DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2006/34

Mesozoic to Palaeogene dyke swarms in West Greenland and their significance for the formation of the Labrador Sea and the Davis Strait

Lotte Melchior Larsen

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
MINISTRY OF THE ENVIRONMENT

G E U S

DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2006/34

Mesozoic to Palaeogene dyke swarms in West Greenland and their significance for the formation of the Labrador Sea and the Davis Strait

Lotte Melchior Larsen

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
MINISTRY OF THE ENVIRONMENT

G E U S

Contents

Abstract

Mesozoic to Palaeogene intrusive igneous rocks occur throughout West Greenland. Occurrences range from a large, coast-parallel dyke swarm to small, poorly defined swarms or intrusions. Twelve occurrences of Jurassic to Cretaceous rocks and eight occurrences of Palaeogene rocks are described here in catalogue form. New precise ages have been obtained by radiometric dating of 14 samples from 11 occurrences. The existing information on chemical compositions has been supplemented with new chemical analyses and in particular modern trace-element analyses by ICP-MS.

The new data indicate that the igneous activity took place in a number of discrete events, and that there was a significant evolution of the melt compositions with time, reflecting a gradually thinning lithosphere.

During the period c. 200–150 Ma incipient stretching is reflected in the production of highly alkaline, volatile-rich melts: kimberlites, alnöites, aillikites, and carbonatites. These melts were formed in small volumes at low degrees of melting in the deep lithosphere.

In the late Jurassic around 150 Ma (Kimmeridgian), an event of increased extension took place. The degrees of melting in the deep lithosphere increased, the melts were monchiquitic, and they were intruded in a min. 60 km long, NNW-oriented dyke swarm around Frederikshåb Isblink. N–S dyke alignments indicate the orientation of the stress field.

In the early Cretaceous, 140–133 Ma (Valanginian-Hauterivian), extension had gone so far that the upwelling asthenospheric mantle started to melt. The melts were produced at still larger degrees of melting, and the rocks are alkaline to enriched tholeiitic basalts. The regional stress field was intense, and the magmas were emplaced in a large, 400 km long swarm of NW–SE oriented dykes. On the conjugate Canadian margin, the alkali basalts of the Alexis Formation were presumably formed around the same time.

During the rest of the Cretaceous, igneous activity onshore West Greenland was sparse. Two occurrences dated at 115 Ma and 105 Ma are known, of which the 115 Ma one is a big, coast-parallel phonolite dyke.

There is a clear two-fold division of West Greenland. The Jurassic–Cretaceous rocks are concentrated south of 64°N, with only two occurrences north of this at 65°22′–24′N. In contrast, all the Palaeogene rocks occur north of 64°N.

In the Palaeogene, continental break-up and extrusion of the voluminous flood basalts took place in the period 63–60 Ma. Dating of sills and dykes has shown that Palaeogene intrusive activity onshore occurred far outside the volcanic areas in the Disko–Nuussuaq–Svartenhuk Halvø region. Sills in the Disko Bugt form an intrusive south-eastern extension of the volcanic areas. Three large dykes in the Aasiaat region have extended the known onshore areas of igneous activity south to 68°N, and one dyke appears to form a stepped link between the Nuussuaq and Sisimiut Basins. Many dykes and sills in the Disko–Nuussuaq–Svartenhuk Halvø region are post-volcanic; they show a concentration of ages in the interval 57–54 Ma. All the dated rocks are asthenosphere-derived tholeiitic basalts.

Two Palaeogene dyke swarms occur much farther south, between 65°30′N and 64°N. These are alkaline, camptonitic, and were formed by shallow melting in the lithosphere. They are dated at 58, 55, and 51 Ma and show no structural relation to the offshore areas. They may result from local stresses set up repeatedly by lithospheric adjustments prior to and during sea-floor spreading.

Introduction

Along the west coast of Greenland several dyke swarms occur which are Mesozoic to Palaeogene, with reported ages ranging between 34 and 200 Ma. The dyke swarms vary from a large, coast-parallel swarm to small, poorly exposed swarms or even (as presently known) single dykes or other small intrusions that typically have been found during regional geological mapping.

The magmatism that gave rise to these dykes and other intrusions is presumably causally connected to events of stretching and rifting of the lithosphere before and during the formation of the Labrador Sea and the Davis Strait. It is known that melt formation takes place by pressure release during stretching and thinning of the lithosphere. The composition and volume of the melts depend on the melting material and the tectonic environment, and the dykes therefore preserve a record of the plate tectonic events during the successive stages of rifting and formation of the basins offshore West Greenland.

Data on these occurrences are found in several published papers and reports as well as in unpublished reports and data files at GEUS. The analytical data have been acquired during a long period; thus many age determinations have been made with old techniques that are prone to give imprecise or misleading results. The coverage with chemical analyses has been patchy, sometimes sparse, and very few modern trace-element analyses have existed. Some, but not all, of the occurrences were last reviewed by Larsen & Rex (1992).

The aim of the present report is to update the information on these dykes and to provide modern precise age determinations and modern chemical analyses, particularly for trace elements. The new age determinations, and all the collated chemical analyses and other information, are provided here in two appendices. Together, these data form the basis for an interpretation of the relation between the tectonic events and the formation of the dykes during the protracted rifting and eventual continental break-up and formation of seafloor between Greenland and Canada.

Figure 1 shows the location of the dyke swarms discussed in this report, and Table 1 gives a listing of them. In the following chapter, the occurrences are briefly described, ages and present analytical coverage are noted, and references given. Some of the occurrences are updated from Larsen (1991) and Larsen & Rex (1992), and references given therein, whereas others have not been described before.

Fig. 1. Location map of the described occurrences of young igneous rocks

Description of dyke swarms and other occurrences

The dykes are presented below on a regional basis, going from the south towards the north. All K-Ar and Rb-Sr ages are calculated with the decay constants of Steiger & Jäger (1977), and all $^{40}Ar/^{39}Ar$ ages for which the the Fish Canyon Tuff (FCT) standard was used are calculated relative to an age of 28.03 Ma (Renne *et al.* 1994). The rock nomenclature follows Le Maitre (2002) with the modifications to the classification of ultramafic lamprophyres suggested by Tappe *et al.* (2005). Existing analyses are assembled in Appendix 1.

Table 1. Summary of occurrences

Locality	Character	Rock type	Appr. age, Ma
Kvanefjeld	One or a few dykes	Monchiquite	1134±17 (new)
Tuttutooq	One or a few sills	Camptonite	**115**
TD dykes	Large regional dyke swarm	Alkali basalt	133–**140**
S Greenland	Small dyke swarm	Kimberlite	~200
Midternæs	Few small dykes	Aillikite	undated
Paamiut	Small dyke swarm	Aillikite	166
Oqummiaq	Single dyke	Ol.monchiquite	**150**
Fr.håb Isblink	Scattered dykes	Ol.monchiquite	**149**
Fr.håb Isblink	Scattered dykes	Monchiquite	144±12; 156±14
Fr.håb Isblink	Few dykes	Alnöite,carbon.	**152**
Fr.håb Isblink	Few dykes, one large	Phonolite	**105**
Færingehavn	Few dykes	Aillikite	175–195
Godthåbsfjord	Scattered dyke swarm	Camptonite	**51**
Søndre Isortoq	Small dyke swarm	Campt; alk.basalt	**55; 58**
Qaqarssuk	Few dykes and sheets	Aillikite	**166**
Fossilik	One explosion breccia	Aillikite	**164**
Aasiaat	Few large dykes	Tholeiitic basalt	**56**
Grønne Ejland	One large sill	Tholeiitic basalt	**60**
W. Disko	Regional dyke swarm	Tholeiitic basalt	54
SE Nuussuaq	Dykes and sills, some large	Tholeiitic basalt	**57**
Disko-Nuussuaq	Few dykes, one volc. neck	Alkali basalt	28
Ubekendt Ejland	Small dyke swarm	Camptonite	34
Svartenhuk	Few dykes	Campt; alk.basalt	post-volcanic
Inland of Svarten.	Few scattered dykes	Aillikite, kimberlite	Unknown

Ages in bold are new, precise determinations

Kvanefjeld

Location: Kvanefjeld, northern part of the Ilímaussaq Intrusion, appr. 60°58.8′N, 45°59′W.
Structure: Scattered dykes trending SW–NE, up to 1.5 m thick. Shown on 1: 35 000 map in Sørensen *et al.* (1974).

Group 1
Rock type: Camptonite or alkali basalt
Lithology: Abundant small phenocrysts of plagioclase, and sometimes large clinopyroxenes and olivines, in a fine-grained matrix of clinopyroxene, plagioclase, oxides and brown mica. The rocks are usually heavily altered and there is extensive reaction with the easily melted Ilímaussaq rocks.
Age: Unknown. Cut the 1160 Ma Ilímaussaq intrusion. Dating of these dykes is considered not feasible or at least very difficult and has not been attempted. After it was realised that the fresh group 2 dyke (see below) is of Gardar age, the group 1 dykes are considered to be of Gardar age too.
Analyses: None.

Group 2
One dyke strikes NNE and is 40 cm wide, completely fresh, and contains no plagioclase.
Rock type: Monchiquite
Lithology: Abundant phenocrysts of clinopyroxene, brown amphibole and lesser olivine and mica in a groundmass of prismatic clinopyroxene, amphibole and mica crystals and oxides in a colourless aphanitic matrix with apatite needles.
Age: This dyke was expected to be Mesozoic and was sent for dating by the Rb-Sr method*. It turned out to be Proterozoic, Gardar, 1134±17 Ma.* The age was obtained on a phlogopite separate as a Rb-Sr one-point model age calculated with a $^{87}Sr/^{86}Sr$ initial ratio of 0.70275±0.000025, taken from the $^{87}Sr/^{86}Sr$ initial ratio range of 0.7025-0.7030 obtained for Gardar ultramafic lamprophyre dykes in the Igaliko area (Pearce & Leng 1996). The Kvanefjeld dyke is maintained in the descriptions and plots as a comparison with the other rocks.
Analyses: 1 major elements, 1 ICP-MS trace elements.
References: Sørensen *et al.* (1974); Larsen (1979).

Tuttutooq sills

Location: Tuttutooq and Illukasik islands, 60°48′–60°52′N, 46°18′–46°20′W.
Structure: One or a few sills. One sill is shown on the 1:100 000 geological map 60 V.2N.
Comments: Tuttutooq and neighbouring islands are transected by numerous dykes and a few sills as shown on the 1:100 000 geological map 60 V.2N Julianehåb. As far as known, the dykes are of Gardar age, and a camptonite sill described by Upton (1965) was then also assumed to be of Gardar age. However, later dating indicated that the sill is Mesozoic.
Rock type: Camptonite.
Lithology: The rock is petrographically characteristic by containing frequent prismatic brown amphibole crystals, and much lesser clinopyroxene, in a matrix of plagioclase and oxides; ocelli are filled with carbonate. Available samples were scarce; one sample has been re-analysed and supplemented with ICP-MS trace elements, and another sample was sent for dating.
Age: Early Cretaceous, Aptian, 115 Ma.
Old age determination 217±5 Ma, K-Ar whole rock age (Bridgwater 1970).
New age determination 114.7±4.7 Ma, Ar/Ar whole rock age (this work). The sample has excess argon; the total fusion age is 212 Ma which explains the high K-Ar age.
Analyses: 6 major elements, 1 ICP-MS trace elements.
References: Upton (1965); Bridgwater (1970).

SW Greenland coast-parallel dyke swarm (TD dykes)

Location: The dyke swarm stretches from south of Nanortalik (60°N) in the south to Grædefjord (63°20′N) in the north., i.e. over more than 400 km. The dykes are shown on several geological maps on scale 1:100 000.

Structure: The dykes occur in a broad, up to 30 km wide strip along the coast. They trend coast-parallel, and the strike of the dykes follow the bend of the coastline from Qaqortoq to Nunarsuit. The dykes are up to 40 m thick, on average about 10 m, and the central part of the swarm between 61°N and 63°N is clearly visible on the aeromagnetic map of West Greenland.The dykes are usually near-vertical except in the south-westernmost part on the Nunarsuit peninsula where they dip seawards and the dips shallow towards the coast to c. 30°SW.

Comments: TD comes from 'Trap Dolerites', an old mapping term.

Rock type: Alkali basalt and transitional basalt.

Lithology: The dykes are fine-to coarse-grained gabbroic with intergranular to subophitic textures. They consist of plagioclase, clinopyroxene, Fe-Ti oxides and accessory apatite, and sometimes also olivine and brown biotite. The dykes frequently contain light grey felsic veins. Most rocks are relatively unaltered, but all have somewhat clouded plagioclase.

Age: Early Cretaceous, Valanginian to Hauterivian, 140–133 Ma.

Old age determination: 138 Ma (K-Ar whole-rock, Watt, 1969).

Newer age determinations: 133.3±0.7 Ma and 138.6±0.7 Ma (40Ar/39Ar for separated biotite and plagioclase in two samples from the northern and southern part of the swarm, Larsen *et al.* 1999). The two samples represent different chemical sub-groups.

Additional new age determination: 140.3±2.2 Ma (Ar/Ar on plagioclase, this work). The sample represents a chemical sub-group that was not dated earlier.

Analyses: 72 major elements, including 6 felsic veins and 2 basic inclusions (26 unpublished analyses from Brian Upton, Edinburgh); 26 ICP-MS trace elements. Even so, analytical coverage in both ends of the swarm (north of Frederikshåb Isblink and south of Julianehåb) is thin because of lack of samples. The swarm ought to be resampled in both ends.

References: Watt (1969); Larsen *et al.* (1999).

South Greenland kimberlites

Location: Pyramidefjeld (Tissaluk), 61°24′N, 48°15′W; Midternæs, 61°32.36′N, 48°10′W; Nigerlikasik, 62°02.57′N, 48°52.3′W.
Structure: Flatlying sheets and dykes usually <1 m thick. The Nigerlikasik occurrence is one 0.5 m thick dyke trending 140°SE that can be followed over more than 3 km. The true extent of the swarms may not be known very well. The distance between the Pyramidefjeld and Midternæs occurrences is only 10 km whereas the distance from Midternæs to Nigerlikasik is about 67 km.
Rock type: Kimberlite, alnöite, aillikite. Peridotite xenoliths.
Lithology: Ultramafic rocks rich in megacrysts of olivine in a groundmass of carbonate, serpentine, oxides and phlogopite, and accessory clinopyroxene, perovskite and apatite. The Pyramidefjeld rocks contain frequent clinopyroxene and perhaps melilite and are therefore more akin to alnöites or aillikites than to kimberlites. In all three occurrences peridotite xenoliths are frequent.
Age: Mesozoic, c 200 Ma.
An imprecise 40Ar/39Ar whole rock age of 193±6 Ma from Pyramidefjeld (Bridgwater 1970). Doubtful K-Ar whole rock ages of 609±36 Ma for Nigerlikasik and 202±6 Ma for Pyramidefjeld. Rb-Sr ages are the same for the two localities, "both a little over 200 m.y." (Andrews & Emeleus 1971). Age dating is in progress in connection with a separate study of the Pyramidefjeld rocks; samples from Nigerlikasik could not be located.
Analyses: 7 major elements (2 Pyramidefjeld, 1 Midternæs, 4 Nigerlikasik), 2 ICP-MS trace elements. More analyses will be made in a separate study.
References: Bridgwater (1970); Andrews & Emeleus (1971, 1975); Emeleus & Andrews (1975); Larsen & Rex (1992).

Dykes between Midternæs and Frederikshåb Isblink

In this general area, scattered lamprophyre dykes have been noted by mapping geologists. Many are of Gardar age (Higgins 1970). Kimberlite sheets on Midternæs are thought to be of the same age as the Pyramidefjeld kimberlites (see above). A few unconstrained dykes have earlier been dated and turned out to be Mesozoic.

Midternæs

Location: Nuna Qernertoq, western Midternæs, 61°33.885′N, 48°47.80′W.

Structure: Small ultramafic dykes striking ENE can be followed over some few metres and are less than 1 m thick.

Rock type: Aillikite

Lithology: The rock is heavily altered but originally contained frequent euhedral olivine (completely altered) and clinopyroxene in a fine-grained oxide-rich matrix of globular aspect and with pockets of carbonate. The oxides include somewhat altered perovskite.

Age: Unknown. Not sent for dating as the perovskites are altered, but a dating attempt ought to be made on the perovskite.

Analyses: 1 major elements, 1 ICP-MS trace elements.

References: Higgins (1970).

Sermiligaarsuk

Location: Sermiligaarsuk, c. 61°30′N, 48°30′W.

In this area lamprophyre dykes are known and considered from cross-cutting relations to be of Gardar age. Not all dykes are thus constrained, and one of these was included in the project.

Structure: Dyke striking 68°ENE, 2 m thick.

Rock type: Camptonite.

Lithology: The rock is medium-grained and consists of euhedral clinopyroxenes and olivines in a groundmass of anhedral plagioclase and oxides. It contains frequent ocelli lined with carbonate and filled with fresh analcime or zeolite.

Age: Presumably Gardar. The dyke is geologically unconstrained and could also be young. *The chemical composition of the dyke suggests it is of Gardar age rather than Mesozoic.*
It was not dated as its plagioclases are unsuited (clouded).

Analyses: 1 major elements, 1 ICP-MS trace elements.

References: Kelstrup (1966).

Paamiut (Frederikshåb)

Location: Paamiut (Frederikshåb), immediately around and south of the town, 61°49′N–62°N, 49°25′W–49°45′W.

A small swarm of porly exposed carbonate-rich lamprophyre dykes is known from coastal exposures in a 23×10 km area. Its extent is not well constrained.

Structure: The dykes strike NW (coast-parallel) and are thin, from a few centimetres to max 1 m wide. At one locality a lamprophyre dyke is intruded into one of the Mesozoic coast-parallel dykes (Walton & Arnold 1970).

Rock type: Aillikite and carbonatite.

Lithology: The dykes are petrographically diverse and contain variable proportions of euhedral olivine (altered), clinopyroxene, anphibole and phlogopite in an oxide- and carbonate-rich matrix. Xenoliths of pyroxenite, hornblendite, glimmerite and garnet granulite occur locally.

Age: Mesozoic, probably Jurassic. The swarm ought to be re-dated, but suitable samples are lacking.

In spite of a reported cross-cutting relation with a presumed 138 Ma Mesozoic dyke, a K-Ar age of 166±5 Ma was obtained on phlogopite from a lamprophyre dyke (Larsen & Møller 1968).

Analyses: 8 major elements, 7 ICP-MS trace elements.

Comment: Of the original material described by Walton & Arnold (1970) only coarse-grained powders of five of the analysed samples were located. Of these, three were sent for re-analysis and trace elements. However, two samples from the same swarm collected by P.B. Sørensen (1966) were located and sent for analysis. One of them contains perovskite, but as this is somewhat altered it was not sent for dating.

References: Sørensen (1966); Larsen & Møller (1968); Walton & Arnold (1970); Larsen & Rex (1992).

Oqummiaq

Location: Oqummiaq, 25 km ESE of Frederikshåb Isblink, 62°23′N, 49°22′W.

Structure: A single lamprophyre dyke c. 1 m thick, striking 92°E.

Comment: The dyke cuts a plagioclase-porphyritic dyke that was also analysed but not dated as it is most probably Proterozoic. The chemical analysis and age suggest that the dyke is part of the monchiquite dyke swarm at Frederikshåb Isblink, see below.

Rock type: Monchiquite.

Lithology: The rock contains frequent centimetre-large megacrysts of clinopyroxene, amphibole and mica in a fine-grained groundmass of the same minerals, oxides and aphanitic matrix.

Age: Late Jurassic, Volgian, 150 Ma.

Old age determination: 172±5 Ma (K-Ar age on biotite, Bridgwater 1970).

New age determination: 149.8±4.4 Ma (Rb-Sr five-point isochron on phlogopite, this work).

Analyses: 1 major elements, 1 ICP-MS trace elements.

References: Bridgwater (1970); A.K. Higgins (personal communication).

Dykes around Frederikshåb Isblink

Location: Lamprophyre dykes are known from many localities near Frederikshåb Isblink, particularly north of it. The general area is 62°30′N–63°N, 49°30′W–50°40′W. The Oqummiaq dyke (see above) is situated 20 km SE of this swarm and is now considered to be part of it.

Structure: The dykes form a loose swarm with general dyke trends running N–S, i.e. slightly oblique to the coast-parallel TD dykes in the same area. With one exception the dykes are max 2.5 m wide, usually 1 m or less, and they occur with equal frequency from the coast to the Inland Ice. The exceptional dyke is a 20 m wide phonolite dyke in the coastal zone which can be followed over more than 16 km along the coast.

Rock types: The dykes have a large compositional range from carbonatite, alnöite (melilitite) and monchiquite (olivine nephelinite and nephelinite) through evolved monchiquite to phonolite (the original terminology in parentheses). The ultramafic to mafic rocks are considered to be genetically related. Detailed descriptions are found in Hansen (1979,1980, 1981, 1984) except for the phonolites which were recognised as being unrelated to the other rocks.

Lithologies: Varying according to the rock type. See references.

Ages: Older age determinations showed a large range of ages for the monchiquites from 116 Ma to 144 Ma, and 152 Ma for an alnöite. New precise age determinations have shown that the monchiquite ages were erroneously young.

New age determinations have been made for each of the compositional groups. Alnöite: 152.1±1.6 Ma (U-Pb on perovskite); olivine monchiquite 149.2±2,7 Ma (Rb-Sr five-point isochron on phlogopite); monchiquite: 156±14 Ma (Rb-Sr one-point model age calculated with the $^{87}Sr/^{86}Sr$ initial ratio of 0.7035±0.0002 obtained for two other dykes in the swarm).

The phonolites have not been dated before. Their age is 105.4±1.5 Ma ($^{40}Ar/^{39}Ar$ on whole rock).

Alnöite-monchiquite: Late Jurassic, Kimmeridgian to Tithonian, 149–152 Ma.

Phonolite: Early Cretaceous, Albian, 105 Ma. This is a large, coast-parallel dyke.

Analyses: 36 major elements, 20 ICP-MS trace elements.

References: Hansen & Larsen (1974); Hansen (1979, 1980, 1981, 1984); Larsen & Rex (1992).

Lamprophyre dykes near Færingehavn

Location: In the coastal region near Færingehavn, 63°38′–42′N, 51°30′–35′W, six localities with ultramafic lamprophyre dykes have been found along the coast of islands and skerries over an 8 km stretch, and there may well be more.
Structure: The dykes strike NE–SW and are 15–50 cm thick.
Rock type: Aillikite grading into carbonatite.
Lithology: One locality is an assemblage of carbonate-rich veins, whereas the other dykes are all mica-rich, with phenocrysts of phlogopite, olivine and clinopyroxene in a groundmass of the same minerals plus oxides (including perovskite), apatite and abundant carbonate. One dyke contains rounded ultramafic xenoliths of pyroxenite, amphibole-clinopyroxene-apatite rocks, dunite and garnet granulite.
Age: Mesozoic, probably Jurassic. The swarm ought to be re-dated.
Old age determinations: 175±7 Ma, 185±7Ma, 196±8 Ma (K-Ar on phlogopite, Larsen & Rex 1992). The age range is larger than the analytical uncertainty.
Analyses: 7 major elements, 7 ICP-MS trace elements.
References: Larsen & Rex (1992).

Dykes in the Godthåbsfjord region

Location: Around the mouth of Ameralik fjord and islands west if it; also in Malenebugten and probably in Kobbefjord, in the general area 64°05′–11′N, 51°30′–50′W. The area is poorly delimited and more work should be done on this swarm.
Structure: Scattered E–W- to NW–SE-trending basic dykes up to 2 m thick.
Rock type: Camptonite.
Lithology: Plagioclase-phyric basalt with a medium-to-finegrained groundmass of plagioclase, clinopyroxene, oxides, olivine, and accessory apatite and biotite. Carbonate fills ocelli and is sometimes disseminated in the groundmass. One NW-trending dyke (the most mafic) contains resorbed xenocrysts and xenoliths of glass-clear plagioclase and olivine+clinopyroxene.
Comment: It proved impossible to locate McGregor's sample collection. Only two samples were found, one of these the remains of the earlier dated sample. Therefore, H.K. Olsen (Nuuk) kindly revisited and sampled four dyke localities of which three are shown on the 1:100 000 geological map.
Age: Early Eocene, 51 Ma.
Old age determination: 57.2±1.1 Ma (whole-rock K-Ar, Bridgwater 1970). The sample is altered.
New age determination: 51.44±0.88 Ma (40Ar/39Ar on separated plagioclase). The sample has excess argon which may explain the discrepancy to the earlier measurement.
Analyses: 6 major elements, 6 ICP-MS trace elements.
References: Bridgwater (1970); McGregor (1993).

The Søndre Isortoq dyke swarm

Location: Dykes occurring in a c. 20 km by 40 km area around the outer part of the fjord Søndre Isortoq, east and south-east of Maniitsoq town in the area 65°15′–30′N, 52°10′–45′W. It is possible that the swarm extends farther to the north.

Comments: The swarm was found during prospecting work by Kryolitselskabet Øresund A/S and was described in a company report by Juhava (1974). The swarm was described by Larsen *et al.* (1999) as the Sukkertoppen dyke swarm, but as there are several other dykes in this region, a more specific name has been chosen here.

Structure: The swarm is weakly arcuate, with strikes varying from NW in the southern part to WNW in the northern part so that the dykes are approximately coast-parallel; however, strikes vary between N and W.

Rock type: Camptonite. One dyke is an alkali basalt.

Lithology: Phenocrysts and xenocrysts in varying proportions of plagioclase, clinopyroxene, brown amphibole (kaersutite) and olivine in a groundmass of the same minerals and Fe-Ti-oxides, brown mica, apatite and isotropic matrix (zeolite?). Ocelli filled with carbonate or zeolite or both are common.

Age: Paleocene to Eocene, Alkali basalt 58 Ma; camptonite 55 Ma.

Old age determination on camptonite: 55.2±1.1 Ma (40Ar/39Ar on separated kaersutite, a rather poor age because of excess argon, Larsen *et al.* 1999).

New age determinations: alkali basalt: 58.05+0.64 Ma (40Ar/39Ar on separated plagioclase); camptonite: 55.42+0.61 Ma (40Ar/39Ar on whole rock); traces of excess argon.

Analyses: 38 major elements, 13 ICP-MS trace elements.

References: Juhava (1974); Larsen *et al.* (1999).

The Qaqarssuk carbonatite complex and associated dykes

Location: In an inland area 57 km due east of Maniitsoq town, 65°21.5′–24.5′N, 51°38′–44′W.

Comments: The Qaqarssuk carbonatite complex as such is not included in this compilation. Many analyses of rocks and minerals exist, and the complex has been described in a monograph (Knudsen 1991). However, the complex includes lamprophyre dykes and these are included here.

Structure: Lamprophyre dykes occurring within and immediately outside the carbonatite complex. The dykes cut the carbonatites and fenites of the complex and are themselves cut by carbonate veins.

Rock type: Aillikite. One sample is marginally a monchiquite. The rocks were termed monchiquite by Larsen et al (1983, 1992), but as the rocks are ultramafic the correct term is aillikite.

Lithology: Phenocrysts of phlogopite, clinopyroxene and apatite in a carbonate-rich fine-grained groundmass with accessory Fe-Ti oxides and pyrochlore. In some cases there is extensive reaction with the sidewall. The dykes contain inclusions of the various rock types of the complex.

Age: Middle Jurassic, Callovian, 166 Ma.

Old age determination: 174±7 Ma (K-Ar on separated phlogopite, Larsen *et al.* 1983). The same age as obtained for the Qaqarssuk carbonatite complex (Larsen *et al.* 1983).

New Rb-Sr age determination: 165.7±1.2 Ma (nine-point Rb-Sr isochron on separated phlogopite from two samples from the carbonatite complex and a cross-cutting dyke (Heaman *et al.* unpublished).

Analyses: 4 major elements, 2 ICP-MS trace elements.

References: Larsen *et al.* (1983); Knudsen (1986, 1991); Knudsen & Buchardt (1991); Larsen & Rex (1992).

Fossilik

Location: In an inland area 5 km due east of the Qaqarssuk carbonatite complex, 65°22.7′N, 51°32.0′W. The area is only around 400 m by 50 m.

Structure: Poorly exposed igneous rocks in the vicinity of occurrences of fossiliferous limestone blocks of Ordovician age. Probably a volcanic explosion breccia (see comment) and possibly also associated with dykes.

Comment: The Fossilik locality was found during prospecting work by Kryolitselskabet Øresund A/S in 1965. It was described by Poulsen (1966) as "situated….. between two parallel faults striking 060°." The outcrop was described as "a breccia with rounded and angular blocks, up to 1 m^3 in diameter, of Precambrian crystalline rocks and a variety of sediments. These include shales, sandstones, limestones, and dolomites. The matrix of the breccia is ferruginous carbonate." Poulsen (1966) suggested that "a fissure was opened towards the close of the Ordovician……..The fissure was filled with debris washed out from the surrounding Palaeozoic beds and the Precambrian basement. The material was then cemented with carbonate."

The locality was subsequently drilled and cored by Kryolitselskabet Øresund A/S in 1968. The drill cores revealed that the matrix to the breccia is an igneous rock rich in carbonate and phlogopite. Analysis of the matrix has shown beyond doubt that it is of igneous origin. Therefore, the explanation of the occurrence as a cemented washout deposit is invalidated. It is more likely that the breccia is of volcanic origin, and it could have formed as a fall-back deposit into a crater formed by a violent volcanic explosion that shattered the overlying rocks.

Rock type: Aillikite.

Lithology: Phenocrysts of phlogopite, clinopyroxene and ilmenite in a groundmass of carbonate, magnetite and phlogopite.

Age: Middle Jurassic, Callovian, 164 Ma.

New age determination: 164.2±1.8 Ma (five-point Rb-Sr isochron on phlogopite (Heaman *et al.* unpublished), i.e. within 1σ the same age as the Qaqarssuk carbonatite complex.

Analyses: 4 major elements, 3 ICP-MS trace elements.

References: Poulsen (1966); Stouge & Peel (1979); Secher & Stendal (1989); Hansen (2002).

The Sisimiut-Kangerlussuaq region

Comment: No young dykes are known between 66°N and 68°N. There are many alkaline dykes: carbonatites, kimberlites, aillikites and lamproites, but they are Proterozoic. There are also unspecified lamprophyres, but no occurrences are sufficiently different from the known Proterozoic ones to have attracted attention as candidates for younger ages. If there are any young dykes in this region, they will be difficult to identify.

Intrusions in the Aasiaat region

Location: South of Disko Bugt and Grønne Ejland, 68°11′–51′N, 50°55′–53°10′W.
Structure: A few large undeformed basic dykes that show columnar jointing and are strongly chilled towards the country rock, sometimes with glassy selvages. Also, a large sill intruded into Cretaceous sandstone on Grønne Ejland where the sill forms most of the outcrop.
Comments: Three long dykes are known to occur within the area. The largest dyke (the 'globule dyke' of Ellitsgaard-Rasmussen 1952) strikes due N and can be followed over 60 km with widths varying from >50 m in the north to 20–25 m in other places. A 6–8 m thick side-stepping dyke at Manermiut trends NNE, and the same dyke is found on Qaarajuttuaraq 10 km farther north. A dyke in Sydostbugt trends WNW and can be followed over 13 km with widths of 6–15 m. A fourth dyke near Aasiaat town is only known from one locality, but as the Sydostbugt dyke runs towards it and is compositionally identical to it, they may be the same dyke.

On the aeromagnetic map, the globular dyke and the Manermiut dyke are both very conspicuous linear features showing reversed magnetic polarity. On this map the Manermiut dyke can be followed along the coast for 110 km from 15 km south of Kangaatsiaq northwards to halfway across the Disko Bugt. The Sydostbugt dyke is magnetically unconspicuous, and there are no traces of any other large dykes. The Grønne Ejland sill is seen to be part of a much larger sill complex in the Disko Bugt area.
Rock type: Tholeiitic basalt.
Lithology: Plagioclase-clinopyroxene-olivine-phyric to aphyric basalt with medium- to fine-grained to aphanitic groundmass of plagioclase, clinopyroxene and Fe-Ti oxides.
Age: Paleocene, 60–56 Ma. The large Manermiut dyke should also be dated.
Newer age determination: the globule dyke: 55.77±0.24 Ma (40Ar/39Ar analysis on plagioclase).
New age determination: Grønne Ejland sill: 60.45±0.88 Ma (40Ar/39Ar analysis on plagioclase).
Analyses: 8 major elements, 6 ICP-MS trace elements.
References: Ellitsgaard-Rasmussen (1952); Henderson (1969); Arting (2004).

Post-volcanic intrusions in the Disko–Svartenhuk Halvø region

Comment: The extrusive rocks of the West Greenland volcanic province are not included in this compilation. The lavas are mainly tholeiitic picrites and basalts, and the youngest lavas are transitional to alkaline basalts. They are dated to c. 61–55 Ma (Storey *et al.* 1998, and unpublished data). However, a number of post-volcanic intrusions are included in the compilation. These have compositions that are not known among the extrusive rocks, and some of them cut the whole lava pile.

Dykes in western Disko
Location: Western Disko, 69°20′–70°20′N, 54°–55°W.
Structure: Dykes that cut the whole pile of Paleocene basalt lavas. Strikes are mainly N–S to NNW–SSE, thicknesses are variable but up to 15 m. Most are vertical but some form inclined sheets.
Rock type: Tholeiitic basalt.
Lithology: Plagioclase-clinopyroxene-olivine-phyric to aphyric basalts.
Age: Eocene, 54 Ma.
Newer age determination: 54.0±0.3 Ma (40Ar/39Ar analysis on plagioclase, Storey *et al.* 1998).
Analyses: 12 major elements, 12 ICP-MS trace elements.
References: Pedersen (1977); Storey *et al.* (1998); Pedersen *et al.* (2003).

Sills and dykes in south-eastern Nuussuaq
Location: South-eastern Nuussuaq, 70°02′–17′N, 52°00′–21′W.
Structure: Sills and dykes cutting sandstones and gneiss basement. The majority of these are associated with the major, deep boundary fault that delimits the Nuussuaq Basin to the east. The sills are very prominent at Atanikerluk and Tartunaq and form many metres thick, brown intrusions that can be followed north into the Saqqaq valley.
Rock type: Enriched tholeiitic basalt.
Lithology: Plagioclase-clinopyroxene-olivine-phyric to aphyric basalts.
Age: Late Paleocene, 56 Ma.
New age determination: 56.47±0.83 Ma ((40Ar/39Ar analysis on whole rock).
Analyses: 6 major elements, 2 ICP-MS trace elements.
References: Koch (1959); Pedersen *et al.* (1993).

Alkaline intrusions on Disko and Nuussuaq

Location: Small skerries (Avatarpaat) west of Disko; and the Itilli valley in western Nuussuaq. There are probably more alkaline dykes, but as they are not visually different from the syn-volcanic tholeiitic dykes, they are difficult to identify. No lamprophyres have been found.

Structure: A volcanic neck exposed on the Avatarpaat skerries; and a single dyke in the Itilli valley.

Rock type: Alkali basalt.

Lithology: Plagioclase-clinopyroxene-olivine-phyric to aphyric basalts.

Age: Eocene? to Oligocene.

Avatarpaat is dated at 27.6±0.6 Ma (Oligocene, 40Ar/39Ar analysis on whole rock, Storey *et al.* 1998). The age of the Itilli dyke is not known.

Analyses: 4 major elements, 2 ICP-MS trace elements.

References: Pedersen (1975); Storey *et al.* (1998).

Ubekendt Ejland

Location: Western side of Ubekendt Ejland, 71°03′–17′N, 53°45′–54°01′W.

Structure: Swarm of small dykes striking NNW, 0.5–1 m thick. The dykes are associated with carbonate-impregnated fault zones.

Rock type: Monchiquite, camptonite.

Lithology: Clinopyroxene-olivine-(sometimes plagioclase-)phyric rocks with groundmass of clinopyroxene, amphibole, mica, plagioclase, iron oxides and aphanitic foid-bearing matrix. Carbonate occurs in ocelli and veins, and replacing earlier minerals. A few dykes contain mantle xenoliths of wehrlite, pyroxenite and spinel lherzolite and megacrysts of olivine, clinopyroxene, amphibole, alkali feldspar and spinel.

Age: Latest Eocene, 34 Ma.

The best age is 34.3±0.2 Ma (40Ar/39Ar analysis on separated hyalophane, Storey *et al.* 1998).

Analyses: 15 major elements, 2 ICP-MS trace elements, 7 partial REE analyses.

References: Drever & Game (1948); Clarke & Pedersen (1976); Larsen (1981, 1982, 1983); Clarke et al (1983); Bernstein & Brooks (1998); Storey *et al.* (1998).

Svartenhuk Halvø

Location: Southern Svartenhuk Halvø, 71°22′–27′N, 54°00′–55°15′W.

Structure: Small dykes cropping out along the south coast of Svartenhuk Halvø. Camptonite dykes strike 114°ESE and are around 3 m thick; some are shown on the 1:100 000 geological map. Alkali basalt dykes strike 47–68°NE and are 4–10 m thick.

Rock type: Camptonite and alkali basalt.

Lithology: Camptonites have phenocrysts of clinopyroxene, olivine and oxide in a groundmass of plagioclase, clinopyroxene, brown amphibole, oxide and aphanitic mesostasis. Ocelli are filled with foids or carbonate or both. Alkali basalts are aphyric to weakly plagioclase-phyric basalts with red-brown clinopyroxenes.

Age: Unknown except they cut the lavas of the Vaigat Formation, i.e. they are younger than 60 Ma.

Analyses: 4 major elements, 2 ICP-MS trace elements.

References: Larsen (1983); unpublished data.

Inland areas east of Ubekendt Ejland and Svartenhuk Halvø

Location: In the general area around Upernivik Ø, 71°–72°N, 52°–53°20′W, there are scattered reports of lamprophyres, mainly as loose blocks.
Comment: More should be done to locate the outcrops, map the distribution, and date these rocks, particularly as one sample is a kimbelite. There is possibly more than one group.
Structure: On the island of Qinngussaq north of Upernivik Ø lamprophyre dykes are found along the coast and shown on the geological map. In the Karrat Isfjord area and on the Qiioqi peninsula, they are found mainly as loose blocks of local aspect or in moraines; blocks of chill zones occur, and the blocks have the aspect of dyke rocks.
Rock type: Aillikite, kimberlite.
Lithology: Aillikites have phenocrysts and megacrysts of phlogopite, green clinopyroxene, oxides and apatite in a groundmass of the same minerals in a carbonate matrix. Kimberlites have megacrysts of olivine and oxide and frequent phenocrysts of olivine in a groundmass of olivine, phlogopite, perovskite, carbonate and serpentine.
Age: Unknown. Dating should be done. They cut the Proterozoic basement and thus could be old.
Analyses: 4 major elements, 2 ICP-MS trace elements.
References: Henderson (1970), unpublished field diaries.

Results

Rock types

The following rock types have been encountered, listed with decreasing degrees of silica (SiO_2) saturation and increasing enrichment in alkalies and volatiles.

Basaltic rocks (plagioclase as phenocrysts and in groundmass):
Tholeiitic basalt
Enriched or transitional basalt
Alkali basalt
Phonolite
Lamprophyres (Phenocrysts of one or more of clinopyroxene, olivine, amphibole, biotite):
Camptonite: plagioclase in groundmass and sometimes also as phenocrysts, but also high volatile contents; essentially 'wet' alkali basalts.
Monchiquite and olivine monchiquite: no plagioclase; glass or feldspatoid in groundmass.
Alnöite: ultramafic, with melilite.
Aillikite: ultramafic, carbonate-rich, no melilite.
Kimberlite: ultramafic, carbonate-rich, difficult to distinguish from aillikite.
Carbonatite: more than 50% carbonate.

Age determinations

New age determinations were obtained for a number of occurrences for which age data have been either doubtful, imprecise or completely lacking. These new ages are given in summary form in Table 2, and details are shown in Appendix 1.

Nine samples were dated by the $^{40}Ar/^{39}Ar$ step-heating method. These samples represent the plagioclase-bearing rock types basalt, camptonite, and phonolite. The analytical work was done at Oregon State University, the Noble Gas Mass Spectrometry Laboratory led by professor Robert Duncan. The laboratory and method is described at http://www.coas.oregonstate.edu/research/mg/chronology.html. Six samples gave good to excellent plateau ages based on 56–89% of the released argon, and one sample gave an acceptable plateau age based on 40% of the released argon. Two samples with excess argon ($^{40}Ar/^{36}Ar > c.\ 300$) yielded no plateau ages but good isochron ages.

Four monchiquite samples were dated by Rb-Sr isotope analysis of phlogopite at Geospec Consultants Limited, Edmonton, Alberta, Canada. For two samples, well-fitted 5-point isochrons were obtained, with resulting estimates of initial $^{87}Sr/^{86}Sr$ ratios (Table 2). For two other samples only one phlogopite fraction was obtained so that the ages are model ages dependent on the choice of initial $^{87}Sr/^{86}Sr$ ratios.

One alnöite sample was dated by U–Pb isotope analysis of perovskite; this was done by L.M. Heaman, University of Alberta, Canada.

Table 2. New radiometric age determinations

^{40}Ar / ^{39}Ar age determinations		Total Fusion (Ma)	Plateau (Ma)				Inverse Isochron (Ma)	
Dyke swarm	Rock type	Age ± 2 σ	Age ± 2 σ	$Steps_1$	$\%^{39}Ar_1$	MSWD	Age ± 2 σ	$^{40}Ar/^{36}Ar$ ± 2 σ
Tuttutooq	Camptonite	212.4 ± 2.7	None				**114.7 ± 4.7**	1736 ± 94
TD Dykes	Basalt	146.5 ± 2.3	**140.3 ± 2.2**	7/11	79.9	1.42	140.4 ± 2.2	291.2 ± 28.0
Fred. Isblink	Phonolite	104.5 ± 1.5	**105.4 ± 1..5**	8/14	89.1	1.84	103.5 ± 2.9	308.8 ± 17.8
Godthåbsfjord	Camptonite	73.57 ± 0.97	None				**51.44 ± 0.88**	423.9 ± 8.4
Søndre Isortoq	Camptonite	68.43 ± 0.69	**55.42 ± 0.61**	4/10	39.8	1.93	54.97 ± 0.77	317.7 ± 25.1
Søndre Isortoq	Alkali basalt	59.12 ± 0.67	**58.05 ± 0.64**	6/9	89.1	1.06	57.75 ± 0.69	310.6 ± 14.0
Aasiaat	Enriched basalt	55.71 ± 0.21	**55.77 ± 0.24**	5/8	79.0	1.49	55.96 ± 0.26	251.7 ± 34.5
Grønne Ejland	Tholeiitic basalt	63.24 ± 0.91	**60.45 ± 0.88**	5/7	86.5	0.39	60.18 ± 0.99	302.2 ± 11.5
SE Nuussuaq	Enriched basalt	57.22 ± 0.84	**56.47 ± 0.83**	6/11	56.2	0.67	56.44 ± 0.88	295.9 ± 4.2

Samples irradiated at OSU TRIGA reactor for 6 hours at 1MW power. Neutron flux measured using FCT-3 biotite monitor (FCT age 28.03 Ma, Renne, *et al.*, 1994). Data reduced by ArArCALC software (Koppers 2002).
1. Plateau age data includes number of steps in the plateau (steps in plateau / total steps) and % 39Ar in plateau.
2. Preferred age in **BOLD TEXT.**

Rb-Sr and U-Pb age determinations

Dyke swarm	Rock type	Method	Age ± 2 σ (Ma)	Initial $^{87}Sr/^{86}Sr$
Oqummiaq	Ol. monchiquite	Rb-Sr 5-pt isoc.	**149.8 ± 4.4**	0.7034 ± 0.0002
Fred. Isblink	Ol. monchiquite	Rb-Sr 5-pt isoc.	**149.2 ± 2.7**	0.7035 ± 0.0002
Fred. Isblink	Alnöite	U-Pb	**152.1 ± 1.6**	
			Model age	Model init. $^{87}Sr/^{86}Sr$
Kvanefjeld	Monchiquite	Rb-Sr 1-pt mod.	1134 ± 17	0.70275 ± 0.00025
Fred. Isblink	Monchiquite	Rb-Sr 1-pt mod.	156 ± 14	0.7035 ± 0.0002

Geochemistry

Analytical methods

Nearly all the major element analyses in the compilation were made in the Rock Geochemical Laboratory at GGU/GEUS over a number of years. Most major elements were determined by X-ray fluorescence analysis (XRF) on glass discs fused with sodium tetraborate flux; Na_2O was determined by atomic absorption spectrometry, FeO by potentiometric titration, and the volatiles were determined as the loss on ignition corrected for uptake of oxygen during the ignition. In some cases separate H_2O and CO_2 determinations were made, but usually these two are lumped together under 'volatiles'. Details of the procedure since 1993 are given in Kystol & Larsen (1999).

Some trace elements were determined by XRF on pressed powder pellets. The major part of these analyses were made at the Geological Institute, University of Copenhagen, using standard analytical methods and with USGS reference materials for calibration.

In connection with this project, many samples were analysed for trace elements by inductively coupled plasma mass spectrometry (ICP-MS) at GEUS, using a modified version of the method described by Turner *et al.* (1999).

Samples analysed in other laboratories comprise some TD dykes analysed at University of Edinburgh and some of the dykes on Ubekendt Ejland. No differences between the laboratories have been noted.

Presentation of the geochemical data

Rocks and melts

A common assumption in petrological work is that the composition of a rock sample represents the composition of a melt. In phenocryst- and megacryst-rich rocks such as many of the lamprophyres in this data set, this assumption may not be fulfilled. Some rocks may represent melts that have lost crystals and others may represent melts plus accumulated crystals. Also, volatiles may have been lost or accumulated. This effect is difficult to correct for. In this treatment it is tentatively assumed that most samples represent melt compositions reasonably well, but some of the data scatter encountered will be due to the failure of this assumption.

Recalculation of the analyses

Volatile-poor rocks such as basalts are usually recalculated on a volatile-free basis before plotting because the volatiles were mainly introduced by secondary alteration processes, and thus the recalculation aims at restoring the composition to that of the original melt. However, in volatile-rich rocks such as the lamprophyres in this data set, the volatiles are mainly an intrinsic part of the original melt and should not be removed by recalculation. Therefore, none of the analyses in the plots shown here are recalculated volatile-free.

A useful calculated parameter for plotting is the *mg* number (100 × atomic $Mg/(Mg+Fe^{2+})$), which is a measure of the degree of evolution of mantle-derived melts. Melts derived directly from the mantle have *mg* numbers around 60–80, and melts with *mg* number <60 are evolved by crystallisation from a more Mg-rich parent melt. Rocks with *mg* number >80 do not represent melts but contain accumulated crystals, mainly of olivine. For the calculation of *mg* numbers, the iron oxidation ratio was adjusted to $Fe_2O_3/FeO=0.15$.

Major elements

In Fig. 2 the major elements are presented in a number of simple cross plots with *mg* number as abscissa. The data variation is very large, with *mg* numbers in an interval as wide as 16–89, because the dyke groups are of such variable compositions; however, many dyke groups stand clearly out as individual entities. The dykes at Frederikshåb Isblink comprise several sub-groups which can be recognised in the plots: olivine monchiquites have *mg* numbers 59–71, monchiquites have *mg* numbers 36–50, two evolved monchiquites have *mg* numbers 29–33, and three phonolites have *mg* numbers 16–22; alnöites and carbonatites have *mg* numbers 37–46.

The contents of SiO_2 and Al_2O_3 are highest in the basalts and camptonites and their evolved liquids (phonolites), lower in the monchiquites, and lowest in the ultramafic lamprophyres, kimberlites and carbonatites. The contents of CaO and volatiles are lowest in the basalts, higher in the camptonites and monchiquites, and highest in the ultramafic lamprophyres, kimberlites and cabonatites. For a given *mg* number there are two groups of FeO contents, with relatively low FeO in the Godthåbsfjord and Søndre Isortoq camptonites, the Ubekendt Ejland camptonites and monchiquites, the Qaqarssuk aillikites, and the Disko-Nuussuaq alkali basalts. This division thus cuts across rock type divisions.

TiO_2, Na_2O, K_2O and P_2O_5 are minor elements which all tend to be increased in alkaline melts, and their concentrations vary according to the composition of the melting source material, the degree of melting, and the nature of the minerals that crystallise from the melts during their evolution. It is clear that the West Greenland dyke swarms have individual levels of these elements, particularly TiO_2, which is a signal caused by the mantle material and melting processes as discussed below.

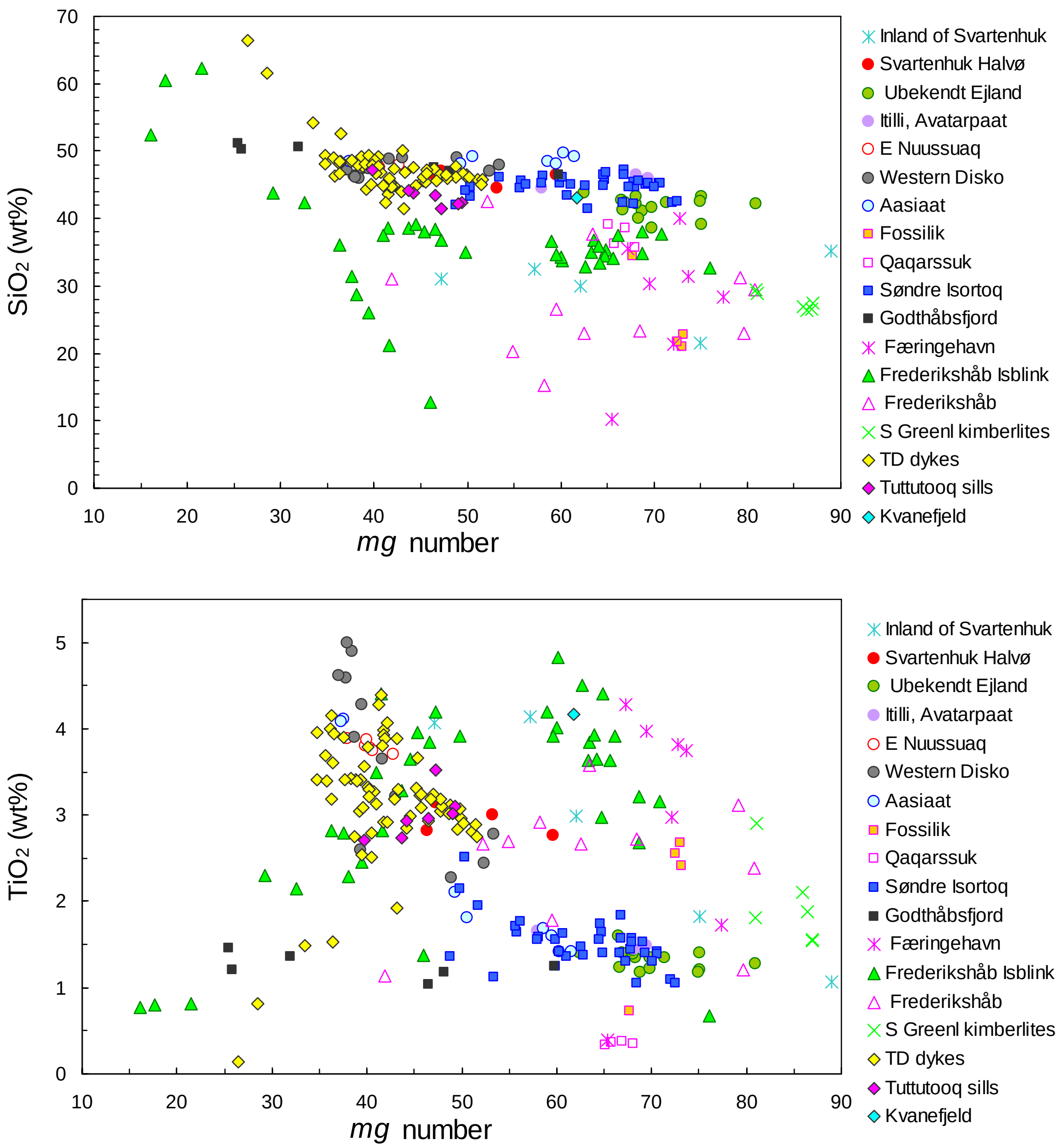
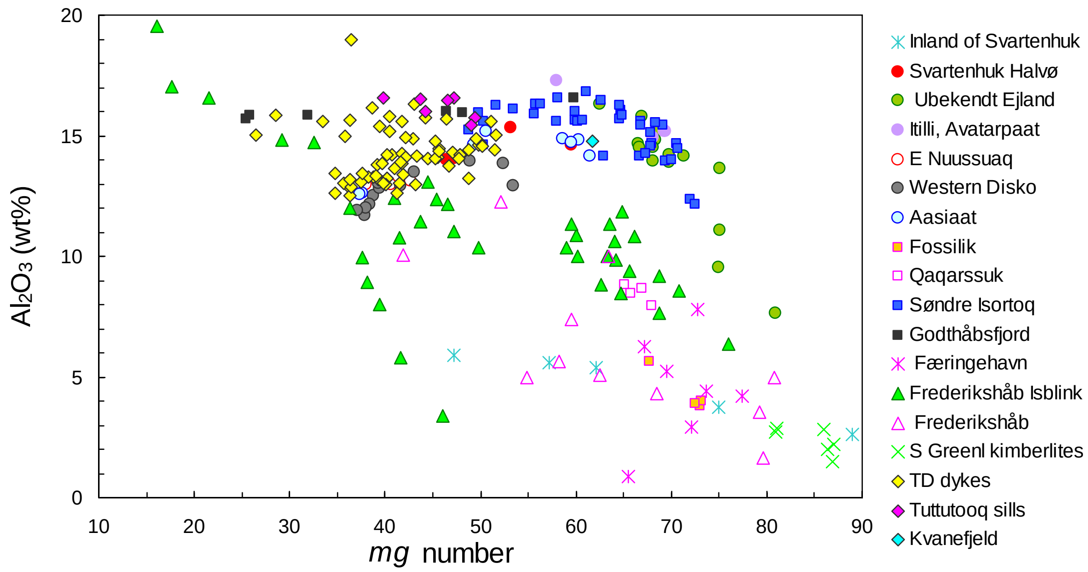
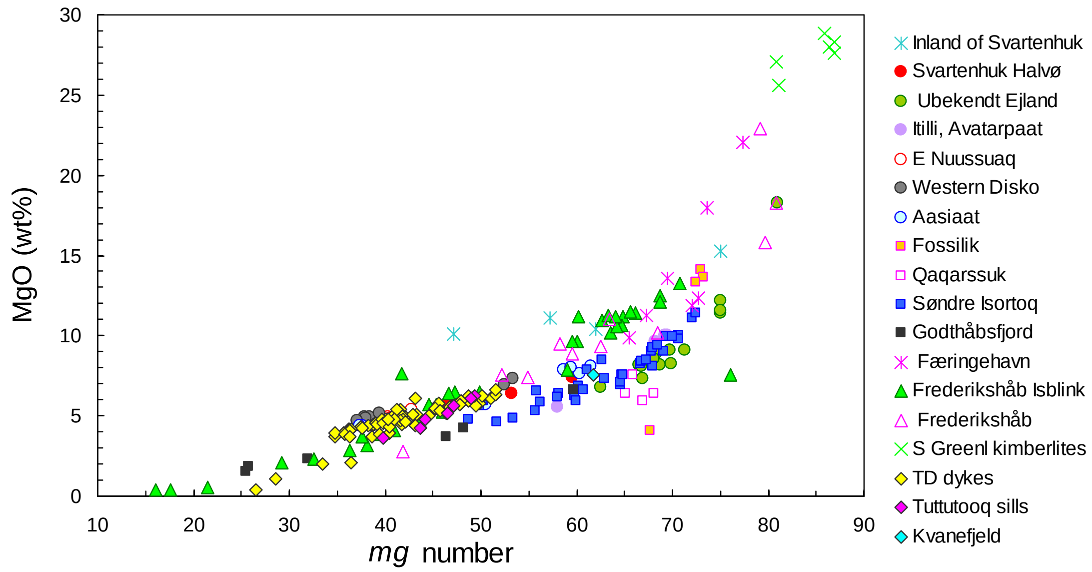


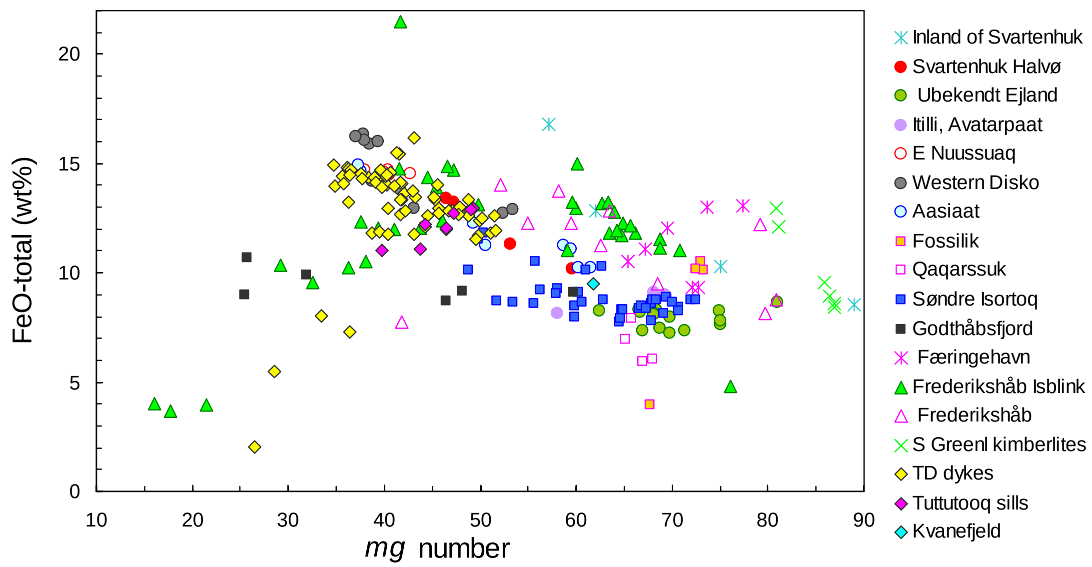
Fig. 2. (this and following pages). Major elements and volatiles for the young dykes in West Greenland. The analyses are not recalculated volatile-free. The *mg* number is atomic 100xMg/(Mg+$Fe2^+$), with the iron oxidation ratio adjusted to Fe_2O_3/FeO=0.15. The Kvanefjeld dyke is Proterozoic (Gardar) but is shown for comparison.



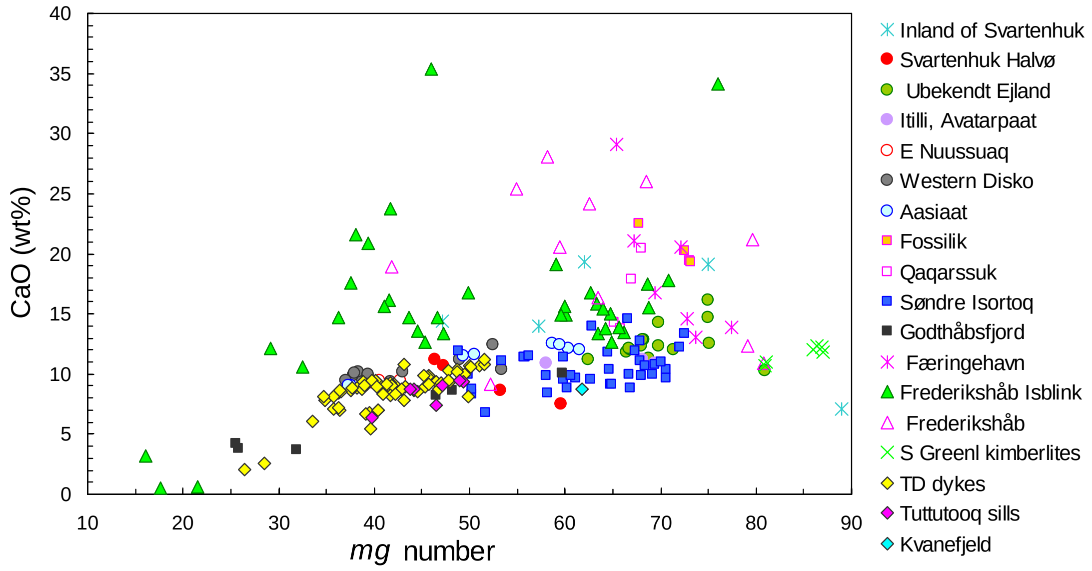
Al2O3 (wt%)
mg number
Inland of Svartenhuk
Svartenhuk Halvø
Ubekendt Ejland
Itilli, Avatarpaat
E Nuussuaq
Western Disko
Aasiaat
Fossilik
Qaqarssuk
Søndre Isortoq
Godthåbsfjord
Færingehavn
Frederikshåb Isblink
Frederikshåb
S Greenl kimberlites
TD dykes
Tuttutooq sills
Kvanefjeld

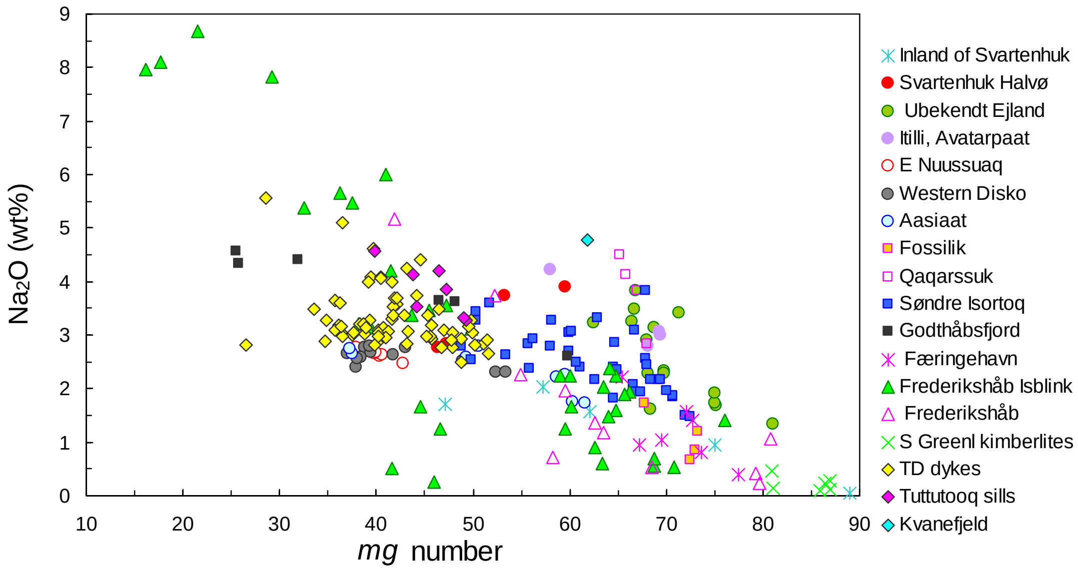


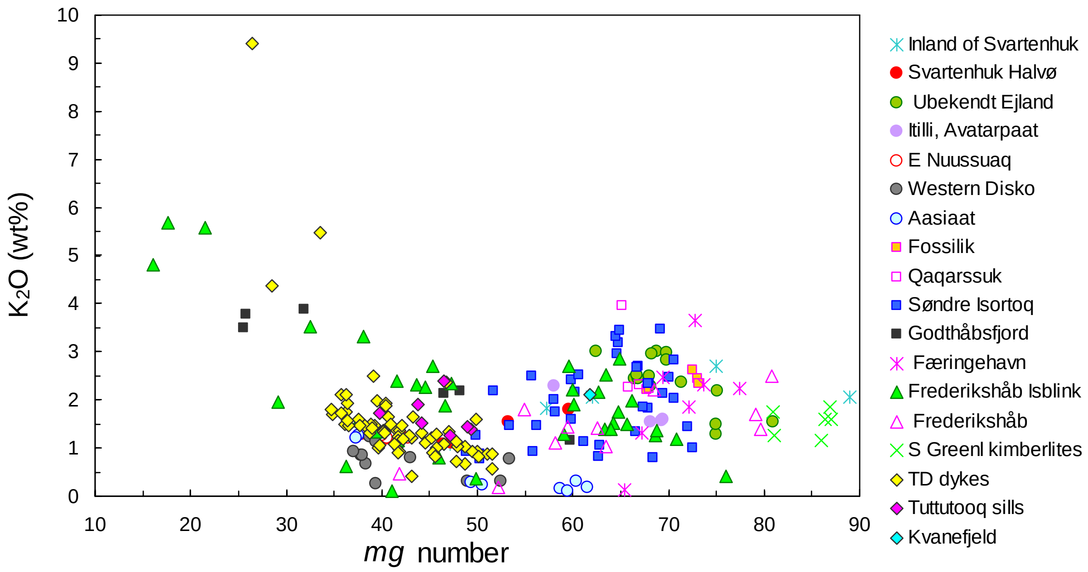
MgO (wt%)
mg number
Inland of Svartenhuk
Svartenhuk Halvø
Ubekendt Ejland
Itilli, Avatarpaat
E Nuussuaq
Western Disko
Aasiaat
Fossilik
Qaqarssuk
Søndre Isortoq
Godthåbsfjord
Færingehavn
Frederikshåb Isblink
Frederikshåb
S Greenl kimberlites
TD dykes
Tuttutooq sills
Kvanefjeld



FeO-total (wt%)
mg number
Inland of Svartenhuk
Svartenhuk Halvø
Ubekendt Ejland
Itilli, Avatarpaat
E Nuussuaq
Western Disko
Aasiaat
Fossilik
Qaqarssuk
Søndre Isortoq
Godthåbsfjord
Færingehavn
Frederikshåb Isblink
Frederikshåb
S Greenl kimberlites
TD dykes
Tuttutooq sills
Kvanefjeld


CaO (wt%)
mg number
Inland of Svartenhuk
Svartenhuk Halvø
Ubekendt Ejland
Itilli, Avatarpaat
E Nuussuaq
Western Disko
Aasiaat
Fossilik
Qaqarssuk
Søndre Isortoq
Godthåbsfjord
Færingehavn
Frederikshåb Isblink
Frederikshåb
S Greenl kimberlites
TD dykes
Tuttutooq sills
Kvanefjeld


Na2O (wt%)
mg number
Inland of Svartenhuk
Svartenhuk Halvø
Ubekendt Ejland
Itilli, Avatarpaat
E Nuussuaq
Western Disko
Aasiaat
Fossilik
Qaqarssuk
Søndre Isortoq
Godthåbsfjord
Færingehavn
Frederikshåb Isblink
Frederikshåb
S Greenl kimberlites
TD dykes
Tuttutooq sills
Kvanefjeld


K2O (wt%)
mg number
Inland of Svartenhuk
Svartenhuk Halvø
Ubekendt Ejland
Itilli, Avatarpaat
E Nuussuaq
Western Disko
Aasiaat
Fossilik
Qaqarssuk
Søndre Isortoq
Godthåbsfjord
Færingehavn
Frederikshåb Isblink
Frederikshåb
S Greenl kimberlites
TD dykes
Tuttutooq sills
Kvanefjeld

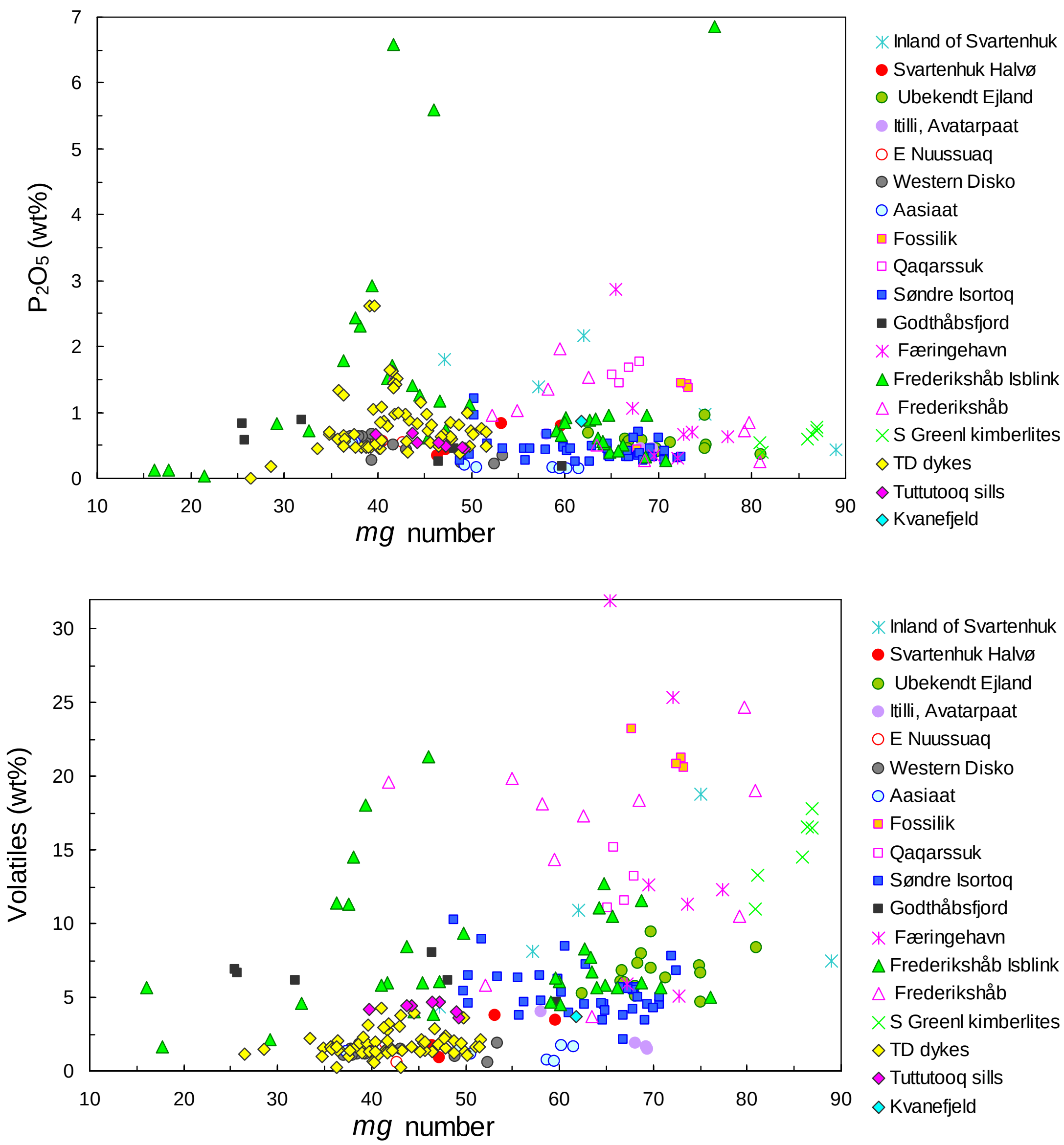


Fig. 2 (concluded). Major elements and volatiles for the young dykes in West Greenland.

Trace elements

The compatible elements Ni and Cr are plotted against *mg* number in Fig. 3. Both elements decrease with increasing evolution of the melts because they are removed in the crystallising minerals olivine and chromite. However, in the primitive mantle melts with *mg* numbers >60 there are differences in Ni and Cr that cannot be ascribed to fractionating minerals but rather to different proportions of minerals taking part in the melting process. Thus, it appears that there is less olivine (Ni) and spinel (Cr) in the melting mineral assemblages of the monchiquites and ultramafic lamprophyres than of the camptonites and basalts.

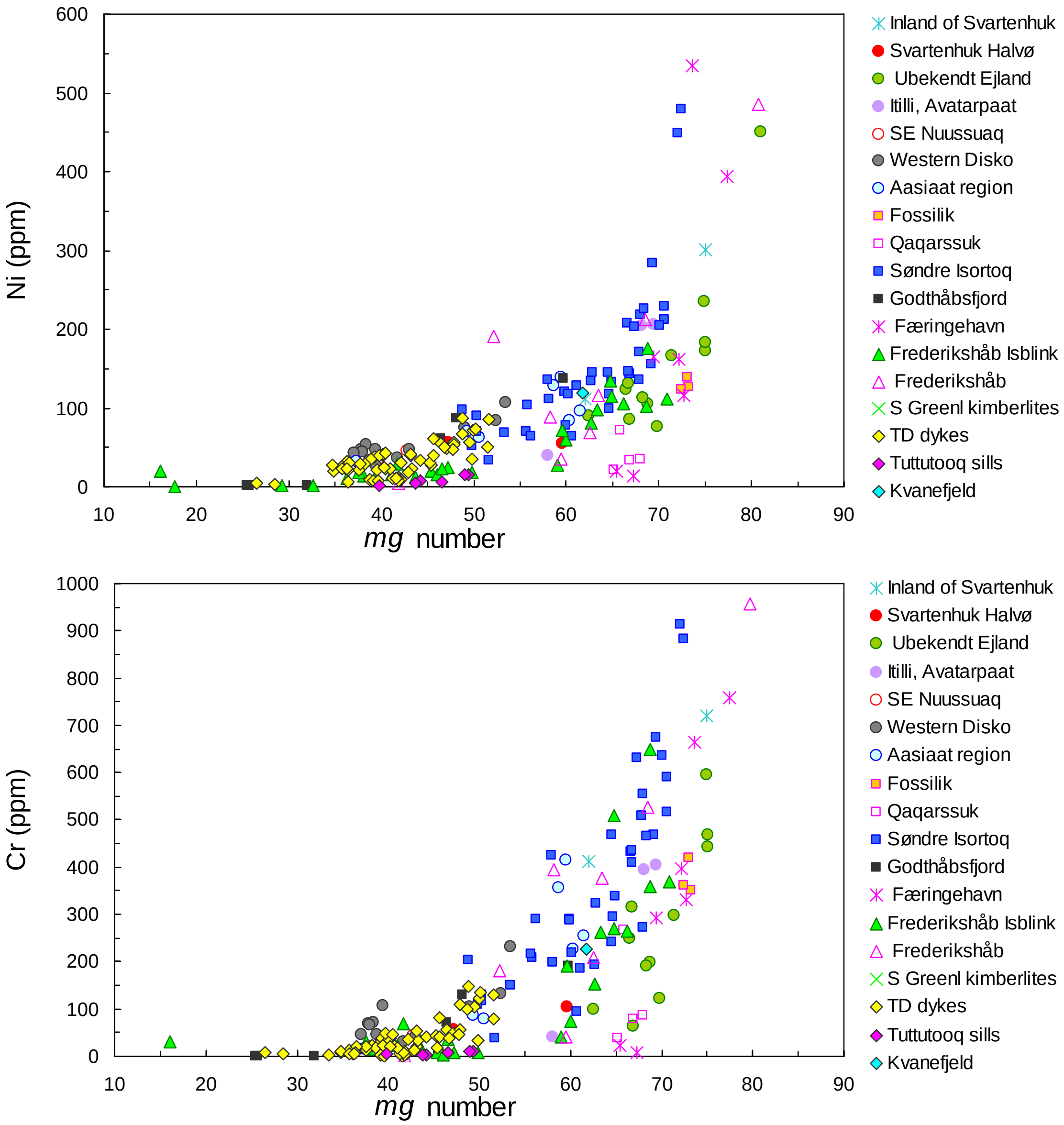


Fig. 3. The compatible trace elements Ni and Cr *vs mg* number. The kimberlites and kimberlite-like aillikite have Ni >600 ppm and Cr >1000 ppm and are off-scale in these diagrams.

The incompatible elements, which in general increase in the melt during evolution, are plotted in Fig. 4 in multi-element diagrams. In these diagrams the elements are ordered with decreasing incompatibility from left to right and normalised to a primitive mantle composition. In addition, the geochemically coherent rare earth elements (REE) La to Lu are plotted separately, normalised against a chondrite composition (Fig. 5). All normalisation values are from McDonough & Sun (1995). In general, the contents of the highly incompatible elements Rb to Nd are lowest in the tholeiitic basalts and increase systematically in the enriched and alkali basalts through the camptonites and monchiquites to maximum values in the ultramafic lamprophyres and carbonatites. The contents of the least incompatible elements are much more constant. A useful measure of the general slope from left to right of a pattern is the ratio Nb_N/Yb_N (N for normalised); Nb is the most incompatible element that is also immobile during secondary alteration processes. These diagrams will be discussed during the presentation of the individual dyke groups below.

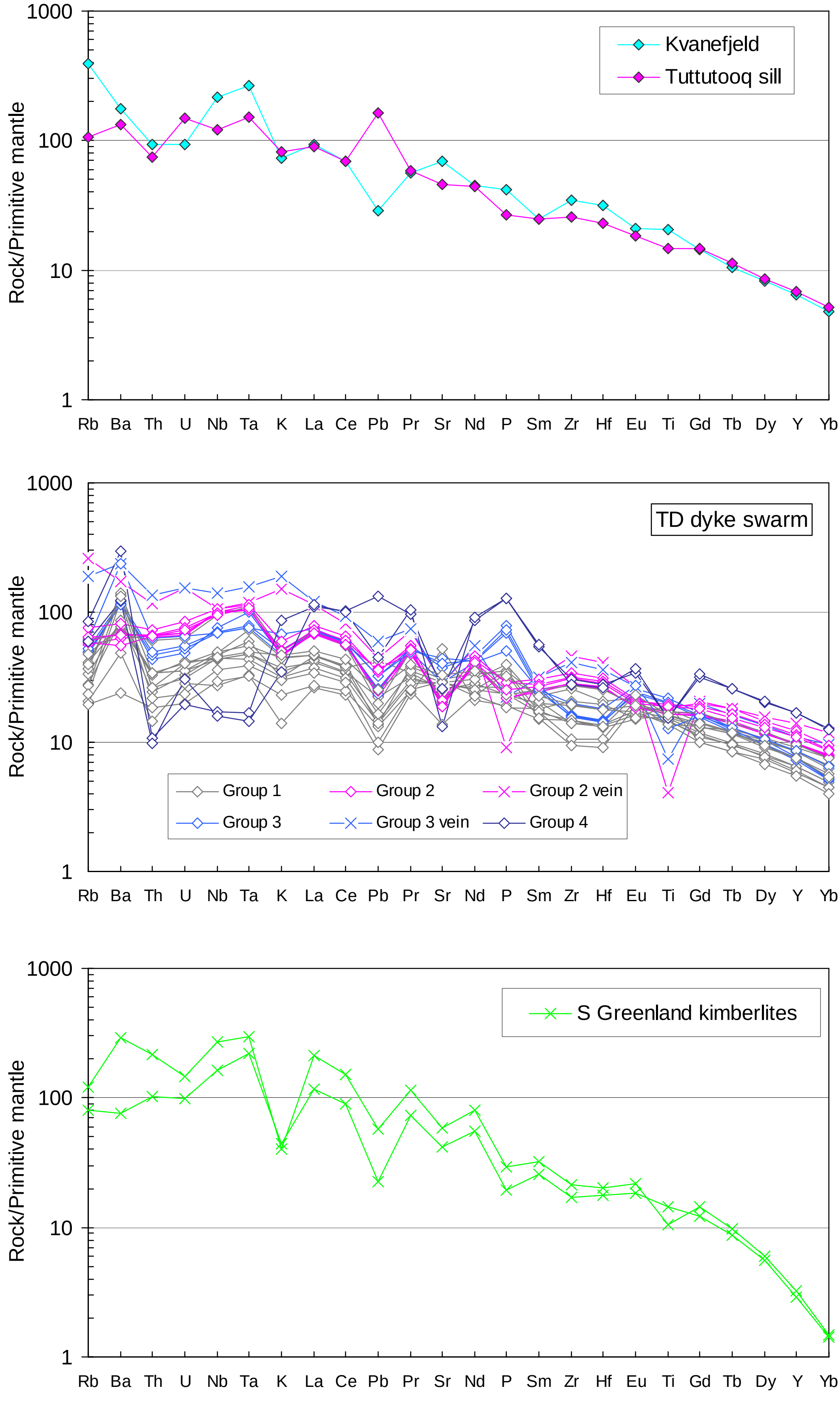


Fig. 4 (this and following pages). Multi-element patterns for the young dykes in West Greenland. See text for discussion of the individual groups.

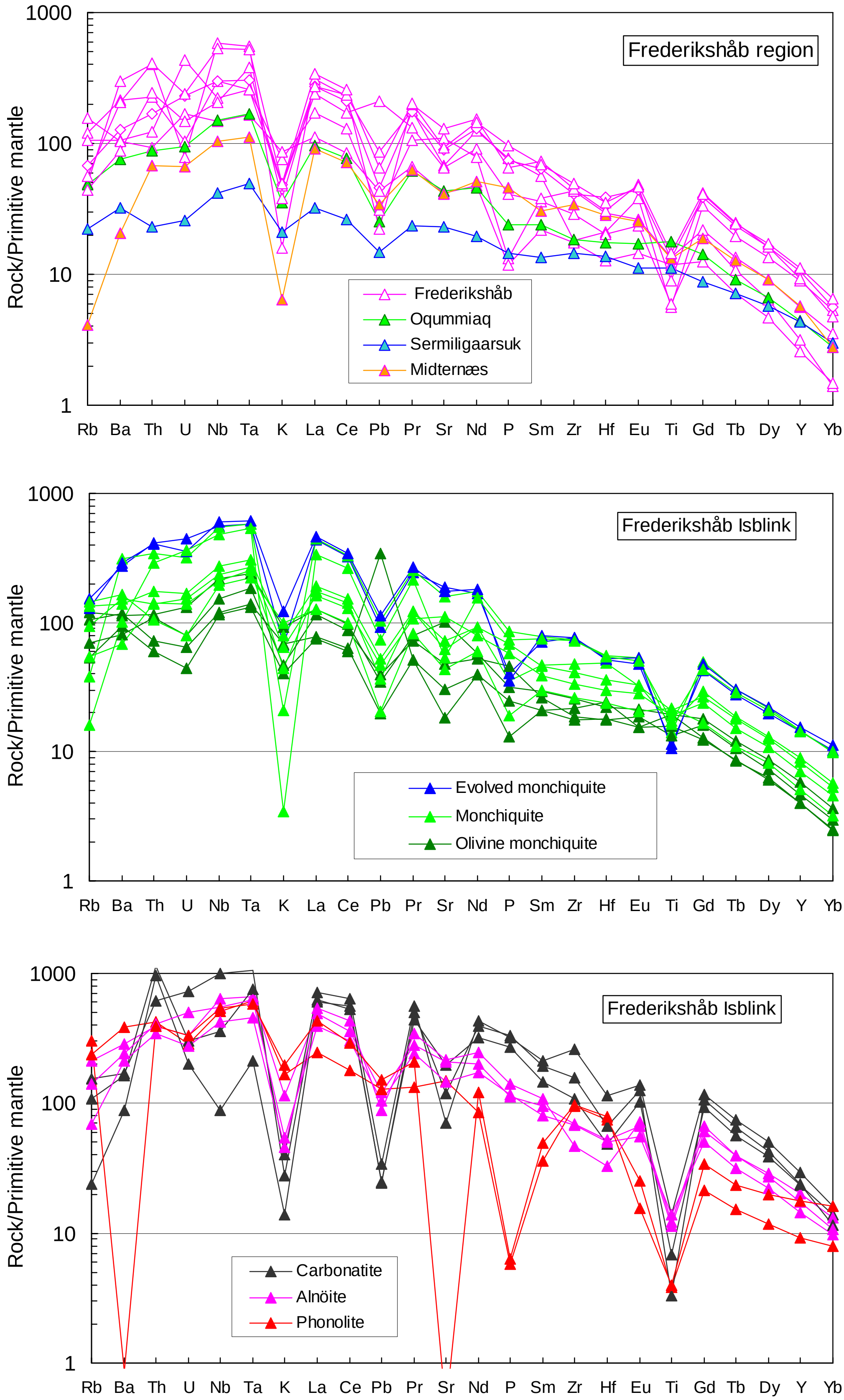


Fig. 4 (continued). Multi-element patterns for the young dykes in West Greenland.

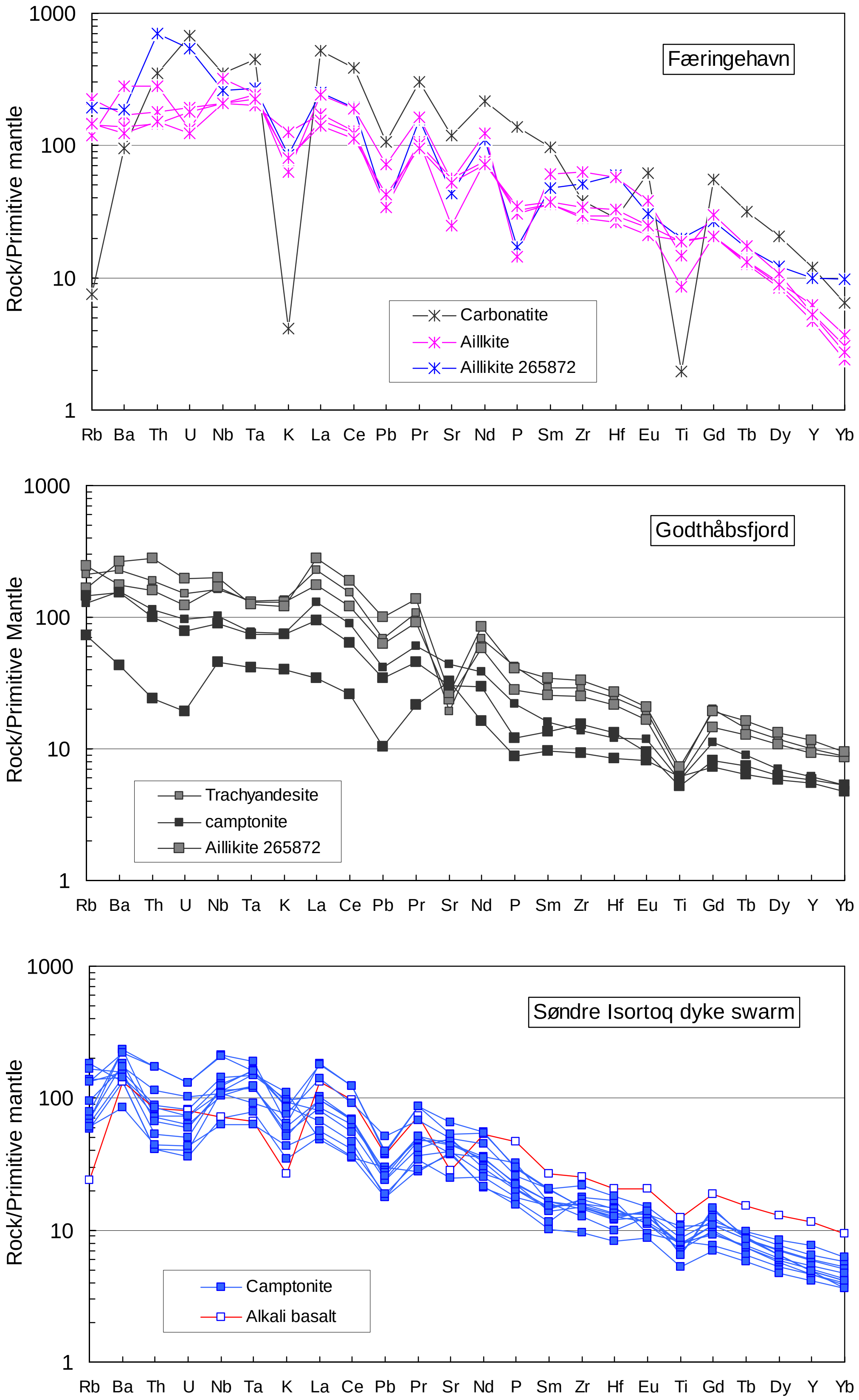


Fig. 4 (continued). Multi-element patterns for the young dykes in West Greenland.

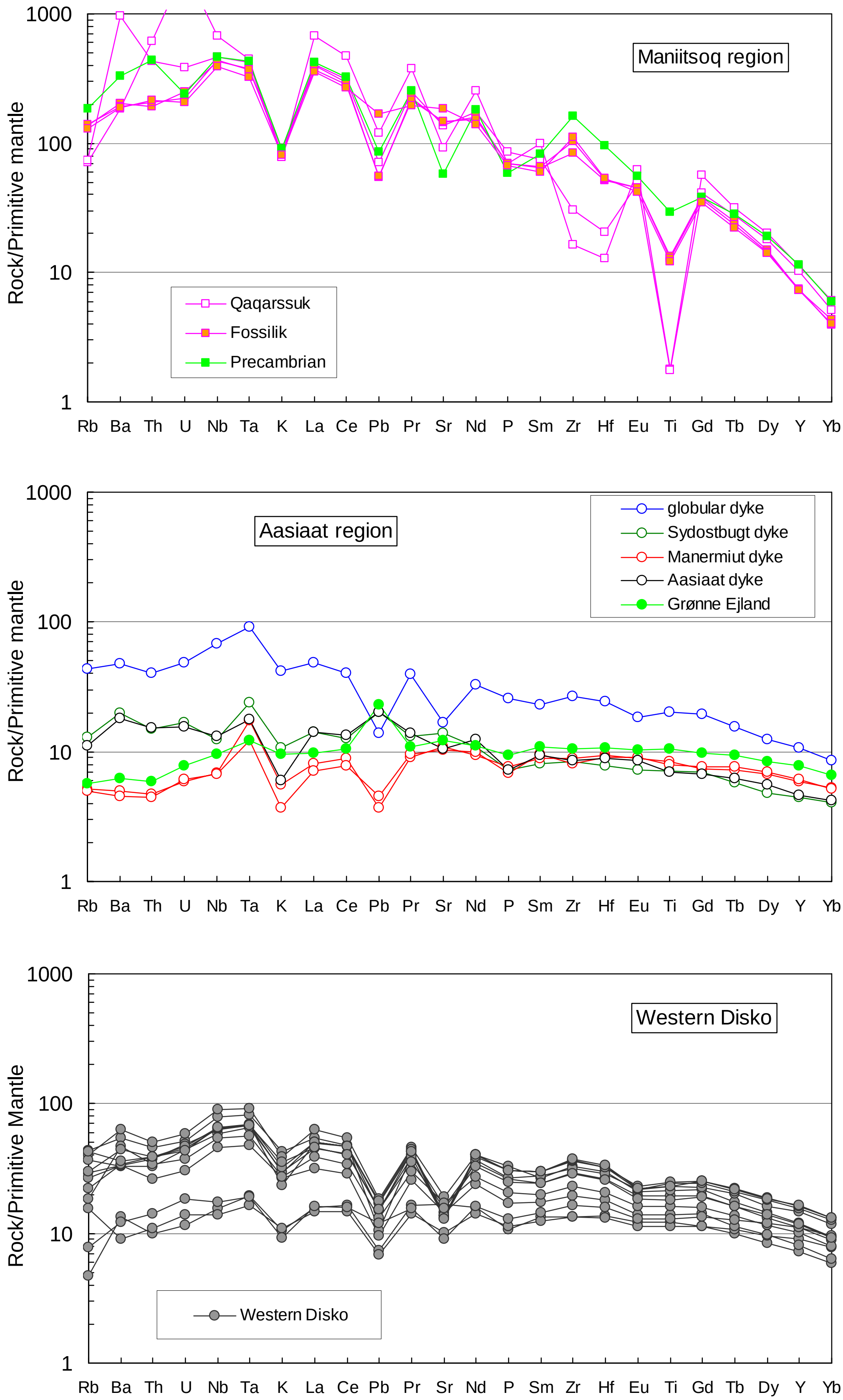


Fig. 4 (continued). Multi-element patterns for the young dykes in West Greenland.

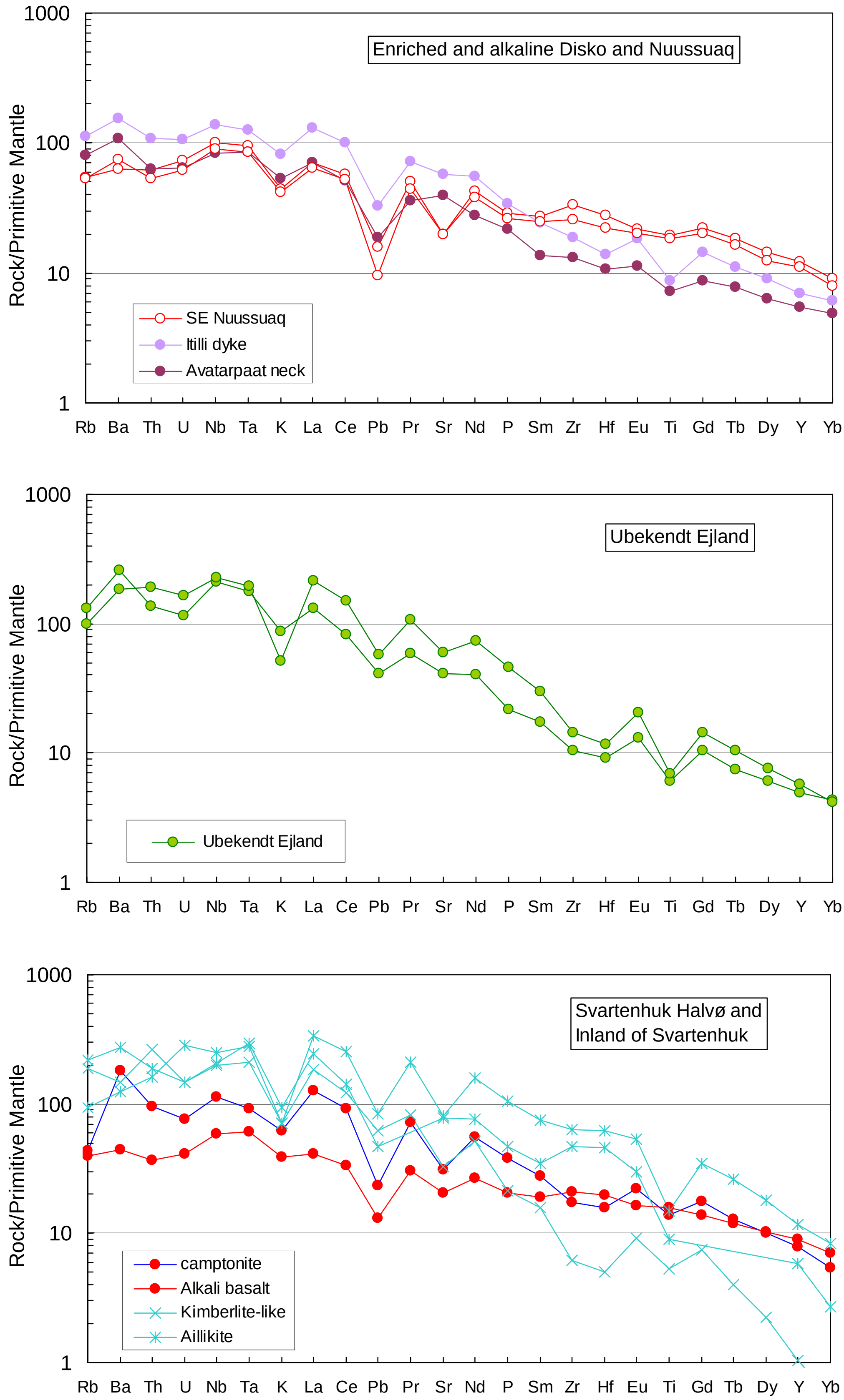


Fig. 4 (concluded). Multi-element patterns for the young dykes in West Greenland.

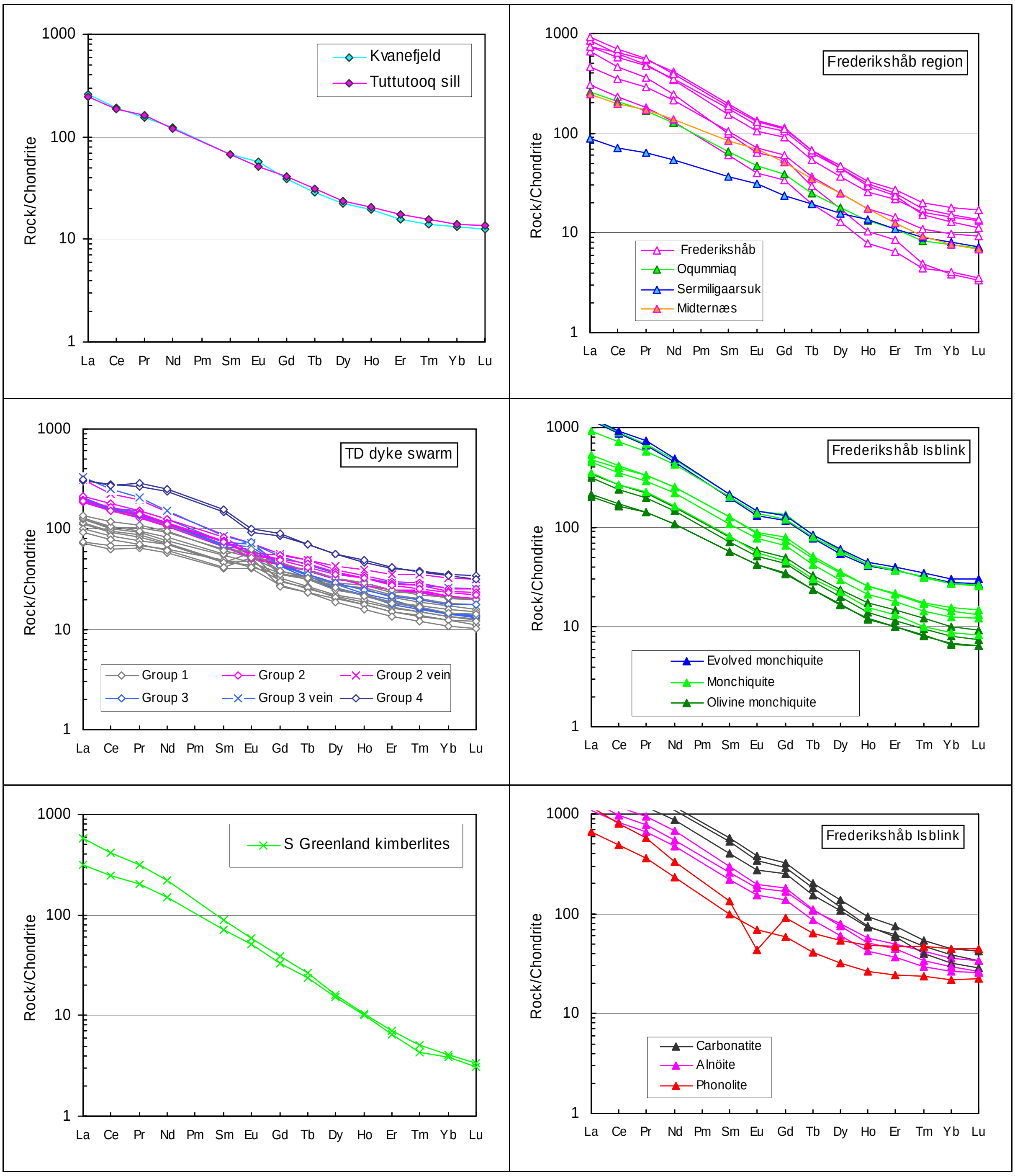


Fig. 5 (this and following pages). Rare earth element (REE) patterns for the young dykes in West Greenland. See text for discussion of the individual groups.

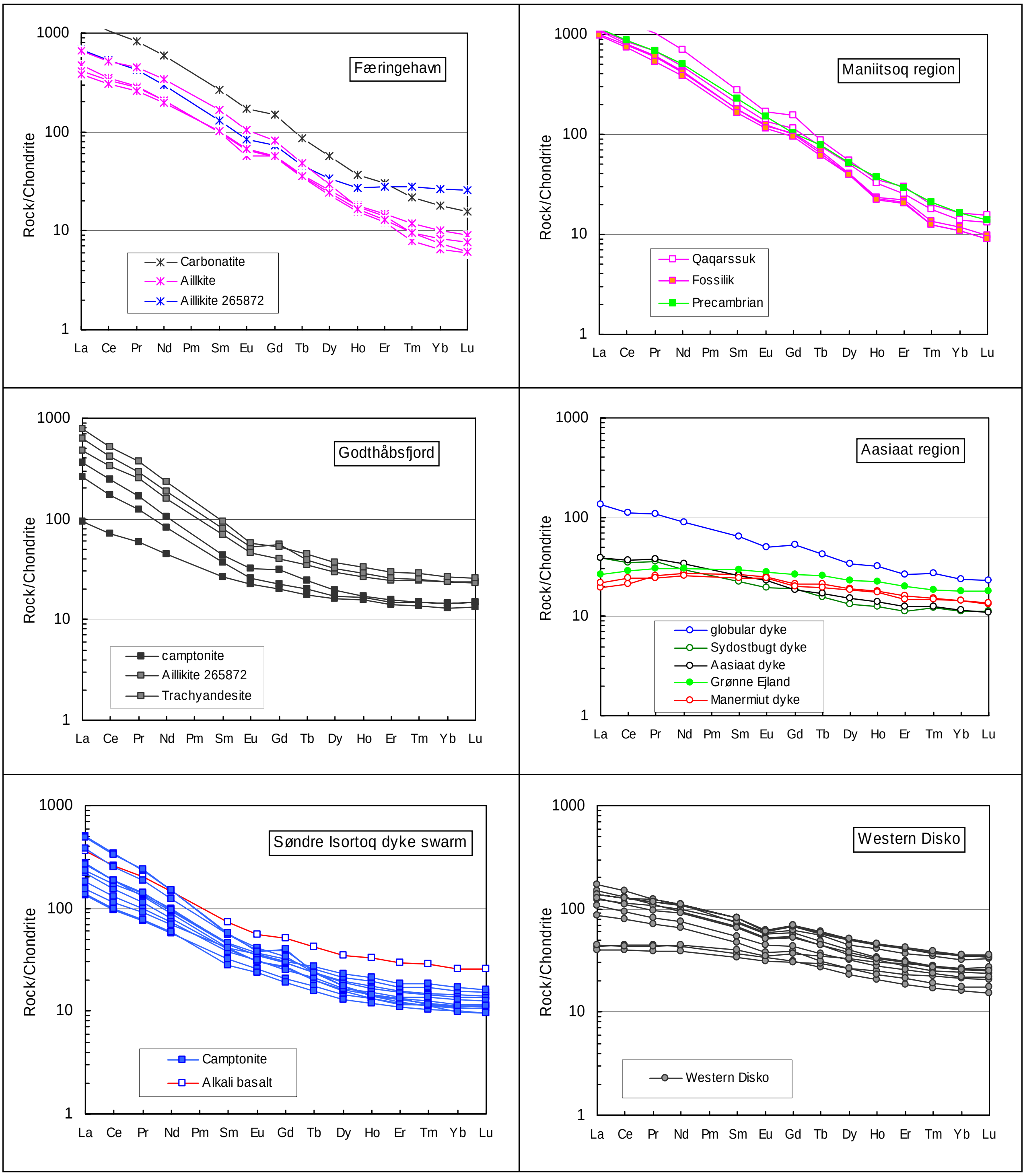


Fig. 5 (continued). Rare earth element (REE) patterns for the young dykes in West Greenland.

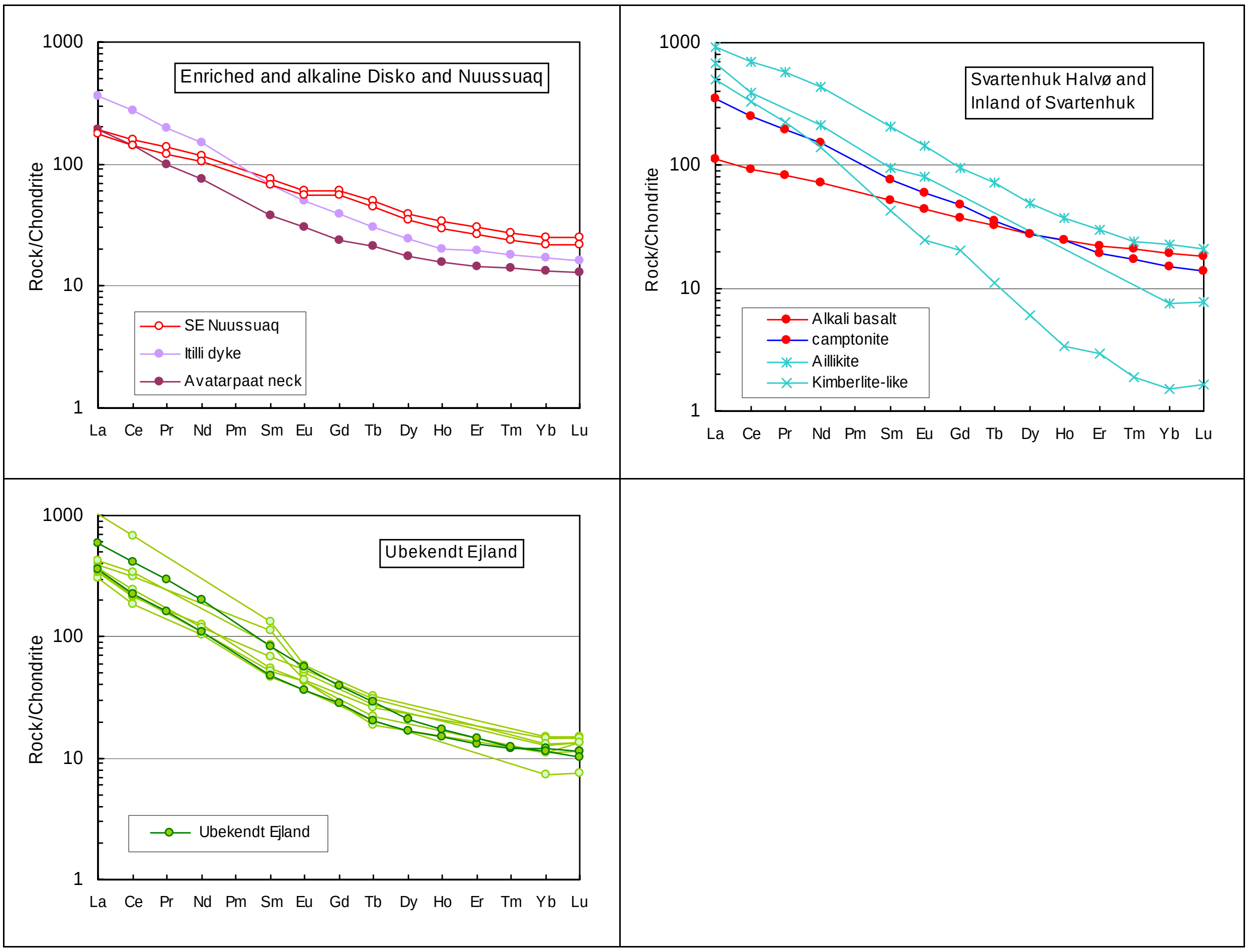


Fig. 5 (concluded). Rare earth element (REE) patterns for the young dykes in West Greenland.

Kvanefjeld dyke

The Kvanefjeld monchiquite dyke is of Gardar age (~1134 Ma) but shows some surprising similarities to the Tuttutooq sills. In particular, the REE patterns are practically identical. However, the multi-element pattern has higher Nb–Ta and Zr–Hf which is characteristic of Gardar magmas. The Kvanefjeld dyke is less evolved than the Tuttutooq sills (*mg* number 62) and has significantly higher MgO, Ni, Cr, and TiO_2, and lower Al_2O_3 and Fe (total).

Tuttutooq sills

The Tuttutooq camptonite sills have *mg* numbers 40–49 and are thus more evolved than the Kvanefjeld dyke. They are not very different from the TD dykes in most major elements but have higher alkalies and volatiles. The one sample analysed for trace elements has a REE pattern very similar to the Kvanefjeld dyke. It has a relatively smooth multi-element pattern with $Nb_N/Yb_N = 23.5$, significantly steeper than the TD dyke patterns ($Nb_N/Yb_N = 4–15$, see below). The multi-element pattern has a distinct peak at Pb which is considered due to contamination; as there are no other signs of significant contamination of the magma with continental crust such as increased SiO_2 in the sample, it is suspected that the very small cut slab sent for chemical analysis has been contaminated with Pb during handling. The Pb peak has then no geological significance.

TD dykes

A large number of XRF analyses of TD dyke samples were acquired during an earlier investigation; for the present project additional samples were analysed from the northern and southern extensions of the swarm which are, however, still poorly covered with samples. The analyses confirm that the TD dyke swarm is a genetic entity but they also show that compositional groups are present. These groups mainly differ in their trace element compositions and are therefore only distinguished in the multi-element diagrams. Group 1, the main group (47 of 72 analyses), has multi-element patterns with peaks at Ba and P, no Sr anomaly, and Zr–Hf troughs. Group 2 (18 analyses) has no Ba peak, troughs at Sr and P, and peaks at Nb–Ta and Zr–Hf. Group 3 (5 analyses) is most similar to group 1 but has higher Nb–Ta and K, distinctly higher P, and somewhat lower Ba. Group 4 (2 analyses) has a strongly contrasting and very jagged pattern with very low Nb–Ta, high REE, and very high P. Nb/Zr ratios for group 4 are extremely low (0.035), lower than any other rocks in the data set; this is highly unusual and inexplicable in terms of ordinary igneous processes. Nb_N/Yb_N ratios (pattern steepness) are 4–10 for group 1, 11–13 for group 2, 11–15 for group 3, and as low as 1.2 for group 4 because of the low Nb.

The differences between the groups cannot be due to different degrees of melting of the same mantle but is either due to the presence of different minor minerals in the melting mantle or to reaction with different minerals during passage of the melts through the lithosphere. Surprisingly, there is no difference in the geographical distribution of groups 1–3, neither in terms of south–north or coast–inland distribution. Judged from only one age determination of each of groups 1–3, there seems to be minor age differences between the groups. Group 2, the most ‘enriched’ in terms of Nb and Zr, is the oldest at about 140 Ma; group 1 is about 137 Ma (the two ages are within the analytical uncertainty of each other); and group 3, with the steepest REE patterns, is the youngest at about 133 Ma.

The only two samples representing group 4 are from north of the Isblink and are presumably from one and the same dyke, collected on strike 4.5 km apart. Their similar composition testifies that the oddity of these samples is intrinsic to this dyke and is not just a local unusual alteration. It is also not a ‘northern’ signature because a completely normal group 1 dyke occurs at the same latitude. It has been considered whether the abnormal dyke is at all a TD dyke, but its direction and petrography are correct, and in total it is more similar to the TD dykes than to anything else. It has not been dated.

More work should be done on this dyke swarm, particularly at the northern and southern extensions where there is presently no sample coverage.

South Greenland kimberlites

These rocks are very magnesian, with *mg* numbers of 79–87, and probably most of them contain accumulated olivine. They have low contents of SiO_2 and Al_2O_3 and high contents of volatiles, mainly carbonate. They are strongly enriched in incompatible trace elements, steep REE patterns with La_N/Lu_N of 100–170 and steep multi-element patterns with Nb_N/Yb_N of 110–180. The jagged multi-element pattern with deep troughs at K and Pb are mantle-derived features.

Paamiut (Frederikshåb) region

One dyke swarm and three unrelated dykes are grouped under this heading. The aillikite dyke swarm near Paamiut has *mg* numbers of 42–80 and rather variable compositions caused by variable mineralogies and particularly varying amounts of carbonates. The REE patterns have variable steepness, with La_N/Lu_N of 50–200 and high La up to nearly 1000 times chondrite. The multi-element patterns all show strong enrichments in the most incompatible trace elements and deep troughs at K, Pb, Ti and sometimes P, which is a mantle feature similar to those of the kimberlites.

The aillikite dyke on Midternæs (*mg* number 52) shares many features with the Paamiut aillikites but is less enriched. It is also less enriched in the most incompatible elements than the Oqummiaq monchiquite dyke, but the patterns cross over around Pr–Sr.

The Oqummiaq monchiquite dyke (*mg* number 63) is in all aspects very similar to the olivine nephelinites (monchiquites) at Frederikshåb Isblink 20 km to the north-west, and it has the same age. It is consifdered to represent a southern extension of this swarm (see below).

The Sermiligaarsuk camptonite dyke (*mg* number 66) is much less enriched than the other dykes in the Paamiut region. It is also less enriched than the other camptonites in this data set and the REE and multi-element patterns are different, e.g. the REE pattern is convex upward whereas the REE patterns of the other camptonites are convex downward. The dyke was originally mapped as being a possible Gardar dyke though no age constraints could be placed geologically, and it was analysed in this project in an attempt to clarify its age. In the Ivittuut area some 40 km south of Sermiligaarsuk, ultramafic and monchiquitic lamprophyre dykes of Gardar age have been described by Goodenough *et al.* (2002). These dykes, though generally more enriched than the Sermiligaarsuk camptonite, have REE and multi-element patterns with shapes very similar to those of the Sermiligaarsuk dyke. Judged from the geochemistry of the Sermiligaarsuk dyke, its age is therefore most probably Gardar, not Mesozoic. It has accordingly been omitted from the geochemical plots excepting the multi-element and REE diagrams.

Frederikshåb Isblink

The olivine monchiquites (*mg* numbers 59–71), monchiquites (*mg* numbers 36–50) and evolved monchiquites (*mg* numbers 29–33) show major elements variations and parallel REE and multi-element patterns suggesting that these sub-groups are genetically related either by mineral fractionation/accumulation from a common parent, or by different degrees of melting of the same mantle material. Hansen (1980, 1984) suggested that the subgroups evolved via fractionation of olivine and clinopyroxene from melts similar to the most primitive olivine monchiquites. The Ti trough that develops in the most evolved rocks is due to fractionation of titanomagnetite. The Oqummiaq monchiquite dyke from south of Frederikshåb Isblink is considered to be part of the swarm. Compared to other young dyke groups in the data set, e.g. the monchiquite dykes at Ubekendt Ejland, the Frederikshåb Isblink dykes have distinctly high TiO_2, FeO(total) and CaO, and low SiO_2 and Al_2O_3.

The ultramafic dykes (alnöites and carbonatites, *mg* numbers 37–46) share the relatively high TiO_2, FeO(total) and CaO, and low SiO_2 and Al_2O_3 with the monchiquites. They are extremely enriched in incompatible elements, and their REE and multi-element patterns are parallel with those of the monchiquites though they have developed the deep troughs at K, Sr and Ti which are a world-wide characteristic feature of carbonatites and related rocks. The low U–Nb–Ta in one carbonatite sample suggests it contains some crustal material; indeed it has a high content of silicate minerals and classifies mineralogically as an aillikite, but as the sample comes from the same dyke as the two other, true carbonatite samples, it probably represents a local accumulation of silicate minerals partly produced by reaction with the silicate wall rock.

The geochemical similarities suggest that the mantle sources for all the monchiquitic and ultramafic melts were similar. Hansen (1980, 1984) suggested that the alnöites and carbonatites are related to the monchiquites via a process of immiscibility, and the new trace element data is consistent with this theory. The older ages ranged from 116 to 152 Ma, precluding a direct genetic relationship between them, whereas the new precise ages obtained here are within the narrow interval 149–152 Ma, supporting a direct genetic relationship between the monchiquitic and ultramafic melts.

The three phonolite analyses (*mg* numbers 16–22) represent two dykes which are distinctly different from the monchiquitic and ultramafic rocks in the Isblink area. The one dated phonolite dyke at 105 Ma is also much younger. Both phonolite dykes represent evolved felsic melts, and the deep P and Ti troughs indicate that apatite and a Fe-Ti-oxide have been fractionated from the melts. The REE patterns are convex downwards and the Tb–Lu part of the patterns are much flatter than for the monchiquitic and ultramafic rocks. This is a fundamental difference which indicates that the phonolites are genetically unrelated to the monchiquitic and ultramafic rocks. Moreover, the two phonolite dykes are significantly different. The thick, coast-parallel phonolite dyke has encountered fractionation of alkali feldspar that has left deep troughs for Ba and Sr and a lesser but significant trough for Eu. The thinner inland phonolite dyke has not fractionated alkali feldspar. The same fractionation differences have rendered the coast-parallel dyke peralkaline (acmite normative), whereas the other is not peralkaline (anorthite normative).

Færingehavn

The Færingehavn ultramafic lamprophyres comprise six aillikites and a carbonatite. They are strongly enriched, with La_N/Lu_N of 50–90 and multi-element patterns with Nb_N/Yb_N of 60–100 except for one aillikite dyke (265872) with HREE significantly higher than in the other samples. This sample also has high levels of Zr, Hf, Th and U and probably contains a relatively high proportion of accessory zircon. The Færingehavn dykes are not quite as strongly enriched as the Frederikshåb and the Frederikshåb Isblink aillikites, alnöites and carbonatites. None the less, except for sample 265872 they have significantly steeper REE patterns than the Isblink rocks, whereas the Rb-to-Nb parts of the patterns are flatter, the K troughs smaller, and there is a P trough. These differences indicate that the mantle material was different beneath Færingehavn, perhaps less metasomatised.

Godthåbsfjord

The camptonites in the Godthåbsfjord region span a large range in *mg* number (25–60) and some of them are very evolved and show evidence of fractionation of feldspar (weak Eu troughs and distinct Sr troughs) and Ti-oxides (distinct Ti troughs) . The less evolved rocks (*mg* numbers 46–60) can best be compared with the camptonites in other areas. Many of their features are similar to the Søndre Isortoq camptonites, viz. their relatively high SiO_2 and low TiO_2 and FeO(total). The REE and multi-element patterns are also similar in general shape, but the Godthåbsfjord dykes have smoother Rb–K patterns and no K trough. The distance between the Godthåbsfjord and Søndre Isortoq occurrences is about 130 km and the dykes do not seem to be continuous between the areas. Moreover, the Godthåbsfjord dykes seem to be slightly younger (51 Ma) than the Søndre Isortoq camptonite dykes (55 Ma).

Søndre Isortoq

The Søndre Isortoq camptonite dyke swarm has *mg* numbers of 49–72. The basaltic character of the rocks is revealed in their high Al_2O_3 and SiO_2, however their low TiO_2 and FeO(total) is a special feature which they share with the Godthåbsfjord and Ubekendt Ejland camptonites but not with the Tuttutooq camptonites. Their REE patterns are convex downwards, with relatively flat HREE parts. The multi-element patterns are medium-steep, with NbN/YbN of 10–50 (quite variable), and troughs at Th–U, K and Ti.

The alkali basalt dyke at Søndre Isortoq has higher FeO(total), TiO_2, Na_2O and P_2O_5 and lower K_2O than the camptonites. The trace element patterns are tilted relative to those of the camptonites, with lower LILE and LREE and higher HFSE and HREE levels, and Nb_N/Yb_N as low as 7–8. There is also a distinct Sr trough. At 58 Ma, the dyke is older than the 55 Ma camptonite dykes in the area.

Qaqarssuk and Fossilik

The aillikites in the Maniitsoq region are some of the most enriched rocks in the set. They are on level with the Frederikshåb aillikites in their high contents of CaO and volatiles (carbonate) and low SiO_2 (Fossilik but not Qaqarssuk) and low Al_2O_3. The REE and multi-element patterns show maximum steepness, with La_N/Lu_N of 80–120 and Nb_N/Yb_N of 90–111. The Qaqarssuk dykes have very high Th–U, distinct troughs at K, Sr, Zr–Hf and a very deep Ti trough, whereas the Fossilik dykes only have a K trough and a lesser Ti trough. The two localities, only 5 km apart, thus have strong similarities but also distinct individual traits.

One aillikite dyke from the Maniitsoq region that was dated at 586 Ma, i.e. latest Proterozoic, was included in the investigation for comparison. It has a REE pattern identical to the young dykes and a multi-element pattern very similar to the young dykes though with higher Zr–Hf and Ti than any of these. In principle, it has arisen from a very similar mantle under very similar conditions of melting as the young dykes.

Aasiaat region

The N–S trending globular dyke is compositionally identical to the Fe-Ti-rich N–S trending dykes in western Disko. They also have similar ages. The dyke may be considered a southern continuation of the Disko dykes. It points north, not towards western but towards eastern Disko where the same magma type is also present at Ippik and Akunnaq though only in a few small dykes.

The Manermiut dyke and the Grønne Ejland sill are chemically very similar though the sill is somewhat more evolved. They are relatively depleted tholeiitic basalts with convex-upward REE patterns with a maximum around Nd. Such REE patterns are a very characteristic feature of the Paleocene lavas of the Vaigat and Maligât Formations and these two intrusions could be synvolcanic. The dyke points north-east towards eastern Disko where the same magma type is found in the large sill at Skansen. The age of the Grønne Ejland sill (60.5 Ma) confirms that it is syn-volcanic.

The Sydostbugt dyke and the Aasiaat dyke are compositionally closely similar and they could well be part of the same long dyke though no dyke trace can be seen on the aeromagnetic map. This dyke has higher Rb–K and LREE than the Manermiut dyke and the Grønne Ejland sill; its multi-element pattern has a distinct Pb peak which is indicative of contamination; the higher Rb–K and LREE can also be interpreted as an effect of crustal contamination of a magma similar to the Manermiut dyke, particularly the higher Th/Nb ratio. No equivalents to this magma composition are found among the intrusions on Disko.

The Grønne Ejland sill also has a Pb peak but does not otherwise show any signs of crustal contamination; the high Pb (3.4 ppm versus the usual 0.4 ppm) may either be a selective crustal contamination or be aquired by contamination of the sample during handling.

Western Disko

The N–S trending dykes that cut the whole Paleocene lava succession are mainly evolved tholeiitic basalts with *mg* numbers of 37–43, high TiO_2 (>3.5 wt%) and high FeO ('Fe-Ti' basalts), smoothly sloping REE patterns with La_N/Lu_N of 4–6 and multi-element patterns with Nb_N/Yb_N of 5–10. However, there appears to be another generation of basalts which are less enriched in incompatible elements and FeO, with nearly flat La–Nd parts of the REE patterns and much lower Nb_N/Yb_N of 1.8–2.7 because of lower Rb–LREE. This generation has not been dated but is assumed to be slightly older than the enriched generation.

Southeastern Nuussuaq

The sills and dykes in southeastern Nuussuaq are evolved and enriched tholeiitic basalts with *mg* numbers of 38–43, and REE and multi-element patterns in shape similar to the dykes in western Disko but slightly tilted, with higher La_N/Lu_N around 8 and Nb_N/Yb_N of 11–12.

Alkaline intrusions on Disko and Nuussuaq

The Avatarpaat volcanic plug and the Itilli dyke are both alkali basalts with higher contents of Na_2O and K_2O and lower SiO_2 than the tholeiitic basalts. They also have steeper REE and multi-element patterns, with La_N/Lu_N of 15 and 22 and Nb_N/Yb_N of 17 and 22.

Ubekendt Ejland

The lamprophyre dykes on Ubekendt Ejland were named diabase, camptonite and monchiquite by Clarke *et al.* (1983); as we do not have access to thin sections of their samples we cannot ascertain these names. The samples of which we have thin sections and ICP-MS trace element analyses are all petrographically monchiquites. Chemically, the monchiquites and camptonites are indistinguishable. Compared to the other dyke swarms they are most similar to the camptonites of the Søndre Isortoq and Godthåbsfjord areas. They are similar to these in a number of elements, notably TiO_2, MgO and FeO(total), but lower in SiO_2 and higher in CaO and volatiles, trending towards the monchiquites in the data set. Their REE and multi-element patterns are medium-steep, with La_N/Lu_N of 25–70 and Nb_N/Yb_N of 30–60 and, similar to the major elements, compare best with the patterns of the camptonites of the Søndre Isortoq and Godthåbsfjord areas. However, the low Zr–Hf is a specific Ubekendt Ejland feature.

Svartenhuk Halvø

The camptonite (one dyke) has *mg* number 53–60 and is thus more magnesian than the two alkali basalt dykes with *mg* numbers of 46–47. The two sub-groups are not related via a single parent melt because the REE and multi-element patterns cross each other. The camptonite has La_N/Lu_N and Nb_N/Yb_N of 21–25 and shows similarities to the least enriched camptonites on Ubekendt Ejland, with the same trough at Zr–Hf though with higher TiO_2. The alkali basalts have La_N/Lu_N and Nb_N/Yb_N both around 6–8 and thus much flatter patterns which are similar in shape to the more evolved enriched tholeiitic basalts of SE Nuussuaq, but at a lower level.

Inland of Svartenhuk Halvø

The lamprophyres in the inland areas are strongly enriched ultramafic types; most are aillikites and one sample is of kimberlite-like aspect. Their REE and multi-element patterns are of the same general type as for the aillikites at Frederikshåb and Færingehavn though with some differences, e.g. in Nb/La ratios. The kimberlite-like sample is very magnesian, with *mg* ratio 89, and may be olivine-accumulative. It is extremely depleted in HREE and has a distinct Zr-Hf trough, suggesting that it has lost zircon at some stage.

Discussion and interpretation

General: Melt compositions as indicators of tectonic development

Melt compositions may be sensitive indicators of the tectonic development of a region. This is because the composition of mantle-derived melt is essentially dependent on three variables: The **composition of the melting mantle**, and the **pressure** and **temperature** at which melting takes place. Beneath an old craton that undergoes stretching and rifting all three factors may vary considerably and give rise to a large range of melt compositions. A systematic tectonic development with time, such as a gradually thinning lithosphere, may thus give rise to a systematic development with time in melt compositions.

The asthenospheric mantle is considered to be of relatively uniform composition, whereas the lithospheric mantle may posses heterogeneities frozen into it during its long existence. The major mantle minerals are olivine (ol), orthopyroxene (opx), clinopyroxene (cpx) and either garnet (deeper than about 80 km) or spinel (shallower than about 80 km). Small amounts of volatiles (water and CO_2) may also be present, and these have a profound influence by decreasing the temperature at which melting begins. At high pressures and small degrees of melting the melts will be undersaturated in SiO_2. Incompatible elements and volatiles are concentrated strongly in the melt, and melts formed at small degrees of melting are therefore rich in incompatible elements and volatiles. With increasing degrees of melting the melts become less undersaturated in SiO_2 and less enriched in volatiles and incompatible elements which become gradually more diluted in the melt. Thus, with increasing degrees of melting the melts change compostion from volatile-rich and SiO_2-poor to volatile-poor and SiO_2-rich, and a generalised melt succession will be (approximate degrees of melting in parentheses) carbonatite (<0.5%), kimberlite and ultramafic lamprophyre (0.5–1%), nephelinite and basanite (1–4%), alkali basalt (4–8%) and tholeiitic basalt (8–20%).

Such a succession of melts may be generated during lithospheric extension and rifting. The lithosphere does not normally melt because it is too thick and cold. Beneath Archaean cratons such as constitute a large part of West Greenland the lithosphere is usually around 200–230 km thick (e.g., Menzies 1990). If the lithosphere becomes thinner the hot asthenosphere will rise beneath the thinned region and start to melt because of the decrease in pressure. With increasing lithospheric thinning and asthenospheric upwelling to shallower levels the degree of melting will increase so that the above-mentioned melt range may be produced. Moreover, the iron content of mantle-derived melts is pressure-sensitive so that melts generated at lower pressures have lower iron contents. These general relations are seen in plots of volatiles and FeO(total) vs SiO_2 (Fig. 6). The volatile-rich, SiO_2-poor ultramafic alkaline rocks would represent the smallest degrees of melting at the highest pressures, the monchiquites and camptonites are intermediate, and the tholeiitic to alkaline basalts represent the highest degrees of melting at the lowest pressures. The pressure-dependence of iron is less evident because all data, also fractionated rocks, are plotted and iron also increases with fractionation. The FeO vs iron diagram is also shown in Fig. 8.

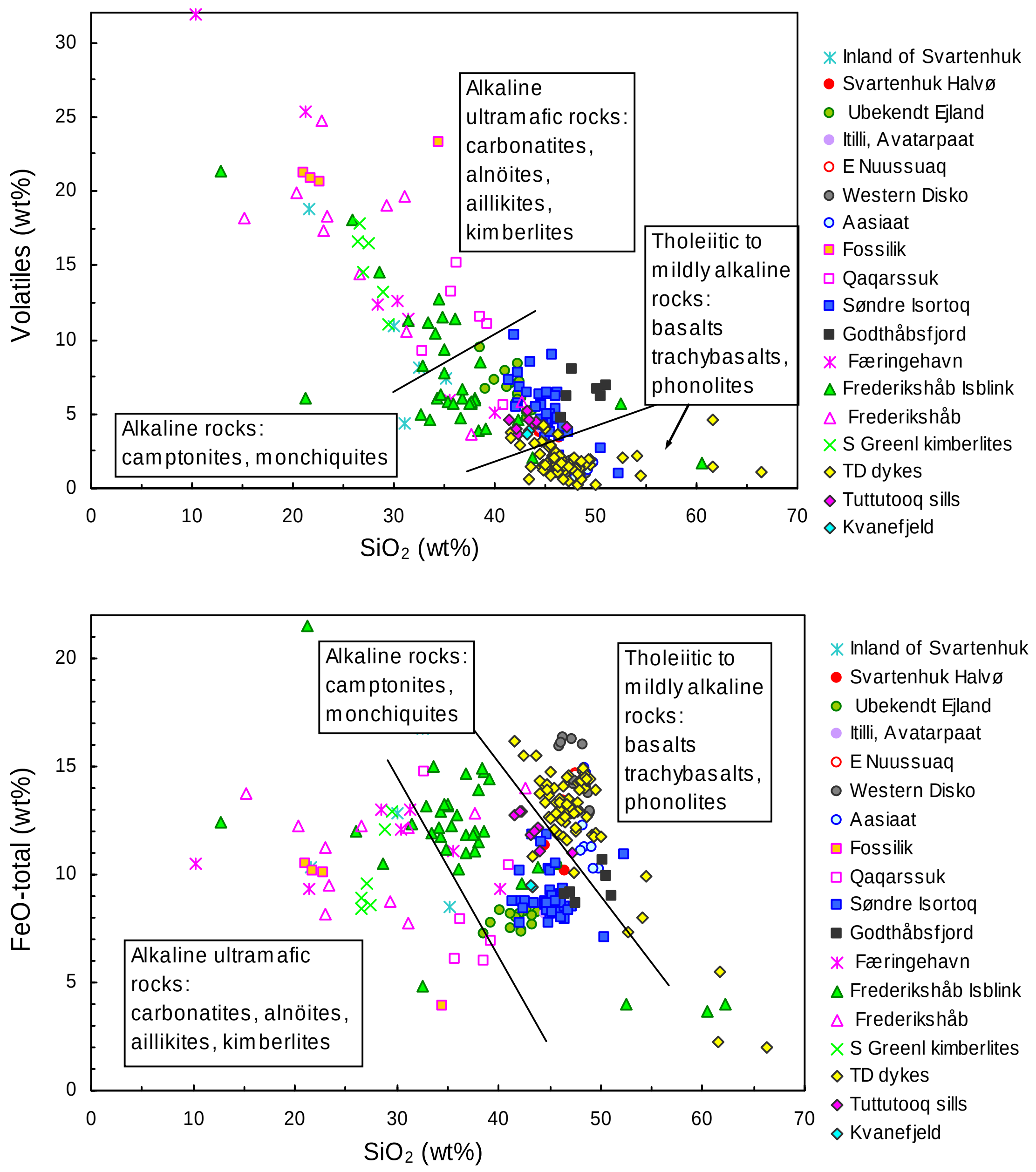


Fig. 6. Volatiles and iron vs SiO_2 for the whole data set. The lines divide the diagrams into fields of alkaline ultramafic rocks, alkaline mafic rocks (camptonites and monchiquites), and mildly alkaline and tholeiitic basalts, with some overlap between fields.

The simple succession of melts may at any time be complicated by melting of material with a composition different from that of the asthenospheric mantle. Two-stage melting is commonly indicated by data: small-degree asthenospheric melts rich in incompatible elements and volatiles may intrude the lithosphere and solidify there, creating trace-element- and volatile-rich, socalled **metasomatised mantle** regions with minerals such as phlogopite, amphibole, apatite and oxides in variable proportions. Later events such as temperature increase or pressure release may lead to re-melting of these metasomatised regions, and these melts have variable compositions because the sources are inhomogeneous.

The concentration of the major elements SiO_2, Al_2O_3, MgO and FeO in a melt will mainly depend on the melting conditions of the major mantle minerals ol + opx + cpx ± gt ± sp. The concentration of the incompatible minor elements (TiO_2, Na_2O, K_2O, P_2O_5) and trace elements and volatiles may vary according to whether or not metasomatised mantle has contributed to the melt.

At a level of about 80 km depth in the lithosphere an important phase transition takes place. Deeper than this, garnet is the stable Al-rich phase, and shallower than this, spinel is the stable Al-rich phase. These two minerals have very different partition coefficients for the rare earth elements (REE) and therefore melts from above and below this level have strongly different REE patterns. Garnet readily incorporates the heavy REE (HREE) but not the light REE (LREE) in its structure, and as a result melts derived from garnet-bearing mantle have low contents of HREE and much higher contents of LREE, expressed as strongly sloping REE patterns and high La/Lu ratios. Spinel excludes all the REE, and therefore melts derived from spinel-bearing mantle have flatter REE patterns and lower La/Lu ratios. As a result of this, REE ratios, particularly HREE ratios such as Tb/Lu or Gd/Yb are reliable depth indicators for melts.

Melts from asthenospheric mantle and metasomatised mantle

A characteristic feature of the strongly enriched (in incompatible elements and volatiles) and alkaline carbonatites, kimberlites, aillikites, alnöites and monchiquites is that they show a large compositional scatter in many chemical diagrams such as the cross plots in Fig. 2. This can be ascribed partly to mineral accumulation effects that make the bulk rock compositions deviate from the original melt compositions, and partly to the melt variations produced in a heterogeneous mantle. Fig. 7 shows La/Sm (the slope of the LREE pattern) and Tb/Lu (the slope of the HREE pattern) plotted against K_2O/SiO_2. All these ratios are high at low degrees of melting in the presence of garnet, and all are sensitive to mantle metasomatism, least so the Tb/Lu ratios. In these plots, tholeiitic and mildly alkaline basalts form positively correlated tight arrays (looser for Tb/Lu due to logarithmic scale) which must be due to mantle melting systematics as the ratios are not sensitive to later fractionation. This suggests that all these rocks, from the TD dyke swarm in southern Greenland to the basalts on Disko and Nuussuaq, arose in very similar mantle which would most likely be unmodified asthenosphere. Tholeiitic dykes from Aasiaat and western Disko were formed at the largest degrees of melting and the TD dykes at the smallest. The camptonites, monchiquites, aillikites, alnöites, kimberlites and carbonatites show a large data scatter and have strongly increased La/Sm and K_2O/SiO_2 ratios, indicating that they originated in a K- and LREE-metasomatised mantle. The low Tb/Lu of the camptonites and Ubekendt Ejland monchiquites could indicate either that the HREE were not changed by the metasomatism, or that amphibole was a residual phase during melting, or that the melts have undergone amphibole fractionation (amphibole selectively removes the middle REE such as Sm and Tb), Indeed, many of these rocks carry amphibole phenocrysts.

In conclusion, the tholeiitic and mildly alkaline basalts are derived from unmodified asthenospheric mantle, whereas the more alkaline rocks include a metasomatic component from either the lithosphere or the asthenosphere.

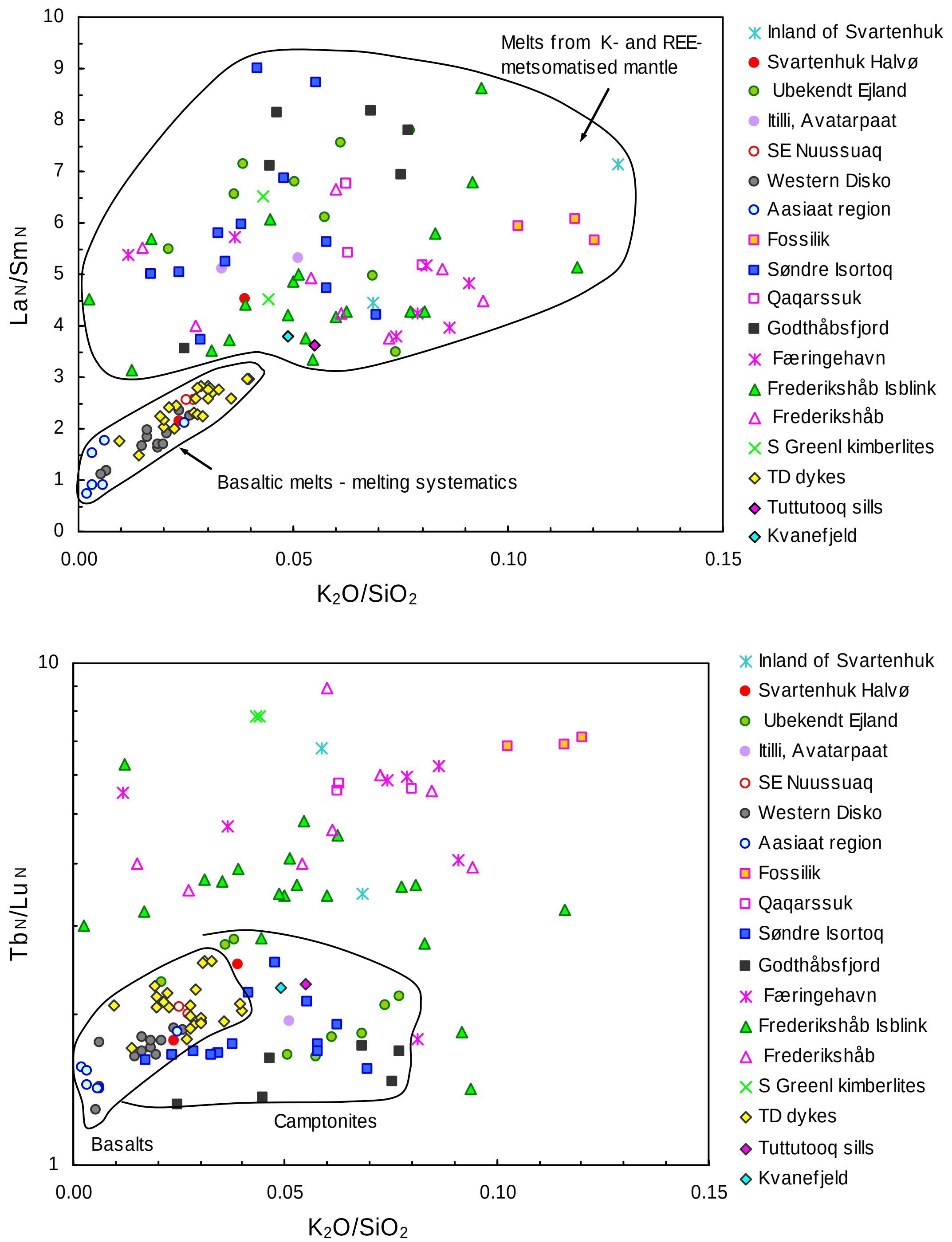


Fig. 7. Ratios of light rare earth elements (La/Sm) and heavy rare earth elements (Tb/Lu) vs K_2O/SiO_2. The REE ratios are normalised against chondrite concentrations.

Degrees of melting

The behaviour of the rare earth elements during mantle melting can be modelled as a function of the melting mineral assemblage (lherzolite: olivine+orthopyroxene+clinopyroxene, with garnet (deeper than c 80 km) or with spinel (shallower than c 80 km)), the composition of the mantle, and the degree of melting. Fig. 8 shows the results of such modelling, with the mantle composition chosen as similar to chondritic meteorites. If a more depleted mantle is chosen, such as is believed to constitute the asthenospheric mantle, the curve for garnet facies melting will move to lower Dy/Yb ratios. It is seen that no melts have Dy/Yb ratios corresponding to an origin solely within the spinel facies. In the other end, all the ultramafic alkaline rocks and the monchiquites of Frederikshåb Isblink have Dy/Yb ratios that are impossibly high even for the chondritic mantle model, and melting of an enriched metasomatised mantle is indicated in accordance with the conclusions reached from Fig. 7. The degrees of melting would have been less than about 3%. The tholeiitic and alkaline basalts form a trend that suggests derivation from similar mantle material; the melting could either be solely in garnet facies (for a depleted mantle) or in a mixed garnet-spinel facies, where the melting started in garnet facies and continued through the garnet-spinel transition. The degrees of melting indicated are lowest for the TD dykes (3–5% in this model) and highest for the tholeiitic Aasiaat-Disko-Nuussuaq dykes (5– >10%). The camptonites have low Dy/Yb ratios corresponding to significant melting in spinel facies, but inspection of Fig. 7 leads to caution in such an interpretation: it is more probable that the camptonites originated in a metasomatised K-enriched mantle with amphibole as a residual phase; this would invalidate the REE modelling.

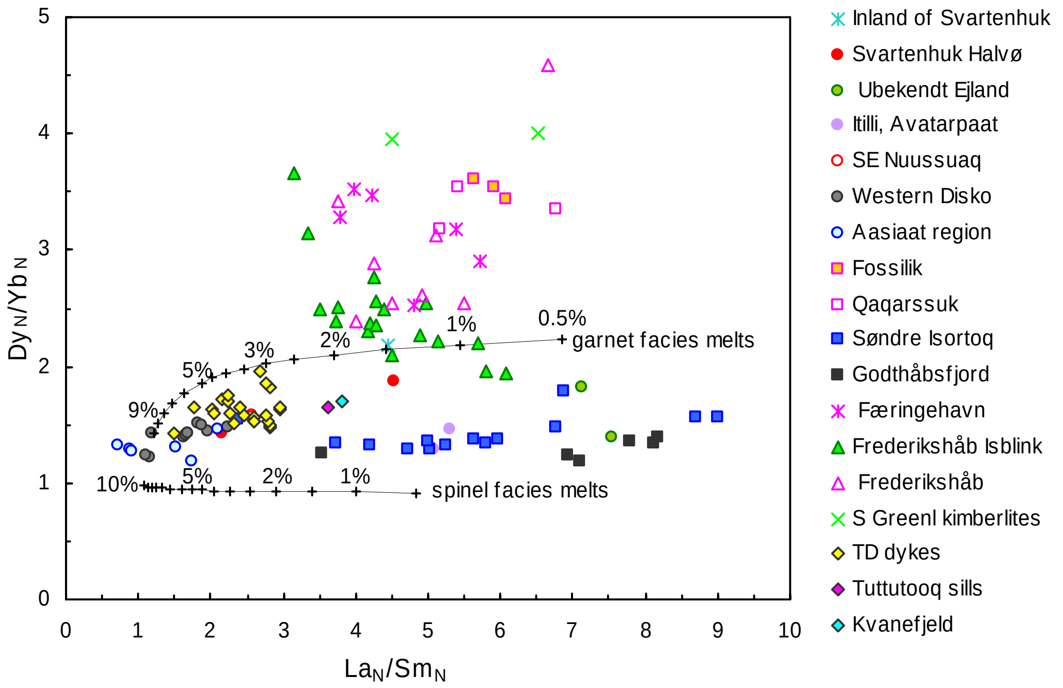


Fig. 8. Rare earth element ratio plot (chondrite normalised) with modelling of mantle lherzolite melting in garnet and spinel facies. The melting model is similar to that of Duggen *et al.* (2005) for a chondritic undepleted mantle. Use of a depleted mantle will shift the garnet facies curve to lower Dy/Yb ratios. The numbers are percent melt formed.

Depths of melting

Largely irrespective of mantle heterogeneities, which are mainly reflected in the contents of minor and trace elements, the major elements can be used for estimating pressures (i.e., depths) of melting. In particular, the iron content of a melt is a good pressure indicator because it is not very sensitive to other variables such as the degree of melting. In general, melting at higher pressures leads to more iron-rich melts. Fig 9 shows a plot of FeO(total) vs SiO_2 with only the least fractionated rocks plotted (MgO>6 wt%) to remove the effects of fractionation which leads to increases in both iron and SiO_2. High levels of iron are seen for the TD dykes and the Tuttutooq sills, the alkali basalt from Søndre Isortoq, and the monchiquites of Frederikshåb Isblink. Lower levels are seen for the camptonites of Godthåbsfjord, Søndre Isortoq and Kvanefjeld and the camptonites–monchiquites of Ubekendt Ejland. The ultramafic rocks are, as always, more variable and less straightforward to interpret, however the Qaqarssuk aillikites clearly have lower iron than the nearby Fossilik aillikites, and lower than the other ultramafic rocks. Compared to experimentally produced volatile-free melts (Fig. 9), the Godthåbsfjord, Søndre Isortoq and Ubekendt Ejland (and the Proterozoic Kvanefjeld) melts would have been produced at around 30 kb pressure (c. 100 km depth) and the TD dykes and Tuttutooq sills at around 50 kb pressure (c. 160 km depth). The TD dykes and Tuttutooq sills are quite fractionated rocks (a screen of 8 wt% MgO removes all of these, as well as the Aasiaat and Svartenhuk Halvø rocks), and if they have been enriched in iron due to fractionation, as is likely, then the pressures of generation for these are overestimated. The high iron contents in the primitive Frederikshåb Isblink monchiquites indicate high pressures of generation, but it is difficult to compare quantitatively with the much more siliceous volatile-free experimental melts.

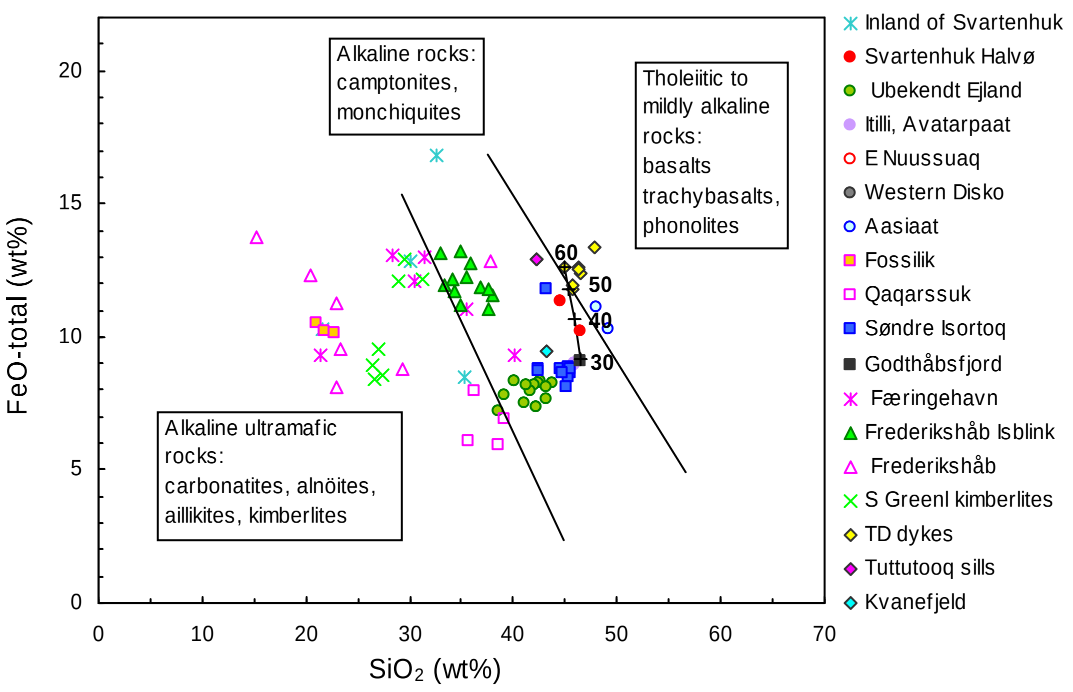


Fig. 9. Iron vs SiO_2 for the least fractionated rocks with MgO >6 wt%. The line with ticks for pressure (30 to 60 kbar) shows the compositions of volatile-free experimental melts produced at these pressures (Walter, 1998).

Recent experiments on melting of volatile-bearing mantle at high pressures between 30 and 80 kbar c found pressure dependence of the MgO/CaO and SiO_2/Al_2O_3 ratios, as shown by the lozenge-shaped area in Fig. 10 (unfortunately, the experimental system was iron-free). In this diagram, most West Greenland rocks plot in a tight cluster indicating generation at low pressures <30 kbar, in conflict with the interpretations from Fig. 9. Though only samples with MgO >6wt% were plotted in Fig. 10, it is possible that the rocks have decreased MgO/CaO due to fractionation. The ultramafic rocks show a large scatter. The South Greenland kimberlites and one sample from inland of Svartenhuk Halvø plot in the high-pressure region around 60–80 kbar and beyond (> 190 km); the Færingehavn and some Frederikshåb aillikites plot around 30–50 kbar (100–160 km), and the Fossilik and inland of Svartenhuk aillikites all plot near 30 kbar (100 km). Some calcite-rich aillikites, alnöites and carbonatites from Qaqarssuk, Frederikshåb and Frederikshåb Isblink plot at impossibly low MgO/CaO. This suggests that these rocks do not represent mantle-derived melts. They could have originated by exsolution from a more Mg-rich melt or by loss of MgO from the original MgO-rich melt by reaction with the silicate sidewall.

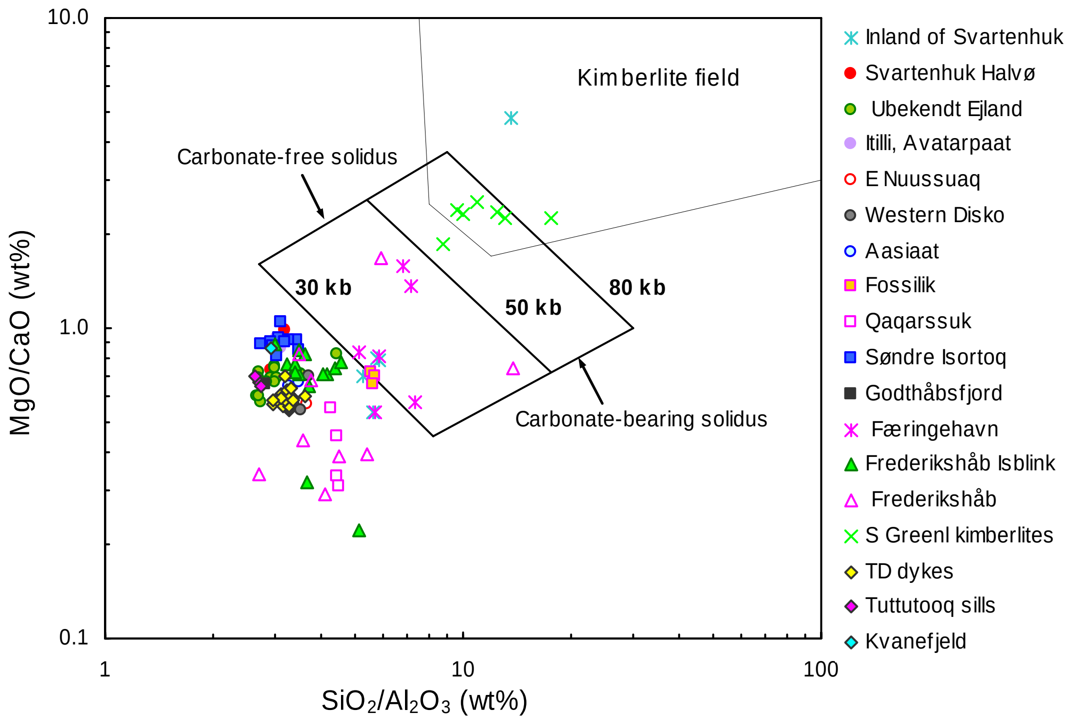


Fig. 10. MgO/CaO vs SiO_2/Al_2O_3 showing the least fractionated rocks with MgO >6 wt%. The lozenge-shaped area indicates experimental volatile-bearing, iron-free melts generated at 30, 50 and 80 kbar pressure by Gudfinnsson & Presnall (2005). The kimberlite field is after Rock (1991).

In conclusion, the pressure estimates suggest that the rocks generated at the highest pressures are the kimberlites of South Greenland and the aillikites of Frederikshåb, Færingehavn and inland of Svartenhuk Halvø. The rocks generated at the lowest pressures are the camptonites of Godthåbsfjord, Søndre Isortoq and Ubekendt Ejland. The iron-rich monchiquites of Frederikshåb Isblink and Kvanefjeld, the TD dykes and the Tuttutooq sills were probably also generated at relatively high pressures, but the evidence is conflicting.

Timing of melting events

In Fig. 11, all the existing age determinations for the young igneous rocks (Fig. 11A) are compared with the precise age determinations only (Fig. 11B). The old 175–200 Ma ages for the ultramafic rocks are likely to be essentially correct but could be too high and should be tested. The effect of excluding uncertain and faulty ages is dramatic for the period 100–220 Ma. The period changes character from one with about evenly spaced volcanic events showing no systematic evolution of melt compositions throug time, to a period during which the character of the melts changed systematically from ultramafic to mafic to plagioclase-bearing. The period of ultramafic magmatism is still *c.* 200–150 Ma. The mafic monchiquites are confined to a well-defined episode around 150 Ma. From around 140 Ma the melts are all plagioclase-bearing.

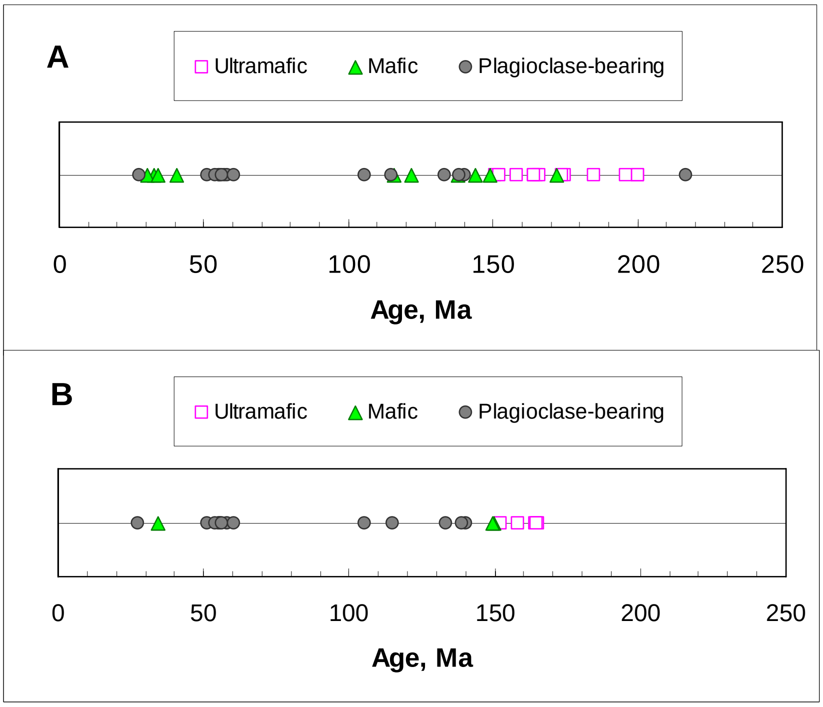


Fig. 11. **A**. All existing age determinations for the young igneous rocks in West Greenland. **B**. All *precise* age determinations only. The ultramafic group comprises kimberlites, aillikites, alnöites and carbonatites. The mafic group comprises the plagioclase-free monchiquites. The plagioclase-bearing group comprises both tholeiitic basalts, alkali basalts and camptonites.

Relation between magmatism and the tectonic development of the Labrador Sea and Davis Strait

In Table 3, the occurrences of young igneous rocks are arranged according to their age, also when the ages are of uncertain merit. The systematic evolution of the melt types with time shown in Fig. 11 is apparent. There is also a significant spatial distribution of ages: all the Jurassic–Cretaceous occurrences except Qaqarssuk–Fossilik are situated south of 64°N, and all the Palaeogene occurrences are situated north of 64°N (Fig. 12). A number of periods can be discerned and related to tectonic events in the region as discussed in the following. Here, all connections between the radiometric ages and the geological epochs and stages are made with reference to Gradstein *et al.* (2004).

Table 3. Occurrences arranged with descending age

Locality	Rock type	Rel. volume	Appr. age, Ma
Inland of Svarten.	Aillikite, kimberlite	Very small	Unknown
S Greenland	Kimberlite	Very small	200?
Færingehavn	Aillikite	Very small	175-195
Paamiut (Fr.håb)	Aillikite	Very small	166
Qaqarssuk	Carbonat., aillikite	Small	**166**
Fossilik	Aillikite	Very small	**164**
Tikiusaaq	Carbonatite	Small	158
Fr.håb Isblink	Alnöite, carbonat.	Very small	**152**
Fr.håb Isblink	Ol.monchiquite	Small	**150**
Fr.håb Isblink	Monchiquite	Small	150
TD dykes	Alkali basalt	Medium-large	**133–140**
Tuttutooq	Camptonite	Small	**115**
Fr.håb Isblink	Phonolite	Small	**105**
Grønne Ejland	Tholeiitic basalt	Medium	**60**
Søndre Isortoq	Alkali basalt	Small	**58**
SE Nuussuaq	Tholeiitic basalt	Medium	**57**
Aasiaat	Tholeiitic basalt	Medium	**56**
Søndre Isortoq	Camptonite	Small	**55**
W. Disko	Tholeiitic basalt	Medium	**54**
Svartenhuk	Campt; alk.basalt	Small	post-volcanic
Godthåbsfjord	Camptonite	Small	**51**
Ubekendt Ejland	Campt., monch.	Small	**34**
Disko-Nuussuaq	Alkali basalt	Very small	**28**

Ages in bold are precise determinations. Ages in ordinary are of uncertain merit.

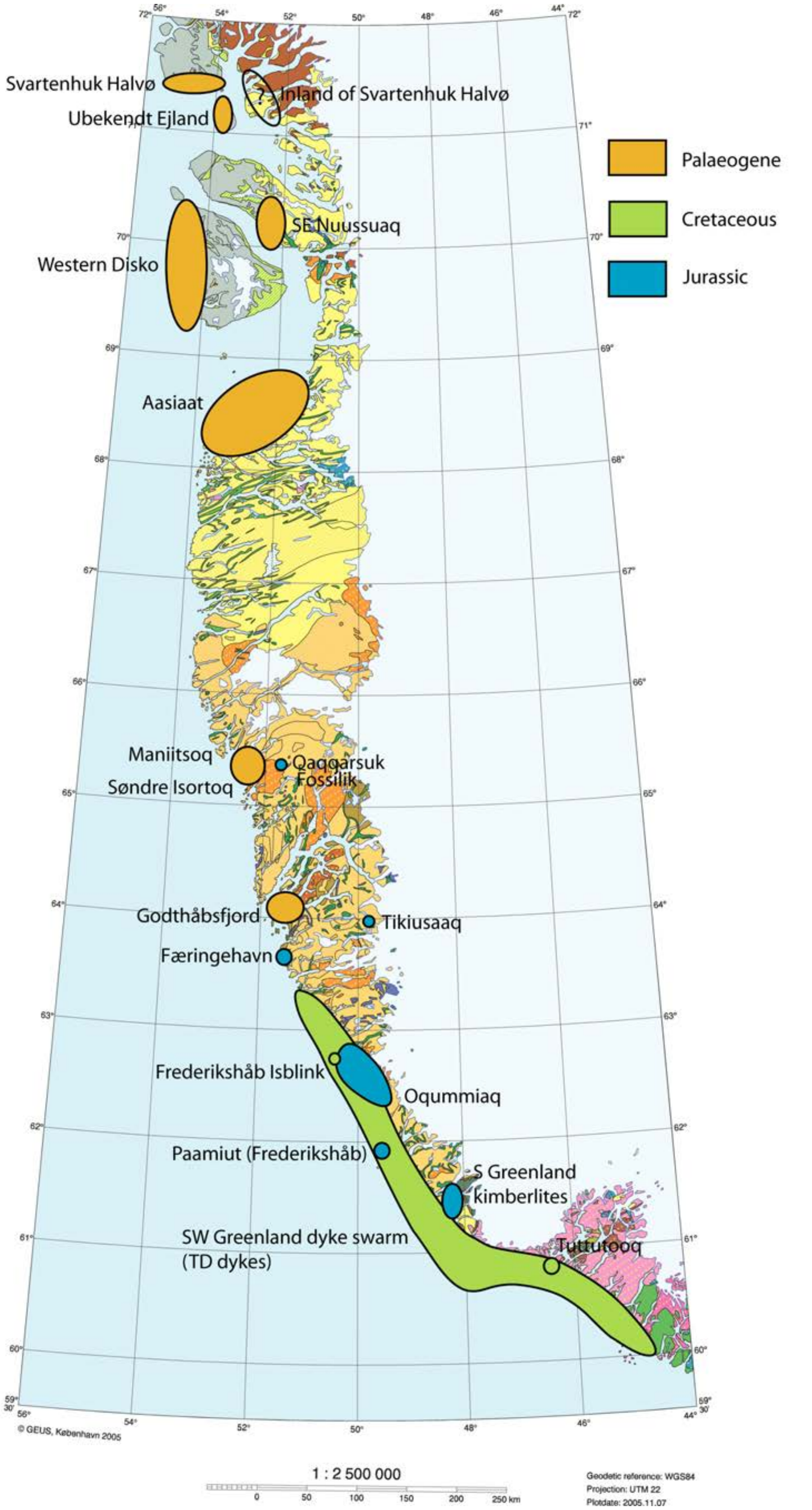


Fig. 12. Occurrences of young igneous rocks in West Greenland colour-coded according to age. Note the different distribution of Jurassic-Cretaceous and Palaeogene occurrences.

Start of extension, *c.* 200 to 150 Ma

The rocks from this period are kimberlites, aillikites, alnöites and carbonatites which are all ultramafic alkaline magmas generated in very small volumes at great depths, probably at the asthenosphere-lithosphere boundary or in the deep part of the lithoshere. All arose from a metasomatised mantle. The triggering of the melting could be incipient lithospheric stretching leading to localised asthenospheric upwelling, or it could be passive uplift alone. The spotwise distribution of the occurrences suggests localised tectonic control. The dyke directions do not give any indications of prevailing stress directions. The six ocurrences of these rocks are situated over a distance of 500 km between 61°24′N (S. Greenland) and 65°24′N (Qaqarssuk). The recently discovered Tikiusaaq carbonatite intrusion near the Inland Ice at 64°N has an age of 158 Ma (Steenfelt e*t al.* in press) and also belongs to this group.

The starting age of *c.* 200 Ma is based on old analyses, and re-dating of the apparently oldest occurrences should have high priority. The 200 Ma age corresponds to the earliest Jurassic, and the end at 152 Ma corresponds to the late Jurassic, Kimmeridgian.

Igneous rocks of equivalent age on the conjugate Labrador margin are not known, but several occurrences are known fron the Atlantic margin along Nova Scotia and Newfoundland (Jansa & Pe-Piper 1988; Pe-Piper *et al.* 1990; 1992; Pe-Piper & Reynolds 2000). Here, occurrences of Triassic and Jurassic alkaline and tholeiitic volcanic and intrusive igneous rocks with ages in a wide range (247–140 Ma) have been related to rifting and opening between North America and Europe, with the opening starting around 200 Ma.

Farther away, in eastern Ontario, Jurassic kimberlite magmatism around 160–140 Ma has been suggested to be related to a hotspot track (Heaman & Kjarsgaard 2000).

Increased extension around 150 Ma

At around 150 Ma (Kimmeridgian), the melting products turned into monchiquites which were presumably produced by somewhat larger degrees of melting than the preceeding ultramafic rocks, but still at great depths. This suggests increased extension. The melts were emplaced in a loosely defined dyke swarm around Frederikshåb Isblink that, as presently known (62°23′N to 62°53′N), extends for 60 km with an overall NNW–SSE direction, though many individual dykes trend N–S. These dykes are very discreet, and the swarm could be more extensive.

On the Labrador side, an ultramafic lamprophyric breccia diatreme at Ford's Bight near Aillik Bay has yielded microfossils of early Jurassic to early Cretaceous age (King & McMillan 1975). Apparently related dykes of melilitite, nephelinite and basanite have ages around 142 Ma (cited in Tappe *et al.* 2006).

No sediments of Jurassic age are known from the Labrador Sea (e.g., Balkwill *et al.* 1990; Chalmers *et al.* 1993; Chalmers & Pulvertaft, 2001). However, seismic sections show the existence of 'deep' successions of unknown age, and the finding of reworked Jurassic and lower Cretaceous palynomorphs in the sediments in the Qulleq-1 well suggests that Jurassic sediments could be be present at depth (Ghexis no 19, 2001).

Regional rifting and dyking at 140–133 Ma

Between 140 Ma and 133 Ma (Early Cretaceous, Berriasian-Valanginian to Hauterivian), the SW Greenland coast-parallel dyke swarm was emplaced in two or three stages. The more than 400 km long swarm was clearly emplaced into a coast-parallel fracture system, indicating a significant regional stretching and rifting event. The basaltic alkaline to enriched tholeiitic compositions indicate much larger degrees of melting than earlier, probably at much shallower depths, of unmodified asthenospheric mantle. The big dykes must have fed a succession of lava flows, but these are eroded away. The dyke swarm pinches out around 63°20′N in a way that suggests it may continue on the shelf.

On the Labrador side, and in a conjugate position relative to the SW Greenland dyke swarm, alkali basaltic volcanic rocks (the Alexis Formation) are known from seven wells covering a NW–SE stretch of about 300 km inboard of the Hopedale Basin (Umpleby 1979; Balkwill *et al.* 1990; Pe-Piper *et al.* 1990). These rocks form the oldest succession drilled on the Labrador shelf. They have been dated radiometrically (K-Ar) at 131–104 Ma but are considered to be Berriasian to Hauterivian, i.e. contemporaneous with the SW Greenland dyke swarm. As far as can be gleaned from diagrams, the basalts of the Alexis Formation have compositions that are comparable to those of the SW Greenland dyke swarm. Keen *et al.* (1994) and Williamson *et al.* (1994) showed that the Alexis melts could be modelled as formed by adiabatic decompression of the asthenosphere during stretching of the lithosphere. An asthenospheric source is also indicated here for the SW Greenland swarm.

Subsidence and sedimentation at 130–120 Ma

After the 140–133 Ma rifting event, subsidence led to deposition of thick sedimentary successions in the offshore basins between Greenland and Canada: the Kitsissut sequence and the Lower Bjarni Formation (e.g., Chalmers & Pulvertaft 2001).

Faulting, sedimentation and magmatism around 120–100 Ma

A major episode of faulting in the Aptian–Albian (120–100 Ma) formed a group of rotated fault-blocks, and the syn-rift Appat sequence and Upper Bjarni Formation were deposited. There are traces of accompanying igneous activity at this time: The camptonite sill on Tuttutooq was emplaced at 115 Ma, and the large coast-parallel phonolite dyke at Frederikshåb Isblink was emplaced at 105 Ma. Moreover, a basalt sample dredged from a seamount in the Labrador Sea at 62°50.5′N and dated at 118 Ma may represent a dyke or a flow from the offshore area or from the coastal zone (Larsen & Dalhoff, in press). All the Cretaceous igneous rocks are plagioclase-bearing and were presumably generated beneath an attenuated lithosphere.

Late Cretaceous subsidence, sedimentation and faulting at 100–65 Ma

The faulting episode was followed by thermal subsidence of the basin during the Late Cretaceous and deposition of the Kangeq sequence and the Markland Formation. From the latest Campanian around 75 Ma and into the Maastrichtian, renewed extension and faulting occurred (e.g., Chalmers & Pulvertaft 2001). No volcanic rocks in the region are known from this period.

During the same period there was volcanic activity in the northern Canadian arctic islands where the Strand Fiord Formation and the Hansen Point volcanics were emplaced; this activity has been related to the formation of the oceanic Canada Basin (Embry & Osadetz 1988) and its relevance for the tectonic events in the Labrador Sea and Davis Strait is doubtful.

Paleogene rifting and magmatism since 65 Ma

In the Paleocene, rifting and lithospheric thinning proceeded to continental break-up and formation of oceanic crust. In the Labrador Sea, the oldest undisputedly identifiable oceanic crust was formed within palaeomagnetic chron 27r (Chalmers & Laursen 1995). The oldest Paleocene volcanic rocks dated from the region are tholeiitic basalts from the Davis Strait High with an $^{40}Ar/^{39}Ar$ age of 63.0 ± 0.7 Ma (Larsen & Dalhoff, in press). This age is within palaeomagnetic chron 27r which ends at 62.0 Ma (Ogg & Smith 2004). The geochemistry of these basalts indicates formation beneath a strongly thinned continental lithospheric lid (Larsen & Dalhoff, in press).

The major part of the voluminous volcanic succession onshore West Greenland from Disko to Svartenhuk Halvø (the Vaigat and Maligât Formations) was emplaced during the period 62–60 Ma (Storey *et al.* 1998). Of the intrusions dated during the present work, the large sill on Grønne Ejland with an age of 60.45 ± 0.88 Ma is contemporaneous with the volcanic rocks. Thus, the extensive sill complex that extends within the sediments throughout the Disko Bugt area apparently forms a SE extension of the Paleocene volcanic succession.

Igneous rocks younger than 60 Ma comprise several dyke generations and a volcanic succession.

Sill intrusions in SE Nuussuaq (Tartunaq) are dated here at 56.47 ± 0.83 Ma. A dyke on Nuussuaq with a similar chemistry was dated by Storey *et al.* (1998) at 55.2 ± 0.4 Ma. The Tartunaq intrusions are emplaced along the deep eastern boundary fault of the Nuussuaq Basin, testifying to significant movements along this fault system around 56.5–55 Ma.

A young volcanic succession that occurs from north-western Nuussuaq to Svartenhuk Halvø was emplaced around the Paleocene-Eocene boundary at 55 Ma (the Kanissut Formation on Nuussuaq, Tegner *et al.* in prep). (NB, Storey *et al.* (1998) reported and age of 52.5 Ma for this succession, but re-dating has shown this age to be erroneous).

The N–S trending western Disko dyke swarm was dated at 54.0 ± 0.3 Ma by Storey *et al.* (1998). A large N–S running dyke in the Aasiaat district (the globule dyke) has yielded an age of 55.77 ± 0.24 Ma (Table 2). The chemistry of these dykes is very similar to each other and to that of the young volcanic succession, and their ages are also within the same interval of 56–54 Ma. The second large dyke in the Aasiaat district (the NNE-trending Manermiut dyke) has a chemistry that is different from the globule dyke but similar to a few dykes in the western Disko swarm, and it is possible that there are two dyke generations present of which only one has so far been dated.

The dating in this work has extended the areas with onshore tholeiitic igneous activity 120 km southwards from southern Disko to nearly the same latitude (68°N) as extends the offshore volcanic area north of the Sisimiut Basin (e.g. Chalmers & Pulvertaft 2001). The two large N- to NNE-trending dykes can be viewed as emplaced into boundary faults of the southern extension of the Nuussuaq Basin towards the Sisimiut Basin. The 110 km long Manermiut dyke sidesteps repeatedly to the right and appears to form a connection between the two basins.

Alkaline rocks. No Palaeogene tholeiitic igneous rocks are known in the onshore areas south of 68°10′N although such rocks occur offshore on the Nukik platform and the Maniitsoq and Hecla Highs. Palaeogene onshore igneous activity in the southern areas produced alkaline rocks: the alkali basalt dyke at Søndre Isortoq and the camptonite dyke swarms in the Søndre Isortoq and Godthåbsfjord areas. The period of formation of these rocks is long, 58–51 Ma, which is the same as the period found for the offshore volcanic area of the Hecla High (Larsen & Dalhoff in press). The alkali basalt dyke is the oldest, 58.05 ± 0.64 Ma, an excellent age with the plateau defined by 89% of the released argon. The two camptonite swarms, situated 120 km apart, gave significantly different ages of 55.42 ± 0.61 Ma (Søndre Isortoq) and 51.44 ± 0.88 Ma (Godthåbsfjord). All these rocks require a metasomatised mantle source (Fig. 7). The camptonites are those rocks that were generated at the shallowest levels (Figs 6, 8), apparently well within the lithosphere. It is conceivable that metasomatic conditioning of the lithosphere, possibly starting in the asthenosphere, took place early in the Paleocene. The metasomatised regions then constituted reservoirs in which melting could subsequently be triggered easily during events of lithospheric stretching. During such events, extension in the thinned offshore areas could be sufficiently high to produce tholeiitic basalts, whereas simultaneous extension beneath the thicker continent was much less but enough to trigger melting of the metasomatised regions. There is no apparent direct tectonic link between the onshore and the offshore areas.

In the northern area between Disko and Svartenhuk Halvø, alkaline rocks were also formed at late stages. The 34 Ma monchiquites and camptonites on Ubekendt Ejland and also the late alkaline dykes and 28 Ma volcanic plug could have formed by melting of previously metasomatised lithosphere as envisaged for the camptonites in the southern areas. Their presence indicates that tectonic events with lithospheric stretching took place during an extended period after the main igneous event, lasting until the latest Palaeogene.

Conclusions and recommendations

Occurrences of Mesozoic to Paleogene igneous rocks in West Greenland were formed in response to successive tectonic events in the period during which the continent was stretched, rifted, and broken up. New high-precision dating has led to the recognition of a number of discrete events; and abandonment of some old erroneous ages has revealed a highly significant systematic evolution of the melt compositions with time, reflecting a gradually thinned lithosphere.

Igneous activity started in the early Jurassic around 200 Ma. Incipient stretching during the period c. 200–150 Ma is reflected in the production of highly alkaline, volatile-rich melts: kimberlites, alnöites, aillikites, and carbonatites. These melts were formed in small volumes at very low degrees of melting in the deep lithospheric mantle; the melting mantle was previously metasomatised and enriched in incompatible elements.

In the late Jurassic around 150 Ma (Kimmeridgian), the extension increased. The site of melting was still in the deep lithospheric (metasomatised) mantle, but the degrees of melting increased to the production of monchiquitic melts. These rocks form a min. 60 km long dyke swarm around Frederikshåb Isblink. N–S dyke alignments indicate the orientation of the stress field.

In the early Cretaceous, 140–133 Ma (Valanginian-Hauterivian), extension had gone so far that the upwelling asthenospheric mantle started to melt. The melts were produced at still larger degrees of melting, and the rocks are alkaline to enriched tholeiitic basalts. At that time the regional stress field was intense, and as a result the magmas were emplaced in the large, 400 km long SW Greenland dyke swarm. On the conjugate Canadian margin, the alkali basalts of the Alexis Formation were presumably formed around the same time.

During the rest of the Cretaceous, igneous activity onshore West Greenland was sparse. Two occurrences dated at 115 Ma and 105 Ma are known. One is a big, coast-parallel phonolite dyke in the outhermost coast zone, suggesting that other Cretaceous igneous rocks could be present in the offshore areas.

There is a clear two-fold division of West Greenland. The Jurassic–Cretaceous rocks are concentrated south of 64°N, with only two occurrences north of this at 65°22′–24′N. In contrast, all the Palaeogene rocks occur north of 64°N.

In the Palaeogene, continental break-up and extrusion of the voluminous flood basalts took place in the period 63–60 Ma. Dating of sills and dykes has shown that Palaeogene intrusive activity onshore occurred far outside the volcanic areas in the Disko–Nuussuaq–Svartenhuk Halvø region. Sills in the Disko Bugt form an intrusive south-eastern extension of the volcanic areas. Three large dykes in the Aasiaat region have extended the known onshore areas of igneous activity south to 68°N, and one dyke appears to form a stepped link between the Nuussuaq and Sisimiut Basins. Many dykes and sills in the Disko–Nuussuaq–Svartenhuk Halvø region are post-volcanic; they show a concentration of ages in the interval 57–54 Ma. All the dated rocks are asthenosphere-derived tholeiitic basalts.

Two Palaeogene dyke swarms occur much farther south, between 65°30′N and 64°N. These are alkaline, camptonitic, and were formed by shallow melting in the lithosphere. They are dated at 58, 55, and 51 Ma and show no structural relation to the offshore areas. They may result from local stresses set up repeatedly by lithospheric adjustments prior to and during sea-floor spreading.

Recommendations

The precise starting time for the Mesozoic igneous activity, marking the very first sign of lithospheric unrest, is now the point in time that is known with the least precision. All dates older than 165 Ma are old and of uncertain merit (Table 3). Re-dating of the kimberlites in South Greenland and the ultramafic lamprophyres at Færingehavn and Paamiut should have high priority. Dating of the Paamiut dykes will require new sampling.

The age of a group of ultramafic lamprophyres including kimberlite-like rocks inland of Svartenhuk Halvø is still unknown. They may perhaps be Proterozoic, but in any case they should be dated.

The large SW Greenland coast-parallel dyke swarm is not sampled in either end. In particular, more field data and samples from the southern extension of the swarm are desirable. Does the swarm extend to Kap Farvel?

The swarm of Eocene dykes in the Godthåbsfjord region is at present poorly delimited and its structure is uncertain. More field and analytical work should be done on this swarm.

More petrological work on any of the dyke swarms with regard to mantle sources and pressures and temperatures of generation will require as a minimum Sr and Nd isotope analyses which are at present practically non-existent.

Acknowledgements

The project was financed mainly by the Bureau of Minerals and Petroleum, Nuuk. Hans Kristian Olsen, Nuuk, kindly sampled the camptonite dyke swarm in the Godthåbsfjord area for me. Many other geologists have over the years contributed with samples and information about the dykes; for the present report contributions from and discussions with Uni Árting, Stefan Bernstein, Kirsten Hansen, Tony Higgins, Niels Kelstrup, Mogens Lind, Asger Ken Pedersen, Thorkild Maack Rasmussen, Karsten Secher, Agnete Steenfelt, Brian Upton, and Stuart Watt are gratefully acknowledged. Bob Duncan and John Huard at the Noble Gas Mass Spectrometry Lab, Oregon State University, and Larry Heaman and Rob Creaser at University of Alberta, are thanked for exerting their analytical skills in the dating of the sometimes rather difficult samples.

References

Andrews, J.R. & Emeleus,C.H. 1971: Preliminary account of kimberlite intrusions from the Frederikshåb district, South West Greenland. Rapport Grønlands Geologiske Undersøgelse **31**, 1–26.

Andrews, J.R. & Emeleus,C.H. 1975: Structural aspects of kimberlite dyke and sheet intrusion in south west Greenland. Physics and Chemistry of the Earth **9**, 43–50.

Arting, U.E. 2004: A petrological study of basic dykes and sills of assumed Palaeoproterozoic age in central West Greenland. Unpublished M.Sc. thesis, University of Copenhagen, 121 pp + appendices.

Balkwill, H.R., Mcmillan, N.J., Maclean, B., Williams, G.L. & Srivastava, S.P. 1990: Geology of the Labrador Shelf, Baffin Bay, and Davis Strait. In: Keen, M.J. & Williams, G.L. (eds) Geology of the Continental Margin of Eastern Canada. Geological Survey of Canada, Geology of Canada **2**, 293–348.

Bernstein, S. & Brooks, C.K. 1998: Mantle xenoliths from Tertiary lavas and dykes from Ubekendt Ejland, West Greenland. Geology of Greenland Survey Bulletin **180**, 152–154.

Bridgwater, D. 1970: A compilation of K/Ar age determinations on rocks from Greenland carried out in 1969. Rapport Grønlands Geologiske Undersøgelse **28**, 47–55.

Chalmers, J.A. & Laursen, K.H. 1995: Labrador Sea: The extent of continental crust and the timing of the start of sea-floor spreading. Marine and Petroleum Geology **12**, 205–217.

Chalmers, J.A. & Pulvertaft, T.C.R. 2001: Development of the continental margins of the Labrador Sea: a review. In: Wilson, R.C.L. *et al.* (eds), Non-volcanic rifting of continental margins: a comparison of evidence from land and sea. Special Publication, Geological Society, London **187**, 77–105.

Chalmers, J.A., Pulvertaft, T.C.R., Christiansen, F.G., Larsen, H.C., Laursen, K.H. & Ottesen, T.G. 1993: The southern West Greenland continental margin: rifting history, basin development, and petroleum potential. In: Parker, J.R. (ed) Petroleum Geology of Northwest Europe: Proceedings of the 4th Conference. The Geological Society, London, 915–931.

Clarke, D.B. & Pedersen, A.K. 1976: Tertiary volcanic province of West Greenland. In: Escher, A. & Watt, W.S. (eds): Geology of Greenland, 364–385. Copenhagen: Geological Survey of Greenland.

Clarke, D.B., Muecke, G.K. & Pe-Piper, G. 1983: The lamprophyres of Ubekendt Ejland, West Greenland: products of renewed partial melting or extreme differentiation? Contributions to Mineralogy and Petrology **83**, 117–127.

Creaser, R.A., Grütter, H., Carlson, J. & Crawford, B. 2004: Macrocrystal phlogopite Rb–Sr dates for the Ekati property kimberlites, Slave Province, Canada: evidence for multiple intrusive episodes in the Paleocene and Eocene. Lithos **76**, 399–414.

Drever, H.I. & Game, P.M. 1948: The geology of Ubekendt Ejland, West Greenland, part I, a preliminary review. Meddelelser om Grønland **134(8)**, 1–35.

Duggen, S., Hoernle, K., van den Bogaard, P. & Garbe-Schönberg, D. 2005: Post-collisional transition from subduction- to intraplate-type magmatism in the westernmost Mediterranean: evidence for continental-edge delamination of subcontinental lithosphere. Journal of Petrology **46**, 1155–1201.

Ellitsgaard-Rasmussen, K. 1951: A West Greenland globule dike. Meddelelser Dansk Geologisk Forening (Bulletin Geological Society of Denmark) **12**, 83–101.

Embry, A.F. & Osadetz, K.G. 1988: Stratigraphy and tectonic significance of Cretaceous volcanism in the Queen Elizabeth Islands, Canadian Arctic Archipelago. Canadian Journal of Earth Sciences **25**, 1209–1219.

Emeleus, C.H. & Andrews, J.R. 1975: Mineralogy and petrology of kimberlite dyke and sheet intrusions and included peridotite xenoliths from South-west Greenland. Physics and Chemistry of the Earth **9**, 179–197.

Goodenough, K.M., Upton, B.G.J. & Ellam, R.M. 2002: Long-term memory of subduction processes in the lithospheric mantle: evidence from the geochemistry of basic dykes in the Gardar Province of South Greenland. Journal of the Geological Society **159**, 705–714.

Gradstein, F.M., Ogg, J.G. & Smith, A.G. (eds) 2004: A Geologic Time Scale 2004. Cambridge: Cambridge University Press, 610 pp.

Gudfinnsson, G.H. & Presnall, D.C. 2005: Continuous gradations among primary carbonatitic, kimberlitic, melilititic, basaltic, picritic, and komatiitic melts in equilibrium with garnet lherzolite at 3–8 GPa. Journal of Petrology **46**, 1645–1659.

Hansen, H. 2002: Description of rock samples from a West Greenland drill core. Rapport Danmarks og Grønlands Geologiske Undersøgelse **2002/109**, 18pp + figs.

Hansen, K. 1979: Lamprofyrgange fra Frederikshåbs Isblink, syd vest Grønland. Unpublished M.Sc. thesis, University of Copenhagen, 83 pp.

Hansen, K. 1980: Lamprophyres and carbonatitic lamprophyres related to rifting in the Labrador Sea. Lithos **13**, 145–152.

Hansen, K. 1981: Systematic Sr isotopic variation in alkaline rocks from West Greenland. Lithos **14**, 183–188.

Hansen, K. 1984: Rare earth abundances in Mesozoic undersaturated alkaline rocks from West Greenland. Lithos **17**, 77–85.

Hansen, K. & Larsen, O. 1974: K/Ar age determinations on Mesozoic lamprophyre dykes near Ravns Storø, Fiskenæsset Region, southern West Greenland. Rapport Grønlands Geologiske Undersøgelse **66**, 9–11.

Heaman. L.M. 1989: The nature of the subcontinental mantle from Sr–Nd–Pb isotopic studies on kimberlitic perovskite. Earth and Planetary Science Letters **92**, 323–334.

Heaman, L.M. 2005: Patterns of kimberlite emplacement – the importance of robust geochronology. Workshop on Greenland's diamond potential, 7–9 November 2005, in Copenhagen. Rapport Danmarks og Grønlands Geologiske Undersøgelse **2005/68**, 25 only.

Heaman, L.M. & Kjarsgaard, B.A. 2000: Timing of eastern North American kimberlite magmatism: continental extension of the Great Meteor hotspot track? Earth and Planetary Science Letters **178**, 253–268.

Henderson, G. 1969: The Precambrian rocks of the Egedesminde-Christianshåb area, West Greenland. Rapport Grønlands Geologiske Undersøgelse **23**, 37 pp. + map.

Henderson, G. 1970: Geological Map of Greenland, 1:100 000, Mârmorilik 71 V.2 Syd. Copenhagen: Geological Survey of Greenland.

Higgins, A.K. 1970: The stratigraphy and structure of the Ketilidian rocks of Midternæs, South-west Greenland. Bulletin Grønlands Geologiske Undersøgelse **87**, 96 pp.

Jansa, L.F. & Pe-Piper, G. 1988: Middle Jurassic to Early Cretaceous igneous rocks along eastern North American continental margin. Bulletin American Association of Petroleum Geologists **72**, 347–366.

Juhava, R. 1974: On young generations of kimberlitic and lamprophyric dyke rocks from Søndre Isortoq area, West Greenland. Internal report no 302, Kryolitselskabet Øresund A/S, 25 pp.

Keen, C.E., Courtney, R.C., Dehler, S.A. & Williamson, M.-C. 1994: Decompression melting at rifted margins: comparison of model predictions with the distribution of igneous rocks on the eastern Canadian margin. Earth and Planetary Science Letters **121**, 403–416.

Kelstrup, N. 1966: Feltdagbog 1966. GGU, unpublished.

King, A.F. and McMillan, N.J. 1975: A Mid-Mesozoic breccia from the coast of Labrador. Canadian Journal of Earth Sciences **12**, 44–51.

Knudsen, C. 1986: Apatite mineralisation in carbonatite and ultramafic intrusions in Greenland. Final Report, EEC contract MSM-119-DK. Grønlands Geologiske Undersøgelse Open file Series 87/1, 176 pp + maps + appendix.

Knudsen, C. 1991: Petrology, geochemistry and economic geology of the Qaqarssuk carbonatite complex, southern West Greenland. Monograph Series of Mineral Deposits **29**, 110 pp.

Knudsen, C. & Buchardt, B. 1991: Carbon and oxygen isotope composition of carbonates from the Qaqarssuk Carbonatite Complex, southern West Greenland. Chemical Geology (Isotope Geoscience Section) **86**, 263–274.

Koch, B.E. 1959: Contribution to the stratigraphy of the non-marine Tertiary deposits on the south coast of the Nûgssuaq Peninsula, northwest Greenland, with remarks on the fossil flora. Bulletin Grønlands Geologiske Undersøgelse **22**, 100 pp. (Also Meddelelser om Grønland **162(1)**, 100 pp.

Kystol, J. & Larsen, L.M. 1999: Analytical procedures in the Rock Geochemical Laboratory of the Geological Survey of Denmark and Greenland. Geology of Greenland Survey Bulletin **184**, 59–62.

Larsen, J.G. 1981: Medium pressure crystallisation of a monchiquitic magma - evidence from megacrysts of Drever's block, Ubekendt Ejland, West Grenland. Lithos **14**, 241–262.

Larsen, J.G. 1982: Mantle-derived dunite and lherzolite nodules from Ubekendt Ejland, west Greenland Tertiary province. Mineralogical Magazine **46**, 329–336.

Larsen, J.G. 1983: Geological Map of Greenland, 1:100 000, Igdlorssuit 71 V.1 Syd. Copenhagen: Geological Survey of Greenland.

Larsen, L.M. 1979: Feltdagbog 1979. GGU, unpublished, 81 pp.

Larsen, L. M. 1991: Occurrences of kimberlite, lamproite and ultramafic lamprophyre in Greenland. Grønlands Geologiske Undersøgelse Open file Series **91/2**, 36 pp + app.

Larsen, L.M. & Rex, D.C. 1992: A review of the 2500 Ma span of alkaline-ultramafic, potassic and carbonatitic magmatism in West Greenland. Lithos **28**, 367–402.

Larsen, L.M. & Dalhoff, F. 2006: Composition, age, and geological and geotectonic significance of igneous rocks dredged from the northern Labrador Sea and the Davis Strait. Rapport Danmarks og Grønlands Geologiske Undersøgelse, in prep.

Larsen, L.M., Rex, D.C. & Secher, K. 1983: The age of carbonatites, kimberlites and lamprophyres from southern West Greenland: recurrent alkaline magmatism during 2500 million years. Lithos **16**, 215–221.

Larsen, L.M., Rex, D.C., Watt, W.S. & Guise, P.G. 1999: 40Ar–39Ar dating of alkali basaltic dykes along the south-west coast of Greenland: Cretaceous and Tertiary igneous activity along the eastern margin of the Labrador Sea. Geology of Greenland Survey Bulletin **184**, 19–29.

Larsen, O. & Møller, J. 1968: K/Ar age determinations from western Greenland I. Reconnaissance programme. Rapport Grønlands Geologiske Undersøgelse **15**, 82–86.

Le Maitre, R.W. (ed) 2002: Igneous Rocks, A classification and glossary of terms. 2nd edition. Recommendations of the IUGS subcommission on the systematics of igneous rocks. Cambridge: Cambridge University Press, 236 pp.

McDonough, W.F. & Sun, S.-S. 1995: The composition of the Earth. Chemical Geology **120**, 223–253.

McGregor, V.R. 1993: Geological map of Greenland 1:100 000, Qôrqut 64 V.1 Syd, Descriptive text. Copenhagen: Geological Survey of Greenland, 40 pp.

Menzies, M.A. 1990: Archaean, Proterozoic, and Phanerozoic lithosphere. In: Menzies, M.A. (ed.), Continental Mantle. Oxford Monograph on Geology and Geophysics **16**, 67–86.

Ogg, J.G. & Smith, A.G. 2004: The geomagnetic polarity time scale. In: Gradstein, F.M., Ogg, J.G. & Smith, A.G. (eds), A geologic time scale 2004, 63–86. Cambridge: Cambridge University Press.

Pe-Piper, G. & Reynolds, P.H. 2000: Early Mesozoic alkaline mafic dykes, southwestern Nova Scotia, Canada, and their bearing on Triassic–Jurassic magmatism. Canadian Mineralogist **38**, 217–232.

Pe-Piper, G., Piper, D.J.W., Keen, M.J. & McMillan, N.J. 1990: Igneous rocks of the continental margin. In Keen, M.J. & Williams, G.L. (eds) Geology of the Continental Margin of Eastern Canada. Geological Survey of Canada, Geology of Canada **2**, 75–85.

Pe-Piper, G., Jansa, L.F. & Lambert R.St.J. 1992: Early Mesozoic magmatism on the eastern Canadian margin: Petrogenetic and tectonic significance. Geological Society of America, Special Paper **268**, 13–36.

Pearce, N.J.G. & Leng, M.J. 1996: The origin of carbonatites and related rocks from the Igaliko Dyke Swarm, Gardar Province, South Greenland: field, geochemical and C–O–Sr–Nd isotope evidence. Lithos **39**, 21–40.

Pedersen, A.K. 1975: New mapping in north-western Disko 1972. Rapport Grønlands Geologiske Undersøgelse **69**, 25–32.

Pedersen, A.K. 1977: Dyke intrusions along the south coast of Disko. Rapport Grønlands Geologiske Undersøgelse **81**, 57–67.

Pedersen, A.K., Larsen, L.M. & Dueholm, K.S. 1993: Geological section along the south coast of Nuussuaq, central West Greenland. 1:20 000 coloured geological sheet. Copenhagen: Geological Survey of Greenland.

Pedersen, A.K., Larsen, L.M., Pedersen, G.K., Heinesen, M.V. & Dueholm, K.S. 2003: Geological section along the south and south-west coast of Disko, central West Greenland. 1:20 000 coloured geological sheet. Copenhagen: Geological Survey of Denmark and Greenland.

Rock, N.M.S. 1991: Lamprophyres. Glasgow: Blackie and Son, 285 pp.

Poulsen, V. 1966: An occurrence of Lower Palaeozoic rocks within the Precambrian terrain near Sukkertoppen. Rapport Grønlands Geologiske Undersøgelse **11**, 26 only.

Secher, K. & Stendal, H. 1989: Weathering products of sulphides in the Arctic – with a case history on a Cu-Ni-sulphide occurrence in West Greenland. In: Barto-Kyriakidis, A. (ed): Weathering; its products and deposits. Vol II: Products – Deposits – Geotechnics. Athens: Theophrastus Publications, 499–522.

Sørensen, H., Rose-Hansen, J., Nielsen, B.L., Løvborg, L., Sørensen, E. & Lundgaard, T. 1974: The uranium deposit at Kvanefjeld, the Ilímaussaq intrusion, South Greenland. Geology, reserves, and beneficiation. Rapport Grønlands Geologiske Undersøgelse **60**, 54 pp.

Sørensen, P.B. 1966: Feltdagbog 1966. GGU, unpublished, 217 pp.

Stacey, J.S. & Kramers, J.D. 1975: Approximation of terrestrial lead isotope evolution by a two-stage model. Earth and Planetary Science Letters **26**, 207–221.

Steenfelt, A., Hollis, J.A. & Secher, K. in press 2006: The Tikiusaaq carbonatite: a new alkaline igneous province in southern West Greenland? Geological Syrvey of Denmark and Greenland Bulletin 10, in press.

Steiger, R.H. & Jäger, E. 1977: Subcommission on geochronology: convention on the use of decay constants in geo- and cosmochronology. Earth and Planetary Science Letters **36**, 359–362.

Storey, M., Duncan, R.A., Pedersen, A.K., Larsen, L.M. & Larsen, H.C. 1998: $^{40}Ar/^{39}Ar$ geochronology of the West Greenland Tertiary volcanic province. Earth andPlanetary Science Letters **160**, 569–586.

Stouge, S. & Peel, J.S. 1979: Ordovician conodonts from the Precambrian shield of southern West Greenland. Rapport Grønlands Geologiske Undersøgelse **91**, 105–109.

Tappe, S., Foley, S.F., Jenner, G.J. & Kjarsgaard, B.A. 2005: Integrating ultramafic lamprophyres into the IUGS classification of igneous rocks: rationale and implications. Journal of Petrology **46**, 1893–1900.

Tappe, S., Foley, S.F., Jenner, G.J., Heaman, L.M., Kjarsgaard, B.A., Romer, R.L., Stracke, A., Joyce, N. & Hoefs, J. 2006: Genesis of ultramafic lamprophyres and carbonatites at Aillik Bay, Labrador: a consequence of incipient lithospheric thinning beneath the North Atlantic craton. Journal of Petrology **47**, advance access publication, 55 pp.

Turner, S.P., Platt, J.P., George, R.M.M., Kelly, S.P., Pearson, D.G. & Nowell, G.M. 1999: Magmatism associated with orogenic collapse of the Beltic–Alboran domain, SE Spain. Journal of Petrology **40**, 1011–1036.

Umpleby, D.C. 1979.: Geology of the Labrador Shelf. Geological Survey of Canada Paper **79–13**, 34 pp.

Upton, B.G.J. 1965: The petrology of a camptonite sill in South Greenland. Bulletin Grønlands Geologiske Undersøgelse **50**, 20 pp. (Also Meddelelser om Grønland **169(11)**).

Walter, M.J. 1998: Melting of garnet peridotite and the origin of komatiite and depleted lithosphere. Journal of Petrology **39**, 29–60.

Walton, B.J. & Arnold,A.R. 1970: Plutonic nodules in lamprophyric carbonatite dykes near Frederikshåb, south west Greenland. Bulletin Grønlands Geologiske Undersøgelse **91**, 1–26.

Watt, W.S. 1969: The coast-parallel dike swarm of southwest Greenland in relation to the opening of the Labrador Sea. Canadian Journal of Earth Sciences **6**, 1320–1321.

Williamson, M.-C., Courtney, R.C., Keen, C.E. & Dehler, S.A. 1995: The volume and rare earth concentrations of magmas generated during finite stretching of the lithosphere. Journal of Petrology **36**, 1433–1453.

Appendix 1 : Radiometric age determinations

^{40}Ar/^{39}Ar age determinations

Nine samples were dated by the Ar-Ar step-heating method at Oregon State University, the Noble Gas Mass Spectrometry Laboratory led by professor Robert Duncan. The laboratory and the method are described at
http://www.coas.oregonstate.edu/research/mg/chronology.html.
This appendix shows three plots for each sample, a plateau, a normal isochron, and a reverse isochron.

Summary table. ^{40}Ar/^{39}Ar radiometric age determinations on rocks from West Greenland

		Total Fusion (Ma)	Plateau (Ma)				Inverse Isochron (Ma)	
Sample	Material	Age ± 2 σ	Age ± 2 σ	Steps$_1$	%^{39}Ar$_1$	MSWD	Age ± 2 σ	^{40}Ar/^{36}Ar ± 2 σ
26388	whole rock	146.5 ± 2.3	**140.3 ± 2.2**	7/11	79.9	1.42	140.4 ± 2.2	291.2 ± 28.0
50068	whole rock	212.4 ± 2.7	None				**114.7 ± 4.7**	1736 ± 94
120403	whole rock	104.5 ± 1.5	**105.4 ± 1..5**	8/14	89.1	1.84	103.5 ± 2.9	308.8 ± 17.8
201449	plagioclase	73.57 ± 0.97	None				**51.44 ± 0.88**	423.9 ± 8.4
318802	whole rock	57.22 ± 0.84	**56.47 ± 0.83**	6/11	56.2	0.67	56.44 ± 0.88	295.9 ± 4.2
455793	plagioclase	63.24 ± 0.91	**60.45 ± 0.88**	5/7	86.5	0.39	60.18 ± 0.99	302.2 ± 11.5
464536	plagioclase	55.71 ± 0.21	**55.77 ± 0.24**	5/8	79.0	1.49	55.96 ± 0.26	251.7 ± 34.5
KØ 17090	plagioclase	59.12 ± 0.67	**58.05 ± 0.64**	6/9	89.1	1.06	57.75 ± 0.69	310.6 ± 14.0
KØ 17154	whole rock	68.43 ± 0.69	**55.42 ± 0.61**	4/10	39.8	1.93	54.97 ± 0.77	317.7 ± 25.1

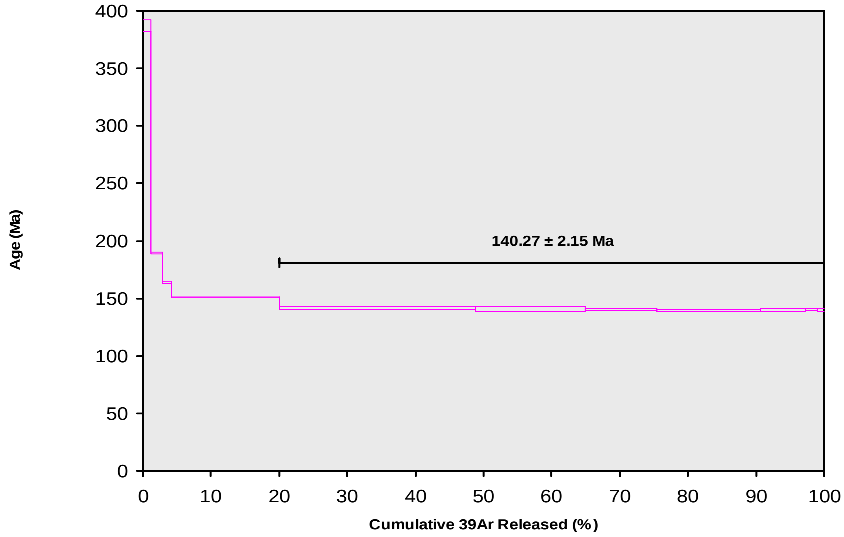
Samples irradiated at Oregon State University TRIGA reactor for 6 hours at 1MW power. Neutron flux measured using FCT-3 biotite monitor (FCT age 28.03 Ma, Renne *et al.* 1998). Data reduced by ArArCALC software (Koppers 2002).

Preferred age in **BOLD TEXT.**

1. Plateau age data includes number of steps in the plateau (steps in plateau / total steps) and % ^{39}Ar in plateau.

Sample GGU 26388, basalt dyke, SW Greenland dyke swarm, group 2

05C3338.AGE >>> 26388 >>> Larsen



Ar-Ages in Ma

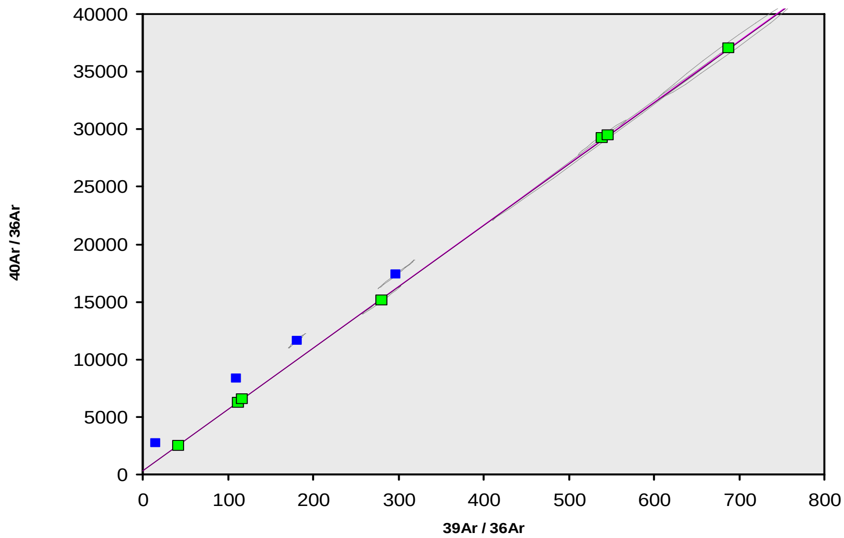
Weighted Plateau
140.27 ± 2.15
Total Fusion
146.54 ± 2.25
Normal Isochron
140.49 ± 2.23
Inverse Isochron
140.36 ± 2.23

MSWD
1.42

Sample Info

whole rock
Greenland
jh
OSU5D05
0.00151705 (J)

05C3338.AGE >>> 26388 >>> Larsen



Ar-Ages in Ma

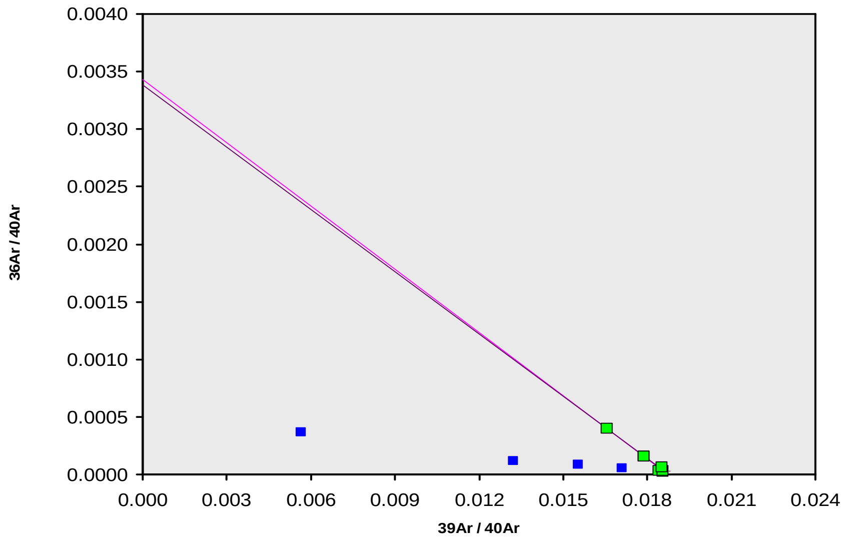
Weighted Plateau
140.27 ± 2.15
Total Fusion
146.54 ± 2.25
Normal Isochron
140.49 ± 2.23
Inverse Isochron
140.36 ± 2.23

MSWD
1.76

Sample Info

whole rock
Greenland
jh
OSU5D05
0.00151705 (J)

05C3338.AGE >>> 26388 >>> Larsen



Ar-Ages in Ma

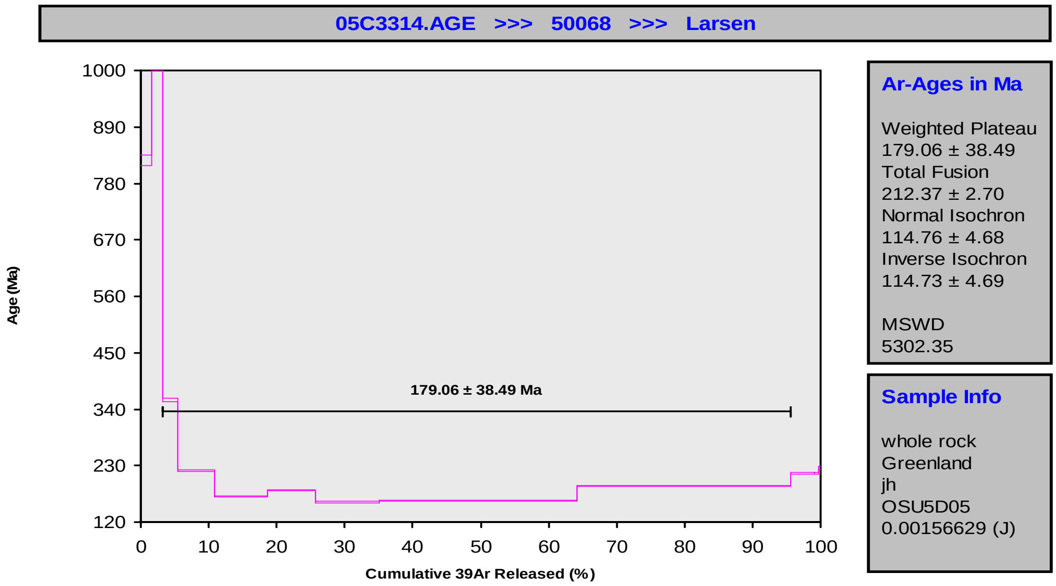
Weighted Plateau
140.27 ± 2.15
Total Fusion
146.54 ± 2.25
Normal Isochron
140.49 ± 2.23
Inverse Isochron
140.36 ± 2.23

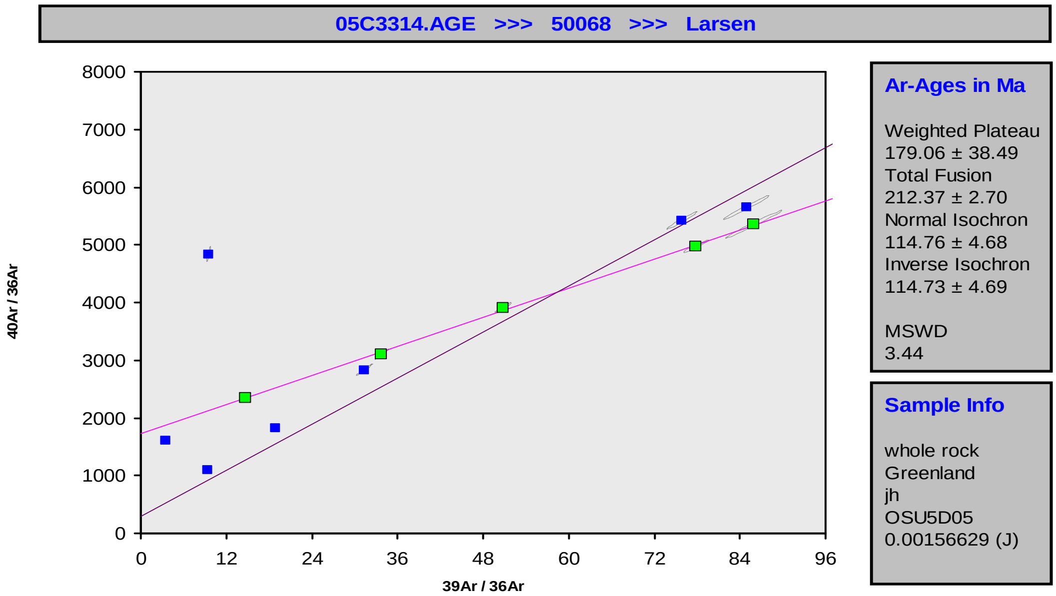
MSWD
1.68

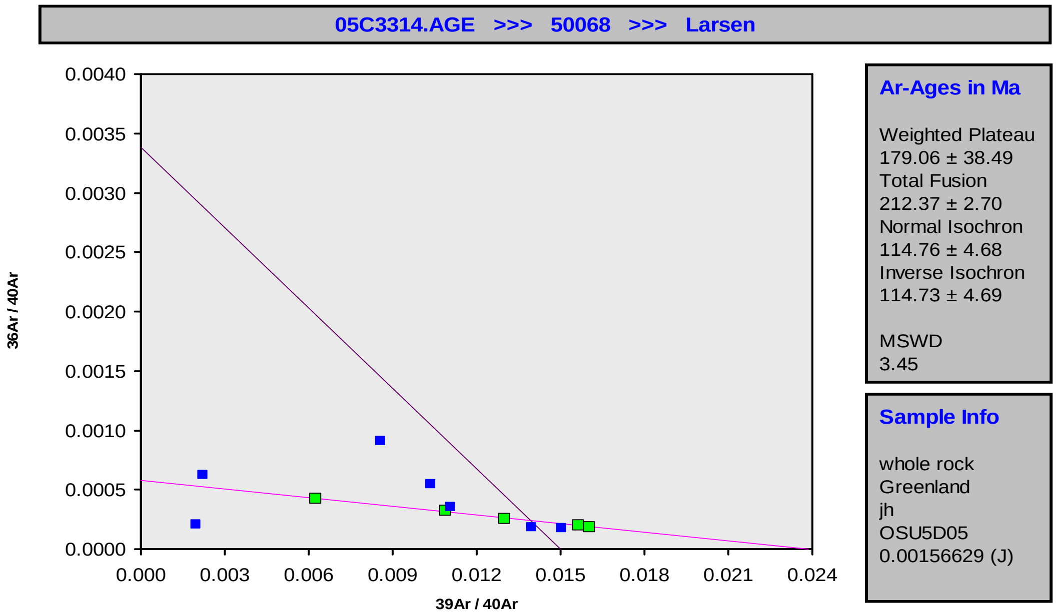
Sample Info

whole rock
Greenland
jh
OSU5D05
0.00151705 (J)

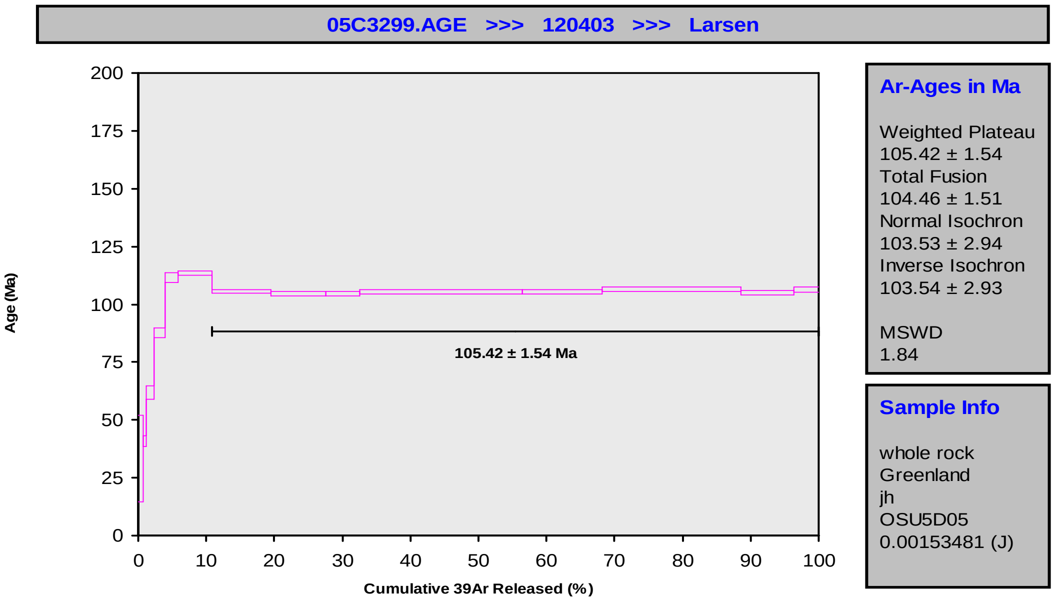
Sample GGU 50068, camptonite sill, Tuttutooq

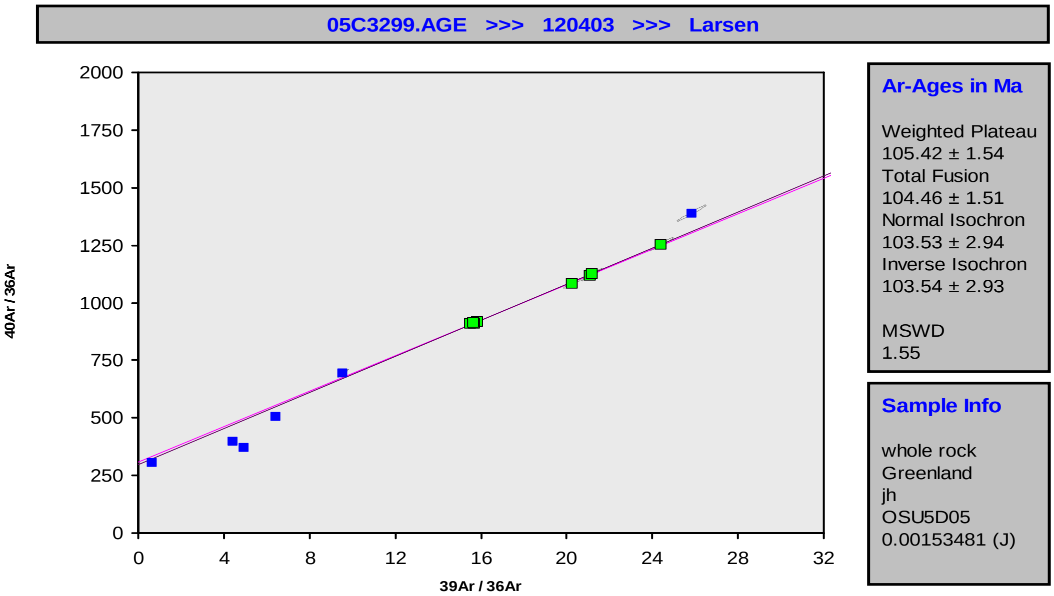


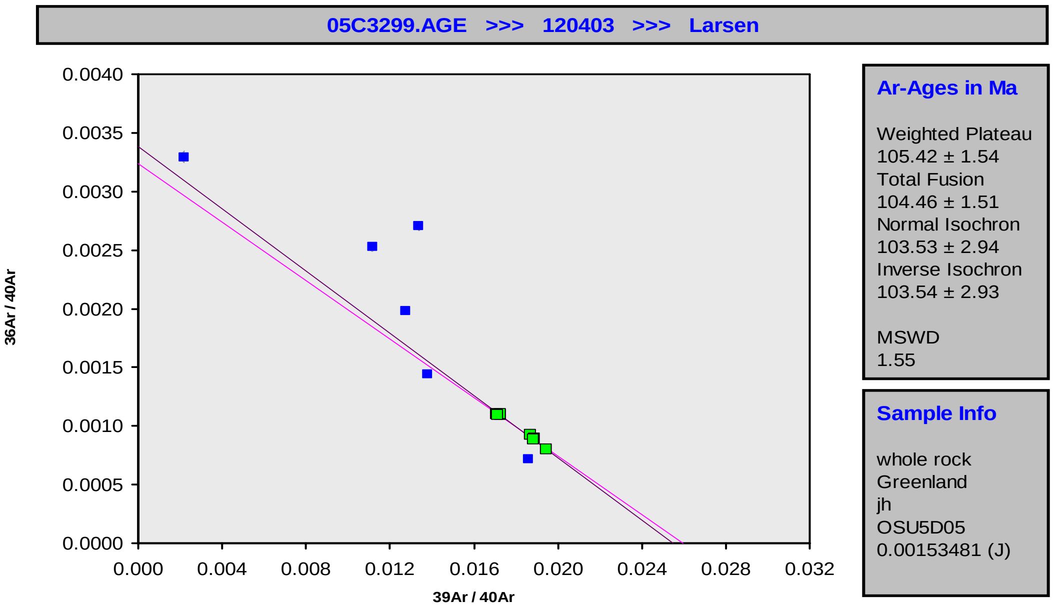




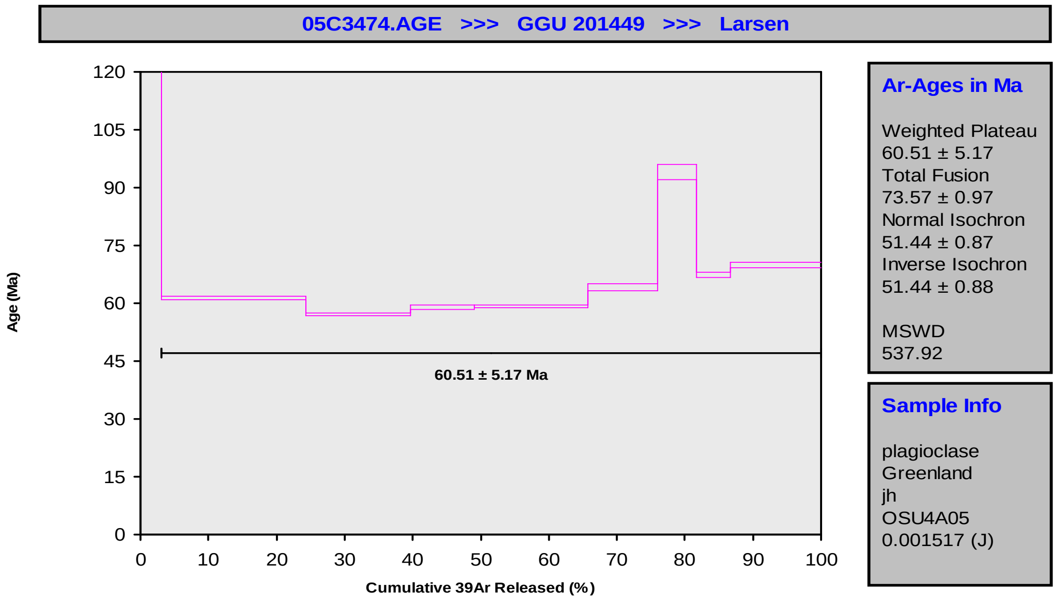
Sample GGU 120403, phonolite dyke, Frederikshåb Isblink

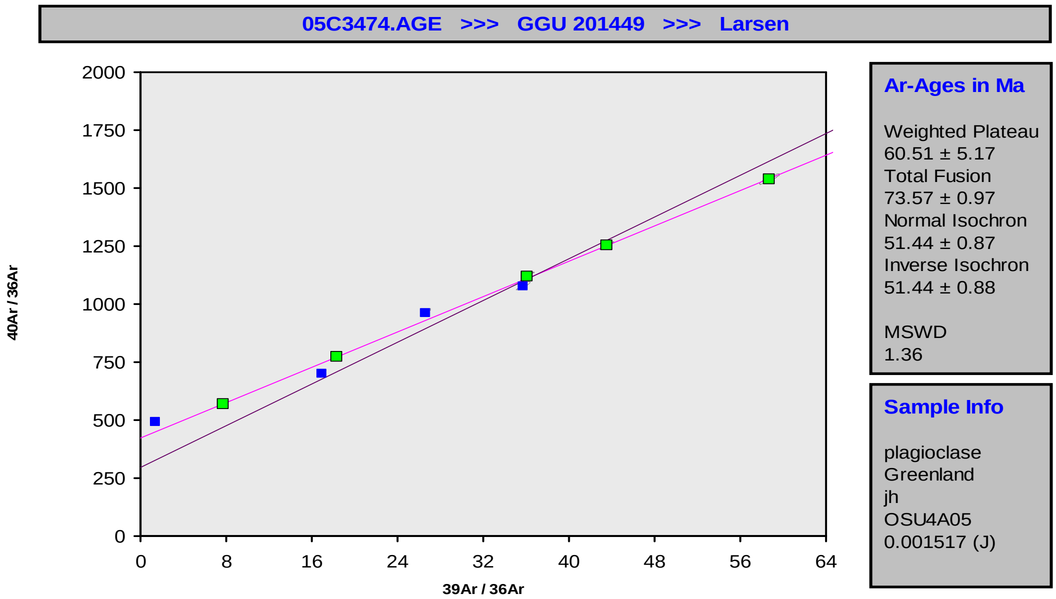


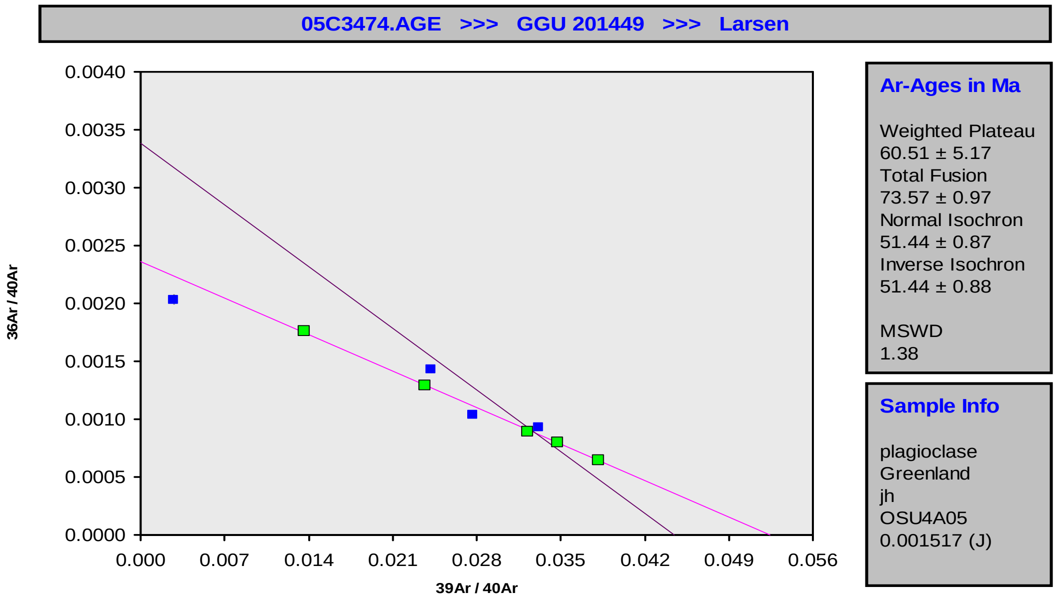




Sample GGU 201449, camptonite dyke, Godthåbsfjord

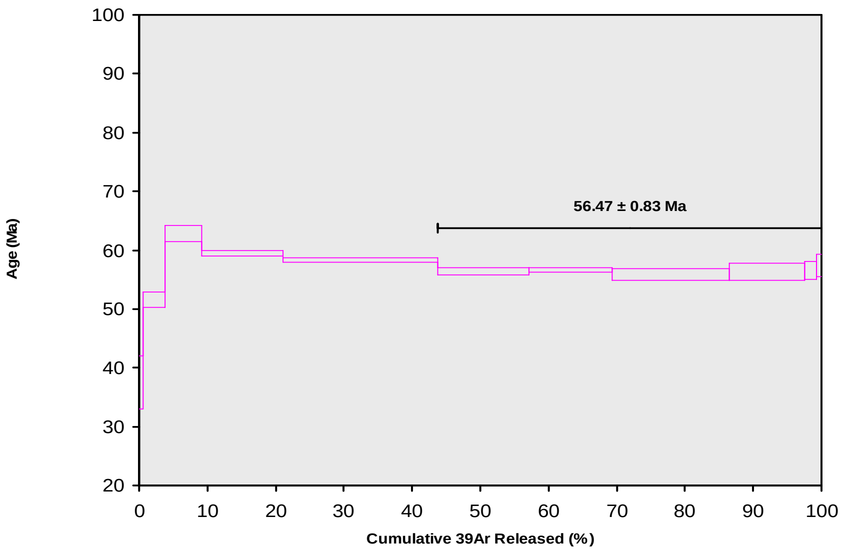






Sample GGU 318802, basalt sill, Tartunaq, SE Nuussuaq

05C3326.AGE >>> 318802 >>> Larsen



Ar-Ages in Ma

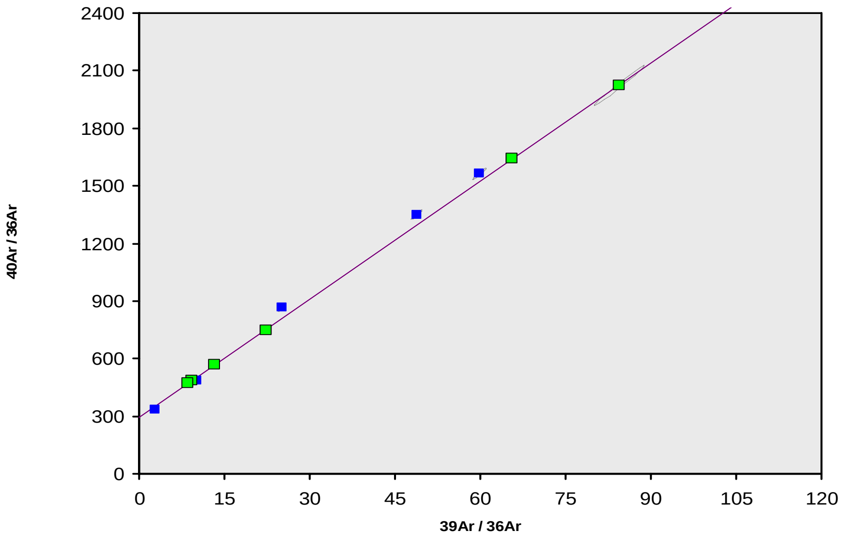
Weighted Plateau
56.47 ± 0.83
Total Fusion
57.22 ± 0.84
Normal Isochron
56.44 ± 0.88
Inverse Isochron
56.44 ± 0.88

MSWD
0.67

Sample Info

whole rock
Greenland
jh
OSU5D05
0.00155216 (J)

05C3326.AGE >>> 318802 >>> Larsen



Ar-Ages in Ma

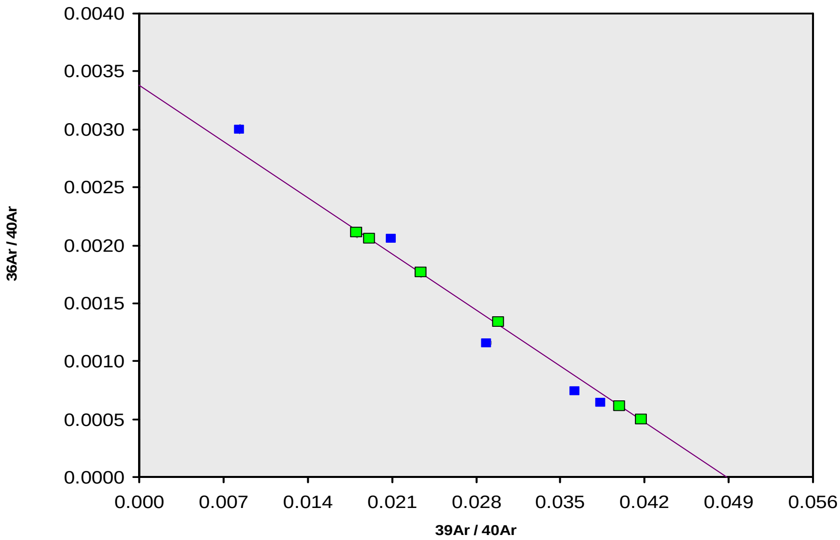
Weighted Plateau
56.47 ± 0.83
Total Fusion
57.22 ± 0.84
Normal Isochron
56.44 ± 0.88
Inverse Isochron
56.44 ± 0.88

MSWD
0.83

Sample Info

whole rock
Greenland
jh
OSU5D05
0.00155216 (J)

05C3326.AGE >>> 318802 >>> Larsen



Ar-Ages in Ma

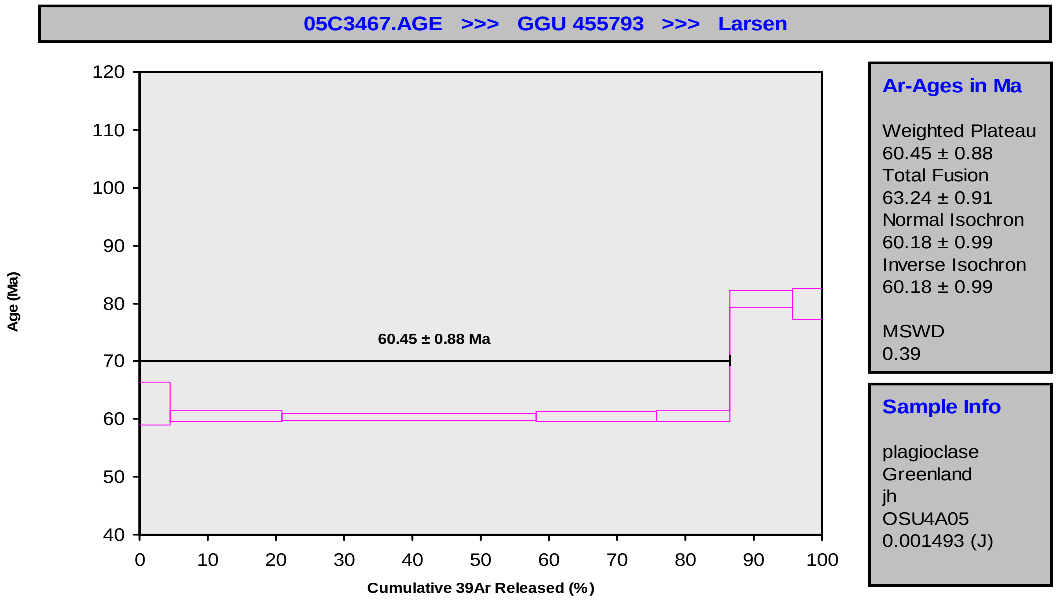
Weighted Plateau
56.47 ± 0.83
Total Fusion
57.22 ± 0.84
Normal Isochron
56.44 ± 0.88
Inverse Isochron
56.44 ± 0.88

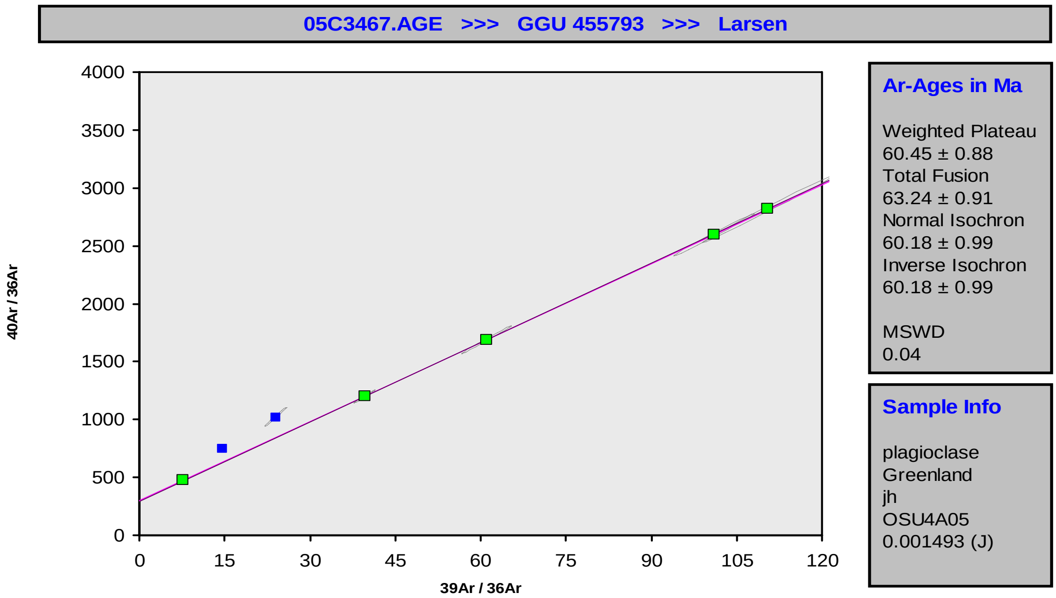
MSWD
0.82

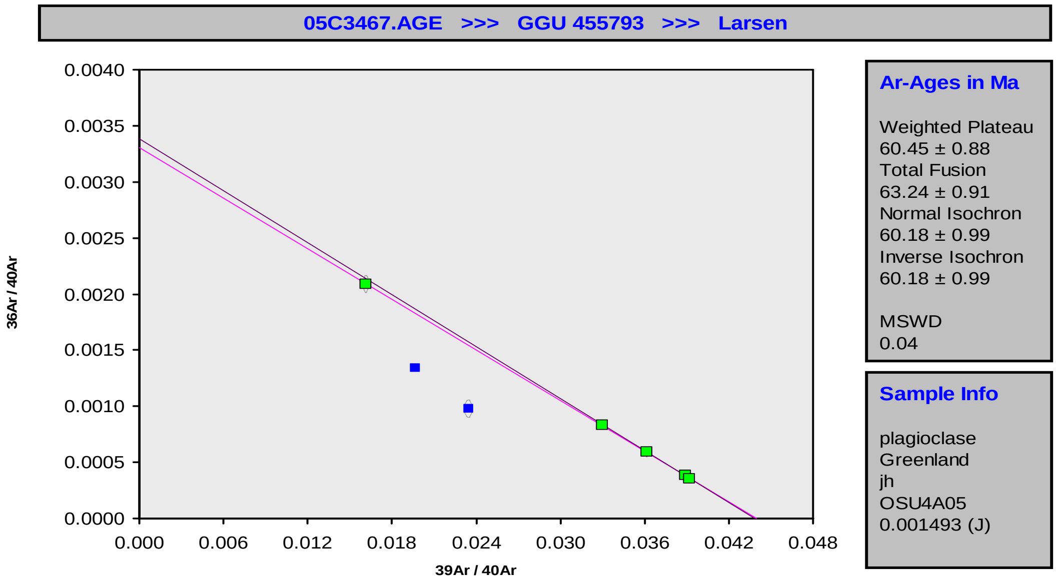
Sample Info

whole rock
Greenland
jh
OSU5D05
0.00155216 (J)

Sample GGU 455793, basalt sill, Grønne Ejland, Disko Bugt

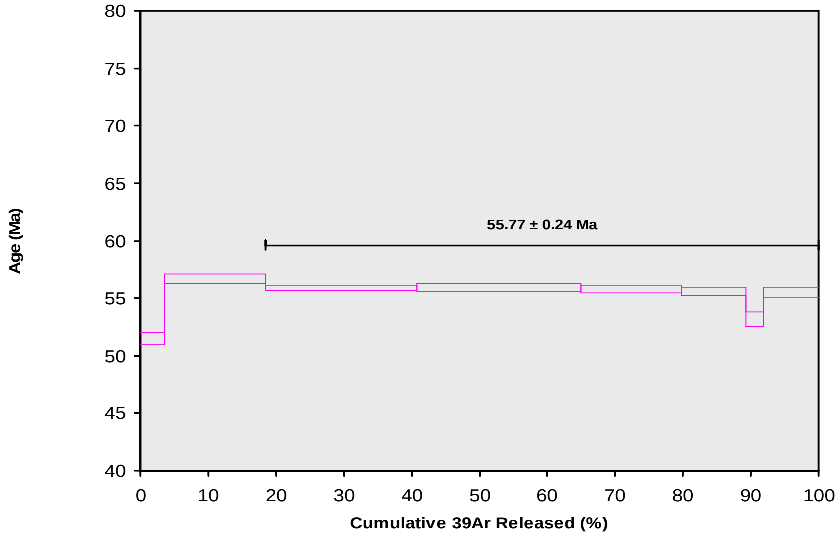






Sample GGU 464536, globular basalt dyke, Aasiaat

03C1813.AGE >>> 464536 1B12-03 >>> Hansen



Ar-Ages in Ma

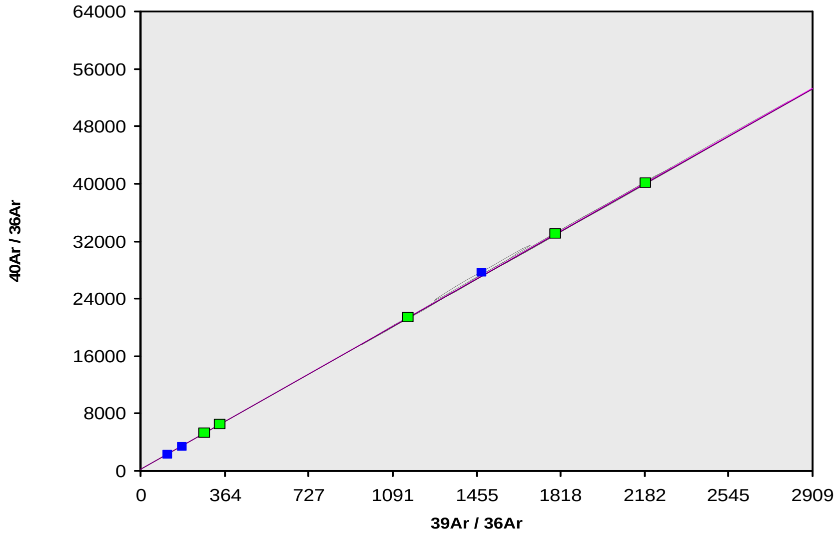
Weighted Plateau
55.77 ± 0.24
Total Fusion
55.71 ± 0.21
Normal Isochron
55.98 ± 0.26
Inverse Isochron
55.96 ± 0.26

MSWD
1.49

Sample Info

plagioclase
West Greenland
rad
OSU1B03
0.001728 (J)

03C1813.AGE >>> 464536 1B12-03 >>> Hansen



Ar-Ages in Ma

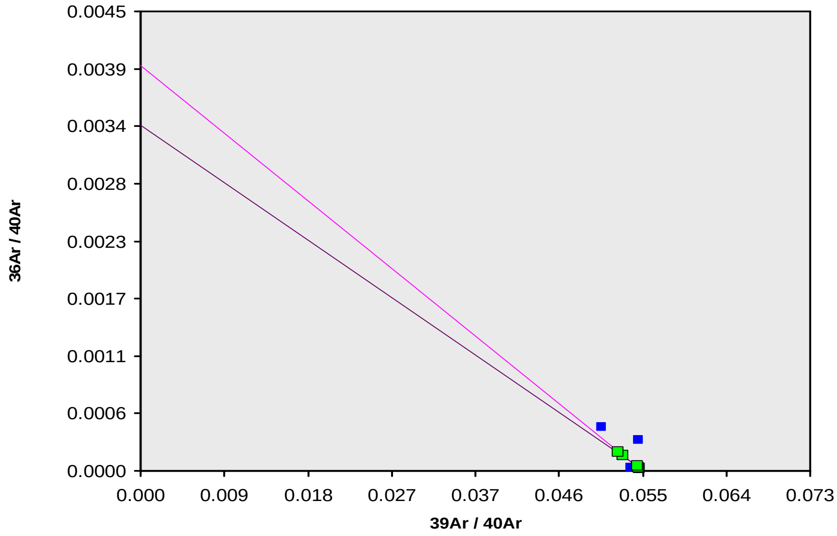
Weighted Plateau
55.77 ± 0.24
Total Fusion
55.71 ± 0.21
Normal Isochron
55.98 ± 0.26
Inverse Isochron
55.96 ± 0.26

MSWD
0.10

Sample Info

plagioclase
West Greenland
rad
OSU1B03
0.001728 (J)

03C1813.AGE >>> 464536 1B12-03 >>> Hansen



Ar-Ages in Ma

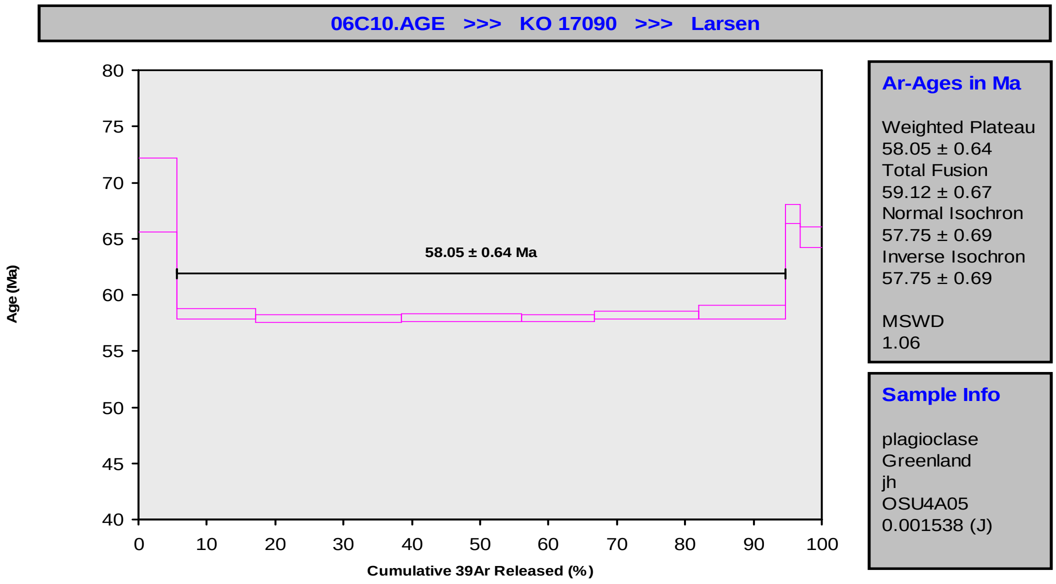
Weighted Plateau
55.77 ± 0.24
Total Fusion
55.71 ± 0.21
Normal Isochron
55.98 ± 0.26
Inverse Isochron
55.96 ± 0.26

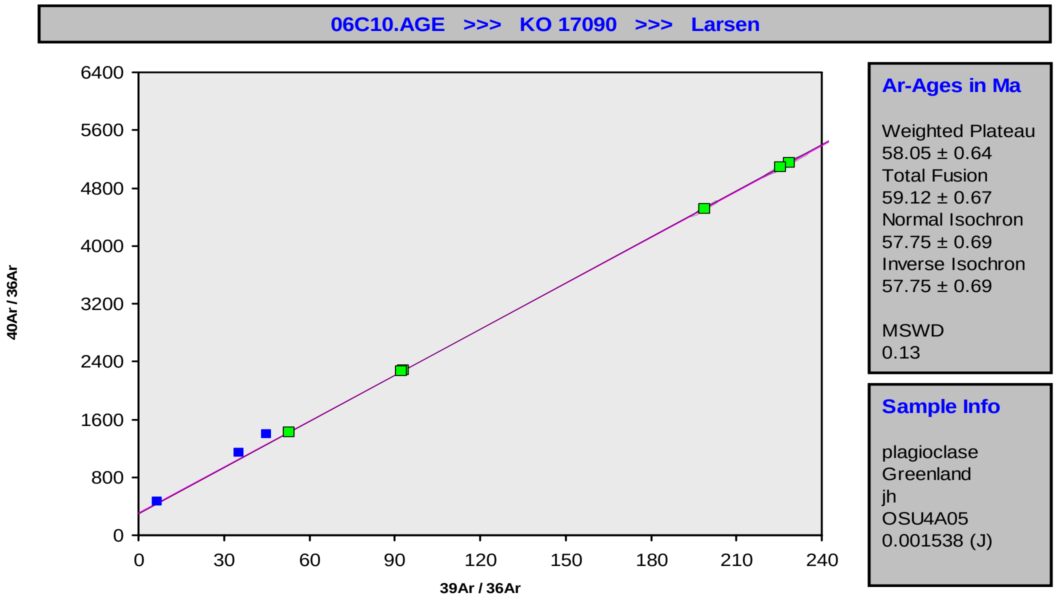
MSWD
0.09

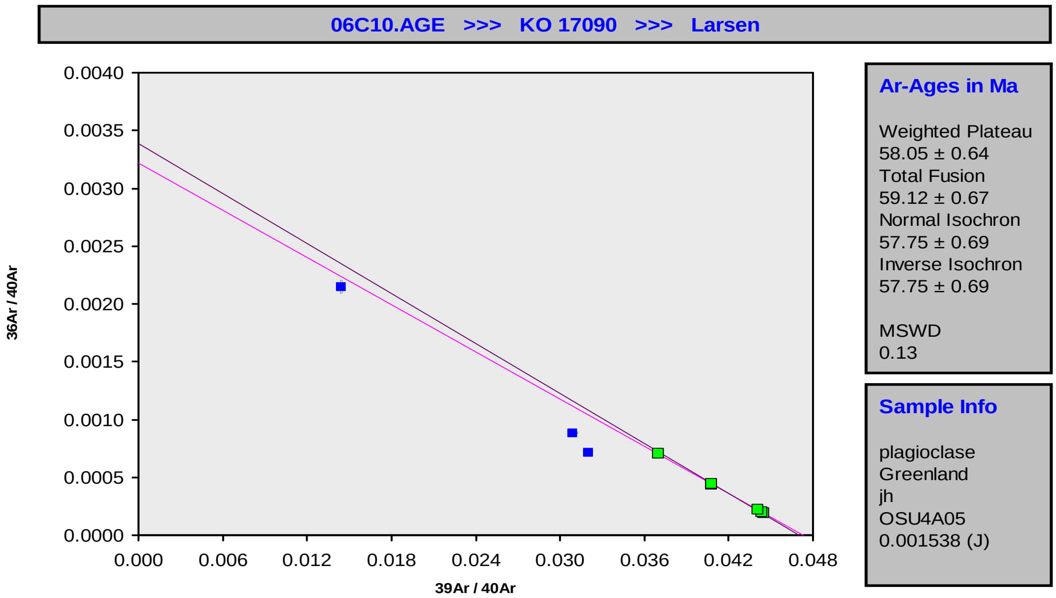
Sample Info

plagioclase
West Greenland
rad
OSU1B03
0.001728 (J)

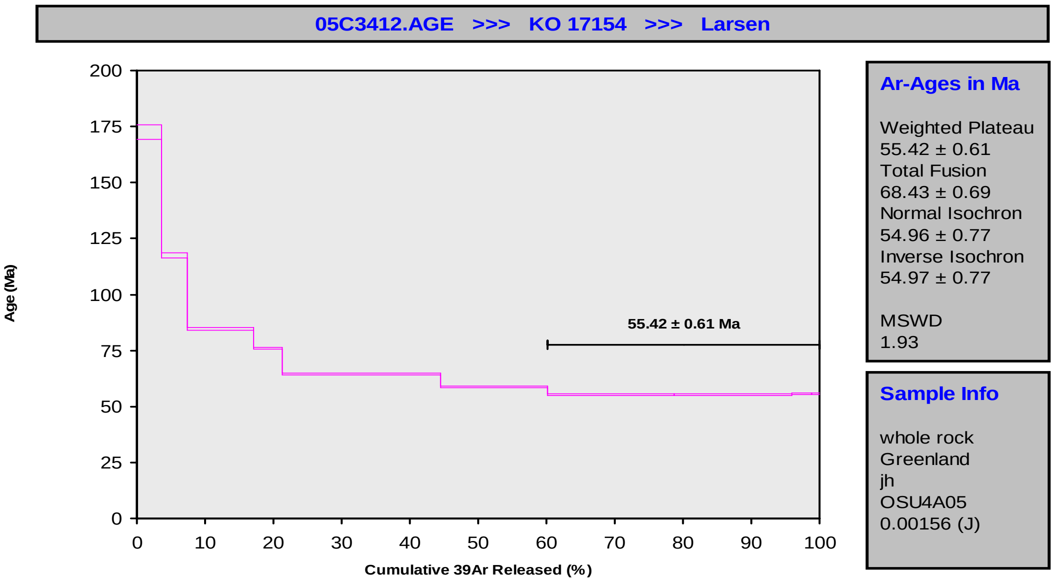
Sample KØ 17090, alkali basalt dyke, Søndre Isortoq

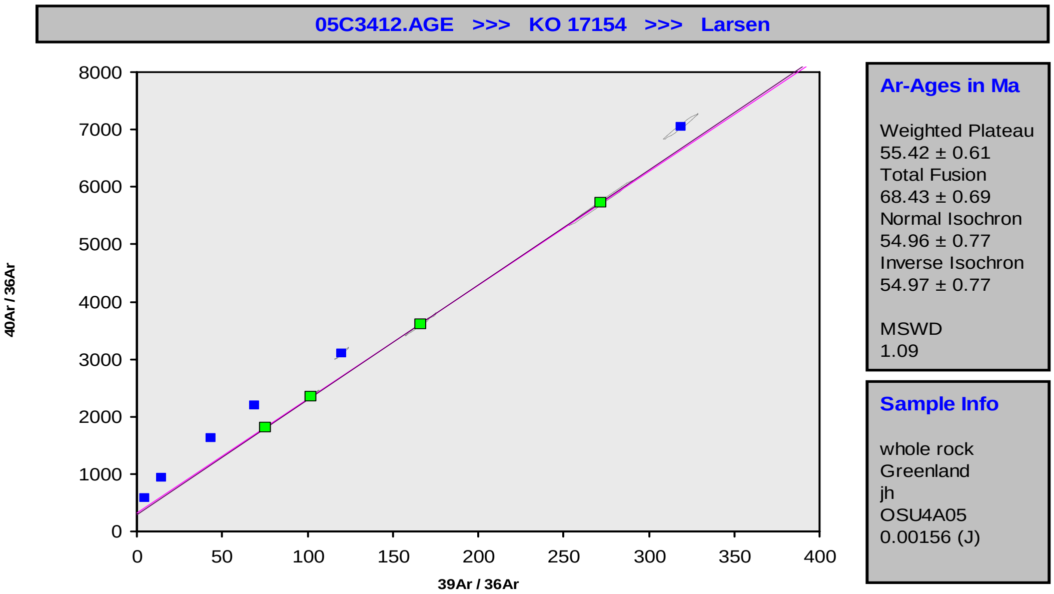


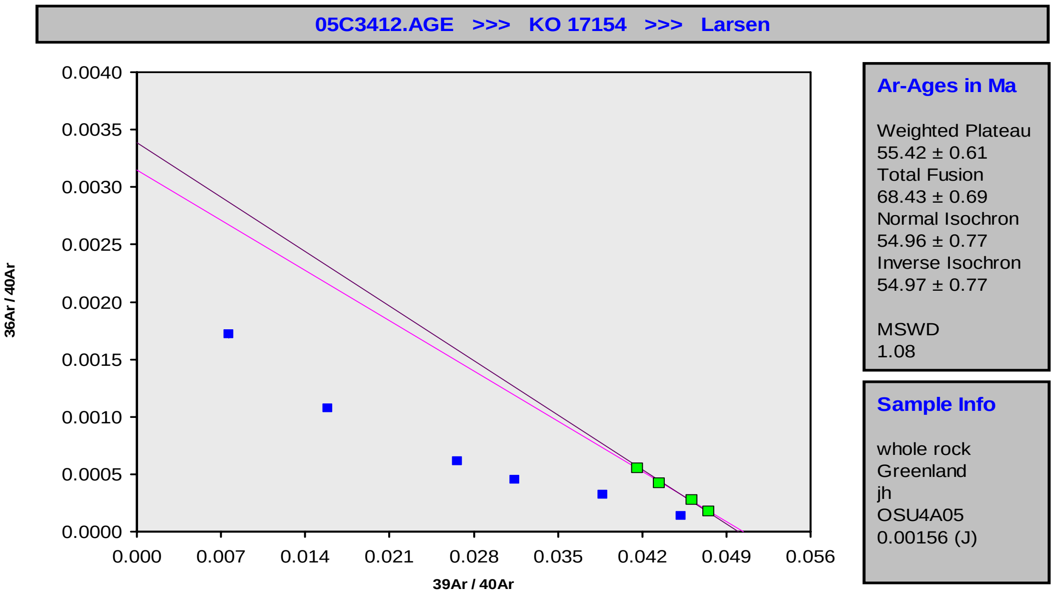




Sample KØ 17154, camptonite dyke, Søndre Isortoq







Rb–Sr and U–Pb age determinations

Summary table. Rb-Sr and U-Pb age determinations on rocks from West Greenland

Sample	Dyke swarm	Material	Method	Age ± 2 σ	MSWD	$^{87}Sr/^{86}Sr_{init}$
GGU 78760	Oqummiaq	phlogopite	Rb-Sr isochron	**149.8 ± 4.4**	0.06	0.7035 ± 0.0002
GGU 183564	Fred. Isblink	phlogopite	Rb-Sr isochron	**149.2 ± 2.7**	1.3	0.7034 ± 0.0003
				Model age		Model $^{87}Sr/^{86}Sr_{init}$
GGU 153375	Kvanefjeld	phlogopite	Rb-Sr model	1134 ± 17		0.70275 ± 0.00025
GGU 183560	Fred. Isblink	phlogopite	Rb-Sr model	156 ± 14		0.7035 ± 0.0002
				Age ± 2 σ	MSWD	
GGU 118016	Fred. Isblink	perovskite	U-Pb	**152.1 ± 1.6**		

Rb-Sr isotope analyses

Rb-Sr isotope analyses of phlogopite from four samples were made by Robert Creaser at Geospec Consultants Limited, Edmonton, Alberta, Canada. The following descriptions and data are from the analysis report, but a description of the analytical methods is also found in Creaser et al. (2004).

Whole-rock samples were provided from which phlogopite mica was extracted. After breaking the whole rock sample, phlogopite was removed from the rock mechanically. For samples 78760 and 183564, five fractions of phlogopite were selected from each sample, from which five separate Rb–Sr analyses were made (called A–E for each sample) and isochron ages determined. For samples 153375 and 183560, single analyses are reported, which derive from purified mineral concentrates of fine-grained phlogopite, comprising tens to hundreds of grains. All phlogopite grains removed from the samples were chosen after careful inspection under a binocular microscope to eliminate altered grains and adhering matrix, any alteration (e.g., carbonate or chlorite) which were completely removed with extra-fine tipped tweezers prior to analysis.

A leaching procedure is essential to remove trace amounts of carbonate minerals present along the mica cleavage planes. Carbonate has very high Sr content, thus its removal is essential to produce clean mica separates, which have very high Rb/Sr ratios and are amenable for precise age determination. Our procedure involves leaching the selected mica grains in dilute HCl in an ultrasonic bath for 15 minutes, prior to repeated rinses in ultrapure water, dissolution and analysis. The leach-cleaned mica grains are then spiked with a mixed 84Sr-87Rb spike to enable isotope dilution analysis and dissolved in a HF:HNO3 mix at 100°C. After evaporation in HEPA-filtered air, the resultant fluoride residue is converted to chloride form with HCl and Sr and Rb chemically separated by use of cation exchange resin. All reagents used are ultra-high purity and chemical separation conducted at better than Class 100 cleanroom conditions. Chemical processing blanks are < 150 picograms of Sr and < 80 picograms Rb, which are insignificant relative to the amount of sample processed.

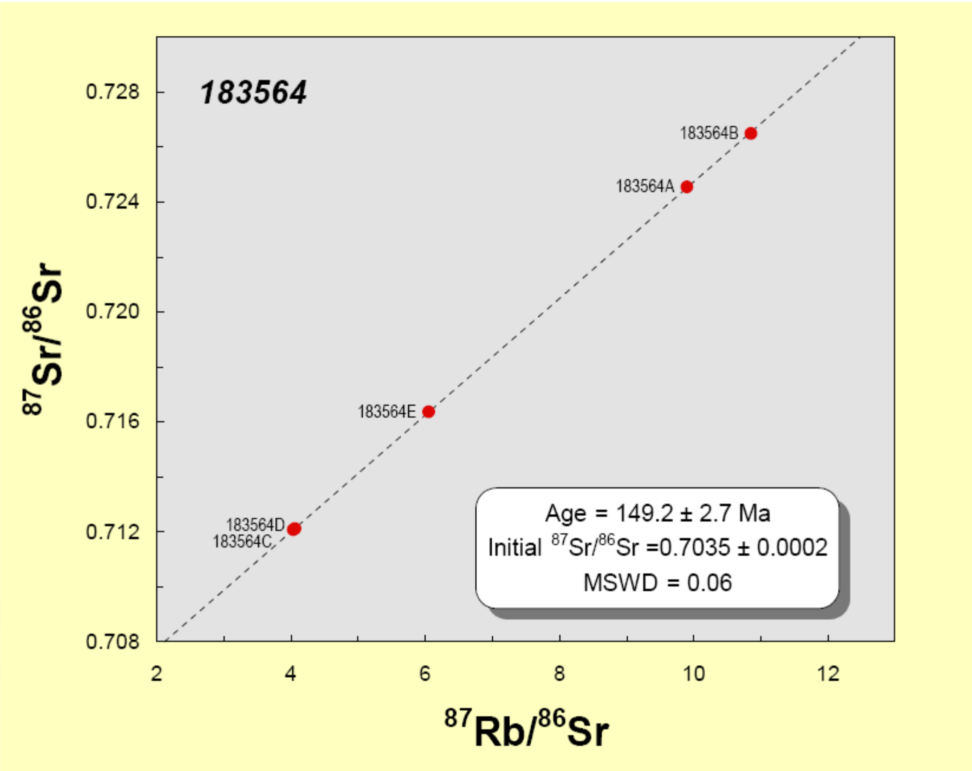
Isotopic analysis is performed using Thermal Ionization Mass Spectrometry. The average value of the National Institute of Standards and Technology (NIST; formerly NBS) Standard Reference Material 987 Sr isotopic standard analyzed at the same time as these samples yielded a value of $^{87}Sr/^{86}Sr = 0.71019$. All analyses are presented corrected relative to a value of 0.71025 for the SRM987 Sr isotopic standard.

Sample 183564

The results of the five Rb-Sr analyses of phlogopite from sample 183564 are presented in Table 2 below. This rock sample contains large macrocrysts of good to excellent quality brown mica. Fractions A and B derive from a single macrocryst, and fractions C and D derive from another. Fraction E derives from a third macrocryst. All fractions show moderate Rb contents but moderate Sr contents and as a result, the Rb/Sr ratios are low and the $^{87}Sr/^{86}Sr$ ratios are relatively unradiogenic (up to ~ 0.726 only). For all samples, a Model Age is calculated and provided in Table 2, using an assumed initial $^{87}Sr/^{86}Sr$ ratio of 0.7050. For sample 183564, early Cretaceous Model Ages are indicated but these are highly imprecise as a result of the weakly radiogenic Sr and low Rb/Sr. For sample 183564, a very limited range in Rb/Sr is present (4–11) but the data still define a well-fitted isochron (MSWD = 0.06) having an age of 149.2 ± 2.7 Ma (2σ, Model 1 solution) as shown in Figure 2, which is the best determination for the age of this rock. The initial $^{87}Sr/^{86}Sr$ ratio derived from the isochron is 0.7035 ± 0.0002, which given the low Rb/Sr ratios of the samples, likely has petrogenetic significance.

Table 2. Rb-Sr data for sample 183564

Sample	Rb ppm	Sr ppm	^{87}Rb / ^{86}Sr	^{87}Sr / ^{86}Sr	+/- $2\sigma_m$	Model age 0.705 initial
183564 A	436.6	127.9	9.896	0.72454	0.00004	138.9
183564 B	373.1	99.67	10.85	0.72649	0.00002	139.3
183564 C	240.7	173.0	4.028	0.71207	0.00002	123.4
183564 D	229.2	163.5	4.058	0.71211	0.00003	123.3
183564 E	318.2	152.4	6.051	0.71637	0.00002	132.2

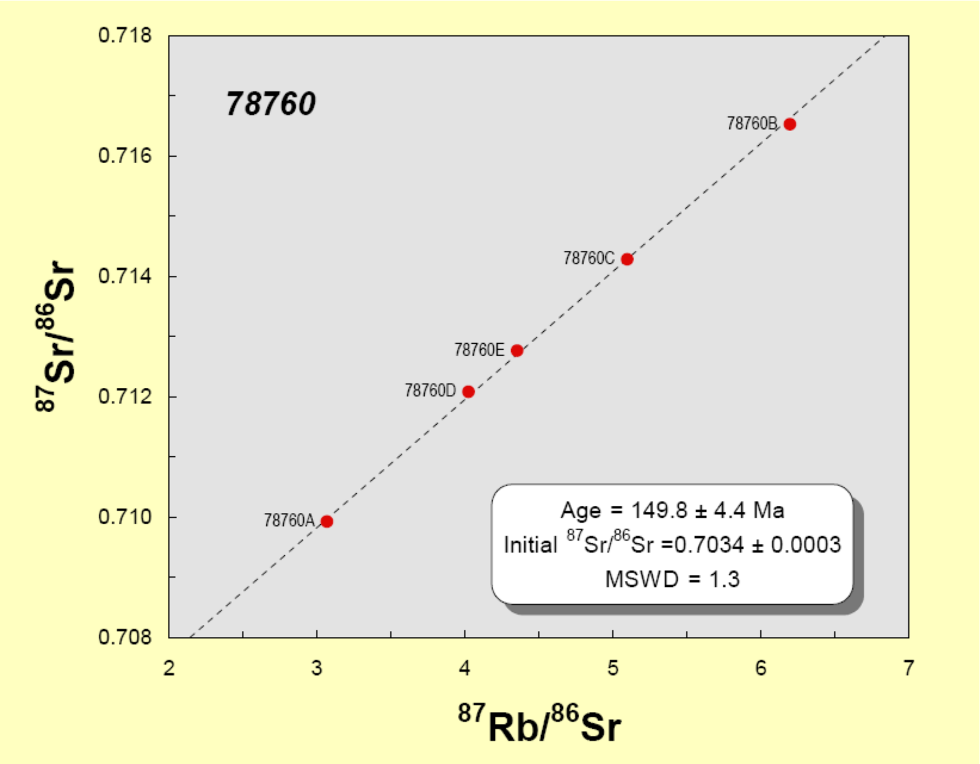


Sample 78760

The results of the five Rb-Sr analyses of phlogopite from sample 78760 are presented in Table 3 below. This rock sample contains large crystals of excellent quality brown mica. Fraction A derives from a single crystal, B and C derive from a single macrocryst, and fractions D and E derive from another large crystal. All fractions show moderate Rb contents but moderate to high Sr contents and as such, the Rb/Sr ratios are low and the $^{87}Sr/^{86}Sr$ ratios are unradiogenic (up to ~ 0.716 only), like sample 183564. For all samples, a Model Age is calculated and provided in Table 3, using an assumed initial $^{87}Sr/^{86}Sr$ ratio of 0.7050. For sample 78760, mid Cretaceous Model Ages are indicated but these are highly imprecise as a result of the weakly radiogenic Sr. For sample 78760, despite the limited range in Rb/Sr is present (3-6), the data do define a well-fitted isochron (MSWD = 1.3) having an age of 149.8 ± 4.4 Ma (2σ, Model 1 solution) as shown in Figure 2, which is the best determination for the age of this rock. The initial $^{87}Sr/^{86}Sr$ ratio is precisely determined at 0.7034 ± 0.0002 for this sample. Both the age and initial 87Sr/86Sr ratio for sample 78760 overlap within uncertainty, the values from sample 183564.

Table 3. Rb-Sr data for sample 78760

Sample	Rb ppm	Sr ppm	^{87}Rb / ^{86}Sr	^{87}Sr / ^{86}Sr	+/- $2\sigma_m$	Model age 0.705 initial
78760 A	130.2	122.9	3.068	0.70992	0.00002	112.8
78760 B	295.9	138.4	6.194	0.71652	0.00002	130.9
78760 C	272.0	154.5	5.097	0.71428	0.00002	128.1
78760 D	274.3	197.4	4.023	0.71207	0.00002	123.7
78760 E	270.5	179.9	4.353	0.71277	0.00002	125.5



Samples 153375 and 183560

Samples 153375 and 183560 contain very fine-grained mica in the groundmass of each rock, and as such individual crystals cannot be removed for analysis. For each sample, part of the rock was roughly crushed and sieved, and mica handpicked from the +70 mesh fraction. In both cases, hundreds of small crystals were picked and cleaned as best possible before analysis. One fraction for each sample was successfully analyzed, using micro-scale Rb-Sr chemistry for samples weighing less than 1.0 milligrams.

Both samples show moderate to high Rb contents, but age indications are compromised by the very high Sr contents of the analyses, and the resulting low Rb/Sr ratios. The high Sr contents indicate that mineral impurities were likely present in the analyses that could not be removed by our standard HCl leaching.

Sample 153375A has high $^{87}Sr/^{86}Sr$ (0.7191), and an indicated minimum Model Age of 979 Ma for an initial $^{87}Sr/^{86}Sr$ ratio of 0.705. The sample is thus with certainty of Proterozoic age. Pearce & Leng (1996) described ultramafic lamprophyre dykes of Gardar age from the Igaliko area, for which they reported initial $^{87}Sr/^{86}Sr$ ratios in the range 0.7025-0.7030. Using a $^{87}Sr/^{86}Sr$ initial ratio of 0.70275 ± 0.000025 (reproducing the range 0.7025-0.7030), gives a model age of 1134 ± 17 Ma, i.e., Gardar age. The dyke cuts the 1160 Ma old Ilimaussaq Intrusion.

Sample 183560 has very low $^{87}Sr/^{86}Sr$ (0.7057) and is young. The two other dated dykes now assumed to be from the same swarm yielded good 5-point isochron ages of 149.2 ± 2.7 Ma and 149.8 ± 4.4 Ma, and initial $^{87}Sr/^{86}Sr$ ratios of 0.7034–0.7035 ± 0.0002 (see above). Using an initial $^{87}Sr/^{86}Sr$ ratio of 0.7035 ± 0.0002 for sample 183560 yields a Model Age of 156 ± 14 Ma which is, well within the quite large uncertainty, the same age as that of the two other dykes.

Rb-Sr data for sample 153375 and 183560

Sample	Rb ppm	Sr ppm	$^{87}Rb / ^{86}Sr$	$^{87}Sr / ^{86}Sr$	+/- $2\sigma_m$	Model age, Ma
153375 A	454.8	1312	1.004	0.71906	0.00005	1134 ± 17
183560 A	244.7	707.0	1.001	0.70572	0.00003	156 ± 14

U–Pb isotope analyses

One sample, GGU 118016, was dated by U–Pb isotope analysis of perovskite; this was done by L.M. Heaman, University of Alberta, Canada.

Mineral Separation

Rock samples were pulverized using standard crushing (Jaw Crusher, Bico disk mill) and mineral separation (Wilfley Table, Methylene Iodide and Frantz) procedures with the utmost of care given to cleanliness at all stages. All perovskite grains analysed were individually selected to isolate euhedral and transparent crystals devoid of inclusions and alteration.

U-Pb techniques

The procedures for isolating U and Pb from perovskite (HBr technique) and measuring the isotopic composition of these elements on a VG354 mass spectrometer in single collector mode have remained essentially unchanged from those described by Heaman (1989). The ^{238}U and ^{235}U decay constants used in the age calculations are 1.55125×10^{-10} yr.-1 and 9.8485×10^{-10} yr.-1.

U-Pb Perovskite Systematics

There are two difficulties that can be encountered with U-Pb perovskite geochronology: (1) groundmass perovskite crystals are often minuscule (10-50 micron range) and can be difficult to recover using standard mineral separation procedures; and (2) perovskite can contain a significant amount of common Pb which can translate into a significant correction in the age calculation. The common Pb correction is especially important where the amount of radiogenic Pb in the analysis is quite low (e.g. < 200 pg), a common feature of young, low-U, small fraction mineral analyses. The $^{206}Pb/^{238}U$ ratios were corrected for the presence of initial common Pb using the two-stage average crustal Pb model of Stacey and Kramers (1975).

For sample GGU 118016, where the amount of perovskite available was sufficient for only one analysis, the $^{206}Pb/^{238}U$ age is taken as the best estimate for the timing of perovskite crystallization as this age is least sensitive to the common Pb correction. The exact initial Pb isotopic composition of the magma may deviate somewhat from the Stacey and Kramer model Pb, and the magnitude of this correction can vary considerably for different perovskite fractions. The approach taken here, therefore, has been to assign rather large uncertainties for the assumed initial Pb isotopic composition (1% on the $^{206}Pb/^{204}Pb$ ratio), such that the error associated with the single $^{206}Pb/^{238}U$ perovskite age reported here reflects the propagation of these uncertainties.

U-Pb perovskite results for Greenland alnöite 118016

Description	Weight (μg)	U (ppm)	Th (ppm)	Pb (ppm)	Th/U	TCPb (pg)	$^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$	Model age (Ma) $^{206}Pb/^{238}U$
Brown cubes (200)*	69	73	1064	12	14.61	212	0.02388±13	0.1369±77	0.0416±23	152.1±0.8

* M@0.4A: Magnetic split at 0.4 Amperes using Frantz Isodynamic Separator. 200 crystals analysed

Atomic ratios corrected for blank (5pg Pb; 1pg U), fractionation and initial common Pb (Stacey & Kramers 1975)

TCPb refers to the total amount of common lead present in the analysis in picograms

Th concentration estimated from the amount of ^{208}Pb present in the analysis and the $^{207}Pb/^{206}Pb$ age

All errors in this table are reported at 1 sigma (0.09402±2 means 0.09402±0.00002)

Appendix 2. West Greenland young dyke swarms, compilation March 2006

Sample no	Comment	Rock name	Strike	Age, Ma	Age reference
Kvanefjeld					
153375 old anal.	Fresh rock	Monchiquite	15		
153375	Fresh rock	Monchiquite	15	1134 ± 17 (Rb-Sr)	This work
Tuttutooq sills					
33822	Allaart sample	Camptonite	sill	217±5 (K/Ar)	Bridgwater 1970
Mean of two	mean of two	Camptonite	sill		
50068	upper part	Camptonite	sill	114.7±4.7 (Ar/Ar)	This work
50069	upper chill	Camptonite	sill		
50070	ocelli-filled layer	Camptonite	sill		
50071	central part	Camptonite	sill		
50071-new	central part	Camptonite	sill		
50072	lover part	Camptonite	sill		
30735	Tuttutooq	Camptonite	sill		
TD dykes					
15683	Sermersut	Basalt	152		
19482.2	north of Kuannit	Basalt	152		
19482.3	north of Kuannit	Felsic vein	152		
19725.2	Arsuk	Basalt	160		
19738	Arpijfik	Basalt	152		
25267	Isertoq	Basalt	143		
26388	Sanerut	Basalt	150	140.3±2.2 (Ar/Ar)	This work
32636	Arsuk Ø	Basalt	165		
32713	Arsuk Ø	Basalt	160		
33000		Basalt	170		
39590	Alangorsuaq	Basalt	147		
40424		Basalt	no inf		
40472		Basalt	no inf		
40573		Basalt	no inf		
45293	Qaarsuarsuk	Basalt	100	133.3±1.4 (Ar/Ar)	Larsen et al. 1999
45497	Qaarsuarsuk	Basalt	122		
45498	Qaarsuarsuk	Felsic vein	122		
50107		Basalt	no inf		
50135		Basalt	no inf		
51313		Basalt	155		
52875	Tornarsuk	Felsic vein	161		
56673	Assakataap Nunaa	Basalt	NNW		
68905	Neria	Basalt	143		
68940	Neria	Basalt	152		
69052	Ol-plag-cumulate	Basalt	no inf		
69251	Sermiligaarsuk	Basalt	154		
69290	Qasigialik	Felsic vein	148		
69639	Narsalik	Basalt	133		
70005		Basalt	136		
70550		Basalt	no inf		
70553	Tasiusaq-Neria	Basalt	no inf		
70858		Basalt	no inf		
71743		Basalt	171		
72401.1		Basalt	151		
72401.2		Basalt	151		
78746	Frh Isblink	Basalt	160		
84556		Basalt	156	138.6±1.4 (Ar/Ar)	Larsen et al. 1999
99006	Nunarsuit	Basalt	150		
99036	Naijamiut	Basalt	130		
101376	Nunarsuit	Basalt	no inf		
106737		Basalt	137		
109515	N. of Isblink	Basalt	148		
109839	N. of Isblink	Basalt	150		
110001	Julianehåb	Basalt	144		
TD dykes, Edinburgh analyses					
40424		Basalt			
40442		Basalt			
40472		Basalt			
50055		Basalt			
50095		Basalt			
50107		Basalt			
50123		Basalt			

Major element analyses (mainly XRF, mainly GEUS's Chemistry Lab.)

Sample no	SiO2	TiO2	Al2O3	Fe2O3	FeO	MnO	MgO	CaO	Na2O	K2O	P2O5	H2O/Vol	CO2	SUM
Kvanefjeld														
153375	43.34	4.26	14.5	0.85	8.69	0.19	7.63	8.82	4.86	2.09	0.89	3.86		99.98
153375-new	43.16	4.161	14.76	2.14	7.55	0.184	7.57	8.73	4.78	2.109	0.869	3.69		99.70
Tuttutooq sills														
33822	not analysed													
Mean of two	41.47	3.52	16.57	3.1	9.92	0.22	5.62	9.09	3.85	1.27	0.49	3.73	0.93	99.78
50068	42.27	3.1	15.74	14.37	0	0.22	6.23	9.36	3.27	1.39	0.46	3.59		100
50069	43.75	2.93	15.98	13.55	0	0.24	4.78	8.76	3.54	1.51	0.55	4.41		100
50070	44.07	2.74	16.52	12.29	0	0.24	4.25	8.71	4.13	1.91	0.68	4.46		100
50071	43.21	2.87	16.27	13.17	0	0.24	5.00	7.37	4.04	2.06	0.54	5.23		100
50071-new	43.42	2.961	16.48	5.49	7.10	0.234	5.18	7.40	4.21	2.385	0.550	4.65		100.05
50072	42.15	3.02	15.45	14.32	0	0.23	6.12	9.47	3.33	1.45	0.47	3.99		100
30735	47.15	2.71	16.54	12.25	0	0.23	3.60	6.38	4.56	1.73	0.67	4.18		100
TD dykes														
15683	48.211	3.994	12.858	4.726	10.55	0.24	4.145	8.41	3.19	1.5	0.554	1.724		100.1
19482.2	48.473	3.415	13.199	3.48	11.16	0.232	4.572	9.174	3.27	1.457	0.474	1.222		100.13
19482.3	61.614	0.818	15.835	3.31	2.49	0.133	1.079	2.521	5.57	4.374	0.185	1.437		99.366
19725.2	47.473	2.929	15.686	6.678	5.96	0.187	5.133	9.405	3.49	1.073	0.486	1.273		99.773
19738	48.18	4.156	12.511	16.432	0	0.236	4.167	8.436	3.05	1.742	0.652	0.28		99.842
25267	47.794	3.411	13.271	4.966	9.78	0.224	4.47	9.322	3.03	1.491	0.489	1.659		99.906
26388	48.44	3.319	13.241	4.277	10.24	0.227	4.677	9.293	3.09	1.373	0.453	1.28		99.908
32636	47.926	3.421	13.28	5.224	9.67	0.236	4.406	8.865	3.21	1.453	0.468	1.666		99.825
32713	47.476	2.845	15.719	4.731	7.87	0.213	4.754	8.612	3.73	1.314	0.827	1.626		99.718
33000	44.928	2.982	14.043	3.588	9.4	0.183	5.013	8.528	4.41	1.108	1.151	3.976		99.309
39590	47.27	3.088	14.464	6.205	7.39	0.197	5.392	9.901	2.94	1.003	0.537	1.433		99.82
40424	45.64	3.659	14.78	6.93	7.11	0.234	5.47	8.99	3.36	0.908	0.728	2.14		99.94
40472	46.77	3.270	14.19	4.34	10.69	0.245	4.96	8.87	3.13	1.641	0.862	1.10		100.06
40573	43.59	4.387	13.05	5.87	10.18	0.253	5.44	9.11	3.31	1.352	1.624	1.46		99.63
45293	44.73	3.984	14.243	4.403	10.11	0.228	5.003	9.086	3.56	1.362	1.418	1.505		99.631
45497	44.897	4.071	14.081	4.498	9.59	0.219	4.905	9.143	3.57	1.473	1.509	1.577		99.533
45498	54.169	1.485	15.584	3.093	5.22	0.176	1.993	6.055	3.48	5.477	0.459	2.191		99.382
50107	49.13	2.743	16.16	5.38	7.00	0.189	3.70	8.75	3.20	1.314	0.476	1.87		99.90
50135	41.53	3.890	12.99	7.48	9.43	0.220	6.07	10.81	2.84	0.403	0.397	3.75		99.81
51313	47.773	3.118	13.209	1.445	12.03	0.216	6.272	10.338	2.49	0.67	0.377	2.049		99.988
52875	66.342	0.138	15.026	0.669	1.41	0.046	0.358	2.081	2.81	9.413	0.007	1.137		99.436
56673	45.39	3.224	14.11	8.28	6.57	0.221	5.81	9.73	2.98	0.828	0.534	1.86		99.53
68905	46.438	2.96	14.711	4.036	8.75	0.217	6.113	10.657	3.04	0.921	0.73	1.294		99.866
68940	48.487	3.299	13.245	3.759	10.64	0.231	4.673	9.397	3.05	1.343	0.446	1.424		99.995
69052	47.40	1.048	19.60	1.11	9.11	0.142	8.82	9.30	2.86	0.335	0.156	0.49		100.38
69251	46.056	3.313	14.072	6.265	7.82	0.23	5.493	9.882	2.97	1.202	0.974	1.33		99.606
69290	52.668	1.526	18.994	3.588	4.08	0.157	2.074	7.037	5.09	1.936	0.568	2.044		99.762
69639	49.424	3.412	13.442	5.397	9.1	0.238	3.683	7.829	3.27	1.709	0.662	1.563		99.728
70005	48.391	3.9	13.053	4.909	10.1	0.234	4.311	8.66	3	1.59	0.663	1.004		99.817
70550	48.59	3.415	13.45	5.55	9.34	0.240	4.28	8.87	3.04	1.473	0.478	1.40		100.13
70553	48.01	3.392	13.33	5.37	9.51	0.233	4.53	9.02	3.15	1.426	0.470	1.27		99.71
70858	45.79	2.807	15.59	5.60	6.78	0.205	6.10	10.65	2.84	0.868	0.761	1.67		99.66
71743	46.872	3.301	14.132	6.036	8.03	0.23	5.078	8.975	3.08	1.634	0.882	1.394		99.644
72401.1	49.409	2.546	15.361	6.128	6.37	0.227	3.833	6.807	4.08	1.97	1.045	1.879		99.655
72401.2	49.24	2.509	15.17	5.71	6.64	0.223	3.95	6.94	4.09	1.938	1.076	1.98		99.46
78746	48.939	3.685	13.043	5.451	9.5	0.237	3.954	8.147	3.1	1.733	0.592	1.617		99.996
84556	45.713	2.75	15.039	5.143	7.32	0.208	6.292	10.808	2.65	0.872	0.698	2.095		99.588
99006	48.46	3.947	12.852	5.469	9.77	0.236	4.172	8.511	2.98	1.46	0.592	1.477		99.926
99036	48.384	3.603	13.156	4.807	10.18	0.232	4.098	8.612	3.17	1.576	0.494	1.383		99.695
101376	48.59	3.783	13.00	2.82	11.90	0.230	4.78	9.41	2.87	1.335	0.526	0.62		99.87
106737	46.661	3.237	14.378	6.678	6.71	0.21	5.289	9.19	3.19	1.287	0.809	1.937		99.576
109515	44.384	3.043	13.807	3.61	10.9	0.38	4.505	6.705	3.99	2.502	2.625	2.273		98.723
109839	45.02	3.082	13.87	12.06	3.88	0.128	4.78	5.47	4.61	0.997	2.625	3.08		99.61
110001	46.429	3.24	14.302	6.169	7.29	0.217	5.64	9.234	3.1	1.349	0.67	1.821		99.46
TD dykes, Edinburgh analyses														
40424	45.91	3.4	14.62	15.03	0	0.25	5.31	8.94	3.43	0.83	0.71	1.57		100
40442	54.44	1.32	14.77	10.99	0	0.15	6.2	6.48	3.54	1.15	0.1	0.86		100
40472	44.05	3.13	13.42	15.91	0	0.26	4.81	8.95	2.94	1.34	0.8	4.39		100
50055	46.24	3.07	14.6	13.03	0	0.19	5.76	8.17	3.27	1.59	0.48	3.6		100
50095	45.27	2.92	15.59	14.05	0	0.23	4.48	8.89	3.54	1.24	0.97	2.82		100
50107	48.62	2.84	15.19	14.08	0	0.21	3.78	8.76	3.11	1.13	0.48	1.8		100
50123	44.79	3.93	13.84	15.73	0	0.23	5.01	9.27	3.37	1.15	1.44	1.24		100

Trace element analyses (XRF, mainly John Bailey, Univ. Copenhagen)

Sample no	Rb	Ba	Pb	Sr	La	Ce	Nd	Y	Th	Zr	Nb	Zn	Cu	Co	Ni	Sc	V	Cr	Ga
Kvanefjeld																			
153375	221	1171	3	1407	45	118	53	28	8	355	130	89	28	39	122	23	272	231	23
153375-new																			
Tuttutooq sills																			
33822																			
Mean of two																			
50068	42	703	6	781	53	111	49	28	3	243	65	102	19		16	27	347	9	
50069	39	859	8	871	61	128	52	28	4	275	72	110	13		7	20	291	2	
50070	59	845	5	855	71	149	61	32	4	291	79	109	12		5	20	229	3	
50071	65	954	27	945	61	130	55	29	3	274	74	136	15		6	19	267	2	
50071-new																			
50072	45	759	8	714	54	111	47	28	4	245	65	105	17		16	26	340	9	
30735	44	1104	7	987	66	141	62	32	2	288	68	94	8		2	10	102	5	
TD dykes																			
15683	43.6	197	7.6	448	62.3	154	88.9	49.1	6.3	319	61.1	145	70.7	175	22.6	1.9	291	5.2	27.8
19482.2	35.2	497	8.7	414	52.4	107	55.1	42.3	5.8	295	70.2	151	110	59.1	37.5	25.9	391	37.3	27
19482.3	163	1166	7.1	630	78.7	147	72.2	60.7	8.4	464	69.8	67.2	3.3	13.8	2.6	7	13.8	5.2	24.8
19725.2	25.8	638	7.4	609	31.2	64.6	35.4	28.7	1.6	139	27	98.7	36.6	41	54.2	20.3	296	55.8	25.7
19738	50.6	604	10	389	68.4	137	69	54.4	10.3	381	80.8	171	186	44.1	32.3	25.4	342	14.3	33.1
25267	37.2	543	7.4	433	52.2	109	54	41.8	3.9	291	64.6	137	124	47.6	35.8	21.7	400	23	27.1
26388	33.7	479	8	430	53.1	107	50.1	41.5	4.5	288	67.6	141	118	47.9	39.8	24.3	356	37.1	29.1
32636	34.7	545	5	444	49.9	98.8	53	41.5	2.4	267	63.9	133	126	49.9	28.5	24.6	378	23.2	25.1
32713	22.1	1252	6	636	32.5	63.2	37.4	30.2	2.3	131	35.7	115	19.7	38.5	34.2	18.9	306	40.3	23.1
33000																			
39590	20.4	647	7.2	557	30.8	64.4	34.1	29.3	3	141	30.2	113	42.8	47.2	60.8	25.7	369	81.1	23.9
40424																			
40472																			
40573																			
45293	28.9	856	7.3	949	46.2	94.7	49.4	30.3	3.7	137	45.4	141	41.2	36.2	12.3	19	240	5.7	31.1
45497	31.5	870	5.7	865	46	98.1	53.3	31.9	3.6	143	46.7	120	22.4	39.1	9.7	19.9	233	6.1	24.8
45498	115	1618	11	589	61.2	124	60.9	45	9.1	374	91.6	101	31.1	11	-0.1	6.7	19.9	3.1	24.6
50107																			
50135																			
51313																			
52875	245	971	12	123	109	165	71.3	73.8	24.4	979	69.9	26.1	30.7	8.5	3.9	-0.1	5.1	6.8	22.1
56673																			
68905	15.1	991	5	578	27.5	57.2	34	26.1	1.3	96.5	31.2	114	37.5	46.9	72.1	26.1	375	123	22.5
68940	33.1	521	9	419	49	104	51.7	41.5	4.1	284	66.9	162	112	52.8	40.8	26.3	385	37.3	25.2
69052																			
69251	15.5	1491	6.2	833	39	82.3	49	30.6	4.4	120	37	160	54.1	45.5	30.3	28.8	349	42	27.4
69290	33.1	1575	9.4	963	35.3	71.2	37.8	31.2	4	166	41.6	83.6	17.5	16.9	6.7	6.6	70.4	8.7	25.4
69639	44.4	561	7.8	432	51.2	108	59.9	53.1	5.6	368	70.3	154	59.3	43.9	19.1	19	259	8.6	28.5
70005	43.6	582	8.1	449	62.3	125	63.5	51.9	6	353	79.2	141	60.6	43	20.7	25	316	13.9	26
70550																			
70553																			
70858																			
71743	26.9	1388	7.5	679	43.1	87.2	47.6	35.9	1.8	143	36.6	113	24.4	39.4	22.6	25.2	303	34.1	23.7
72401.1	38.8	1745	10	629	40.8	87.4	46	36.2	4.2	218	43.3	137	15.3	34.9	21.9	13.4	207	22	27.9
72401.2																			
78746	47.3	604	11	444	55	110	58.7	50	8.8	352	67.3	177	81.3	49.8	25.6	19.8	288	12.3	34.5
84556	14.6	1038	6.4	634	25.4	53.6	29.3	23.3	4.2	82.4	23.1	115	55	46.9	85.7	21.7	322	129	27.6
99006	37.7	490	8	403	56.4	110	56.4	48.1	4.1	319	66.1	151	97.4	47	30.2	23.3	383	19.9	27.3
99036	40.8	556	8.4	440	53.2	112	55.2	44.9	6.5	312	71.9	132	74.2	46.1	21	20.5	369	6.4	26.1
101376																			
106737	22.4	1081	5.8	589	36.7	67.8	39.4	31.8	3.6	133	31.8	114	25.1	48.4	39.4	24.9	370	41.7	24.7
109515	50.1	1994	20	535	72.2	166	113	70.4	-0.1	309	11.2	178	13.6	43	7.8	26.2	119	2.3	24.9
109839																			
110001	23	915	8.6	658	33.7	73.7	45.6	31.5	2.6	188	30.4	136	49.1	51.6	48.5	24.2	382	47.9	24
TD dykes, Edinburgh analyses																			
40424	20	704	5	605	33	70	40	34	1	272	28	117	27		28	22	337	22	
40442	97	460	9	480	7	9	8	16	0	62	7	113	27		107	27	168	239	
40472	21	986	2	633	35	82	42	32	0	142	32	132	28		23	26	333	18	
50055	65	765	6	1148	29	72	38	27	0	205	28	97	21		35	18	318	32	
50095	29	1071	4	784	48	96	47	29	0	154	42	108	20		11	17	223	11	
50107	31	615	12	480	31	64	33	36	0	213	31	139	20		10	26	240	23	
50123	30	875	6	827	47	109	54	31	1	169	44	116	22		10	23	244	5	

Trace element analyses (ICP-MS, GEUS's Chemistry Lab.)

Sample no	Sc	Ti	V	Cr	Mn	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr
Kvanefjeld														
153375														
153375-new	25.32	2.55	258.71	226.88	0.14	40.12	118.85	43.00	96.70	22.99	237.58	1367.70	27.60	363.34
Tuttutooq sills														
33822														
Mean of two														
50068														
50069														
50070														
50071														
50071-new	18.44	1.74	247.22	6.86	0.18	42.75	5.68	22.19	152.07	22.30	63.78	908.04	29.37	269.85
50072														
30735														
TD dykes														
15683														
19482.2	28.06	2.03	352.21	30.61	0.18	48.38	38.92	122.73	143.35	23.05	37.20	389.74	41.80	299.20
19482.3	7.91	0.49	14.21	-0.96	0.10	10.35	0.94	8.23	70.35	24.39	156.42	563.66	60.04	481.41
19725.2	23.46	1.67	307.96	60.04	0.14	40.15	50.95	39.10	107.17	21.94	24.68	561.26	27.87	153.13
19738														
25267														
26388	29.00	1.98	348.00	33.13	0.18	45.02	41.49	120.36	143.61	22.80	34.14	400.39	41.31	293.99
32636														
32713														
33000														
39590	27.63	1.84	349.72	78.73	0.15	43.42	61.83	47.43	120.32	21.46	20.20	523.23	28.04	146.85
40424	23.31	1.99	305.70	17.17	0.17	45.16	27.55	29.74	130.13	21.70	16.58	601.61	35.89	269.33
40472														
40573	24.65	2.35	236.95	1.10	0.18	40.98	10.08	27.95	146.26	20.68	29.67	748.70	33.11	170.10
45293	22.97	2.32	231.50	0.85	0.18	36.56	9.17	29.03	130.70	20.29	28.53	874.61	31.09	165.45
45497	23.85	2.43	233.73	0.91	0.17	36.19	8.82	27.17	127.80	20.61	31.51	802.01	32.37	164.22
45498	9.71	0.87	22.14	-1.31	0.13	10.97	1.21	39.23	91.85	25.01	114.36	558.52	46.64	432.74
50107	24.69	1.49	209.68	17.24	0.14	37.51	8.88	25.18	137.74	23.85	28.45	505.15	36.97	198.83
50135	31.80	2.13	506.78	21.32	0.16	58.94	39.32	37.33	134.31	21.52	12.24	1042.94	24.96	155.34
51313	37.33	1.87	371.97	147.92	0.17	45.28	86.76	199.25	145.51	21.76	11.70	272.92	39.24	217.79
52875														
56673														
68905	30.17	1.76	336.24	133.40	0.17	43.84	74.36	47.31	106.37	21.01	16.36	575.71	25.95	109.82
68940	29.31	1.96	348.00	37.57	0.18	45.87	42.18	118.01	152.24	23.52	35.55	415.91	42.07	297.85
69052														
69251														
69290														
69639														
70005														
70550	25.34	1.87	311.72	19.09	0.18	43.83	28.72	123.33	147.59	22.89	37.01	413.09	41.16	286.34
70553														
70858														
71743														
72401.1	19.27	1.33	188.34	22.52	0.17	29.40	20.65	34.64	116.76	23.91	36.17	569.40	36.82	208.53
72401.2	18.54	1.40	197.41	24.38	0.17	29.88	22.32	22.43	120.77	23.89	37.66	553.41	37.94	211.01
78746	23.89	2.13	266.25	8.41	0.18	37.96	21.53	71.49	161.57	24.26	45.38	420.75	52.04	358.73
84556	27.34	1.59	299.78	132.93	0.16	45.36	76.77	43.60	96.78	19.43	14.11	580.68	23.37	98.66
99006	27.02	2.28	344.93	18.86	0.18	41.32	32.41	106.65	153.87	23.87	38.49	375.47	48.54	333.87
99036														
101376	29.37	2.13	313.99	36.13	0.17	47.74	41.50	178.86	158.96	23.28	35.33	372.36	46.87	326.78
106737	27.06	1.89	343.80	41.20	0.16	42.19	37.23	30.91	123.85	21.93	21.89	573.83	32.10	147.35
109515	24.64	1.78	110.52	0.61	0.30	35.31	7.19	23.22	187.10	23.73	50.87	511.31	72.07	318.98
109839	24.59	1.81	111.00	0.14	0.10	37.38	7.80	426.26	183.03	24.00	35.72	262.33	71.84	293.93
110001	23.04	1.85	325.41	40.57	0.17	45.91	48.13	55.25	120.96	21.25	23.86	654.07	32.30	204.10
TD dykes, Edinburgh analyses														
40424														
40442														
40472														
50055														
50095														
50107														
50123														

Trace element analyses (ICP-MS)

Sample no	Nb	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er
Kvanefjeld														
153375														
153375-new	143.47	56.367	1170.94	60.81	116.35	14.43	56.19	9.99	3.20	7.79	1.03	5.53	1.08	2.50
Tuttutooq sills														
33822														
Mean of two														
50068														
50069														
50070														
50071														
50071-new	80.43	13.649	870.63	58.15	115.27	14.89	54.97	10.04	2.850	8.062	1.117	5.770	1.119	2.814
50072														
30735														
TD dykes														
15683														
19482.2	66.44	0.450	448.61	45.84	96.02	12.50	48.99	10.18	2.888	8.998	1.374	7.822	1.602	3.969
19482.3	70.50	0.600	1151.27	74.15	138.34	18.16	67.06	12.92	4.097	11.217	1.786	10.425	2.171	5.692
19725.2	28.60	0.249	541.33	26.73	57.37	7.66	31.83	6.80	2.508	6.125	0.922	5.223	1.029	2.606
19738														
25267														
26388	64.40	1.876	418.48	44.35	93.47	12.41	48.56	9.85	2.903	8.689	1.380	7.832	1.599	3.991
32636														
32713														
33000														
39590	28.48	1.518	573.50	27.41	58.35	8.10	33.27	7.11	2.662	6.422	0.971	5.473	1.074	2.646
40424	30.72	0.504	571.67	29.88	63.59	9.67	42.03	9.25	3.324	7.720	1.197	6.919	1.367	3.359
40472														
40573	49.96	0.428	770.65	47.41	99.34	14.05	57.79	11.04	3.990	9.075	1.282	6.896	1.251	3.197
45293	45.79	1.031	755.29	44.87	95.02	12.90	52.79	9.98	3.591	8.483	1.190	6.275	1.201	2.843
45497	46.52	0.797	803.10	46.17	98.22	13.20	53.48	10.43	3.727	8.822	1.237	6.486	1.207	2.986
45498	93.44	0.468	1573.14	79.19	155.10	18.99	69.57	12.78	4.103	10.762	1.599	8.949	1.787	4.658
50107	31.86	0.818	507.08	30.10	62.32	8.69	35.42	8.11	2.624	7.213	1.132	6.730	1.413	3.502
50135	17.78	0.628	317.91	17.12	38.23	5.95	26.43	6.06	2.297	5.450	0.838	4.968	0.980	2.385
51313	19.20	0.183	157.78	17.50	41.47	6.29	28.72	7.36	2.356	6.971	1.221	7.167	1.490	3.744
52875														
56673														
68905	29.39	0.502	900.11	24.10	52.47	7.20	31.78	6.96	3.227	5.935	0.942	5.183	0.968	2.379
68940	65.82	0.755	461.08	45.68	94.93	12.02	48.24	10.19	2.840	8.724	1.426	7.957	1.524	3.944
69052														
69251														
69290														
69639														
70005														
70550	62.73	0.586	451.51	45.35	93.38	12.78	50.26	10.28	2.998	9.139	1.384	8.041	1.599	3.986
70553														
70858														
71743														
72401.1	45.92	0.512	1554.55	48.80	100.16	12.65	51.48	10.27	4.223	8.548	1.283	7.150	1.349	3.398
72401.2	50.37	0.512	1561.11	50.15	100.59	13.52	54.01	10.58	4.497	8.463	1.323	7.376	1.400	3.550
78746	69.96	0.464	542.39	51.07	109.44	14.16	57.16	12.33	3.308	10.806	1.775	9.706	1.886	4.830
84556	23.74	0.158	817.44	22.19	48.20	6.46	28.09	6.17	2.920	5.388	0.839	4.539	0.860	2.145
99006	64.86	0.530	439.79	47.06	102.14	13.29	53.35	11.34	3.183	10.182	1.620	9.276	1.783	4.549
99036														
101376	62.99	0.384	364.25	45.23	94.04	12.94	51.18	10.89	3.063	9.900	1.510	8.746	1.768	4.444
106737	32.28	0.160	933.45	30.52	65.50	8.91	38.13	8.39	3.560	7.118	1.140	6.141	1.200	3.014
109515	11.18	1.287	1972.28	72.11	171.51	24.51	109.08	21.89	5.223	17.057	2.538	13.728	2.564	6.521
109839	10.35	0.363	809.53	74.01	167.09	26.68	115.57	23.09	5.672	18.193	2.541	13.882	2.706	6.638
110001	29.86	0.268	881.20	32.82	72.20	10.11	43.95	9.19	2.958	7.591	1.161	6.364	1.185	2.930
TD dykes, Edinburgh analyses														
40424														
40442														
40472														
50055														
50095														
50107														
50123														

Trace element analyses (ICP-MS)

Sample no	Tm	Yb	Lu	Hf	Ta	Pb	Th	U	Decim.degrees West	Decim.degrees North	Degrees and minutes Deg	Minutes	Deg	Minutes	Altitude
Kvanefjeld															
153375									-45.9800	60.9816	-45	-58.800	60	58.896	630
153375-new	0.35	2.12	0.31	8.88	9.92	4.30	7.45	1.88	-45.9800	60.9816	-45	-58.800	60	58.896	630
Tuttutooq sills															
33822															
Mean of two															
50068									-46.3162	60.804	-46	-18.972	60	48.240	
50069									-46.3162	60.804	-46	-18.972	60	48.240	
50070									-46.3162	60.804	-46	-18.972	60	48.240	
50071									-46.3162	60.804	-46	-18.972	60	48.240	
50071-new	0.383	2.291	0.333	6.461	5.623	24.480	5.943	3.029	-46.3162	60.804	-46	-18.972	60	48.240	
50072									-46.3162	60.804	-46	-18.972	60	48.240	
30735									-46.3217	60.8444	-46	-19.302	60	50.664	
TD dykes															
15683									-48.8257	61.2758	-48	-49.542	61	16.548	
19482.2	0.589	3.482	0.486	7.397	4.191	3.414	5.309	1.402	-48.4204	61.2804	-48	-25.224	61	16.824	
19482.3	0.862	5.207	0.784	11.703	4.392	6.577	9.365	3.155	-48.4204	61.2804	-48	-25.224	61	16.824	
19725.2	0.370	2.166	0.304	3.798	1.765	2.219	2.620	0.850	-48.4268	61.1748	-48	-25.608	61	10.488	
19738									-48.5474	61.2521	-48	-32.844	61	15.126	
25267									-47.6651	60.9185	-47	-39.906	60	55.110	
26388	0.608	3.427	0.494	7.335	3.973	3.803	5.211	1.399	-48.0132	61.0379	-48	-0.792	61	2.274	
32636									-48.318	61.1731	-48	-19.080	61	10.386	
32713									-48.4713	61.1465	-48	-28.278	61	8.790	
33000									-48.6916	61.4208	-48	-41.496	61	25.248	
39590	0.370	2.169	0.313	3.854	1.761	3.356	2.722	0.716	-48.1798	60.8565	-48	-10.788	60	51.390	
40424	0.461	2.768	0.395	5.845	2.189	2.040	1.952	0.668	-46.3983	60.8319	-46	-23.898	60	49.914	
40472									-46.5484	60.7871	-46	-32.904	60	47.226	
40573	0.406	2.311	0.344	4.144	3.740	3.531	3.480	0.995	-46.7143	60.7487	-46	-42.858	60	44.922	
45293	0.387	2.253	0.322	4.076	2.825	3.841	3.721	1.064	-47.0211	60.8301	-47	-1.266	60	49.806	
45497	0.406	2.288	0.331	3.975	2.934	4.844	3.951	1.116	-46.8631	60.7917	-46	-51.786	60	47.502	
45498	0.689	4.251	0.618	10.258	5.825	8.889	10.839	3.127	-46.8631	60.7917	-46	-51.786	60	47.502	
50107	0.502	2.930	0.431	4.999	2.712	6.443	2.727	0.715	-46.5957	60.6989	-46	-35.742	60	41.934	
50135	0.329	1.975	0.274	3.681	1.223	1.302	1.139	0.577	-46.2381	60.8279	-46	-14.286	60	49.674	
51313	0.571	3.303	0.487	5.465	1.193	1.959	1.457	0.405	-44.7223	59.9841	-44	-43.338	59	59.046	
52875															
56673									-46.2807	60.6998	-46	-16.842	60	41.988	
68905	0.340	1.972	0.296	2.960	1.610	2.076	2.083	0.632	-48.9003	61.6476	-48	-54.018	61	38.856	
68940	0.578	3.402	0.492	7.517	3.936	5.474	5.073	1.365	-48.829	61.6592	-48	-49.740	61	39.552	
69052									-48.3985	61.7441	-48	-23.910	61	44.646	
69251									-49.0172	61.457	-49	-1.032	61	27.420	
69290									-48.7657	61.5308	-48	-45.942	61	31.848	
69639									-49.3358	61.6616	-49	-20.148	61	39.696	
70005									-49.2668	61.55	-49	-16.008	61	33.000	
70550	0.552	3.337	0.481	7.094	4.102	2.999	4.873	1.279	-49.0938	61.7702	-49	-5.628	61	46.212	
70553									-49.0198	61.7229	-49	-1.188	61	43.374	
70858									-49.1822	61.7388	-49	-10.932	61	44.328	
71743									-49.063	61.596	-49	-3.780	61	35.760	
72401.1	0.488	2.873	0.431	5.098	2.830	4.791	4.974	1.327	-49.2666	62.0273	-49	-15.996	62	1.638	
72401.2	0.482	2.939	0.428	4.941	3.309	4.563	4.824	1.279	-49.2666	62.0273	-49	-15.996	62	1.638	
78746	0.719	4.138	0.626	8.857	4.217	5.181	5.833	1.714	-50.2124	62.295	-50	-12.744	62	17.700	
84556	0.299	1.750	0.252	2.554	1.445	1.489	1.743	0.477	-49.7127	62.3387	-49	-42.762	62	20.322	
99006	0.676	3.865	0.575	8.255	3.834	5.390	5.273	1.530	-48.2147	60.7918	-48	-12.882	60	47.508	
99036									-47.3838	60.7744	-47	-23.028	60	46.464	
101376	0.634	3.759	0.549	7.948	4.023	3.700	5.240	1.494	-47.7996	60.8176	-47	-47.976	60	49.056	
106737	0.423	2.524	0.374	3.753	2.046	2.458	2.703	0.812	-50.035	62.6492	-50	-2.100	62	38.952	
109515	0.942	5.628	0.839	7.861	0.625	20.146	0.852	0.398	-49.9446	62.7288	-49	-56.676	62	43.728	
109839	0.923	5.490	0.787	7.419	0.535	6.817	0.781	0.613	-49.9134	62.6912	-49	-54.804	62	41.472	
110001	0.411	2.368	0.354	4.984	1.830	3.790	2.089	0.821	-46.1086	60.723	-46	-6.516	60	43.380	
TD dykes, Edinburgh analyses															
40424									-46.3983	60.8319	-46	-23.898	60	49.914	
40442															
40472									-46.5484	60.7871	-46	-32.904	60	47.226	
50055															
50095															
50107									-46.5957	60.6989	-46	-35.742	60	41.934	
50123									-46.6451	60.725	-46	-38.706	60	43.500	

Analytical references

Sample no	Majors	XRF traces	ICP-MS traces
Kvanefjeld			
153375	GEUS unpubl.		
153375-new	GEUS unpubl.		GEUS unpubl.
Tuttutooq sills			
33822	Not analysed		
Mean of two	Upton 1965		
50068	Upton 1965	Upton 1965	
50069	Upton 1965	Upton 1965	
50070	Upton 1965	Upton 1965	
50071	Upton 1965	Upton 1965	
50071-new	GEUS unpubl.		GEUS unpubl.
50072	Upton 1965	Upton 1965	
30735	Upton unpubl.	Upton unpubl.	
TD dykes			
15683	GEUS unpubl.	GEUS unpubl.	
19482.2	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
19482.3	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
19725.2	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
19738	GEUS unpubl.	GEUS unpubl.	
25267	GEUS unpubl.	GEUS unpubl.	
26388	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
32636	GEUS unpubl.	GEUS unpubl.	
32713	GEUS unpubl.	GEUS unpubl.	
33000	GEUS unpubl.		
39590	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
40424	GEUS unpubl.		GEUS unpubl.
40472	GEUS unpubl.		
40573	GEUS unpubl.		GEUS unpubl.
45293	Larsen et al. 1999	Larsen et al. 1999	GEUS unpubl.
45497	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
45498	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
50107	GEUS unpubl.		GEUS unpubl.
50135	GEUS unpubl.		GEUS unpubl.
51313	GEUS unpubl.		GEUS unpubl.
52875	GEUS unpubl.	GEUS unpubl.	
56673	GEUS unpubl.		
68905	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
68940	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
69052	GEUS unpubl.		
69251	GEUS unpubl.	GEUS unpubl.	
69290	GEUS unpubl.	GEUS unpubl.	
69639	GEUS unpubl.	GEUS unpubl.	
70005	GEUS unpubl.	GEUS unpubl.	
70550	GEUS unpubl.		GEUS unpubl.
70553	GEUS unpubl.		
70858	GEUS unpubl.		
71743	GEUS unpubl.	GEUS unpubl.	
72401.1	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
72401.2	GEUS unpubl.		GEUS unpubl.
78746	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
84556	Larsen et al. 1999	Larsen et al. 1999	GEUS unpubl.
99006	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
99036	GEUS unpubl.	GEUS unpubl.	
101376	GEUS unpubl.		GEUS unpubl.
106737	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
109515	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
109839	GEUS unpubl.		GEUS unpubl.
110001	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
TD dykes, Edinburgh analyses			
40424	Upton unpubl.	Upton unpubl.	
40442	Upton unpubl.	Upton unpubl.	
40472	Upton unpubl.	Upton unpubl.	
50055	Upton unpubl.	Upton unpubl.	
50095	Upton unpubl.	Upton unpubl.	
50107	Upton unpubl.	Upton unpubl.	
50123	Upton unpubl.	Upton unpubl.	

Sample no	Comment	Rock name	Strike	Age, Ma	Age reference
50129	inclusion	Basalt			
50135		Basalt			
81101		Basalt			
81114		Basalt			
81115		Basalt			
81161		Basalt			
81163		Basalt			
81164		Basalt			
86171		Basalt			
101268		Basalt			
101269		Basalt			
101270		Basalt			
101330		Basalt			
101335		Basalt			
101375		Basalt			
186381		Basalt			
186382		Basalt			
186385		Basalt			
186387		Basalt			
186386A		Basalt			
186386B		Basalt			
186387A		Basalt			
186387C	inclusion	Basalt			
81118A		Basalt			
81118B		Felsic vein			
S Greenland kimberlites					
Average of six	Pyramidefjeld	Kimberlite		around 200 Ma	Bridgwater 1970
126746.12	Pyramidefjeld	Kimberlite			Andrews & Emeleus 1971
Average of two	Nigerlikasik	Kimberlite		around 200 Ma	And & Emel 1971
Nigerlikasik	Nigerlikasik	Kimberlite		(K/Ar; Rb/Sr)	
59197	Nigerlikasik	Kimberlite			
59199	Nigerlikasik	Kimberlite			
71246.2	Midternæs	Kimberlite			
Midternæs					
33918	Small dyke	Aillikite			
Sermiligaarsuk					
76254	Dyke, possibly Gardaı	Camptonite			
Paamiut					
60242	old analysis	Aillikite			
60242-new	new analysis	Aillikite			
64241	dated	Aillikite		166±5 (K/Ar)	Larsen & Møller 19
66720-new	new analysis	Aillikite			
73632	old analysis	Aillikite			
73632-new	new analysis	Aillikite			
73642	old analysis	Aillikite			
73642-new	new analysis	Aillikite			
73681	old analysis	Aillikite			
73701	old analysis	Aillikite			
73701-new	new analysis	Aillikite			
73703	old analysis	Carbonatite			
73703-new	new analysis	Carbonatite			
74041-new	new analysis	Aillikite			
Oqummiaq					
78760	Big lamprophyre	Monchiquite		172±5 (K/Ar)	Bridgwater 1970
78760	Big lamprophyre	Monchiquite		149.8±4.4 (Rb/Sr)	This work
78759	cut by 78760	Tholeiitic basalt			
Frederikshåb Isblink					
78262	Ol-nephelinite	Monchiquite			
109502	Evolved neph.	Monchiquite			
109507	Ol-nephelinite	Monchiquite		116±4 (K/Ar)	Hansen & Larsen 1
109509	Evolved neph.	Monchiquite		144±12 (fis. track)	Hansen 1980
109546	Phonolite	Phonolite			
109806	Nephelinite	Monchiquite			

Sample no	SiO2	TiO2	Al2O3	Fe2O3	FeO	MnO	MgO	CaO	Na2O	K2O	P2O5	H2O/Vol	CO2	SUM
50129	43.33	2.36	9.86	12	0	0.18	13.12	16.64	1.19	0.44	0.31	0.57		100
50135	41.6	3.91	12.58	17.99	0	0.23	6.12	10.54	2.84	0.45	0.39	3.35		100
81101	47.96	3.56	13.04	15.46	0	0.23	4.54	9.48	2.82	1.05	0.53	1.33		100
81114	46.64	2.84	14.85	12.85	0	0.22	5.61	10	3.16	0.92	1	1.91		100
81115	46.15	3.05	14.21	14.15	0	0.24	5.77	10.31	3.04	0.71	0.84	1.53		100
81161	46.19	3.01	14.43	14.03	0	0.23	5.93	10.19	2.93	1.02	0.81	1.23		100
81163	46.2	2.9	14.54	13.91	0	0.23	6.23	10.62	2.82	0.81	0.67	1.07		100
81164	48.18	3.96	12.63	16.58	0	0.24	3.93	8.11	2.89	1.8	0.7	0.98		100
86171	47.73	2.79	15.77	14.39	0	0.2	4.35	6.95	4.06	1.87	0.58	1.31		100
101268	46	3.1	14.21	14.44	0	0.21	5.9	9.36	2.77	1.02	0.59	2.4		100
101269	46.43	3.18	14.06	14.06	0	0.21	5.72	9.5	2.9	1.12	0.64	2.18		100
101270	45.62	3.18	13.74	14.26	0	0.22	5.57	8.74	2.78	2.36	0.63	2.9		100
101330	45	2.89	14.42	14.02	0	0.24	6.63	11.23	2.9	0.57	0.49	1.61		100
101335	44.61	3.88	13.38	14.85	0	0.23	4.76	9.07	3.69	0.93	1.43	3.17		100
101375	50.06	1.92	16.29	13.05	0	0.19	4.4	7.8	4.24	1.21	0.56	0.28		100
186381	42.44	4.28	12.62	17.2	0	0.26	5.38	9.13	3.06	1.07	1.64	2.92		100
186382	45.97	3.8	13.91	14.83	0	0.23	4.71	8.24	3.99	0.89	1.38	2.05		100
186385	43.95	3.19	14.87	15.3	0	0.25	5.12	8.71	3.38	1.26	0.97	3		100
186387	44.79	3.13	13.64	15.5	0	0.24	4.79	8.38	2.96	1.48	0.8	4.29		100
186386A	46.31	3.39	14.99	15.63	0	0.21	3.87	7.06	3.64	2.12	1.34	1.44		100
186386B	46.65	3.18	15.62	14.73	0	0.22	3.73	7.23	3.59	2.12	1.26	1.67		100
186387A	46.75	3.22	14.18	16.07	0	0.25	4.82	8.99	2.98	1.31	0.84	0.59		100
186387C	45.47	2.35	13.22	13.43	0	0.2	9.27	11.47	2.26	1.09	0.38	0.86		100
81118A	47.4	2.92	14.94	14.26	0	0.24	4.63	8.32	3.69	1.18	1	1.42		100
81118B	61.54	0.18	15.69	2.53	0	0.06	2.19	2.66	2.66	7.92	0.02	4.55		100
S Greenland kimberlites														
Average of s	29.5	1.81	2.7	5.6	7.9	0.21	27.1	10.7	0.47	1.76	0.54	3.2	7.8	99.5
126746.12	28.85	2.91	2.89	5.5	7.14	0.19	25.64	11.05	0.14	1.27	0.4	13.27		99.25
Average of t	26.45	1.88	2.02	4	5.31	0.42	28	12.33	0.23	1.6	0.66	3.98	12.6	99.67
Nigerlikasik	26.57	1.56	1.51	3.48	5.28	0.66	27.64	12.2	0.27	1.86	0.72	3.61	14.2	99.7
59197	26.99	2.11	2.82	4.21	5.77	0.2	28.86	12.02	0.09	1.161	0.604	14.56		99.4
59199	27.47	1.55	2.2	3.24	5.66	0.17	28.27	11.86	0.11	1.603	0.772	16.47		99.36
71246.2	31.17	3.12	3.54	5.23	7.49	0.21	22.94	12.31	0.41	1.7	0.73	10.49		99.34
Midternæs														
33918	42.59	2.672	12.26	4.44	10.01	0.159	7.56	9.18	3.74	0.185	0.952	5.79		99.55
Sermiligaarsuk														
76254	40.22	2.251	9.68	3.48	8.92	0.164	11.63	8.68	2.36	0.607	0.299	10.72		99.01
Paamiut														
60242	30.47	1.19	9.72	1.54	6.52	0.3	2.82	19.36	5.07	0.49	1.69	4.12	16.1	99.6
60242-new	31.06	1.140	10.07	1.55	6.37	0.289	2.76	18.93	5.17	0.463	1.593	19.63		99.02
64241														
66720-new	22.94	1.203	1.66	3.59	4.92	0.192	15.77	21.14	0.22	1.376	0.846	24.71		98.56
73632	22.91	2.71	5.02	5.05	6.94	0.3	7.81	24.82	1.46	1.53	1.63	3.17	17	100.8
73632-new	23.00	2.660	5.09	4.98	6.78	0.316	9.31	24.19	1.35	1.411	1.541	17.28		97.89
73642	22.91	2.74	4.18	4.62	5.48	0.25	9.55	26.19	0.53	2.4	0.2	2.54	16	97.9
73642-new	23.38	2.726	4.31	5.35	4.70	0.244	10.21	26.06	0.54	2.207	0.275	18.36		98.36
73681	20.35	2.7	4.95	7.85	5.22	0.26	7.4	25.44	2.27	1.8	1.03	1.88	18	99.5
73701	29.03	2.41	4.54	3.01	6.31	0.1	18.36	11.74	1.04	2.6	0.26	1.51	19	100.1
73701-new	29.37	2.382	4.96	2.60	6.44	0.152	18.25	10.92	1.06	2.489	0.244	19.00		97.87
73703	14.99	3.06	5.67	9.21	5.34	0.25	9.79	29.53	0.71	1.23	1.4	1.89	17.3	100.6
73703-new	15.19	2.913	5.64	10.16	4.58	0.236	9.45	28.10	0.71	1.099	1.354	18.17		97.60
74041-new	26.57	1.783	7.40	4.57	8.15	0.396	8.90	20.56	1.97	1.434	1.971	14.39	98.10	
Oqummiaq														
78760														
78760	37.72	3.576	9.98	7.65	5.98	0.197	11.05	16.32	1.18	1.021	0.498	3.70		98.87
78759	50.11	1.222	14.57	3.10	9.49	0.201	5.87	10.44	1.78	0.526	0.105	2.37		99.78
Frederikshåb Isblink														
78262	33.66	4.83	9.98	7.66	8.1	0.23	11.19	14.95	1.67	1.9	0.92	4.55		99.64
109502	43.82	2.3	14.82	9.51	1.78	0.46	2.11	12.14	7.83	1.95	0.83	2.1		99.65
109507	32.89	4.5	8.8	5.42	8.29	0.17	10.92	16.77	0.89	2.17	0.88	2.04	6.25	99.99
109509	42.31	2.14	14.71	8.56	1.88	0.46	2.29	10.64	5.38	3.51	0.73	4.29	0.3	97.2
109546	52.5	0.77	19.52	3.72	0.66	0.34	0.38	3.15	7.97	4.82	0.12	3.34	2.32	99.41
109806	36.76	4.19	11.03	4.32	10.82	0.25	6.51	13.37	3.56	2.35	0.74	3.3	2.78	99.98

Sample no	Rb	Ba	Pb	Sr	La	Ce	Nd	Y	Th	Zr	Nb	Zn	Cu	Co	Ni	Sc	V	Cr	Ga
50129	24	341	3	592	32	76	41	23	0	209	34	65	60		217	47	302	365	
50135	12	412	3	1016	18	31	23	25	0	155	16	115	33		41	32	581	26	
81101	27	427	6	393	47	99	47	41	3	302	55	141	93		39	30	381	49	
81114	20	1244	3	605	29	68	39	30	0	140	29	95	33		57	24	251	105	
81115	15	974	3	531	29	61	34	26	0	114	25	109	43		57	35	383	110	
81161	16	1227	5	589	22	61	37	27	0	107	22	96	48		67	25	329	99	
81163	17	1028	0	556	22	53	30	24	0	112	22	89	47		74	29	365	135	
81164	52	661	7	388	69	148	65	55	6	411	70	145	153		27	22	288	10	
86171	38	1197	5	551	32	75	38	31	0	235	25	117	30		42	19	177	46	
101268	22	813	6	722	33	74	40	30	0	203	27	120	52		54	28	389	55	
101269	23	860	6	647	35	77	43	30	0	205	28	120	48		47	26	382	46	
101270	98	1342	4	880	28	69	41	30	0	206	26	91	53		51	18	338	39	
101330	12	565	6	492	21	44	25	25	0	143	20	96	33		51	36	419	79	
101335	26	976	4	782	46	102	52	31	0	173	44	103	29		8	26	268	3	
101375	25	1253	8	629	32	68	38	27	0	138	9	131	54		41	28	227	54	
186381	29	817	6	745	52	112	54	32	1	172	45	128	22		11	24	272	5	
186382	26	635	6	695	49	104	51	31	3	188	45	122	17		10	22	208	7	
186385	24	1065	4	709	38	88	43	28	1	150	38	113	25		18	18	251	12	
186387	19	946	5	572	33	87	42	32	0	145	31	134	32		23	24	329	17	
186386A	56	1483	9	726	53	124	63	42	0	269	41	148	49		23	21	114	6	
186386B	64	1430	8	741	54	116	58	39	0	239	37	136	45		23	20	110	6	
186387A	21	975	2	589	42	89	45	33	0	154	33	141	26		24	29	344	21	
186387C	28	586	4	604	38	79	40	23	0	170	38	99	85		130	32	318	231	
81118A	27	1268	4	576	36	86	44	33	0	186	38	120	30		31	21	276	35	
81118B	166	1847	7	135	114	234	84	79	24	1132	71	22			5	1		5	
S Greenland kimberlites																			
Average of six																			
126746.12																			
Average of two																			
Nigerlikasik																			
59197																			
59199																			
71246.2																			
Midternæs																			
33918																			
Sermiligaarsuk																			
76254																			
Paamiut																			
60242																			
60242-new																			
64241																			
66720-new																			
73632																			
73632-new																			
73642																			
73642-new																			
73681																			
73701																			
73701-new																			
73703																			
73703-new																			
74041-new																			
Oqummiaq																			
78760																			
78760																			
78759																			
Frederikshåb Isblink																			
78262																			
109502																			
109507		865		854				20		243	128		123	66	81	36	345	153	
109509																			
109546																			
109806	57	530		1008				28		316	115		110	60	24	24	455	7	

Sample no	Sc	Ti	V	Cr	Mn	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr
50129														
50135														
81101														
81114														
81115														
81161														
81163														
81164														
86171														
101268														
101269														
101270														
101330														
101335														
101375														
186381														
186382														
186385														
186387														
186386A														
186386B														
186387A														
186387C														
81118A														
81118B														
S Greenland kimberlites														
Average of six														
126746.12	18.12	1.70	194.88	1449.20	0.15	89.79	857.70	76.63	93.10	11.88	48.29	835.88	12.45	180.68
Average of two														
Nigerlikasik														
59197	20.39	1.21	142.24	1616.71	0.15	77.80	946.11	50.49	77.12	9.40	72.33	1156.69	14.06	226.19
59199														
71246.2														
Midternæs														
33918	11.91	1.61	153.46	181.22	0.13	54.20	190.71	50.84	187.20	30.05	2.45	820.13	24.48	360.21
Sermiligaarsuk														
76254	23.30	1.37	245.15	479.87	0.13	67.41	429.01	96.11	114.03	18.51	13.22	455.70	18.62	151.07
Paamiut														
60242														
60242-new	7.61	0.69	153.36	0.15	0.23	21.42	4.69	14.43	119.60	19.96	29.88	1338.10	38.25	190.31
64241														
66720-new	14.84	0.69	118.54	956.33	0.15	68.98	976.63	61.62	58.20	6.93	72.36	1305.39	13.71	300.73
73632														
73632-new	23.26	1.62	321.48	209.56	0.25	41.62	68.67	75.54	122.43	16.42	40.82	1782.97	45.47	432.00
73642														
73642-new	22.37	1.62	342.73	526.34	0.19	52.43	211.66	71.39	93.52	13.65	63.58	2201.94	24.37	452.46
73681														
73701														
73701-new	20.66	1.46	214.41	1359.72	0.12	65.71	484.76	73.26	67.67	10.25	93.08	827.31	10.99	182.14
73703														
73703-new	16.20	1.77	308.17	395.39	0.18	48.62	89.31	31.44	120.44	20.40	26.43	2561.77	40.18	473.26
74041-new	24.92	1.05	224.72	41.47	0.32	40.08	34.73	53.28	156.51	17.66	34.01	1861.01	47.97	522.58
Oqummiaq														
78760														
78760	35.43	2.23	382.56	376.66	0.16	68.06	116.17	105.96	101.90	16.42	29.10	862.16	19.12	194.10
78759	39.31	0.71	287.63	74.67	0.16	62.86	65.12	160.27	105.01	17.97	17.77	119.69	25.00	69.65
Frederikshåb Isblink														
78262														
109502	8.80	1.08	121.57	-0.30	0.28	26.54	2.06	7.52	201.87	27.47	91.17	3746.99	61.87	799.24
109507														
109509	7.13	1.19	132.76	-0.60	0.30	21.37	2.07	8.21	186.78	24.42	77.36	3500.40	67.11	808.87
109546	1.48	0.36	22.17	29.65	0.21	8.79	20.18	2.70	137.19	28.78	143.25	2949.59	39.30	1003.56
109806														

Sample no	Nb	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er
50129														
50135														
81101														
81114														
81115														
81161														
81163														
81164														
86171														
101268														
101269														
101270														
101330														
101335														
101375														
186381														
186382														
186385														
186387														
186386A														
186386B														
186387A														
186387C														
81118A														
81118B														
S Greenland kimberlites														
Average of six														
126746.12	107.81	1.466	502.09	75.61	151.08	18.58	69.06	10.47	2.84	6.60	0.87	3.78	0.54	1.03
Average of two														
Nigerlikasik														
59197	178.19	3.623	1942.48	136.88	254.47	28.94	100.23	13.09	3.35	7.82	0.96	4.02	0.56	1.14
59199														
71246.2														
Midternæs														
33918	67.95	0.188	136.67	58.89	120.51	16.01	63.67	12.48	3.861	10.304	1.265	6.154	0.943	2.030
Sermiligaarsuk														
76254	27.41	0.941	211.81	20.76	43.72	5.96	24.58	5.47	1.734	4.755	0.711	3.839	0.738	1.736
Paamiut														
60242														
60242-new	380.89	5.527	1969.48	201.03	386.97	44.83	156.62	22.81	5.824	18.153	1.944	9.081	1.393	3.464
64241														
66720-new	195.93	1.636	1422.44	155.91	287.39	33.47	112.99	14.65	3.592	11.061	1.069	4.342	0.561	1.379
73632														
73632-new	197.06	1.569	837.66	176.66	353.81	44.01	162.33	25.93	6.804	21.040	2.328	10.966	1.718	4.026
73642														
73642-new	145.01	1.256	691.49	110.16	215.84	27.03	98.45	15.32	4.019	11.915	1.331	6.116	0.962	2.337
73681														
73701														
73701-new	96.29	0.833	684.03	73.10	142.76	16.85	59.55	8.92	2.229	6.810	0.706	3.143	0.435	1.054
73703														
73703-new	136.48	0.567	582.29	176.72	396.30	50.60	190.79	29.45	7.468	22.919	2.449	10.969	1.600	3.768
74041-new	352.17	0.609	1352.46	219.38	430.21	51.75	181.34	27.82	7.256	22.303	2.429	11.474	1.809	4.347
Oqummiaq														
78760														
78760	98.18	0.446	502.67	62.21	128.05	15.59	57.62	9.67	2.637	7.703	0.897	4.447	0.728	1.736
78759	3.94	0.205	113.54	5.23	13.18	2.10	10.13	2.96	0.971	3.215	0.608	4.123	0.912	2.440
Frederikshåb Isblink														
78262														
109502	370.83	1.873	1801.24	281.73	540.68	62.25	208.51	29.00	7.420	23.415	2.771	13.356	2.271	5.923
109507														
109509	400.11	0.446	1909.08	297.61	570.79	67.68	226.22	32.11	8.273	25.805	3.005	14.825	2.462	6.387
109546	333.15	1.812	2542.32	158.89	299.32	33.70	105.85	14.60	3.862	11.594	1.499	7.868	1.428	3.896
109806														

Sample no	Tm	Yb	Lu	Hf	Ta	Pb	Th	U	West	North	Deg.	Minut	Deg.	Minut	Altitude
50129															
50135									-46.2381	60.8279	-46	-14.286	60	49.674	
81101															
81114															
81115															
81161															
81163															
81164															
86171															
101268															
101269															
101270															
101330															
101335															
101375															
186381															
186382															
186385															
186387															
186386A															
186386B															
186387A															
186387C															
81118A															
81118B															
S Greenland kimberlites															
Average of six															
126746.12	0.11	0.63	0.08	5.04	8.16	3.38	8.21	2.02							
Average of two									-48.865	62.0424	-48	-51.900	62	2.544	
Nigerlikasik									-48.865	62.0424	-48	-51.900	62	2.544	
59197	0.12	0.66	0.08	5.70	11.04	8.67	17.11	2.97	-48.865	62.0424	-48	-51.900	62	2.544	
59199									-48.865	62.0424	-48	-51.900	62	2.544	
71246.2															
Midternæs															
33918	0.229	1.234	0.168	8.033	4.132	5.100	5.396	1.342	47.7801	61.5648	47	46.805	61	33.885	
Sermiligaarsuk															
76254	0.225	1.321	0.180	3.891	1.827	2.231	1.821	0.519							
Paamiut															
60242															
60242-new	0.398	2.344	0.331	5.989	20.465	12.960	32.236	1.583							
64241															
66720-new	0.122	0.620	0.082	5.766	9.520	31.810	18.144	2.122	49.5606	61.9487	49	33.634	61	56.920	
73632									49.6478	61.9306	49	38.869	61	55.835	
73632-new	0.431	2.480	0.339	10.888	11.260	6.940	13.355	4.663	49.6478	61.9306	49	38.869	61	55.835	
73642									49.6048	61.9315	49	36.286	61	55.888	
73642-new	0.269	1.573	0.230	8.249	9.566	4.632	9.771	8.762	49.6048	61.9315	49	36.286	61	55.888	
73681									49.564	61.8972	49	33.8382	61	53.834	
73701									49.4655	61.8401	49	27.9288	61	50.405	
73701-new	0.108	0.657	0.087	3.623	6.068	6.533	7.416	3.428	49.4655	61.8401	49	27.9288	61	50.405	
73703									49.6076	61.893	49	36.453	61	53.582	
73703-new	0.376	2.096	0.279	8.557	14.078	3.330	19.519	2.991	49.6076	61.893	49	36.453	61	53.582	
74041-new	0.496	2.873	0.415	10.031	19.361	9.796	32.566	4.856							
Oqummiaq															
78760															
78760	0.208	1.220	0.174	4.905	6.275	3.785	6.941	1.903	49.3667	62.3833	49	22	62	23	
78759	0.369	2.374	0.340	2.063	1.317	1.503	0.452	0.121	49.3667	62.3833	49	22	62	23	
Frederikshåb Isblink															
78262									-49.5948	62.5436	-49	-35.687	62	32.618	
109502	0.789	4.488	0.669	14.701	21.531	13.873	32.952	8.989	-49.9571	62.7241	-49	-57.426	62	43.446	
109507									-49.9668	62.724	-49	-58.008	62	43.440	
109509	0.868	4.944	0.742	14.888	22.643	16.901	32.351	7.194	-49.9571	62.7214	-49	-57.426	62	43.284	
109546	0.591	3.515	0.554	21.079	22.583	19.212	33.412	5.793	-49.8814	62.6403	-49	-52.884	62	38.418	
109806									-50.1016	62.7043	-50	-6.096	62	42.258	

Sample no	Majors	XRF traces	ICP-MS traces
50129	Upton unpubl.	Upton unpubl.	
50135	Upton unpubl.	Upton unpubl.	
81101	Upton unpubl.	Upton unpubl.	
81114	Upton unpubl.	Upton unpubl.	
81115	Upton unpubl.	Upton unpubl.	
81161	Upton unpubl.	Upton unpubl.	
81163	Upton unpubl.	Upton unpubl.	
81164	Upton unpubl.	Upton unpubl.	
86171	Upton unpubl.	Upton unpubl.	
101268	Upton unpubl.	Upton unpubl.	
101269	Upton unpubl.	Upton unpubl.	
101270	Upton unpubl.	Upton unpubl.	
101330	Upton unpubl.	Upton unpubl.	
101335	Upton unpubl.	Upton unpubl.	
101375	Upton unpubl.	Upton unpubl.	
186381	Upton unpubl.	Upton unpubl.	
186382	Upton unpubl.	Upton unpubl.	
186385	Upton unpubl.	Upton unpubl.	
186387	Upton unpubl.	Upton unpubl.	
186386A	Upton unpubl.	Upton unpubl.	
186386B	Upton unpubl.	Upton unpubl.	
186387A	Upton unpubl.	Upton unpubl.	
186387C	Upton unpubl.	Upton unpubl.	
81118A	Upton unpubl.	Upton unpubl.	
81118B	Upton unpubl.	Upton unpubl.	
S Greenland kimberlites			
Average of six	Emeleus & Andrews 1975		
126746.12	Larsen et al. 1992	Larsen et al. 1992	GEUS unpubl.
Average of two	Emeleus & Andrews 1975		
Nigerlikasik	Emeleus & Andrews 1976		
59197	GEUS unpubl.		GEUS unpubl.
59199	Larsen et al. 1992	Larsen et al. 1992	
71246.2	GEUS unpubl.		
Midternæs			
33918	GEUS unpubl.		GEUS unpubl.
Sermiligaarsuk			
76254	GEUS unpubl.		GEUS unpubl.
Paamiut			
60242	Walton & Arnold 1970		
60242-new	GEUS unpubl.		GEUS unpubl.
64241	Not analysed		
66720-new	GEUS unpubl.		GEUS unpubl.
73632	Walton & Arnold 1970		
73632-new	GEUS unpubl.		GEUS unpubl.
73642	Walton & Arnold 1970		
73642-new	GEUS unpubl.		GEUS unpubl.
73681	Walton & Arnold 1970		
73701	Walton & Arnold 1970		
73701-new	GEUS unpubl.		GEUS unpubl.
73703	Walton & Arnold 1970		
73703-new	GEUS unpubl.		GEUS unpubl.
74041-new	GEUS unpubl.		GEUS unpubl.
Oqummiaq			
78760			
78760	GEUS unpubl.		GEUS unpubl.
78759	GEUS unpubl.		GEUS unpubl.
Frederikshåb Isblink			
78262	Hansen 1979		
109502	Hansen 1979		
109507	Hansen 1979	Hansen 1979	
109509	Hansen 1979		
109546	Hansen 1979		
109806	Hansen 1979	Hansen 1979	

Sample no	Comment	Rock name	Strike	Age, Ma	Age reference
109813	Nephelinite	Monchiquite			
109824	Melilitite	Alnöite		151±7 (fis. track)	Hansen 1980
109837	Nephelinite	Monchiquite			
110689.1_r	Nephelinite	Monchiquite			
110689.2_c	Nephelinite	Monchiquite			
118016	Melilitite	Alnöite		152.1±1.6 (U/Pb)	This work
118101	Carbonatite	Carbonatite			
118102	Carbonatite	Carbonatite			
118103	Carbonatite	Carbonatite			
118200	Nephelinite	Monchiquite			
118293	Nephelinite	Monchiquite			
118295	Ol-nephelinite	Monchiquite		122±5 (K/Ar)	Hansen & Larsen 1
120337	Nephelinite	Monchiquite			
120366c	Ol-nephelinite	Monchiquite		138±5 (K/Ar)	Hansen & Larsen 1
120366r	Ol-nephelinite	Monchiquite			
120367	Ol-nephelinite	Monchiquite			
120390	Phonolite	Phonolite			
120403	Phonolite	Phonolite		105.4±1.5 (Ar/Ar)	This work
120560	Ol-nephelinite	Monchiquite			
129554	Ol-nephelinite	Monchiquite			
129948	Nephelinite	Monchiquite			
131205	Melilitite	Alnöite			
183560r	Nephelinite	Monchiquite		156 ± 14 (Rb-Sr)	This work
183561c	Nephelinite	Monchiquite			
183563r	Ol-nephelinite	Monchiquite			
183564c	Ol-nephelinite	Monchiquite		149.2±2.7 (Rb/Sr)	This work
183567c	Ol-nephelinite	Monchiquite			
183567r	Ol-nephelinite	Monchiquite			
183568r	Ol-nephelinite	Monchiquite			
183569c	Ol-nephelinite	Monchiquite			
Færingehavn					
211094	Lamprophyre	Aillkite		175±7 (K/Ar)	Larsen & Rex 1992
265872	Lamprophyre	Aillkite		185±7 (K/Ar)	Larsen & Rex 1992
265873	Lamprophyre	Aillkite			
265874	Lamprophyre	Aillkite			
265875	Lamprophyre	Carbonatite			
265876	Lamprophyre	Aillkite			
265877	Lamprophyre	Aillkite		196±8 (K/Ar)	Larsen & Rex 1992
Godthåbsfjord					
110953		camptonite	W-E	57.2±1.1 (K/Ar)	Bridgwater 1970
201449		camptonite	?	51.4±0.9 (Ar/Ar)	This work
265896		camptonite	NW-SE		
265897		camptonite	W-E		
265898		camptonite	W-E		
265899		camptonite	W-E		
Søndre Isortoq dyke swarm					
KØ 14530		camptonite			
KØ 14594		camptonite			
KØ 14970	Precambrian?	ankaramite			
KØ 15004		camptonite			
KØ 15014		camptonite			
KØ 15015		camptonite			
KØ 15038		camptonite			
KØ 15045		camptonite			
KØ 15046		camptonite			
KØ 15926		camptonite			
KØ 15927		camptonite			
KØ 15931		camptonite			
KØ 15941		camptonite			
KØ 16003		camptonite			
KØ 16020		camptonite			
KØ 16021		camptonite			
KØ 16031		camptonite			
KØ 16101	Sulloq pipe, contam.	camptonite			
KØ 16106	Sulloq pipe	camptonite			

Sample no	SiO2	TiO2	Al2O3	Fe2O3	FeO	MnO	MgO	CaO	Na2O	K2O	P2O5	H2O/Vol	CO2	SUM
109813	38.03	3.96	12.36	3.91	10.42	0.28	5.73	12.65	3.47	2.69	0.62	2.46	3.56	100.14
109824	28.63	2.28	8.9	3.07	7.75	0.49	3.2	21.56	3.21	3.32	2.31	2.31	12.22	99.25
109837	35.08	3.91	10.34	2.08	11.27	0.23	6.45	16.76	3.12	0.36	1.12	3.03	6.35	100.1
110689.1_r	36.69	4.19	10.36	9.77	2.21	0.2	7.84	19.13	2.25	1.29	0.73	1.83	2.88	99.37
110689.2_c	35.44	4.4	11.84	5.37	7.42	0.21	11.17	12.64	2.24	2.86	0.39	3.08	2.72	99.78
118016	31.39	2.79	9.95	6.48	6.5	0.39	3.67	17.55	5.47	1.57	2.43	3.53	7.8	99.52
118101	12.8	1.37	3.39	6.7	6.35	0.4	5.22	35.4	0.26	0.8	5.6	0.97	20.35	99.43
118102	32.61	0.67	6.37	2.47	2.61	0.18	7.59	34.19	1.4	0.4	6.85	2.03	3	100.37
118103	21.22	2.82	5.79	20.45	3.11	0.66	7.6	23.79	0.51	1.16	6.59	0.96	5.05	99.71
118200	38.61	3.28	11.43	3.28	9.08	0.31	4.62	14.67	3.38	2.31	1.4	2.55	5.91	100.83
118293	36.1	2.82	12.01	1.29	9.06	0.51	2.88	14.71	5.66	0.61	1.78	3.89	7.5	98.82
118295	34.28	4.01	10.89	4.69	8.73	0.23	9.61	15.63	2.24	2.22	0.84	1.53	4.55	99.25
120337	38.51	4.41	10.76	0	14.74	0.34	5.18	16.13	4.19	2.38	1.72			98.36
120366c	38	3.21	9.16	4.38	7.6	0.14	12.52	17.5	0.55	1.27	0.32	2.52	3.45	100.62
120366r	34.92	3.63	9.99	4.39	9.26	0.14	11.28	15.87	0.6	1.39	0.91	4.14	3.6	100.12
120367	37.64	3.15	8.54	3.81	7.62	0.17	13.26	17.83	0.53	1.17	0.27	2.9	2.75	99.64
120390	62.3	0.82	16.57	4.43	0	0.39	0.54	0.64	8.68	5.57	0.04			100
120403	60.52	0.8	17.04	3.64	0.4	0.43	0.39	0.54	8.09	5.67	0.13	1.68		99.33
120560	34.38	2.98	8.45	2.92	9.09	0.19	10.64	15.06	1.6	1.75	0.95	1.93	10.8	100.74
129554	34.87	2.68	7.64	2.79	8.65	0.2	12.13	15.57	0.69	1.36	0.95	1.75	9.8	99.08
129948	37.59	3.49	12.42	0.62	11.42	0.43	4.12	15.59	6	0.1	1.52	4.12	1.7	99.12
131205	25.94	2.46	8.01	1.83	10.38	0.42	3.87	20.91	3.15	1.33	2.93	2.67	15.36	99.26
183560r	38.37	3.84	12.14	8.08	7.61	0.26	6.42	14.69	1.25	1.87	1.18	3.84		99.55
183561c	39.11	3.65	13.07	7.02	8.07	0.25	5.71	13.59	1.67	2.25	1.27	4.03		99.69
183563r	36.74	3.85	11.33	4.13	8.13	0.16	10.2	13.35	2.04	2.53	0.61	6.71		99.78
183564c	37.55	3.92	10.81	6.12	6.31	0.15	11.43	13.47	1.93	1.99	0.51	5.66		99.85
183567c	34.16	3.63	9.38	4.6	8.04	0.16	11.52	13.88	1.9	1.5	0.41	10.48		99.66
183567r	33.38	3.65	9.85	3.52	8.74	0.16	10.56	13.8	2.38	1.52	0.52	11.11		99.49
183568r	34.73	3.92	11.32	5.57	8.23	0.2	9.65	14.9	1.24	2.69	0.65	6.31		99.41
183569c	35.93	3.93	10.64	5.52	7.79	0.18	11.22	15.47	1.48	1.39	0.56	5.64		99.75
Færingehavn														
211094	40.06	3.82	7.78	4.13	5.63	0.15	12.32	14.64	1.4	3.64	0.66	5.08		99.31
265872	30.42	3.97	5.25	5.35	7.24	0.21	13.56	16.79	1.03	2.47	0.35	12.6		99.24
265873	35.56	4.28	6.27	6.5	5.22	0.17	11.23	21.03	0.95	1.3	1.07	5.94		99.52
265874	21.31	2.97	2.9	3.36	6.29	0.24	11.91	20.61	1.56	1.84	0.3	25.38		98.67
265875	10.28	0.39	0.86	6.17	4.96	0.36	9.84	29.09	2.21	0.12	2.86	31.92		99.06
265876	28.43	1.72	4.18	5.01	8.53	0.26	22.08	13.86	0.39	2.24	0.63	12.32		99.65
265877	31.36	3.74	4.4	5.36	8.17	0.21	17.96	13.06	0.8	2.32	0.71	11.36		99.45
Godthåbsfjord														
110953	50.53	1.367	15.83	4.26	6.08	0.184	2.30	3.71	4.40	3.888	0.878	6.19		99.60
201449	47.085	1.174	15.935	3.125	6.37	0.143	4.219	8.666	3.63	2.181	0.453	6.129		99.11
265896	46.539	1.243	16.569	3.473	5.960	0.151	6.663	10.026	2.610	1.149	0.181	4.713		99.277
265897	50.206	1.211	15.827	3.571	7.460	0.203	1.831	3.838	4.330	3.777	0.577	6.620		99.451
265898	51.117	1.460	15.717	2.228	6.980	0.151	1.518	4.259	4.560	3.486	0.837	6.907		99.220
265899	47.596	1.038	16.024	1.627	7.220	0.142	3.723	8.249	3.650	2.124	0.247	8.044		99.684
Søndre Isortoq dyke swarm														
KØ 14530	44.934	1.48	16.487	4.751	6.01	0.186	8.521	9.59	2.18	0.816	0.255	4.519		99.731
KØ 14594	45.434	1.451	15.11	2.42	6.44	0.159	8.985	11.111	2.57	1.832	0.345	4.157		100.02
KØ 14970	52.328	1.004	8.228	3.124	8.13	0.193	10.973	11.53	2.37	0.936	0.155	0.915		99.886
KØ 15004	45.704	1.647	16.056	2.546	6.03	0.158	7.539	9.116	2.87	3.179	0.345	4.551		99.74
KØ 15014	44.624	1.565	14.664	2.766	6.29	0.161	9.218	9.858	2.45	2.352	0.376	5.7		100.02
KØ 15015	45.232	1.42	14.647	3.204	5.57	0.156	10.043	9.615	1.85	2.816	0.423	4.49		99.465
KØ 15038	45.084	1.533	15.457	2.971	5.46	0.166	9.008	9.931	2.16	3.481	0.447	3.438		99.136
KØ 15045	44.914	1.556	15.701	2.879	5.13	0.171	6.944	11.851	1.82	3.313	0.457	4.601		99.337
KØ 15046	46.456	1.74	16.253	2.046	6.05	0.16	7.114	10.347	2.41	2.956	0.523	3.483		99.538
KØ 15926	42.329	1.091	12.361	3.733	5.39	0.19	11.127	12.251	1.49	1.452	0.313	7.81		99.536
KØ 15927	42.52	1.053	12.16	3.203	5.86	0.22	11.378	13.366	1.48	0.997	0.32	6.802		99.36
KØ 15931	45.111	1.365	16.843	3.727	6.79	0.175	7.868	9.692	2.4	1.128	0.252	3.966		99.316
KØ 15941	45.304	1.399	13.939	2.536	6.6	0.17	9.946	10.829	2.17	2.139	0.317	4.525		99.874
KØ 16003	42.053	1.354	15.221	2.368	8.01	0.182	4.773	11.885	2.8	0.916	0.268	10.292		100.12
KØ 16020	42.344	1.405	14.176	3.738	5.03	0.181	8.281	14.64	2.08	1.328	0.328	5.68		99.208
KØ 16021	45.567	1.644	16.297	5.399	5.67	0.18	6.564	11.414	2.38	0.921	0.268	3.771		100.08
KØ 16031	47.259	1.831	15.608	3.918	4.94	0.144	8.421	8.799	1.95	2.694	0.316	3.75		99.631
KØ 16101	50.448	1.319	14.616	2.947	4.43	0.13	8.564	8.787	3.17	2.282	0.315	2.623		99.631
KØ 16106	46.494	1.577	15.456	2.831	5.93	0.156	8.417	10.008	3.09	2.686	0.415	2.15		99.211

Sample no	Rb	Ba	Pb	Sr	La	Ce	Nd	Y	Th	Zr	Nb	Zn	Cu	Co	Ni	Sc	V	Cr	Ga
109813	61	725		1870				27		290	110		96	56	20	10	370	7	
109824	110	1830		3921				82		689	325		13	24	13		300	16	
109837	14	485		836				31		326	110		80	43	18	26	310	7	
110689.1_r	30	460		1248				36		496	140		60	42	27	47	275	41	
110689.2_c	88	870		881				23		274	100		71	56	115	29	337	270	
118016	73	1930		2780				60		686	285		29	36	18		540	31	
118101	75	1033		3726				96		1027	470		8	27	15		195		
118102	4	595		2295				101		1543	54		3	20	18	25	58		
118103	60	940		1421				131		2626	190		25	48	29		235		
118200	81	725		1396				27		413	135		23	31	12		240	14	
118293	12	2485		2965				61		737	335		2	22	10		195		
118295	56	850		1470				29		328	125		107	58	60	28	385	73	
120337																			
120366c	38	475		328				18		225	61		81	58	103	36	310	360	
120366r	42	570		393				21		267	86		93	59	97	47	373	263	
120367	30	640		367				18		229	67		62	62	112	40	310	370	
120390																			
120403																			
120560	43	670		1199				20		176	71		125	61	135	29	350	510	
129554	39	700		940				20		120	88		130	66	175	34	245	650	
129948	6	660		1056				64		743	268		11	31	16		230	23	
131205	25	1400		3994				72		482	245		16	30	14	25	170	23	
183560r																			
183561c																			
183563r																			
183564c																			
183567c																			
183567r																			
183568r																			
183569c																			
Færingehavn																			
211094	136	1286	0.1	500	112	209	91.2	27	14.4	311	133	61.3	130	58.1	117	33.4	235	330	13.5
265872	117	1630	1.1	830	147	271	117	40	54.8	520	159	83.1	128	58.3	165	52.4	237	292	17
265873	57.3	1147	3.6	755	171	291	113	32.9	19.8	855	202	46.6	306	39.5	13	68	195	6.4	15.3
265874	68.1	2066	10	1032	135	264	128	21.3	22.2	626	198	85.8	80.1	42.9	161	28.4	247	397	12.2
265875	5.6	693	12	2364	331	646	264	48.3	28	394	220	130	7.8	25.7	19.3	31.2	121	24	3.9
265876	83.5	1030	3.6	1123	94.4	169	76.9	19.1	11.7	309	134	99.6	60.1	77.6	394	28	195	758	9.8
265877	88.8	935	1.2	1016	84.8	157	72.7	21	9.6	361	131	90.1	96.3	83.6	534	22.7	287	663	15.2
Godthåbsfjord																			
110953																			
201449																			
265896																			
265897																			
265898																			
265899																			
Søndre Isortoq dyke swarm																			
KØ 14530	22.7	633		988	34.1	67	24.5	23.8		132	36.6	73	83		134	21.6	246	194	
KØ 14594	42.2	806		751	39.5	76.2	29.3	20.9		157	71.3	75	80.7		171	27	218	510	
KØ 14970	23.3	322		338	13.8	38.5	19.7	14.7		101	6.8	96.1	133		284	35.4	197	1046	
KØ 15004	111	864		803	30.6	62.9	25.2	18.1		198	79.2	68.7	49.3		117	17.8	186	296	
KØ 15014	71.7	895		801	46.7	83.8	31.9	19.9		164	85.4	72.3	58.2		218	25.2	191	555	
KØ 15015	98.8	1081		975	69.6	122	41.7	18		183	100	72.7	59.4		213	19.7	173	517	
KØ 15038	113	1275		1095	65.9	110	38.6	19.4		212	117	73	51.7		155	19.5	183	469	
KØ 15045	105	1307		1049	59.2	111	39.3	19.7		206	114	70.2	59.1		145	21	187	468	
KØ 15046	101	1399		1122	91.6	158	49.9	21		218	137	76.7	57.4		98.5	16.4	180	242	
KØ 15926	38.7	843		600	33.9	68.5	27.7	17.7		108	47.8	65.7	79.9		449	24.9	200	913	
KØ 15927	35.1	957		756	34	65.7	25.4	17		112	49.6	66.3	83.7		479	18.1	186	882	
KØ 15931	39.4	527		696	30.5	59.3	24	23		126	38.3	73.5	74.1		128	18.8	199	186	
KØ 15941	69.4	894		733	38.9	76.7	28.5	18.8		154	67.3	71.9	65.6		283	24	194	674	
KØ 16003	25.2	588		809	39.4	72.1	26.9	23.8		134	40.3	72.4	73.3		98.3	18.6	217	205	
KØ 16020	85.3	1066		930	50.5	100	34.5	17.4		168	93	81.4	72		207	30.5	221	432	
KØ 16021	26	468		483	31	57.4	24.4	25.4		127	33.2	77.6	95.1		104	24	257	209	
KØ 16031	82.4	1019		985	30.8	62.5	27	16		167	75	72.4	48.2		143	17.7	175	436	
KØ 16101	74.9	772		709	39.7	83	30.3	16.9		156	65.6	64.9	59.4		165	24.8	174	467	
KØ 16106	80.8	951		1008	54.7	101	36.3	19.6		190	90.2	70.2	63.2		147	23.1	185	409	

Sample no	Sc	Ti	V	Cr	Mn	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr
109813														
109824	5.85	1.44	265.14	2.39	0.41	24.80	7.14	18.18	193.77	25.60	127.34	4166.54	86.38	725.85
109837														
110689.1_r	44.95	2.36	282.94	20.60	0.16	36.39	18.27	58.19	102.15	18.61	32.45	1243.39	36.07	504.52
110689.2_c	24.64	2.41	330.72	308.31	0.15	55.85	124.77	69.79	98.94	19.37	86.96	868.38	21.91	273.91
118016	14.13	1.72	211.87	4.27	0.31	26.85	9.48	28.76	194.07	26.53	85.25	2891.61	61.74	709.56
118101	6.89	0.92	160.03	1.47	0.38	25.73	8.40	11.88	190.07	20.28	93.38	3937.42	100.28	1145.52
118102	7.77	0.37	43.17	-0.19	0.17	18.83	5.16	7.21	286.34	21.79	14.31	2374.76	102.47	1652.89
118103	14.95	1.64	194.35	68.82	0.50	40.54	47.90	19.51	259.15	30.65	65.09	1408.68	125.45	2748.04
118200	12.73	1.96	224.37	7.99	0.24	32.01	10.36	28.87	149.38	21.97	80.29	1437.01	38.38	432.92
118293	8.72	1.68	183.16	0.30	0.34	22.73	3.07	10.58	188.65	27.24	22.94	3142.42	63.32	768.63
118295														
120337														
120366c														
120366r														
120367	49.52	1.83	305.26	404.59	0.13	55.83	121.84	57.16	150.86	15.68	32.05	367.78	17.14	229.23
120390														
120403	4.74	0.39	20.08	-0.50	0.26	10.96	0.29	2.34	179.57	38.16	183.35	8.82	76.87	1010.32
120560														
129554	30.69	1.61	291.81	831.00	0.17	61.74	213.78	123.41	96.01	14.79	42.06	957.75	20.16	197.10
129948	10.05	1.97	204.11	1.09	0.30	24.37	3.89	15.63	177.78	27.41	9.74	1058.89	61.76	756.13
131205	9.00	1.54	179.43	7.27	0.34	29.02	11.16	18.68	209.05	22.90	41.76	4268.98	74.76	493.10
183560r	20.43	2.28	289.40	36.00	0.22	47.92	22.31	46.59	155.37	23.49	56.34	2226.09	30.21	348.07
183561c														
183563r														
183564c	35.77	2.27	370.05	265.38	0.14	61.37	106.02	83.48	92.13	17.65	63.13	606.81	17.39	185.33
183567c														
183567r														
183568r	19.05	2.30	446.67	190.08	0.19	58.01	71.19	87.60	123.28	21.58	71.95	2031.42	25.01	270.79
183569c														
Færingehavn														
211094	35.98	2.23	214.63	263.22	0.12	53.23	108.83	136.50	71.04	14.72	134.87	489.34	26.73	298.34
265872	54.22	2.25	234.15	248.77	0.16	51.03	160.51	142.53	91.80	17.12	115.99	868.17	42.87	543.55
265873	64.50	2.50	191.23	3.00	0.13	38.29	14.14	339.55	68.05	18.34	60.62	791.02	35.31	893.90
265874	29.38	1.74	234.40	351.86	0.19	42.27	181.26	100.15	76.85	12.98	71.11	1077.21	23.01	657.62
265875	26.43	0.22	110.22	19.00	0.28	27.29	21.32	13.20	116.84	8.80	4.50	2357.23	51.24	397.58
265876	25.52	0.97	181.12	692.42	0.20	72.80	435.84	63.71	97.06	11.97	86.44	1120.21	20.33	308.00
265877	23.58	2.25	280.25	673.75	0.17	74.82	550.03	117.61	101.71	14.54	88.07	1033.59	22.61	355.29
Godthåbsfjord														
110953	8.99	0.84	21.92	0.10	0.14	25.13	1.45	22.06	100.94	20.11	126.25	384.40	42.96	307.74
201449	23.57	0.73	133.80	129.74	0.12	40.17	87.45	52.47	66.34	15.72	76.46	880.54	26.29	145.25
265896	27.17	0.68	197.54	191.42	0.12	49.98	137.43	76.14	63.49	14.44	43.46	644.57	23.52	96.74
265897	8.06	0.69	15.72	0.18	0.15	28.77	1.09	22.80	83.59	17.29	148.64	469.59	39.85	264.45
265898	11.66	0.82	37.30	0.18	0.12	37.15	2.03	25.49	68.17	22.78	100.39	524.21	50.11	345.26
265899	18.61	0.58	128.47	71.03	0.11	35.93	60.49	46.27	65.46	15.78	86.71	603.83	24.89	162.16
Søndre Isortoq dyke swarm														
KØ 14530														
KØ 14594														
KØ 14970	30.22	0.58	174.98	960.55	0.15	65.87	285.32	126.60	82.05	12.42	23.21	324.03	15.49	91.47
KØ 15004	23.74	0.98	171.20	281.82	0.12	39.23	114.84	46.46	57.13	15.74	110.65	774.97	19.86	185.21
KØ 15014														
KØ 15015	24.97	0.82	165.59	494.21	0.12	44.88	211.21	57.24	60.45	14.55	100.69	950.10	19.94	165.95
KØ 15038														
KØ 15045														
KØ 15046														
KØ 15926														
KØ 15927	25.70	0.61	170.75	819.12	0.17	58.56	457.80	72.04	53.16	11.85	35.04	737.65	17.83	99.73
KØ 15931														
KØ 15941														
KØ 16003														
KØ 16020														
KØ 16021														
KØ 16031														
KØ 16101														
KØ 16106	25.99	0.89	176.67	373.89	0.12	40.76	148.93	61.82	60.63	15.69	82.47	984.93	21.71	178.95

Sample no	Nb	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er
109813														
109824	417.21	1.444	1882.38	316.83	600.51	71.48	248.94	38.52	10.242	33.292	3.923	19.413	3.114	8.040
109837														
110689.1_r	138.62	1.076	453.22	113.60	237.84	30.96	115.42	18.99	4.927	14.533	1.769	8.527	1.389	3.352
110689.2_c	127.55	0.721	1093.36	82.49	165.01	20.75	74.78	12.06	3.148	9.021	1.095	5.478	0.852	2.119
118016	358.69	0.733	1599.47	255.94	510.61	61.51	216.12	32.78	8.582	27.186	3.143	14.887	2.324	5.879
118101	653.80	1.598	1117.06	407.89	889.19	110.92	398.21	59.77	15.646	50.590	5.555	26.113	3.992	9.845
118102	58.64	0.397	583.95	393.09	930.76	128.08	492.18	78.00	19.290	57.665	6.489	28.500	4.085	9.521
118103	236.52	0.973	1088.35	459.53	1077.14	143.16	539.08	85.97	21.211	63.920	7.385	34.132	5.055	11.927
118200	181.48	3.269	925.87	124.44	254.78	31.15	114.40	18.64	5.058	15.864	1.846	8.865	1.407	3.493
118293	362.57	1.378	2048.09	288.22	552.63	64.00	219.72	31.56	8.215	26.821	2.997	14.592	2.304	6.073
118295														
120337														
120366c														
120366r														
120367	76.02	0.439	622.01	48.23	99.85	13.09	49.43	8.57	2.396	6.680	0.863	4.102	0.661	1.603
120390														
120403	355.87	1.016	5.64	277.24	490.35	52.81	152.81	20.06	2.416	18.407	2.323	13.289	2.644	7.483
120560														
129554	101.25	3.333	529.70	74.40	147.29	18.37	66.08	10.56	2.853	8.684	1.046	4.957	0.776	1.876
129948	315.35	0.075	664.90	218.72	438.48	54.12	194.26	30.25	7.845	23.719	2.844	14.106	2.336	5.963
131205	278.62	0.799	1392.49	353.10	723.82	87.23	307.80	44.24	11.120	36.501	3.946	18.329	2.768	7.151
183560r	155.56	0.312	1015.22	105.87	215.68	27.26	99.94	15.77	4.314	13.073	1.517	7.278	1.146	2.910
183561c														
183563r														
183564c	79.59	0.671	778.33	50.82	105.21	13.17	49.68	8.47	2.376	6.966	0.844	4.219	0.657	1.609
183567c														
183567r														
183568r	143.15	1.886	746.01	81.70	164.06	20.24	72.27	11.89	3.272	9.866	1.202	5.850	0.952	2.403
183569c														
Færingehavn														
211094	136.47	0.830	1111.97	111.90	215.87	27.08	95.44	14.52	3.222	11.281	1.330	6.267	0.986	2.378
265872	172.51	2.891	1235.94	161.46	323.36	39.81	138.03	19.53	4.667	14.581	1.659	8.270	1.503	4.446
265873	212.95	3.202	970.75	188.85	325.78	36.76	125.02	20.62	5.462	16.800	1.938	8.908	1.338	3.163
265874	212.56	0.420	1858.68	157.14	318.50	41.68	155.09	24.70	5.916	16.297	1.733	7.247	0.943	2.248
265875	232.75	0.200	626.44	337.44	645.46	77.27	269.18	39.05	9.550	30.145	3.108	13.932	2.025	4.832
265876	137.60	2.251	911.75	99.45	205.94	26.19	95.72	14.68	3.709	11.111	1.264	5.626	0.848	1.966
265877	137.32	1.203	819.96	91.15	188.50	24.29	90.22	15.06	3.836	11.266	1.308	6.042	0.912	2.070
Godthåbsfjord														
110953	107.89	0.383	1495.13	146.93	255.69	27.15	85.86	11.77	2.984	10.943	1.403	7.959	1.558	4.171
201449	66.54	0.733	1026.16	84.66	150.51	15.37	48.46	6.50	1.82	6.13	0.88	4.77	0.92	2.48
265896	30.00	1.11	286.60	22.18	43.21	5.51	20.28	3.91	1.264	3.977	0.637	3.952	0.849	2.255
265897	111.75	1.34	1150.65	114.17	203.00	23.19	72.58	10.30	2.552	7.942	1.261	7.205	1.433	3.903
265898	131.70	1.21	1731.94	182.81	317.45	34.90	106.30	13.95	3.189	10.450	1.622	8.978	1.790	4.716
265899	58.39	1.85	1010.54	61.76	106.53	11.57	36.85	5.44	1.456	4.449	0.731	4.204	0.900	2.370
Søndre Isortoq dyke swarm														
KØ 14530														
KØ 14594														
KØ 14970	6.33	0.322	336.67	16.32	36.00	4.84	20.41	4.31	1.189	3.707	0.554	3.050	0.573	1.489
KØ 15004	74.02	0.971	872.37	31.44	59.15	6.99	26.26	4.69	1.447	4.126	0.637	3.556	0.717	1.874
KØ 15014														
KØ 15015	94.57	0.719	1032.31	65.90	115.16	12.18	40.90	6.08	1.714	5.401	0.734	3.808	0.722	1.927
KØ 15038														
KØ 15045														
KØ 15046														
KØ 15926														
KØ 15927	46.04	0.757	876.73	33.00	60.68	7.27	26.62	4.11	1.348	3.796	0.571	3.193	0.657	1.738
KØ 15931														
KØ 15941														
KØ 16003														
KØ 16020														
KØ 16021														
KØ 16031														
KØ 16101														
KØ 16106	84.03	0.861	952.85	52.56	93.38	10.60	36.83	5.83	1.727	5.209	0.729	3.953	0.779	2.121

Sample no	Tm	Yb	Lu	Hf	Ta	Pb	Th	U	West	North	Deg.	Minut	Deg.	Minut	Altitude
109813									-50.1016	62.7043	-50	-6.096	62	42.258	
109824	1.032	5.748	0.831	14.873	24.620	18.035	31.512	6.693	-49.9752	62.6452	-49	-58.512	62	38.712	
109837									-49.9383	62.6765	-49	-56.298	62	40.590	
110689.1_r	0.423	2.330	0.329	13.860	9.350	5.530	11.189	2.813	-49.8322	62.6658	-49	-49.932	62	39.948	
110689.2_c	0.248	1.402	0.207	6.747	8.183	3.095	8.387	1.616	-49.8322	62.6658	-49	-49.932	62	39.948	
118016	0.733	4.283	0.624	14.229	23.338	15.671	32.733	10.134	-50.1094	62.7267	-50	-6.564	62	43.602	
118101	1.157	6.184	0.832	13.786	39.141	3.711	48.504	14.744	-49.9254	62.7216	-49	-55.524	62	43.296	
118102	0.980	5.099	0.700	19.027	7.859	3.643	76.889	4.105	-49.9254	62.7216	-49	-55.524	62	43.296	
118103	1.318	7.117	1.042	32.466	28.111	5.146	91.205	6.186	-49.9254	62.7216	-49	-55.524	62	43.296	
118200	0.432	2.527	0.364	10.267	11.384	7.856	13.945	3.438	-49.9559	62.7872	-49	-57.354	62	47.232	
118293	0.778	4.345	0.639	15.757	21.623	15.585	27.342	6.433	-50.0053	62.6583	-50	-0.318	62	39.498	
118295									-50.0107	62.655	-50	-0.642	62	39.300	
120337									-50.3035	62.6566	-50	-18.210	62	39.396	
120366c									-50.3409	62.645	-50	-20.454	62	38.700	
120366r									-50.3409	62.645	-50	-20.454	62	38.700	
120367	0.206	1.079	0.159	6.868	4.911	51.037	4.789	0.898	-50.3409	62.645	-50	-20.454	62	38.700	
120390									-50.3771	62.8398	-50	-22.626	62	50.388	
120403	1.158	7.096	1.112	22.490	21.375	22.781	31.427	6.810	-50.3771	62.8451	-50	-22.626	62	50.706	
120560									-50.3828	62.724	-50	-22.968	62	43.440	
129554	0.237	1.299	0.184	5.037	6.814	5.989	8.642	1.600	-50.4023	62.6735	-50	-24.138	62	40.410	
129948	0.800	4.420	0.646	15.377	20.067	10.965	23.175	7.354	-50.18	62.7406	-50	-10.800	62	44.436	
131205	0.836	4.716	0.658	9.322	16.888	13.127	27.438	5.633	-49.8283	62.6534	-49	-49.698	62	39.204	
183560r	0.357	2.012	0.298	8.529	9.982	7.087	11.057	3.106	-50.5539	62.8763	-50	-33.232	62	52.578	
183561c									-50.5539	62.8763	-50	-33.232	62	52.578	
183563r									-50.2781	62.6577	-50	-16.686	62	39.462	
183564c	0.200	1.102	0.159	5.057	5.168	2.965	5.698	1.309	-50.2781	62.6577	-50	-16.686	62	39.462	
183567c									-50.3535	62.6665	-50	-21.210	62	39.990	
183567r									-50.3535	62.6665	-50	-21.210	62	39.990	
183568r	0.303	1.623	0.229	6.246	8.837	5.173	9.178	2.657	-50.3549	62.7007	-50	-21.294	62	42.042	
183569c									-50.3549	62.7007	-50	-21.294	62	42.042	
Færingehavn															
211094	0.291	1.620	0.223	7.441	7.361	5.586	14.173	3.896	-51.6842	63.9134	-51	-41.052	63	54.803	
265872	0.693	4.266	0.636	16.924	10.106	5.045	56.189	10.964	-51.5587	63.6483	-51	-33.522	63	38.898	
265873	0.370	2.003	0.279	25.537	7.618	6.927	21.999	15.815	-51.5587	63.6483	-51	-33.522	63	38.898	
265874	0.235	1.346	0.189	16.183	9.081	10.785	22.204	2.726	-53.5628	63.6399	-53	-33.768	63	38.392	
265875	0.537	2.871	0.384	8.066	16.581	15.897	28.025	13.785	-51.5223	63.6667	-51	-31.338	63	40.000	
265876	0.196	1.059	0.145	8.340	8.999	5.140	11.718	3.657	-51.5698	63.6971	-51	-34.188	63	41.828	
265877	0.237	1.202	0.153	9.253	8.254	6.408	11.957	2.504	-51.5698	63.6971	-51	-34.188	63	41.828	
Godthåbsfjord															
110953	0.616	3.847	0.570	6.976	4.896	10.325	14.977	3.083	-51.5167	64.0833	-51	-31	64	5	
201449	0.36	2.33	0.37	3.42	2.86	6.20	9.01	1.97	-51.8000	64.1167	-51	-48	64	7	
265896	0.340	2.069	0.329	2.373	1.530	1.562	1.900	0.390	-51.6879	64.1574	-51	-41.272	64	9.442	
265897	0.603	3.796	0.588	6.088	4.777	9.439	12.645	2.511	-51.5303	64.0818	-51	-31.816	64	4.909	
265898	0.706	4.202	0.639	7.638	4.651	15.072	22.379	4.004	-51.6603	64.1003	-51	-39.62	64	6.018	
265899	0.364	2.335	0.365	3.713	2.721	5.122	8.021	1.584	-51.6873	64.1049	-51	-41.24	64	6.296	
Søndre Isortoq dyke swarm															
KØ 14530									-52.2065	65.3322	-52	-12.39	65	19.93	
KØ 14594									-52.2210	65.3717	-52	-13.26	65	22.30	
KØ 14970	0.214	1.293	0.202	2.450	5.515	3.884	1.516	0.299	-51.9113	65.4757	-51	-54.68	65	28.54	
KØ 15004	0.285	1.758	0.279	4.779	5.631	4.525	3.291	0.822	-52.5575	65.3257	-52	-33.45	65	19.54	
KØ 15014									-52.5517	65.2908	-52	-33.10	65	17.45	
KØ 15015	0.282	1.694	0.263	4.129	5.468	3.659	7.033	1.673	-52.5328	65.3007	-52	-31.97	65	18.04	
KØ 15038									-52.4543	65.3488	-52	-27.26	65	20.93	
KØ 15045									-52.4408	65.3447	-52	-26.45	65	20.68	
KØ 15046									-52.4548	65.3302	-52	-27.29	65	19.81	
KØ 15926									-52.3592	65.3590	-52	-21.55	65	21.54	
KØ 15927	0.259	1.613	0.235	2.331	2.920	2.675	3.257	0.737	-52.3758	65.3630	-52	-22.55	65	21.78	
KØ 15931									-52.3667	65.3762	-52	-22.00	65	22.57	
KØ 15941									-52.3930	65.3500	-52	-23.58	65	21.00	
KØ 16003									-52.2657	65.3447	-52	-15.94	65	20.68	
KØ 16020									-52.3802	65.3058	-52	-22.81	65	18.35	
KØ 16021									-52.3657	65.3135	-52	-21.94	65	18.81	
KØ 16031									-52.4123	65.2848	-52	-24.74	65	17.09	
KØ 16101									-52.2677	65.3027	-52	-16.06	65	18.16	
KØ 16106	0.308	1.883	0.285	4.077	5.968	3.601	5.803	1.486	-52.2677	65.3027	-52	-16.06	65	18.16	

Sample no	Majors	XRF traces	ICP-MS traces
109813	Hansen 1979	Hansen 1979	
109824	Hansen 1979	Hansen 1979	GEUS unpubl.
109837	Hansen 1979	Hansen 1979	
110689.1_r	Hansen 1979	Hansen 1979	GEUS unpubl.
110689.2_c	Hansen 1979	Hansen 1979	GEUS unpubl.
118016	Hansen 1979	Hansen 1979	GEUS unpubl.
118101	Hansen 1979	Hansen 1979	GEUS unpubl.
118102	Hansen 1979	Hansen 1979	GEUS unpubl.
118103	Hansen 1979	Hansen 1979	GEUS unpubl.
118200	Hansen 1979	Hansen 1979	GEUS unpubl.
118293	Hansen 1979	Hansen 1979	GEUS unpubl.
118295	Hansen 1979	Hansen 1979	
120337	Hansen 1979		
120366c	Hansen 1979	Hansen 1979	
120366r	Hansen 1979	Hansen 1979	
120367	Hansen 1979	Hansen 1979	GEUS unpubl.
120390	Hansen 1979		
120403	Hansen 1979		GEUS unpubl.
120560	Hansen 1979	Hansen 1979	
129554	Hansen 1979	Hansen 1979	GEUS unpubl.
129948	Hansen 1979	Hansen 1979	GEUS unpubl.
131205	Hansen 1979	Hansen 1979	GEUS unpubl.
183560r	Hansen 1979		GEUS unpubl.
183561c	Hansen 1979		
183563r	Hansen 1979		
183564c	Hansen 1979		GEUS unpubl.
183567c	Hansen 1979		
183567r	Hansen 1979		
183568r	Hansen 1979		GEUS unpubl.
183569c	Hansen 1979		
Færingehavn			
211094	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
265872	Larsen et al. 1992	Larsen et al. 1992	GEUS unpubl.
265873	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
265874	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
265875	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
265876	Larsen et al. 1992	Larsen et al. 1992	GEUS unpubl.
265877	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
Godthåbsfjord			
110953	GEUS unpubl.		GEUS unpubl.
201449	GEUS unpubl.		GEUS unpubl.
265896	GEUS unpubl.		GEUS unpubl.
265897	GEUS unpubl.		GEUS unpubl.
265898	GEUS unpubl.		GEUS unpubl.
265899	GEUS unpubl.		GEUS unpubl.
Søndre Isortoq dyke swarm			
KØ 14530	GEUS unpubl.	G. Fitton unpubl.	
KØ 14594	GEUS unpubl.	G. Fitton unpubl.	
KØ 14970	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 15004	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 15014	GEUS unpubl.	G. Fitton unpubl.	
KØ 15015	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 15038	GEUS unpubl.	G. Fitton unpubl.	
KØ 15045	GEUS unpubl.	G. Fitton unpubl.	
KØ 15046	GEUS unpubl.	G. Fitton unpubl.	
KØ 15926	GEUS unpubl.	G. Fitton unpubl.	
KØ 15927	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 15931	GEUS unpubl.	G. Fitton unpubl.	
KØ 15941	GEUS unpubl.	G. Fitton unpubl.	
KØ 16003	GEUS unpubl.	G. Fitton unpubl.	
KØ 16020	GEUS unpubl.	G. Fitton unpubl.	
KØ 16021	GEUS unpubl.	G. Fitton unpubl.	
KØ 16031	GEUS unpubl.	G. Fitton unpubl.	
KØ 16101	GEUS unpubl.	G. Fitton unpubl.	
KØ 16106	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.

Sample no	Comment	Rock name	Strike	Age, Ma	Age reference
KØ 16670		monchiquite			
KØ 16687		camptonite			
KØ 16688		camptonite			
KØ 16691		camptonite			
KØ 16698		camptonite			
KØ 16812		monchiquite			
KØ 17088		Alkali basalt			
KØ 17090		Alkali basalt		58.1±0.6 (Ar/Ar)	This work
KØ 17094		camptonite			
KØ 17144		camptonite			
KØ 17146		camptonite			
KØ 17148		camptonite		55.2±1.2 (Ar/Ar)	Larsen et al. 1999
KØ 17149		camptonite			
KØ 17151		camptonite			
KØ 17154		camptonite		55.4±0.6 (Ar/Ar)	This work
KØ 17156		camptonite			
KØ 17159		camptonite			
KØ 17160		camptonite			
265424		camptonite			
265880		camptonite			
Sukkertoppen, Proterozoic, for comparison					
253644		Kimberlite			
265881	Dated	Aillikite		586 (K/Ar)	Larsen & Rex 1992
Qaqarssuk					
223812	Cuts carbonatite	Aillikite		174±7 (K/Ar)	Larsen & Rex 1992
266082	Cuts carbonatite	Aillikite			
266105	Cuts carbonatite	Aillikite			
320415	Cuts carbonatite	Aillikite			
320432	Cuts carbonatite	Aillikite			
Fossilik					
257463		Aillikite		164.2±1.8 (Rb/Sr)	GEUS unpublished
265890	Drillcore 1995	Aillikite			
409788.1	Drillcore 2001	Aillikite			
409788.2	Drillcore 2001	Aillikite			
409788.5	Drillcore 2001	Aillikite			
Aasiaat region					
464506	globular dyke	Tholeiitic basalt	N-S		
464536	globular dyke	Tholeiitic basalt	N-S	55.8±0.2 (Ar/Ar)	GEUS unpublished
464593	Sydostbugt dyke	Tholeiitic basalt	WNW		
464599	Manermiut dyke	Tholeiitic basalt	N-S		
467561	Manermiut dyke	Tholeiitic basalt	N-S		
467564	Aasiaat dyke	Tholeiitic basalt	120		
455791	Grønne Ejland sill	Tholeiitic basalt	Sill		
455793	Grønne Ejland sill	Tholeiitic basalt	Sill	60.5±0.9 (Ar/Ar)	This work
Western Disko dykes					
156579	RinksDal	Tholeiitic basalt			
156628	Hanekammen	Tholeiitic basalt			
176421	Niaqussat	Tholeiitic basalt			
176454	HammersDal	Tholeiitic basalt			
176489	HammersDal	Tholeiitic basalt			
176554	Mellemfjord	Tholeiitic basalt			
176569	NLaksebugt	Tholeiitic basalt			
176584	NLaksebugt	Tholeiitic basalt			
176601	NLaksebugt	Tholeiitic basalt		54.0±0.3 (Ar/Ar)	Storey et al. 1998
176607	Sapernuvik	Tholeiitic basalt			
176613	Sapernuvik	Tholeiitic basalt			
176680	NukKilleq	Tholeiitic basalt			
South-eastern Nuussuaq					
318717	Tartunaq	Tholeiitic basalt	Dyke		
318701	Saqqaqdal	Tholeiitic basalt	Sill		
318712	Tartunaq	Tholeiitic basalt	Sill		
318718	Tartunaq	Tholeiitic basalt	Sill		
318741	Atanikerluk	Tholeiitic basalt	Sill		
318802	Tartunaq	Tholeiitic basalt	Sill	56.5±0.8 (Ar/Ar)	This work

Sample no	SiO2	TiO2	Al2O3	Fe2O3	FeO	MnO	MgO	CaO	Na2O	K2O	P2O5	H2O/Vol	CO2	SUM
KØ 16670	42.115	1.535	14.557	3.193	4.91	0.194	8.136	12.7	3.83	2.339	0.696	5.506		99.712
KØ 16687	44.487	1.707	15.914	2.451	6.4	0.17	5.335	11.421	2.83	2.5	0.455	6.332		100
KØ 16688	46.195	1.126	16.126	2.586	6.3	0.168	4.884	11.139	2.64	1.473	0.447	6.431		99.515
KØ 16691	45.236	1.248	15.976	2.207	6.48	0.187	6.242	9.575	3.04	2.41	0.508	6.251		99.361
KØ 16698	46.159	1.551	15.642	1.907	6.28	0.17	5.905	11.396	2.69	1.584	0.466	6.199		99.95
KØ 16812	41.404	1.368	14.149	2.939	6.14	0.21	7.347	13.946	3.32	1.052	0.496	7.213		99.584
KØ 17088	44.69	2.516	15.597	6.201	6.23	0.196	5.907	8.354	3.27	0.766	0.961	4.603		99.29
KØ 17090	43.242	2.512	14.634	5.266	7.07	0.207	5.909	8.714	3.43	0.885	1.201	6.477		99.547
KØ 17094	46.104	1.42	15.599	3.15	6.29	0.172	6.828	8.87	3.06	2.156	0.42	5.31		99.379
KØ 17144	44.726	1.299	14.262	2.853	5.79	0.162	8.505	11.918	1.94	1.863	0.606	5.554		99.478
KØ 17146	45.601	1.049	15.514	3.582	5.57	0.151	9.41	10.704	2.16	0.796	0.274	4.97		99.781
KØ 17148	46.244	1.591	16.544	1.996	7.5	0.167	6.371	8.473	3.27	1.751	0.667	4.765		99.339
KØ 17149	46.824	1.399	15.845	3.063	5.56	0.164	7.593	9.195	2.35	3.451	0.317	4.079		99.839
KØ 17151	43.502	1.626	15.656	1.732	7.1	0.162	6.597	9.893	2.5	2.517	0.454	8.47		100.21
KØ 17154	45.11	1.761	16.299	2.954	6.58	0.21	5.869	11.498	2.93	1.475	0.454	4.642		99.783
KØ 17156	44.191	2.153	15.934	4.374	7.59	0.256	5.664	9.95	2.54	1.267	0.364	5.425		99.708
KØ 17159	45.223	1.56	15.598	2.621	6.68	0.188	6.167	9.865	2.79	2.014	0.44	6.453		99.6
KØ 17160	45.207	1.384	14.474	2.821	5.71	0.17	9.81	10.386	1.86	2.034	0.276	5.026		99.16
265424	45.67	1.95	16.24	1.71	7.18	0.12	4.61	6.83	3.59	2.19	0.53	8.92		99.54
265880	44.78	1.31	14	2.42	6.45	0.16	9.97	11	1.96	2.48	0.62	4.3		99.44
Sukkertoppen, Proterozoic, for comparison														
253644	40.93	0.16	4.2	5.22	5.71	0.18	32.65	1.84	0.35	1.5	0	5.52		98.26
265881	32.778	5.878	4.371	7.211	8.23	0.245	13.106	12.385	0.94	2.626	1.223	9.186		98.177
Qaqarssuk														
223812	not analysed													
266082	36.28	0.36	8.48	2.16	5.99	0.34	7.55	13.76	4.13	2.26	1.44	15.15		97.9
266105	38.6	0.38	8.66	2.74	3.5	0.23	5.96	17.87	3.82	2.32	1.68	11.55		97.31
320415	35.65	0.35	7.95	3.21	3.18	0.25	6.38	20.5	2.84	2.24	1.76	13.19		97.5
320432	39.21	0.34	8.84	4.88	2.54	0.2	6.4	14.33	4.49	3.95	1.57	11.09		97.84
Fossilik														
257463	not analysed													
265890	34.383	0.729	5.666	2.621	1.590	0.088	4.090	22.486	1.740	2.208	0.440	23.217		99.257
409788.1	21.02	2.68	3.8	6.381	4.79	0.249	14.097	19.436	0.86	2.436	1.425	21.233		98.408
409788.2	22.75	2.42	4.01	5.522	5.15	0.24	13.662	19.383	1.19	2.336	1.375	20.603		98.639
409788.5	21.75	2.56	3.89	6.288	4.55	0.24	13.304	20.217	0.68	2.616	1.435	20.846		98.381
Aasiaat region														
464506	48.53	4.12	12.61	5.51	9.71	0.28	4.36	9.09	2.66	1.27	0.54	1.26		99.94
464536	48.43	4.08	12.55	5.52	9.98	0.24	4.40	9.09	2.75	1.20	0.53	1.33		100.11
464593	49.76	1.42	14.83	2.32	8.13	0.17	7.67	12.13	1.75	0.31	0.15	1.70		100.33
464599	48.52	1.69	14.87	2.63	8.88	0.19	7.90	12.53	2.22	0.16	0.16	0.76		100.50
467561	48.060	1.598	14.707	2.986	8.390	0.170	8.038	12.418	2.270	0.106	0.142	0.674		99.559
467564	49.258	1.411	14.156	2.215	8.260	0.153	8.109	12.047	1.720	0.172	0.148	1.649		99.298
455791	48.17	2.11	14.63	5.29	7.51	0.19	5.91	11.54	2.59	0.277	0.194	1.63		100.03
455793	49.21	1.81	15.20	3.68	7.95	0.18	5.70	11.62	2.79	0.227	0.171	1.19		99.72
Western Disko dykes														
156579	47.45	3.90	12.53	5.92	8.85	0.20	4.43	9.63	2.77	1.235	0.540	1.83		99.28
156628	47.09	2.44	13.86	2.06	10.89	0.21	6.94	12.46	2.31	0.304	0.219	0.60		99.38
176421	47.30	4.28	12.84	4.46	10.34	0.24	4.62	9.73	2.68	1.123	0.673	1.48		99.77
176454	49.02	2.28	13.95	2.43	10.61	0.22	6.07	11.17	2.52	0.315	0.232	1.00		99.81
176489	47.88	2.78	12.91	4.84	8.53	0.20	7.30	10.36	2.30	0.777	0.351	1.89		100.12
176554	46.24	4.59	11.70	2.66	13.93	0.27	4.92	9.90	2.41	0.860	0.550	1.44		99.47
176569	45.98	4.90	12.13	4.26	12.06	0.25	4.90	10.22	2.59	0.680	0.624	1.11		99.70
176584	46.17	4.99	11.99	4.45	12.08	0.26	4.87	10.03	2.57	0.856	0.634	1.03		99.93
176601	47.12	4.61	11.89	4.50	12.17	0.26	4.72	9.45	2.66	0.927	0.627	1.03		99.96
176607	49.00	3.22	13.48	5.77	7.76	0.20	4.84	10.14	2.78	0.791	0.426	1.46		99.87
176613	48.18	2.60	13.02	3.77	12.62	0.28	5.14	9.98	2.79	0.267	0.265	1.12		100.03
176680	48.86	3.65	12.94	7.61	6.93	0.20	4.87	9.31	2.62	1.017	0.507	1.40		99.91
South-eastern Nuussuaq														
318717	47.61	3.78	13.07	4.28	10.84	0.23	4.92	9.09	2.60	1.172	0.561	1.35		99.50
318701	47.63	3.88	13.00	4.34	10.78	0.24	4.44	9.15	2.78	1.289	0.594	1.43		99.55
318712	47.94	3.70	13.11	4.18	10.77	0.23	5.36	9.45	2.46	1.214	0.542	0.60		99.56
318718	47.49	3.75	13.00	4.50	10.41	0.23	4.88	9.44	2.64	1.205	0.552	1.46		99.56
318741	47.86	3.80	13.08	3.44	11.50	0.24	4.78	9.29	2.65	1.274	0.567	1.50		99.98
318802	47.48	3.87	12.97	5.23	9.91	0.23	4.82	9.31	2.68	1.251	0.548	1.28		99.58

Sample no	Rb	Ba	Pb	Sr	La	Ce	Nd	Y	Th	Zr	Nb	Zn	Cu	Co	Ni	Sc	V	Cr	Ga
KØ 16670	52.7	2054		1404	92.7	168	57.2	25.9		197	144	72.7	50		136	18.1	178	271	
KØ 16687	79.3	1116		855	53.3	90.9	33.3	23.1		167	90.7	86.6	74		69.7	19.6	219	217	
KØ 16688	41.1	1329		873	78.3	134	46.6	21.4		135	87.4	86	67.7		68	21	215	151	
KØ 16691	61.3	1596		868	56.5	104	37.3	20.6		161	76	67.1	60.1		121	12.1	181	290	
KØ 16698	47.2	1625		895	60	112	44.4	25		166	73.5	84.4	81		78	24.7	229	287	
KØ 16812	54.2	1449		915	84.4	142	48.8	24		166	110	87.9	66.1		145	20.6	193	324	
KØ 17088	13.2	883		553	88.9	165	67.1	51.8		252	51.3	107	68.5		90.7	28.6	300	129	
KØ 17090	14.7	990		610	99	192	76.3	53.8		274	51.8	97.5	63.3		70.7	18.8	239	116	
KØ 17094	50.9	879		549	37.6	77.6	31.4	25.1		161	53.3	76.5	76.7		117	19.8	191	218	
KØ 17144	39.5	1668		1322	129	220	65.5	20.1		175	151	71.7	70.8		204	19.5	178	630	
KØ 17146	17.6	554		531	33.3	58.3	23.7	17.3		85.9	36.2	59.8	91.1		226	23.2	183	465	
KØ 17148	41.8	1205		935	67.5	120	43.9	25.6		149	81	63.9	65.4		111	15.9	178	199	
KØ 17149	138	867		659	51.6	89.4	29.8	16.6		231	98.8	71.5	60.1		133	17.3	171	338	
KØ 17151	78.4	1121		817	46.5	85.1	33.8	23		170	88.3	58.6	65.1		64.6	18.5	199	92.9	
KØ 17154	37.9	1004		779	67	125	44.9	28.5		175	79.3	67.5	84		63.9	35	256	289	
KØ 17156	35.5	562		492	39.9	75.2	33.4	32.5		171	44	84.6	90		51.6	26.6	290	110	
KØ 17159	53.2	1012		740	38	75.1	29.4	23.5		151	62.8	73.3	79.4		136	24.2	212	424	
KØ 17160	66.9	706		585	31	57	23.9	16.4		133	61.5	67.3	68.6		230	20.8	180	590	
265424	57	1194		1016	91	156	53	21		237	71	87	37		34	16	140	38	
265880	78	1790		1090	125	211	69	20		146	141	76	74		204	20	177	636	
Sukkertoppen, Proterozoic, for comparison																			
253644																			
265881																			
Qaqarssuk																			
223812																			
266082	39	1233	17	1811	487	847	313	45	50	207	383	190	20	28	71	24	109	268	11
266105	42	5801	3	2086	269	500	214	35	16	348	345	153	17	14	34	13	107	79	13
320415	42	5125	6	2683	310	555	235	40	35	370	283	140	17	14	35	10	117	86	11
320432	50	1880	8	4574	382	687	268	42	17	164	546	287	47	13	21	27	89	37	12
Fossilik																			
257463																			
265890																			
409788.1																			
409788.2																			
409788.5																			
Aasiaat region																			
464506																			
464536																			
464593																			
464599																			
467561																			
467564																			
455791	3.8	36.6	6.2	260.3	7.5	18.3	19.3	33.1	1.2	108.8	6.3	107	246	43.3	69.8	36	392	86.3	22
455793	3.7	40	9.3	236.3	8.2	10.3	13.7	29.1	1.7	96.9	5.8	98.2	204	46.4	62.5	39.9	377	79.7	17.7
Western Disko dykes																			
156579	29.6	371	5.3	343.0	39.2	85.6	49.4	46.9	6.5	297.2	54.1	135	209	43.8	33.8	25.3	353	46.8	22.1
156628																			
176421	62.8	490	13	195.9	29.8	64.6	32.5	29.1	8	268.4	11.9	73.2	111	36	185	23.4	94.9	106.6	17.7
176454																			
176489																			
176554	21.4	168	5.4	244.4	30	65	46.9	57.9	3.8	317.6	39.7	189	333	55.9	46.6	39.9	473	68.7	24
176569																			
176584	12.5	317	1.4	272	34.1	81.7	59.3	66.3	0.8	348	41.7	135	349	28.7	44.9	27.9	420	66.6	32.4
176601	27.9	243	4.8	272.1	38.4	86.1	56.6	67.2	3.8	371.0	44.7	166	367	52.4	42.6	29.9	443	46.6	25.1
176607	12.1	321	4.9	358.6	29.4	57.7	36.9	42.5	5.2	231.8	38.4	124	185	50.6	47.6	26	339	41.9	21.8
176613	5.2	97.4	1.6	178	11	24.9	23	45.8	0.5	159	12.1	131	199	34.7	28.2	36.8	488	28.3	26.8
176680	19.7	307	5.9	319.2	35.3	71.5	43.1	47.9	4.8	287.9	45.4	154	240	48.7	36.7	26.5	425	30.9	22.8
South-eastern Nuussuaq																			
318717																			
318701	34.2	444	4	408.2	51.8	102	55.4	49.0	4.2	332.4	66.6	136	208	46.7	31.5	28	382	21.4	23.1
318712	30	628	0	407	37.3	92.6	54.7	47.6	1.3	290	55.7	122	181	28.9	45.2	24.8	327	44.2	26.8
318718																			
318741	29.8	471	1.3	407	44.8	89.9	59.2	47.6	4.2	296	60.9	150	175	27.8	35.3	22.6	361	35.3	29.3
318802																			

Sample no	Sc	Ti	V	Cr	Mn	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr
KØ 16670														
KØ 16687														
KØ 16688														
KØ 16691														
KØ 16698	27.19	0.91	199.28	270.90	0.13	33.75	76.99	76.89	65.84	16.41	47.70	878.56	25.83	152.51
KØ 16812														
KØ 17088	31.00	1.46	261.49	107.23	0.15	50.46	89.59	68.87	103.32	20.23	14.45	560.27	49.56	267.52
KØ 17090														
KØ 17094														
KØ 17144	25.55	0.74	175.29	600.57	0.12	43.17	202.66	66.11	51.31	14.97	40.47	1294.71	21.21	157.00
KØ 17146														
KØ 17148	18.59	0.91	161.69	180.77	0.13	39.43	111.61	64.17	54.24	15.03	41.70	901.04	25.41	133.59
KØ 17149														
KØ 17151	23.00	0.92	175.05	74.42	0.12	33.35	61.15	58.26	46.61	14.99	79.18	781.68	22.94	156.63
KØ 17154	35.33	1.02	229.09	257.16	0.16	41.74	65.31	82.10	59.12	16.47	38.32	751.78	28.01	160.55
KØ 17156	25.89	1.24	254.12	86.30	0.20	43.85	54.18	87.87	83.11	17.30	36.46	497.92	32.65	167.19
KØ 17159														
KØ 17160														
265424	13.79	1.12	126.19	32.29	0.10	28.26	33.80	42.93	78.69	20.29	56.76	983.77	21.01	229.93
265880	25.16	0.75	177.09	617.52	0.12	49.64	204.39	68.34	51.33	15.00	79.54	1070.20	21.18	153.14
Sukkertoppen, Proterozoic, for comparison														
253644														
265881	33.55	3.33	371.76	978.32	0.19	75.48	343.28	204.16	145.62	18.76	110.56	1,155.57	48.94	1,686.52
Qaqarssuk														
223812														
266082	26.29	0.21	93.85	209.08	0.25	25.38	68.28	13.32	125.08	16.62	42.78	1835.83	48.69	170.60
266105														
320415	12.11	0.20	112.34	74.12	0.19	18.19	34.76	11.44	23.66	14.28	43.78	2743.61	43.91	318.65
320432														
Fossilik														
257463														
265890														
409788.1	18.96	1.33	196.85	420.27	0.17	51.05	139	125.44	107.14	15.44	82.41	2872.55	31.64	873.7
409788.2	17.81	1.14	193.21	350.6	0.16	49.82	126.49	130.06	104.78	14.8	77.94	3643.54	31.35	1158.94
409788.5	17.27	1.19	176.26	361.94	0.15	50.29	124.37	130.97	112.97	15.4	83.11	2928.57	31.92	1079.79
Aasiaat region														
464506														
464536	31.18	2.34	411.15	16.47	0.17	93.46	31.34	190.43	146.98	23.02	25.85	334.45	45.93	283.19
464593	37.00	0.87	299.56	226.58	0.14	78.98	83.93	51.39	81.56	16.48	7.75	278.28	19.03	87.94
464599	39.65	0.95	347.48	355.55	0.14	91.27	127.50	182.64	93.02	19.53	3.12	216.18	25.27	93.30
467561	48.36	1.00	368.40	415.01	0.15	55.60	138.88	176.49	83.68	19.30	3.00	203.78	26.06	84.32
467564	46.91	0.87	307.65	253.68	0.14	52.16	96.25	58.92	83.48	16.43	6.62	211.07	20.02	90.61
455791	40.67	1.25	437.78	98.21	0.15	45.20	77.83	250.45	107.32	21.32	3.39	241.60	33.24	110.79
455793														
Western Disko dykes														
156579	32.36	2.17	394.43	59.85	0.16	41.50	37.55	231.20	143.55	22.52	26.17	319.80	48.25	308.95
156628	41.39	1.42	392.46	133.13	0.16	52.74	84.38	212.37	103.87	20.37	2.83	336.21	31.00	140.45
176421	30.71	2.22	418.16	30.06	0.18	58.33	47.57	223.93	157.39	23.52	24.08	382.38	51.62	343.82
176454	43.12	1.35	449.93	103.80	0.17	47.14	74.06	291.01	109.24	21.38	9.26	200.89	38.76	141.56
176489	35.33	1.61	331.66	230.41	0.15	56.50	107.33	176.86	117.19	19.64	17.49	286.63	34.67	206.25
176554	38.25	2.53	432.83	66.87	0.19	53.59	49.19	382.43	172.00	24.59	22.10	262.24	63.11	334.95
176569	35.99	2.57	431.41	72.09	0.19	50.06	53.93	398.26	168.65	25.21	16.14	271.47	67.49	380.26
176584	34.30	2.59	424.40	63.90	0.19	47.17	47.46	392.51	163.08	25.08	13.40	272.67	69.09	387.84
176601	35.59	2.42	437.87	53.02	0.20	49.46	42.30	379.42	169.99	24.94	25.42	257.76	70.42	391.73
176607	31.78	1.67	367.22	51.90	0.14	50.44	48.47	191.89	130.61	22.30	11.10	341.18	43.72	239.72
176613	40.18	1.48	485.57	19.88	0.21	56.86	29.86	217.37	131.90	21.53	4.70	179.39	47.62	173.44
176680	29.84	1.93	370.53	31.71	0.15	42.53	36.84	232.29	142.48	22.61	17.98	309.65	50.72	301.47
South-eastern Nuussuaq														
318717														
318701	28.58	2.22	370.92	22.19	0.18	42.49	33.42	227.54	158.87	24.45	32.34	395.30	52.00	352.37
318712	30.74	2.17	387.45	48.70	0.18	45.24	46.92	206.75	148.42	23.54	32.12	391.92	47.45	268.67
318718														
318741														
318802														

Sample no	Nb	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er
KØ 16670														
KØ 16687														
KØ 16688														
KØ 16691														
KØ 16698	68.42	0.849	1533.82	55.62	105.58	12.31	43.27	6.62	1.943	5.909	0.854	4.745	0.956	2.508
KØ 16812														
KØ 17088	47.72	0.316	882.13	86.79	161.19	18.59	66.54	10.86	3.161	10.136	1.519	8.676	1.801	4.708
KØ 17090														
KØ 17094														
KØ 17144	139.31	0.316	1538.84	117.81	207.07	21.85	68.58	8.18	2.175	7.649	0.874	4.344	0.776	2.075
KØ 17146														
KØ 17148	75.74	0.484	1201.23	63.11	115.41	12.95	44.70	6.60	1.936	5.918	0.845	4.686	0.909	2.438
KØ 17149														
KØ 17151	81.14	1.004	1047.97	42.85	79.06	9.31	33.54	5.67	1.766	5.048	0.756	4.104	0.843	2.208
KØ 17154	72.28	0.398	953.98	62.47	113.61	13.00	44.57	6.73	2.045	6.337	0.922	5.190	1.056	2.743
KØ 17156	41.40	0.428	559.53	36.76	69.39	8.58	31.84	6.14	2.025	5.958	0.971	5.633	1.167	2.957
KØ 17159														
KØ 17160														
265424	70.97	0.910	1146.05	91.53	152.91	17.25	56.54	8.32	2.287	6.769	0.861	4.343	0.776	1.965
265880	137.18	0.681	1465.95	116.66	205.41	22.04	68.43	8.36	2.159	7.993	0.855	4.338	0.781	2.126
Sukkertoppen, Proterozoic, for comparison														
253644														
265881	305.36	1.330	2197.40	275.36	539.31	64.08	227.71	33.29	8.54	20.61	2.80	12.78	2.05	4.60
Qaqarssuk														
223812														
266082	440.38	1.549	1212.28	440.26	797.75	96.17	318.08	40.69	9.516	31.018	3.109	13.635	1.924	4.828
266105														
320415	305.30	1.026	6356.82	262.14	521.22	63.52	217.16	30.24	7.534	22.560	2.720	12.235	1.765	4.082
320432														
Fossilik														
257463														
265890														
409788.1	283.02	1.16	1327.72	256.45	497.64	56.53	196.92	26.38	6.9	20.63	2.43	10.05	1.26	3.52
409788.2	259.82	1.34	1235.85	230.71	448.87	49.8	174.45	24.32	6.41	18.78	2.2	9.58	1.22	3.27
409788.5	288.93	1.28	1264.05	239.13	477.05	54.91	190.48	26.46	6.97	20.06	2.3	9.66	1.23	3.33
Aasiaat region														
464506														
464536	44.93	0.12	316.68	31.69	68.03	10.01	41.08	9.42	2.83	10.61	1.54	8.38	1.74	4.25
464593	8.26	0.32	131.79	9.19	21.14	3.33	13.62	3.28	1.11	3.82	0.57	3.23	0.69	1.78
464599	4.54	0.10	32.86	5.20	14.75	2.28	11.74	3.64	1.36	3.99	0.71	4.56	0.94	2.38
467561	4.43	0.09	29.82	4.57	13.06	2.42	12.35	3.91	1.41	4.20	0.76	4.66	0.98	2.59
467564	8.60	0.42	119.86	9.20	22.50	3.56	15.60	3.81	1.31	3.66	0.62	3.74	0.76	1.99
455791	6.30	0.046	40.92	6.329	17.639	2.785	13.977	4.396	1.577	5.294	0.922	5.657	1.215	3.238
455793														
Western Disko dykes														
156579	52.06	0.085	356.69	35.307	79.644	10.165	43.377	9.882	2.980	10.624	1.598	8.821	1.738	4.500
156628	10.25	0.018	88.73	10.252	27.663	4.142	19.949	5.399	1.883	6.130	0.978	5.655	1.137	2.936
176421	59.29	0.219	416.27	40.853	90.807	11.572	50.470	10.887	3.221	11.732	1.738	9.818	1.868	4.926
176454	9.15	0.067	59.71	9.472	24.515	3.603	17.551	5.082	1.749	6.120	1.061	6.441	1.371	3.695
176489	29.96	0.159	220.02	20.679	48.638	6.563	29.737	7.057	2.147	7.657	1.130	6.545	1.276	3.356
176554	38.51	0.394	216.41	29.367	68.763	9.872	45.473	11.268	3.328	12.294	2.016	10.974	2.237	5.899
176569	41.18	0.292	222.15	32.298	78.171	10.756	48.790	12.104	3.361	13.336	2.084	12.160	2.445	6.611
176584	42.47	0.086	226.96	32.739	78.732	11.324	50.007	12.173	3.516	13.712	2.178	12.573	2.511	6.584
176601	42.83	0.272	236.05	32.846	78.888	10.816	49.920	12.138	3.409	13.793	2.144	12.491	2.533	6.754
176607	35.57	0.070	306.05	25.385	56.963	7.585	34.018	8.100	2.491	8.632	1.341	7.794	1.536	4.091
176613	11.36	0.080	79.93	10.431	26.497	3.982	20.266	5.856	1.982	7.267	1.255	8.028	1.667	4.682
176680	42.91	0.199	290.41	29.718	67.706	9.023	41.293	9.838	2.853	10.358	1.612	9.323	1.820	4.789
South-eastern Nuussuaq														
318717														
318701	66.46	0.353	418.12	45.624	96.463	12.793	53.531	11.094	3.380	12.011	1.805	9.653	1.825	4.795
318712	59.23	0.535	488.37	41.523	87.407	11.296	47.686	10.106	3.106	10.956	1.614	8.451	1.634	4.224
318718														
318741														
318802														

Sample no	Tm	Yb	Lu	Hf	Ta	Pb	Th	U	West	North	Deg.	Minut	Deg.	Minut	Altitude
KØ 16670									-52.4553	65.2887	-52	-27.32	65	17.32	
KØ 16687									-52.4962	65.4175	-52	-29.77	65	25.05	
KØ 16688									-52.4780	65.4338	-52	-28.68	65	26.03	
KØ 16691									-52.5193	65.4045	-52	-31.16	65	24.27	
KØ 16698	0.370	2.334	0.349	3.408	4.534	4.231	5.716	1.283	-52.5210	65.4270	-52	-31.26	65	25.62	
KØ 16812									-52.4838	65.4397	-52	-29.03	65	26.38	
KØ 17088	0.711	4.158	0.642	5.837	2.486	5.615	6.669	1.633	-52.6382	65.3903	-52	-38.29	65	23.42	
KØ 17090									-52.6382	65.3903	-52	-38.29	65	23.42	
KØ 17094									-52.7075	65.4590	-52	-42.45	65	27.54	
KØ 17144	0.292	1.818	0.269	3.449	7.015	5.716	13.656	2.635	-52.7075	65.4590	-52	-42.45	65	27.54	
KØ 17146									-52.6462	65.4635	-52	-38.77	65	27.81	
KØ 17148	0.355	2.219	0.332	2.815	4.397	4.082	5.275	1.202	-52.6462	65.4635	-52	-38.77	65	27.81	
KØ 17149									-52.6710	65.4942	-52	-40.26	65	29.65	
KØ 17151	0.334	2.094	0.306	3.591	6.048	2.672	4.273	1.022	-52.6710	65.4942	-52	-40.26	65	29.65	
KØ 17154	0.418	2.529	0.379	3.712	4.537	3.845	6.797	1.501	-52.5225	65.4730	-52	-31.35	65	28.38	
KØ 17156	0.451	2.765	0.394	3.792	2.317	2.802	3.505	0.884	-52.5225	65.4730	-52	-31.35	65	28.38	
KØ 17159									-52.5677	65.4352	-52	-34.06	65	26.11	
KØ 17160									-52.5473	65.4045	-52	-32.84	65	24.27	
265424	0.275	1.593	0.232	5.110	3.411	7.734	9.191	2.082	-52.4000	65.3923	-52	-24.00	65	23.54	
265880	0.288	1.816	0.276	3.562	5.956	5.889	13.644	2.632	-52.7075	65.4590	-52	-42.45	65	27.54	
Sukkertoppen, Proterozoic, for comparison															
253644									-52.4162	65.2818	-52	-24.97	65	16.91	
265881	0.52	2.63	0.34	26.99	15.83	12.87	34.88	4.90	-52.7078	65.4588	-52	-42.468	65	27.528	
Qaqarssuk															
223812									-51.7000	65.5500	-51	-42	65	33	
266082	0.496	2.661	0.379	3.628	16.624	18.018	48.759	44.717	-51.7000	65.5500	-51	-42	65	33	
266105									-51.7000	65.5500	-51	-42	65	33	
320415	0.441	2.266	0.323	5.855	15.570	10.678	34.037	7.827	-51.7000	65.5500	-51	-42	65	33	
320432									-51.7000	65.5500	-51	-42	65	33	
Fossilik															
257463									-52.7078	65.4588	-51	-33.16	65	22.57	
265890									-51.5336	65.3778	-51	-32.017	65	22.667	
409788.1	0.33	1.91	0.24	14.59	14.02	8.14	15.37	5.06			-51		65		
409788.2	0.31	1.77	0.22	15.13	11.98	25.01	17.06	4.17			-51		65		
409788.5	0.31	1.75	0.22	14.73	13.79	8.36	16.58	4.48			-51		65		
Aasiaat region															
464506									-52.4503	68.5048	-52	-27.02	68	30.29	
464536	0.67	3.77	0.57	6.90	3.38	2.07	3.20	0.99	-52.5542	68.2112	-52	-33.25	68	12.67	
464593	0.30	1.79	0.27	2.19	0.89	3.05	1.20	0.34	-50.9367	68.6365	-50	-56.202	68	38.188	
464599	0.37	2.32	0.34	2.68	0.64	0.56	0.37	0.12	-53.1300	68.5951	-53	-7.801	68	35.708	
467561	0.38	2.29	0.33	2.57	0.45	0.68	0.36	0.12	-53.0613	68.6913	-53	-3.676	68	41.480	
467564	0.31	1.87	0.27	2.49	0.66	3.01	1.22	0.32	-52.8548	68.6918	-52	-51.286	68	41.509	
455791	0.456	2.923	0.443	3.004	0.452	3.460	0.468	0.158	-51.9688	68.8360	-51	-58.131	68	50.157	
455793									-51.9688	68.8360	-51	-58.131	68	50.157	
Western Disko dykes															
156579	0.626	3.909	0.585	7.383	3.009	1.586	3.645	1.037	-54.7653	70.0864	-54	-45.919	70	5.187	306.05
156628	0.421	2.592	0.379	3.840	0.719	1.097	0.790	0.236	-54.3454	70.0717	-54	-20.724	70	4.300	1369.48
176421	0.695	4.143	0.633	8.391	3.410	2.743	3.994	1.187	-54.6910	70.2520	-54	-41.462	70	15.117	352.76
176454	0.554	3.453	0.506	3.698	0.611	1.023	0.867	0.284	-54.5565	70.1551	-54	-33.388	70	9.306	499.97
176489	0.473	2.824	0.429	5.107	1.769	1.431	2.072	0.614	-54.6536	70.1782	-54	-39.217	70	10.693	436.50
176554	0.853	5.152	0.803	8.087	2.436	2.269	2.619	0.890	-54.5349	69.7434	-54	-32.097	69	44.604	513.30
176569	0.931	5.626	0.866	9.135	2.510	2.581	2.977	0.982	-54.8081	69.6424	-54	-48.483	69	38.546	211.47
176584	0.915	5.774	0.840	9.099	2.503	2.638	3.082	0.914	-54.7942	69.6006	-54	-47.655	69	36.039	7.83
176601	0.956	5.762	0.884	9.475	2.549	2.233	3.116	0.942	-54.8072	69.6421	-54	-48.431	69	38.525	195.34
176607	0.582	3.514	0.541	5.825	2.083	1.983	2.716	0.766	-54.9196	69.6879	-54	-55.174	69	41.275	315.79
176613	0.685	4.260	0.667	4.461	0.710	1.789	1.121	0.377	-54.9126	69.7022	-54	-54.754	69	42.133	645.57
176680	0.663	4.089	0.623	7.342	2.494	2.285	3.071	0.874							
South-eastern Nuussuaq															
318717									-52.2158	70.0376	-52	-12.9499	70	2.2558	12.00
318701	0.671	3.980	0.616	7.885	3.534	2.377	4.914	1.478	-52.1730	70.0647	-52	-10.3802	70	3.8841	470.55
318712	0.582	3.521	0.532	6.240	3.139	1.442	4.269	1.246	-52.1930	70.0374	-52	-11.5802	70	2.2468	54.36
318718									-52.2158	70.0376	-52	-12.9499	70	2.2558	12.00
318741									-52.3414	70.0603	-52	-20.4848	70	3.6169	10.86
318802									-52.1293	70.0489	-52	-7.7591	70	2.9355	30.56

Sample no	Majors	XRF traces	ICP-MS traces
KØ 16670	GEUS unpubl.	G. Fitton unpubl.	
KØ 16687	GEUS unpubl.	G. Fitton unpubl.	
KØ 16688	GEUS unpubl.	G. Fitton unpubl.	
KØ 16691	GEUS unpubl.	G. Fitton unpubl.	
KØ 16698	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 16812	GEUS unpubl.	G. Fitton unpubl.	
KØ 17088	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 17090	GEUS unpubl.	G. Fitton unpubl.	
KØ 17094	GEUS unpubl.	G. Fitton unpubl.	
KØ 17144	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 17146	GEUS unpubl.	G. Fitton unpubl.	
KØ 17148	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 17149	GEUS unpubl.	G. Fitton unpubl.	
KØ 17151	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 17154	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 17156	GEUS unpubl.	G. Fitton unpubl.	GEUS unpubl.
KØ 17159	GEUS unpubl.	G. Fitton unpubl.	
KØ 17160	GEUS unpubl.	G. Fitton unpubl.	
265424	Larsen et al. 1999	Larsen et al. 1999	GEUS unpubl.
265880	Larsen et al. 1999	Larsen et al. 1999	GEUS unpubl.
Sukkertoppen, Proterozoic, for comparison			
253644	GEUS unpubl.		
265881	GEUS unpubl.		GEUS unpubl.
Qaqarssuk			
223812	Not analysed		
266082	Larsen et al. 1992	Larsen et al. 1992	GEUS unpubl.
266105	Knudsen 1986	Knudsen 1986	
320415	Knudsen 1986	Knudsen 1986	GEUS unpubl.
320432	Knudsen 1986	Knudsen 1986	
Fossilik			
257463	GEUS unpubl.		
265890	GEUS unpubl.		
409788.1	Hansen 2002		Hansen 2002
409788.2	Hansen 2002		Hansen 2002
409788.5	Hansen 2002		Hansen 2002
Aasiaat region			
464506	Arting 2004		
464536	Arting 2004		Arting 2004
464593	Arting 2004		Arting 2004
464599	Arting 2004		Arting 2004
467561	GEUS unpubl.		GEUS unpubl.
467564	GEUS unpubl.		GEUS unpubl.
455791	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
455793	GEUS unpubl.	GEUS unpubl.	
Western Disko dykes			
156579	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
156628	GEUS unpubl.		GEUS unpubl.
176421	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
176454	GEUS unpubl.		GEUS unpubl.
176489	GEUS unpubl.		GEUS unpubl.
176554	Pedersen 1977	GEUS unpubl.	GEUS unpubl.
176569	GEUS unpubl.		GEUS unpubl.
176584	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
176601	Pedersen 1977	GEUS unpubl.	GEUS unpubl.
176607	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
176613	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
176680	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
South-eastern Nuussuaq			
318717	GEUS unpubl.		
318701	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
318712	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
318718	GEUS unpubl.		
318741	GEUS unpubl.	GEUS unpubl.	
318802	GEUS unpubl.		

Sample no	Comment	Rock name	Strike	Age, Ma	Age reference
Alkaline, Disko and Nuussuaq					
156835	Dyke, Itilli, Nuussuaq	Alkali basalt			
Avatarpaat, west of Disko					
156688	neck	Alkali basalt		27.6±0.6 (Ar/Ar)	Storey et al. 1998
447256	neck	Alkali basalt			
447257	neck	Alkali basalt			
Ubekendt Ejland. Old names of Clarke et al. (1983) retained as thin sections are not available.					
138878	No sample in GEUS	diabase			
138920	No sample in GEUS	camptonite			
138939	No sample in GEUS	camptonite		30.6±6.4 (Ar/Ar)	Parrot & Reynolds
138940	No sample in GEUS	camptonite			
138946B	No sample in GEUS	camptonite			
138955	No sample in GEUS	monchiquite			
139001	No sample in GEUS	camptonite			
139004	No sample in GEUS	camptonite			
139012	No sample in GEUS	monchiquite		32.8±6.8 (Ar/Ar)	Parrot & Reynolds
139064	No sample in GEUS	camptonite			
139068	No sample in GEUS	diabase		40.7±12.2 (Ar/Ar)	Parrot & Reynolds
170107		monchiquite			
170124		monchiquite			
UE500		monchiquite		34.3±0.2 (Ar/Ar)	Storey et al. 1998
UE500 chill (265895)		monchiquite			
456211		monchiquite			
Southern Svartenhuk Halvø					
447119	on map	camptonite	114/35S	Cuts Vaigat Fm	
447120	same dyke	camptonite	114/35S	Cuts Vaigat Fm	
447122		Alkali basalt	68/74N	Cuts Vaigat Fm	
456217	Different dyke from 44	Alkali basalt	47/90	Cuts Vaigat Fm	
Inland east of Ubekendt Ejland and Svartenhuk Halvø					
482915	Local block	Kimberlite?			
445643	Local block	Aillikite			
445644	Local block	Aillikite			
445645	Local block	Aillikite			
435312	Dyke, Upernivik Ø	Aillikite			

Sample no	SiO2	TiO2	Al2O3	Fe2O3	FeO	MnO	MgO	CaO	Na2O	K2O	P2O5	H2O/Vol	CO2	SUM
Alkaline, Disko and Nuussuaq														
156835	44.59	1.66	17.26	1.76	6.58	0.16	5.58	10.87	4.22	2.281	0.675	3.98		99.62
Avatarpaat, west of Disko														
156688	46.50	1.45	14.93	1.70	7.57	0.25	9.62	11.20	2.80	1.550	0.450	1.88		99.90
447256	45.85	1.47	15.19	1.92	7.29	0.17	10.04	10.83	3.06	1.562	0.452	1.66		99.50
447257	45.93	1.49	15.18	1.91	7.24	0.17	10.06	10.95	2.99	1.582	0.443	1.52		99.45
Ubekendt Ejland														
138878	42.26	1.27	7.66	3.2	5.79	0.17	18.25	10.29	1.34	1.53	0.36	2.53	5.87	100.52
138920	42.7	1.6	14.69	3.24	5.41	0.17	8.17	11.83	3.26	2.45	0.6	1.56	4.48	100.16
138939	43.29	1.21	13.66	3.37	4.61	0.16	11.39	12.5	1.69	2.19	0.5	3.85	0.85	99.27
138940	42.3	1.35	14.15	3.52	4.21	0.16	9.08	12	3.41	2.37	0.55	1.86	4.42	99.38
138946B	42.47	1.18	9.56	3.9	4.73	0.17	12.2	14.71	1.74	1.28	0.46	2.98	4.14	99.52
138955	42.27	1.41	15.81	3.99	3.74	0.17	7.32	12.05	3.84	2.43	0.56	4.18	1.81	99.58
139001	41.1	1.18	15.24	3.21	4.59	0.15	8.14	11.36	3.15	3	0.41	2.18	5.74	99.45
139004	40.06	1.35	14.84	3.68	5.02	0.15	8.88	12.89	1.62	2.96	0.57	4.08	3.22	99.32
139012	38.62	1.22	14.21	3.15	4.4	0.17	8.28	14.3	2.32	2.98	0.46	3.91	5.51	99.53
139064	43.8	1.4	16.29	3.85	4.77	0.16	6.78	11.17	3.22	3	0.68	2.42	2.81	100.35
139068	45.76	1.83	14.18	4.06	6.74	0.18	8.08	11.07	2.23	0.96	0.54	3.52	1.09	100.24
170107	42.09	1.39	13.96	2.27	6.12	0.18	8.59	12.37	2.91	2.5	0.4	1.83	3.9	98.51
170124	43.26	1.43	14.5	2.55	5.82	0.16	8.57	12.89	2.29	2.29	0.38	2.41	2.7	99.25
UE500	41.65	1.34	13.88	2.68	5.58	0.17	9.13	12.29	2.28	2.82	0.39	2.86	4.14	99.21
UE500 chill (	41.20	1.23	14.53	2.84	5.64	0.18	8.12	12.17	3.49	2.53	0.45	6.78		99.16
456211	39.18	1.40	11.07	3.34	4.78	0.17	11.56	16.18	1.92	1.500	0.948	6.67		98.71
Southern Svartenhuk Halvø														
447119	46.51	2.76	14.63	3.27	7.26	0.18	7.43	7.53	3.91	1.809	0.786	3.41		99.48
447120	44.49	3.01	15.31	4.45	7.33	0.19	6.37	8.64	3.74	1.539	0.835	3.75		99.65
447122	46.40	2.82	14.01	3.44	10.29	0.22	5.73	11.26	2.77	1.087	0.337	1.69		100.04
456217	46.98	3.15	14.03	2.83	10.68	0.22	5.85	10.74	2.84	1.116	0.427	0.94		99.80
Inland east of Ubekendt Ejland and Svartenhuk Halvø														
482915	35.20	1.06	2.60	2.753	6.04	0.164	33.957	7.145	0.05	2.068	0.439	7.432		98.909
445643	32.55	4.14	5.58	8.099	9.5	0.233	11.095	14.005	2.02	1.825	1.389	8.147		98.584
445644	30.01	2.99	5.38	6.165	7.29	0.287	10.381	19.309	1.56	2.053	2.161	10.931		98.522
445645	31.09	4.07	5.91	13.672	10.59	0.299	10.11	14.387	1.7	1.086	1.805	4.389		99.11
435312	21.55	1.82	3.76	11.44	0	0.2	15.28	19.1	0.95	2.71	0.97	18.8		96.58

Sample no	Rb	Ba	Pb	Sr	La	Ce	Nd	Y	Th	Zr	Nb	Zn	Cu	Co	Ni	Sc	V	Cr	Ga
Alkaline, Disko and Nuussuaq																			
156835	67	1080	4	1098	93	159	66	28	8	173	100	79	105	40	39	21	239	41	18
Avatarpaat, west of Disko																			
156688	49	726	3.6	774.5	45.7	83.3	36.2	22.1	6.6	132.0	68.3	77.8	85.9	47.3	205	25.5	212	394.6	14
447256															0	0	0	0	0
447257	46.7	750	4.3	763.3	47.2	84.5	38.2	22.4	5.5	132.9	68.5	90.5	91.4	51	206	26	220	404.5	15.8
Ubekendt Ejland																			
138878	47	897		503	72.8	113	47	16.4	9.4	149	55	64	75		450	32.5	288	2098	
138920	68	1235		1114	79.6	130	57	24.7	7.9	240	121	66	79		123	24.9	242	249	
138939	50	1529		1071	83.3	133	50.8	24.6	8.1	209	106	59	71		172	30.8	190	444	
138940	63	1288		1198						217	108	56	80		167	0	216	298	
138946B	40	965		971						183	78	57	110		235	0	211	596	
138955	66	1660		1727						335	206	65	66		86	0	196	64	
139001	79	1640		1377						264	141	77	65		106	0	190	199	
139004	73	1419		1604	93.4	192		28.6	8.6	281	122	62	64		113	27.6	260	192	
139012	100	1902		1345	247	421		33.4	20.8	257	212	63	88		76	30	240	121	
139064	85	1443		1195	101	210		32.2	11.1	261	147	71	86		90	23.3	227	98	
139068	85	1441		1193	88.7	151	54.3	29.1	8.9	260	146	70	73		114	25.4	248	467	
170107																			
170124																			
UE500																			
UE500 chill (265895)																			
456211																			
Southern Svartenhuk Halvø																			
447119																			
447120																			
447122																			
456217																			
Inland east of Ubekendt Ejland and Svartenhuk Halvø																			
482915																			
445643																			
445644																			
445645																			
435312	131	1811	7	1556				25		492	135	67	79	61	301	0	185	680	5

Sample no	Sc	Ti	V	Cr	Mn	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr
Alkaline, Disko and Nuussuaq														
156835	21.54	0.96	242.16	45.12	0.12	36.06	43.6	74.85	69.07	16.88	66.92	1153.64	30.05	197.16
Avatarpaat, west of Disko														
156688	26.88	0.83	221	409.44	0.14	49.49	222.36	86.63	70.8	15.46	47.83	789.76	23.66	137.18
447256														
447257														
Ubekendt Ejland														
138878													16.4	149
138920													24.7	240
138939													24.6	209
138940														217
138946B														183
138955														335
139001														264
139004													28.6	281
139012													33.4	257
139064													32.2	261
139068													29.1	260
170107														
170124														
UE500														
UE500 chill (	26.30	0.70	217.69	314.98	0.14	40.29	130.66	94.08	66.49	14.39	78.39	810.83	21.35	109.23
456211	36.22	0.80	239.21	468.15	0.13	43.86	183.56	103.13	58.73	12.07	60.12	1,183.76	24.55	149.56
Southern Svartenhuk Halvø														
447119	16.13	1.62	197.48	103.56	0.13	34.86	54.79	39.84	103.36	17.16	26.03	616.12	33.89	180.74
447120														
447122														
456217	35.16	1.85	373.72	54.77	0.17	49.96	56.75	201.07	119.49	21.08	23.84	407.29	38.42	217.91
Inland east of Ubekendt Ejland and Svartenhuk Halvø														
482915	11.80	0.61	103.33	1598.50	0.12	98.06	1336.12	83.67	48.40	5.33	113.88	654.54	4.46	64.45
445643														
445644	27.30	1.76	296.36	411.81	0.21	45.21	111.71	169.71	130.52	16.42	55.86	1,623.46	50.36	660.93
445645														
435312	19			720										

Sample no	Nb	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er
Alkaline, Disko and Nuussuaq														
156835	90.71	1.48	1017.11	84.47	169.51	18.42	68.89	9.94	2.84	7.82	1.11	6.05	1.1	3.12
Avatarpaat, west of Disko														
156688	54.95	0.5	713.53	45.32	85.73	9.15	34.8	5.56	1.73	4.71	0.77	4.25	0.86	2.28
447256														
447257														
Ubekendt Ejland														
138878	55			72.8	113.2		47	6.94	2.05		0.74			
138920	121			79.6	129.9		57	8.13	2.39		0.79			
138939	106			83.3	132.6		50.8	7.67	2.44		0.68			
138940	108													
138946B	78													
138955	206													
139001	141													
139004	122			93.4	192			16.7	2.86		1			
139012	212			247	421			19.8	3.23		1.18			
139064	147			101	210			12.7	2.5		0.95			
139068	146			88.7	150.5		54.3	10.1	3.03		1.12			
170107														
170124														
UE500														
UE500 chill (	137.76	0.994	1697.48	84.62	138.53	14.94	50.60	6.99	2.02	5.65	0.74	4.08	0.82	2.06
456211	149.45	0.594	1218.42	139.08	250.84	27.17	92.35	12.18	3.17	7.84	1.04	5.08	0.94	2.32
Southern Svartenhuk Halvø														
447119	74.12	0.192	1192.62	82.05	153.71	18.41	68.86	11.34	3.40	9.56	1.26	6.84	1.33	3.07
447120														
447122														
456217	38.48	0.192	291.56	26.52	56.19	7.80	33.45	7.71	2.51	7.48	1.17	6.86	1.36	3.54
Inland east of Ubekendt Ejland and Svartenhuk Halvø														
482915	131.79	5.943	978.91	118.92	202.92	21.11	64.91	6.39	1.41	4.05	0.40	1.50	0.18	0.47
445643														
445644	163.52	14.493	815.62	216.92	425.35	53.39	199.05	30.41	8.20	18.81	2.62	12.18	2.06	4.76
445645														
435312		4	1200	160	240		96	14	4.6		-0.5			

Sample no	Tm	Yb	Lu	Hf	Ta	Pb	Th	U	West	North	Deg.	Minut	Deg.	Minut	Altitude
Alkaline, Disko and Nuussuaq															
156835	0.45	2.71	0.392	3.93	4.69	4.96	8.59	2.15							
Avatarpaat, west of Disko															
156688	0.35	2.15	0.314	3.01	3.13	2.79	5.03	1.31	-54.8823	70.0878	-54	-52.9356	70	5.2685	1.43
447256									-54.8834	70.0873	-54	-53.0051	70	5.2387	1.29
447257									-54.8791	70.0865	-54	-52.7454	70	5.1898	1.3
Ubekendt Ejland															
138878		1.19	0.184	3.65	3.28		9.45								
138920		1.79	0.327	3.32	6.6		7.95								
138939		1.78	0.281	2.87	5.29		8.07								
138940															
138946B															
138955															
139001															
139004		2.07	0.329	3.48			8.6								
139012		2.42	0.371	3.34			20.8								
139064		2.33	0.354	3.55			11.1								
139068		2.11	0.331	4.9	3.88		8.87								
170107															
170124															
UE500															
UE500 chill (	0.30	1.91	0.28	2.59	6.63	6.12	10.81	2.33							
456211	0.31	1.82	0.25	3.29	7.17	8.58	15.24	3.34							
Southern Svartenhuk Halvø															
447119	0.42	2.39	0.34	4.45	3.39	3.53	7.60	1.55	-54.3663	71.3777	-54	-21.977	71	22.662	2
447120									-54.3663	71.3777	-54	-21.977	71	22.662	2
447122									-54.1828	71.4147	-54	-10.97	71	24.884	5
456217	0.52	3.13	0.45	5.56	2.27	1.96	2.90	0.83	-54.1190	71.4236	-54	-7.139	71	25.414	2
Inland east of Ubekendt Ejland and Svartenhuk Halvø															
482915	0.05	0.24	0.04	1.43	7.75	9.29	20.90	3.01	-52.4271	71.2151	-52	-25.625	71	12.907	280
445643									-52.1303	71.4902	-52	-7.82	71	29.41	
445644	0.59	3.65	0.51	17.61	10.36	12.70	12.98	5.80	-52.7898	71.4727	-52	-47.39	71	28.36	60
445645									-52.7898	71.4727	-52	-47.39	71	28.36	
435312		1.2	0.19	13	11		15	3	-53.0125	71.2133	-53	-0.750	71	12.800	

Sample no	Majors	XRF traces	ICP-MS traces
Alkaline, Disko and Nuussuaq			
156835	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
Avatarpaat, west of Disko			
156688	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.
447256	GEUS unpubl.		
447257	GEUS unpubl.	GEUS unpubl.	
Ubekendt Ejland			
138878	Clarke et al. 1983	Clarke et al. 1983	
138920	Clarke et al. 1983	Clarke et al. 1983	
138939	Clarke et al. 1983	Clarke et al. 1983	
138940	Clarke et al. 1983	Clarke et al. 1983	
138946B	Clarke et al. 1983	Clarke et al. 1983	
138955	Clarke et al. 1983	Clarke et al. 1983	
139001	Clarke et al. 1983	Clarke et al. 1983	
139004	Clarke et al. 1983	Clarke et al. 1983	
139012	Clarke et al. 1983	Clarke et al. 1983	
139064	Clarke et al. 1983	Clarke et al. 1983	
139068	Clarke et al. 1983	Clarke et al. 1983	
170107	Larsen 1981		
170124	Larsen 1981		
UE500	Larsen 1981		
UE500 chill (26	GEUS unpubl.		GEUS unpubl.
456211	GEUS unpubl.		GEUS unpubl.
Southern Svartenhuk Halvø			
447119	GEUS unpubl.		GEUS unpubl.
447120	GEUS unpubl.		
447122	GEUS unpubl.		
456217	GEUS unpubl.		GEUS unpubl.
Inland east of Ubekendt Ejland and Svartenhuk Halvø			
482915	GEUS unpubl.		GEUS unpubl.
445643	GEUS unpubl.		
445644	GEUS unpubl.		GEUS unpubl.
445645	GEUS unpubl.		
435312	GEUS unpubl.	GEUS unpubl.	GEUS unpubl.