DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2016/48

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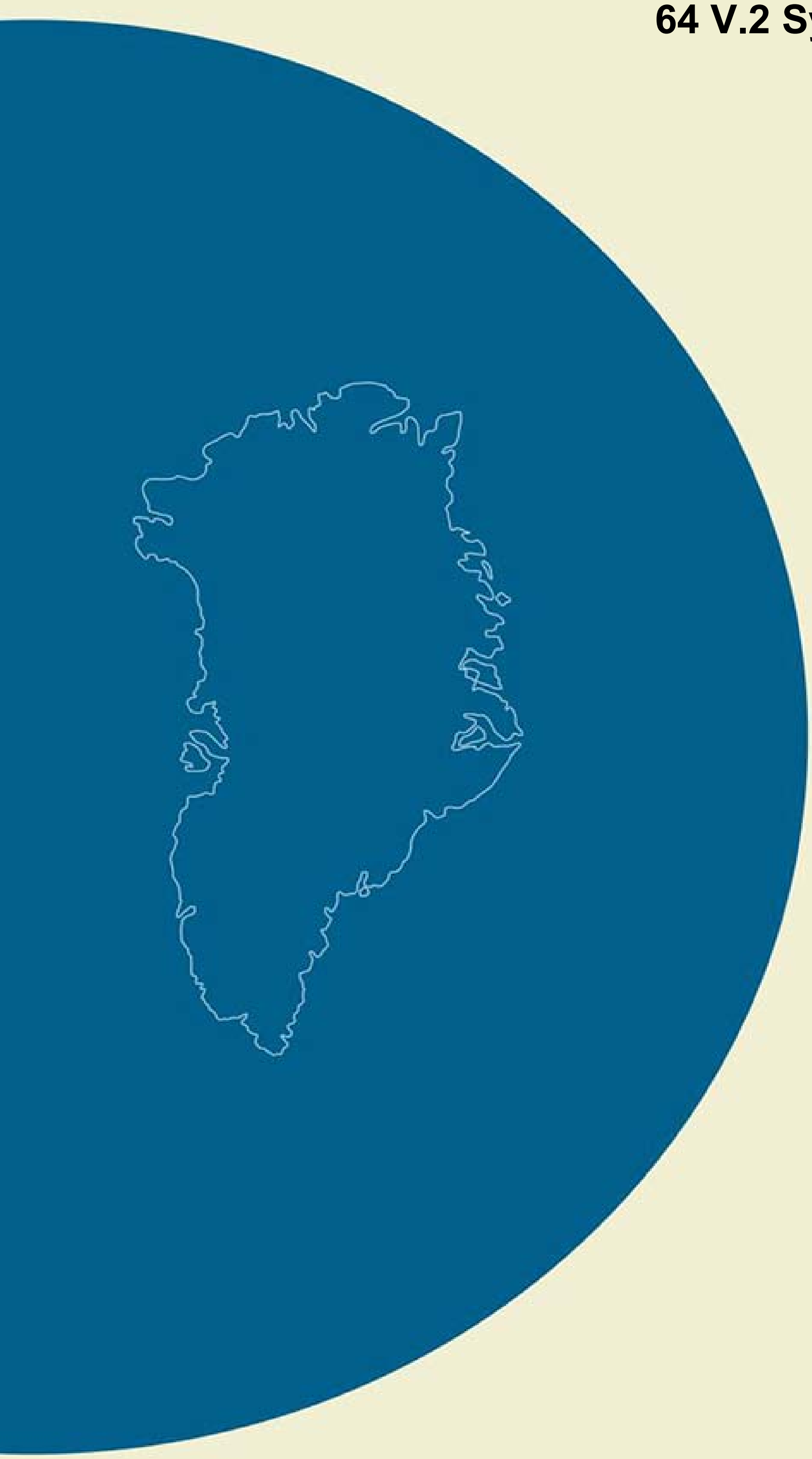
Emma F. Rehnström



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GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
DANISH MINISTRY OF ENERGY, UTILITIES AND CLIMATE

G E U S

Abstract

This report is a compilation of geochronological data from the area covered by the geological map sheet Kapisillit, 64 V.2 Syd (Rehnström 2011) in Southwest Greenland. Most of the data presented here was obtained as a part of the mapping campaign and the people responsible for the geochronological work have also mostly been part of the mapping field teams. Ages produced outside this group and published internationally have also been considered in the compilation of two inset maps on the map sheet. The two inset maps depict *i*) main phases of TTG-gneiss protolith formation and *ii*) the main, alternatively youngest metamorphic overprint recorded. In this report some geochronological data from metasedimentary, anorthositic, granitic and mafic rock types, apart from TTG gneisses are also presented. The main phases of TTG-gneiss protoliths are separated into seven groups, and the main regionally important metamorphic events were divided into four groups.

The oldest group contain rocks formed between 3900 – 3700 Ma, which more or less corresponds to the Eoarchaean Færingehavn terrane. The terrane is composed of several pieces characterised by discrete phases of tonalite emplacement, amalgamated, perhaps as late as 3660 Ma. The next group of TTG-gneisses formed between 3650 – 3550 Ma, which also correspond to the Færingehavn terrane.

The younger intervals are shorter and most of them reflect periods of known crust formation in the region. The interval between 3250 – 3100 Ma is only represented by one data point, but the age interval is recognised from felsic and dioritic rocks. Rocks of this age are typically found in the Kapisillik terrane. The next group defined were emplaced between 3050 – 2950 Ma, which is also typical of the Kapisillik terrane and occurring in the north-central parts of the map sheet area, but folded together with the Færingehavn terrane in the western part of the area. The next group contains rocks emplaced at 2890 – 2840Ma, which is typical of the Tasiusarsuaq terrane, which consists of tonalitic gneiss with protolith emplacement ages of 2920 – 2820 Ma, and granite emplacement and high-grade metamorphism shortly thereafter.

The next group, defined as rocks emplaced between 2840 and 2810 Ma, may be of Tasiusarsuaq affinity, but this age interval also comprise the ca. 2825 Ma Ikkatoq gneisses of the Tre Brødre terrane. Further work, with better constraints on metamorphic ages and structures may be required to resolve these questions. The youngest group consist of rocks emplaced between 2810 – 2780 Ma and is only represented by three samples. However, considering the new data presented this may prove to be an important crust forming episode in the SE-central parts of the map sheet area.

Metamorphic ages were divided into five groups, the oldest one representing all metamorphic ages more than 2850 Ma. These are the samples that have avoided the effects of younger orogenic events amalgamating the different crustal blocks. They are seen primarily in the oldest rocks, in the Færingehavn terrane and in the Tasiusarsuaq terrane towards the south.

The next age group, 2790 – 2740 Ma is present in the northernmost and southwestern parts of the map sheet, in what would be the Kapisilik and Tasiusarsuaq terranes.

The 2790 – 2660 Ma age range comprises the 2700 Ma event has been interpreted as a major orogenic event. A belt of these ages occurs approximately from the head of the Ameralik fjord, southeast towards the inland ice. Such a metamorphic belt would put a question to a Tasiusarsuaq affinity for the central part of the area, because the metamorphic ages suggest that the Tasiusarsuaq terrane was amalgamated with this area at about 2700 Ma.

Younger still is the 2660 – 2610 Ma group that seem to be occurring around the edges of the postulated Kapisilik terrane. The ca. 2650 Ma metamorphic event is also recognised as one of the major orogenic episodes in the area.

The youngest group with ages 2610 – 2550 Ma is also represented in the data that was not available at the time of map compilation and it can also be confused with crystallisation ages of granites related to emplacement of the Qôrqut Granite Complex.

Introduction

The geological map, 64 V.2 Syd 1:100 000, Kapisillit (Fig. 1) (Rehnström 2011), contains two inset maps summarising a large amount of geochronological data that have been obtained from this area. The first map contains formation ages from the protolith rocks of tonalite-tronhjemite-granodiorite (TTG)-gneisses, where seven age groups are identified. The other is a summary of metamorphic ages from different rock types, including TTG gneisses, granitic and dioritic gneisses, supracrustal units, metagabbro and metaanorthosite. Displayed is mainly the youngest metamorphic event that affected an area, but also some area specific older metamorphic events. On the map with metammophic ages there are also showed the emplacement ages of the Qôrqut Granite and a Palaeoproterozoic dolerite dyke.

The rationale behind these maps is two-fold; firstly, a vast number of geochronological analyses, published and unpublished, have been performed on samples from the map sheet area and secondly, during the field campaign it was not possible to separate gneiss units based on field observations only. Nevertheless, there are several generations of TTG-gneisses and the inset maps are meant as an aid to interpret the distribution of the main generations of TTG emplacement and metamorphic events in the area. The geology and hence distribution of ages in the area is highly complex and the inset maps are by necessity simplified. However, they do present an opportunity to aid the understanding of the geological evolution of this old and complex part of Greenland.

The majority of age determinations were obtained within the framework of the map project, by a number of workers. Many of those ages have been published internationally in peer reviewed journals and a majority of the ages have been published (Friend et al. 1996, Friend & Nutman 2005, Friend et al. 2009, Hiess 2008, Hiess et al. 2009, Hoffmann et al. 2011, 2012, Horie et al. 2010, Jørgensen 2008, Lee 2009, Nilsson et al. 2010, Nutman & Friend 2007, Nutman et al. 2007a, Nutman et al. 2010, Næraa 2011, Næraa & Scherstén 2008, Sounders et al. 2013, Szilas et al. 2015, Tappe et al. 2009). In addition, A section is dedicated to data that for different reasons were not incorporated in the inset maps or have been published after the completion of the map. These data come from the following publications: Friend et al. 2009, Hoffmann et al. 2011, 2012, Horie et al. 2010, Nutman & Friend 2007, Nutman et al. 2010, Næraa 2011, Sounders 2013, Szilas et al. 2015.

This report is a compilation of the data used for constructing the age distribution maps on the geological map sheet 64 V.2 Syd 1:100 000, Kapisillit. The data presentation is subdivided based on which rock type the sample represents. Some detrital and/ or protolith ages from supracrustal units, amphibolite, anorthosite, diorite and some granite ages have not been used on the inset maps, but are reported here since they are relevant for understanding the geology of the Kapisillit map area and some of them have metamorphic ages that are used on one of the inset maps.

The report also contains a comprehensive reference list of work published from the area, at the time of writing this report.

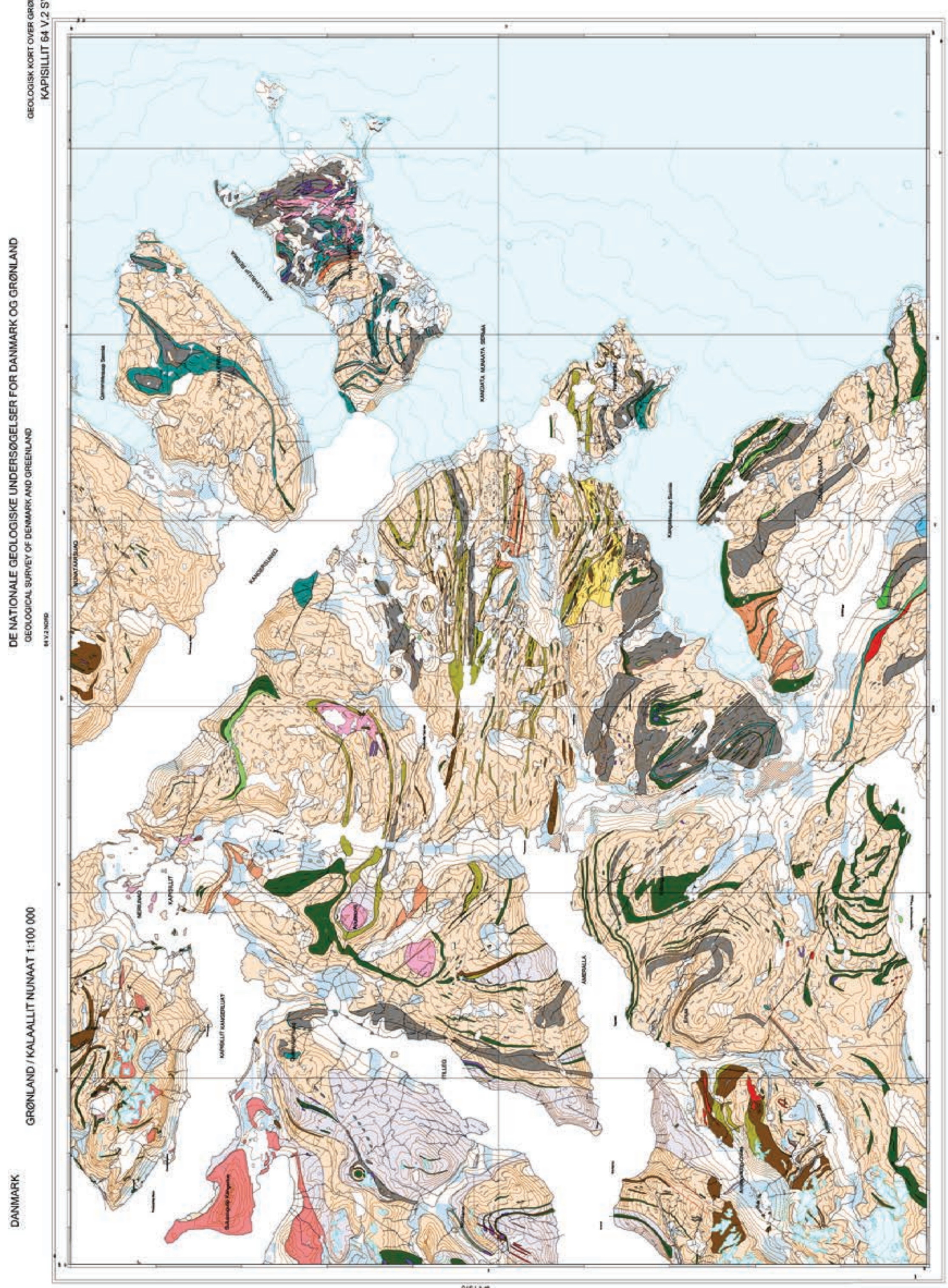

Figure 1. *Geological map 1:100 000 64 V.2 Syd of the Kapisillit area, West Greenland.*

Background

The geology of the Archaean craton in southwestern Greenland is intricately complex and any representation of that geology, for example on a geological map, will at any scale be a gross simplification. Decisions have to be taken on what features should earn their presence on a particular map or not. In many areas the dominant rock types are gneisses with trondhjemitic, tonalitic and granodioritic compositions, TTG-gneisses. These are often rather uniform and may not differ in any characteristics except age. Initially in the process of compiling the 1:100 000 geological map sheet 64 V.2 Syd Kapisillit, division of the TTG gneisses were based on a terrane model. Terrane based maps from the area have been published in Nutman et al. (2010) and Horie et al. (2012). However, the difficulties involved in correctly differentiating different generations of TTG-gneisses led to a decision to abandon the terrane model on the map and base the map on rock types readily identifiable in the field (Fig. 1) (Rehnström 2011).

Geochronological thematic maps are used widely in geological map making (e.g. Krill 1988) and represent an excellent tool to illustrate a second dimension to the map itself.
Large amounts of geochronological data have been obtained from the Kapisillit map sheet area and some of these data could then be summarised in two inset maps. The first depicting formation ages of TTG gneisses and the second metamorphic overprinting and the youngest intrusive rocks known in the area. From these data it is possible to get an overview of the main phases of TTG protolith formation in different areas as well as area specific metamorphic overprints and age of juxtaposition.

Regional geology

The geology of the Archaean craton of SW Greenland is an intricate mosaic of small terranes and proto-continents (Friend & Nutman 1987, 1988). They have formed, collided, deformed and subsequently amalgamated. There are different models on the interpretation of the Archaean successions (e.g. Friend & Nutman 1988, Windley & Garde 2009). Using the terminology of Friend & Nutman (2005), the area around the Nuuk Fjord can be divided into six terranes with different geological evolutions prior to amalgamation in the Neoarchaean (Nutman & Friend 2007a). The four terranes, as presently known, present in the Kapisillit map area are: the Færingehavn, the Tasiusarsuaq, the Tre Brødre and the Kapisillik terranes (see Fig. 2).

The Færingehavn terrane

This terrane occupies parts of the western part of the map-sheet area (Fig. 1), tectonostratigraphically sandwiched between the overlying Tre Brødre terrane and underlying Kapisillik terrane (e.g.Friend & Nutman 2005). This contributes significantly to the complex map pattern in this area. The Færingehavn terrane is composed of mainly Eoarchaean gneisses with tonalite-trondhjemite-granodiorite (TTG) compositions known as the Itsaq Gneiss Complex (IGC) (formerly known as Amîtsoq Gneiss) and of subordinate amounts of supracrustal rocks, anorthosites and granites (e.g. McGregor 1973, Bridgewater 1974, Nutman et al. 1996, 2007b). The IGC is present in one other terrane apart from the

Færingehavn terrane, namely the Isukasia terrane to the north (Friend et al. 1988, Nutman et al. 2004). The Færingehavn terrane is characterised by containing the oldest TTG component documented in the Nuuk region with protolith ages >3.85 Ga and strong effects of late Eoarchaean crustal reworking and melting (Nutman et al. 2007, Horie et al. 2010).

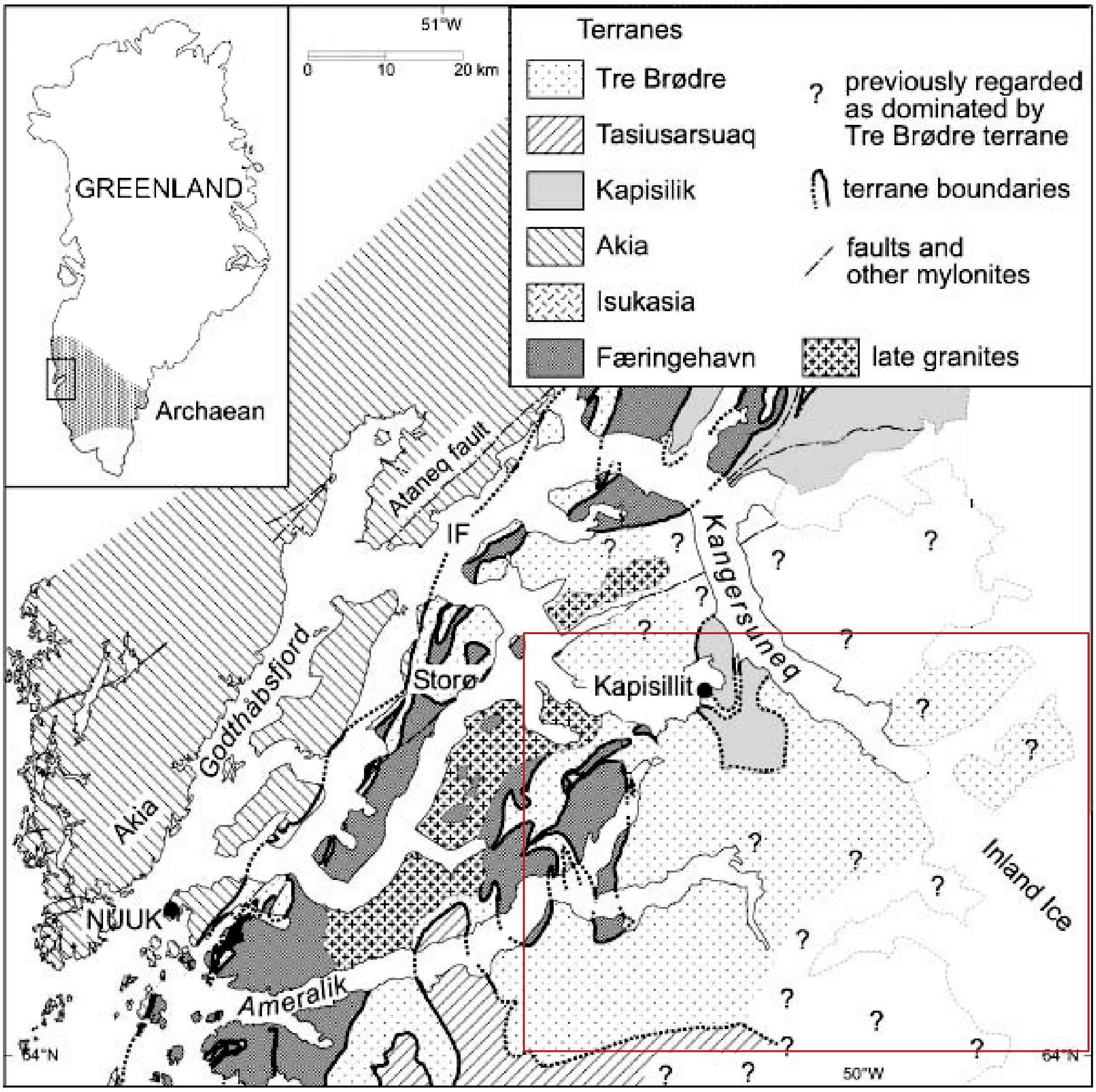

Figure 2. *Map of the Nuuk region in SW Greenland with terrane boundaries. The red rectangle mark the approximate boundaries of the Kapisillit map sheet.* Modified from Friend & Nutman (2005).

The Tasiusarsuaq terrane

This terrane occur in the southernmost part of the map sheet area and is dominated by TTG-gneisses with an age span between 2850 and 3250 Ma associated with subordinate supracrustal rocks and gabbro-anorthosite complexes (Schiøtte et al. 1989, Crowley 2002, Næraa & Scherstén 2008). Parts of the terrane underwent granulite facies metamorphism at ca. 2800 Ma. The boundary to the Eoarchaean gneiss complex towards the north, is in places coincident with the Qarliit Nunaat fault (Næraa 2011).

The Kapisillik terrane

This terrane was defined by Friend & Nutman (2005) as a tectonically bounded unit of ca. 3070-2960 Ma old tonalitic and granitic gneisses with associated anorthosites and supracrustal rocks. There is local evidence of anataxis and metamorphism at ca. 2600 Ma (Friend & Nutman 2005). This terrane is exposed in a smaller part in the northern part of the area, but probably underlies the other terranes in the western and central parts of the map sheet area.

The Tre Brødre terrane

The Tre Brødre terrane was defined in the Nuuk area to the SW of the present area of interest (Friend et al. 1988) and in this area it is dominated by the ca. 2830-2820 Ma tonalitic Ikkatoq gneisses. Large parts of the map sheet area have been speculatively assigned to this terrane (e.g. Friend & Nutman 2005), but with uncertain boundaries to the east. Age determination from an area just north of the map sheet area indicate that rocks of Ikkatoq gneiss affinity may be as young as 2800 Ma (Friend & Nutman 2005).

The most important amalgamation events are the young metamorphic pulses of 2700 and 2650 Ma (e.g. Nutman & Friend 2007a). Indications of even younger metamorphism may indicate the formation of post-assembly metamorphic core complexes.

Contributors

Several people have contributed to the geochronological database of the Kapisillit map sheet. Some of the data presented here have been published elsewhere, but some of it have not. The persons indebted for the geochronological analyses are as follows, in alphabetical order: Venessa Bennett (vbe), Clark Friend (crlf), Natasha Henwood (formerly Lee) (nrl), Joseph Hiess (jmh), Elis Hoffmann (jeh), Julie Hollis (jho), Tomas Næraa (tomn), Susanne Schmid (ssc), Henrik Svahnberg (formerly Solgevik) (hso) and Haifeng Yu (yhf). References to relevant publication are listed in Tables 1-3.

Original data that is presented in this report have been produced in different laboratories. The majority have been acquired at the LA-ICP-MS laboratory at GEUS, primarily by Julie Hollis, but also by Natasha Henwood, Henrik Svahnberg and Tomas Næraa. The analytical procedure for LA-ICP-MS data produced at GEUS is available in Frei & Gerdes (2009).

Some data was obtained at the geochronological laboratory at the Chinese Geological Survey in Tianjin, China. This was made possible through a *Memorandum of Understanding on Geoscience Cooperation* between GEUS and the China Geological Survey (CGS) that included fieldwork and input to the Kapisillit geological map by two geologists (Haifeng Yu and Huichu Wang) from the CGS. Subsequently geochemical and geochronological analyses of selected samples from the Kapisillit area were analysed at the geochronological laboratory at the Tianjin Institute of Geology and Mineral Resources, a branch of the CGS. The ages were obtained using laser ablation ICP-MS instrumentation and a description of the analytical procedure at the laboratory can be found in Yuan et al. (2011).

Some of the samples were analysed at the Memorial University in Yukon, Canada by Venessa Bennett. The analytical protocol for LA-ICP-MS analyses at this laboratory can be found in Bennett & Tubrett (2004).

In addition, data from the following publications has also been utilised for constructing the maps: Friend & Nutman (2005), Friend et al. (1996, 2009), Hiess et al. (2009), Hoffmann et al. (2011, 2012), Horie et al. (2010), Nilsson et al. (2010), Nutman & Friend (2007a), Nutman et al. (2007a, 2010), Næraa & Scherstén (2008), Szilas et al. (2015) and Tappe et al. (2009). Data from the unpublished Ph.D.-theses of Joseph Hiess (Hiess 2008) and Thomas Næraa (Næraa 2011) was also used. The data from these publications have been used as they were published, no re-calculations have been done. The aim of this study was to make a comprehensive compilation of geochronological U-Pb data from the area. However, some data may have been missed and a few reported ages have been omitted due to large uncertainties or to uncertainty regarding the meaning of the age.
Data that was first presented in one Master-thesis (Matilde Rink Jørgensen, Jørgensen 2008) and one Ph.D.-thesis (Natasha Henwood (former Lee), Lee 2009), respectively, have kindly been made available for publication in this report to increase the availability of the data. The samples in these two publications were analysed at GEUS.

The geochronological data used to construct the inset maps, therefore comes in two different categories:

1) *Not previously published geochronological data*
   These data are also presented in short form in Table 1 as well as in tables 2, 3, 4 and 5. The isotopic raw data are listed in Appendix 2 and can be found on the attached CD.
2) *Previously published geochronological data*
   These data are presented in Tables 2, 3, 4 and 5, with GEUS sample number, if applicable, position, age used for the map compilation, reference to the peer-reviewed article. In some cases the published age is different from the preliminary age used in the map compilation and where applicable, the table contains a comment on this.

Geochronological data compilation

The data presented in this report will be presented in the next section. Table 1 presents all the data presented in the following section in short form, in chronological order with the oldest rocks first. In the sample descriptions section, the samples are organised after rock type, first TTG-gneiss protolith ages, thereafter supracrustal rocks, dioritic to granitic rocks, anorthosites and amphibolite and lastly one dolerite age. In each group, the data is presented in order of decreasing age and all ages obtained from a sample is presented, whether it be protolith ages, metamorphic ages, inherited and/ or detrital ages.

Table 1. *All ages presented in the sample description section. The raw data for these ages are found in Appendix 2. All sample numbers are GEUS / GGU-numbers.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ	MSWD	Type	Comments	Lab
TTG orthogneiss										
499928	2007yhf033	7153195	555822	Orthogneiss, tonalitic, with amphibolitic enclaves	3816	21	2.5	E	May be emplacement age	CGS
499928	2007yhf033	7153195	555822	Orthogneiss, tonalitic, with amphibolitic enclaves	3623	14	2.5	I	May be emplacement age	CGS
499928	2007yhf033	7153195	555822	Orthogneiss, tonalitic, with amphibolitic enclaves	3024	50	4.8	E	May be emplacement age	CGS
482426	nrl2005-017	7124443	513880	Polyphase homogeneous orthogneiss	3531	23		E	One grain	GEUS
482426	nrl2005-017	7124443	513880	Polyphase homogeneous orthogneiss	2701	31	0.0027	M		GEUS
499948	2007yhf069	7133218	517810	Banded tonalitic gneiss, amphibolite enclaves	3661	15	6.7	E	One old outlier and 4 discordant grains.	CGS
499962	2007hcw078	7136396	520780	Interlayered bt-gneiss and hbl-bt-gneiss	3509	37	8.1	E	Not well defined	CGS
499962	2007hcw078	7136396	520780	Interlayered bt-gneiss and hbl-bt-gneiss	2690	24	2.3	M		CGS
481417	2004jho044	7119142	525340	Medium-grained homogeneous grey orthogneiss with strung out felsic layers.	3137	4	1.08	E		GEUS
481409	2004jho026	7144231	528446	Host grey granodioritic phase of banded grey orthogneiss	3052	4	2	E		GEUS
496831		7125753	561167	Tonalitic orthogneiss	3046	10	2	E		GEUS
496831		7125753	561167	Tonalitic orthogneiss	2680	11	7.2	M		GEUS
478212	2006jho290	7136836	551927	Regional tonalitic gneiss from fairly homogeneous outcrop. Intrudes gabbro and has anorthosite enclaves	3031	3	5.4	E	No significant inherited grains	GEUS
478222	2006jho366	7144941	542666	Dominant homogeneous tonalitic biotite-gneiss.	3016	7	27	E	Poorly defined, weighted mean	GEUS
481418	2004jho047	7119594	526576	Homogeneous granodiorite with some pegmatite layering. Abundant leucogabbro inclusions. Sample of homogeneous part.	3027	15	11.5	E	Upper intercept	GEUS
481418	2004jho047	7119594	526576	Homogeneous granodiorite with some pegmatite layering. Abundant leucogabbro inclusions. Sample of homogeneous part.	2719	7	0.48	M		GEUS
493406	2006ssc304	7121592	529209	Orthogneiss, homogeneous (qz, fsp, bt), brown weathering, well foliated, contact to anorthosite	3010	9	0.64	E		GEUS
481405	2004jho010	7144613	534878	Grey felsic orthogneiss with early pegmatite layering, later folded in isoclinal folds	2981	8	2	E		GEUS
492720	2006ydk091	7133862	543445	Tonalitic bt-hbl-gneiss	2955	9	2	E	Small consistent group, younger than all others	GEUS
482493	nrl2005-100	7100276	535651	Bt-orthogneiss. Bt-plag-qz. Non-granulitic	2884	21	1	E		GEUS
482493	nrl2005-100	7100276	535651	Bt-orthogneiss. Bt-plag-qz. Non-granulitic	2694	11	1.4	M		GEUS
477917	spi2005_096	7116336	538919	Fresh granulite facies orthogneiss	2870	5	1.05	E		GEUS
477924	spi2005_101	7117175	537229	Orthogneiss, tonalitic	2869	10	4.1	E		GEUS
496449	2005jeh184	7106100	533775	TTG gneiss	2862	5	1.4	E	Excludes youngest 8 grains (many rims) and oldest grain (very discordant)	GEUS
496443	2005jeh165	7105427	531381	Gneiss - Tasiusarsuaq or Ikkattoq	2858	8	0.58	E	Most grains are discordant	GEUS
499312	2005cm027	7109128	530453	Homogenous biotite gneiss - Ikkattoq?	2851	5	2	E	More consistent with Tasiusarsuaq terrane. Excludes youngest 5 grains and oldest grain.	GEUS
496450	2005jeh188	7104320	531362	TTG gneiss	2848	4	0.85	E	Age consistent with Tasiusarsuaq terrane. Several outlying grains excluded.	GEUS
499902	2007yhf005	7150761	559571	Orthogneiss, tonalitic	2833	25	3.8	E	Enclaves of older tonalitic gneiss	CGS
481403	2004jho007	7142709	534674	Banded polyphase dioritic gneiss with some segregations	2829	4	0.5	E		GEUS
485241	hso2005-174	7107165	529522	Tonalitic orthogneiss, large hbl-crystals in leucosome	2810	5	5.6	E		GEUS

Table 1 continued. *All ages presented in the sample description section.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ	MSWD	Type	Comments	Lab
499937	2007yhf047	7141923	567732	Banded tonalitic and granitic gneiss	2805	15	7.1	E	This report	
485206	hso2005-034	7118631	533278	Homogeneous orthogneiss, tonalitic	2783	5	3.3	E		GEUS
479004	2005nrl142	7101691	546099	Felsic part of mafic-intermediate-felsic orthogneiss. Hbl-bt-qz-plag with possible diopside	2782	15	10.1	M	Emplacement age poorly defined - cores dominated by 3.0 to 3.3 Ga	GEUS
482486	nrl2005-080	7098876	534998	Grt-2pyroxene felsic vein intruding [482485]. Age of granulite facies	2774	15	2	M		GEUS
481402	2004jho004	7140187	529609	Homogeneous grey felsic gneiss with some pegmatite banding.	2743	29	31	E		GEUS
482444	nrl2005-043	7122573	517988	Grt-hbl leucosome in Ikkattoq gneiss	2720	14	10.8	M		GEUS
Supracrustal rocks										
514824	2007hst539	7139608	576249	Grt-fsp-qz-bt gneiss	2876	13	3.2	E		GEUS
499911	2007yhf021	7151368	551912	Grt-bt schist, thin sliver in tonalitic gneiss	2838	15	9.2	E	Probable metavolcanic	CGS
493403	2006ssc091	7117051	551450	Aluminous schist in supracrustal unit, fsp, qtz, bt, sill, amphibole	2838	29	0.48	D		GEUS
493403	2006ssc091	7117051	551450	Aluminous schist in supracrustal unit, fsp, qtz, bt, sill, amphibole	2752	13	0.44	D		GEUS
493403	2006ssc091	7117051	551450	Aluminous schist in supracrustal unit, fsp, qtz, bt, sill, amphibole	2704	7	0.49	M		GEUS
499954	2007ckn086	7138652	525634	Biotite cordierite(?) gneiss	2835	16	5.2	E	Volcanic depositional age	CGS
499959	2007yhf079	7136780	522507	Cord-sill-gt-bt gneiss	2832	15	20	E	Probable metavolcanic	CGS
481406	2004jho019	7149384	540092	Bt-plag-qz ? g gneiss with S parallel felsic (melt) layers. Possible metasedimentary or metavolcanic rock	2821	4	0.053	dep		GEUS
497008	2005nrl148	7096909	530452	Bt-plag-qtz metasediment? Homogeneous.	2801	4	4.6	dep	Homogeneity of morphologies and of ages indicate volcanic origin	GEUS
499955	2007ckn087	7138592	525600	Sillimanite biotite gneiss	2775	28	8.6	E	Probable volcanic depal age	CGS
497014	nrl2005-156	7109070	555836	Grt-diop? In leucosome within grt-amphibolite in volcano-sedimentary unit. Leucosome is foliation-parallel	2704	10	7.2	M		GEUS
497017	nrl2005-159	7109366	555765	Grt-diopside-bearing leucosome in grt-amphibolite with bt pseudomorphing possile orthopyroxene. Highly retrogressed.	2693	6	8.5	M		GEUS
492237	2006vbe192	7122976	551444	Grt-sill-bt metapelite	2678	6	1.8	M	Youngest DZ age - 2779 ± 21	
478334		7124217	560155	Grt-bearing felsic leucosome	2659	17	7.3	A		GEUS
492234	2006vbe084	7137884	532948	Grt-bt gneiss	2655	4	0.98	M	Youngest DZ age - 2763 ± 19	
492202	2006vbe001	7136601	534936	Grt-sill-bt metapelite	2649	6	0.1	M	Youngest DZ Age - 2751.8 ± 8.0	MUN
492219	2006vbe042	7133108	534275	Grt-sill-bt metapelite	2645	6	0.33	M	Youngest DZ Age - 2723.3 ± 16 Ma	MUN
492206	2006vbe010	7135523	534299	Grt-bt metapelite, retrogressed	2643	5	0.00075	M	Youngest DZ Age - 2708 ± 13 Ma	MUN
492209	2006vbe013	7135234	533912	Grt-sill-bt gneiss	2637	5	0.00	M	Metamorphic rims and grains	MUN
499926		7151511	551835	Plag-bt-sill gneiss, layered with amphibolite				I	Several age groups in metasediment	CGS
499953	2007ckn085	7138862	525637	Sill-cord-bt schist				I	Large spread in ages	CGS
Diorite and granite										
481433	2004jho074	7125134	523511	Intermediate phase of intrusive diorite	3675	50	7	E	2 populations at c. 3650 and 3700	GEUS
499956	2007ckn099	7134796	522854	Finegrained granodioritic biotite-gneiss	3641	54	7.0	E		CGS

Table 1 continued. *All ages presented in the sample description section.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ	MSWD	Type	Comments	Lab
499950	2007yhf071	7133380	518283	Homogeneous granitic orthogneiss	3548	52	10.8	E	Large spread in ages	CGS
482496	nrl2005-124	7099658	528453	Diorite. Dominant, intermediate part of mafic-intermediate-felsic orthgneiss. Intrudes amphibolite	3140	50	3.8	E		GEUS
481436	2004jho077	7127928	526076	Dioritic. Blebby texture, for geochron	2838	19	25	E		GEUS
482424	nrl2005_035	7124690	515284	Homogeneous dioritic orthogneiss	2806	15	10.7	E	All discordant grains (>5%) excluded	GEUS
481408	2004jho024	7140862	526677	Pre-syn mylonite granite intruded and deformed within the mylonite	2990	6	2.5	E		GEUS
477905	spi2005_020	7116651	528940	Granitic body	2886	15	1.2	E		GEUS
514832	2007hst550	7139884	578289	Finegrained homogeneous granite, Nunatarsuuk	2862	7	2	E		GEUS
514832	2007hst550	7139884	578289	Finegrained homogeneous granite, Nunatarsuuk	2630	17	0.69	M	Lower cluster of ages	GEUS
485257	hso2005-244	7112940	545578	Weakly foliated granitic sheet, intruded into the anorthosite complex	2755	7	4.4	E		GEUS
481410	2004jho028	7145227	530271	Pre- to syn-mylonitic granite. Holds an S - same as the mylonite. For max age of mylonite movement	2740	12	4.4	E	Messy spread of ages but probably c. 2740 Ma emplacement with older inheritance	GEUS
492211	2006vbe014	7136266	534511	Coarse grained pegmatitic granite	2665	3	0.77	E		MUN
492211	2006vbe015	7136266	534511	Coarse grained pegmatitic granite	2640	3	0.44	M		MUN
Anorthosite and amphibolite										
492235	2006vbe129	7130355	550266	Grt-bearing anorthosite-leucogabbro complex	2858	4	1.18	E	Pb-loss at 2800 and metamorphic events at 2610, 2640, 2694, 2760 Ma	MUN
514881	2007hst598	7109813	563967	White gneiss (metaanorthosite)	2832	10	1.3	E		GEUS
481438	2004jho079	7121290	515251	Felsic melt segregations from within amphibolite. Possible former orthopyroxene pseudomorphed by orthoamphibole?	2720	4	5	M		GEUS
495113	2007hcw050	7145982	571230	Metaanorthosite, Akullersuaq	2799	20	3.7	E	In contact with 495110	CGS
495113	2007hcw050	7145982	571230	Metaanorthosite, Akullersuaq	2658	10	5.2	M	In contact with 495110	CGS
495110	2007hcw050	7145982	571230	Metagabbro, Akullersuaq	2660	8	0.23	M	In contact with 495113	CGS
Dolerite										
499929	2007ckn057	7152227	553400	Dolerite, Nunatarsuaq	2541	60	2.1	E		CGS

[1] All locations are qouted in UTM coodinates, zone 22 with map datum WGS84.

Abbreviations as follows: A- anatexis E-emplacement, I- inheritance, M- metamorphism, dep- deposition

bt-biotite, hbl-hornblende, grt-garnet, plag-plagioclase, qz-quartz, fsp-feldspar, sill-sillimanite, cord-cordierite, opx-orthopyroxene

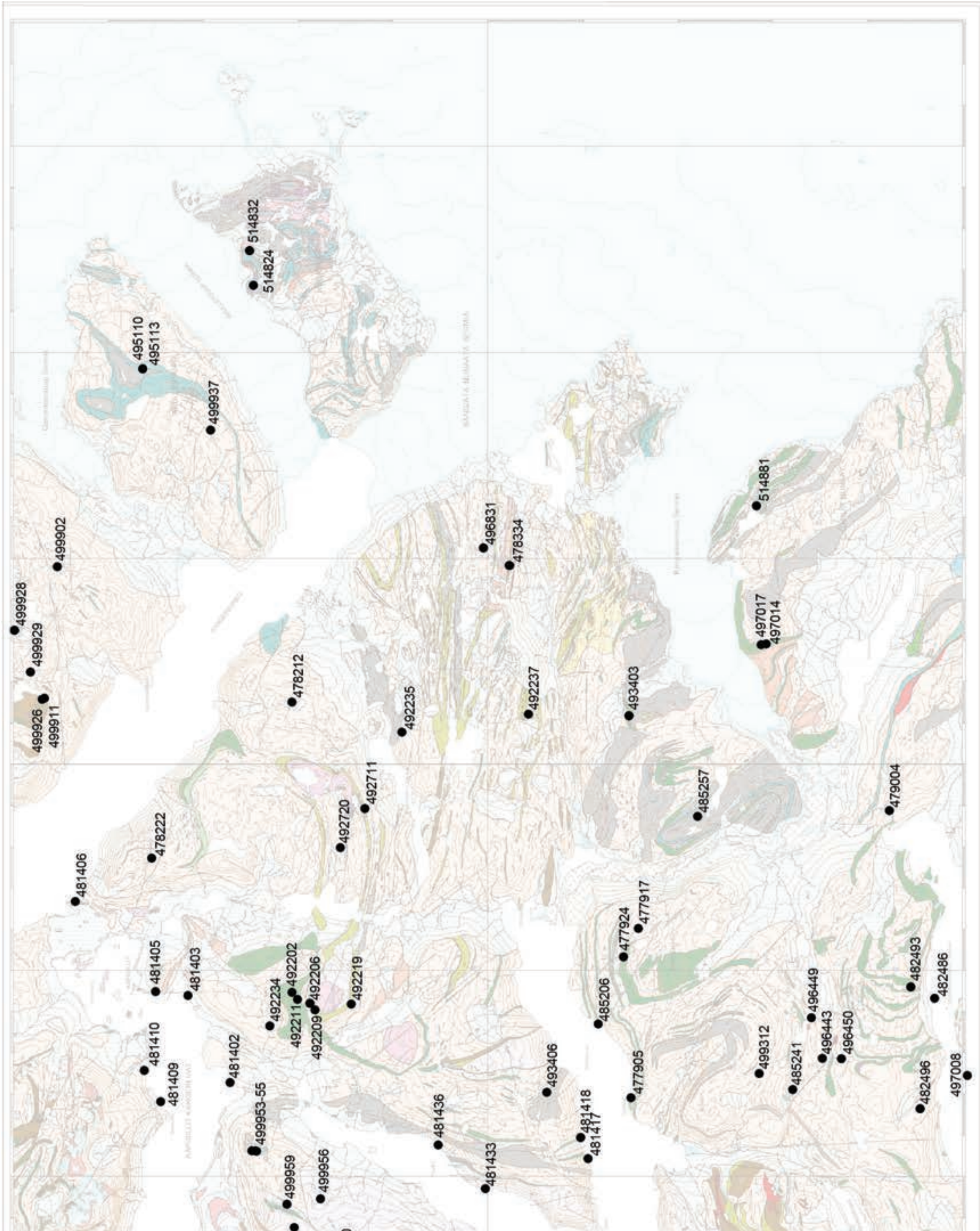

Figure 3. *Map with positions of all samples in Table 1.*

Sample descriptions

The samples presented here were collected and analysed by different people and therefore the kind of documentation, in the field and in the laboratory process, vary. Some samples were subject to detailed studies, while others were mere reconnaissance analyses.

There are also variations between the laboratories that have been used and these are difficult to quantify.

All sample locations are quoted in UTM coordinate system, zone 22 in map datum WGS 84. All weighted average ages are quoted at a 95% confidence level, while intercept and Concordia ages are quoted with a 2σ error, if not stated otherwise.

TTG orthogneiss samples

499928
Location: 2007yhf033, N 7153195, E 555822
Collected by: Yu Haifeng

This sample is a banded tonalite gneiss containing hornblende, biotite, quartz and plagioclase. Weakly foliated amphibolitic enclaves (up to 200 m wide) are aligned with the general gneissosity (Fig. 4).

Figure 4. *Field picture of the banded tonalitic gneiss with a small amphibolite enclave. Hammer for scale, photo by Yu Haifeng.*

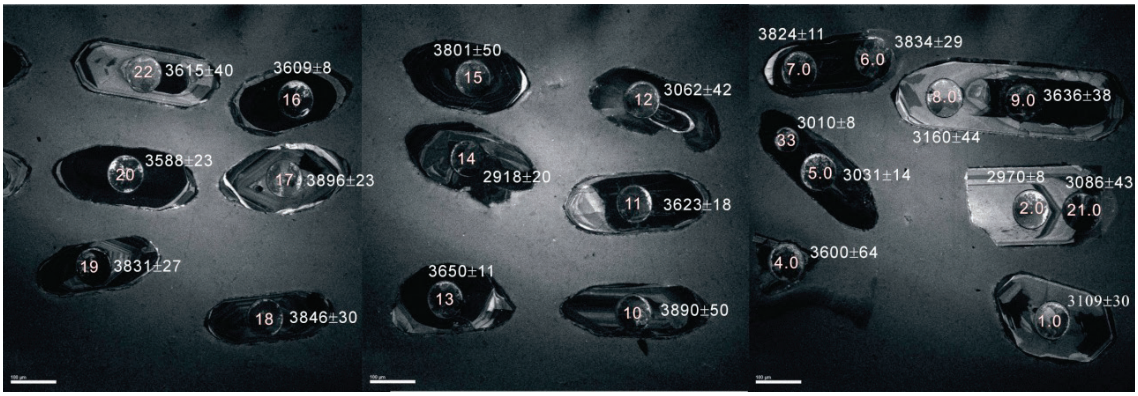

Figure 5. *Cathodoluminenscence images of zircon grains from sample 499928.*

The sample contains zircon grains with mainly oscillatory zoned cores and abundant overgrowths (Fig. 5). Three populations were identified based on the age distribution (Fig. 6).

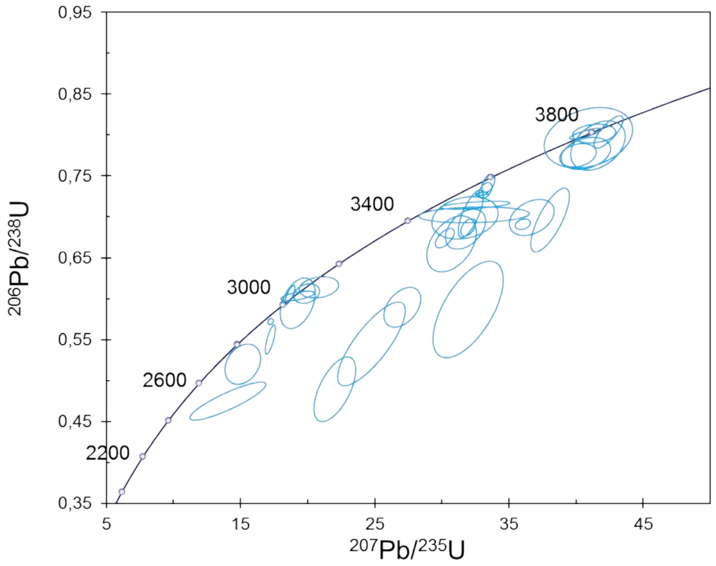

Figure 6. *Wetherill concordia diagram with all analyses from sample 499928.*

The oldest group in the sample consists of analyses 6, 7, 10, 15, 17, 18, 19, 24, 28, 31, 32, which yield an upper intercept age of 3816 ± 21 Ma (MSWD = 2.5). This age is interpreted as the magmatic emplacement age of the tonalitic protolith (Fig. 7). This interpretation follows Nutman et al. (2007), who argue that the typical tonalitic melts of the Itsaq Gneiss Complex would be grossly undersaturated in zircon and that any xenocrystic zircon would therefore be dissolved. The oldest generation of zircon grains in the gneiss is therefore likely to represent the magmatic crystallisation of the gneiss precursor.

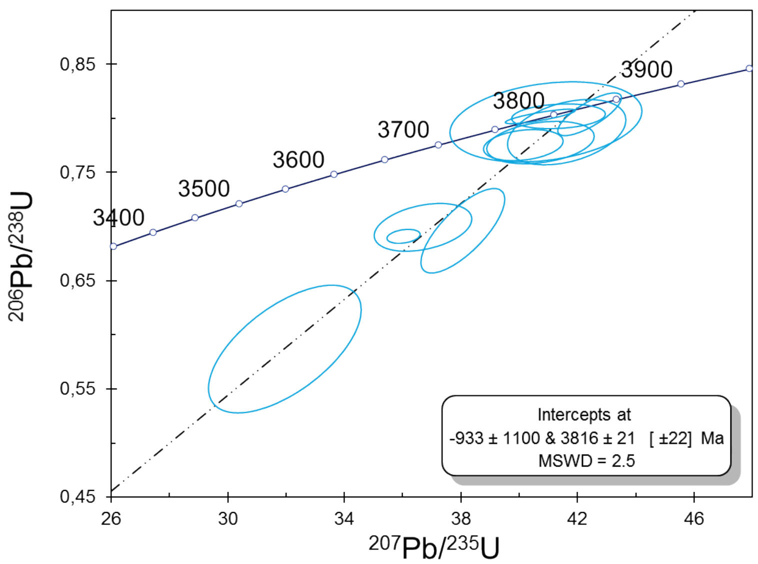

Figure 7. *Wetherill concordia diagram showing analyses from the oldest age group in sample 499928.*

The second group (Fig. 8) consists of analyses 3, 4, 9, 11, 13, 16, 20, 22, 23, 25.1, 26, 27, 29 and 30. They yield an upper intercept age of 3623 ± 14 Ma (MSWD = 1.4). This could be interpreted either as the older of two recorded metamorphic ages or a second phase of tonalitic magma influx.

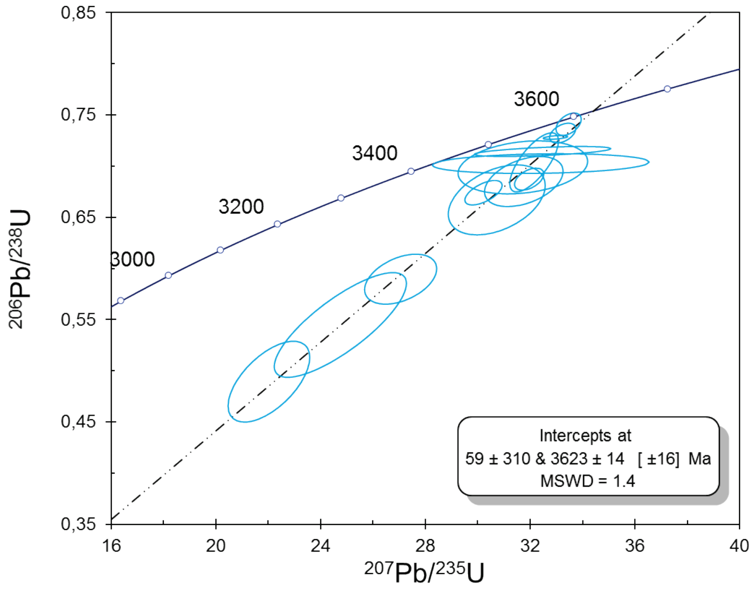

Figure 8. *Wetherill concordia diagram showing analyses from the oldest metamorphic age group in sample 499928.*

The youngest age group (Fig. 9) consists of analyses 1, 2, 5, 8, 12, 14, 21, 33 and 25.2. They yield an upper intercept age of 3096 ± 80 Ma (MSWD = 4.8), which is interpreted as a second metamorphic age. Both these ages are known from regional metamorphic events.

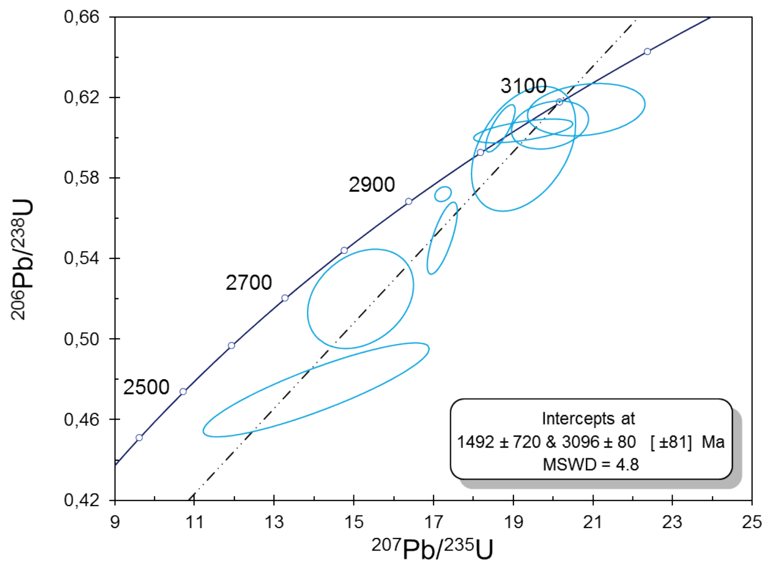

Figure 9. *Wetherill concordia diagram showing analyses from the youngest metamorphic age group in sample 499928.*

482426
Location: nrl2005-017, N 7124443, E 513880
Collected by: Natasha Henwood

This sample is from a poly-phase orthogneiss from the eastern part of the area. The sample contains three distinct morphological zircon populations. The oldest grain yields a concordant age of 3707± 7 Ma. Population 1 (green ellipses, Fig. 10) consist of zircon grains with oscillatory zoned grains with rounded cores or grains with pyramidal end terminations with a strong CL response. This group includes analyses 4, 9, 12, 17, 20-21, 24, which spread substantially. One analyses yield an age of 3531 ± 23 Ma, which is interpreted as the best approximation of a magmatic age. A second age population, represented by zircon grains that show patchy to sector zoned sub-ovoid grains or rims on Population 1 and display a moderate to weak CL response. One grain yield an age of 2701 ± 31 Ma, which is interpreted as a metamorphic overprint (Lee 2009), based on the presence of metamorphic overgrowths. Data from Lee (2009).

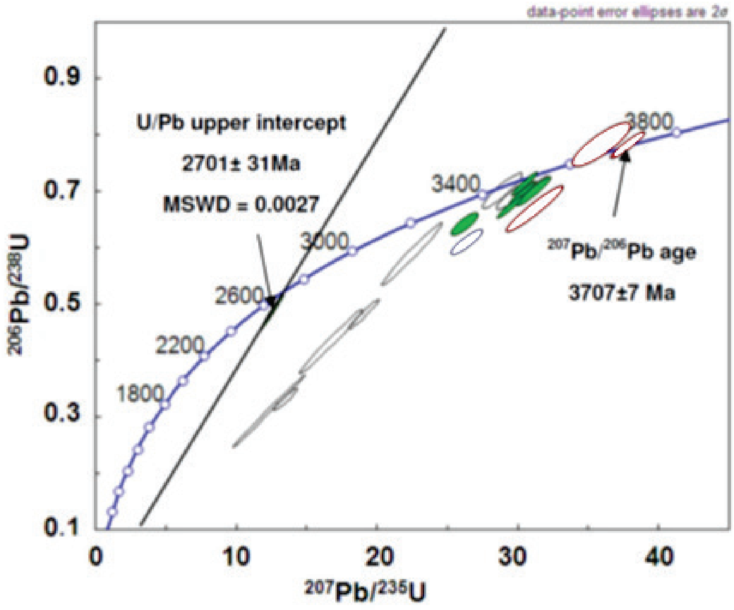

Figure 10. *Wetherill concordia diagram showing data from sample 482426.*

499948
Location: 2007yhf069, N 7133218, E 517810
Collected by: Yu Haifeng

This sample is a banded and isoclinally folded orthogneiss (Fig. 11), of mainly tonalitic composition, consisting of hornblende, biotite, quartz and plagioclase, with minor amphibolite enclaves.

Figure 11. *Photograph of the complexly folded orthogneiss. Photo by Yu Haifeng.*

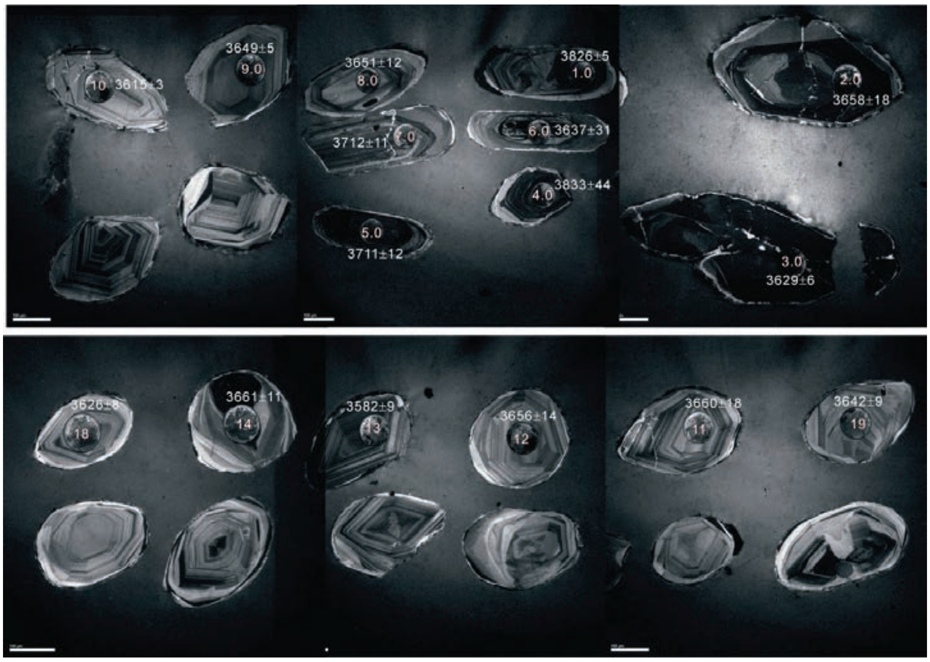

Figure 12. *Cathodoluminescence images of zircon grains from sample 499948.*

The gneiss contains one age population of zircon grains, generally stubby grains with oscillatory zoning, but with some resorption textures and zoning truncated by later overgrowths (Fig. 12). One older outlier (Fig. 13) has a concordant $^{207}Pb/^{206}Pb$-age of 3826 ± 10 Ma (2 σ). Three additional analyses (brown ellipses) were excluded from the age calculation due to old $^{207}Pb/^{206}Pb$-ages, indicating inherited xenocrystic material.

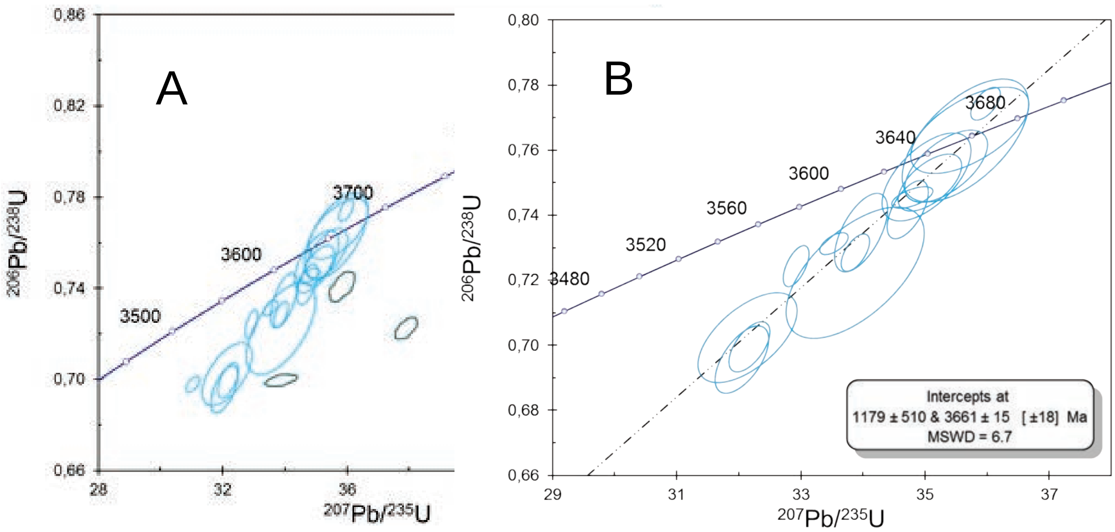

Figure 13. *Wetherill concordia diagrams displaying, in A) all analyses from sample 499948, and in B) a close-up of data used in the age calculation and the resulting regression line..*

The resulting 17 analyses (2, 3, 6 and 8-21), yield an upper intercept age of 3661 ± 15 Ma (MSWD = 6.7). This is interpreted as a magmatic emplacement age (Fig. 13b). The large MSWD indicate a disturbance in the isotope systematics, either minor xenocrystic zircon or ancient and recent lead loss, or both.

499962
Location: 2007hcw084, N 7136396, E 520780
Collected by: Wang Huichu

This sample consists of fine-grained biotite-gneiss with a gneissic texture and a strongly developed stretching lineation. It is interlayered with hornblende-bearing biotite ortho-gneiss (Fig. 14).

Figure 14. *Field photograph of the layered gneiss. Photo by Wang Huichu.*

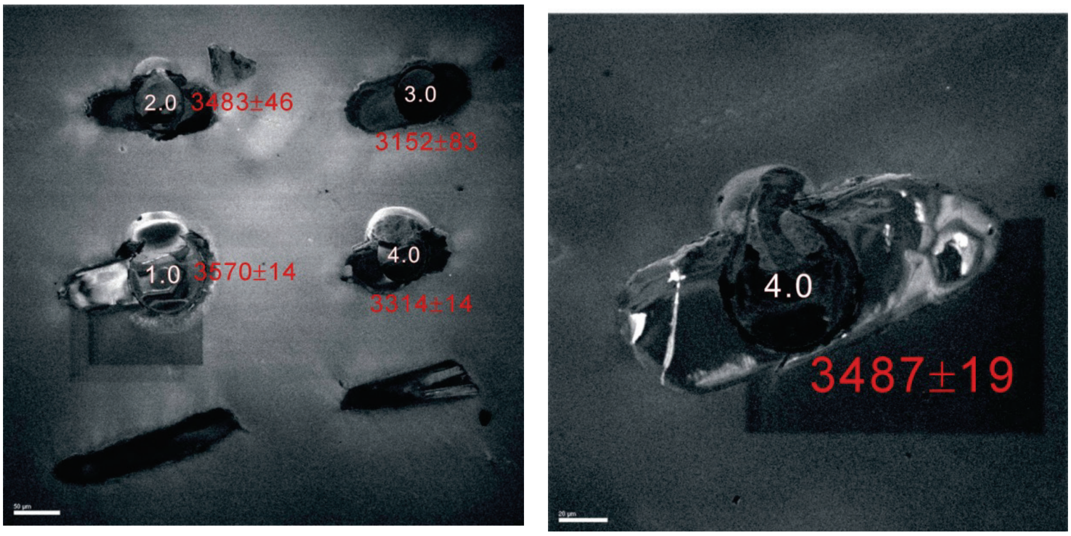

Figure 15. *Cathodoluminescence images of zircon grains from sample 499962.*

The zircon grains show complex internal structures, with both simple oscillatory zoning and patchy or resorbed textures (Fig. 15). Analyses define three age groups (Fig. 16). An old group is concentrated around 3500 Ma and there is a young group with a fairly well defined upper intercept age at ca. 2700 Ma. A loosely constrained group fall between these groups, probably the result of mixed ages combined with one or more lead loss events.

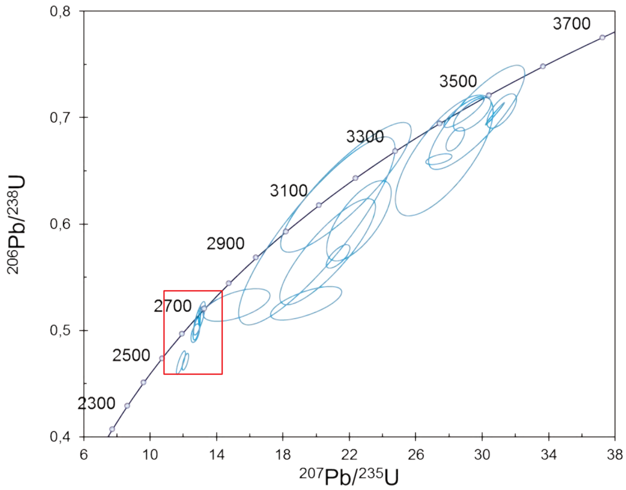

Figure 16. *Wetherill concordia diagram showing all analyses from sample 499962. Red box indicate content of Fig. 17.*

The oldest group (Fig. 17, see also Fig. 16) is defined by analyses 1, 2, 5, 6, 7, 8, 12 and 16, which yield a weighted mean of $^{207}Pb/^{206}Pb$-ages of 3509 ± 37 Ma (MSWD = 8.1). The age is interpreted as a magmatic crystallisation age. The large MSWD may indicate the presence of small amounts of xenocrystic zircon and/ or recent lead loss.
Analyses 9, 10, 11, 17, 18 and 21 define a discordia with an upper intercepts at 2690 ± 24 Ma (MSWD = 2.3) (Fig. 18). A weighted average age of the four most concordant (solid lined ellipses) analyses is 2691 ± 12 Ma (MSWD = 0.75). This is the youngest age group and it is interpreted as most likely a metamorphic age.

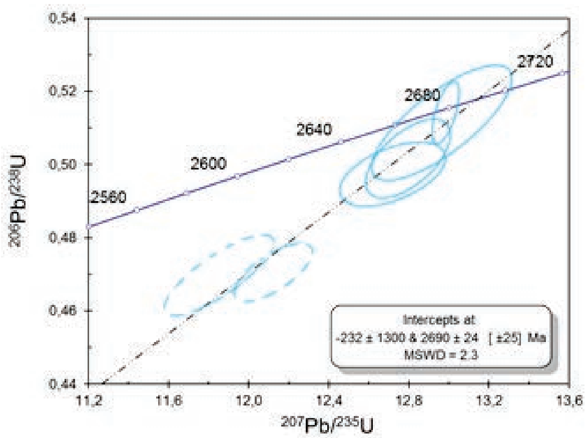

Figure 17. *Wetherill concordia diagram showing the youngest age group in sample 499962.*

481417
Location: 2004jho044, N 7119142, E 525340
Collected by: Julie Hollis

The sample come from a medium grained homogeneous grey orthogneiss with strung out felsic layers. The zircon grains are typically 100-400 microns, with aspect ratios 1:1 to 1:4 and prismatic. Zircon morphology varies considerably from dull homogeneous grains (CL), some with broad sector zonation, to dull patchily zoned, to bright oscillatory zoned grains. A few grains are almost completely metamict.

Nine of 20 grains define a population with an upper intercept age at 3137 ± 4 Ma (2σ, MSWD = 1.08), interpreted as the age of emplacement (Fig. 18). These analyses come from grains that cover the range of morphologies outlined above, i.e. there is no distinction in ages based on morphology in this sample. All but one of these grains have very low Th/U (0 .01-0.03 with an outlier at 0.44 - grain 23). All but one of the older grains have much higher Th/U (0.21 -0.57 with an outlier at 0.03). These may be inherited. Of the four younger grains (3116-3038 Ma), 3 have very low Th/U - 0.01-0.04 and high U (1387-2221 ppm) and one has Th/U 0.314 and 46 ppm U. Again, there is no real distinction that can be made on the basis of morphology.

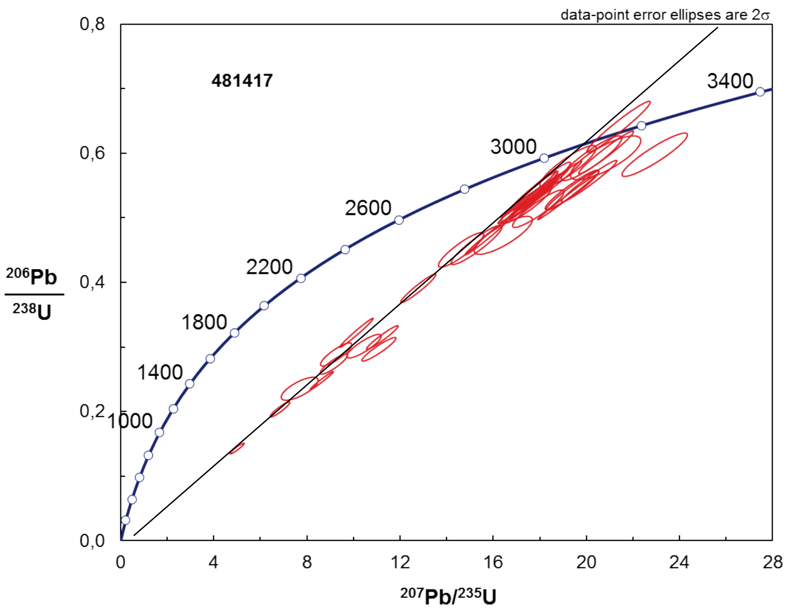

Figure 18. *Wetherill concordia diagram showing data from sample 481417.*

481409
Location: 2004jho026, N 7144231, E 528446
Collected by: Julie Hollis

This sample comes from the host grey granodioritic phase of banded grey orthogneiss, interpreted in the field as possibly Ikkatoq Gneiss. Zircons are 200-600 microns, with aspect ratios of 1:2 to 1:4 and prismatic. All show well-defined oscillatory zonation with no significant indication of alteration or recrystallisation.

Twenty-three of 27 analyses define a single population with a weighted average age of 3052 ± 4 Ma (MSWD = 2.0), interpreted as the emplacement age of the gneiss protolith (Fig. 19). Three younger grains with ages 3019, 2992, and 2966 Ma, were omitted from the age calculation. They may possibly indicate partial recrystallisation during ca. 2980 Ma metamorphism.

The protolith age at 3052 Ma is compatible with the Ikkatoq gneiss field interpretation.

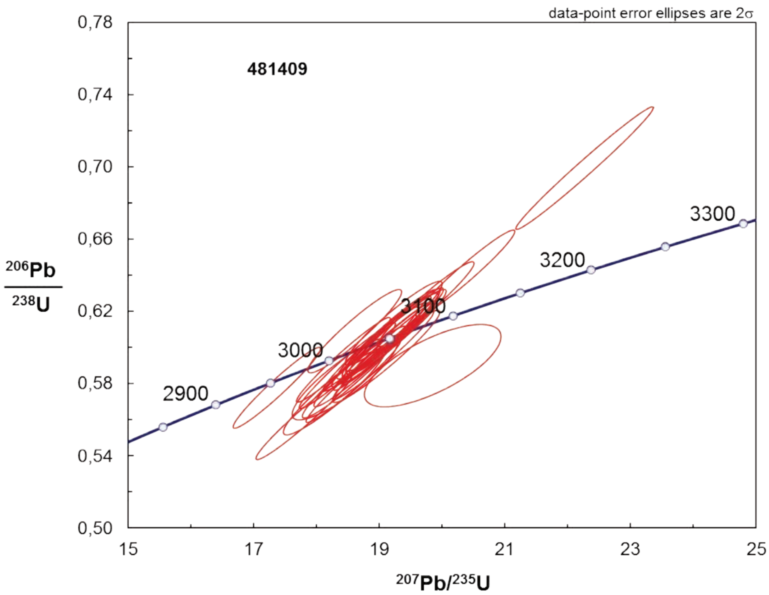

Figure 19. *Wetherill concordia diagram showing data from sample 481409.*

496831
Location: N 7125753, E 561167
Collected by: Natasha Henwood

This sample was collected from an apparently homogeneous part of a tonalitic orthogneiss. The gneiss at the sampling locality contains the assemblage hornblende-biotite-plagioclase. It is intruded by granodioritic veins and later pegmatite and it contains rafts of earlier mafic rocks. The oldest population consists of oscillatory zoned equant to stubby cores with strong CL response. Analyses 77-78, 85, 89-90, 100, 102, 106, 111-112 yield an upper intercept age of 3046 ± 10 Ma (MSWD = 2.0), which is regarded to represent emplacement of the protolith tonalite (red ellipses in Fig. 20). Population 2 consist of planar banded or patchy zoned stubby to elongate mantles on Population 1 with a weak to very weak CL response. Analyses 60-68, 72-76, 79-80, 86-88, 91-94, 98-99, 101, 103-105, 107, 113-120 yield an upper intercept age of 2680 ± 11 Ma (MSWD = 7.2), which is interpreted to represent new growth and recrystallisation of zircon in the tonalitic orthogneiss under high grade metamorphic conditions (green ellipses in Fig. 20) (published in Lee 2009).

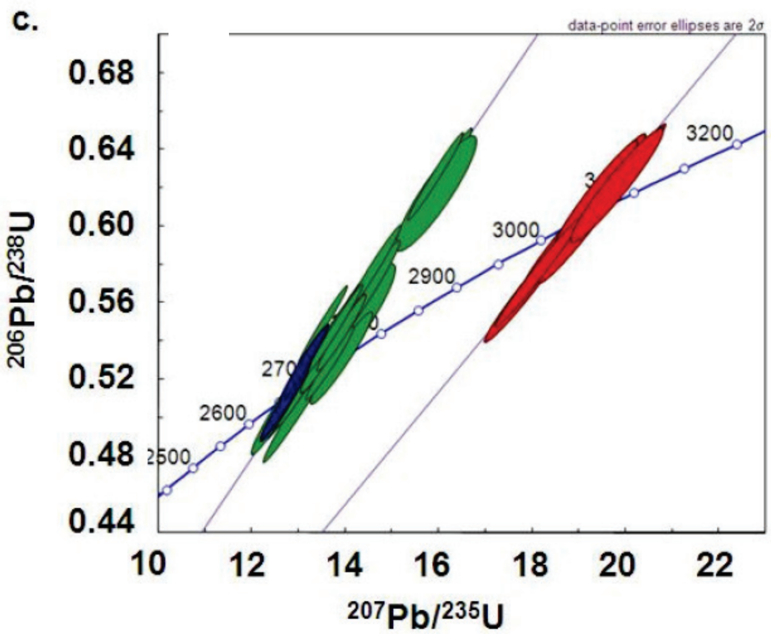

Figure 20. *Wetherill concordia diagram showing data from sample 496831. Analyses marked as red ellipse represent CL bright oscillatory zoned cores, green represent CL dull zircon grains with patchy zonation, while blue represent rims.*

478212
Location: 2006jho290, N 7136835, E 541926
Collected by: Julie Hollis

This sample comes from a medium grained, grey, banded tonalitic gneiss. Zircon morphologies vary within the sample (Fig. 21), from stubby, oscillatory zoned grains to rounded unzoned ones. Age analyses yield a single group of ages and the twenty nine most concordant analyses that comprise a plateau, yield a weighted average age of 3031 ± 3 Ma (29 of 39 analyses, MSWD = 5.4), which is interpreted as a magmatic emplacement age (red ellipses in Fig. 22). The age is not well defined and it is uncertain whether it represents a geologically meaningful age. Data was first published in Jørgensen (2008).

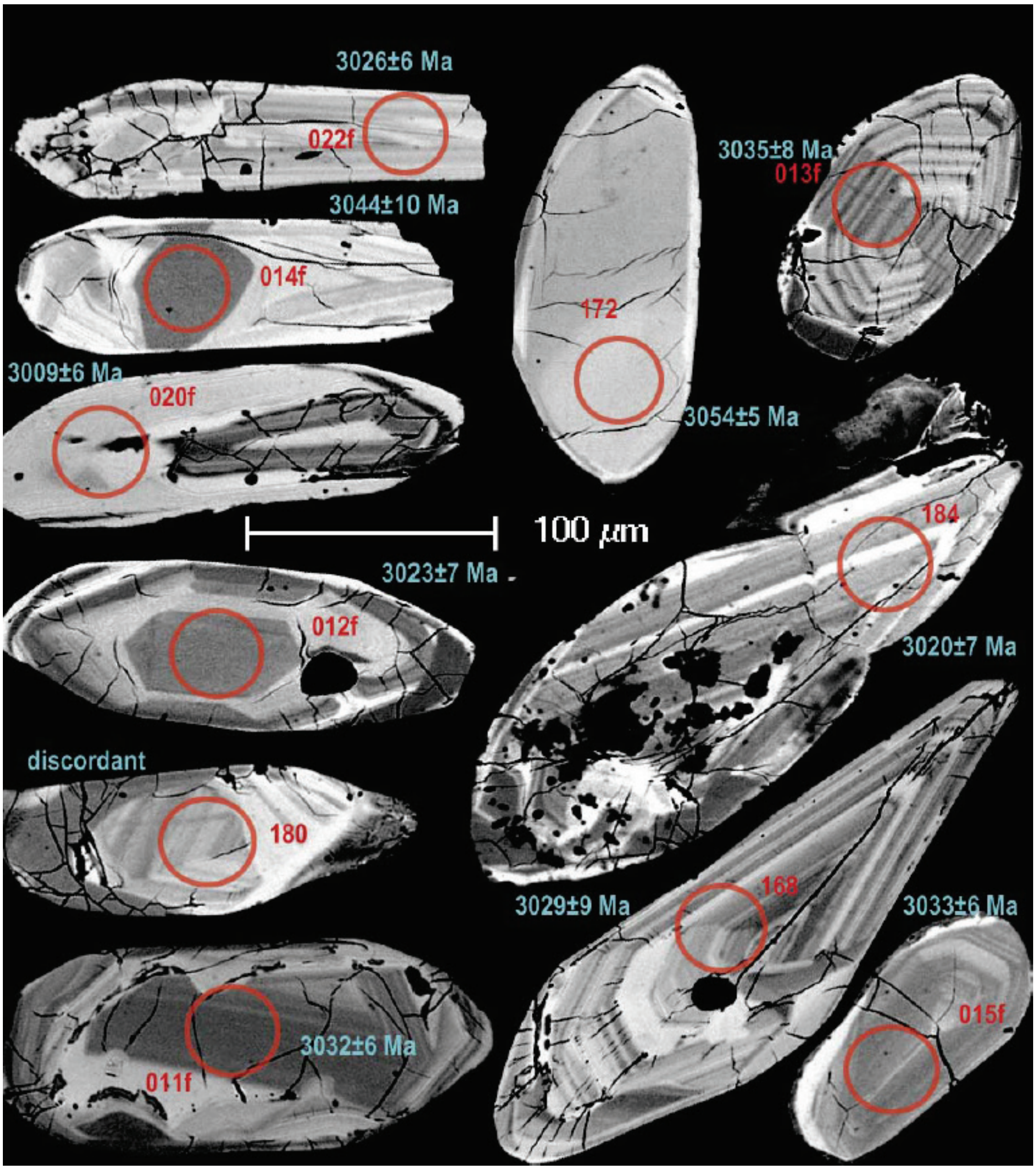

Figure 21. *Cathodoluminescence image of typical zircon grains from sample 478212, figure from Jørgensen (2008).*

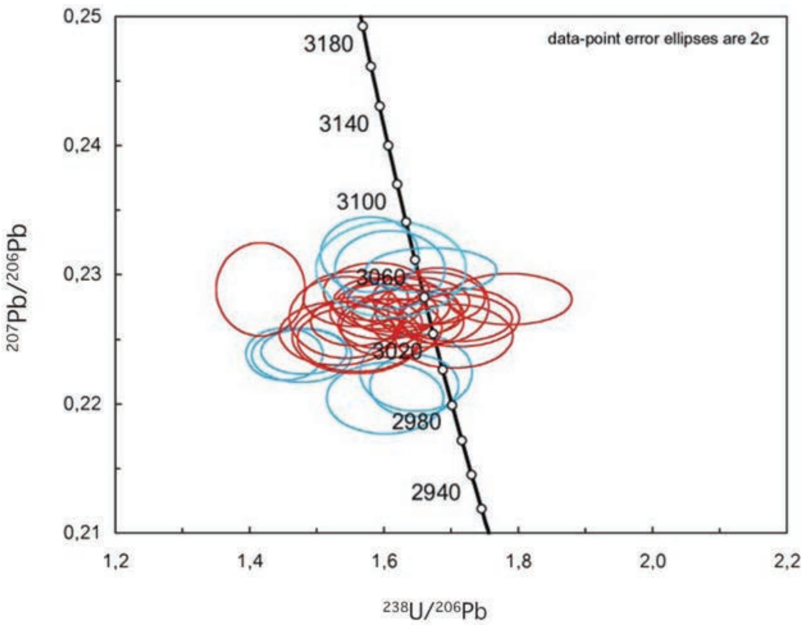

Figure 22. *Terra-Wasserburg concordia diagram showing data from sample 478212, figure from Jørgensen (2008). Red ellipses were used in the age calculation, whereas the blue ones were omitted.*

478222
Location: 2006jho366, N 7144941, E 542666
Collected by: Julie Hollis

This sample come from a medium grained, grey tonalitic orthogneiss. The zircon grains show varied morphologies, but many of them have oscillatory zoned cores (Fig. 23). Twenty one analyses were obtained from the sample and of them a few analyses excluded from the calculation because of apparent lead loss effects (blue ellipses in Fig. 24). A weighted average of 17 analyses (red ellipses in Fig. 24) yield an age of 3016 ± 7 Ma (MSWD = 27), interpreted as the best approximation of the magmatic age. The large MSWD indicate that this may not be a coherent group, but neither morphology or Th/U-ratios indicate separate populations. Notably one grain yields a significantly younger concordant age of 2638 ± 8 Ma (see Fig. 24), possibly indicating metamorphic recrystallisation. Data was first published in Jørgensen (2008).

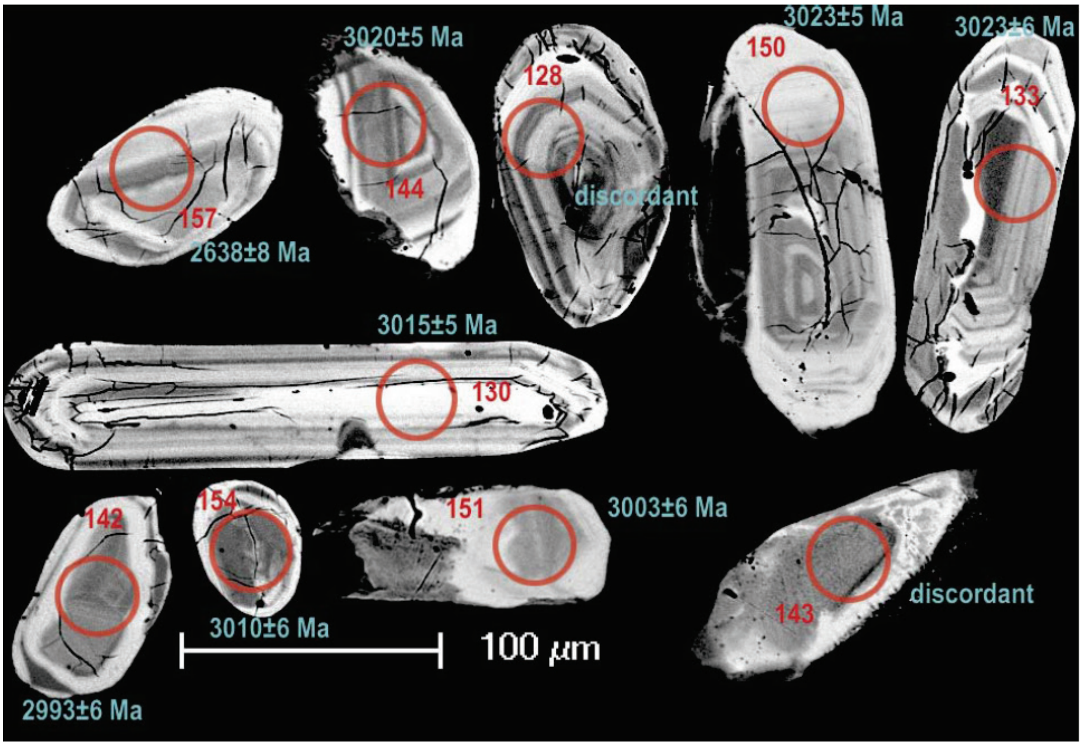

Figure 23. *Cathodoluminescence image of typical zircon grains from sample 478222, figure from Jørgensen (2008).*

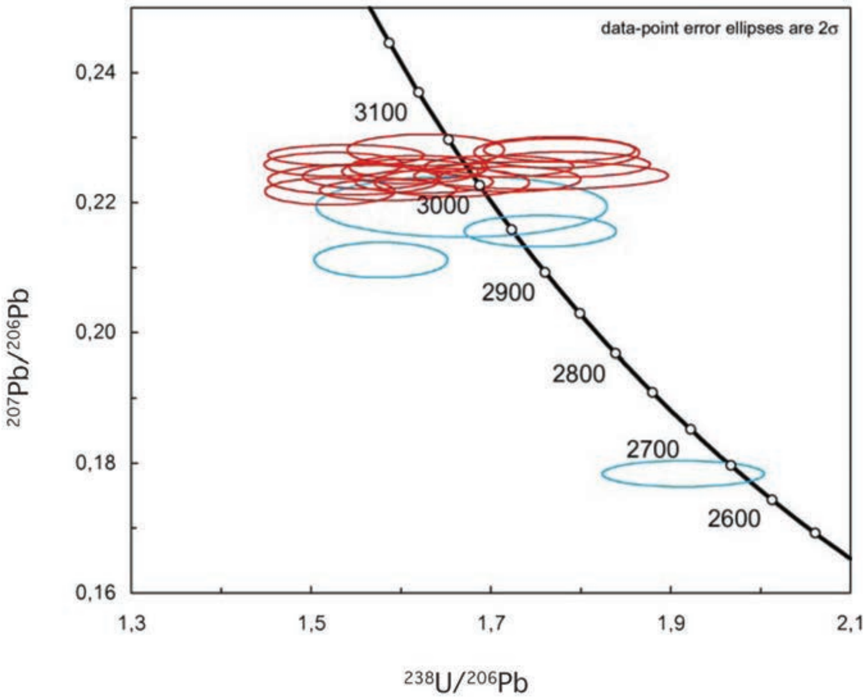

Figure 24. *Terra-Wasserburg concordia diagram showing all data from sample 478222, figure from Jørgensen (2008). Red ellipses show data used in the age calculations that yield the 3016 ± 7 Ma age and blue ellipses represent data points omitted from this age calculation.*

481418
Location: 2004jho047, N 7119594, E 526576
Collected by: Julie Hollis

This sample is from a granodiorite with some leucosome layering and abundant leucogabbro inclusions. The sample was collected from the homogeneous part for the purpose of establishing the magmatic age of the protolith. Population 1 consists of oscillatory zoned cores or equant to acicular grains with rounded pyramidal end terminations and a strong CL response. Twenty three of 40 analyses (5,8, 11-13, 18-21, 25-26, 30-31, 43-45, 47, 49-51) (red ellipses in figure 25) yield an upper intercept age of 3016 ± 13 Ma (MSWD = 4.7). Another population contains faint concentric (potentially relict oscillatory) zoning in stubby to elongate whole grains or mantles on Population 1 and weak to moderate CL response. Analyses 4, 6-7, 9-10, 22-24, 32-35, 37-38, 46, 48, 52 (green ellipses in figure 25) were used for the age calculation. Population 2 yield an upper intercept age of 2719 ± 7 Ma (MSWD = 3.2), where four strongly discordant analyses from this group were rejected (unfilled in figure). The first age is interpreted as a magmatic emplacement age. The rather large MSWD could indicate that the age does not represent one coherent group, but perhaps two phases of tonalitic melt emplacement. The second age is interpreted to represent the age of metamorphism, based on zircon morphology and that rims were analysed with this age. From Lee 2009.

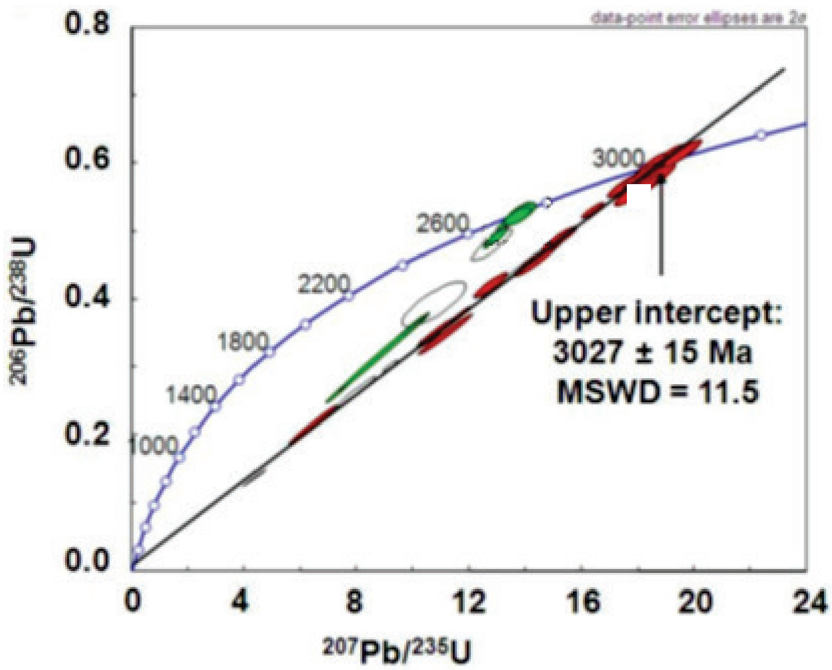

Figure 25. *Wetherill concordia diagram showing data from sample 481418. Red ellipses represent the older generation of zircon ages and the green ellipses the younger analyses. Red ellipses represent mainly oscillatory zoned cores, green ellipses represent elongated grains and rims.*

493406
Location: 2006ssc304, N 7121592, E 529209
Collected by: Susanne Schmid

This sample was collected from a homogeneous, well foliated orthogneiss containing quartz, feldspar and biotite and characterised by a brown weathering surface. The unit is in contact with anorthosite (Fig. 26).

Figure 26. *The upper brownish part of the outcrop consist of sample 493406 orthogneiss and the lower is anorthosite. Photo by Susanne Schmid.*

Zircon analyses yield a coherent, single age group. An upper intercept age of 3010 ± 9 Ma (MSWD = 0.64) is interpreted as a magmatic emplacement age (Fig. 27).

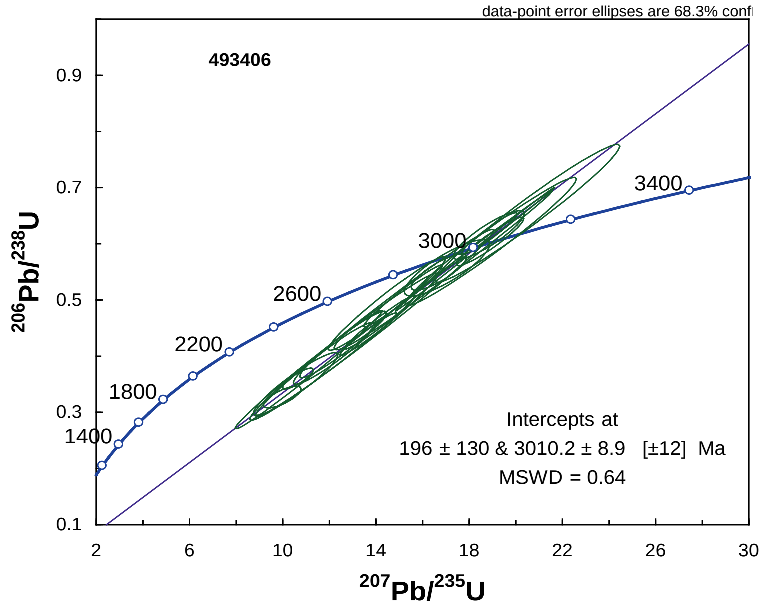

Figure 27. *Wetherill concordia diagram showing data from sample 493406.*

481405
Location: 2004jho010, N 7144613, E 534878
Collected by: Julie Hollis

This sample was collected from a grey felsic orthogneiss with an early leucosome that have been subsequently folded in isoclinal folds (Fig. 28).

Figure 28. *Field relations of the rock in sample 481405. Photo by Julie Hollis.*

Zircon grains are 50-200 microns with aspect ratios of 1: 1 to 1:3 and prismatic. Approximately half show a bright CL response with well-defined oscillatory zonation. These include both elongate and blocky grains. A few have darker tips or partial rims. The remainder show a dull homogeneous CL response.

Many of the analyses show significant normal discordance and there is a significant spread in ages. Notably seven of 16 grains analysed (Fig. 29) have very low Th/U (0.01-0.05), high U (895-3731 ppm), and a corresponding dull homogeneous CL response. They yield an age of 2982 ± 9 Ma (weighted average, 2σ, MSWD = 2.5). It is tempting to interpret these as a metamorphic population on the basis of the zircon chemistry, morphology and the non-zoned crystals. Also, this is the age of amphibolite to granulite facies metamorphism in the Akia terrane (to the north) and the Kapisillik terrane. However, given the presence of younger oscillatory zoned grains in the sample, the 2982 ± 9 Ma population probably represents the age of emplacement (3070-2960 Ma orthogneiss is known in the Kapisillik terrane, Friend & Nutman 2005). Both younger (2930-2845 Ma) and older grains (3128-3007 Ma) have significantly higher Th/U.

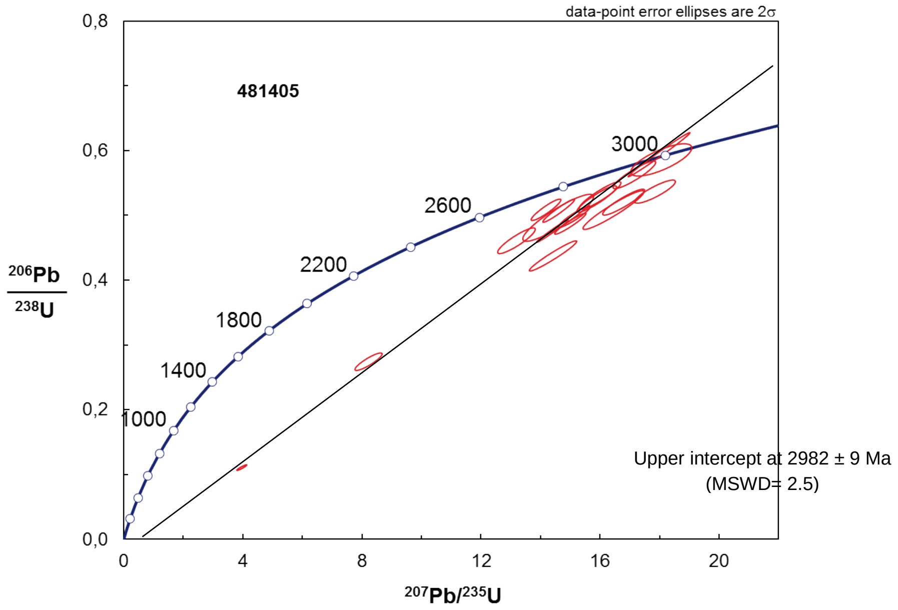

Figure 29. *Wetherill concordia diagram showing data from sample 481405.*

492720
Location: 2006ydk091, N 7133862, E 543445
Collected by: Yvette Kuiper

This sample come from a medium grained, grey, foliated granodioritic orthogneiss. The rock has a continuous spectrum of ages with the oldest population yielding a weighted average age of 3704 ± 9 Ma (8 oldest red circles, MSWD = 13, Fig. 30). The high MSWD is a sign of a con-coherent population that may have suffered a disturbance in the isotope systematics due to later recrystallisation events.

A well-defined population of four grains with mainly sector zoned grains with only very thin rims that may be metamorphic, yield a weighted average age of 2954 ± 9 Ma (MSWD = 2.0) (green elllipses in Fig. 30). Analyses marked in blue were excluded from the calculations. Zircon morphologies reveal no clues regarding formation, but the preferred interpretation is that the 3704 Ma age represent magmatic crystallisation, perhaps with multiple slightly younger phases of magma emplacement. The ca. 2950 Ma age is interpreted as a metamorphic recrystallization event, based on regional correlations (e.g. Næraa & Scherstén 2008). Data from Jørgensen (2008).

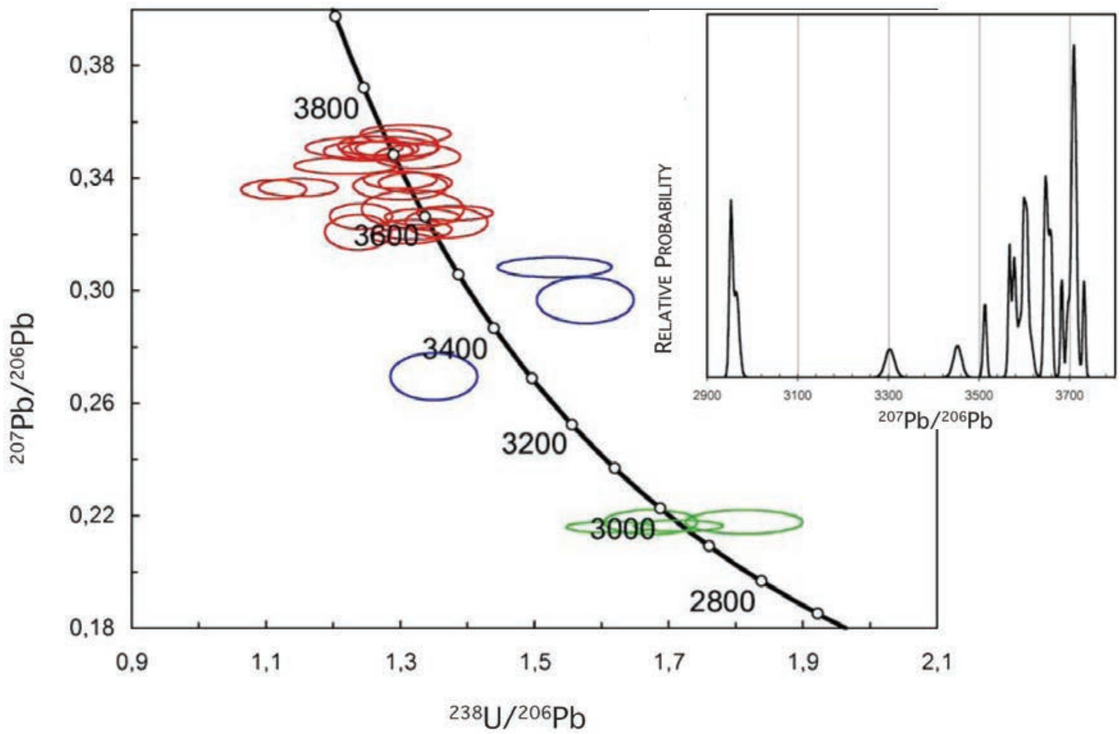

Figure 30. *Terra-Wasserburg concordia diagram and relative probability plot showing data from sample 492720. Red ellipses represent the oldest population with an age of 3704 Ma, green ellipses represent mainly sector zoned grains and blue ellipses represent analyses excluded from the age calculations.*

482493
Location: nrl2005-100, N 7100276, E 535651
Collected by: Natasha Henwood

This sample was collected from a biotite-orthogneiss containing biotite, plagioclase and quartz. Based on mineral assemblages and textures observed in the field, the sample was interpreted to have reached a maximum of amphibolite facies metamorphic grade (pers. com, J. Hollis). Four cores with concentric zoning (pink in figure 31) yield an age of 2884 ± 21 Ma (MSWD = 1.0). Five elongated grains define a younger generation that have an upper intercept age of 2694 ±11 Ma (MSWD = 1.4) (purple in figure 31). The older age is interpreted as a magmatic emplacement age, which is consistent with regional observations (Næraa & Scherstén 2008) and the younger age is interpreted to represent regional metamorphism, based on differences in zircon morphology and regional geological considerations. The large number of grains with ages between these two may have suffered a lead loss event at ca. 2700 Ma.

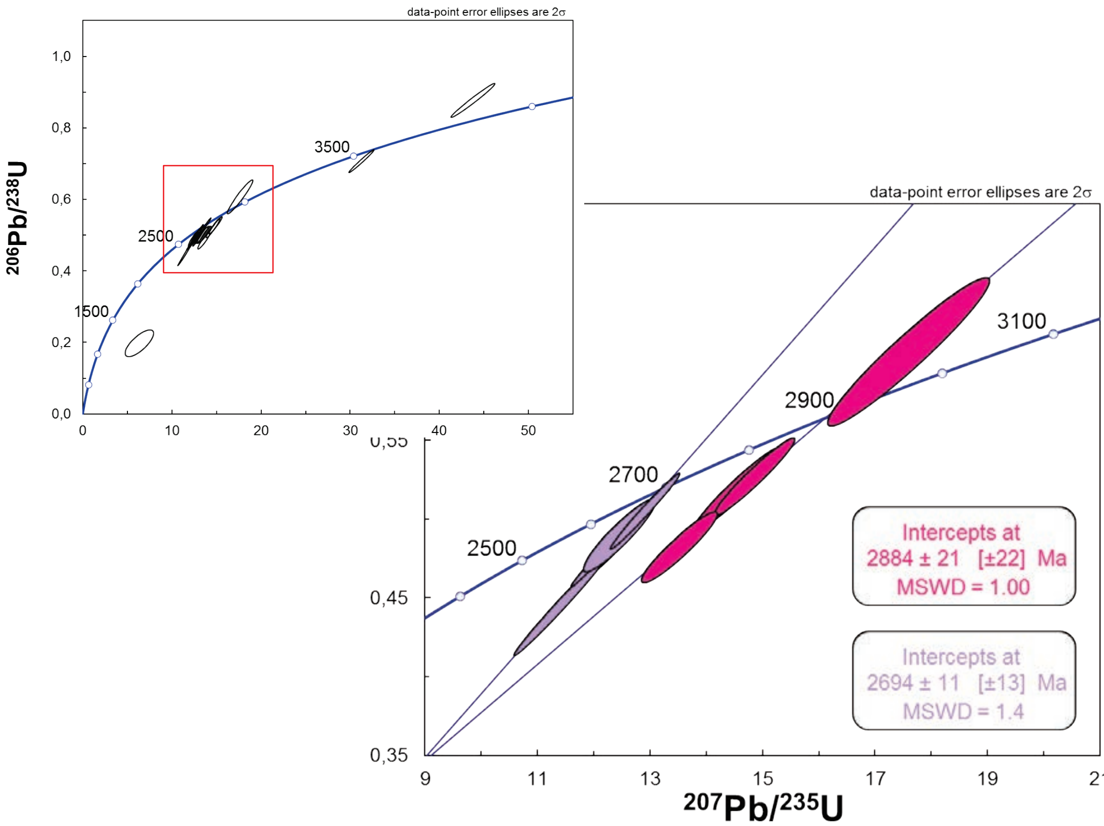

Figure 31. *Top left Wetherill concordia diagram showing all data from sample 482493 and outline of area presented in the right plot. The lower right diagram show analyses from four concentrically zoned cores in pink and five elongated grains in purple.*

477917
Location: spi2005_096, N 7116336, E 538919
Collected by: Sandra Piazolo

The sample was collected from a brownish homogeneous orthogneiss, interpreted as a fresh felsic granulite with high-temperature feldspars. The gneiss show some signs of retrogression, like hydration and recrystallisation of feldspars, along veins (Fig. 32).

Figure 32. *Vein with retrogressive envelope. Photo by Sandra Piazolo.*

Zircon grains are generally stubby to prismatic with weak or no oscillatory zonation. Grains are often fractured and some possibly recrystallized. Seventeen analyses were performed and of those were two rejected as they seem to reflect a younger generation of zircon crystallisation. The resulting group is rather coherent and yields an upper intercept age of 2870 ± 5 Ma (MSWD =1.05) (Fig. 33). This age is interpreted as a magmatic emplacement age but possibly under granulite facies conditions.

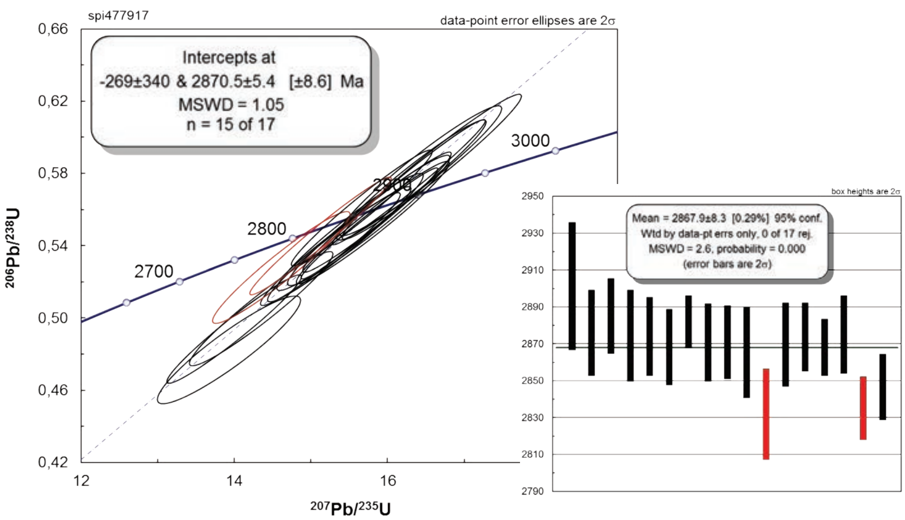

Figure 33. *Wetherill concordia diagram and weighted average plot showing data from sample 477917. Analyses marked by red were excluded from the age calculation.*

477924
Location: spi2005_101, N 7117175, E 537229
Collected by: Sandra Piazolo

This sample was taken from a high-strain domain in a poly-phase tonalitic orthogneiss with a high proportion of mafic material (Fig. 34). The gneiss is in contact with granulite.

Figure 34. *Field photograph of the analysed orthogneiss. Photo by Sandra Piazolo.*

Zircon grains are generally stubby subrounded grains without zoning. Some grains are elongated and prismatic and some have small overgrowths. All analyses represent cores. Thirty analyses were obtained from the gneiss and the age data indicate a single population. Two analyses were discarded as they sampled fractures. An upper intercept age of all analyses at 2869 ± 10 Ma (MSWD = 4.1) (Fig. 35) is regarded as the best estimate of a magmatic age. The high MSWD may indicate a mix of recent and ancient lead loss affecting the isotope systematics.

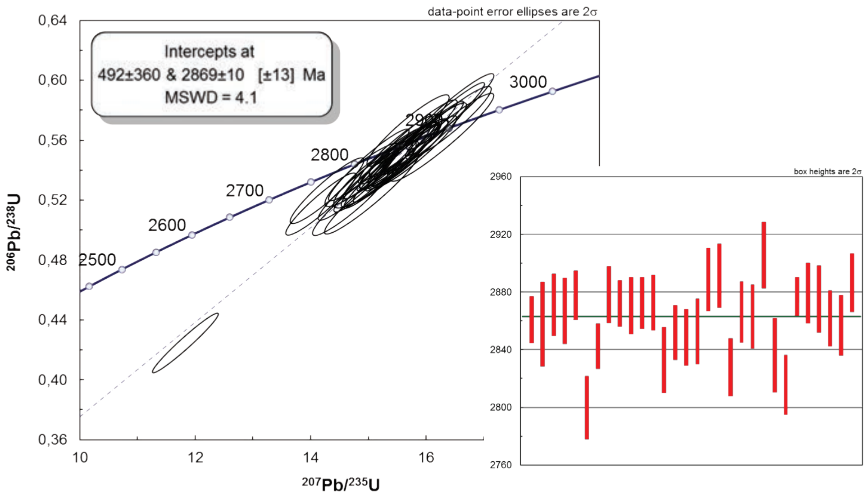

Figure 35. *Wetherill concordia diagram and $^{207}Pb/^{206}Pb$-age plot showing data from sample 477924.*

496449
Location: 2005jeh184, N 7106100, E 533775
Collected by: Elis Hoffmann

This sample was taken from a homogeneous flaky TTG gneiss with abundant biotite in high-strain zones and abundant inclusions. A weighted mean of $^{207}Pb/^{206}Pb$-ages based on 15 of 24 analyses (Fig. 36) yield an age of 2862 ± 5 Ma (MSWD = 1.4). The 8 youngest analyses (many rims) and oldest grain (very discordant) were excluded from the age calculation. This age is interpreted as a magmatic emplacement age.

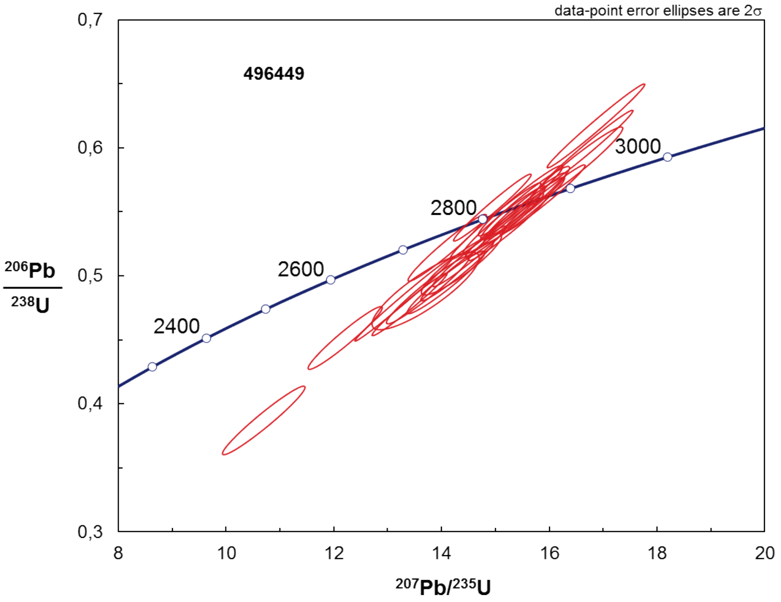

Figure 36. *Wetherill concordia diagram showing data from sample 496449.*

496443

Location: 2005jeh165, N 7105427, E 531381

Collected by: Elis Hoffmann

This sample was collected from an internally folded tonalitic gneiss. Seventeen grains were analysed and five of those yielded a weighted average $^{207}Pb/^{206}Pb$-age of 2858 ± 8 Ma (MSWD = 0.58) (Fig. 37), which is interpreted to represent a magmatic emplacement age. Most grains yield discordant data and there seem to have been up to several younger event affecting the isotope systematics.

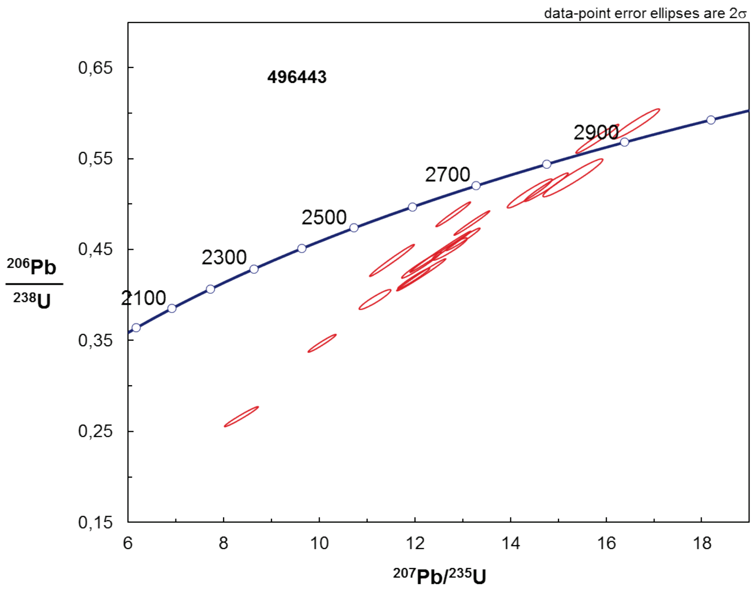

Figure 37. *Wetherill concordia diagram showing data from sample 496443.*

499312
Location: 2005cm027, N 7109128, E 530453
Collected by: Carsten Münker

This sample was collected from a homogenous biotite gneiss. Twenty five analyses were performed and of these the oldest and the 5 youngest grains were excluded in the age calculation. The remaining nineteen analyses yielded a weighted mean of $^{207}Pb/^{206}Pb$-ages of 2851 ± 5 Ma (MSWD = 2) (Fig. 38). This age is interpreted as a magmatic crystallisation age. Some spread towards younger ages may indicate a younger event affected the isotope systematics of the sample.

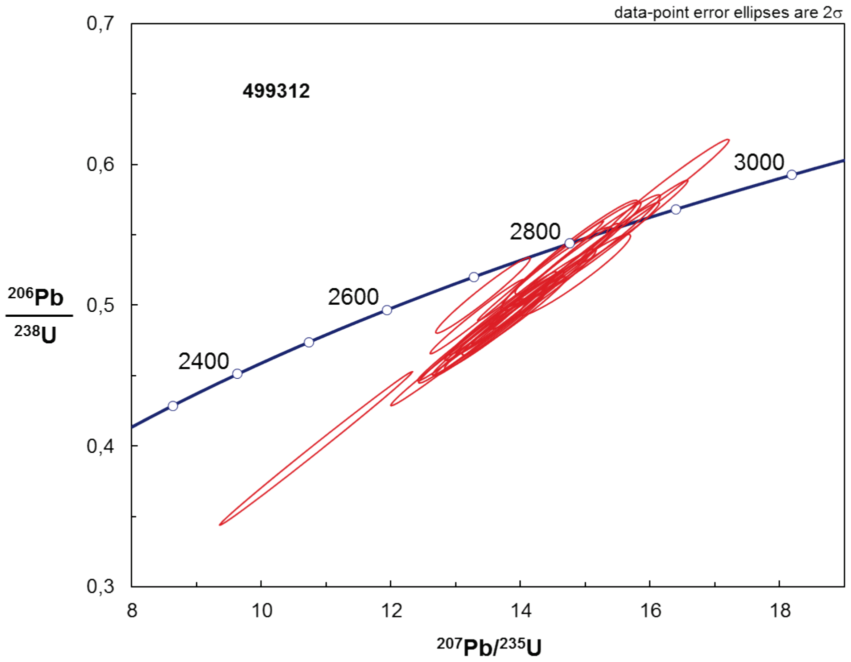

Figure 38. *Wetherill concordia diagram showing data from sample 499312.*

496450
Location: 2005jeh188, N 7104320, E 531362
Collected by: Elis Hoffmann

This sample was taken from a low-strain tonalitic orthogneiss that lack inclusions and is not intensely folded. 11 of 24 analyses were used in the weighted average $^{207}Pb/^{206}Pb$-age calculation (Fig. 39), excluding several outlying young and old grains. The resulting age of 2848 ± 4 Ma (MSWD = 0.85) is interpreted as a magmatic emplacement age. Some spread towards younger ages may indicate that a younger recrystallization event affected the sample.

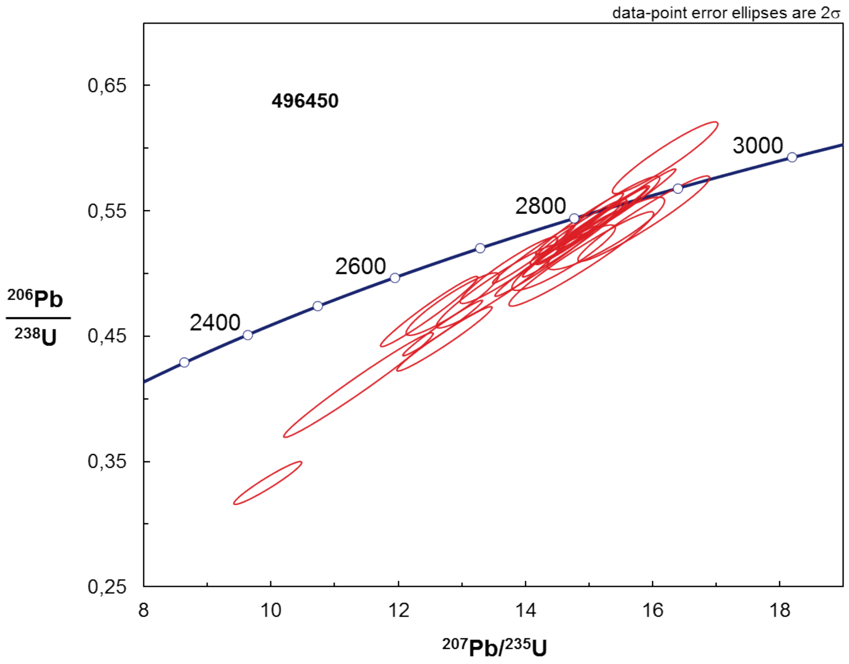

Figure 39. *Wetherill concordia diagram showing data from sample 496450.*

499902
Location: 2007yhf005, N 7150761, E 559571
Collected by: Yu Haifeng

The sample is of a tonalitic gneiss with a penetrative foliation. The gneiss hosts enclaves of an older banded tonalitic gneiss with an early foliation. A diverse population of zircon grains exhibit both oscillatory and sector zoning as well as a more convoluted internal structure (Fig. 40).

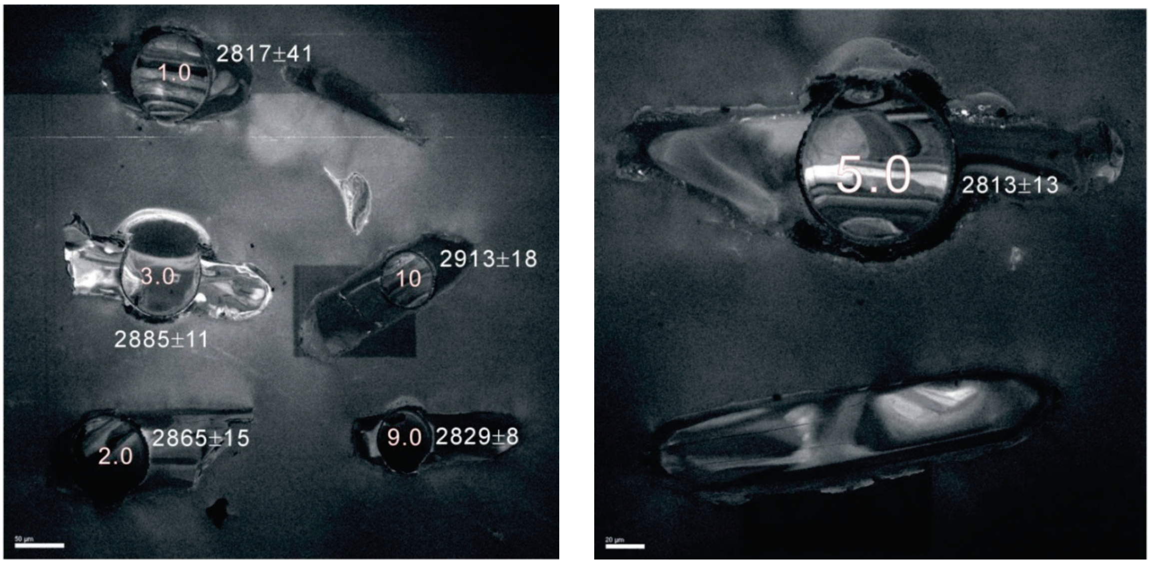

Figure 40. *Cathodoluminescence images of zircon grains from sample 499902.*

Fifteen analyses were performed on the sample and they yielded a single age group with a weighted average $^{207}Pb/^{206}Pb$-age of 2851 ± 17 Ma (MSWD = 4.8) (Fig. 41a). This age is within error of an upper intercept age of 2833 ± 25 Ma (MSWD = 3.8) (Fig. 41b) determined from the same data. The apparent spread in ages resulting in the increased MSWD could be the result of recent lead loss.

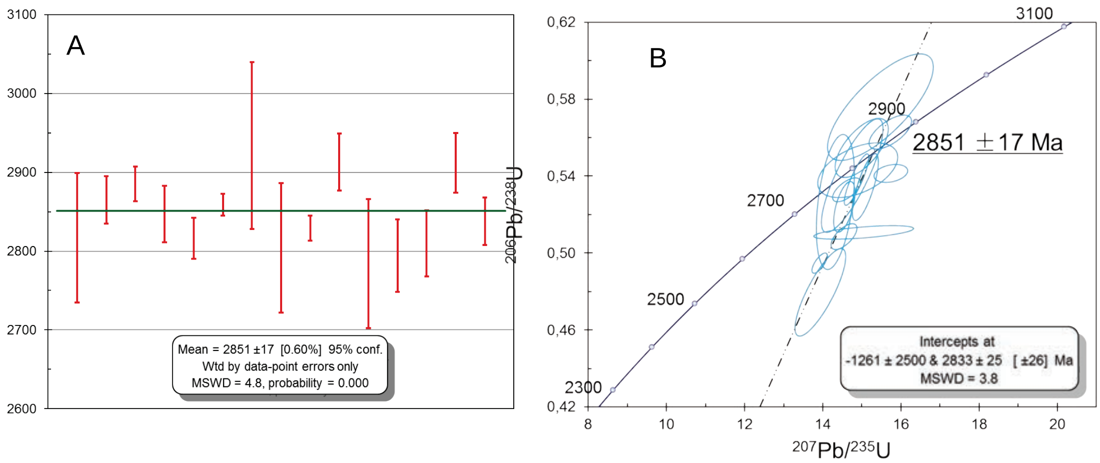

Figure 41. *Data plots for sample 499902. A) Plot showing $^{207}Pb/^{206}Pb$-ages with 2σ error bars. B) Wetherill concordia diagram.*

481403
Location: 2004jho007, N 7142709, E 534674
Collected by: Julie Hollis

This sample comes from a banded poly-phase dioritic gneiss with some felsic segregations (Fig. 42).

Figure 42. *Field photograph of the locality of sample 481403. Photo by Julie Hollis.*

Zircons are typically 200-400 microns with aspect ratios of 1:2 to 1:4 and prismatic. Most show well-defined oscillatory zonation. Patchy bright areas in some grains may be indicative of partial recrystallization. No distinct rims are present.

Fourteen of 25 oscillatory zoned grains yield a weighted average age population (Fig. 43) at 2829 ± 4 Ma (2σ, MSWD = 0.5), consistent with the age of the Ikkattoq gneiss. However, there is also considerable spread in ages down to c. 2800 Ma, with three significantly younger grains. There is also a trend of decreasing Th/U with decreasing age, consistent with partial recrystallisation of many of the grains. The youngest analysis is a bright patch within an oscillatory zoned grain and has low Th/U (0.03), consistent with recrystallisation.

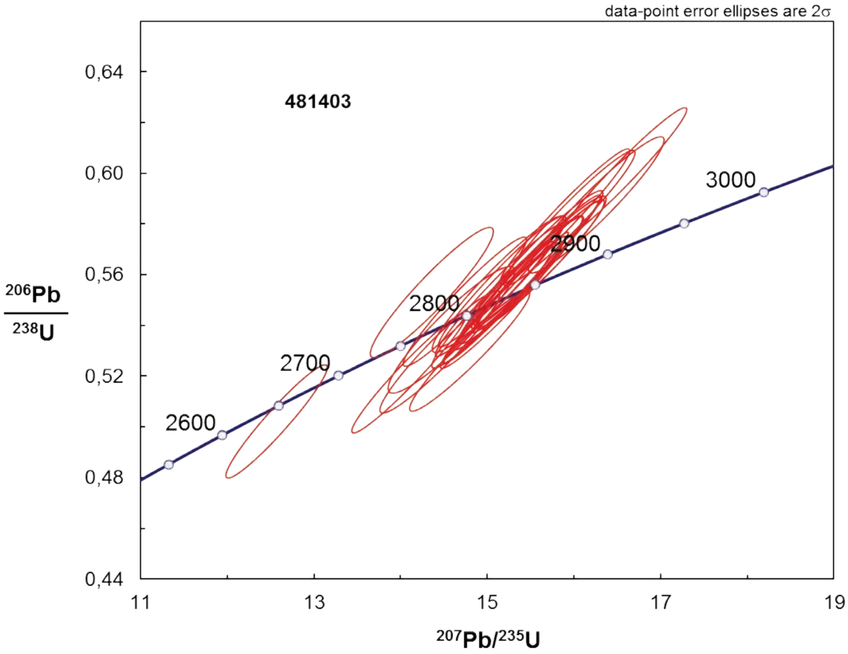

Figure 43. *Wetherill concordia diagram showing data from sample 481403.*

485241
Location: hso2005-174, N 7107165, E 529522
Collected by: Henrik Svahnberg

This sample is from a homogeneous, flaky, biotite-rich tonalitic orthogneiss. Leucosome bands are 1-10 cm thick with quartz, feldspar, biotite ± hornblende ± garnet. The leucosome bands has a blebby texture due to large hornblende crystals. The bands are subparallel to the foliation (Fig. 44). The gneiss is cut by late fluid veins, creating erosion resistant ridges.

Figure 44. *Field photograph of sample 485241, note the large hornblende crystals in the leucosome veins in the upper part of the picture. Photo by Henrik Svahnberg.*

Zircon grains are generally stubby to prismatic with oscillatory zonation. The 36 analyses performed on the sample yield a single age group. One grains is strongly discordant, probably due to Pb-loss and was excluded from age calculations. A weighted average age of 2810 ± 5 Ma (MSWD = 6.0) is statistically overlapping with an upper intercept age of 2813 ± 9 Ma (MSWD = 5.6). The age is interpreted as a magmatic emplacement age (Fig. 45).

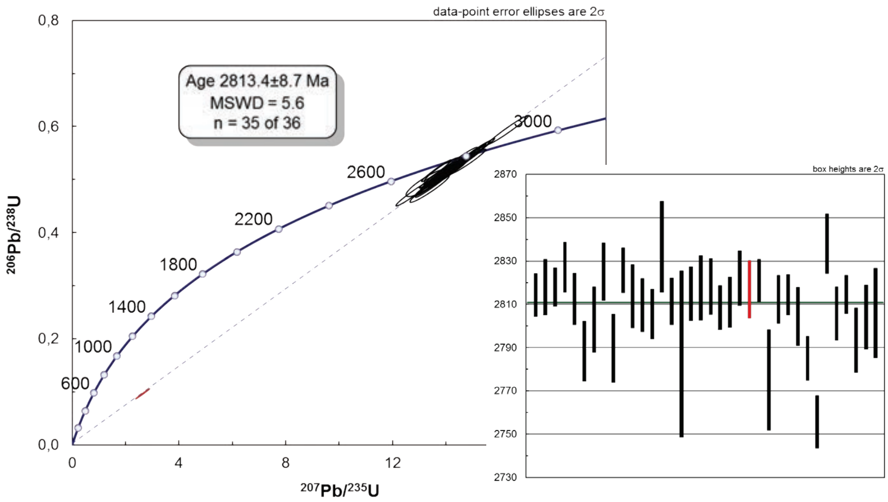

Figure 45. *Wetherill concordia diagram showing data from sample 485241.*

485206
Location: hso2005-034, N 7118631, E 533278
Collected by: Henrik Svahnberg

This sample was taken from a grey, medium grained, mainly homogeneous tonalitic orthogneiss. Some parts are more heterogeneous and contains enclaves of anorthosite as well as migmatized layers and mafic layers that could represent former dykes. Garnet is generally replaced by hornblende (Fig. 46).

Figure 46. *Field photograph of sample 485206. The notebook is ca. 10 cm wide for scale. Photo by Henrik Svahnberg.*

Zircon grains are generally stubby to prismatic with oscillatory zonation. Thirty two analyses were obtained from the sample and three grains were excluded from further age calculations: one spot sampled a fracture, one grain had anomalously high U- and Pb-content compared to other grains and one grain was dark and did not have clear oscillatory zonation. The 29 remaining analyses, yield an upper intercept age of 2783 ± 5 Ma (MSWD = 3.3) (Fig. 47). The age is interpreted as a magmatic emplacement age. Three zircon grains record a younger age of ca. 2700, whereof two have conspicuously low Th/U-ratios. These grains probably record metamorphic recrystallization.

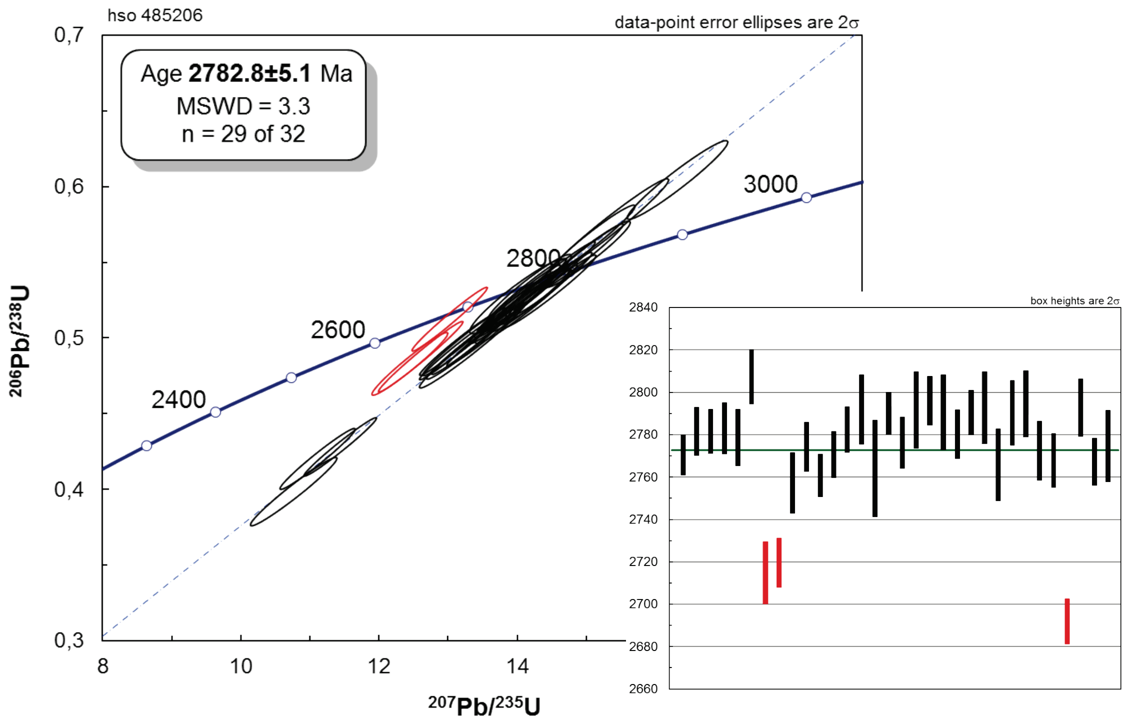

Figure 47. *Wetherill concordia diagram showing data from sample 485206. Inset show a plot of $^{207}Pb/^{206}Pb$-ages with errors. Analyses marked in red were excluded from age calculations.*

499937
Location: 2007yhf047, N 7141923, E 567732
Collected by: Yu Haifeng

This sample is from a banded composite gneiss, with granitic and tonalitic layers (Figs. 48 - 49). The granitic gneiss is fine to medium grained and composed of phenocrystic K-feldspar, plagioclase, quartz and biotite.

Figure 48*. Photograph showing a banded tonalitic gneiss with granitic veins. Photo by Yu Haifeng.*

Figure 49. *Photograph showing the outcrop of tonalitic gneiss. Photo by Yu Haifeng.*

Nineteen analyses were obtained from the gneiss. A discordia through all the points (Fig. 50a) yield an upper intercept at 2818 ± 38 Ma (MSWD = 14).

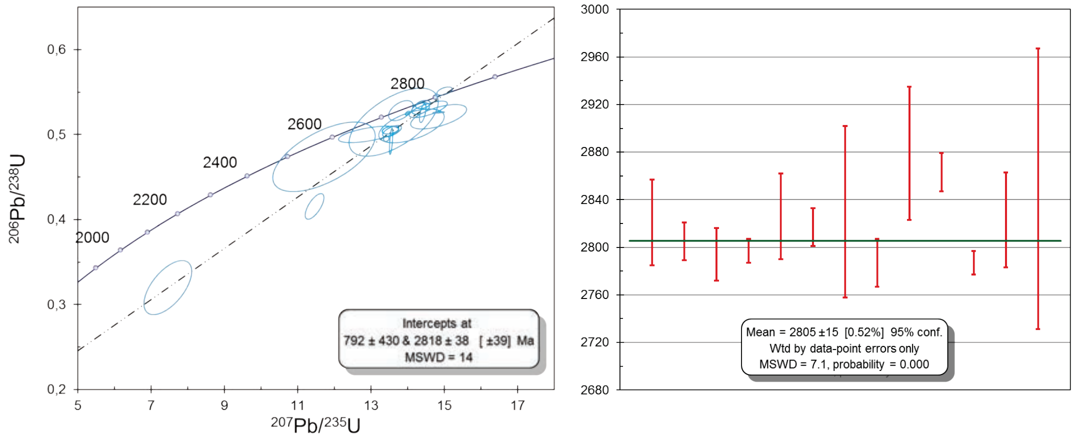

Figure 50. *A) Wetherill concordia diagram and B) $^{207}Pb/^{206}Pb$-ages with error from sample 499937.*

13 of the least discordant analyses yield a weighted mean of $^{207}Pb/^{206}Pb$-ages of 2805 ± 15 (MSWD = 7.1) (Fig. 50b). This age is regarded the best estimate of a magmatic crystallisation age.

479004
Location: 2005nrl142, N 7101691, E 546099
Collected by: Natasha Henwood

This sample come from the felsic part of mafic-intermediate-felsic layered orthogneiss containing hornblende-biotite-quartz-plagioclase and possible diopside. The age data cluster in one group, but with several outliers, both older and younger. The older population of zircon grains are dominated by ages between 3.0 and 3.3 Ga (Fig. 51). Nine of 17 analyses yield a weighted average $^{207}Pb/^{206}Pb$-age of 2782 ± 15 Ma (MSWD = 10.1). The high MSWD indicate that this population may have suffered ancient lead loss or that it in fact represent more than one episode of zircon formation. The 2782 Ma age is interpreted to represent a metamorphic recrystallisation event (Fig. 51).

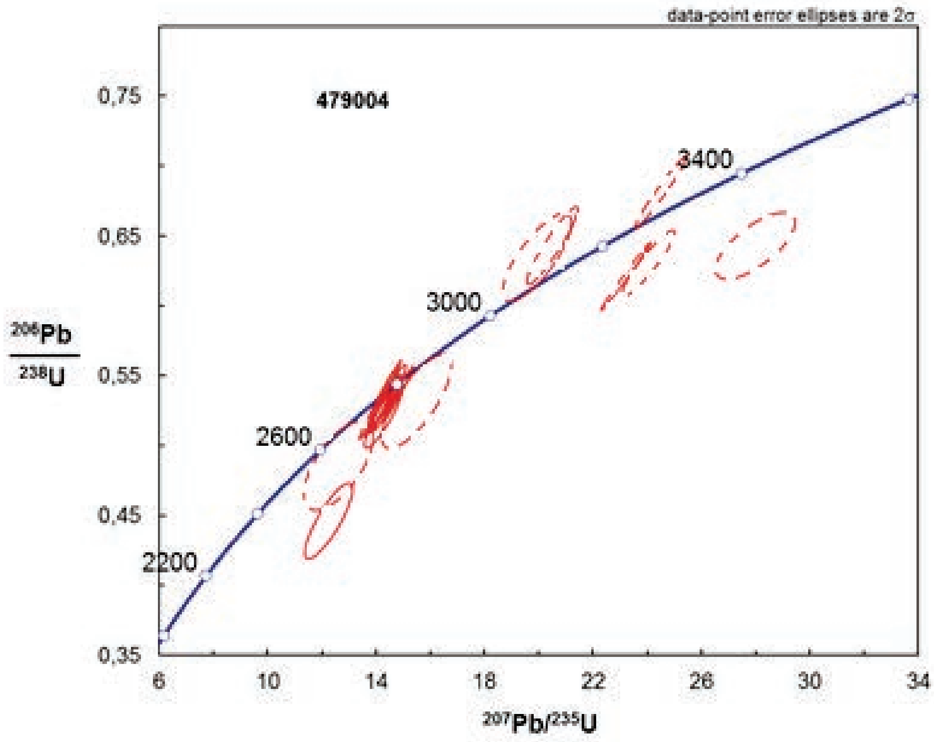

Figure 51. *Wetherill concordia diagram showing data from sample 479004. Analyses marked with dashed lines were excluded from the age calculation.*

482486
Location: nrl2005-080, N 7098876, E 534998
Collected by: Natasha Henwood

The sample was taken from a garnet-orthopyroxene-clinopyroxene-bearing felsic vein intruding paragneisses. The coarse grained vein can be seen in Fig. 52.

Figure 52. *Picture of the garnet- cpx-opx-bearing dated leucosome. Photo by Julie Hollis.*

Zircon grain morphologies vary substantially, e.g. concentrically zoned, sector zoned or partially recrystallised or resorbed, but the ages obtained from different types of zircon grains overlap within error.
Twenty analyses were performed and all analyses yield an upper intercept age of 2774 ± 15 Ma (MSWD = 2.0). The age is interpreted to date crystallisation of the vein and granulite facies metamorphism (Fig. 53).

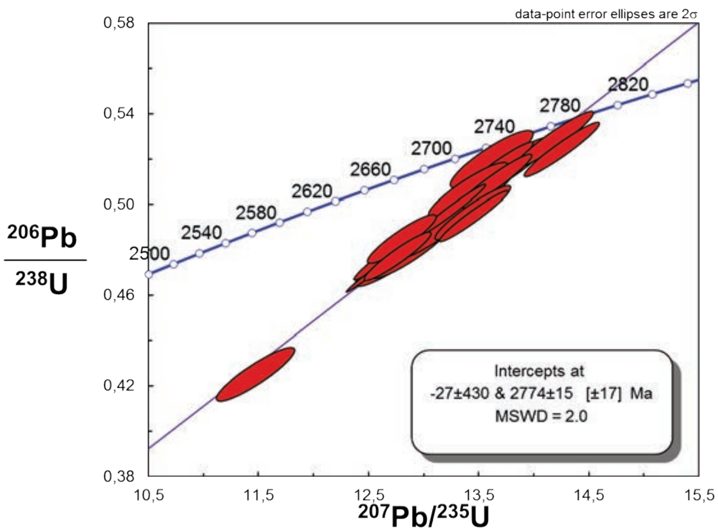

Figure 53. *Wetherill concordia diagram showing data from sample 482486.*

481402
Location: 2004jho004, N 7140187, E 529609
Collected by: Julie Hollis

The sample was taken from a homogeneous leucocratic tonalitic orthogneiss.

BSE and CL imaging of zircon grains reveal cores and rims in some grains and highlights areas of patchy and sector zoning in the largest crystals. The stubby to prismatic grains show concentric, oscillatory zoning, indicating a primary magmatic origin. The ovoid grains are generally unzoned and are thus interpreted as metamorphic zircon. Some larger grains exhibit sector zoning in BSE and failed to luminesce, indicating high U contents.
Two oscillatory-zoned grains yielded a poorly defined concordia intercept age of 3032 ± 170 Ma. Due to the failure of the data points to overlap within error, little can be concluded about this population. Grains interpreted to be metamorphic, yielded an upper intercept age (9/20 analyses) of 2737 ± 23 Ma (MSWD = 31) (Fig. 54) and this was interpreted as the age of metamorphic zircon growth. The large MSWD indicates that this is not a coherent group. There seem to some spread towards older ages indicating mixed protolith and metamorphic age domains.

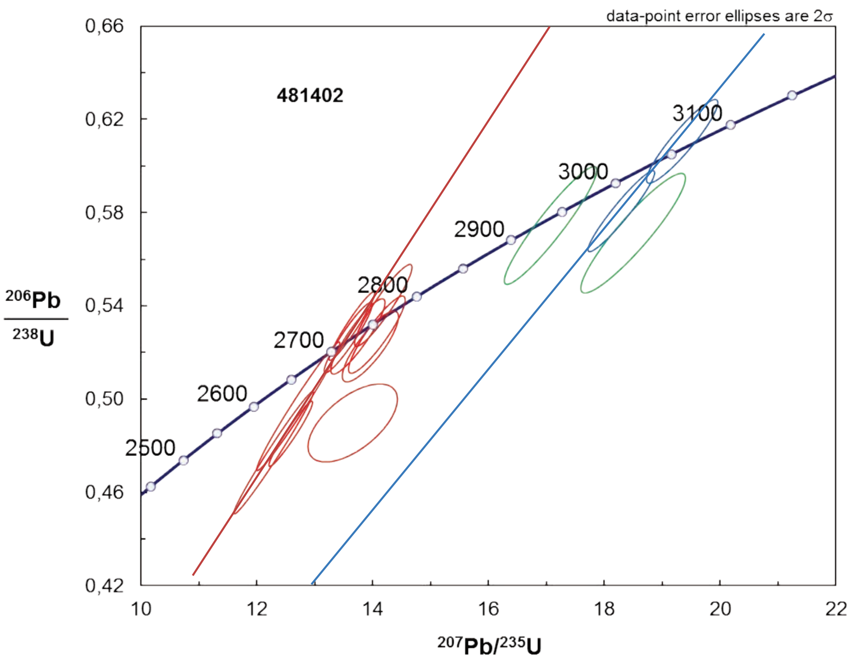

Figure 54. *Wetherill concordia diagram showing data from sample 481402. Analyses marked in red yield an age of 2737 ± 23 Ma and the two analyses in blue yield an age of 3032 ± 170 Ma. The two analyses marked in green were excluded from age calculations.*

482444
Location: nrl2005-043, N 7122667, E 518143
Collected by: Natasha Henwood

This sample was taken from a felsic garnet-hornblende-bearing leucosome invading an amphibolite-bearing TTG gneiss. The leucosome intrudes both gneiss and amphibolite and is interpreted to be linked to amphibolite facies metamorphism. Zircon grains from the sample have variable morphologies. One population consists of blurred and convoluted oscillatory zoned cores with some patchy zoning and strong CL response and another consists of sector zoned and planar banded stubby to sub-ovoid grains with a weak to moderate CL response. Thirty analyses yield a single age population, however with some scatter. Eleven analyses were discarded, 2 of these were very discordant and have high uranium-content, remaining 9 were discarded due to a suspicion of age mixing because analytical pits were located on domain boundaries in the zircon grains. The remaining twenty one analyses yield an upper age of 2720 ± 14 Ma (MSWD = 10.8), which is interpreted as dating amphibolite facies metamorphism (see Fig. 55) (Lee 2009). The large MSWD may be attributed to prolonged crystallisation of zircon combined with some ancient lead loss.

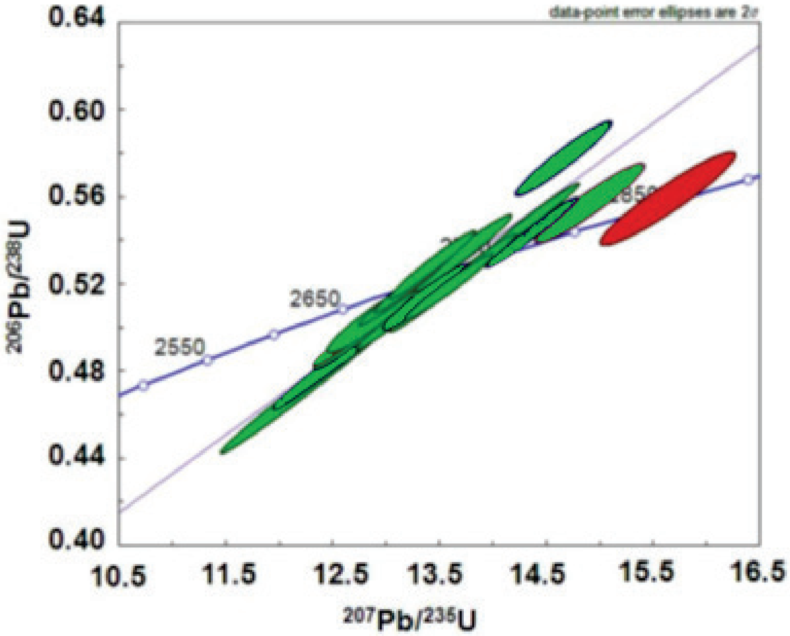

Figure 55. *Wetherill concordia diagram showing data from sample 482444. A single age population defining a recent Pb loss trend, with an upper intercept age of 2720 ± 14 Ma (lower intercept = 339 ± 630Ma). The red analysis is not included in the age calculation due to its interpretation as an inherited grain.*

Metavolcanics and/or paragneiss samples

514824
Location: 2007hst539, N 7139608, E 576249
Collected by: Henrik Stendal

The sampled rock is a garnet-feldspar-quartz-biotite-bearing gneiss interpreted in the field as a metavolcanic rock. Twenty two analyses were performed and they yield a single age population. One analyses was discarded due to >4% discordance and the remaining analyses yield a weighted average age of 2876 ± 13 Ma (MSWD = 3.2). This age is interpreted as a volcanic emplacement age (Fig. 56).

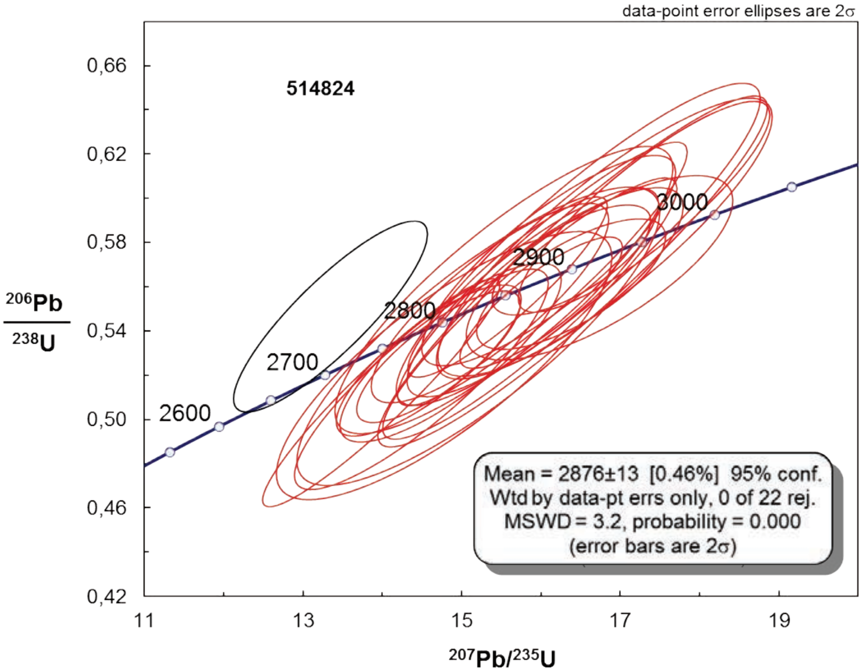

Figure 56. *Wetherill concordia plot showing all analyses from sample 514824. Analyses marked in black was excluded from the age calculation.*

499911
Location: 2007yhf021,N 7151368, E 551912
Collected by: Yu Haifeng

This sample comes from a garnet-biotite schist that occur as a thin layer in a banded tonalitic gneiss (Fig. 57). It contains pockets of leucosome interpreted as partial melts (Fig. 58).

Figure 57. *Photo of a garnet-mica schist lens is a TTG-gneiss. Photo by Yu Haifeng.*

Figure 58. *Field picture of pockets of leucosome interpreted as partial melt. Photo by Yu Haifeng.*

Sixteen grains were analysed from this sample and a discordia utilising all analytical values yield an upper intercept age of 2849 ± 49 Ma (MSWD = 6.6) (Fig. 59). The Mesoproterozoic lower intercept is considered geologically meaningless and may be caused by multiple lead-loss events.

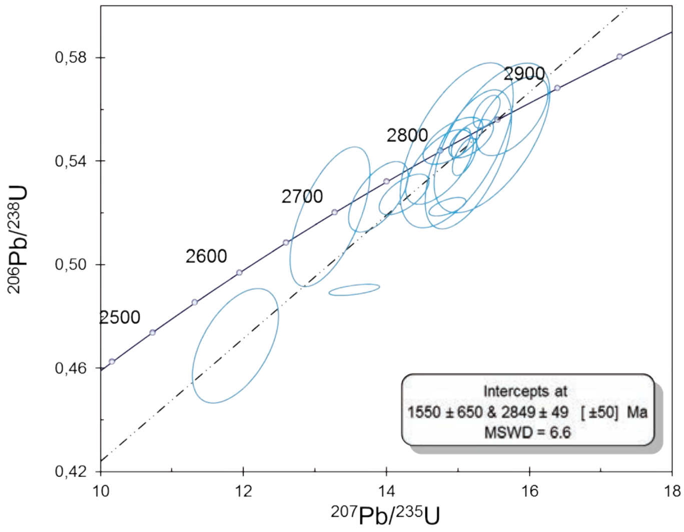

Figure 59. *Wetherill concordia plot showing all analyses from sample 499911.*

A filtered data set with points 1, 3 and 6 excluded due to their apparent lead loss, yield a weighted mean $^{207}Pb/^{206}Pb$ age of 2838 ± 15 Ma (MSWD = 9.2) (Fig. 60), which is considered the best age estimate.

The rock contains only one generation of zircon and could therefore be interpreted either as a supracrustal rock with a volcanic origin and a volcanic depositional age of 2838 Ma or a rock with a sedimentary origin, with only one single-population source. The age could also represent a metamorphic event if only zircon grains from the proposed partial melts were analysed. A volcanic origin is preferred by the present author.

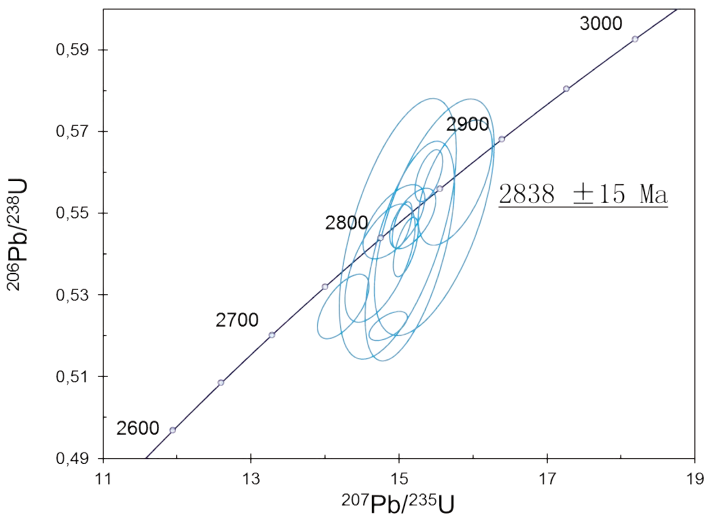

Figure 60. *Wetherill concordia plot showing the analyses used for age calculation in sample 499911.*

493403
Location: 2006ssc091, N 7117051, E 551450
Collected by: Susanne Schmid

The sample was taken from an aluminous schist within supracrustal unit (amphibolite), containing feldspar, quartz, biotite, sillimanite and amphibole (Fig. 61).

Figure 61. *Field picture of the garnet mica schist of sample 493403. Photo by S. Schmid.*

Sixty five analyses were performed on the sample and three age populations were identified based on morphology and age data. The two oldest populations yield upper intercept ages at 2838 ± 29 Ma (MSWD = 0.48) and 2752 ± 13 Ma (MSWD = 0.44) are interpreted as detrital populations, as many of the analyses come from cores (Fig. 62a). The youngest population with an upper intercept age at 2704 ± 7 Ma (MSWD = 0.49) is interpreted as a metamorphic age, as many of the analyses were done on rims. The age is interpreted to date amphibolite facies metamorphism (Fig. 62b).

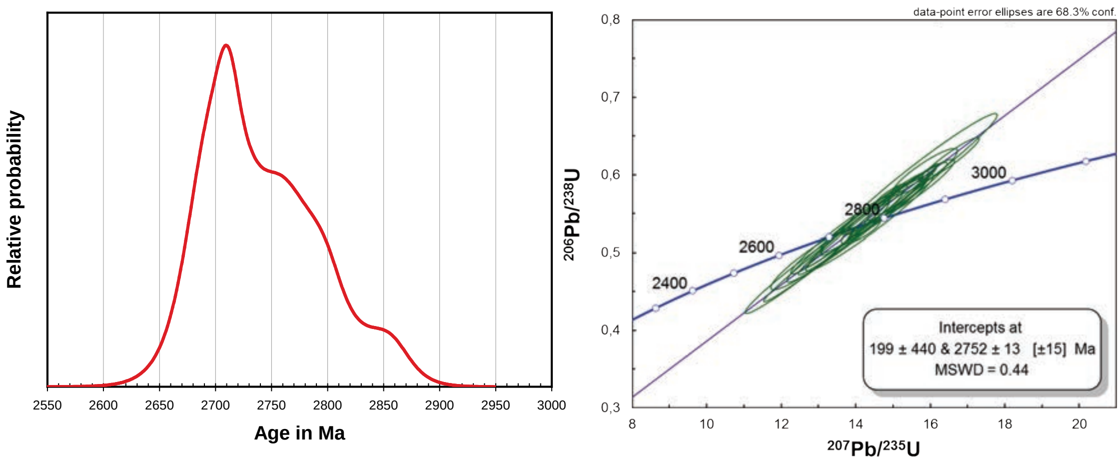

Figure 62. *A). Probability density plot showing all analyses from sample 493403. B) Concordia diagram of the analyses defining the youngest age.*

499954
Location: 2007ckn086, N 7138652, E 525634
Collected by: Christian Knudsen

This sample was taken from a biotite gneiss with suspected cordierite. Zircon grains show a variety of different morphologies (Fig. 63), although many have oscillatory zonation.

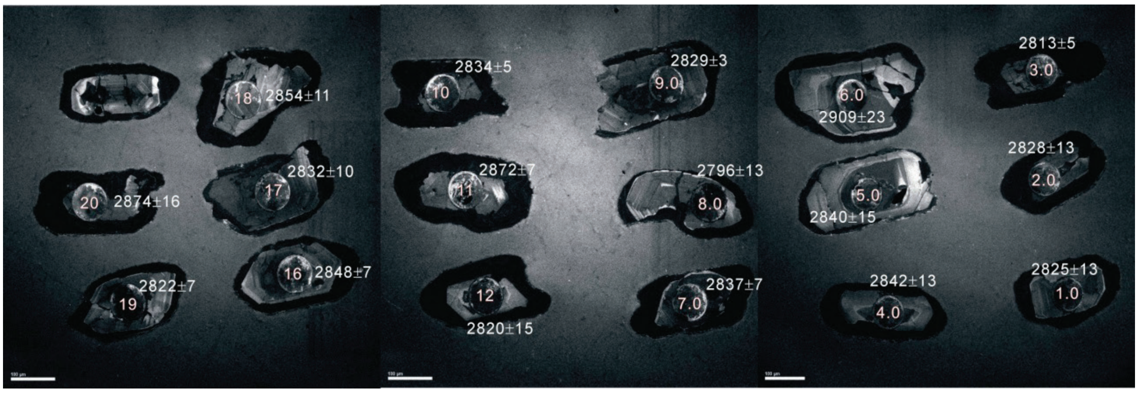

Figure 63. *Cathodoluminescence images of zircon grains from sample 499954.*

Twenty analyses from the sample define a single population that give an upper intercept age of 2835 ± 16 Ma (MSWD = 5.2) (Fig. 64). This is interpreted as volcanic depositional age.

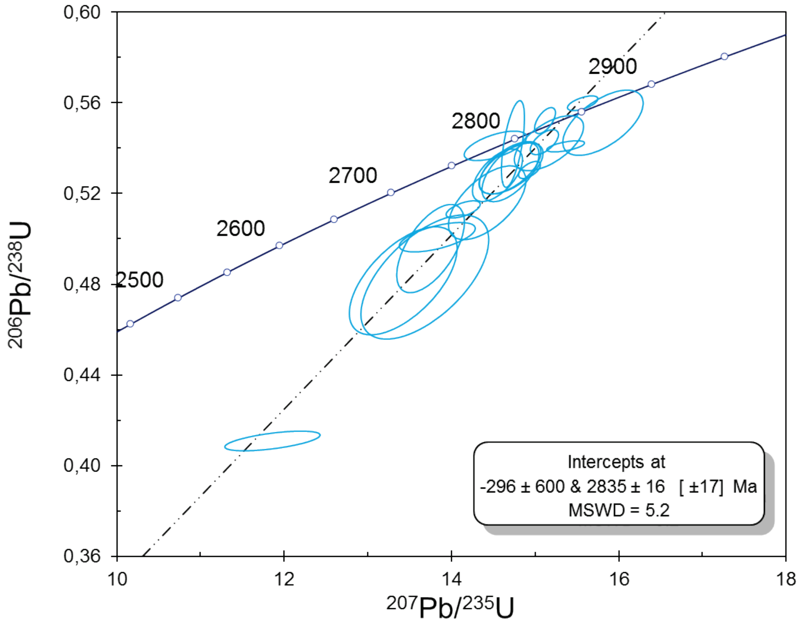

Figure 64. *Wetherill concordia plot showing all analyses from sample 499954.*

499959
Location: 2007yhf079, N 7136780, E 522507
Collected by: Yu Haifeng

This sample is a cordierite-sillimanite-biotite-plagioclase gneiss, containing 20% cordierite, 15% sillimanite, 5% garnet, 15% biotite, 25% plagioclase and 20% quartz (Fig. 65). The rock is medium grained and foliated. The sample is taken from a 25 m wide screen enclosed in a granodiorite gneiss.

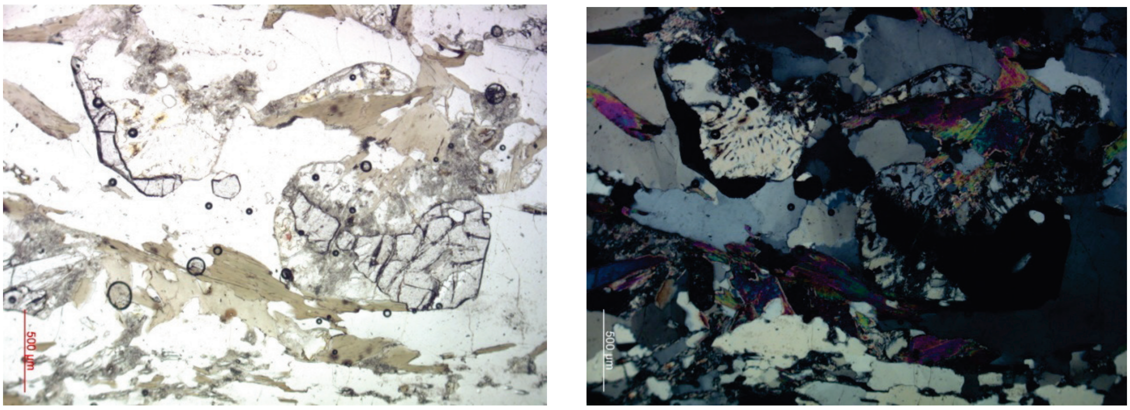

Figure 65. *Photo micrograph of former euhedral garnets with symplectitic breakdown textures. The picture to the left is in plane polarized light and the picture to the right is taken under cross polarised light.*

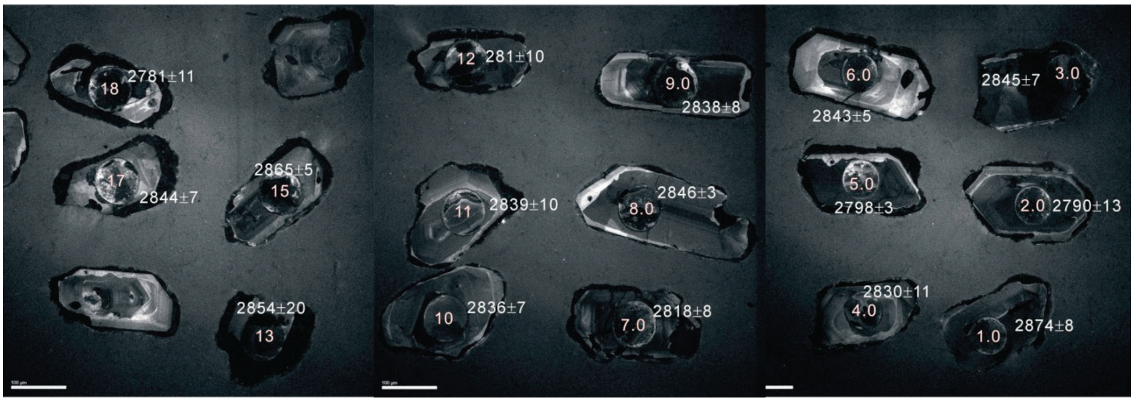

Figure 66. *Cathodoluminescence images of zircon grains from sample 499959.*

Many zircon grains display faint internal oscillatory zonation with thin CL-bright overgrowths, sometimes with resorbtion features along boundaries (Fig. 66). All analyses from the sample yield a discordia with intercepts at 975 ± 900 and 2841 ± 18 Ma (MSWD = 8.7) (Fig. 67), whereas the 12 most concordant analyses yield a weighted mean of $^{207}Pb/^{206}Pb$-ages of 2832 ± 15 Ma (MSWD= 20) (Fig. 68). The origin of this rock is uncertain, but the single age population point toward a formation age (volcanic or metamorphic) of ca. 2830 Ma.

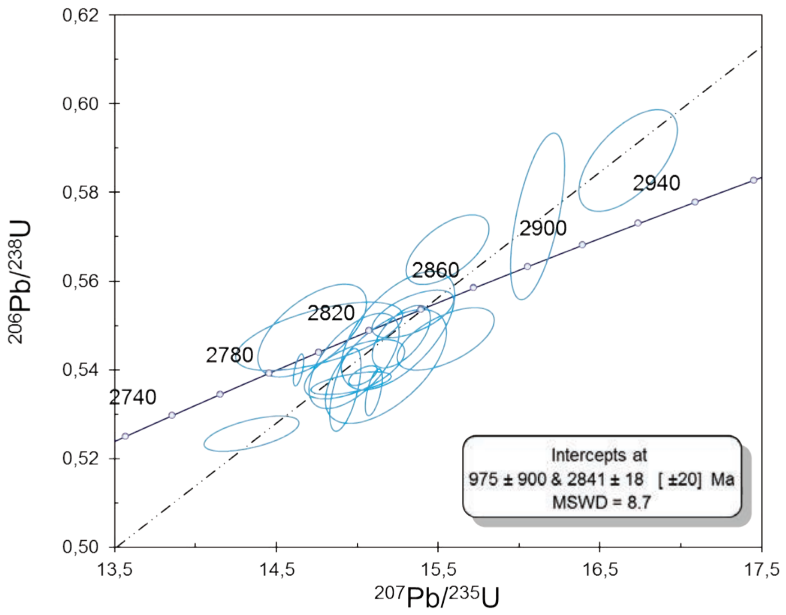

Figure 67. *Wetherill concordia plot showing all analyses from sample 499959.*

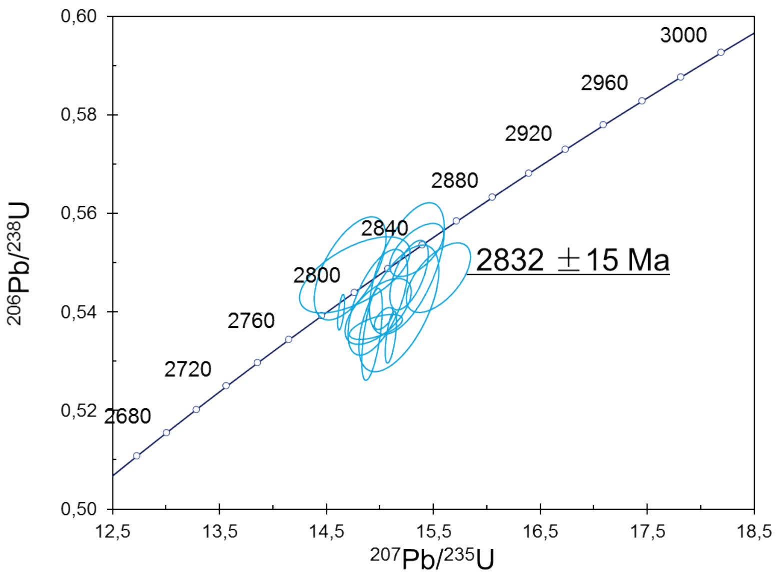

Figure 68. *Wetherill concordia plot showing analyses 2, 3, 4, 5, 6, 8, 9, 10, 11, 14, 15 and 16 from sample 499959.*

481406
Location: 2004jho019, N 7149384, E 540092
Collected by: Julie Hollis

The sampled rock is a biotite-plagioclase-quartz dominated granitic gneiss, occasionally with garnet, with foliation-parallel felsic layers. This is possibly a metasedimentary or a metavolcanic rock.

Zircons are 50-150 microns, typically with aspect ratios of 1:1 and rounded, consistent with a detrital sedimentary origin. They all show a homogeneous dull SSE response.

The zircon grains analysed form a rather tight population with some spread in ages from 2843-2786 Ma (Fig. 69). All have low Th/U (0.01-0.12). Eight of 20 grains form an age plateau and these yield a weighted average age of 2821 ± 4 Ma (MSWD = 0.053), interpreted as derived from a source of this age. This is consistent with a dominant ca. 2830 Ma source for metavolcanic rocks (also present as detrital grains in metasedimentary rocks) from throughout the Nuuk region (Schiøtte et al., 1988; Nutman et al. 2005; Hollis 2005). The spread in ages is consistent with derivation from a restricted source of late Archaean rocks with a minimum depositional age of c. 2800 Ma.

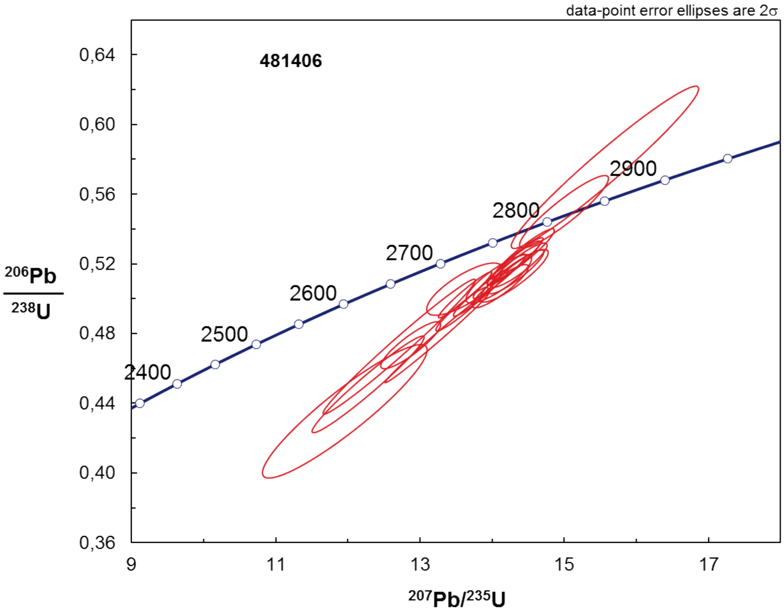

Figure 69. *Wetherill concordia plot showing all analyses from sample 481406.*

497008
Location: 2005nrl148, N 7096909, E 530452
Collected by: Natasha Henwood

This sample was taken from a homogeneous biotite-plagioclase-quartz schist, interpreted in the field to be of possible sedimentary origin. The zircon grains form a homogeneous morphological population. Forty analyses were performed on zircon grains from the sample and they yield a single age population (Fig. 70). The weighted average of $^{207}Pb/^{206}Pb$-ages yield an age of 2801 ± 4 Ma (MSWD = 4.6). The homogeneity of zircon morphologies and of ages argue for either a single source or, more likely, a volcanic origin and the age is therefore interpreted to date volcanic deposition.

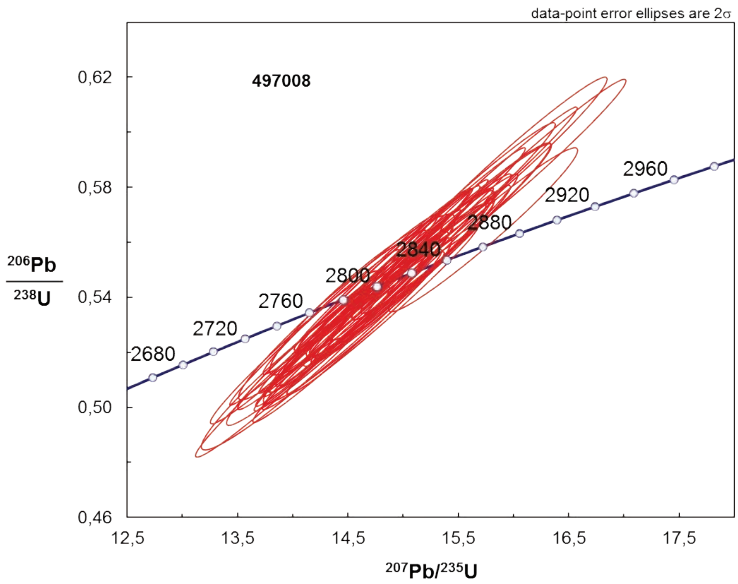

Figure 70. *Wetherill concordia plot showing all analyses from sample 497008.*

499955
Location: 2007ckn087, N 7138592, E 525600
Collected by: Christian Knudsen

The sample come from a sillimanite-biotite gneiss, interpreted as a supracrustal rock. The zircon grains have varied morphologies, although many display a dull CL-response (Fig. 71).

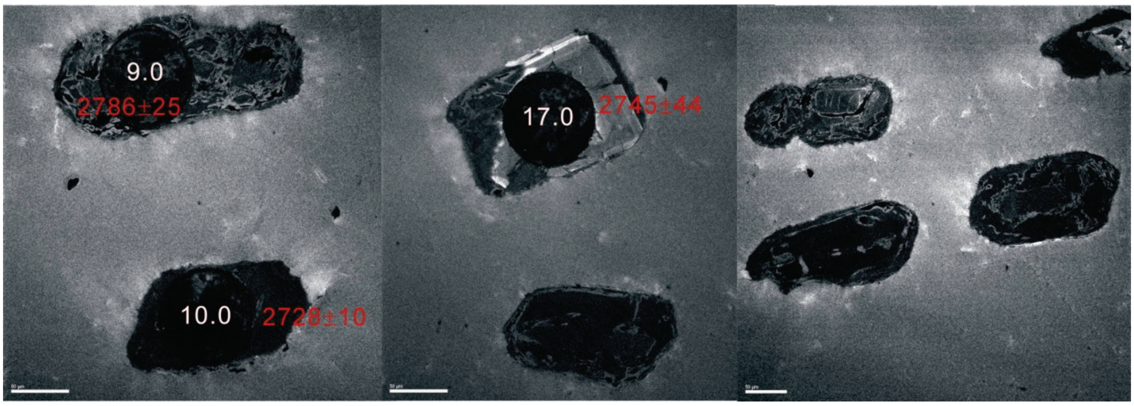

Figure 71. *Cathodoluminescence images of zircon grains from sample 499955.*

Eighteen zircon analyses (Figs. 72) yield a single age population with an upper intercept age of 2775 ± 28 Ma (MSWD = 8.6) (Fig. 72). The rather large MSWD may indicate that some ancient lead loss may have occurred. The age is interpreted as a volcanic depositional age.

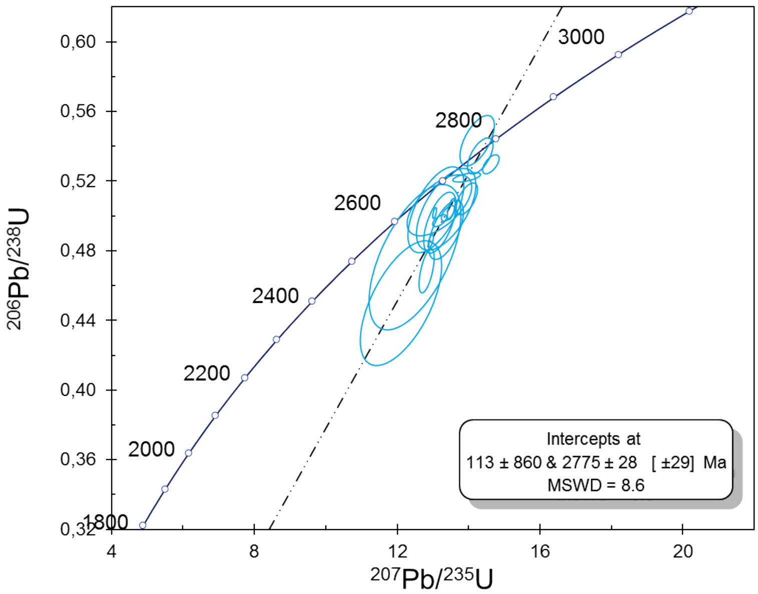

Figure 72. *Wetherill concordia plot showing all analyses from sample 499955.*

497014
Location: nrl2005-156, N 7109070, E 555836
Collected by: Natasha Henwood

The sample come from foliation-parallel leucosome containing garnet and possibly diopside intruding a garnet amphibolite in a volcano-sedimentary unit. Thirty analyses were performed and yield a single age population despite varying zircon grain morphologies. Although the age data indicate a single age, they are displaying varying degree of recent lead loss (Fig. 73). Excluding the five most discordant grains yield an upper intercept age of 2704 ± 10 Ma (MSWD = 7.2) and a weighted mean age of 2701 ± 6 (MSWD = 5.2). This is interpreted as the age of the leucosome formation and of peak amphibolite facies metamorphism.

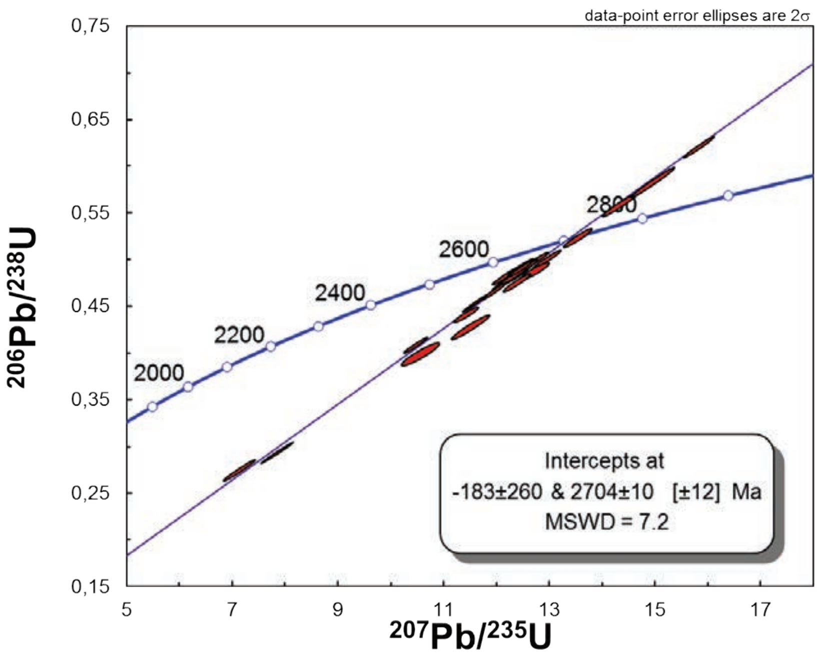

Figure 73. *Wetherill concordia plot showing selected analyses from sample 497014 used for an upper intercept age calculation. The excluded analyses are not shown in the figure.*

497017

Location: nrl2005-159, N 7109366, E 555765

Collected by: Natasha Henwood

This sample come from a garnet-diopside-bearing leucosome in supracrustal garnet-amphibolite. The sample is strongly retrogressed from granulite facies metamorphism with biotite pseudomorphing after possible orthopyroxene. The sample carry zircon grains of varying morphologies, but with obvious core-rim relations. Many analyses show signs of significant, bur probably recent lead loss. Analyses from cores yield a slightly older upper intercept age, 2703 ± 11 (MSWD = 11.4) than analyses of rims alone which yield an upper intercept age of 2687 ± 7 (MSWD = 7.5). A combined upper intercept age is 2693 ± 6 Ma (MSWD = 8.5) (Fig. 74). The interpretation is that the cores date the formation of the leucosome and the rims record a later metamorphic pulse, possibly retrogression. However, the two episodes are close in time and probably the same metamorphic event, thus a combined age is preferred.

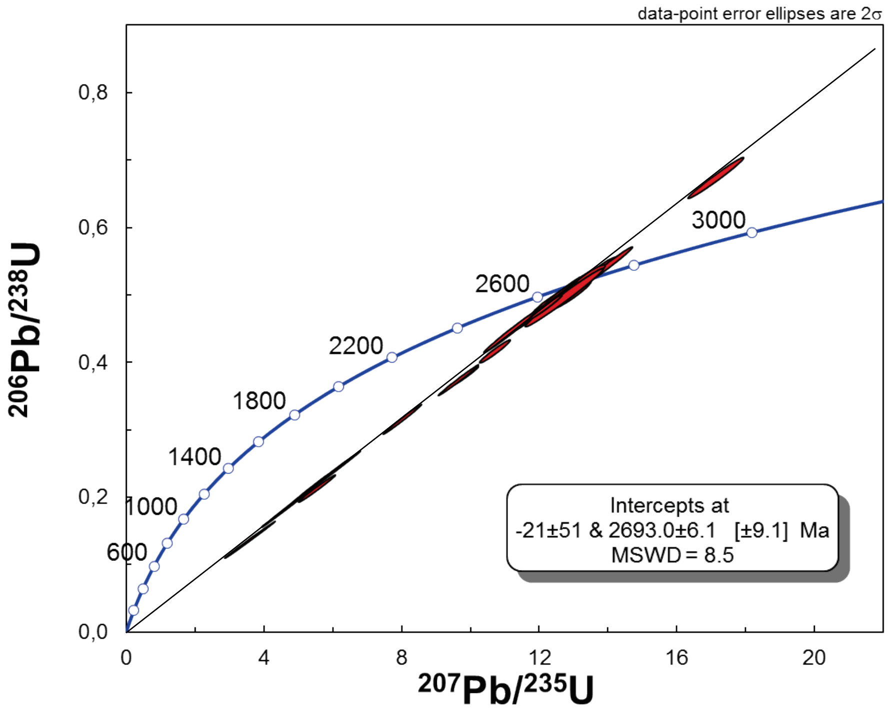

Figure 74*. Wetherill concordia plot showing selected analyses from sample 497017 used for an upper intercept age calculation.*

492237
Location: 2006vbe192, N 7122976, E 551444
Collector: Venessa Bennett

This sample was taken from a garnet-sillimanite-biotite gneiss interpreted to have a metapelitic origin (Fig. 75). Eighty two grains were analysed and three rejected due to a >5 % discordancy.

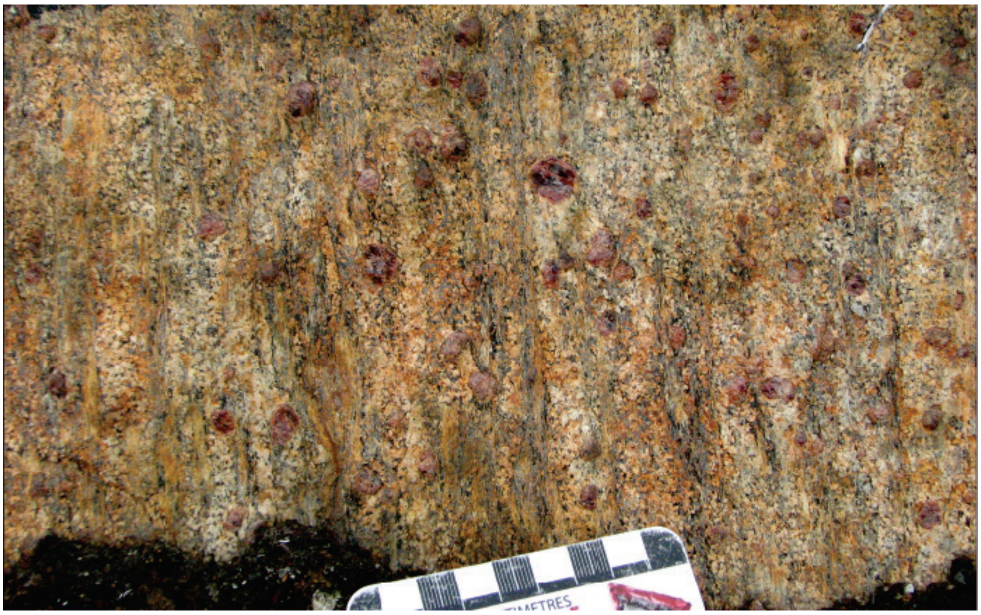

***Figure* 75.** *Field picture of metapelitic gneiss of sample 492237. Photo by Venessa Bennett.*

The sample contains detrital age populations at ca. 2810, 2840 and 2870 Ma, but also a small, but statistically significant population at 3100 Ma (Fig. 76). The two youngest detrital ages yield a weighted mean of 2779 ± 21 Ma (MSWD = 0.0109). Metamorphism is recorded as one generation of grains as well as rims on detrital grains with consistently low Th/U-ratios. Analyses with discordance <1% were used for a concordia age calculation that yield an age of 2678.2 ±5.7 Ma (MSWD = 1.8) (Fig. 77). This is interpreted to reflect peak metamorphic conditions.

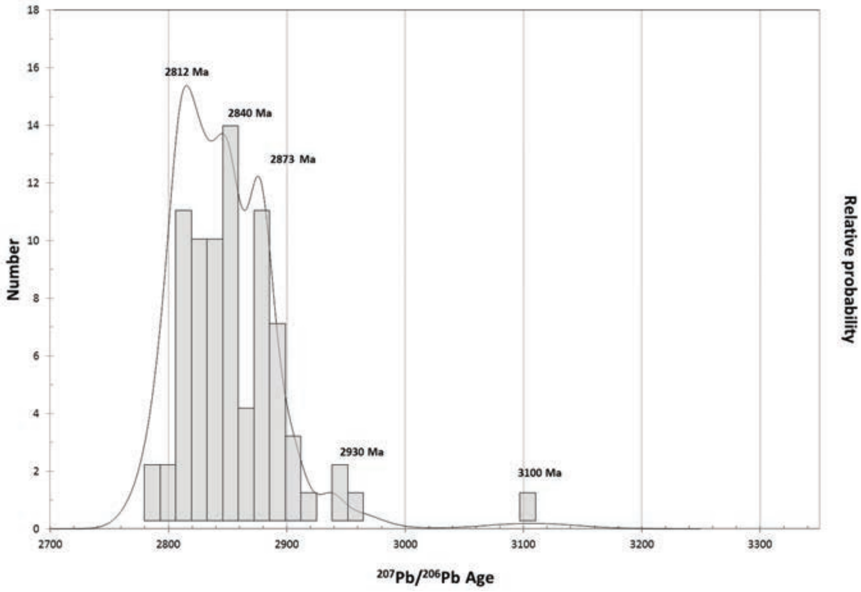

Figure 76. *Probability plot of detrital zircon grain age analyses from sample 492237.*

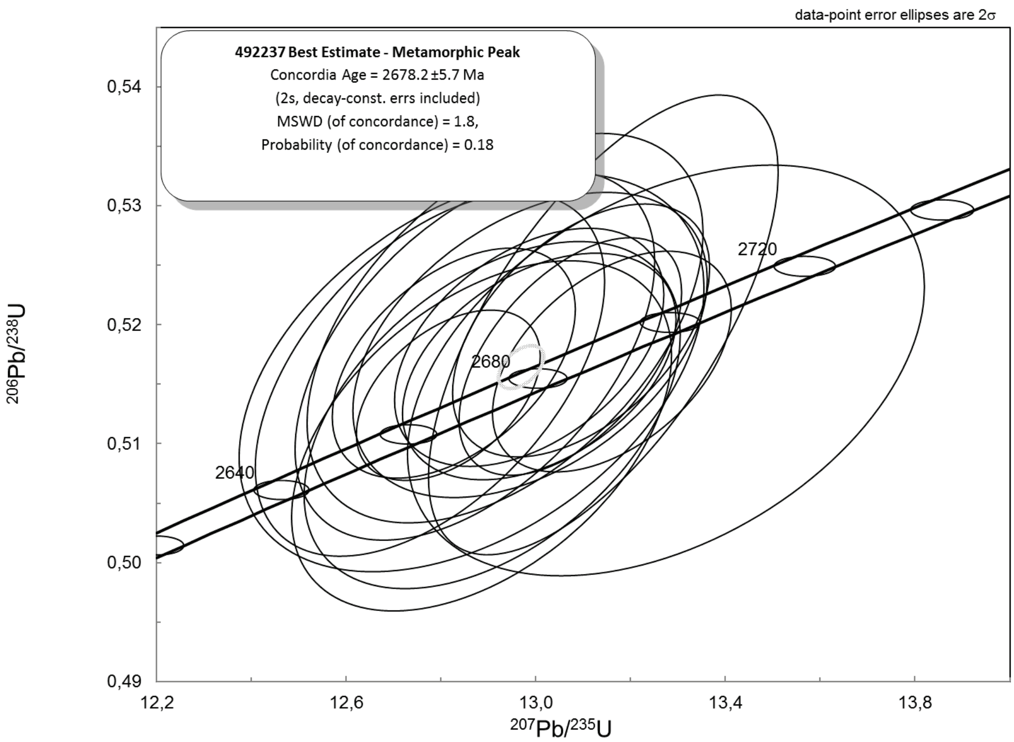

Figure 77. *Wetherill Concordia plot of analyses recording metamorphism in sample 492237.*

478334
Location: N 7124217, E 560155
Collected by: Natasha Henwood

The sampled rock is a garnet-bearing felsic leucosome intruding supracrustal amphibolite. The leucosome contains the assemblage garnet-plagioclase-quartz, with large (>30mm) garnet porphyroblasts (Fig. 78). Zircon grains show faint planar banding or patchy zoning in ovoid to stubby grains and very weak CL response. The 18 most concordant analyses (Fig. 79) yield an upper intercept age of 2659 ± 17 Ma (MSWD = 7.3), which is interpreted to date anataxis (see Lee 2009).

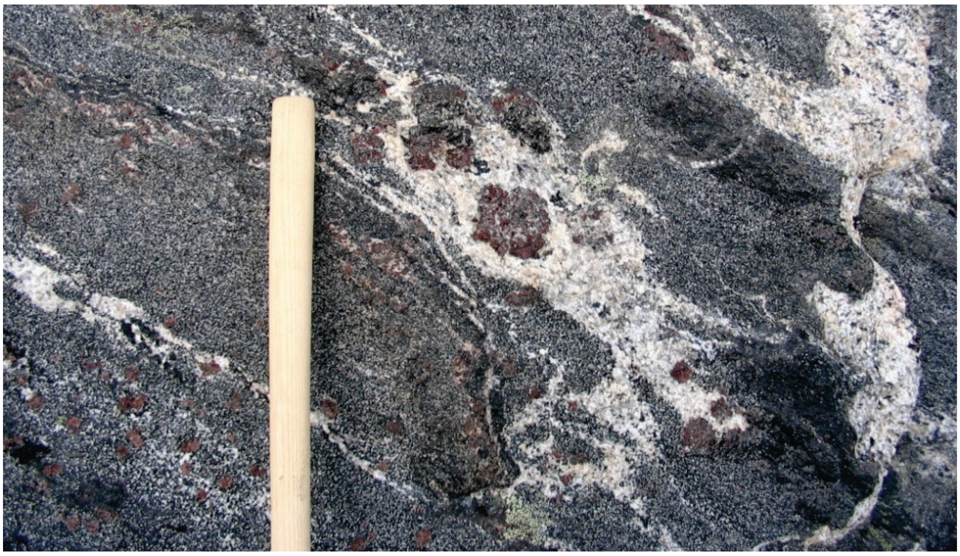

Figure 78. *Field picture of anatectic melts in the supracrustal amphibolite. Photo by Julie Hollis.*

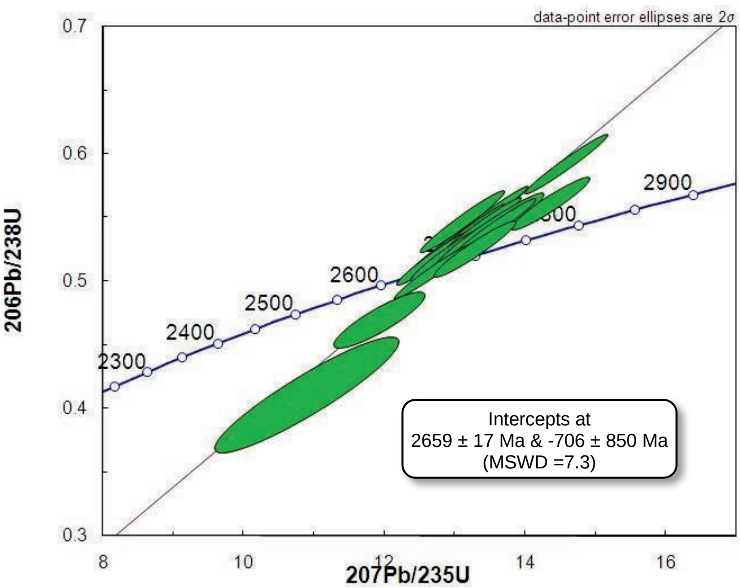

Figure 79. *Wetherill concordia plot showing analyses selected for age calculation from sample 478334.*

492234
Location: 2006vbe084: N 7137884, E 532948
Collected by: Venessa Bennett

This sample comes from a garnet-biotite gneiss, interpreted as a metapelite (Fig. 80).

Figure 80*. Field picture of the garnet-biotite gneiss of sample 492234. Photo by V. Bennett.*

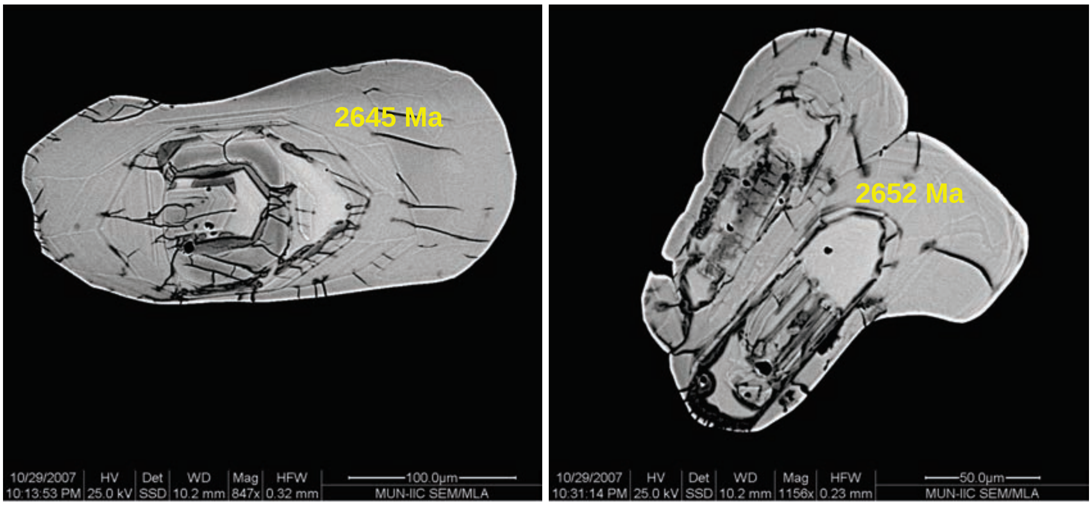

Figure 81*. Cathodluminescence images of zircon grains with thick metamorphic rims from sample 492234. Photo by V. Bennett.*

Of 107 analyses, 2 were rejected for final age calculation. The sample contains a range of detrital age groups. The dominant detrital populations (Fig. 82) have ages of 2900 and 2830 Ma, but the sample also contains a few grains older than 3000 Ma. The three youngest detrital zircon grains yield a concordia age of 2763 ±19 Ma (MSWD= 0.043), indicating the maximum age of onset of sedimentary deposition. Thirteen analyses are from metamorphic rims enclosing detrital grains (Figs. 81, 83). They yield a rather uniform population that yield a weighted average $^{207}Pb/^{206}Pb$-age of 2655.0 ± 4.2 Ma (MSWD= 0.98) (Figs. 82, 83). This age is interpreted to date peak metamorphism.

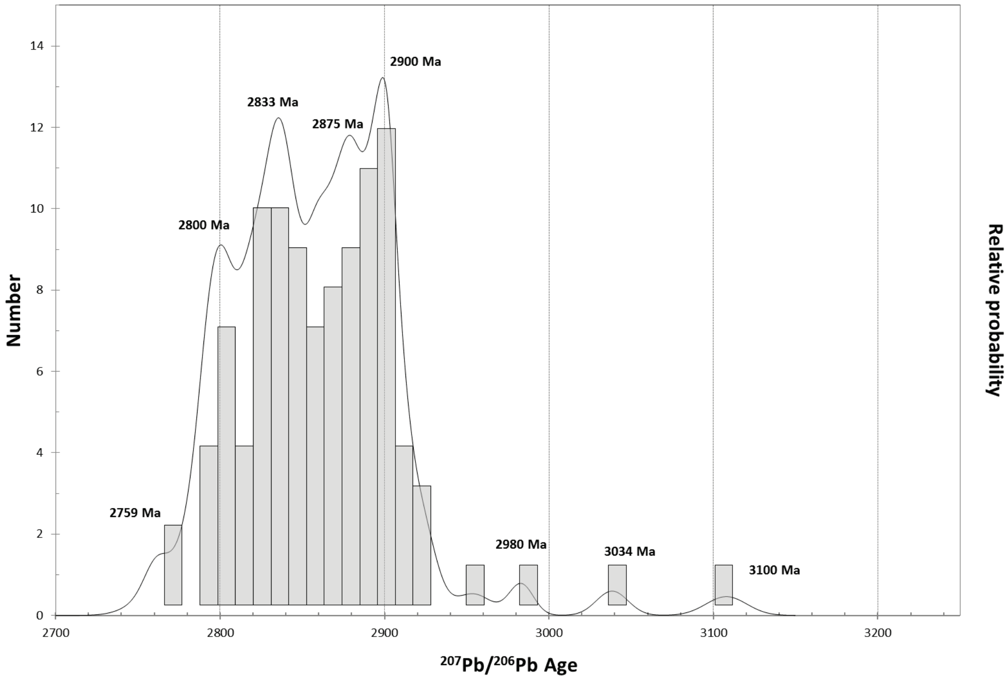

Figure 82*. Probability density plot of analyses from detrital grains in sample 492234.*

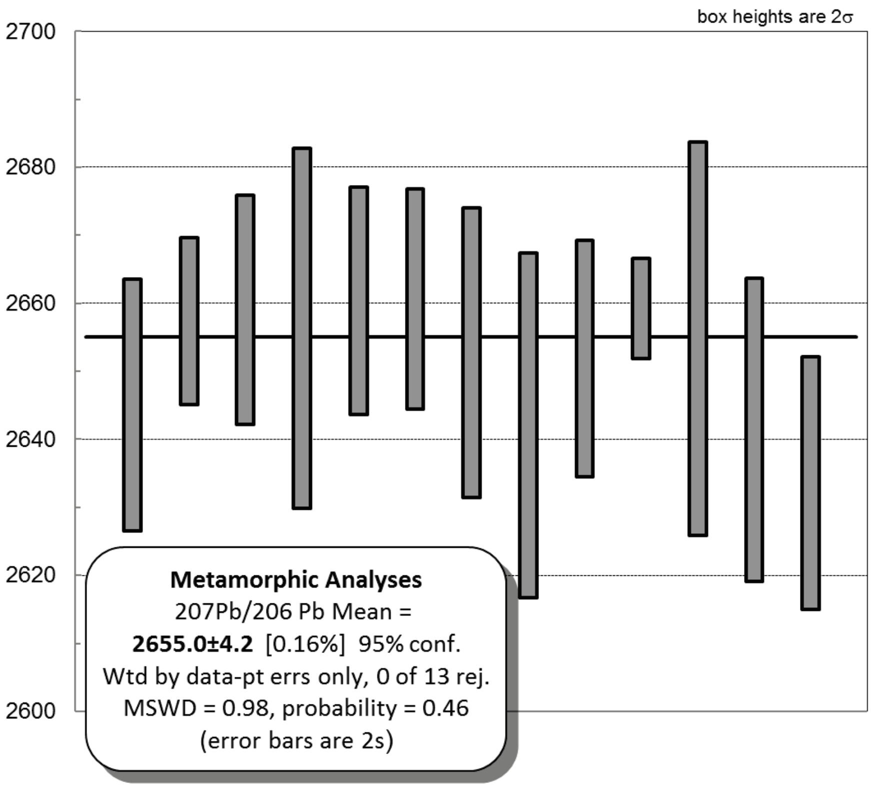

Figure 83*. Weighted average of analyses of metamorphic grains from sample 492234.*

492202
Location: 2006vbe001, N 7136601, E 534936
Collected by: Venessa Bennett

The sample is a garnet-sillimanite-biotite gneiss, interpreted in the field as having a pelitic origin (Fig. 84).

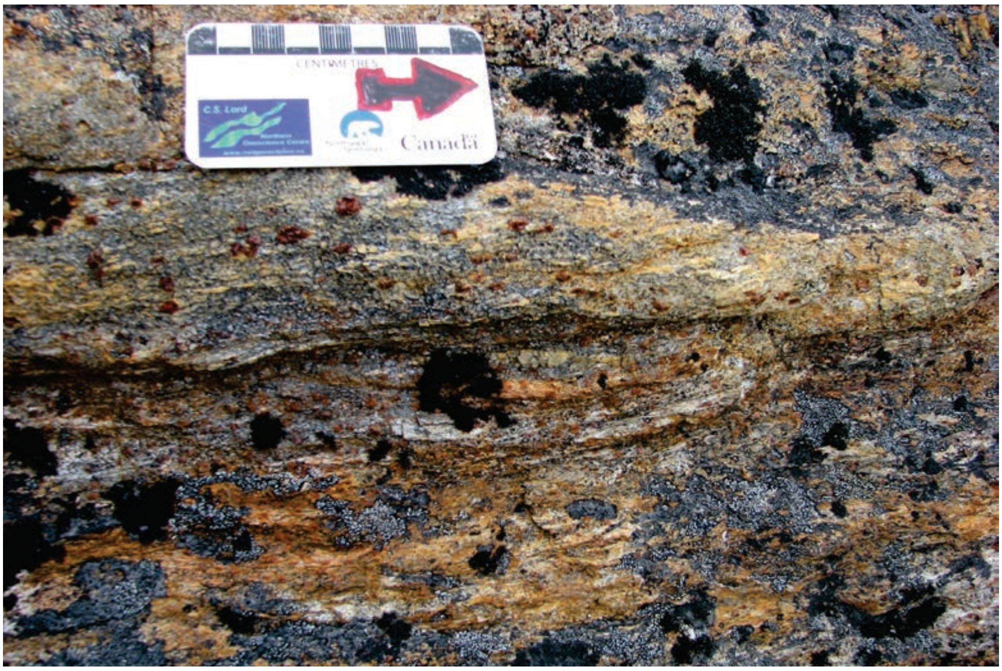

Figure 84*. Field picture of the metasedimentary rock. Photo by Venessa Bennett.*

Eighty-three grains were analysed (e.g. Fig. 85) and 4 of these rejected due to discordance exceeding 5 %. There are several detrital populations with the major components at 2824 and 2800 Ma (Fig. 86). The four youngest detrital grains yield a weighted average age 2752 ± 8 Ma (MSWD = 1.1), indicating this as the maximum age for onset of sediment deposition.

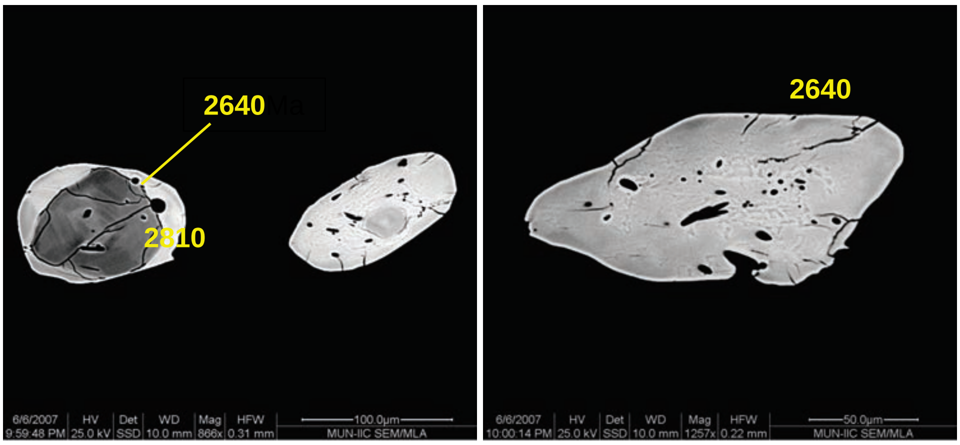

Figure 85*. Cathodluminescence images of metamorphic rims (left) and a metamorphic grain (right) from sample 492202.*

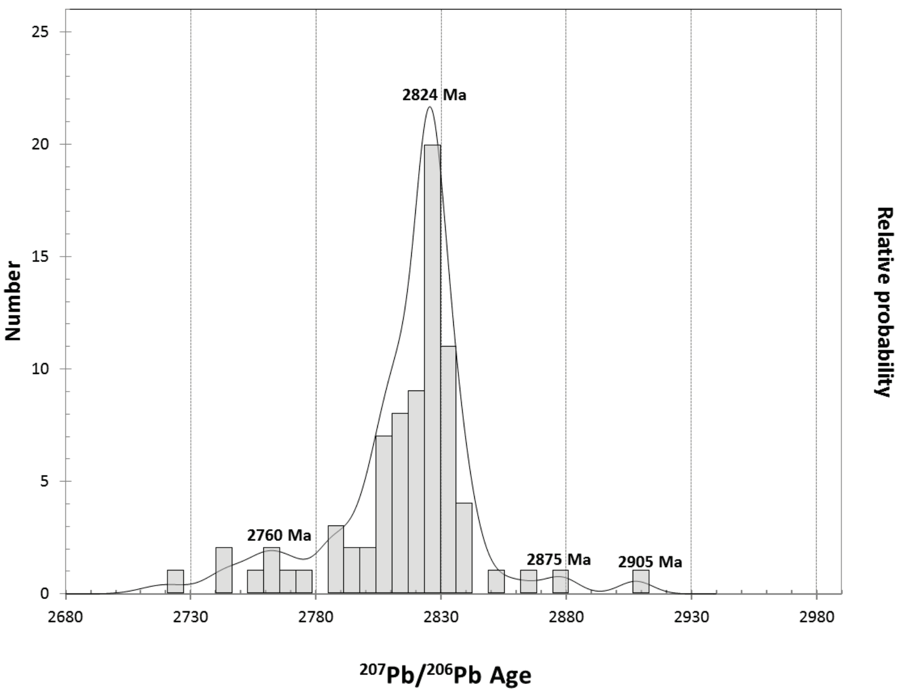

Figure 86*.* *Probability density plot showing analyses from detrital grains in sample 492202. Note that there are no detrital grains recording an age older than 3.0 Ga.*

Thirty-one analyses were made on metamorphic grains or rims (Figs. 85, 87) and of these eight were rejected due to discordance exceeding 1 %. Three metamorphic episodes were recorded in the sample with the largest cluster of ages possibly indicating peak metamorphism at 2649 ± 6 Ma (Concordia age with MSWD = 0.104).

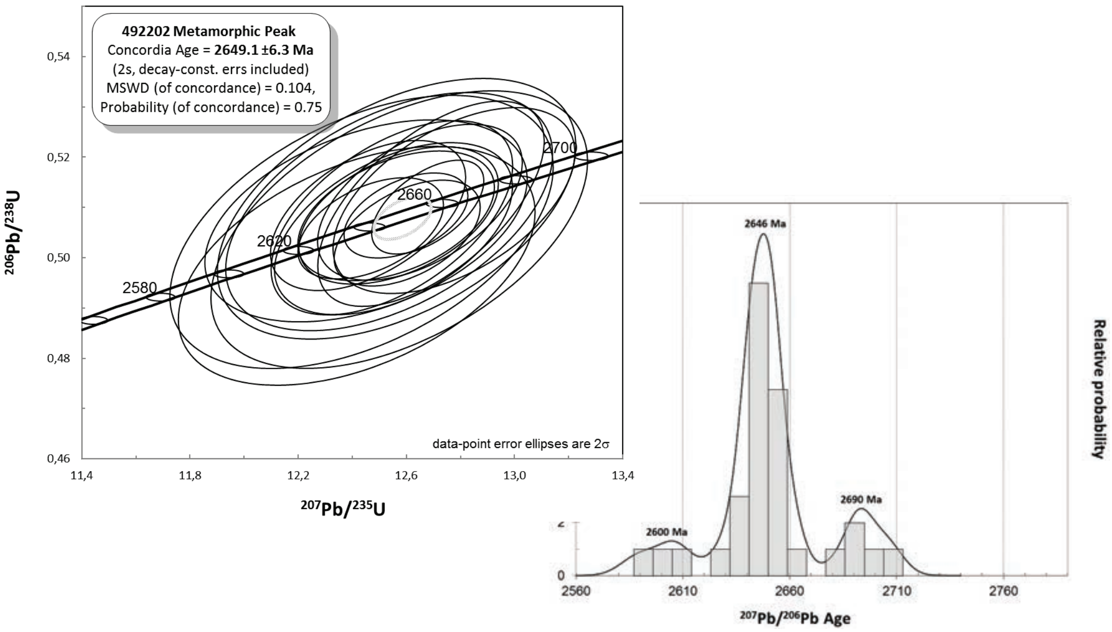

Figure 87*.* ***A)*** *Wetherill Concordia plot and Concordia age of analyses defining the main metamorphic component in sample 492202.* ***B)*** *Probability density plot showing analyses from metamorphic grains and rims.*

492219

Location: 2006vbe042, N 7133108, E 534275
Collected by: Vennessa Bennett

This sample is from a garnet-sillimanite-biotite gneiss, interpreted to be of pelitic origin (Fig. 88). One hundred six grains were analysed in this sample and two of these were rejected in the age calculations due to discordance exceeding 5 %.

Figure 88. *Field photo of the partially melted metasediment of sample 492219. Photo by Venessa Bennett.*

The sample contains a varied detrital population, with the main components being 2835 and 2810 Ma (Fig. 90). The four youngest detrital grains define a concordia age of 2723 ± 16 Ma (MSWD = 1.11), marking the maximum age of onset of deposition. Metamorphism is recorded as newly crystallised grains (Fig. 89) and rims on detrital grains. Fourteen analyses yield ages between 2630 – 2660 Ma and a concordia age of 2645 ± 6 Ma (MSWD= 0.33). This is interpreted to date peak metamorphism (Fig. 91).

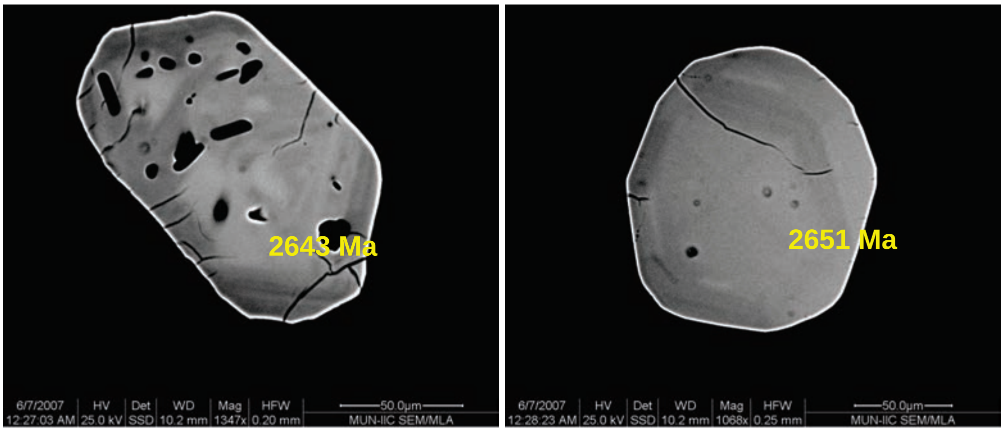

Figure 89. *Cathodluminescence images of metamorphic zircon grains from sample 492219. Photo by Venessa Bennett.*

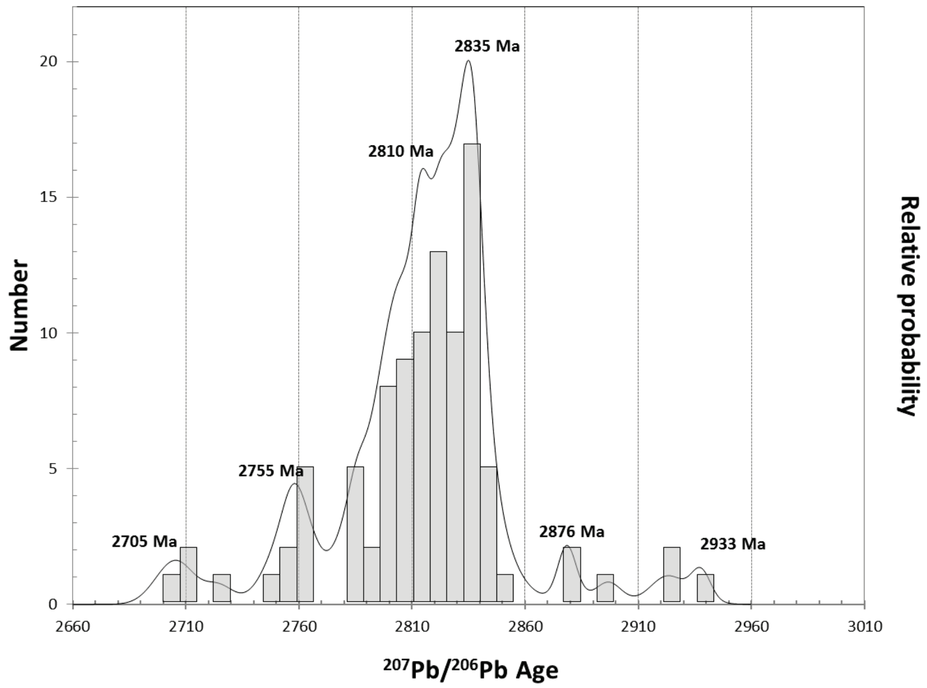

Figure 90. *Probability density plot showing detrital grain analyses from sample 492219. Analyses are 95-105 % concordant.*

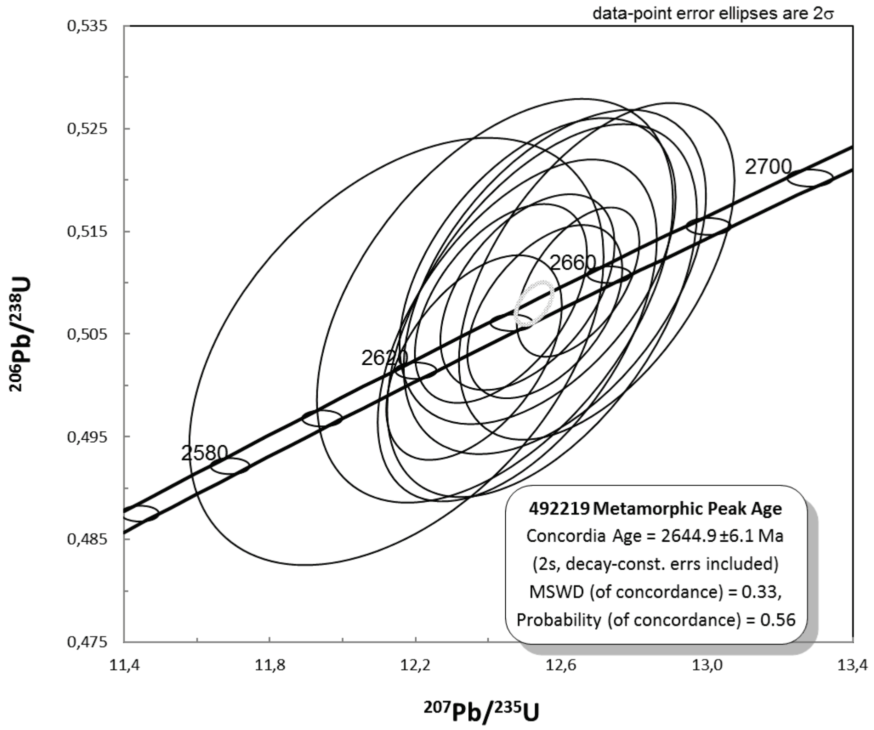

Figure 91. *Wetherill Concordia plot of analyses from metamorphic rims in sample 492219.*

492206
Location: 2006vbe010, N 7135523, E 534299
Collected by: Vennessa Bennett

The sample is a retrogressed garnet-biotite gneiss/schist, interpreted as having a pelitic origin (Fig. 92).

Figure 92. *Field picture of the metasediment of sample 492206. Note the glomerophyric aggregates of garnet rimmed with retrogressive plagioclase. Photo by Venessa Bennett.*

Forty five detrital zircon grains were analysed and thirty eight of these were used for age calculations. The remaining seven analyses exceeded 5% discordant. There is a large spread of ages, but with significant detrital populations at ca. 3070, 3052, 2790, 2436 and 3130 Ma (Fig. 93). This is rather different than the detrital age spectra from e.g. sample 492202, which is dominated by material from a 2825 Ma source (see Fig. 86). The three youngest detrital grains analysed define a group with a concordia age of 2708 ± 13 Ma (MSWD = 1.7), indicating the maximum age for the onset of deposition.

In addition 63 analyses were performed on metamorphic grains and rims, whereof nineteen were discarded due to discordance exceeding 2 %. These grains record two metamorphic episodes, an older at 2643 ± 5 Ma (Concordia age, MSWD = 0.00075) and a younger, represented by three grains, with a weighted average age of 2533 ± 10 Ma (MSWD = 0.61) (Fig. 94).

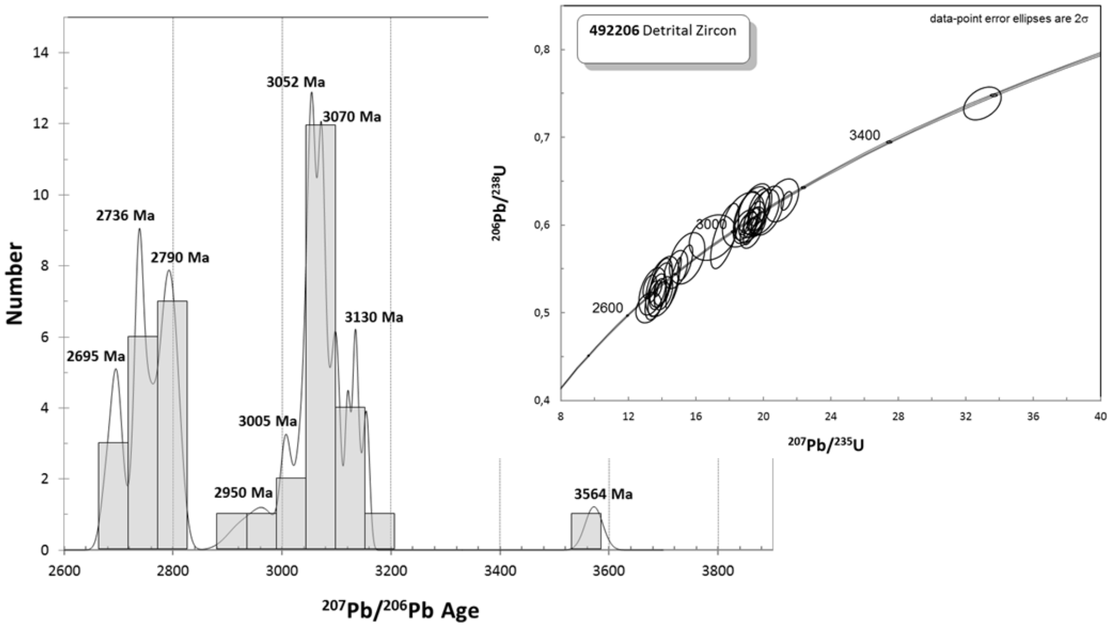

Figure 93. *Probability density plot showing analyses of detrital zircon grains from sample 492206. Note the large fraction of zircon ages over 3.0 Ga.*

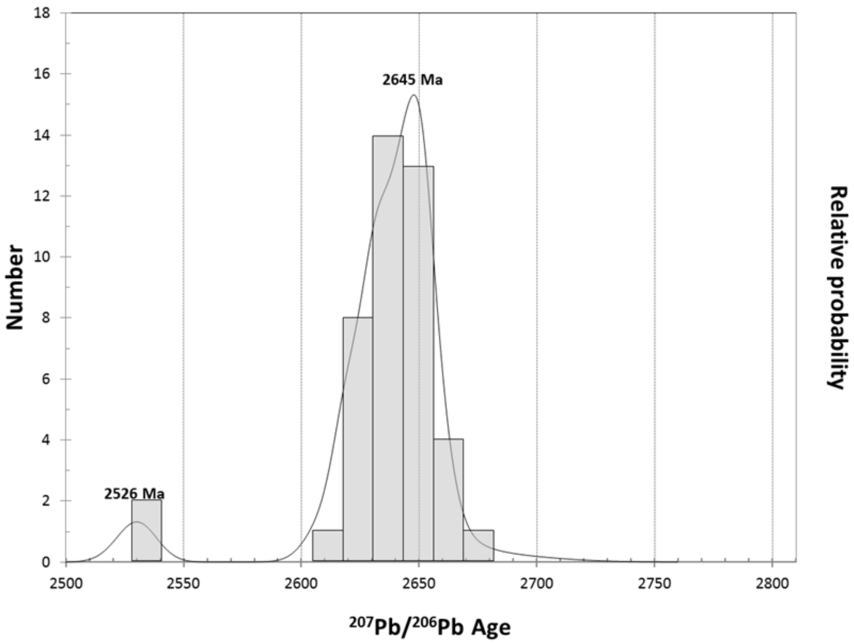

Figure 94. *Probability density plot showing metamorphic ages from sample 492206.*

492209
2006vbe013, N 7135234, E 533912
Collected by: Venessa Bennett

This sample comes from a garnet-sillimanite-biotite gneiss, interpreted to have a pelitic origin (Fig. 95). Of 91 analyses of detrital grains, 5 were more than 5 % discordant and not used in age calculations. The detrital age population consists of multiple components with dominant influence from 2830, 2810 and 2885 Ma sourced rocks (Fig. 96). The four youngest detrital zircon grains define a group with a weighted average age of 2721 ± 11 Ma (MSWD = 0.86), marking the maximum age of sedimentation onset.

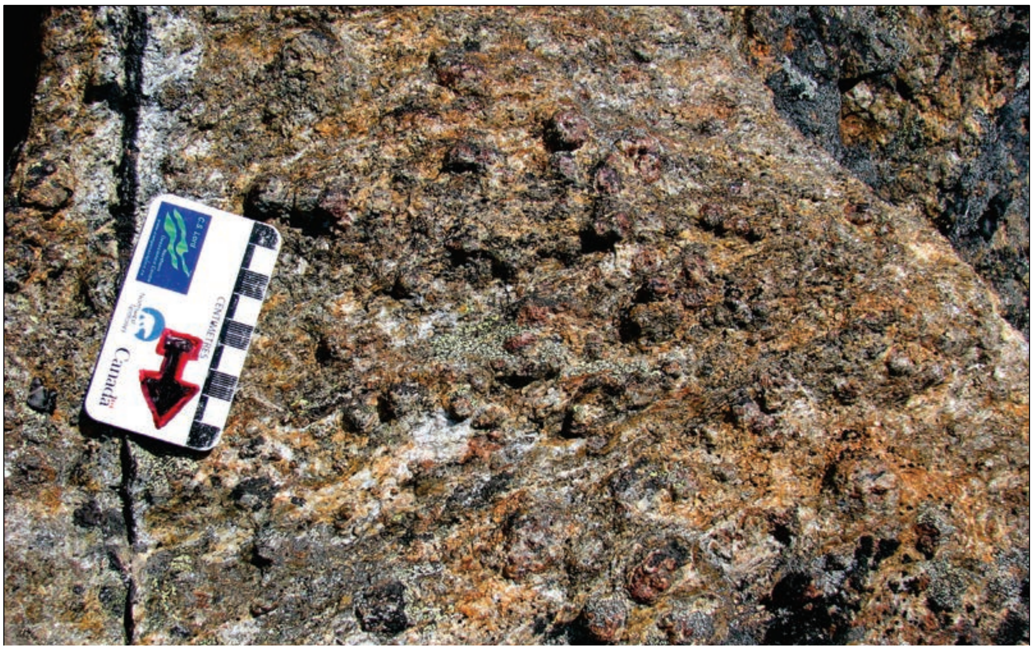

Figure 95. *Field photo of the metapelitic gneiss of sample 492209. Photo by Venessa Bennett.*

In addition to detrital grain analyses, another 45 analyses were performed on metamorphic rims enclosing the detrital grains. Eighteen of these analyses were discarded from age calculations due to a discordance >1%. Analyses from the metamorphic rims yield a fairly homogeneous age population, with a Concordia age of 2636.7 ± 4.7 Ma (MSWD = 0.000) (Fig. 97).

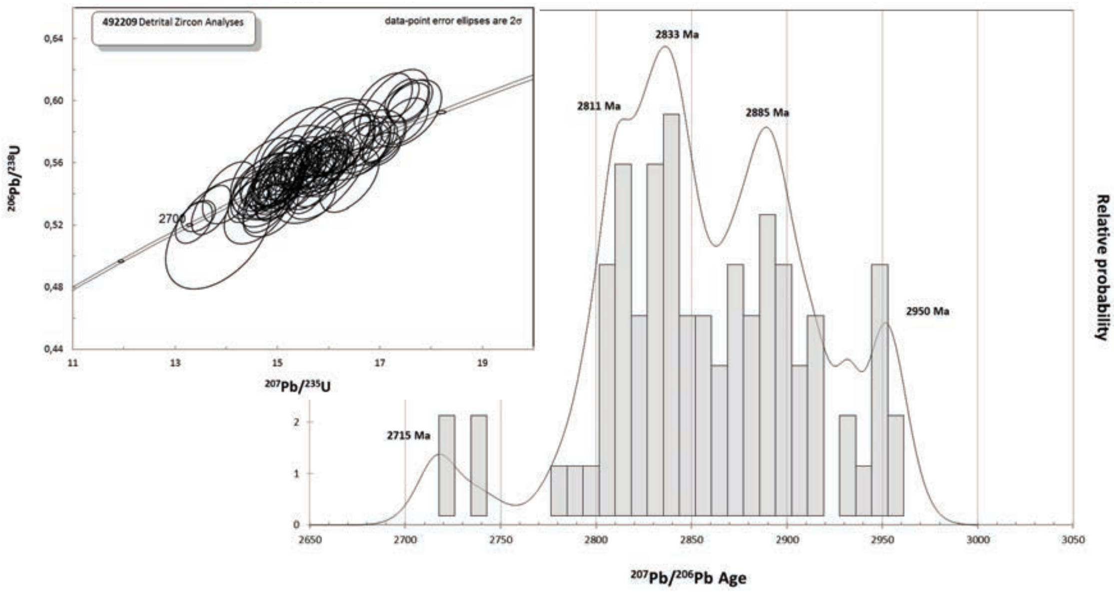

Figure 96. *Wetherill Concordia and probability density plot of analyses of detrital zircon grains from sample 492209. Note the lack of grains older than 3.0 Ga.*

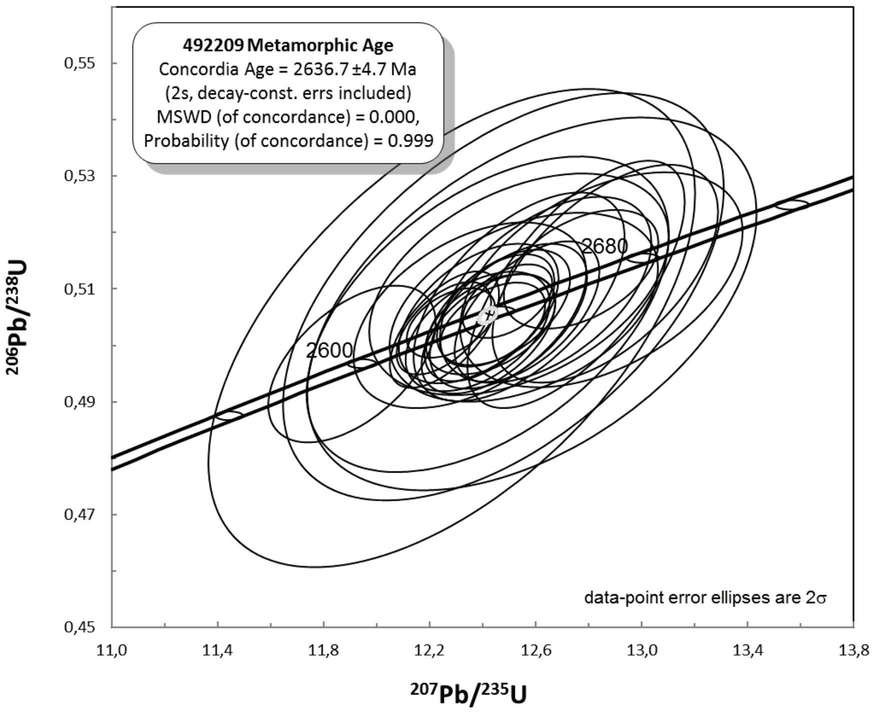

Figure 97. *Probability density plot of analyses of metamorphic grains and rims from zircon grains in sample 492209.*

499926
Location: N 7151511, E 551835
Collected by: Christian Knudsen

This sample is from a plagioclase-biotite-garnet-sillimanite-bearing gneiss interpreted as a metasedimentary rock. The mica- and alumino-silicate-rich layers are intercalated with thin amphibolite layers (Figs. 98 - 99).

Figure 98. *Field picture of the schist with hammer for scale. Photo by Wang Huichu.*

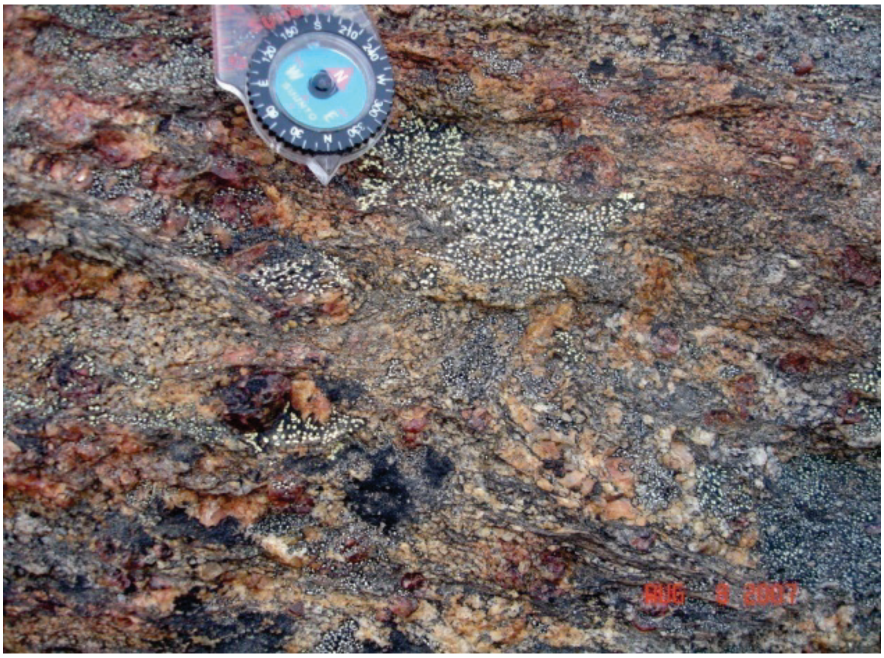

Figure 99. *Close-up field picture of large garnet porphyroblasts in the schist. Photo by Wang Huichu.*

Cathodoluminescence images of zircon (Fig. 100) show that grains 8, 13 and 20 possibly contain xenocrystic zircon cores for which the average age is about 2850-2900 Ma, and other zircons give an age of 2650-2750 Ma.

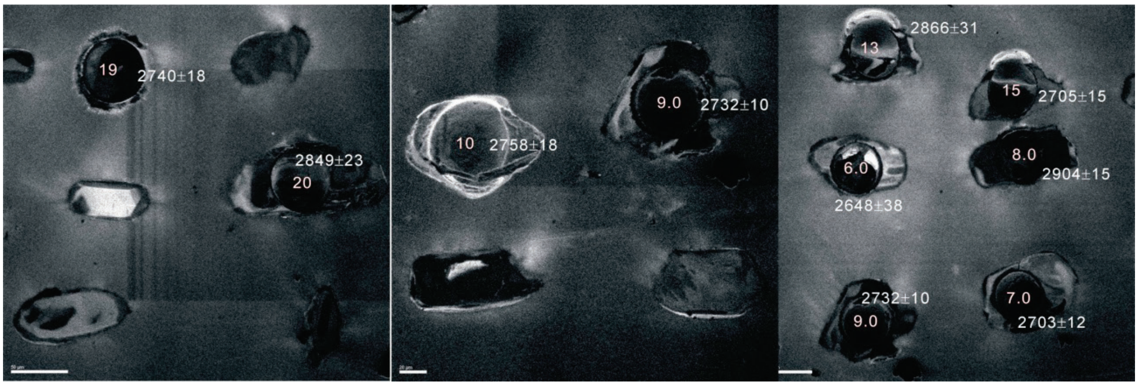

Figure 100. *Cathodoluminescence image of zircon grains from sample 499926.*

This sample yields a complex age pattern with multiple age populations between 2950 and 2600 Ma (Fig. 101 a & b). Some grains (8, 13 and 20) seem to have older, possibly xenocrystic cores, whereas others do not. The youngest ages may record a metamorphic event. An upper intercept age calculated from the 15 youngest ages yields an age of 2797 ± 54 (MSWD = 4.4), which is also the maximum depositional age.

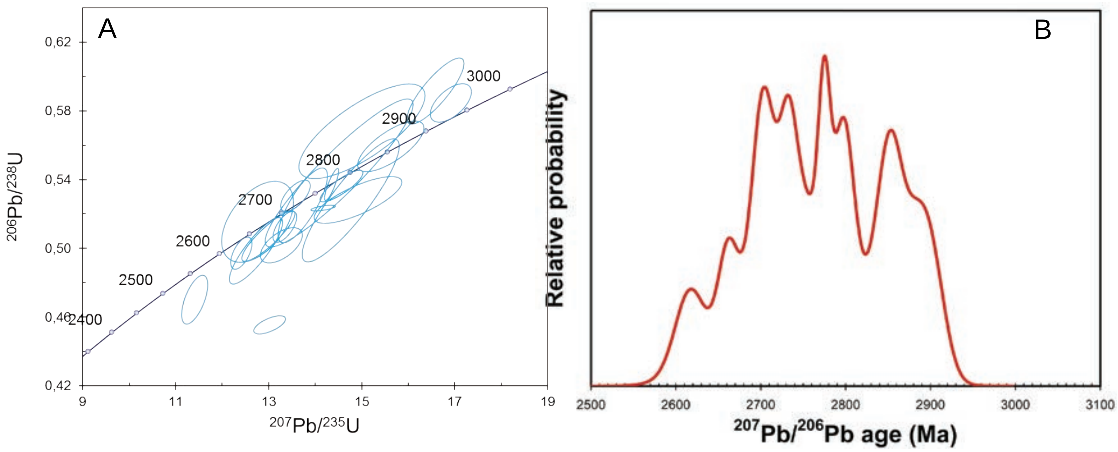

Figure 101. *U-Pb data from sample 499926. A) Wetherill concordia plot showing all analyses. B) Probability density plot of all analyses.*

499953
Location: 2007ckn085, N 7138862, E 525637
Collected by: Christian Knudsen

This sample comes from a fine-grained, rusty, sillimanite-biotite gneiss with suspected cordierite. Short, stubby grains dominate the zircon population, with no distinct rims. (Fig. 102).

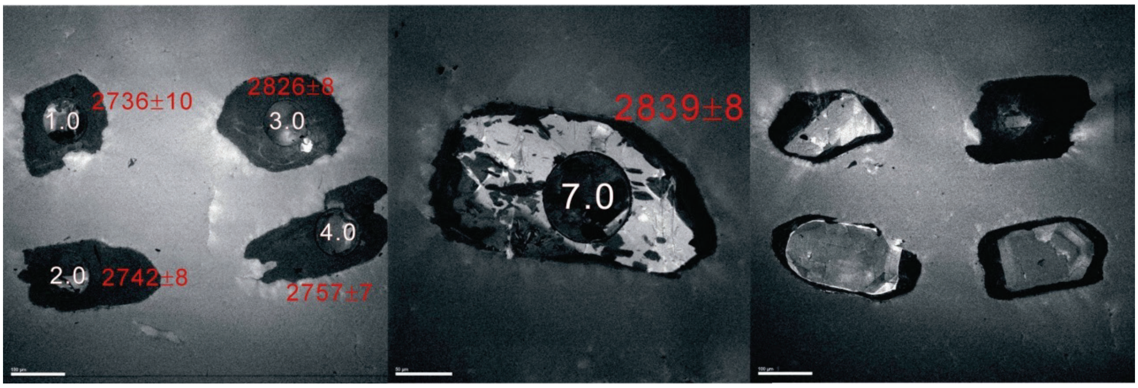

Figure 102. *Cathodoluminescence images of zircon grains from sample 499953.*

The sample contains quite a spread of ages, however no distinct populations (Fig. 103a). The large spread and large errors may indicate substantial mixing of age domains in the analytical data.

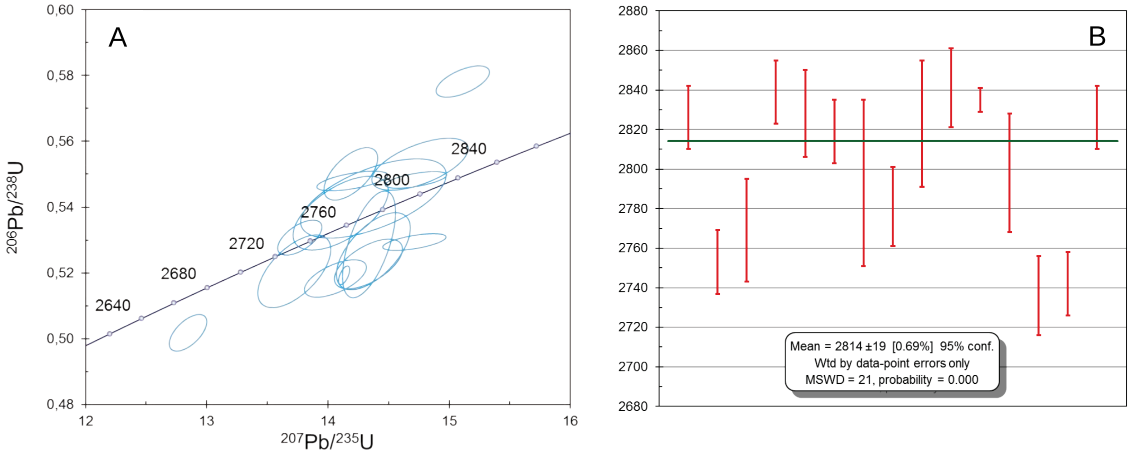

Figure 103. *A) Wetherill concordia plot showing all analyses and B) Age plot of 7/6-agesm both from sample 499953.*

Excluding the youngest and oldest analyses yield a weighted average $^{207}Pb/^{206}Pb$-age of 2814 ± 19 Ma (Fig. 103b), but with a MSWD = 21 this age is probably pointless and this age was not used on the inset maps.

Diorite and granite samples

481433
Location: 2004jho074, N 7125134, E 523511
Collected by: Julie Hollis

This is an intermediate phase of a Fe-Ti-rich diorite that intrudes into surrounding early Archaean orthogneiss, the same lithology is seen on both sides of the Itilleq fjord (Fig. 104).

Figure 104. *Field relations of the dioritic augengneiss of sample 481433 and more mafic enclaves.*

Zircon grains are typically 200-500 µm, with aspect ratios of 1:3 to 1:4 and prismatic. Most show well-defined oscillatory zonation. Patchy bright BSE zones occur in many grains and in some of these, some fracture healing has occurred, indicative of recrystallisation. A few grains have metamict cores.
Eighteen analyses show a spread in ages from 3797-3618 Ma (Fig. 105). There is an indication of two distinct populations at c. 3700 and 3650 Ma, though significant spread even within these groups show relatively large MSWD (c. 6-8). There is a slight tendency toward lower Th/U with younger ages. It is not clear whether this rock was emplaced at c. 3700 Ma and metamorphosed at c. 3650 Ma, if it comprises two magmatic components, or it was emplaced at c. 3650 with a c. 3700 Ma inherited component. In any case it is clearly early Archaean. These ages were not used on the inset maps.

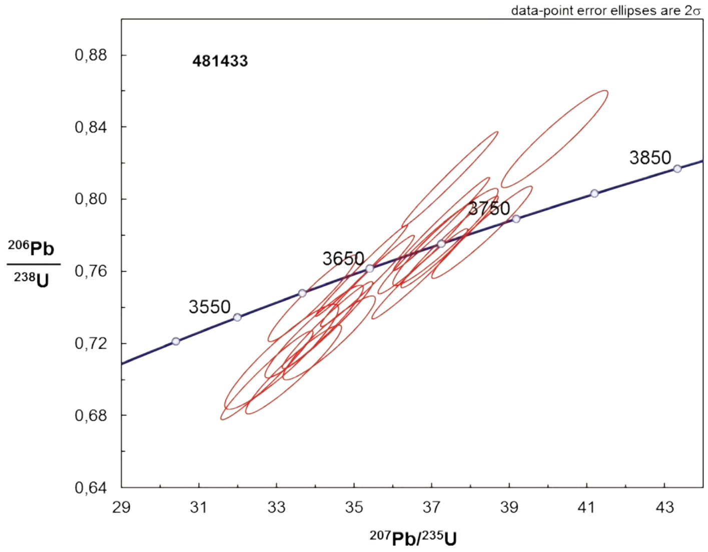

Figure 105. *Wetherill Concordia diagram with analyses from sample 481433.*

499956
Location: 2007ckn099, N 7134796, E 522854
Collected by: Christian Knudsen

The sample consists of a fine-grained granodioritic biotite gneiss, with a banded K-feldspar-rich vein. CL imagery on grains show irregular zoning and no significant rims (Fig. 106).

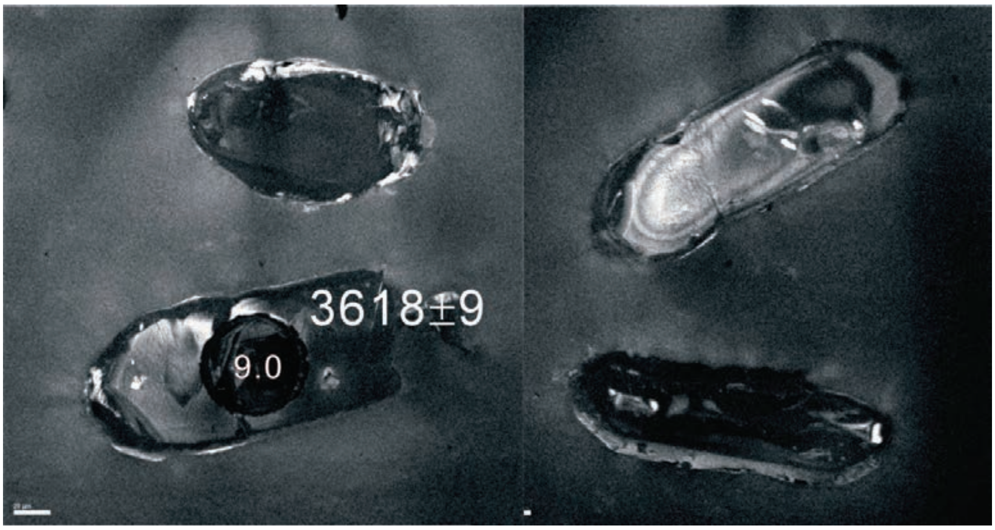

Figure 106. *Cathodoluminescence images of zircon grains from sample 499956.*

All analyses (Figs. 107), except one, yield a discordia line with intercepts at 1004 ± 720 and 3641 ± 54 Ma (MSWD =7.0). The outlier is discordant and has an anomalously young $^{207}Pb/^{206}Pb$-age at ca. 2800 Ma (not in figure 107).

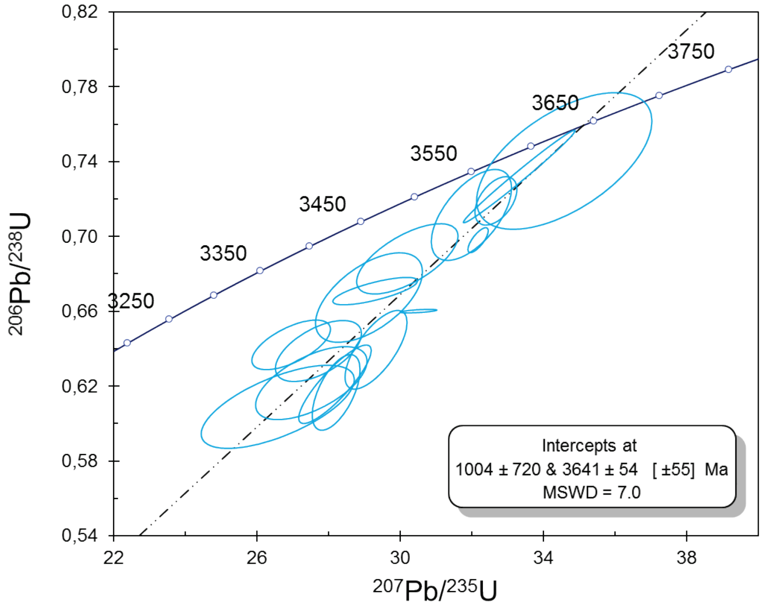

Figure 107. *Wetherill concordia diagram showing 16 of 17 analyses from sample 499956.*

499950
Location: 2007yhf071, N 7133380, E 518283
Collected by: Yu Haifeng

This is a sample of deformed homogeneous granitic orthogneiss (Fig. 108). It does not contain amphibolite enclaves and it occurs in banded tonalite gneisses. The granitic gneiss contains deformation bands from strong shearing.

Figure 108. *A) Outcrop picture for sample 499950. B) Close-up of the granitic orthogneiss. Hammerhead for scale is 10 cm. Photos by Yu Haifeng.*

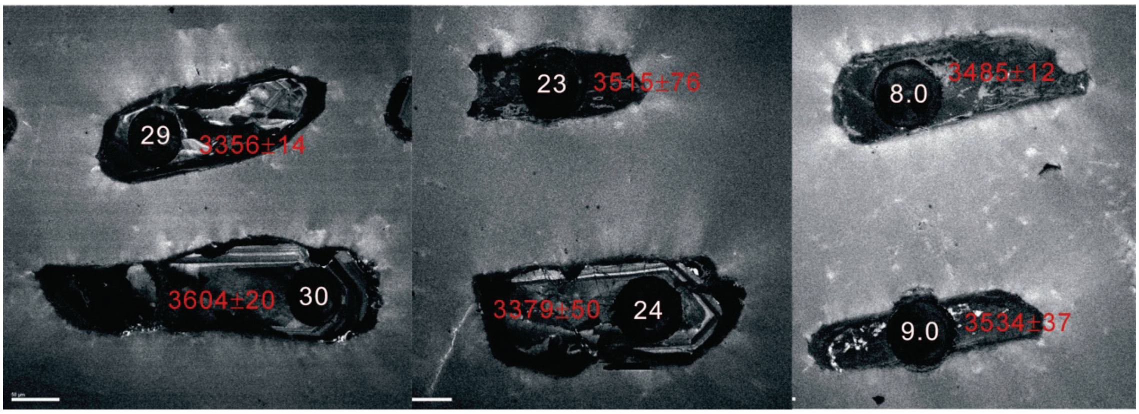

Figure 109. *Cathodoluminescence images of zircon grains from sample 499950.*

The zircon population consist of rather large grains with fine oscillatory zonation and no significant rims (Fig. 109). The granitic gneiss seems to contain two generations of zircon grains based on the age distribution (Fig. 110a).

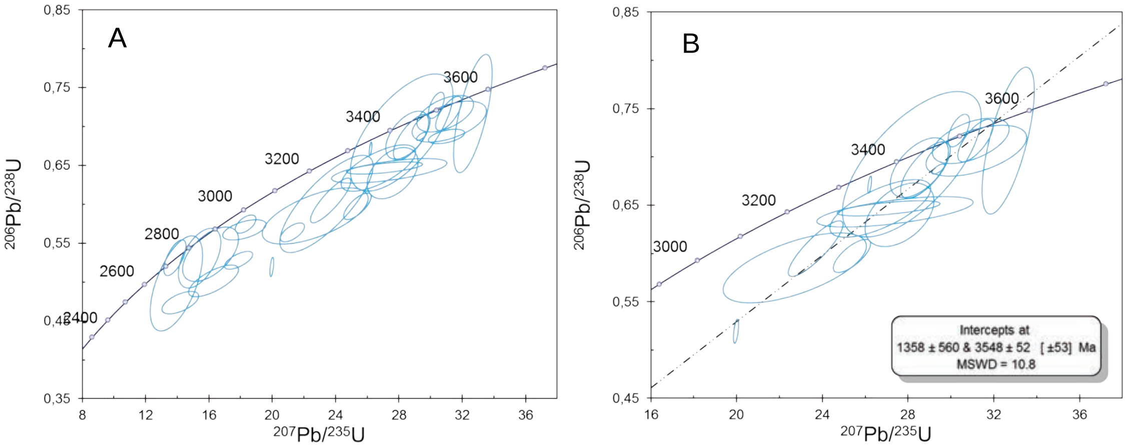

Figure 110. *Wetherill concordia diagram showing all analyses and B) showing analyses from the older group and the discordia line, both from sample 499950.*

The oldest group consist of analyses 1-5, 7-10, 13, 16, 20, 21 and 23-30 (Fig. 110b) and they yield an upper intercept age of 3548 ± 52 Ma (MSWD = 10.8). This age is interpreted as the magmatic crystallisation age.
A cluster of ages around 2800 (Fig. 110a) indicate a metamorphic disturbance of the isotope systematics at this time, but the timing is rather ill defined.

482496
Location: nrl2005-124, N 7099658, E 528453
Collected by: Natasha Henwood

This is a diorite that forms the dominant, intermediate part of a mafic-intermediate-felsic orthogneiss, intruding amphibolite (Fig. 111).

Figure 111. *Picture of the field relations of the orthogneiss. Photo by J. Hollis.*

A wide range of zircon morphologies come from this sample and 28 analyses were performed. A population of 7 mainly elongated grains with oscillatory zoning (blue in Fig. 112) yield an upper intercept age of 3141 ± 83 Ma (MSWD = 3.8), which is interpreted as a magmatic crystallisation age. Another population of 14 more stubby grains with patchy or homogeneous inner structure (red in Fig. 112) yield an upper intercept age of 2840 ± 25 Ma (MSWD = 5.6). This is rather high, but may be explained by ancient and recent lead loss. This age is interpreted as recording metamorphic overprinting (Fig. 112).

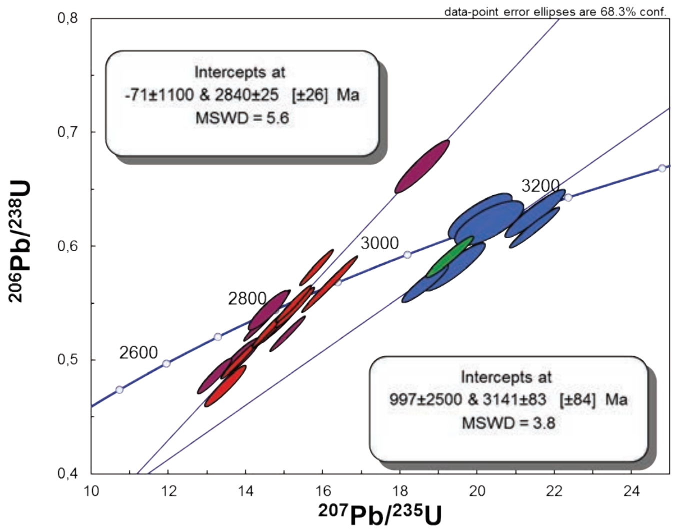

Figure 112. *Wetherill concordia plot showing all analyses from sample 482496.*

482424
Location: nrl2005-035, N 7124238, E 515382
Collected by: Natasha Henwood

This sample was taken from a homogeneous dioritic orthogneiss, thought to be of the ca. 2835 Ma Ikkattoq gneiss-type, based on field observations. Zircon grains in the sample are generally stubby to acicular and display oscillatory zoning that is sometimes blurred by local recrystalllisation.
Analysis of 20 points on 20 grains yields a single age population, which lies on a relatively tight Pb-loss trend (78-104% concordant) that intersects the concordia curve at 2806 ± 15 Ma (MSWD 10.7) with a lower intercept at 141 ± 180 Ma (Fig.113). Grains with acicular morphologies and well-preserved oscillatory zoning tend to yield marginally older ages when compared with stubby grains with embayed margins and those that contained metamict domains or sinuous fronts.
This is interpreted as a magmatic emplacement age (Lee 2009).

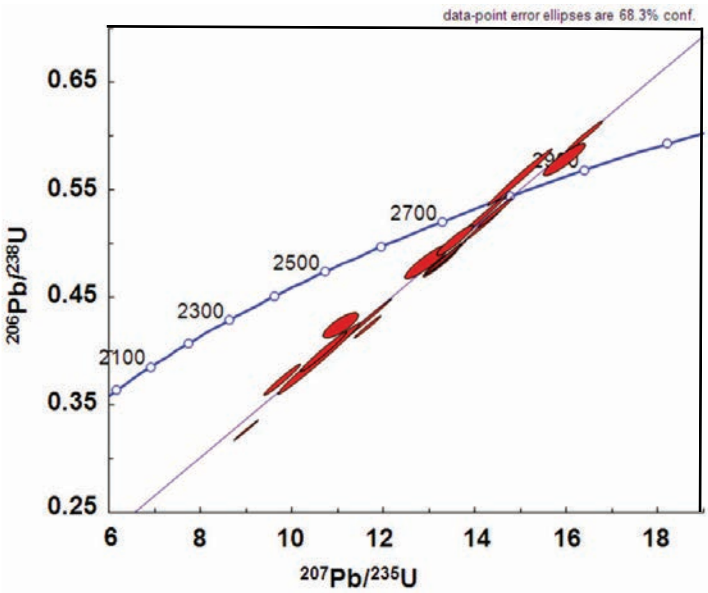

Figure 113. *Wetherill concordia diagram showing data from sample 482424. The upper intercept is at 2806 ± 15 Ma.*

481436
Location: 2004jho077, N 7127928, E 526076
Collected by: Julie Hollis

This sample was taken from a migmatitic dioritic gneiss with blebby texture (Fig. 114). The texture could possibly indicate retrograde replacement of early granulite facies mineral assemblage.

Figure 114. *Field relations at the sampling site of sample 481436. Photo by Julie Hollis.*

The sample was identified in the field as Tasiusarsuaq gneiss and yielded large (200-700 µm), pale brown to colourless zircons, with a predominantly prismatic morphology. The majority of grains exhibit the striped magmatic zoning typical of diorites although a few high-U grains with small cores and sector or convoluted zoning are also present. Ages in this sample fall into a single population with an upper intercept age at 2838 ± 15 Ma (MSWD = 1.9), suggesting a single phase of zircon crystallisation (Fig. 115). The age is consistent with the age range of the Ikkattoq gneiss.

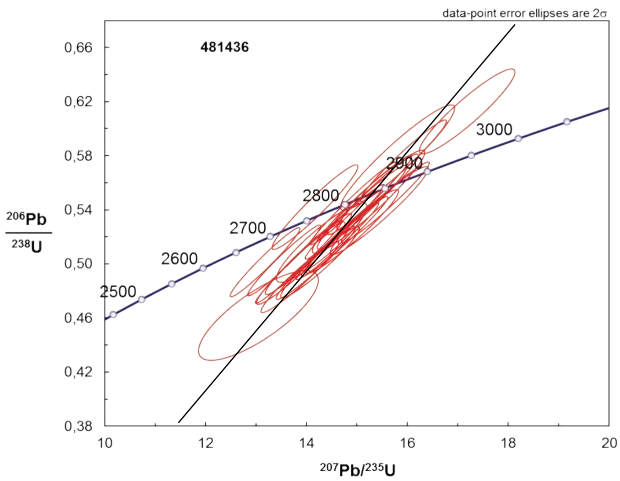

Figure 115. *Wetherill concordia diagram showing data from sample 481436.*

481408
Location: 2004jho024, N 7140862, E 526677
Collected by: Julie Hollis

This is a pre- to syn-mylonite granite intruded and deformed within a mylonite at the location.
Zircons are typically 200-500 µm, with aspect ratios of 1:3 prismatic. They all show a dull, fairly homogeneous BSE response but with some oscillatory zonation. A few grains are partially metamict.
About half the grains form an age plateau around 3000-2990 with the other half spreading to ca. 3100 Ma (Fig. 116). Twelve of 20 grains form a population at 2990 ± 6 Ma (MSWD = 2.5). There is a rough trend toward lower Th/U for the younger end of the spectrum, which may indicate that the 2990 ± 6 Ma age reflects metamorphism at this time. This is consistent with the age of amphibolite to granulite facies metamorphism in the Akia terrane (to the north) and the Kapisillik terrane. The age of emplacement is difficult to estimate.

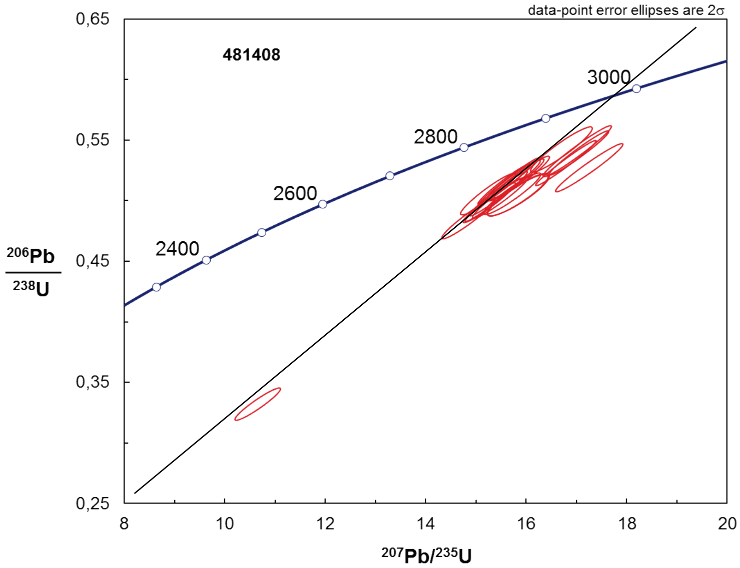

Figure 116. *Wetherill concordia plot showing all analyses from sample 481408.*

477905
Location: spi2005_020, N 7116651, E 528940
Collected by: Sandra Piazolo

The sampled rock is from an only slightly deformed intrusive granitic body. It intrudes within a supracrustal unit with amphibolite and lots of pegmatite (Fig. 117). The granite cut a high-strain zone that separates the metasedimentary unit from a poly-deformed gneiss.

Figure 117. *Field photograph of granite intruding supracrustal amphibolites. Photo by Sandra Piazolo.*

Zircon grains are dominated by fragments of elongated prismatic grains with oscillatory zoned cores. Twenty six analyses were obtained from the sample, but only 11 analyses were used for age calculations due to the comparably high uranium content and variable amounts of ancient lead loss. An upper intercept age calculated for these eleven analyses is 2886 ± 15 Ma (MSWD = 1.2) (Fig. 118). This is interpreted as a magmatic crystallisation age.

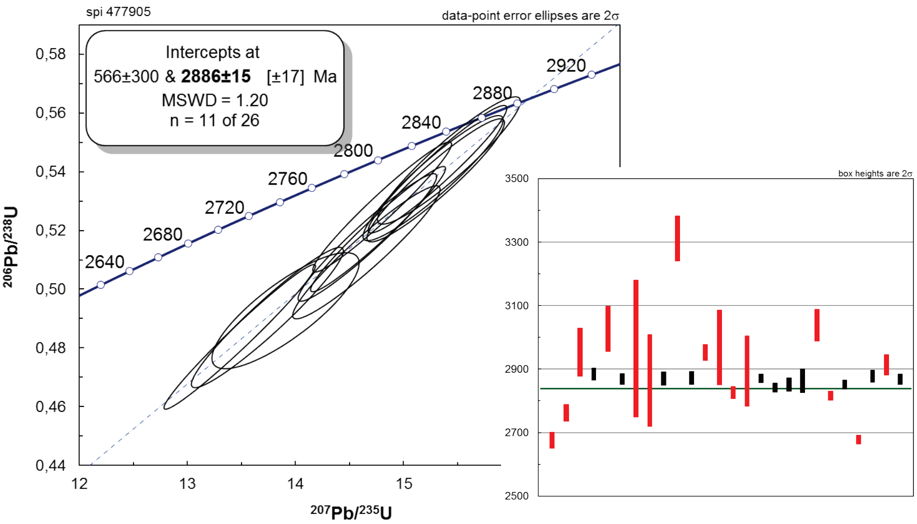

Figure 118. *Wetherill Concordia diagram with the 11 analyses used for the age calculation from sample 477905. The inset show all $^{207}Pb/^{206}Pb$-ages.*

514832
Location: 2007hst550, N 7139884, E 578289
Collected by: Henrik Stendal

The sampled rock is a fine-grained homogeneous granite from the eastern part of the area. Fifty-five analyses were obtained from the sample and 50 of those define an older cluster and 5 analyses a younger one (Fig. 119). Forty seven of the older 50 analyses yield a weighted average age of 2862 ± 7 Ma (MSWD = 2), which is interpreted as a magmatic emplacement age (red ellipses in Fig. 119). The five analyses in the younger groups yield a weighted average of 2630 ± 17 Ma (MSWD = 0.69), shown in green in Fig. 119. This is interpreted as the age of metamorphism.

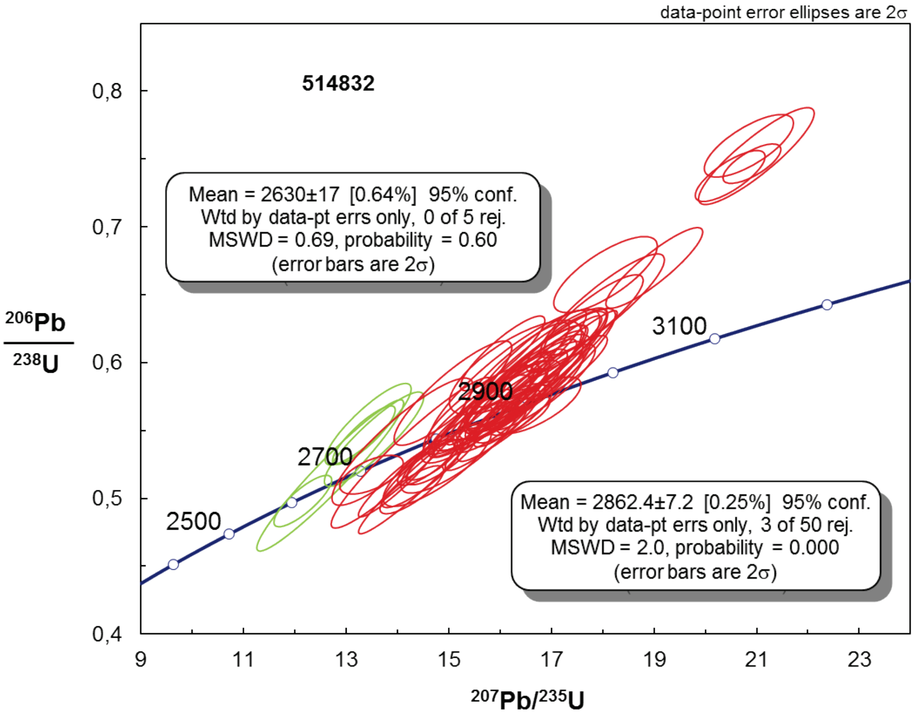

Figure 119. *Wetherill concordia plot showing all analyses from sample 514832. Analyses marked in red show the older age population and the younger group is marked in green.*

485257
Location: hso2005-244, N 7112940, E 545578
Collected by: Henrik Svahnberg

The sampled rock comes from a weakly foliated granitic sheet that intrudes an anorthosite complex. The locality also contains abundant medium-grained partial melt veins with hornblende. Orthopyroxene was suspected in these veins (Fig 120).

Figure 120. *Field photograph of granite in anorthosite complex. Photo by Henrik Svahnberg.*

Zircon grains display a weak internal zoning in partly recrystallized grains. Twenty nine analyses were performed on the sample and 8 analyses were discarded from age calculations due to high uranium content (inset in Fig. 121). The resulting 21 analyses yield an upper intercept age of 2755 ± 7 Ma (MSWD = 4.4) (Fig. 1261). The MSWD is rather high and could indicate ancient lead loss. The resulting age is interpreted to represent either magmatic crystallisation or metamorphic recrystallization under granulite facies conditions (cf. Fig. 12 in Hoffmann et al. 2012)

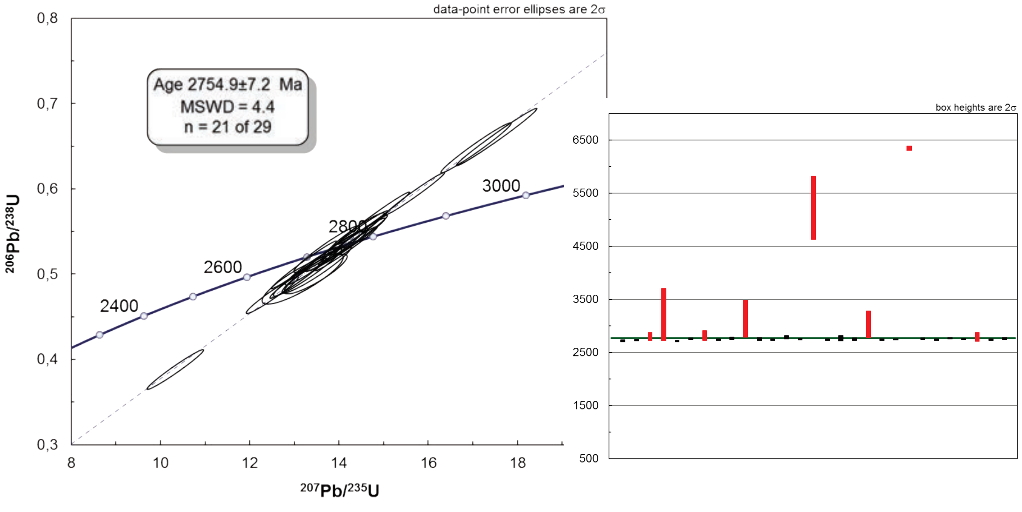

Figure 121. *Wetherill concordia plot showing analyses used in the age calculation from sample 485257. The inset shows all analyses.*

481410
Location: 2004jho028, N 7145227, E 530271
Collected by: Julie Hollis

The sampled rock is a pre- to syn-mylonite granite. The granite holds an S-fabric, which is the same as in the mylonite.

Zircons are 200-500 microns, with aspect ratios typically 1:3 to 1:4 and prismatic. All show a rather dull, fairly homogeneous CL response though quite a lot of grains show some evidence of oscillatory zonation.

In many grains there are minor patchy bright areas, possibly zones of recrystallisation. In the few cases where a core-rim structure is apparent the core is often metamict.

This sample shows a very large spread in ages, from 3634-2548 Ma (Fig. 122). The main group (of 13) fall between ca. 2800 and 2700 Ma, but with a significant spread in ages and no convincing age plateau. Three older grains at 2996-2954 Ma may reflect a real population. Almost all of the grains (regardless of age) have very low Th/U (typically 0.01 to 0.05), also with no distinction that can be made on the basis of U content (typically 100-1000 ppm). Thus, it is difficult to further interpret the age distribution based on zircon chemistry or morphology. The 2800-2700 Ma range is tentatively interpreted as the timing of recrystallisation during metamorphism, though this is not well constrained by this sample.

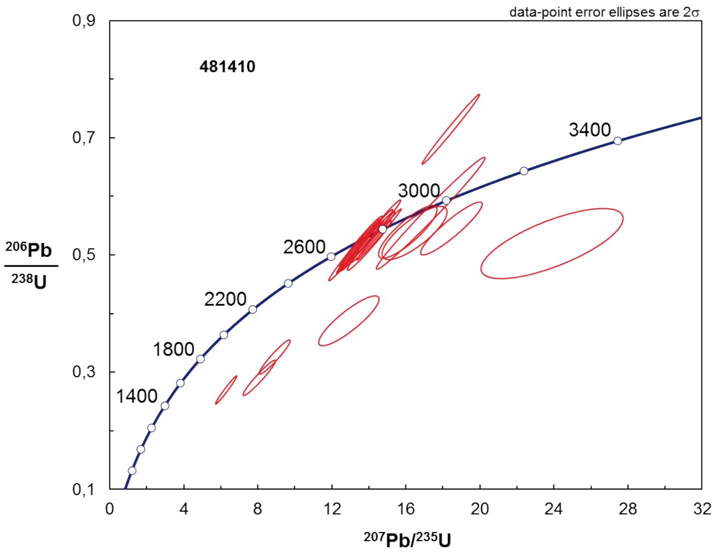

Figure 122. *Wetherill concordia plot showing all analyses from sample 481410.*

492211
Location: 2006vbe014, N 7136266, E 534511
Collected by: Venessa Bennett

This sample comes from a coarse grained recumbently folded pegmatitic granite associated with amphibolite (Fig. 123).

Figure 123. *Complex recumbent folding of mafic amphibolite – pegmatite unit (U-Pb site - pegmatite). Black dotted lines outline the surface trace of the fold, the yellow lines represent traces of the fold axial planes. Photo by Venessa Bennett.*

A moderate amount of zircon of variable quality was extracted from the sample 492211. Zircons were divided into (i) dark pink, equi-dimensional prisms, sometimes with thin metamorphic overgrowths (Fig. 124, left), (ii) light pink fragments of variable size and (iii) grains with clear core/rim relationships (Fig. 124, right).

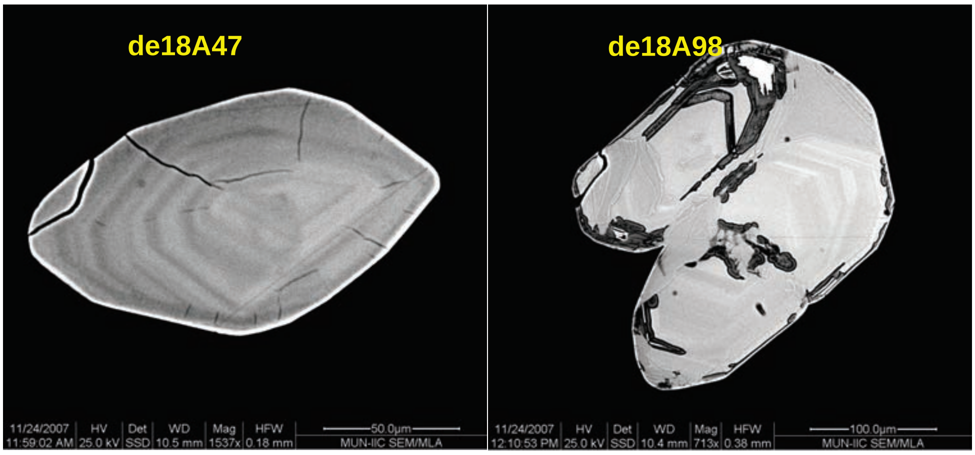

Figure 124. *Zircon grains from sample 492211. Left: An equi-dimensional prism; Right: Two grains grown together with overgrowths as well.*

Forty-six analyses were collected from both magmatic zircon grains and metamorphic rims. A cumulative probability curve of all $^{207}Pb/^{206}$ Pb ages indicates two main populations, 2661 Ma and 2640 Ma, with some minor zircon inheritance.
A weighted average $^{207}Pb/^{206}Pb$ age calculated for 23 analyses of magmatic zircon yielded an age of 2665 ± 3.2 Ma (MSWD = 0.77) (Fig. 125), which is considered to represent the best estimate for the age of crystallization of the pegmatite. For this population of zircon, the Th/U ratios ranged from 0.38 to 0.94. A concordia age calculated for the magmatic zircon analyses yielded an age of 2666.5 ± 4.3 Ma (MSWD = 0.036).

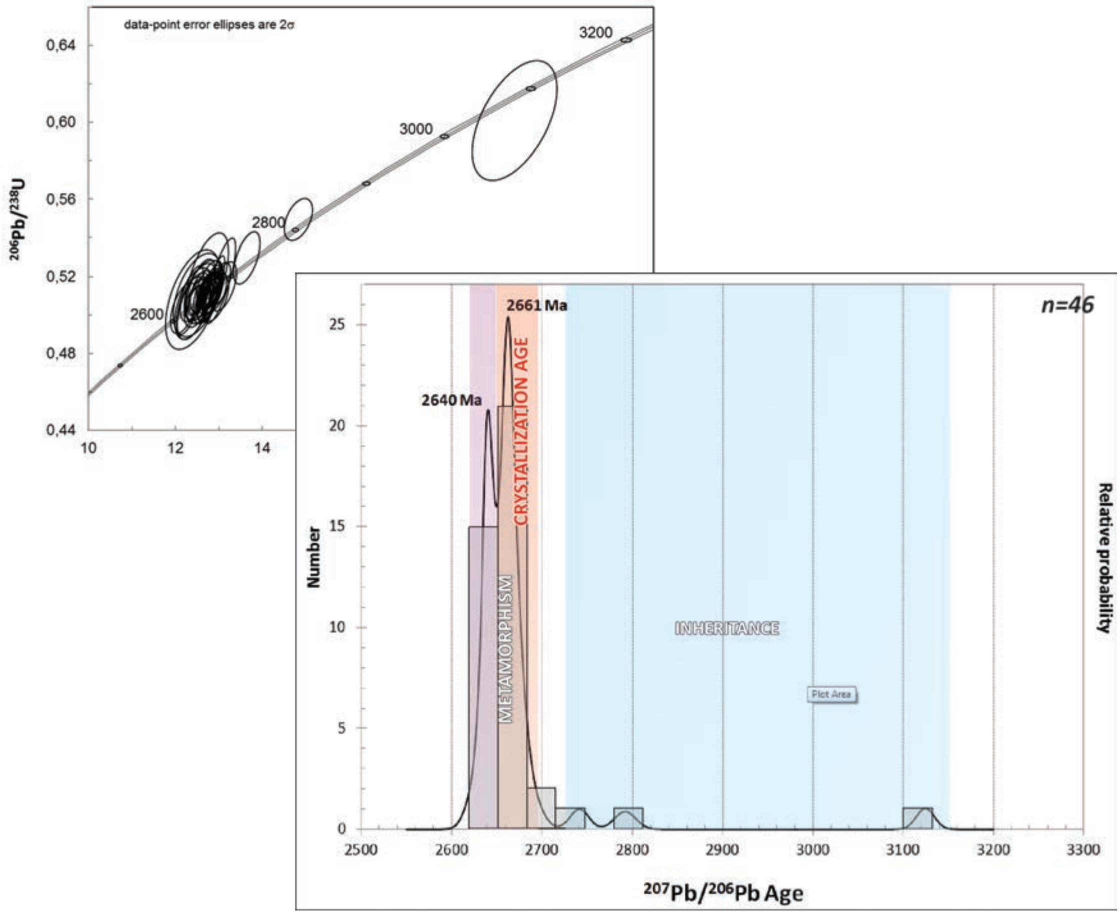

Figure 125. *Wetherill Concordia and relative probability plot of age data from sample 492211.*

Fifteen analyses were measured from metamorphic rims or entire metamorphic grains. A weighted average $^{207}Pb/^{206}Pb$-age calculated for the 15 analyses yielded a metamorphic age of 2640.3 ± 3.4 Ma (MSWD = 0.44), which is consistent with a concordia age calculated for metamorphic zircon of 2640.5 ± 5.8 Ma (MSWD = 3.3) (Fig. 125). Th/U ratios for metamorphic zircon analyses ranged from 0.01 to 0.06.

Anorthosite and amphibolite samples

492235
Location: 2006vbe129, N 7130355, E 550266
Collected by: Venessa Bennett

This sample comes from the anorthositic part of an anorthosite-leucogabbro complex. The anorthosite has been metamorphosed under at least amphibolite facies conditions and contains large porphyroblasts of garnet (Fig. 126).

Figure 126. *Metamorphosed anorthosite of sample 492235. Photo by Venessa Bennett.*

A total of 134 analyses were performed on this sample that contains a complex zircon population recording inheritance, magmatic crystallisation, significant Pb-loss events and multiple events of metamorphic recrystallization (Fig. 127).

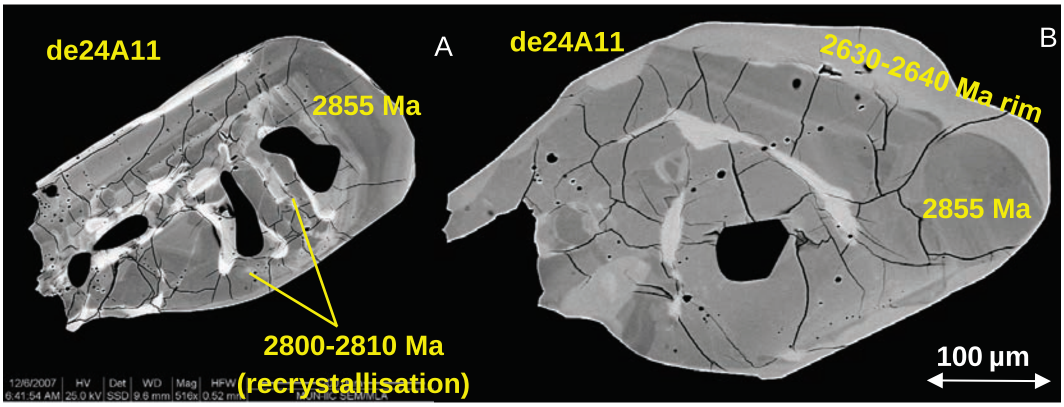

Figure 127. *Cathodluminescence imagery of zircon grains from sample 492235. Note similarily aged cores in A and B and 2800 Ma recrystallization and 2640 Ma rim formation, respectively.*

Inheritance is recorded by three older grains with ages around 2900 Ma. The main population is interpreted as recording the magmatic crystallisation and 72 analyses yield a weighted average age of 2857.9 ± 3.5 Ma (MSWD = 1.18). There is a significant Pb-loss event which is recorded as internal embayments and recrystallized domains in certain zircon grains (Fig. 127a). Several peaks in the probability density plot were interpreted to represent metamorphic events recorded in the sample, the most important being at 2610, 2640, 2694, 2760 Ma (Figs. 127b, 128).

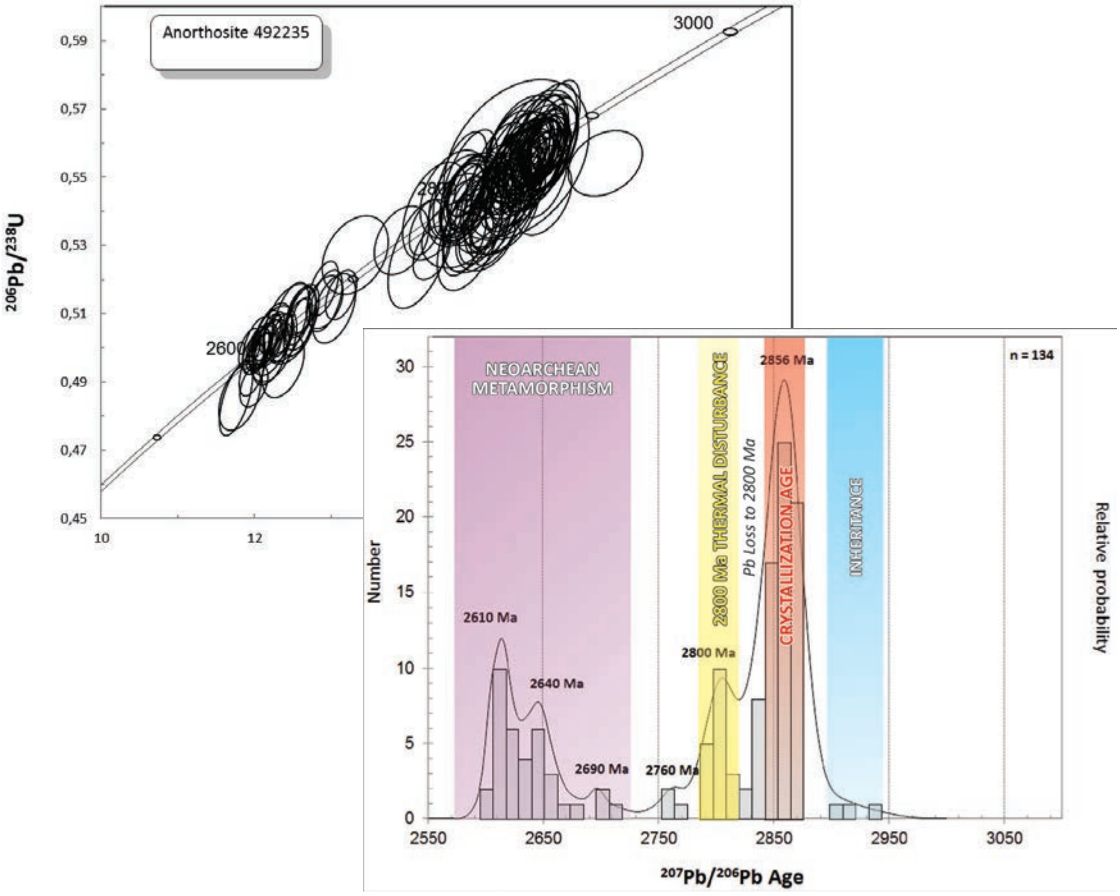

Figure 128. *Wetherill Concordia and probability density plot of all analyses from sample 492235, with interpretations of the different populations given in the lower plot.*

514881
Location: 2007hst598, N 7109813, E 563967
Collected by: Henrik Stendal

The sampled rock is a metamorphosed anorthosite from Nunatarsuk, in the eastern part of the area. Of 42 analyses, one analysis was rejected due to strong reverse discordance. The remaining analyses form a tight cluster with a weighted average age of 2832 ± 10 Ma (MSWD = 1.3) (Fig. 129). This is interpreted as the magmatic crystallisation age of the anorthosite.

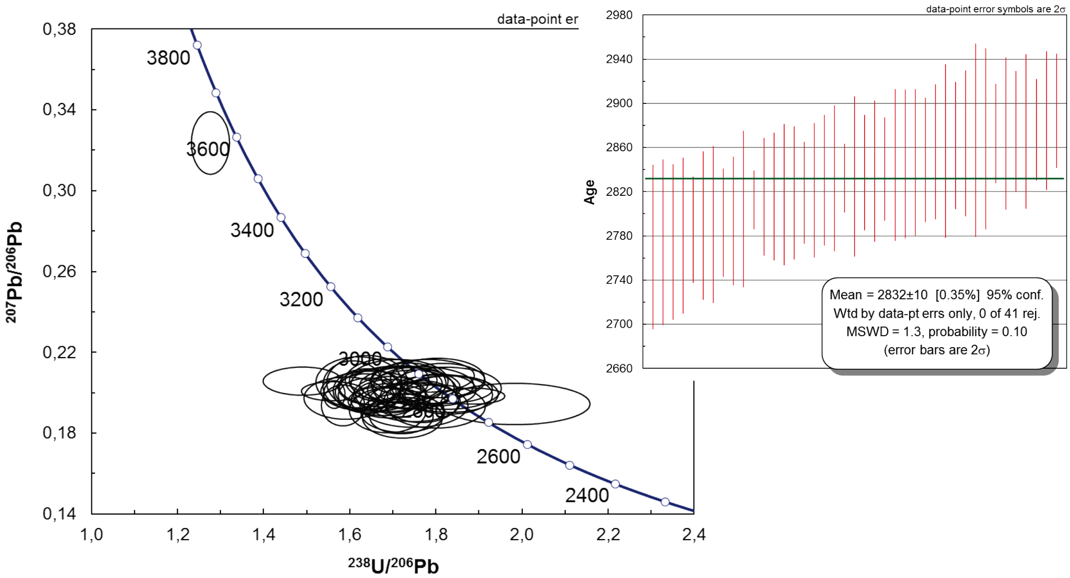

Figure 129. *Wetherill concordia plot showing all analyses from sample 514881. Inset show $^{207}Pb/^{206}Pb$-ages and the weighted average age.*

481438
Location: 2004jho079, N 7121290, E 515251
Collected by: Julie Hollis

This sample collected from the north shore of Ameralik Fjord comprises felsic layers from within a garnet-bearing amphibolite associated with garnet-sillimanite schist, interpreted as melt segregations from within amphibolite (Fig. 130). It contains ortho-amphibole grains that are possible pseudomorphs after orthopyroxene.

Figure 130. *Field picture of partial melt patch within garnet amphibolite. Note greenish ortho-amphibole. Photo by Julie Hollis.*

Zircon grains from the sample contain a variety of zircon morphologies, with abundant resorption phenomena. Abundant, very large (up to 1000 µm) zircon grains characterise the sample. CL imaging revealed dark, U-rich cores with broad oscillatory zoning visible in some grains. These are mantled by rims of brighter zircon, with similar zoning patterns. Forty analyses were obtained from the sample and seven were discarded from further age calculation, of these two had very large errors and four were situated on domain boundaries in the zircon grains. The U-Pb ages identify a single, well-constrained age population with an upper intercept of 2720 ± 3.6 Ma (MSWD = 5) (Fig. 131), and no difference between cores and rims. The age is interpreted to date the metamorphic recrystallization of the mafic protolith rock. Further sample description in Lee 2009.

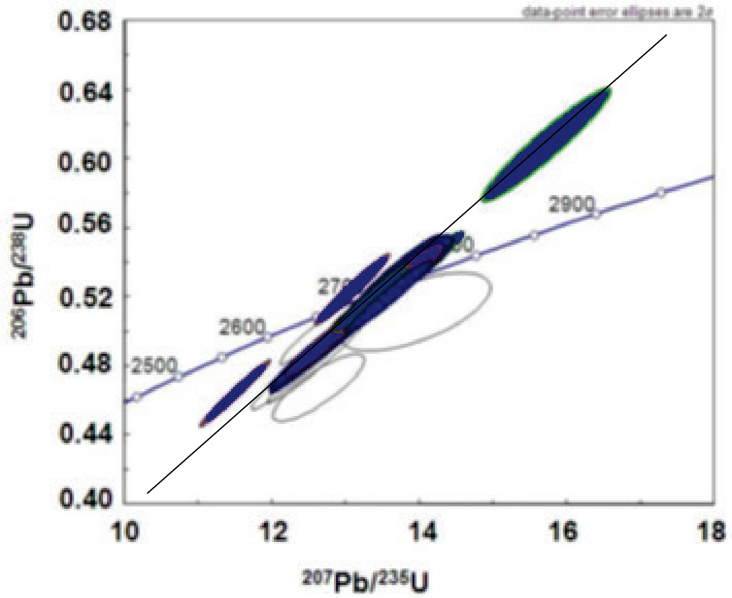

Figure 131. *Wetherill concordia plot showing all analyses from sample 481438. Filled ellipses were used in the age calculation, whereas the non-filled were excluded.*

495110-495113
Location: 2007hcw050, N 7145982, E 571230
Collected by: Wang Huichu

This locality contains both anorthosite and amphibolite in contact with each other. The nature of the contact is not known. Both were sampled for geochronology. The anorthosite is composed of plagioclase, minor hornblende/biotite and garnet and has a medium-fine grained texture and banded or massive structure (Fig. 132). Gneissosity in the anorthosite increases towards the contact with the amphibolite. The amphibolite is mainly composed of hornblende, plagioclase and garnet and has a fine-medium grained texture and banded structure (Fig. 133). Garnet in the amphibolite is euhedral with a 1-3 mm diameter and reaches up to 20% of the mineral content.

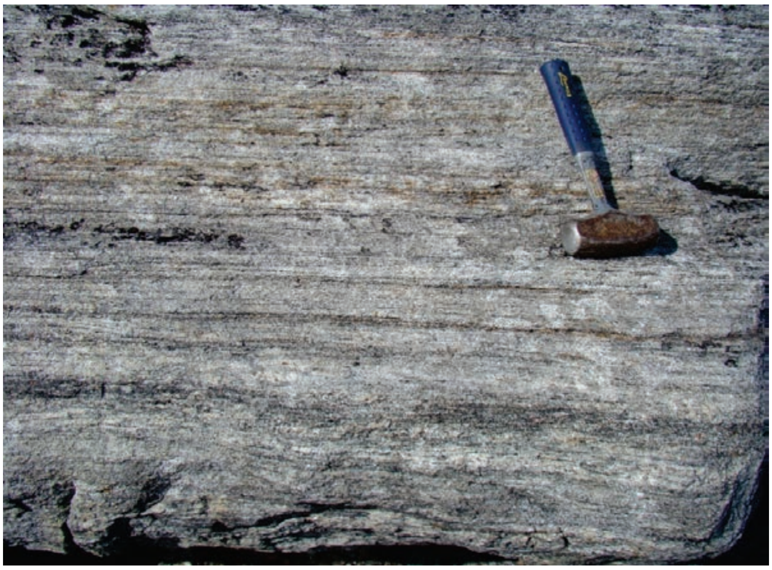

Figure 132. *Banded anorthosite. Photo by Wang Huichu.*

Figure 133. *Garnet-rich amphibolite. Photo by Wang Huichu.*

Geochronology of the anorthosite, sample 495113.

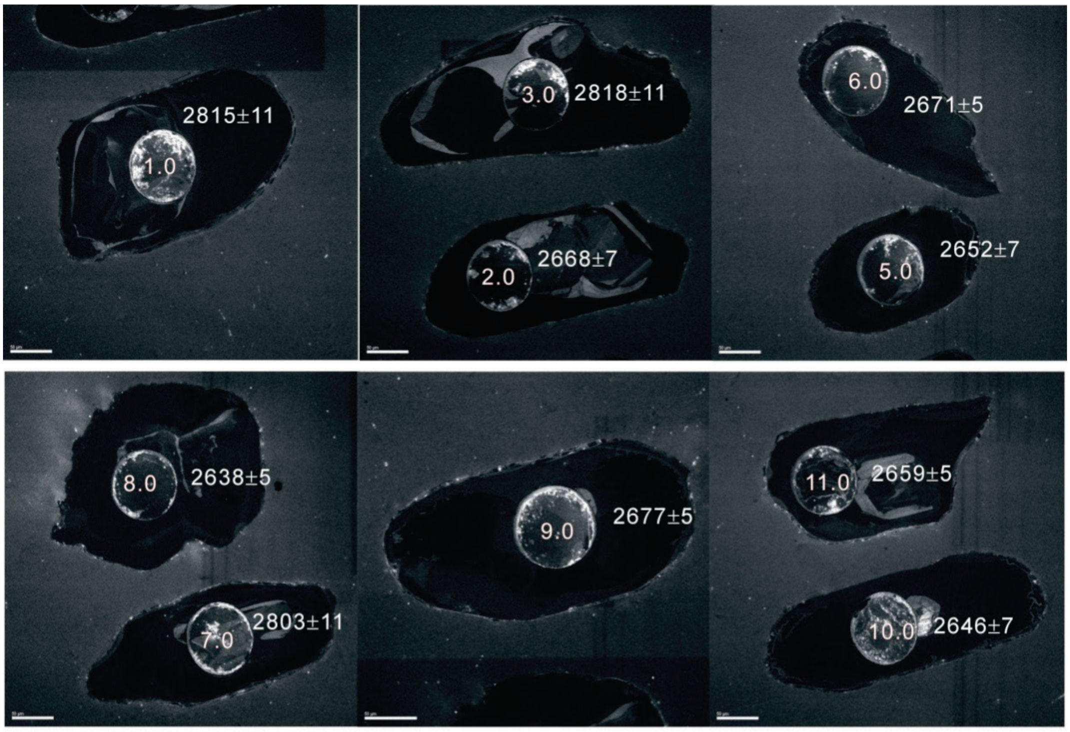

Figure 134. *Cathodoluminescence images of zircon grains from sample 495113.*

This sample contains two generations of zircons (Fig. 134). Analyses 1, 3, 4, 7 and 12 yield a weighted mean $^{207}Pb/^{206}Pb$-age of 2799 ± 20 Ma (Fig. 135), which is interpreted as the magmatic crystallisation age of the anorthosite. Analyses 2, 5-6, 8-11 and 13-15 give a weighted mean $^{207}Pb/^{206}Pb$-age of 2658 ± 10 Ma. The younger age overlaps within uncertainty with the age obtained from the amphibolite and is interpreted as dating metamorphic recrystallisation of the anorthosite.

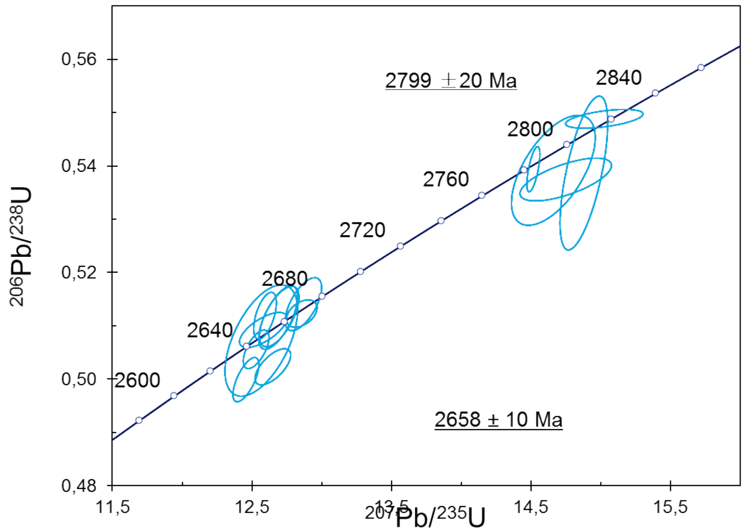

Figure 135. *Wetherill concordia plot showing all analyses from sample 495113.*

Geochronology of the garnet amphibolite, sample 495110.

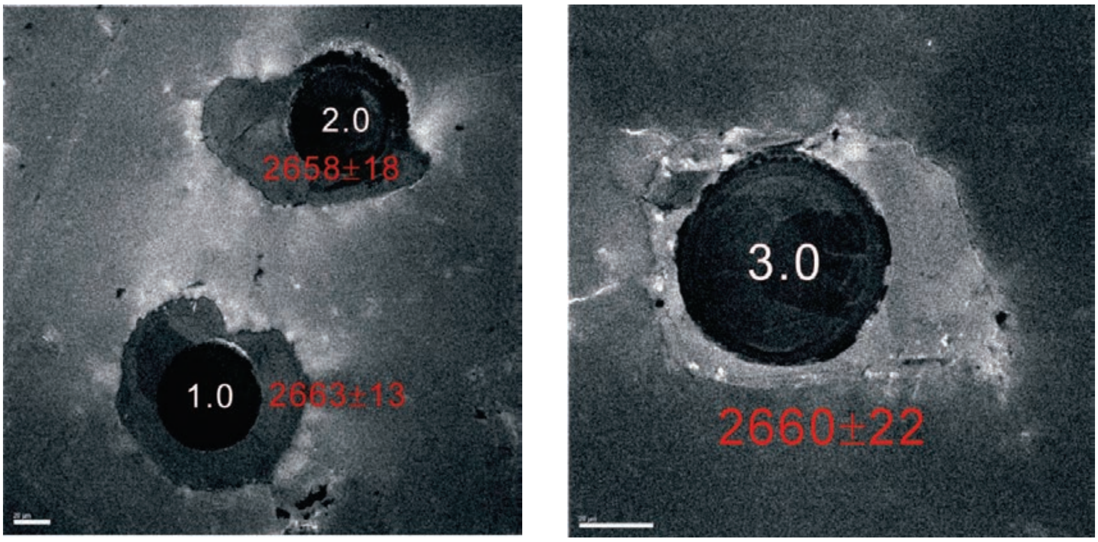

Figure 136. *Cathodoluminescence images of zircon grains from sample 495110.*

Zircon grains were imaged with catholuminescence (Fig. 136). 11 analyses yield a discordia line with an upper intercept at 2660 ± 7.8 Ma (MSWD = 0.23) (Fig. 137). The sample contains only one age generation and this age is interpreted to record formation of zircon during metamorphic recrystallisation under amphibolite facies conditions of a zircon free protolith.

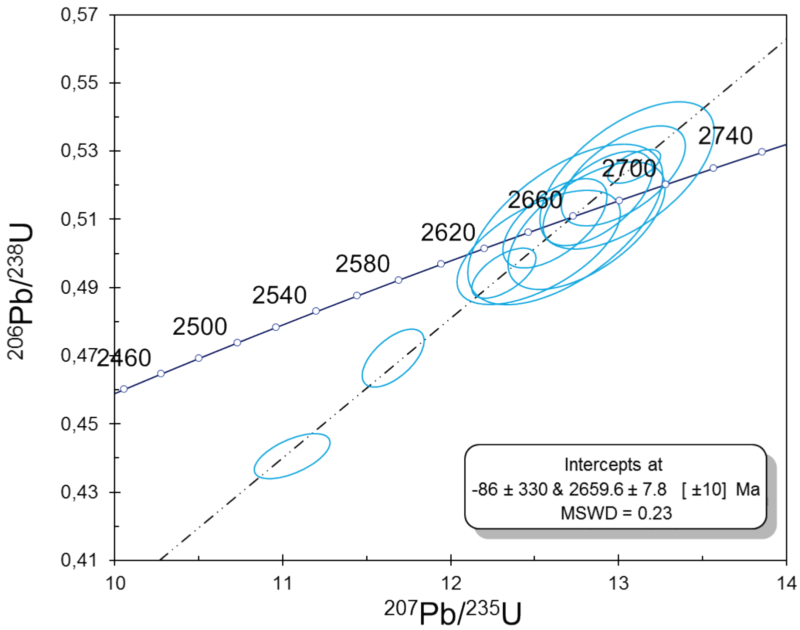

Figure 137. *Wetherill concordia plot showing all analyses from sample 495110.*

Dolerite samples

499929
Location: 2007ckn057, N 7152227, E 553400
Collector: Christian Knudsen

The sampled rock is from a late dolerite dyke cutting all other rocks and structures in the area. The dolerite does not contain zircon grains and the U-Pb isotopic analyses were performed on baddeleyite. Twelve analyses out of 15 yield an upper intercept age of 2541 ± 60 Ma (MSWD = 2.1) (Fig. 138), which is within error of the age from Nilsson et al. (2010) of 2499 ± 1 Ma. This age is interpreted as the magmatic emplacement age of the dolerite

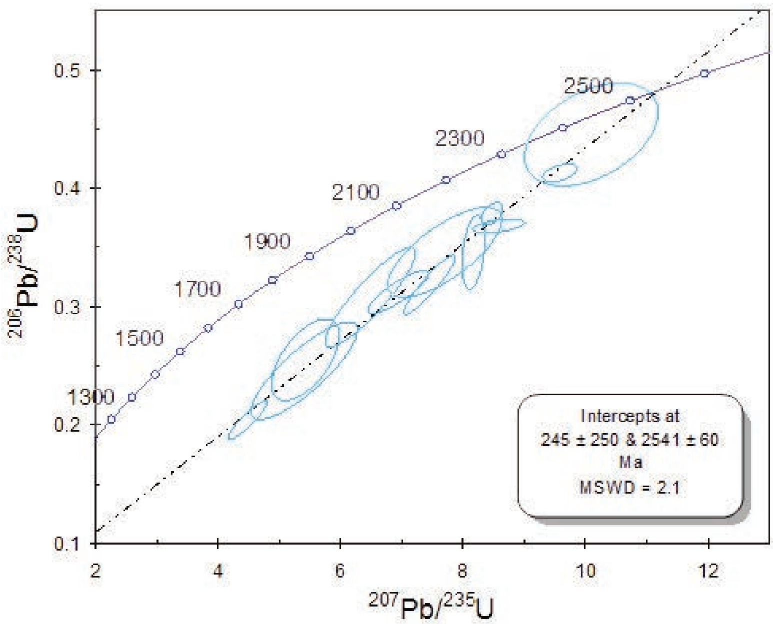

Figure 138. *Wetherill Concordia diagram with analyses from sample 499929 and a discordia line for the best estimate of a crystallisation age of the dolerite.*

Inset maps

TTG protolith age

The ages presented as TTG protolith ages, have been interpreted as such by the person who did the analytical work and ages have not been recalculated for the purpose of this report. In this category are rocks that have been interpreted in the field as TTG gneisses (Table 2), but felsic, dioritic and granitic gneisses are referred to the section on “Age data from other types of rocks” below. This may be a point of discussion, but that was the rationale behind data selection in this case.

Figures 138-140 summarises the age data from the TTG-gneisses. Figure 138 shows locations of samples with a colour code for age and the TTG protolith ages are shown in figures 139 and 140. Figure 140 show an interpretation of the areal distribution pattern of the age groups from the Kapisillit inset map.

The two oldest groups contain rocks formed between 3900 – 3800 Ma and 3800 – 3700 Ma, respectively. The two groups have been combined in figure 140. This combined group more or less corresponds to the Eoarchaean Færingehavn terrane of Friend et al. (1987, 1988), Nutman et al. (2007) and Horie et al. (2010). The terrane is composed of several pieces characterised by discrete phases of tonalite emplacement. The pieces were amalgamated, perhaps as late as 3660 Ma (Horie et al. 2010). The complex details of the early Archaean crust formation are, however, beyond the scope of this compilation. The reader is referred to Nutman et al. (2007a), Horie et al. (2010) and Hoffmann et al. (2011b) and references therein for further information. The next group of TTG-gneisses formed between 3650 – 3550 Ma also belong to the Færingehavn terrane (e.g. Nutman et al. 2010).

The younger intervals are shorter and most of them reflect periods of known crust formation in the region (see e.g. Horie et al. 2010, Friend & Nutman 2007, Næraa 2011 and references therein). Even though the interval between 3250 – 3100 Ma is only represented by one data point in figure 140, it can also be recognised from felsic and dioritic rocks in figure 6. Rocks of this age are found in the Kapisillik terrane (e.g. Friend & Nutman 2005, Nutman et al. 2010). The next group defined were emplaced between 3050 – 2950 Ma, which is also typical of the Kapisillik terrane (e.g. Nutman et al. 2010) and occurring in the north-central parts of the map sheet area, but folded together with the Færingehavn terrane in the western part of the area. The next group contains rocks emplaced at 2890 – 2840Ma, which is typical of the Tasiusarsuaq terrane, which consists of tonalitic gneiss with protolith emplacement ages of 2920 – 2820 Ma, and granite emplacement and high-grade metamorphism shortly after (e.g. Friend & Nutman 2005, Nutman et al. 2010, Næraa & Scherstén 2008).

The next group, defined as rocks emplaced between 2840 and 2810 Ma, may be of Tasiusarsuaq affinity, but this age interval also comprise the ca. 2825 Ma Ikkatoq gneisses of the Tre Brødre terrane e.g. Nutman & Friend 2010). Further work, with better constraints on metamorphic ages and structures may be required to resolve these questions. The youngest group consist of rocks emplaced between 2810 – 2780 Ma and is only represented by three samples. However, considering the new data presented in figure 144, it is obvious that this generation is quite common in the SE-central parts of the map sheet area.

Table 2. *U-Pb ages from TTG-gneisses interpreted as emplacement or protolith ages. For further details on individual samples, it is referred to the electronic appendix on the CD.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ[2]	MSWD[2]	Comments	Publication
492120	G01/36	7130929	524069	Meta-tonalite	3880	16		Oldest age component	Hiess et al. 2009
437602		7139306	528998	Neosome rich migmatitic tonalite gneiss	3850			Oldest age component	Horie et al. 2010
437603	jho2004-035	7140770	527273	Neosome rich migmatitic tonalite gneiss	3850			Oldest age component	Horie et al. 2010
437616		7117358	515083	Neosome rich migmatitic tonalite gneiss	3850			Oldest age component	Horie et al. 2010
437621	jho2004-067	7123091	519044	Neosome rich migmatitic tonalite gneiss	3850			Oldest age component	Horie et al. 2010
G01/034		7127604	521544		3850			Oldest age component	Horie et al. 2010
G01/035		7127604	521544		3850			Oldest age component	Horie et al. 2010
499928	2007yhf033	7153195	555822	Orthogneiss, tonalitic, with amphibolitic enclaves	3816	21	2.5	May be emplacement age	This report
VM95/02		7124790	523562	Schlieric migmatite with abundant neosome	3800			Composite gneiss with multiple ages	Nutman et al. 2007a
437626	jho2004-073	7123790	523370	Neosome rich migmatitic tonalite gneiss	3710			Oldest age component	Horie et al. 2010
482426	nrl2005-017	7124443	513880	Polyphase homogeneous orthogneiss	3707	7		One old outlier	This report and Lee 2009
437604	crlf05-066	7143561	518996	Neosome rich migmatitic tonalite gneiss	3700				Horie et al. 2010
437606	jho2004-043	7150833	516850	Neosome rich migmatitic tonalite gneiss	3700			Oldest age component	Horie et al. 2010
437607	jho2004-052	7113445	524640	Neosome rich migmatitic tonalite gneiss	3700			Oldest age component	Horie et al. 2010
437610		7119442	525827	Neosome rich migmatitic tonalite gneiss	3700			Oldest age component	Horie et al. 2010
437617		7114638	520426	Neosome rich migmatitic tonalite gneiss	3700			Oldest age component	Horie et al. 2010
437619	2005nrl042	7115047	525006	Neosome rich migmatitic tonalite gneiss	3700			Oldest age component	Horie et al. 2010
437625	jho2004-072	7127149	521571	Neosome rich migmatitic tonalite gneiss	3700			Oldest age component	Horie et al. 2010
437627	jho2004-075	7126130	523890	Neosome rich migmatitic tonalite gneiss	3700	50		Oldest age component	Horie et al. 2010
499948	2007yhf069	7133218	517810	Banded tonalitic gneiss, amphibolite enclaves	3661	15	6.7	One old outlier and 4 discordant grains.	This report
499956	2007ckn099	7134796	522854	Finegrained granodioritic bt-gneiss	3641	54	7.0		This report
459807	jmh2005-033	7140973	526170	Grey homog orthogneiss.	3634	2			Hiess 2008
499928	2007yhf033	7153195	555822	Orthogneiss, tonalitic, with amphibolitic enclaves	3623	14	1.4	May be emplacement age	This report
G01/026		7129066	523350	Discordant gneiss sheet in supracrustal rocks	3619	15	1.2		A.P. Nutman, unpubl. data
496417	2005jeh053	7106269	520078	Amitsoq gneiss?	3613				Szilas et al. 2015
G87/159		7121095	513533	Migmatite	3570			Lacks >3800 age component	Horie et al. 2010
482426	nrl2005-017	7124443	513880	Polyphase homogeneous orthogneiss	3531	23			This report and Lee 2009
499962	2007hcw078	7136396	520780	Interlayered bt-gneiss and hbl-bi-gneiss	3509	37	8.1	Poorly defined	This report
481417	2004jho044	7119142	525340	Medium- grained homogeneous grey orthogneiss with strung out felsic layers	3137	4	1.1		This report
481409	2004jho026	7144231	528446	Host grey granodioritic phase of banded grey orthogneiss	3052	4	2.0		This report
496831		7125753	561167	Tonalitic orthogneiss	3046	10	2.0		This report and Lee 2009
459841	jmh2005-263	7132058	516658	Homogeneous grey orthogneiss	3045	1			Hiess 2008
459839	jmh2005-260	7132503	516768	Homogeneous grey orthogneiss	3042	2			Hiess 2008
478212	2006jho290	7136836	551927	Regional tonalitic gneiss from fairly homogeneous	3031	3	5.4	No significant inherited grains	This report, Jørgensen 2008
499928	2007yhf033	7153195	555822	Orthogneiss, tonalitic, with amphibolitic enclaves	3024	50	4.8	May be metamorphic age	This report
478222	2006jho366	7144941	542666	Homogeneous tonalitic biotite-gneiss	3016	7	27	Poorly defined, weighted mean	This report, Jørgensen 2008

Table 2 continued. *U-Pb ages from TTG-gneisses interpreted as emplacement or protolith ages.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ[2]	MSWD[2]	Comments	Publication
493406	2006ssc304	7121592	529209	Orthogneiss, homogeneous (qtz, fsp, bt), brown weathering, well foliated	3010	9	0.64	Contact to anorthosite	This report
G01/047		7149164	541066	Homogeneous, possibly retrograde granulite gneiss	3005	12	0.79	Cores	A.P. Nutman, unpubl. data
492720	2006ydk091	7133862	543445	Tonalitic bt-hbl- gneiss	2955	9	2.0	Small consistent group, younger than all others	This report, Jørgensen 2008
	jho04-016	7149225	536141		2950			Age quoted on map	Nutman et al. 2010
G87/167		7121906	517433	Orthogneiss	2870	10			unpubl. data in Nutman et al. 2007b
477924	spi2005_101	7117175	537229	Orthogneiss, tonalitic	2869	10	4.1		This report
496408	2005jeh012	7108660	521982	Ikkattoq gneiss? From southern part of Kapisillit map sheet	2867	11			Szilas et al. 2015
496449	2005jeh184	7106100	533775	TTG gneiss	2862	5	1.4	Excludes youngest 8 grains (many rims) and oldest grain	This report
G03/018		7121372	532333	Heterogeneous migmatite with mafic dyke remnants,	2860			>3600 Ma cores present	A.P. Nutman, unpubl. data
437624	G87/197	7131908	525875	Tonalitic to qz-dioritc gneiss on island in Itilleq	2858	6	0.6		A.P. Nutman, unpubl. data
496443	2005jeh165	7105427	531381	Gneiss - Tasiusarsuaq or Ikkattoq	2858	8	0.58	Most grains are discordant	This report
459801	jmh2005-009	7142013	520505	Homog grey retrograde granulite facies orthogneiss	2851	3			Hiess 2008
499312	2005cm027	7109128	530453	Homogenous biotite gneiss - Ikkattoq?	2851	5	2.0	Excludes youngest 5 grains and oldest grain.	This report
496442	2005jeh163	7105679	530781	Granodioritic gneiss, Tasiusarsuaq?	2851	6	0.91	Excludes discordant and outlying (old) grains	Hoffmann et al. 2011
498005	2007jeh112	7135076	570265	Tonalitic gneiss, Nunatarsuuk	2851	5	1.17		Næraa 2011
496450	2005jeh188	7104320	531362	TTG gneiss	2848	4	0.85	Excludes several outlying young and old grains	This report
499902	2007yhf005	7150761	559571	Orthogneiss, tonalitic	2833	25	3.8	Enclaves of older tonalitic gneiss	This report
G03/023		7121462	516335	TTG orthogneiss	2826	12			Nutman & Friend 2007a
G03/014		7123396	535615	TTG orthogneiss	2823	11			Nutman & Friend 2007a
G87/188		7123407	535648	Tonalitic gneiss, possibly Ikkatoq	2820				Friend et al. 2009
G03/016		7122540	533750	TTG orthogneiss	2810	15			Nutman & Friend 2007a
485241	hso2005-174	7107165	529522	Tonalitic orthogneiss, large hbl crystals in leucosome	2810	5	5.6		This report
499937	2007yhf047	7141923	567732	Banded tonalitic and granitic gneiss	2805	15	7.1	Discordant grains excluded	This report
485231	hso2005-121	7115531	547946	Strained tonalitic orthogneiss	2802	6	1.6		Hoffmann et al. 2012
485206	hso2005-034	7118631	533278	Homogeneous tonalitic orthogneiss	2783	5	3.3		This report
459815	jmh2005-015	7144167	515669	Homogeneous grey orthogneiss with anorthosite	2553	6			Hiess 2008

[1] All locations are qouted in UTM coodinates, zone 22 with map datum WGS84.

[2] Where there is no entry, none was reported.

Mineral abbreviations as follows: bt-biotite, hbl-hornblende, grt-garnet, plag-plagioclase, qz-quartz, fsp-feldspar, sill-sillimanite, cord-cordierite, opx-orthopyroxene

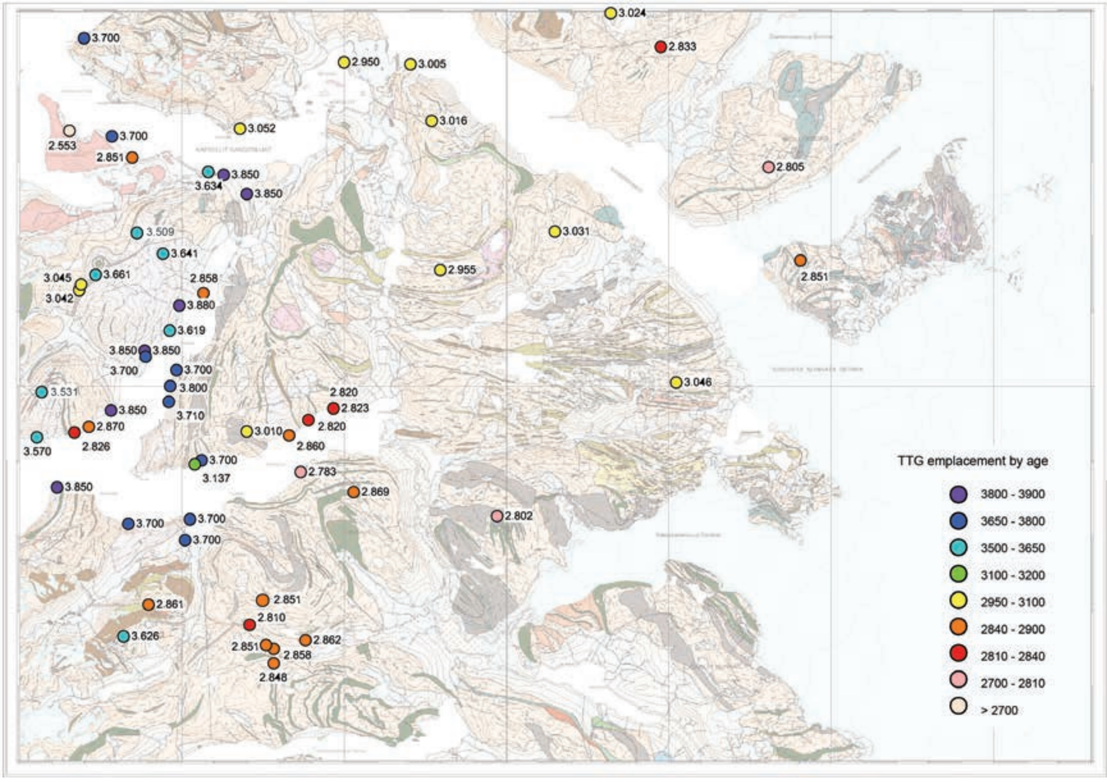

Figure 139. *Location of samples of TTG-gneiss and their interpreted protolith age in Ma.*

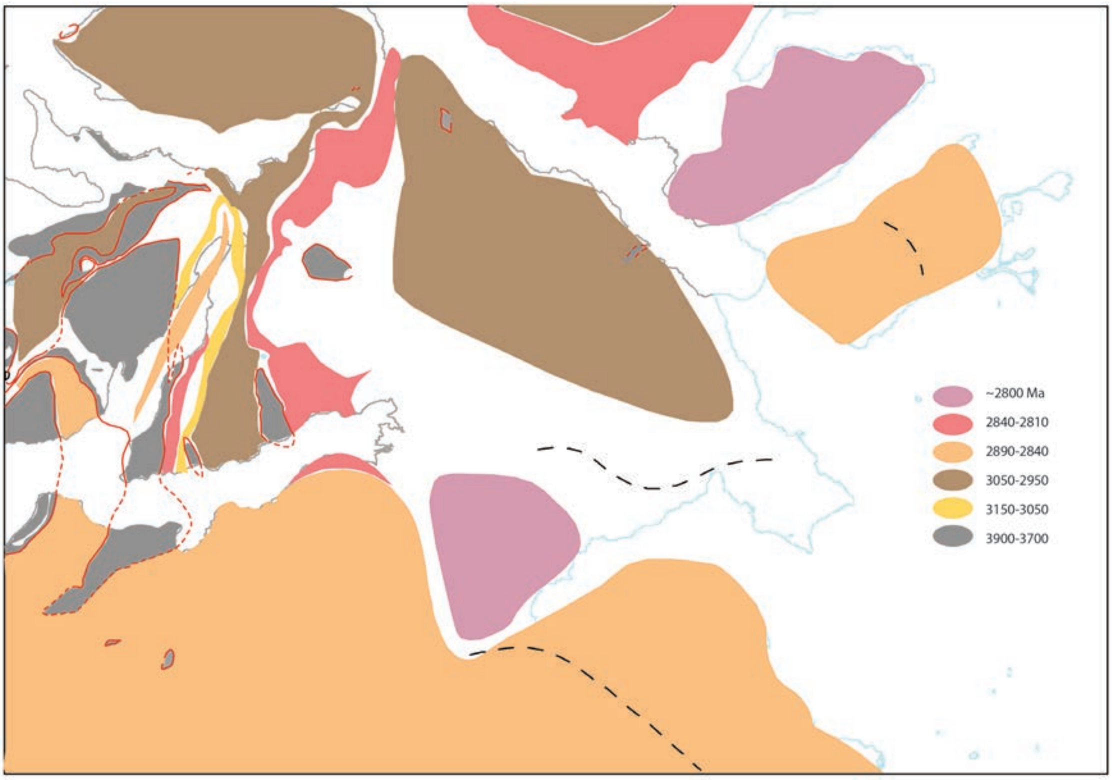

Figure 140. *Interpreted areal distribution of different phases of gneiss protolith formation.*

Metamorphic ages

Ages are divided into five groups, the oldest one representing all metamorphic ages more than 2850 Ma. These are the samples that have avoided the effects of younger orogenic events amalgamating the different crustal blocks. They are seen primarily in the oldest rocks, in the Færingehavn terrane and in the Tasiusarsuaq terrane towards the south.

The next age group, 2790 – 2740 Ma is present in the northernmost and southwestern parts of the map sheet, in what would be the Kapisilik and Tasiusarsuaq terranes.

The 2790 – 2660 Ma age range comprises the 2700 Ma event has been interpreted (e.g. Nutman & Friend 2007) as a major orogenic event. A belt of these ages occurs approximately from the head of the Ameralik fjord, southeast towards the inland ice. Such a metamorphic belt would put a question to a Tasiusarsuaq affinity for the central part of the area, because the metamorphic ages suggest that the Tasiusarsuaq terrane was amalgamated with this area at about 2700 Ma.

Younger still is the 2660 – 2610 Ma group that seem to be occurring around the edges of the Kapisilik terrane (Figs. 141 and 142). The ca. 2650 Ma metamorphic event is also recognised as one of the major orogenic episodes in the area (e.g. Nutman & Friend 2007a).

The youngest group with ages 2610 – 2550 Ma is also represented in the data that was not available at the time of map compilation and it can also be confused with crystallisation ages of granites related to emplacement of the Qôrqut Granite Complex (e. g. Næraa et al. 2012). They may represent a thermal response to post-orogenic adjustments subsequent to terrane amalgamation at around 2650 Ma (V. Bennett, pers. com. 2015).

Table 3. *List of samples that yield one or more metamorphic ages.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ	MSWD[2]	Comments	Publication
482493	nrl2005-100	7100276	535651	Non-granulitic bt-plag-qz-orthogneiss.	2884	22	1.0		This report
G01/047		7149164	541066	As homogeneous as a sample possible gneiss (maybe ex-granulite), west coast of Kangersuneq	2875	14	0.66	Rims	A.P. Nutman, unpubl. data
477917	spi2005_096	7116336	538919	Fresh granulite facies orthogneiss	2870	5	1.05		This report
482496	nrl2005-124	7099658	528453	Diorite. Dominant, intermediate part of mafic-intermediate-felsic orthgneiss. Intrudes amphibolite	2840	25	5.6		This report
G01/047		7149164	541066	As homogeneous as a sample possible gneiss (maybe ex-granulite), west coast of Kangersuneq	2786	17	0.26	Rims	A.P. Nutman, unpubl. data
479004	2005nrl142	7101691	546099	Felsic part of mafic-intermediate-felsic orthogneiss. Hbl-bt-qtz-pl with possible diopside	2782	15	10.1	Poorly defined emplacement age - cores dominated by 3.0 to 3.3 Ga	This report
482486	nrl2005-080	7098876	534998	Grt-2px felsic vein intruding [482485]. Age of granulite facies	2774	15	2.0		This report
VM93-01		7121289	515260	Sillimanite gneiss with HP relicts	2736	12	0.7		Nutman & Friend 2007a
		7121080	513680		2724	12		Quoted from published map	Friend et al. 1996
G01/031		7128727	522707	Granitic portion of a deformed composite mafic-felsic intrusion, Itilleq	2720				A.P. Nutman, unpubl. data
481438	2004jho079	7121290	515251	Felsic melt segregations from within amphibolite. Possible former opx pseudomorphed by orthoamphibole?	2720	4	5.0		This report and Lee 2009
481418	2004jho047	7119594	526576	Homogeneous granodiorite with some pegmatite layering. Abundant leucogabbro inclusions. Sample of homogeneous part.	2718	7	0.48		This report and Lee 2009
482444	nrl2005-043	7122573	517988	Grt-hbl leucosome in Ikkattoq gneiss	2716	15	6.2		This report and Lee 2009
485231	hso2005-121	7115531	547946	Strained tonalitic orthogneiss	2715	x		Recalculated age. This age not used on map.	Hoffmann et al. 2012
VM93-01		7121289	515260	Sillimanite gneiss with HP relicts	2715	8	0.78		Nutman & Friend 2007a
		7131110	524660		2710			Quoted from published map	Friend et al. 1996
		7131740	525000		2710			Quoted from published map	Friend et al. 1996
493403	2006ssc091	7117051	551450	Aluminous schist within supracrustal unit (amphibolite), fsp, qz, bt, sill, amphibole	2704	7	0.49		This report
497014	nrl2005-156	7109070	555836	Grt-diopside? In leucosome within grt-amphibolite in volcano-sedimentary unit. Leucosome is foliation-parallel.	2704	10	7.2		This report
G01/047		7149164	541066	As homogeneous as a sample possible gneiss (maybe ex-granulite), west coast of Kangersuneq	2703	9	0.14	Equant grains	A.P. Nutman, unpubl. data
482426	nrl2005-017	7124443	513880	Polyphase homogeneous orthogneiss	2701	31	0.0027	One grain	This report and Lee 2009
498005	2007jeh112	7135076	570265	Tonalitic gneiss, Nunatarsuuk	2698	14	0.29	Poorly constrained	Næraa 2011
482493	nrl2005-100	7100276	535651	Non-granulitic bt-plag-qz-orthogneiss.	2694	11	1.4		This report
497017	nrl2005-159	7109366	555765	Retrogressed grt-diopside?-bearing leucosome, supracrustal unit	2693	6	8.5		This report
499962	2007hcw078	7136396	520780	Interlayered bt-gneiss and hbl-bt-gneiss	2690	24	2.3	Large group of ill-defined analyses in sample	This report

Table 3 continued. *List of samples that yield one or more metamorphic ages.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ[2]	MSWD[2]	Comments	Publication
496831		7125753	561167	Tonalitic orthogneiss	2680	11	7.2		This report and Lee 2009
495110	2007hcw050	7145982	571230	Metagabbro, Akullersuaq	2660	8	0.23	In contact with 495113	This report
478334		7124217	560155	Grt-bearing felsic leucosome	2659	17	7.3	Anatexis	This report and Lee 2009
495113	2007hcw050	7145982	571230	Metaanorthosite, Akullersuaq	2658	10	5.2	In contact with 495111	This report
480132	apn05-238	7147125	539310	Felsic segregation in amphibolite	2657	21	0.62		Nutman & Friend 2007a
G03/015		7123339	534735	Granite sheet in mylonite	2651	3	0.47	Also 2004jho054	Nutman & Friend 2007a
492202	2006vbe001	7136601	534936	Grt-sill-bt metapelite	2649	6	0.1	Youngest DZ Age - 2751.8±8.0	This report
492219	2006vbe042	7133108	534275	Grt-sill-bt metapelite	2645	6	0.33	Youngest DZ Age - 2723.3 ±16 Ma	This report
437639		7140887	537494	Enclaves of supracrustal rock	2643	10	0.75	Rims on detrital grains	Nutman & Friend 2007a
492206	2006vbe010	7135523	534299	Grt-bt metapelite, retrogressed	2643	5	0.001	Youngest DZ Age - 2708 ±13 Ma	This report
437636		7141236	535441	Granite	2630				Friend et al. 2009
437641		7142393	538883	Granite	2630				Friend et al. 2009
514832	2007hst550	7139884	578289	Finegrained homogeneous granite, Nunatarsuuk	2630	17	0.69	Lower cluster of ages	This report
G01/048		7148038	537287	Syn-kinematic granitic sheet intruded along mylonite zone, head of Kapisillit fjord	2600			Quoted from published map	Nutman et al. 2010
G87/223		7148038	537287	Diatextite granite	2598	29	5.5	Several detrital generations	Friend & Nutman 2005

[1] All locations are qouted in UTM coodinates, zone 22 with map datum WGS84.

[2] Where there is no entry, this was not reported.

bt-biotite, hbl-hornblende, grt-garnet, plag-plagioclase, qz-quartz, fsp-feldspar, sill-sillimanite, cord-cordierite, opx-orthopyroxene

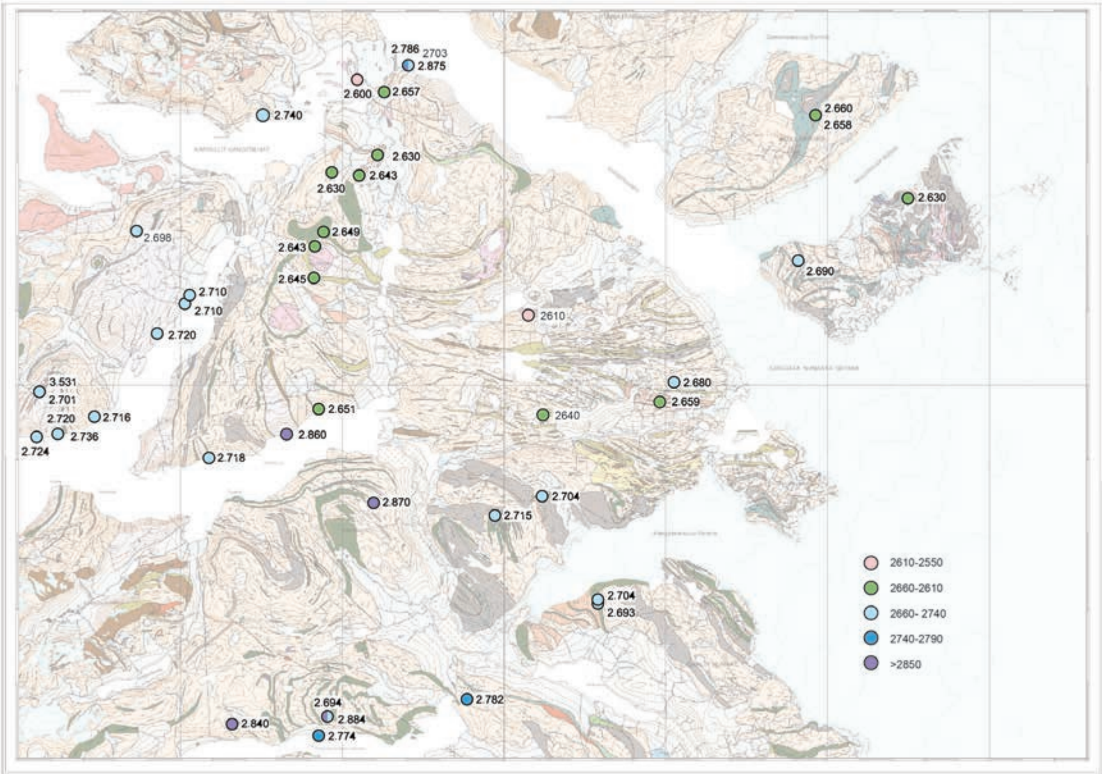

Figure 141. *Location of samples with metamorphic ages and their age in Ma.*

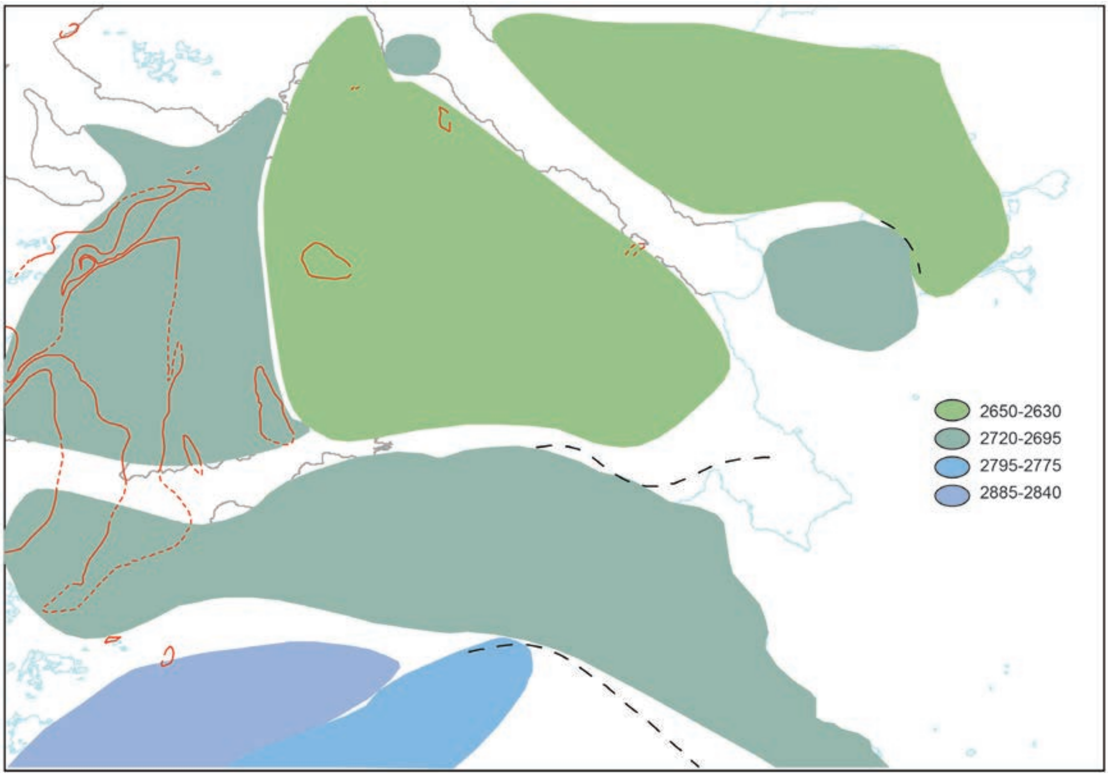

Figure 142. *Interpreted areal distribution of the youngest recorded metamorphic event in Ma.*

Age data from other types of rocks

Figure 143 depicts ages obtained from rock units other than TTG-gneisses that are not interpreted as metamorphic. This includes emplacement ages from one Proterozoic dolerite dyke, the Proterozoic Qôrqut Granite and the Cenozoic Tikiussaq Carbonatite complex. It also includes depositional and/ or detrital age components from supracrustal units, whether volcanic or sedimentary. In this map, ages of orthogneisses with granitic or dioritic composition, are also plotted. In addition, there are two age determinations from anorthosites.

The main findings include that the supracrustals are heavily dominated by a ca. 2840 Ma phase.

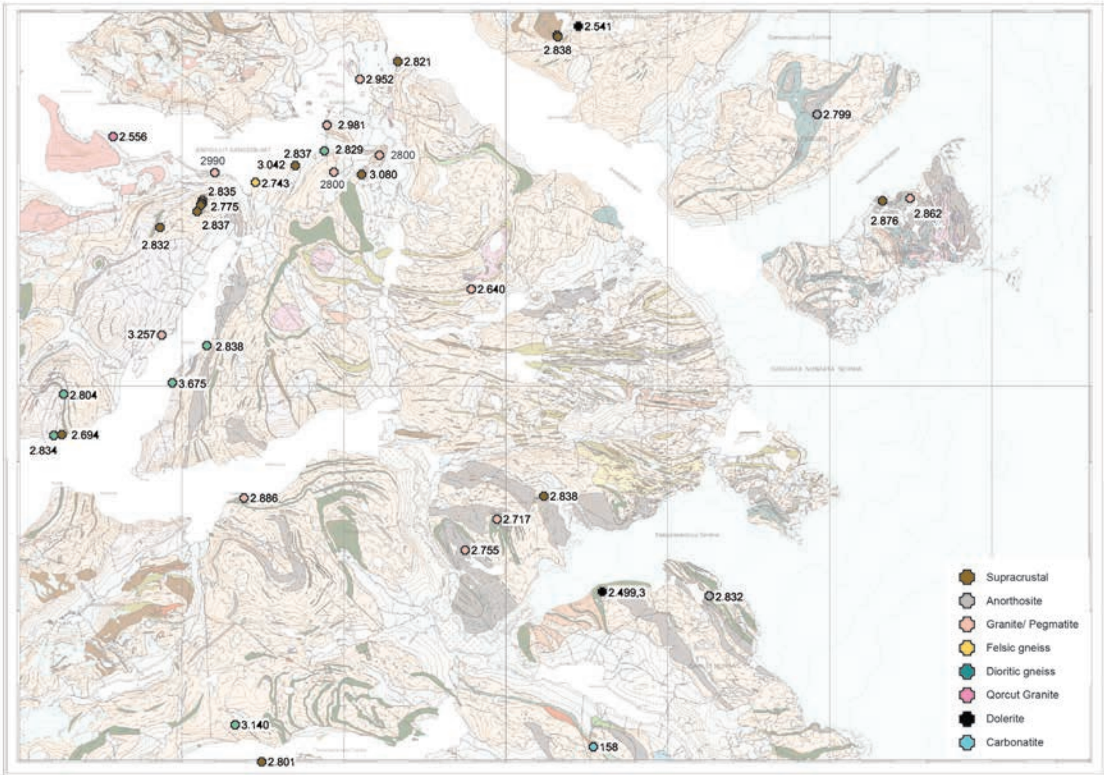

Figure 143. *Location of samples of other dated rocks and their interpreted age in Ma.*

Table 4. *List of samples from other rock types than TTG-gneisses.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ[2]	MSWD[2]	Type	Comments	Publication
Diorite										
481433	2004jho074	7125134	523511	Intermediate phase of intrusive diorite	3675	50		E	2 populations at c. 3650 and 3700	This report
482496	nrl2005-124	7099658	528453	Diorite. Dominant, intermediate part of mafic-intermediate-felsic orthgneiss. Intrudes amphibolite	3140	50	3.8	E		This report
481418	2004jho047	7119594	526576	Homogeneous granodiorite with some pegmatite layering. Abundant leucogabbro inclusions.	3027	15	11.5	E	Upper intercept	This report
481436	2004jho077	7127928	526076	Possible Tasiusarsuaq? Dioritic. Blebby texture.	2838	19	25	E		This report
481403	2004jho007	7142709	534674	Banded polyphase dioritic gneiss with some segregations	2829	4	0.5	E		This report
482424	nrl2005_035	7124690	515284	Homogeneous dioritic orthogneiss, thought to be Ikkattoq gneiss (2835 Ma) based on field observations.	2806	15	10.7	E	All discordant grains (>5%) excluded	This report & Lee 2009
Anorthosite										
514881	2007hst598	7109813	563967	Metaanorthosite	2832	10	1.3	E		This report
495113	2007hcw050	7145982	571230	Metaanorthosite, Akullersuaq	2799	20	5.2	E	In contact with 495110	This report
Granite/ pegmatite										
499950	2007yhf071	7133380	518283	Homogeneous granitic orthogneiss	3548	52	10.8	E	Large spread in ages	This report
G01/031		7128727	522707	Granitic portion of a deformed composite mafic-felsic intrusion, Itilleq	3257	14	0.06	E		A.P. Nutman, unpubl. data
481408	2004jho024	7140862	526677	Pre-syn mylonite granite intruded and deformed within the mylonite here	2990	6	2.5	E		This report
481405	2004jho010	7144613	534878	Grey felsic orthogneiss with early pegmatite layering, later folded in isoclinal folds	2981	8	2.0	E		This report
G01/048		7148038	537287	Syn-kinematic granitic sheet intruded along mylonite zone, head of Kapisillit fjord	2952	22	0.93	E		A.P. Nutman, unpubl. data
477905	spi2005_020	7116651	528940	Granitic body	2886	15	1.2	E		This report
514832	2007hst550	7139884	578289	Finegrained homogeneous granite, Nunatarsuuk	2862	7	0.3	E		This report
437636		7141236	535441	Granite	2800			E		Friend et al. 2009
437641		7142393	538883	Granite	2800			E		Friend et al. 2009
485257	hso2005-244	7112940	545578	Weakly foliated granitic sheet, intruded into the anorthosite complex	2755	7	4.4	E		This report
481402	2004jho004	7140187	529609	Homog grey felsic gneiss with some peg banding.	2743	29	31	E	Thought to be Ikkatoq	This report
481410	2004jho028	7145227	530271	Pre- to syn-mylonite granite. Holds an S - same as the mylonite. For max age of mylonite movement	2740	12	4.4	E	Messy spread of ages, with older inheritance	This report
485220	hso2005-104	7115293	547974	Weakly foliated granitic intrusion	2717	3		E	Revised age 2716 ± 5 Ma.	Hoffmann et al. 2012
492711	2006ydk060	7132440	545746	Pegmatite, undeformed, crosscutting foliation	2640	20		E	poorly defined.	Jørgensen 2008
G87/223		7148038	537287	Diatextite granite	2598	29	5.5	A	Several detrital generations	Friend & Nutman 2005
459809	jmh2005-034	7140909	526559	Granite lithon within mylonite (synmylonite).	2558	2		E	Revised age 2559 ± 3	Nutman et al. 2010
481415	2004jho-035	7143559	518998	Qorcut Granite	2556	5		E	Revised age 2563 ± 5	Nutman et al. 2010

Table 4 continued. *List of samples from other rock types than TTG-gneisses.*

Sample nr	Locality	Northing[1]	Easting[1]	Sample description	Age	2 σ[2]	MSWD[2]	Type	Comments	Publication
Supracrustals										
480119	crlf05-118	7137955	525269	Grt-bt diatexite with sill & graphite	3750	50		E		A.P. Nutman, unpubl. data
437639		7140887	537494	Enclaves of supracrustal rock	3080			V	Volcanic	Nutman & Friend 2007a
459812	crlf05-038	7141493	532559	Grt-bt metasediment	3042	5		E		A.P. Nutman, unpubl. data
514824	2007hst539	7139608	576249	Grt-fsp-qz-bt gneiss	2876	13	3.2	E		This report
499911	2007yhf021	7151368	551912	Grt-bt schist, thin sliver in tonalitic gneiss	2838	15	9.2	V	Probable metavolcanic	This report
493403	2006ssc091	7117051	551450	Aluminous schist within supracrustal unit (amphibolite), fsp, qz, bt, sill, amphibola	2838	29	0.48	D		This report
459814	jmh2005-09	7138449	525545	Homogeneous qz-cord gneiss.	2837	1		-		J. Hiess, unpubl. data
459812	crlf05-038	7141493	532559	Grt-cord paragneiss.	2837	7		V		A.P. Nutman, unpubl. data
499954	2007ckn086	7138652	525634	Bt-cord(?) gneiss	2835	16	5.2	V	Volcanic depositional age	This report
VM93-01		7121291	515250	Sillimanite gneiss with HP relicts	2834	10		V		Nutman & Friend 2007a
499959	2007yhf079	7136780	522507	Cord-sill-grt-bt gneiss	2832	15	20	V	Probable metavolcanic	This report
481406	2004jho019	7149384	540092	Bi-plag-qz gneiss with S parallel felsic (melt) layers. Possible metasedimentary or metavolcanic.	2821	4	0.053	V		This report
497008	2005nrl148	7096909	530452	Bt-plag-qz metasediment? Homogeneous	2801	4	4.6	V	Probably volcanic origin	This report
499955	2007ckn087	7138592	525600	Sillimanite biotite gneiss	2775	28	8.6	V	Probable volcanic depositional age	This report
493403	2006ssc091	7117051	551450	Aluminous schist within supracrustal unit (amphibolite), fsp, qz, bt, sill, amphibole	2752	13	0.44	D		This report
499926		7151511	551835	Plag-bt-sill gneiss, layered with amphibolite				D	Several age groups in metasediment	This report
499953	2007ckn085	7138862	525637	Sill-cord-bt schist				D	Large spread in ages	This report
Dolerite										
499929	2007ckn057	7152227	553400	Dolerite, Nunatarsuaq	2541	60		E		This report
499217	2006hst466	7109972	555918	Dolerite dyke, Qarliit Nunaat	2499	2	1.4	E	Baddeleyite analyses	Nilsson et al. 2010
Carbonatite										
493310	2005jho043	7098382	555488	Carbonatite breccia with inclusions of host rock.	158	2	0.66	E	12 analyses of a single zircon grain.	Tappe et al. 2009

[1] All locations are qouted in UTM coodinates, zone 22 with map datum WGS84.

[2] Where there is no entry, this was not reported.

Abbrieviations as follows: A-anatexis, D-detrital, E-emplacement, V-volcanic deposition

bt-biotite, hbl-hornblende, grt-garnet, plag-plagioclase, qz-quartz, fsp-feldspar, sill-sillimanite, cord-cordierite, opx-orthopyroxene

Recently published data and its impact on the inset maps

A number of age determinations from the Kapisillit area were either published subsequent to the publication of the geological map (Rehnström 2011) or was not noticed by the present authors at the time of map compilation. These data are listed in Table 5 and plotted with location, rock type and age in Figure 141.

Table 5. *U-Pb zircon ages that were not included on the inset maps.*

Sample no.	Northing[1]	Easting[1]	Description	Age	2 σ[2]	MSWD[2]	Type	Reference
292407	7148601	573450	Tonalitic gneiss, possibly Ikkatoq	2820			E	Friend et al. 2009
G01/037	7134470	557980	Homogenous non-granulite ?grano-dioritic gneiss	2820			E	Friend et al. 2009
496431	7113063	521570	Homogeneous TTG	3763	29	2.5	E	Hoffmann et al. 2011
496430	7113028	521598	Homogeneous TTG	3731	41	7.5	E	Hoffmann et al. 2011
498032	7127442	521718	Migmatitic TTG	3711	19	0.16	E	Hoffmann et al. 2011
498034	7128645	522976	Intra-crustal differentiates	3242	7	1.3	E	Hoffmann et al. 2011
498033	7128636	522974	Intra-crustal differentiates	3223	12	2.3	E	Hoffmann et al. 2011
498002	7135184	574825	Grt-bearing tonalite gneiss	2851	5		E	Hoffmann et al. 2011
469704	7128544	560047	Homogeneous orthogneiss	2850			E	Hoffmann et al. 2011
469718	7126514	552608	Homogeneous metadioritic gneiss	2850			E	Hoffmann et al. 2011
469735	7130684	553620	Homogeneous tonalitic orthogneiss	2850			E	Hoffmann et al. 2011
468001	7119689	552679	Homogeneous TTG	2823	5	0.39	E	Hoffmann et al. 2011
468034	7109783	561497	Homogeneous TTG	2805	5	1.6	E	Hoffmann et al. 2011
468079	7131761	551901	Polyphase migmatitic gneiss	2800			E	Hoffmann et al. 2011
498032	7127442	521718	Migmatitic TTG	2737	18	1.8	M	Hoffmann et al. 2011
496439	7105262	530425	Intra-crustal differentiates	2730	31	3.3	M	Hoffmann et al. 2011
468001	7119689	552679	Homogeneous TTG	2710			M	Hoffmann et al. 2011
486047	7115992	546340	Anorthosite	2807	7		E	Hoffmann et al. 2012
486047	7115992	546340	Anorthosite	2707	4		M	Hoffmann et al. 2012
437601	7121095	513533	Neosome rich migmatitic tonalite gneiss	3700			E	Horie et al. 2010
480124	7150527	528357	Unmelted qz-fsp sediments	2661	8	0.52	M	Nutman & Friend 2007a
480117	7146008	519040	Pegmatite from strain shadow	2656	5	1.1	M	Nutman & Friend 2007a
480125	7150527	528357	Partial melt in kyanite gneiss	2656	3		M	Nutman & Friend 2007a
480117	7146008	519040	Pegmatite from strain shadow	2558	4	0.63	M	Nutman & Friend 2007a
480115	7152244	518292	Medium-coarse-grained gneiss	2567	9		M	Nutman et al. 2010
G87/218	7142049	523299	Granite sheet, Qorcut granite	2559	5		E	Nutman et al. 2010
498027	7127502	521776	Migmatitic TTG	3872	12	1.5	E	Næraa 2011
498028	7127502	521776	Migmatitic TTG	3869	10	1.2	E	Næraa 2011
N03-81	7138793	578994	Anorthosite	2846*	14	0.77	E	Sounders et al. 2013
N03-81	7138793	578994	Anorthosite	2600*			M	Sounders et al. 2013
N03-83	7140020	581310	Anorthosite	2789*	13	0.62	M	Sounders et al. 2013
N03-83	7140020	581310	Anorthosite	2882*	10	1.9	E	Sounders et al. 2013
496408	7106269	520078	Amitsoq gneiss?	2741	17		M	Szilas et al. 2015
492235	7130355	550266	Grt Anorthosite-leucogabbro complex	2858	5	1.18	E	This report
492237	7122976	551444	Grt-sill-bt metapelite	2678	6	1.8	M	This report
492211	7136266	534511	Coarse grained pegmatitic granite	2665	3	0.77	E	This report
492234	7137884	532948	Grt-bt metapelite	2655	4	0.98	M	This report
492209	7135234	533912	Grt-sill-bt metapelite	2637	5	0.00	M	This report
492206	7135523	534299	Grt-bt metapelite, retrogressed	2533	10	0.61	M	This report

Abbreviations as follows: E-emplacement, M- metamorphism, bt-biotite, grt-garnet, qz-quartz, fsp-feldspar, sill-sillimanite

[1] All locations are qouted in UTM coodinates, zone 22 with map datum WGS84.

[2] Where there is no entry, error or MSWD was not reported.

* These ages are not published in Sounders et al. 2013, but were recalculated for this report by V. Bennett on data from Sounders et al (2013). The coordinates for these samples come are estimated from fieldmaps by J. Myers located at GEUS.

Some new observation can be made from the new data, but the large picture remains essentially the same. Most of the new ages come from the previously little known central and eastern parts, and these parts seem to be dominated by rocks intruded or deposited between 2800 and 2850 Ma. It is not clear whether this area has Tasiusarsuaq terrane affinity or if it should be referred to the Tre Brødre terrane, or perhaps both, tectonically intercalated. Some very large recumbent folds with E-W trending fold axes are present in this area, which could mean that several different tectonostratigraphic levels are exposed. There seem to be several generations of metamorphic overprinting, with a belt of ca. 2700 Ma metamorphic ages closest to the Tasiusarsuaq terrane s.s. occurring in the southern part, and younger, ca. 2650-2630, towards the NE. indicating a possible juxtaposition at this time.

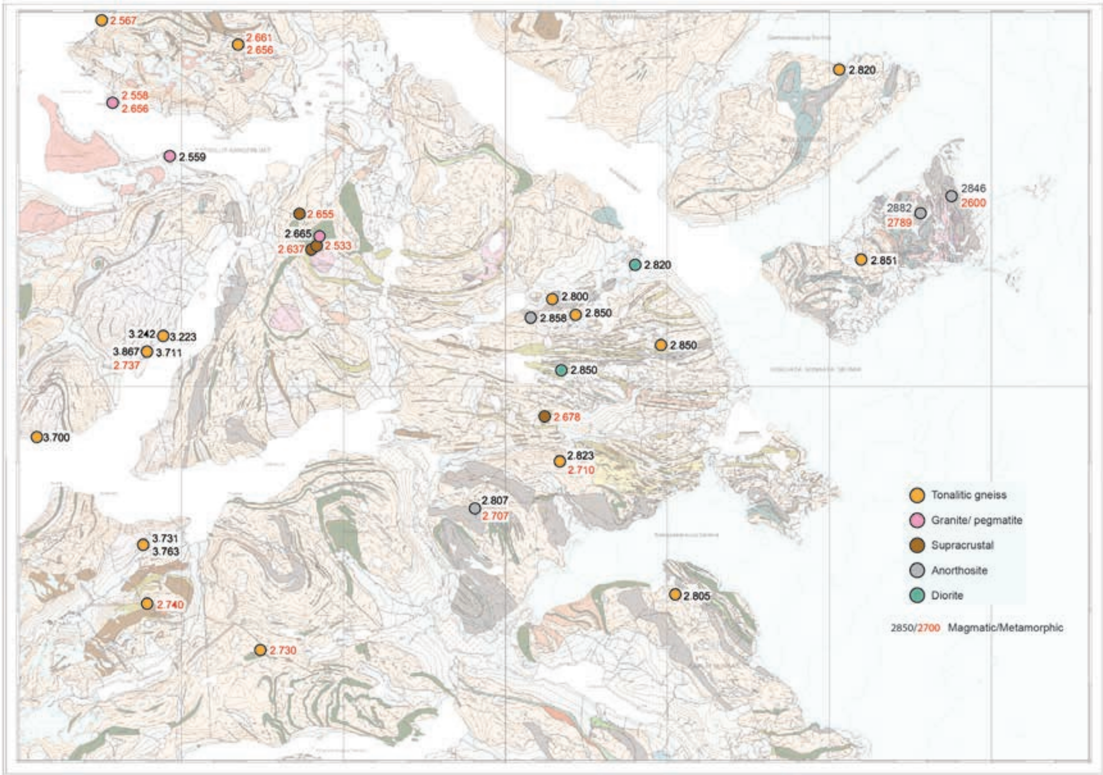

Figure 144. *Location of samples not used in the age compilation and their interpreted age in Ma. Data are shown from the following publications Hoffmann et al. (2011, 2012), Horie et al. (2010), Næraa (2011), Nutman & Friend (2007b, 2010), Souders et al. (2013) and Szilas et al. 2015.*

Main findings

The oldest rocks are present mainly in the western part of the map-sheet and in the structurally highest and lowest position in the large fold south of Kapisillik, younger rocks being sandwiched between the Eoarchaean thrust-sheets. There may also be Eoarchaean rocks along the NE boundary of the map-sheets, which would be in accordance with occurrencies of Eoarchaean gneisses in the map-sheet area north of Kapisillit, 64 V.2 Nord, Ivisârtoq (Chadwick & Coe 1988). They display ages older than 3.5 Ga and often record a metamorphic overprint as well. This would be the southern continuation of the Isukasia terrane of Friend & Nutman (2005). Ages between ca. 3.2 and 2.9 Ga probably belong to the Kapisillik terrane (Friend & Nutman 2005), a terrane with its primary distribution in the northern half of the map sheet area. A volumetrically large group aged 2.89-2.84 Ga is mainly present in the southern part of the area and may represent the Tasiuarsuaq terrane (e.g. Friend et al. 1988). The covered central part of the map sheet originally had a less dense data coverage, but have yielded some interesting data lately (2010-2016) and it seems to be composed by tonalitic orthogneisses with associated supracrustal rocks and anorthosites, all deposited and emplaced between 2850 and 2800 Ma. The main metamorphic ages at 2.7 and 2.65 Ga reflect the two major tectonometamorphic events in the region, as was also discussed in Friend & Nutman (2007). The older metamorphic ages in the southern part are typical of the Tasiuarsuaq terrane. However, this may be a gross simplification since large fold structures complicate the surface expression of map units.

Interestingly, very young, metamorphic ages around 2550 Ma have emerged from some samples, especially from the vicinity of the implied southern boundary of the Kapisillik terrane.

These are just some preliminary conclusions from the large dataset and much more may be revealed upon a more detailed inspection of the data.

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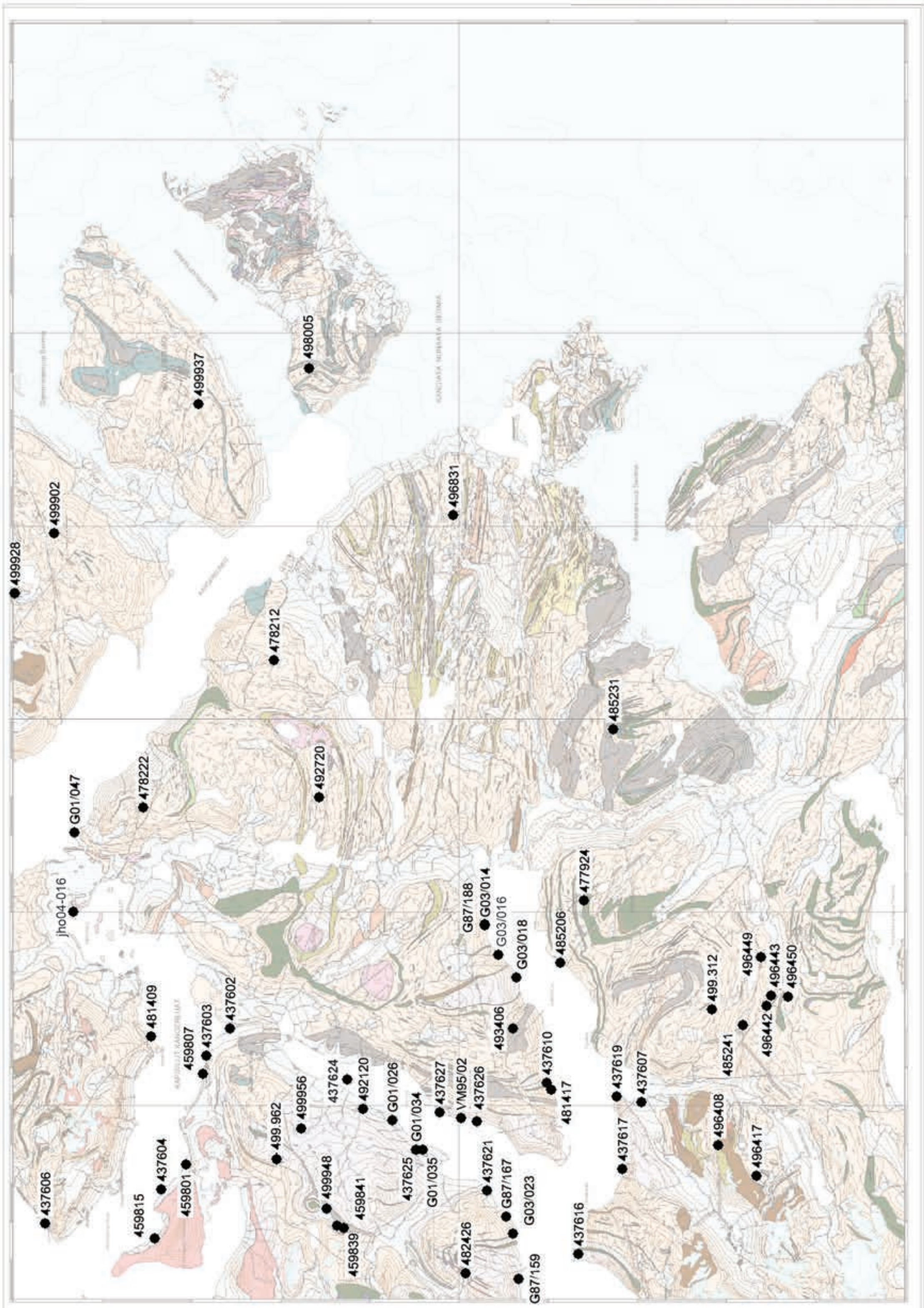
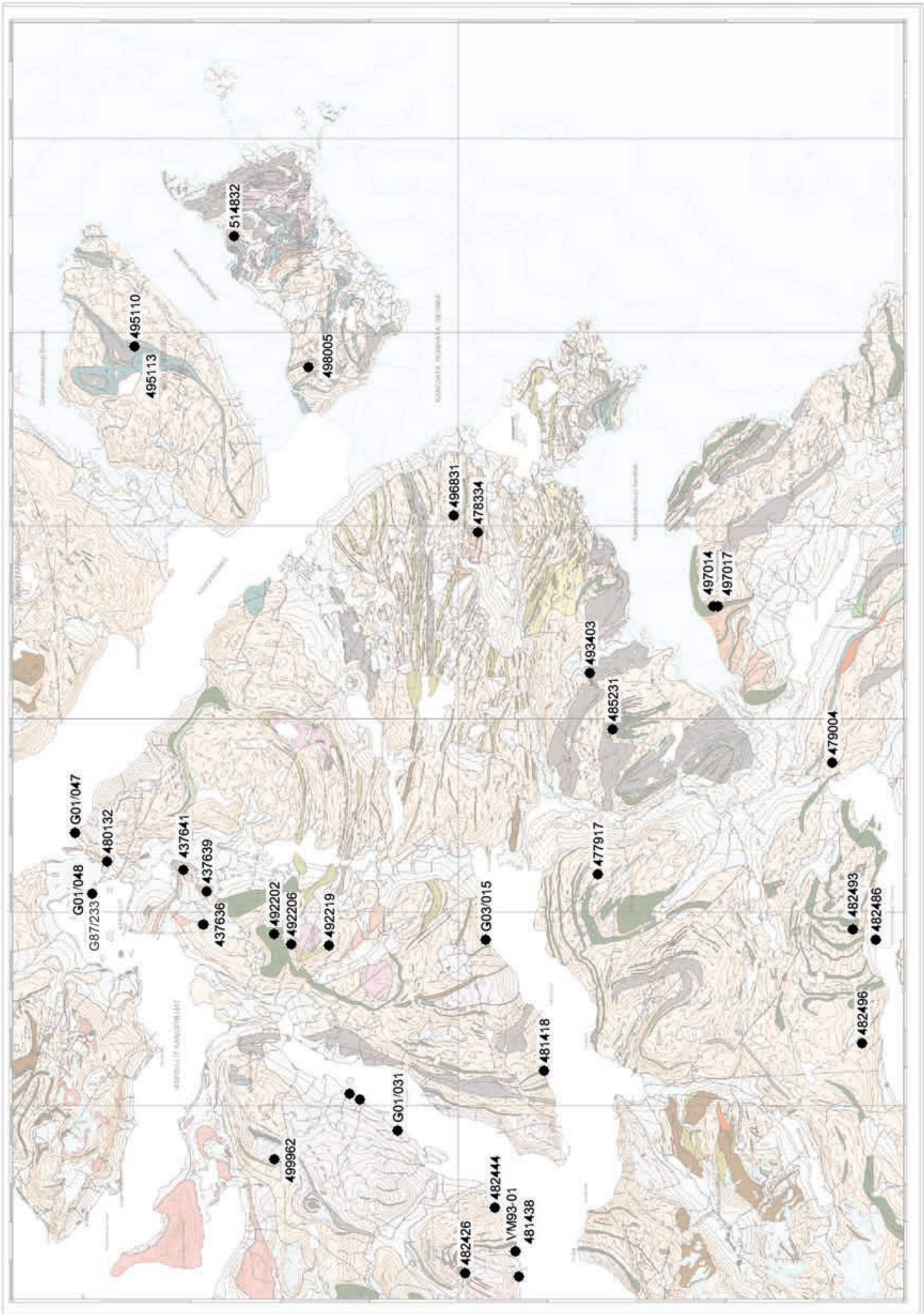
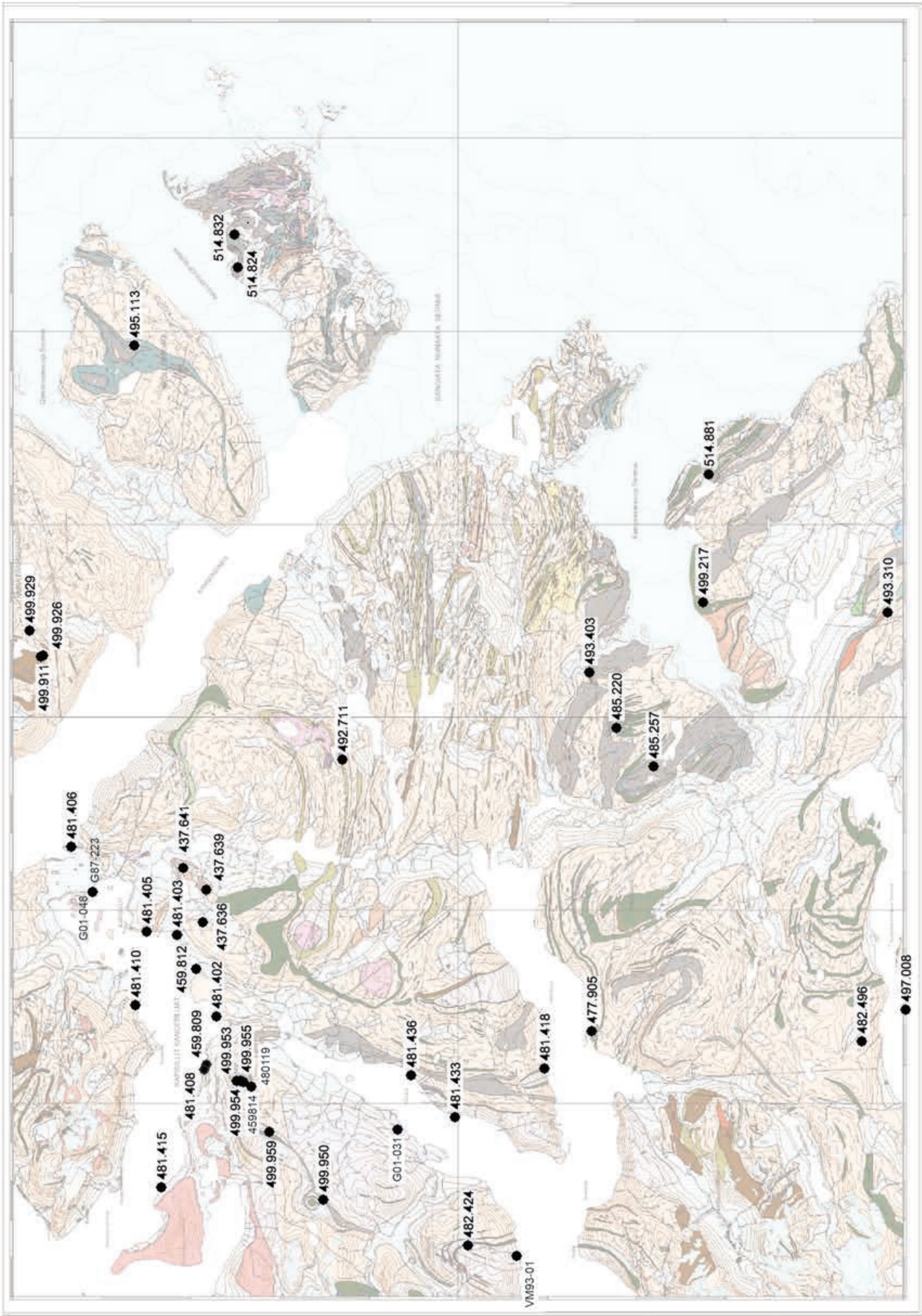
Appendix 1- Geochronological sample maps



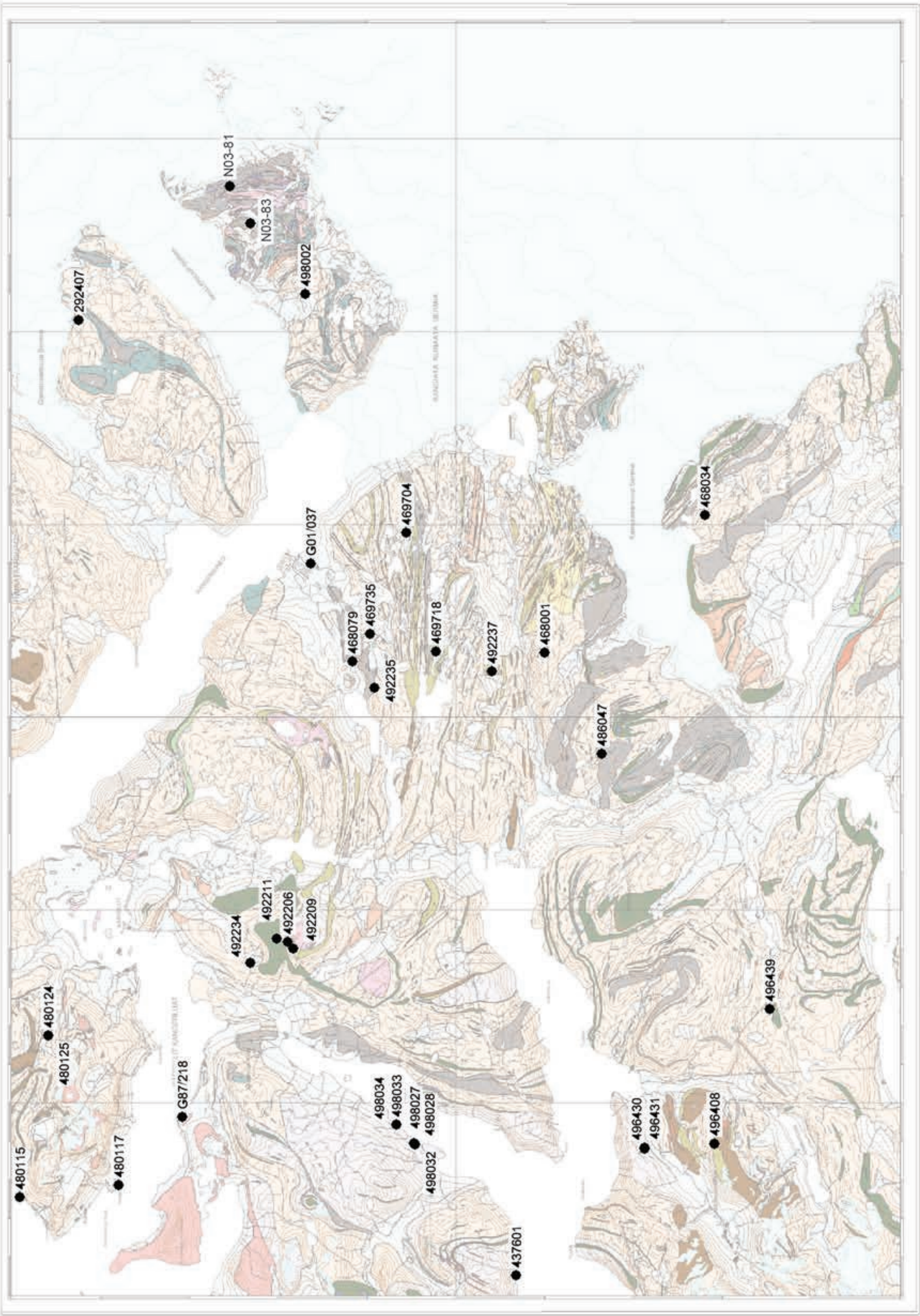
Map 1. *Location of samples of tonalitic composition.*



Map 2. *Location of samples with metamorphic ages.*



Map 3. *Location of samples of other than tonalitic composition.*



Map 4. *Location of samples not included on the inset maps.*

Appendix 2- Geochronological raw data for original data

These tables can be found on the attached CD-rom.