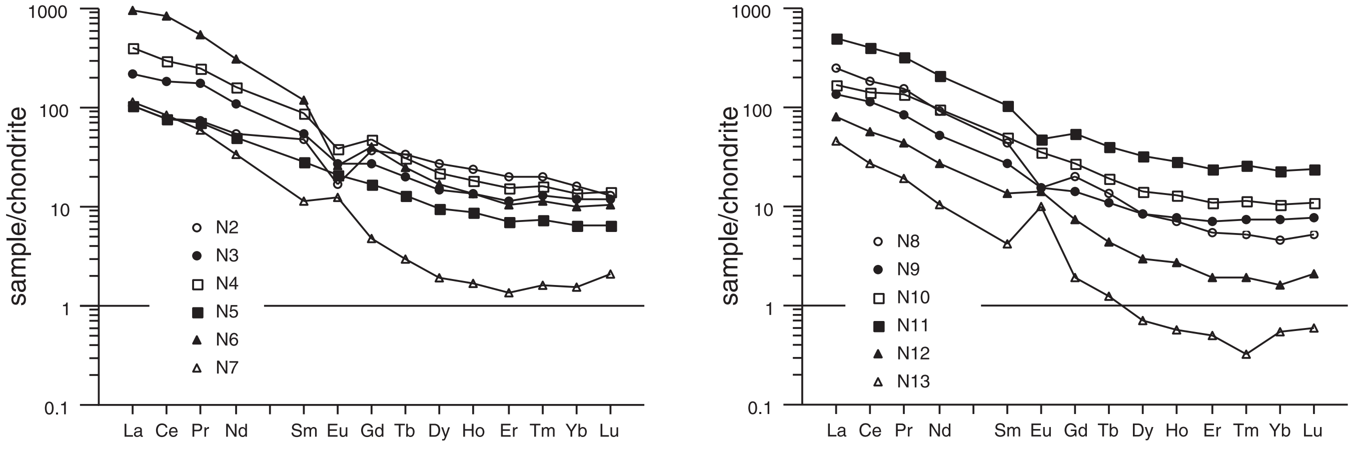

Figure 4. MORB-normalized REE (normalization after Wheatley and Rock, 1988).

Table 2. U-pb SHRIMP analyses.

																Age (Ma)				
Sample*	U (ppm)	Th (ppm)	Th/U	Pb (ppm)	^{204}Pb (ppb)	$\frac{^{204}Pb}{^{206}Pb}$	±1s	f^{206}**	$\frac{^{208}Pb}{^{206}Pb}$	±1s	$\frac{^{207}Pb}{^{235}U}$	±1s	$\frac{^{206}Pb}{^{238}U}$	±1s	$\frac{^{207}Pb}{^{206}Pb}$	±1s	$\frac{^{206}Pb}{^{238}U}$	±1s	$\frac{^{207}Pb}{^{206}Pb}$	±1s	Conc. (%)
N5. Biotite-hornblende gneiss																					
8242-69.1	92	53	0.59	49	7	0.00019438	0.00008373	0.00337	0.16498	0.00723	10.69789	0.24194	0.45888	0.00733	0.16908	0.00239	2435	32	2549	24	4.5
8242-32.1	68	33	0.50	36	3	0.00009626	0.00004484	0.00167	0.13863	0.00372	11.1612	0.26692	0.46546	0.00799	0.17391	0.00255	2464	35	2596	25	5.1
8242-18.1	100	64	0.66	58	1	0.00003569	0.0000276	0.00062	0.18312	0.00249	12.30214	0.19878	0.4889	0.00685	0.1825	0.00118	2566	30	2676	11	4.1
8242-42.1	106	67	0.65	64	1	0.00001154	0.00007195	0.0002	0.18246	0.00592	13.08528	0.23884	0.5157	0.0075	0.18403	0.00172	2681	32	2690	16	0.3
8242-46.1	106	68	0.67	65	2	0.00004568	0.00003704	0.00079	0.18766	0.00364	13.13921	0.2155	0.51708	0.0061	0.1843	0.00185	2687	26	2692	17	0.2
8242-84.1	144	91	0.65	89	3	0.00004198	0.00004625	0.00073	0.17592	0.00284	13.34329	0.23653	0.52466	0.00744	0.18445	0.00166	2719	32	2693	15	-1
8242-63.1	114	72	0.65	68	0	0.00001	0.00001	0.00017	0.18368	0.00259	12.96455	0.24192	0.50884	0.0074	0.18479	0.00185	2652	32	2696	17	1.7
8242-12.1	86	58	0.69	52	1	0.00003215	0.00007388	0.00056	0.18948	0.0037	13.11655	0.21462	0.51373	0.00642	0.18518	0.00169	2673	27	2700	15	1
8242-82.1	103	69	0.69	62	5	0.00011464	0.00005413	0.00199	0.18728	0.00332	13.04357	0.22118	0.5107	0.00637	0.18524	0.00186	2660	27	2700	17	1.5
8242-43.1	106	46	0.44	61	2	0.00004837	0.00002816	0.00084	0.12562	0.0021	13.03705	0.21189	0.50991	0.00721	0.18543	0.0012	2656	31	2702	11	1.7
8242-61.1	130	79	0.63	78	1	0.0000135	0.00004307	0.00023	0.17116	0.00372	13.19768	0.18509	0.51388	0.00597	0.18627	0.00122	2673	25	2709	11	1.3
8242-9.1	86	56	0.67	53	1	0.00002476	0.00002998	0.00043	0.18952	0.00264	13.33017	0.2367	0.51825	0.00609	0.18655	0.00222	2692	26	2712	20	0.7
8242-53.1	70	35	0.52	42	3	0.00008472	0.00009534	0.00147	0.13926	0.00438	13.54057	0.28109	0.52597	0.00701	0.18671	0.00268	2724	30	2713	24	-0.4
8242-17.1	137	106	0.80	84	2	0.00003715	0.00004999	0.00064	0.21587	0.00296	13.17052	0.18201	0.50871	0.00577	0.18777	0.00124	2651	25	2723	11	2.6
8242-31.1	163	43	0.27	92	1	0.0000135	0.00001721	0.00023	0.07603	0.00126	13.43474	0.21718	0.51529	0.0068	0.18909	0.00148	2679	29	2734	13	2
N8. Foliated hornblende-biotite monzonite																					
8245-35.1	137	1	0.00	43	8	0.00020565	0.00007279	0.00356	-0.00399	0.00272	5.0914	0.11978	0.3308	0.00432	0.11163	0.00201	1842	21	1826	33	-0.9
8245-68.1	253	1	0.01	80	1	0.00001764	0.00002624	0.00031	0.00228	0.001	5.16383	0.08441	0.33079	0.00415	0.11322	0.00102	1842	20	1852	16	0.5
8245-84.1	698	4	0.01	223	0	0.00000157	0.00000748	0.00003	0.00174	0.0003	5.2105	0.06604	0.33375	0.00362	0.11323	0.0006	1857	18	1852	10	-0.3
8245-36.1	791	5	0.01	255	1	0.00000559	0.00001234	0.0001	0.00185	0.00047	5.24224	0.06809	0.33561	0.00359	0.11329	0.00069	1866	17	1853	11	-0.7
8245-77.2	554	3	0.01	176	1	0.00000418	0.00000944	0.00007	0.00188	0.00039	5.19004	0.0654	0.33115	0.00365	0.11367	0.00055	1844	18	1859	9	0.8
8245-60.1	1261	6	0.00	407	8	0.00002269	0.00001168	0.00039	0.00126	0.00044	5.29557	0.0733	0.33649	0.00359	0.11414	0.00087	1870	17	1866	14	-0.2
8245-66.1	1349	7	0.01	434	3	0.0000079	0.00000588	0.00014	0.00175	0.00023	5.29031	0.06057	0.33534	0.00349	0.11442	0.00042	1864	17	1871	7	0.3
8245-65.1	627	4	0.01	200	1	0.00000538	0.0000094	0.00009	0.00253	0.0004	5.28303	0.06777	0.33218	0.00365	0.11535	0.00062	1849	18	1885	10	1.9
8245-41.1	113	1	0.01	36	2	0.00005063	0.00003622	0.00088	0.0022	0.0014	5.24882	0.13519	0.32968	0.00592	0.11547	0.00189	1837	29	1887	30	2.7
8245-38.1	190	60	0.33	84	8	0.00011722	0.00004894	0.00203	0.08642	0.00279	8.52009	0.15278	0.41394	0.00534	0.14928	0.00163	2233	24	2338	19	4.5
8245-34.1	62	29	0.48	30	3	0.00012904	0.00013639	0.00224	0.14629	0.00611	9.41765	0.23807	0.4286	0.00603	0.15936	0.00308	2299	27	2449	33	6.1
8245-2.1	433	117	0.28	210	1	0.00000863	0.00001644	0.00015	0.07968	0.00106	10.25078	0.16956	0.45265	0.00538	0.16424	0.00166	2407	24	2500	17	3.7
8245-64.1	853	262	0.32	434	4	0.00001068	0.00000602	0.00019	0.0883	0.00077	10.73598	0.14036	0.47173	0.00519	0.16506	0.00096	2491	23	2508	10	0.7
8245-28.1	665	156	0.24	327	22	0.00008301	0.00001693	0.00144	0.0805	0.00089	10.51955	0.11931	0.45819	0.00479	0.16651	0.00055	2432	21	2523	6	3.6
8245-23.1	1259	46	0.04	613	5	0.00001021	0.00000425	0.00018	0.01044	0.00037	11.11248	0.41642	0.48024	0.01235	0.16782	0.00407	2528	54	2536	41	0.3
8245-69.1	736	172	0.24	373	8	0.00002823	0.00001077	0.00049	0.06983	0.0007	11.03779	0.14581	0.47554	0.00518	0.16834	0.00105	2508	23	2541	10	1.3
8245-32.1	772	114	0.15	385	3	0.0000087	0.00000748	0.00015	0.0425	0.00052	11.16319	0.14054	0.47814	0.0053	0.16933	0.00081	2519	23	2551	8	1.2
8245-33.1	2051	1275	0.64	1191	9	0.00001	0.00001	0.00017	0.18076	0.00121	11.74062	0.1447	0.49917	0.00548	0.17059	0.00075	2610	24	2563	7	-1.8
8245-97.1	2999	287	0.10	1732	3	0.00000204	0.00000098	0.00004	0.02719	0.00035	13.21746	0.21934	0.56037	0.00901	0.17107	0.00044	2868	37	2568	4	-11.7
8245-60.2	2308	441	0.20	1278	21	0.00002002	0.00000375	0.00035	0.0537	0.00041	12.42632	0.19427	0.52533	0.00798	0.17156	0.00038	2722	34	2573	4	-5.8
8245-52.1	1188	238	0.21	620	2	0.00000487	0.00000273	0.00008	0.05803	0.00058	11.72837	0.14912	0.49351	0.00564	0.17236	0.00075	2586	24	2581	7	-0.2
8245-77.1	457	167	0.38	246	5	0.00002664	0.00001241	0.00046	0.10135	0.00125	11.65097	0.21754	0.49024	0.00754	0.17237	0.00152	2572	33	2581	15	0.4
8245-80.1	76	34	0.47	41	7	0.00020865	0.00007029	0.00362	0.12621	0.0054	11.69953	0.32919	0.48994	0.00703	0.17319	0.00389	2570	30	2589	38	0.7
8245-81.1	153	91	0.61	87	4	0.0000579	0.00003259	0.001	0.17003	0.00246	11.81863	0.19134	0.49173	0.00607	0.17432	0.00158	2578	26	2600	15	0.8
N10. Foliated hornblende-biotite tonalite																					
8247-64.1	170	73	0.44	61	0	0.00000353	0.00003056	0.00006	0.12763	0.00329	5.70373	0.09024	0.33675	0.00422	0.12284	0.00101	1871	20	1998	15	6.4
8247-1.2	249	146	0.60	125	3	0.00003149	0.0000215	0.00055	0.17769	0.00176	9.74612	0.1493	0.43357	0.00603	0.16303	0.0008	2322	27	2487	8	6.7

Uncertainties reported at one sigma and are calculated by numerical propagation of all known sources of error (Stern, 1997);

*Sample# -grain# .spot#

**f^{206} refers to mole fraction of total ^{206}Pb that is due to common Pb;

Data are common-Pb corrected according to procedures outlined in Stern (1997); Conc. = 100 x (^{206}Pb/^{238}U age)/(^{207}Pb/^{206}Pb age).

Table 2. (cont.)

																Age (Ma)				
Sample*	U (ppm)	Th (ppm)	Th/U	Pb (ppm)	^{204}Pb (ppb)	$\frac{^{204}\text{Pb}}{^{206}\text{Pb}}$	±1s	f^{206}**	$\frac{^{208}\text{Pb}}{^{206}\text{Pb}}$	±1s	$\frac{^{207}\text{Pb}}{^{235}\text{U}}$	±1s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	±1s	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	±1s	$\frac{^{206}\text{Pb}}{^{238}\text{U}}$	±1s	$\frac{^{207}\text{Pb}}{^{206}\text{Pb}}$	±1s	Conc. (%)
8247-1.1	267	157	0.61	136	4	0.00004122	0.00004091	0.00071	0.17931	0.00434	9.98243	0.34151	0.43838	0.00498	0.16515	0.0051	2343	22	2509	53	6.6
8247-83.1.1	116	63	0.56	59	1	0.00002845	0.0000321	0.00049	0.15782	0.00243	10.1962	0.20268	0.44382	0.00549	0.16662	0.00235	2368	25	2524	24	6.2
8247-13.1	117	98	0.86	65	4	0.0000941	0.00003624	0.00163	0.25376	0.00325	10.57888	0.19437	0.45577	0.00575	0.16834	0.002	2421	26	2541	20	4.7
8247-65.1	335	205	0.63	185	1	0.00000712	0.00001352	0.00012	0.1808	0.0022	11.3072	0.14737	0.47202	0.00526	0.17374	0.00095	2492	23	2594	9	3.9
8247-45.11	250	153	0.63	145	4	0.00003979	0.00002009	0.00069	0.17134	0.00221	12.24957	0.22109	0.49866	0.00658	0.17816	0.00192	2608	28	2636	18	1.1
8247-100.1	102	49	0.50	58	5	0.00012003	0.00003737	0.00208	0.14101	0.00263	12.38678	0.25197	0.49586	0.00732	0.18118	0.00222	2596	32	2664	20	2.5
8247-29.1	107	44	0.43	60	3	0.00005465	0.0000658	0.00095	0.11972	0.00309	12.57262	0.25085	0.50294	0.0081	0.18131	0.0018	2626	35	2665	17	1.4
8247-48.1	214	50	0.24	115	0	0.0000049	0.00002553	0.00008	0.06778	0.00138	12.57185	0.22056	0.49842	0.00618	0.18294	0.00201	2607	27	2680	18	2.7
8247-81.2	208	139	0.69	124	3	0.00003135	0.00003216	0.00054	0.19236	0.00252	12.78129	0.18119	0.50252	0.00561	0.18447	0.00137	2625	24	2693	12	2.6
8247-5.1	365	290	0.82	231	4	0.00002383	0.00001784	0.00041	0.22833	0.00156	13.25419	0.18979	0.52011	0.00565	0.18482	0.00149	2700	24	2697	13	-0.1
8247-28.1	683	455	0.69	414	3	0.00000937	0.00000608	0.00016	0.19498	0.00225	13.02582	0.17231	0.50986	0.00578	0.18529	0.00103	2656	25	2701	9	1.7
8247-99.1	420	303	0.75	258	7	0.00003941	0.00001148	0.00068	0.20945	0.00175	13.14801	0.19799	0.51105	0.00617	0.18659	0.00142	2661	26	2712	13	1.9
N12. Foliated granodiorite																					
8249-84.1	67	70	1.08	26	6	0.00031198	0.00017361	0.00541	0.31057	0.009	4.96929	0.15339	0.32188	0.00454	0.11197	0.00288	1799	22	1832	47	1.8
8249-66.1	64	69	1.11	26	3	0.00017231	0.00008113	0.00299	0.32784	0.0062	5.04857	0.12495	0.32554	0.00518	0.11248	0.00192	1817	25	1840	31	1.3
8249-17.1	63	10	0.17	21	1	0.00006366	0.0000711	0.0011	0.04977	0.00376	5.09374	0.10369	0.32563	0.00456	0.11345	0.00149	1817	22	1855	24	2.1
8249-21.1	221	7	0.03	70	3	0.00004568	0.00002454	0.00079	0.00765	0.00104	5.16538	0.07102	0.32953	0.00388	0.11369	0.00066	1836	19	1859	10	1.2
8249-26.1	203	5	0.02	64	2	0.00002661	0.0000245	0.00046	0.00749	0.001	5.20994	0.1025	0.3296	0.00452	0.11464	0.00143	1836	22	1874	23	2
8249-9.1	176	10	0.06	56	2	0.00003635	0.00003534	0.00063	0.01896	0.00152	5.18018	0.07964	0.32717	0.00387	0.11483	0.00097	1825	19	1877	15	2.8
8249-35.1	95	32	0.35	44	1	0.00002894	0.00003659	0.0005	0.09983	0.00234	9.34957	0.17245	0.42429	0.00572	0.15982	0.00176	2280	26	2454	19	7.1
8249-57.1	225	129	0.59	124	5	0.00004951	0.00002955	0.00086	0.1649	0.00205	11.43453	0.16694	0.47862	0.00604	0.17327	0.00103	2521	26	2590	10	2.6
8249-18.1	204	75	0.38	109	3	0.00003786	0.00002072	0.00066	0.11049	0.00168	11.65865	0.1653	0.48342	0.00579	0.17491	0.00109	2542	25	2605	10	2.4
8249-8.1	230	107	0.48	125	1	0.00000567	0.00001472	0.0001	0.13287	0.00142	11.84274	0.15758	0.48203	0.00564	0.17819	0.0009	2536	25	2636	8	3.8
8249-59.2	97	82	0.87	60	0	0.00000931	0.00005699	0.00016	0.2393	0.0039	12.45464	0.19402	0.50254	0.006	0.17974	0.00155	2625	26	2651	14	1
8249-59.3	116	119	1.06	73	2	0.00003871	0.00003889	0.00067	0.2999	0.00376	12.37363	0.21199	0.495	0.00687	0.1813	0.00153	2592	30	2665	14	2.7
8249-59.3.2	110	112	1.06	68	1	0.00002573	0.00002554	0.00045	0.30243	0.00728	12.14453	0.22758	0.4826	0.00795	0.18251	0.0013	2539	35	2676	12	5.1
8249-59.1	112	98	0.90	71	4	0.00007062	0.00005102	0.00122	0.24687	0.00513	13.07111	0.29419	0.51794	0.00762	0.18303	0.0028	2690	32	2681	26	-0.4
8249-63.1	326	84	0.27	179	0	0.00000036	0.00001297	0.00001	0.07361	0.00102	12.9039	0.17643	0.50875	0.00597	0.18396	0.00105	2651	26	2689	9	1.4
8249-61.1	405	77	0.20	226	2	0.00001354	0.00001225	0.00023	0.05451	0.00079	13.31331	0.15249	0.52321	0.00548	0.18455	0.00064	2713	23	2694	6	-0.7
8249-75.1	475	83	0.18	263	2	0.00001	0.00001	0.00017	0.04944	0.00071	13.29454	0.20859	0.52142	0.00662	0.18492	0.00144	2705	28	2697	13	-0.3
8249-67.1	362	92	0.26	205	5	0.00003067	0.00001453	0.00053	0.07322	0.00105	13.3426	0.1973	0.52296	0.00611	0.18504	0.00143	2712	26	2699	13	-0.5
8249-71.1	146	54	0.38	82	2	0.00002418	0.00003428	0.00042	0.1052	0.0021	12.96146	0.20934	0.50423	0.0061	0.18643	0.00173	2632	26	2711	15	2.9
8249-2.1	744	474	0.66	459	2	0.00000505	0.00000833	0.00009	0.18229	0.0017	13.53502	0.16312	0.52311	0.00546	0.18766	0.00091	2712	23	2722	8	0.3
8249-78.1	134	124	0.95	89	5	0.00008356	0.00003642	0.00145	0.26443	0.00555	14.04237	0.22526	0.52567	0.00594	0.19374	0.00195	2723	25	2774	17	1.8
8249-4.1	192	74	0.40	120	3	0.00002999	0.00001433	0.00052	0.11063	0.00151	15.93677	0.21577	0.5504	0.00618	0.21	0.00132	2827	26	2906	10	2.7
8249-62.1	181	70	0.40	114	1	0.00001	0.00001	0.00017	0.11037	0.00308	16.1293	0.24951	0.55381	0.00705	0.21123	0.00155	2841	29	2915	12	2.5
8249-31.1	81	32	0.41	48	3	0.00009524	0.00004249	0.00165	0.11576	0.00262	15.38995	0.26529	0.52646	0.00784	0.21202	0.00149	2727	33	2921	11	6.7
8249-80.1	122	50	0.42	78	1	0.00001099	0.00003073	0.00019	0.11972	0.00391	16.48821	0.32226	0.55427	0.00838	0.21575	0.0023	2843	35	2949	17	3.6
8249-69.1	114	28	0.26	72	3	0.00005543	0.00003121	0.00096	0.06768	0.0018	17.10987	0.28174	0.57137	0.00827	0.21718	0.00136	2913	34	2960	10	1.6

Uncertainties reported at one sigma and are calculated by numerical propagation of all known sources of error (Stern, 1997);

*Sample# -grain# .spot#

**f^{206} refers to mole fraction of total ^{206}Pb that is due to common Pb;

Data are common-Pb corrected according to procedures outlined in Stern (1997); Conc. = 100 x (^{206}Pb/^{238}U age)/(^{207}Pb/^{206}Pb age).

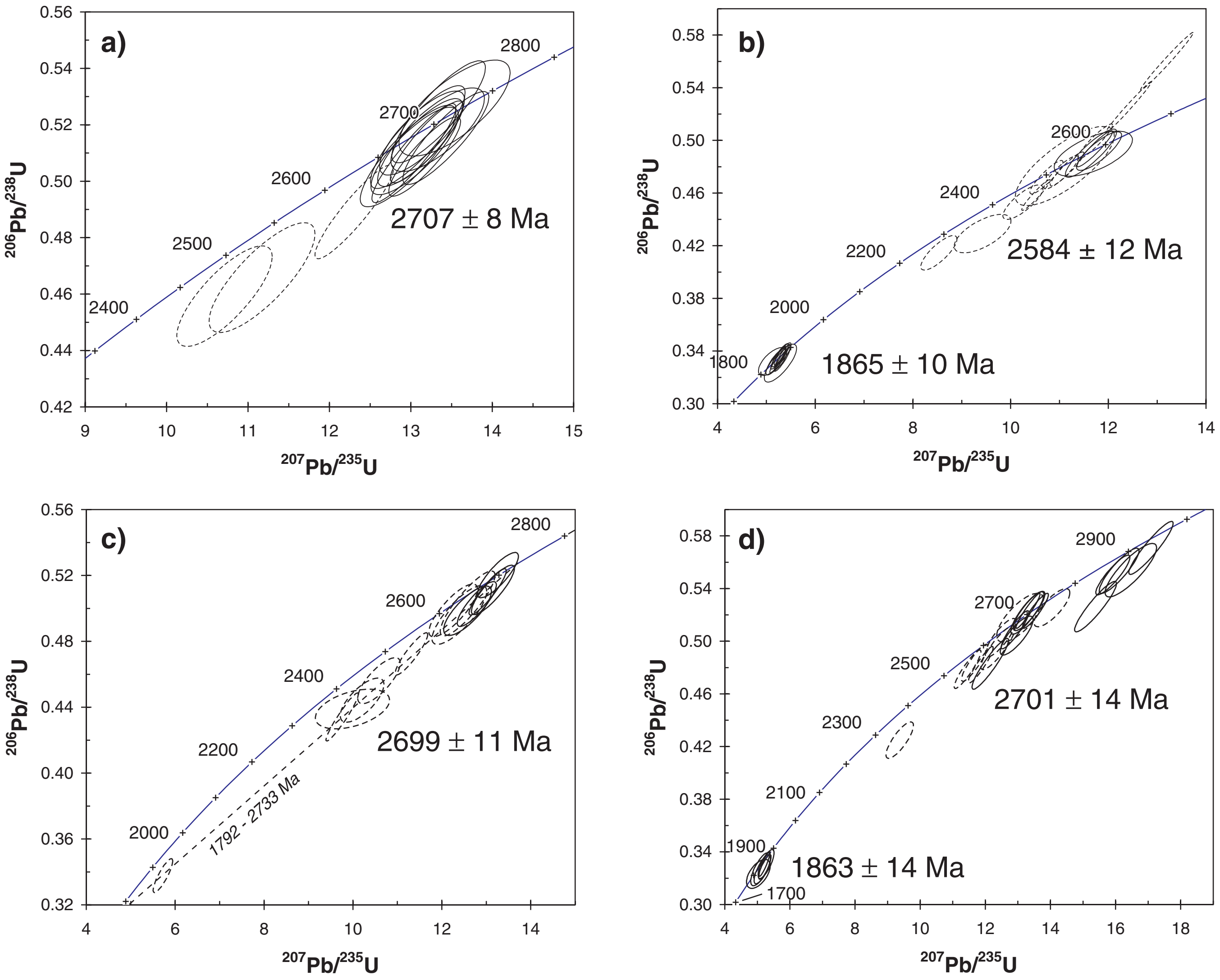

Figure 5. U-Pb concordia diagrams for samples a) N5, biotite-hornblende gneiss; b) N8, hornblende-biotite foliated monzonite; c) N10, foliated, recrystallized, hornblende-biotite tonalite; and d) N12, foliated granodiorite.

POF of 0.19. These zircons have low Th/U ratios of 0.004 to 0.007 that are characteristic of zircon grown during amphibolite-facies metamorphic conditions (Williams and Cleasson, 1987; Rubatto, 2002). The older analyses, by contrast, had Th/U ratios ranging from 0.04 to 0.64. The difference reflects low Th in the metamorphic zircons as zircons of both ages have variable U concentrations that are moderate to high. The 1865 ± 10 Ma age is interpreted as dating a metamorphic event. The remaining analyses showed a large spread with ^{207}Pb/^{206}Pb ages ranging from 2600 Ma 2338 Ma. A regression analysis of these data points, excluding the two reversely discordant analyses, yielded upper and lower intercept ages of 2594 ± 32 Ma and 1779 ± 200 Ma, respectively, with MSWD of 0.95 and POF of 0.48. The data distribution is, therefore, interpreted in terms of an Archean crystallization age with U-Pb systems disturbed during Paleoproterozoic metamorphism. The age is calculated from the four oldest analyses, which yielded a weighed average age of 2584 ± 12 Ma. This granodiorite pluton could, therefore be part of the ca. 2.6 Ga Snow Island suite, a regionally developed diorite-to-leucogranite suite that is widespread throughout the Rae domain (LeCheminant and Roddick, 1991; Peterson and Born, 1994; Davis et al., 2000).

Zircons from the foliated, recrystallized, hornblende-biotite tonalite, N10, consist of rounded prisms that are well zoned to unzoned in an irregular distribution that suggests recrystallization of originally igneous zircon. One 6.4 per cent discordant analysis yields a ^{207}Pb/^{206}Pb age of 1998 ± 30 Ma. This spot analysis corresponded to a Th/U ratio of 0.44, which was within the 0.24 to 0.86 Th/U range for all spot analyses in this sample. The remaining analysis results were spread along a discordia trend (Fig. 5c) that fit a regression line with upper and lower intercept ages of 2733 ± 33 Ma and 1792 ± 160 Ma, with a MSWD of 0.61 and POF of 0.82. These intercept ages were interpreted in terms of a Neoarchean igneous precursor with U-Pb zircon systems that were disturbed during the Paleoproterozoic, probably as a result of incipient recrystallization. The upper intercept age is not precise because of the near-parallel orientation of the discordia and the concordia. It may also be biased towards an older age if the oldest analyses are discordant due to recent Pb loss. Assuming that the tightly clustered five oldest analyses were not significantly affected by Paleoproterozoic disturbance, the best estimate of igneous age is the weighted mean $^{207}Pb/^{206}Pb$ age of 2699 ± 11 Ma, with a MSWD of 0.63 and POF of 0.64.

Zircons from foliated granodiorite, N12, range from rounded subhedral to equidimensional forms. Zoning is generally poorly developed. Unzoned rims are distinguishable in a number of cases. Analyses show a three-fold distribution on a concordia plot (Fig. 5d). The youngest cluster of 6 concordant analyses, from unzoned, ovoid grains and rims, yielded a weighted mean $^{207}Pb/^{206}Pb$ age of 1863 ± 14 Ma with a MSWD of 0.47 and POF of 0.80. This age is interpreted in terms of metamorphic zircon growth on the basis of the lack of zoning and isometric morphology. Also, Th/U ratios for these analyses range from 0.02 to 1.11 (Table 2). While metamorphic zircon can have a wide range of Th/U rations, with high values documented in zircon grown in a granulite-facies environment (Vavra, 1999), low values are only found in metamorphic zircon and are, therefore, diagnostic of a metamorphic growth environment. The oldest cluster of 5 analyses yields a range of $^{207}Pb/^{206}Pb$ ages from 2960 Ma to 2906 Ma. These ages are interpreted in terms of inherited zircon. This zircon is not, however, distinguishable from the main igneous zircon population. The age of igneous crystallization is calculated from a cluster of six concordant analyses with a weighted mean $^{207}Pb/^{206}Pb$ age of 2701 ± 14 Ma, corresponding to a MSWD of 2.0 and POF of 0.07. A somewhat older analysis of 2774 Ma is also attributed to inheritance, while younger analyses with $^{207}Pb/^{206}Pb$ ages of 2681 Ma to 2454 Ma are attributed to Pb loss during Paleoproterozoic metamorphism.

Sm-Nd ISOTOPES

Analytical procedure

The powdered rock samples were spiked with mixed ^{148}Nd-^{149}Sm tracers, and digested in HF+HNO_3 mixture in Savillex™ PFA Teflon® at 120°C. Evaporated samples were treated with concentrated HCl and HNO_3 to break down fluorides. REE fractions (including Sm and Nd) were separated using cation-exchange chromatography on columns containing 0.5 ml of AG50x12W resin and 4M HCl as eluant. Sm and Nd were subsequently separated using 0.5 ml columns filled with Eichrom Ln-Spec REE-specific resin, and 0.23-0.50M HNO_3 as an eluant. Procedural blanks were below 0.005 ng for column chemistry, and the dissolution blanks were below 0.02 ng.

Isotopic analyses were done using a Nu Plasma™ multicollector ICP-MS. Nd and Sm solutions were measured directly without additional chemical conversions on a fixed array of Faraday collectors in static multicollector mode. The isotopic ratios were corrected for spike contribution and mass discrimination by numeric solution of the isotope dilution equations with exponential normalization. Monitoring the uniformity of four non-radiogenic isotopic ratios performed quality control. The $^{143}Nd/^{144}Nd$ ratios in the samples were reported relative to $^{143}Nd/^{144}Nd=0.51186$ in the La Jolla standard. The correction was applied using average measured $^{143}Nd/^{144}Nd$ in the La Jolla standard of 0.511827±0.000022 (2 SD), measured during the course of this study. Five aliquots of dissolved standard BCR-1, spiked after dissolution, yielded $^{147}Sm/^{144}Nd=0.13666\pm0.00008$ and $^{143}Nd/^{144}Nd= 0.512643\pm0.000026$ (2 SD), also corrected for the La Jolla standard value. Two sigma uncertainties for the $\varepsilon_{Nd(T)}$ values were around +/-0.5.

Results and interpretation

Sm-Nd isotopic data are given in Table 3 and Nd evolution lines for individual samples in Figure 6, which also shows depleted mantle growth curves according to the models of DePaolo (1981), Goldstein et al. (1984) and Nägler and Kramers (1998). In this paper the authors refer to the depleted mantle ages modelled after DePaolo (1981), which are typically 100 million years younger than model ages based on Goldstein et al. (1984), as can be seen from the intersections on Figure 6. Sample N2, although granodioritic in composition, has a $^{147}Sm/^{143}Nd$ >0.17 and an unrealistic T_{DM} of 5.2 Ga and is, therefore, not plotted in Figure 6.

The ε_{Nd} of the samples dated at 2.7 Ga are +1.5 (N5), +1.3 (N10), and -2.9 (N12); the sample dated at 2.6 Ga (N8) has ε_{Nd} = +0.6 (N8). Only one of these (N12) shows a significant older crustal component with a T_{DM} of 3.08 Ga. Sample N1 has a similarly old T_{DM} of 3.08 Ga while sample N4 has a slightly younger T_{DM} of 2.92 Ga. A single Sm-Nd analysis from the Ford Lake suite reported by Dudas et al. (1991) is also indicative of Mesoarchean crust in the area. The majority of the samples from this study have T_{DM} ages between 2.83 Ga and 2.72 Ga with an average of 2.88 Ga. This crust-mantle separation age is close to the age of known Mesoarchean basement immediately to the southwest (Zaleski et al., 2001).

Three samples have significantly younger T_{DM} ages of 2.56 Ga (N7), 2.53 Ga (N6) and 2.53 Ga (N13). Sample N6 from the margin of the Ford Lake Batholith has the greatest LREE enrichment and appears chemically to be the most evolved of the samples analyzed. It may be part of the Proterozoic Hudson granite suite. As pointed out above, samples N7 and N13 both have distinctive chemistry with

Table 3. Sm-Nd isotopic data and sample coordinates.

	N1*	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13
Sm	2.542	9.044	10.296	16.950	5.401	22.243	2.169	8.243	5.227	9.646	19.243	2.312	0.762
Nd	17.743	31.553	65.289	96.399	28.808	184.297	18.962	55.485	31.869	56.598	120.985	14.31	5.734
^{147}Sm/^{144}Nd	0.0866 ± 1	0.1733 ± 2	0.0953 ± 1	0.1063 ± 3	0.1133 ± 2	0.0730 ± 4	0.0692 ± 1	0.0898 ± 1	0.0991 ± 1	0.1030 ± 2	0.0961 ± 5	0.0977 ± 1	0.0803 ± 1
^{143}Nd/^{144}Nd	0.510502 ± 24	0.511831 ± 23	0.510944 ± 23	0.511006 ± 22	0.511231 ± 23	0.510720 ± 23	0.510626 ± 22	0.510848 ± 23	0.510934 ± 22	0.511034 ± 22	0.510888 ± 22	0.510724 ± 24	0.510845 ± 24
U-Pb Age**	unknown	unknown	unknown	unknown	2.708	unknown	unknown	2.584	unknown	2.699	unknown	2.701	unknown
T_{DM} DePaolo *(Goldstein)*	3.08 *(3.15)*	5.16 *(4.90)*	2.72 *(2.82)*	2.92 *(3.02)*	2.78 *(2.90)*	2.53 *(2.62)*	2.56 *(2.65)*	2.72 *(2.82)*	2.83 *(2.93)*	2.79 *(2.89)*	2.82 *(2.91)*	3.08 *(3.16)*	2.53 *(2.62)*
ε_{Nd}					1.5			0.6		1.3		-2.9	

*Uncertainties in Sm-Nd isotopic ratios are 2σ.
**All ages in Ga.

positive Eu/Eu* anomalies, less abundant LREE, and strong HREE depletion and may represent plutons of the ca. 2.60 Ga Snow Island suite. Sample N8, with a U-Pb age of 2584 ± 12 Ma has, however, trace element and REE abundances similar to the main group of samples.

DISCUSSION

The oldest U-Pb age, 2707 ± 8 Ma, was obtained from a biotite-hornblende tonalitic gneiss (N5), while ages of 2700 were obtained from a foliated, recrystallized, hornblende-biotite tonalite (N10) and a foliated granodiorite (N12). The latter sample also yielded five Mesoarchean inherited ages from 2960 Ma to 2906 Ma. These Neoarchean emplacement ages are within the range of ages for the Woodburn Lake and Prince Albert groups. Neoarchean volcanism and associated plutonism of this age are widespread in both the Hearne and Rae provinces (Skulski et al. 2003b; Davis and Zaleski, 2004). None of the units analyzed, therefore, constitute basement to the regional supracrustal assemblages. A fourth sample of foliated biotite-hornblende monzonite (N8) has a significantly younger U-Pb age of 2584 ± 12 Ma, which suggests that this sample is from the 2.62 to 2.58 Ga Snow Island plutonic suite of the Rae Province and Chesterfield domain.

Strong evidence for the existence of Mesoarchean crust comes from samples N12, N1, and N4, which have T_{DM} ages of 3.08 Ga, 3.08 Ga, and 2.92 Ga. Such older Nd isotopic signatures are widespread in both the Rae and Hearne provinces, although they are absent in the Central Hearne domain, and mostly absent in the Northwestern Hearne domain. Six of the T_{DM} ages are in the range 2.83 to 2.72 Ga, which is a common Nd model age throughout the western Churchill Province. Silica concentrations for these rocks show the greatest variation, from 55 % to 70 %. Concentrations for the remaining rocks are close to 70 %. There is no apparent correlation between T_{DM} ages and silica content and, therefore, no indication of two component mixing. The majority of the samples are chemically evolved featuring LREE enrichment, HREE depletion, and with negative Eu/Eu* to slightly positive (N12) anomalies. They are also characterized by Nb depletion. Our preferred interpretation is that the U-Pb and Sm-Nd data indicate a major crust-forming event at ca. 2.7 Ga, but building on a substrate or fragments of Mesoarchean crust, for which there is abundant evidence in both Nd T_{DM} and U-Pb zircon ages (this work; Zaleski, 2001; Skulski et al., 2003b). The depleted Nd signature may reflect arc magmatism at 2.7 Ga, but it is possible that this is also inherited from evolved granitoid components of older crust, as is commonly noted in the Proterozoic Hudson suite of the western Churchill Province (van Breemen et al., 2005).

Two samples with late Neoarchean T_{DM} ages, N7 and N13, have compositions that differ markedly from the main population in having positive Eu/Eu* anomalies and extreme HREE depletion. The profile for the HREE (heavy rare earth

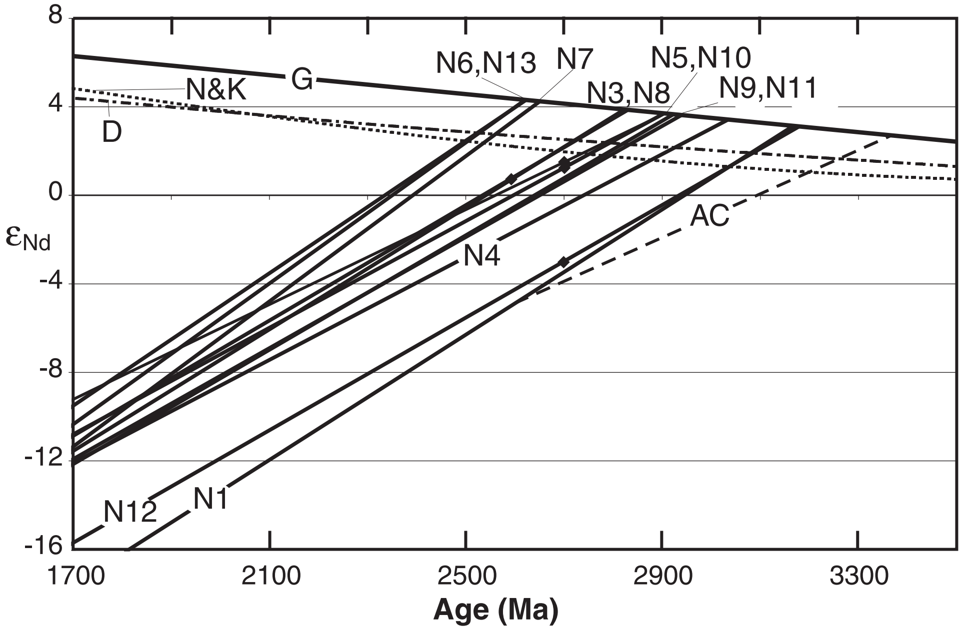

Figure 6. Nd isotopic evolution lines for samples from the Tehery-Wager Bay area. Depleted mantle curves for the Goldstein et al. (G), DePaolo (D), and Nägler and Kramers (N&K) models are shown. AC = average continental crustal evolution line. Diamonds overlying evolution lines represent the age at which ε_{Nd} values were calculated.

elements) values for both samples are concave up. These rocks likely formed through a cumulative process, which may have affected Sm/Nd ratios rendering their T_{DM} ages suspect. Sample N13 is the only sample analyzed that does not show Nb depletion. It was collected from the area around the Chesterfield Inlet where the Hudson granites yielded late Archean T_{DM} ages (van Breemen et al., 2005). Sample N6 also has a late Neoarchean T_{DM} of 2.53 Ga but it has the most evolved composition of this study, with strong LREE enrichment, negative Eu/Eu* anomaly, and Nb depletion. As this sample comes from the margin of the 1825 Ma Forde Lake Batholith, it is likely to belong to the Hudson granite suite.

Samples N8 and N12 have metamorphic zircon overgrowths dated at 1865 ± 10 Ma and 1863 ± 14 Ma, and these are the first metamorphic ages in the Tehery-Wager Bay area. Amphibolite-facies metamorphism at this time was widespread in the Rae Province of the Western Churchill Province and preceded emplacement of plutons of the 1845 to 1795 Ma Hudson granite suite, which are generally interpreted as crustal melts generated by regional metamorphism (Peterson and van Breemen, 1999; Peterson et al., 2002; van Breemen et al., 2005).

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