G E U S

Report file no.

16101

Mineral resources of the sedimentary basins of the North and East Greenland - final report

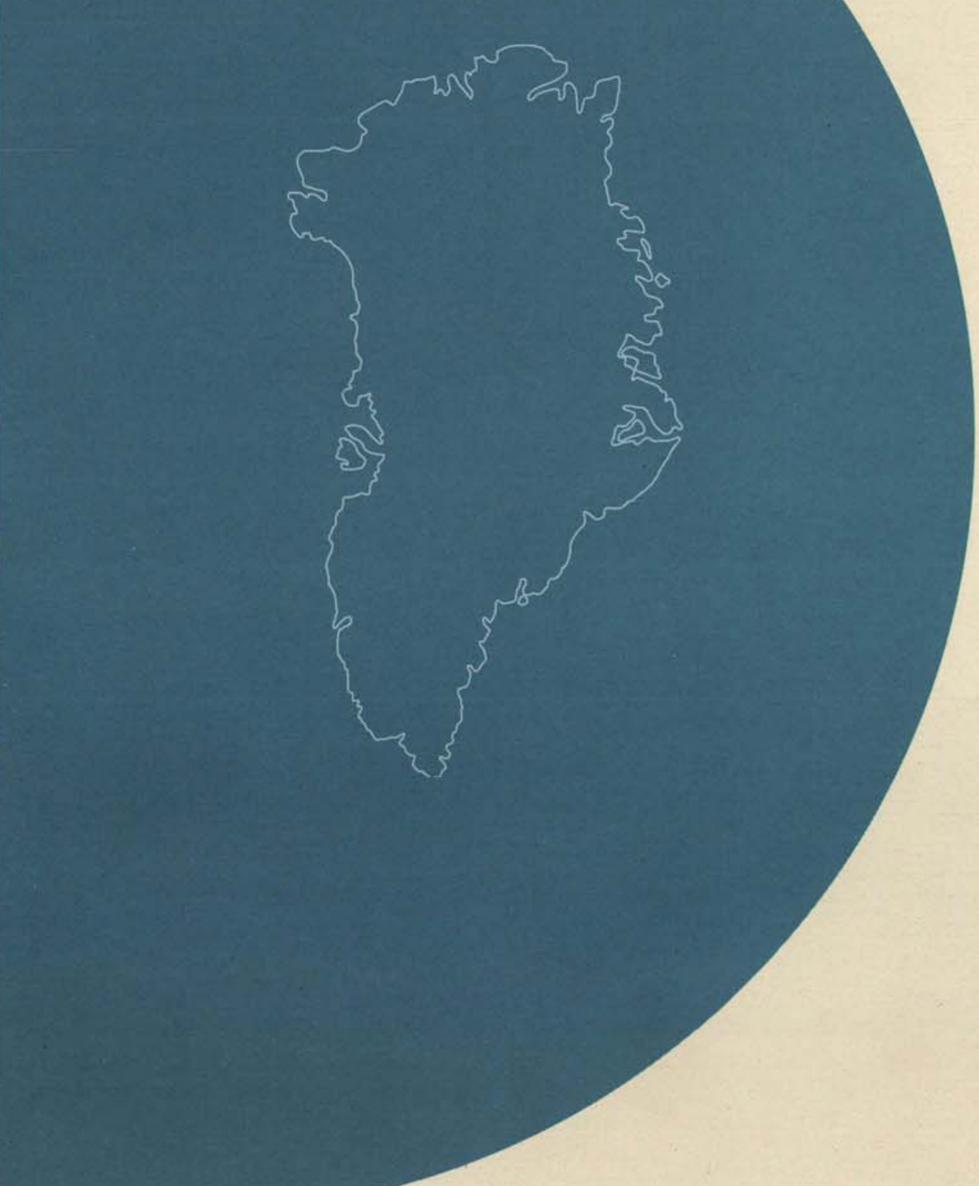
Fought, H., Jensen, S.M., Kragh, K., Langdahl, B.R. & Pedersen, M.

Copenhagen
23-02-1999

DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 1999/4

Mineral resources of the sedimentary basins of North and East Greenland - final report

Henrik Fougt, Sven Monrad Jensen, Karsten Kragh,
Bjarne R. Langdahl and Mikael Pedersen



GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
MINISTRY OF ENVIRONMENT AND ENERGY

GEUS

DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 1999/4

Mineral resources of the sedimentary basins of North and East Greenland - final report

Henrik Fougt, Sven Monrad Jensen, Karsten Kragh,
Bjarne R. Langdahl and Mikael Pedersen

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
MINISTRY OF ENVIRONMENT AND ENERGY

GEUS

Contents

Introduction

The multidisciplinary research project 'Resources of the sedimentary basins of North and East Greenland' was initiated in 1995 with financial support from the Danish Natural Science Research Council (SNF). This report summarises the results of three years of research on mineral resources in the respective basins. Five people have been directly involved in this part of the project. A group consisting of postdoctoral (now senior research scientist) Sven M. Jensen (SMJ), Ph.D. student Henrik Fougt (HF) and Ph.D. student Karsten Kragh (KK) have investigated the occurrences of zinc and lead in North Greenland, with special focus on the large Citronen Fjord zinc-deposit. Ph.D. student Bjarne R. Langdahl (BRL; biologist), University of Aarhus, has during the project been attached to this group while studying the mineral-oxidising bacteria in the Citronen Fjord area. The East Greenland part of the project was concentrated on lead, zinc and copper occurrences in the Upper Permian Ravnefjeld Formation. This part was undertaken by postdoctoral Mikael Pedersen (MP) in co-operation with Ph.D. student Jesper K. Nielsen (JKN) from the Geological Institute at University of Copenhagen.

A group of external collaborators has been important for the fulfilment of the ore geological part of the project. Dr. D.J. Kontak, Nova Scotia Department of Natural Resources, attended field work in North Greenland in 1996. Professor A.E. Fallick and Dr. A.J. Boyce at the Scottish Universities Research and Reactor Centre (SURRC) supervised the sulphur isotope work and have been very helpful and showed much enthusiasm for the project. Laboratory leader Robert Frei at the Geological Institute, University of Copenhagen has likewise been helpful in analysing part of the lead isotopes. Professor Wayne Goodfellow, Geological Survey of Canada is acknowledged for fruitful discussions and help with the fluid inclusion work. The Greenland Bureau of Minerals and Petroleum is acknowledged for financial support to a three week field season in central East Greenland in 1994 during which most of the East Greenland samples were collected.

This report is three-fold divided. First section describes the main scientific results obtained during the course of the project. Second section lists all the publications that are at this point (December 1998) printed or in preparation. The last section of the report (the appendices) contains a list of all data that have been gathered by the ore geology group and a short description of the analysis methods. Appendix 1 describes the analysis methods, Appendix 2–14 contain North Greenland, while Appendix 15–19 list all data from central East Greenland. A Microsoft Access database containing these data exists. Interested persons can contact the Department of Economic Geology at GEUS.

The Citronen Fjord Zn-deposit

Ore textures

The large Citronen Fjord Zn-deposit, on the south side of Frederick E. Hyde Fjord, was discovered by Platinova A/S in 1993. It is hosted by Upper Ordovician–Lower Silurian deep-sea mudstone and comprises at least five major massive sulphide mounds found on a 10 km long NW-SE striking trend. The distance between the mounds varies from a few hundred metres up to 4 km. The main sulphides include pyrite, sphalerite and galena. Microscopic studies of ore textures have shown that the ore contains primary (synsedimentary) textures that are overprinted by diagenetic and metasomatic dissolution, precipitation and recrystallisation textures. The geological setting and the primary and diagenetic ore textures indicate that the stratiform Citronen Fjord deposit is a sedimentary exhalative (SEDEX) deposit (Kragh 1996; Kragh 1997b; Kragh *et al.* 1997; van der Stijl & Mosher 1998).

A characteristic textural feature of the sulphide mounds at Citronen Fjord is spheres with radial inter-growth of pyrite, carbonate, sphalerite and galena (Fig. 1a). The spheres are overgrown by colloform sulphides and the last overgrowth is generally sub- to euhedral pyrite. Diagenetic and metasomatic recrystallisation and replacement textures are commonly encountered.

Intimate 'gel'-like intergrowths of fine-grained calcite and sphalerite have been recognised in samples from the sulphide mounds and are interpreted as synsedimentary textures (Fig. 1b). Microprobe investigations reveal the sphalerite in these calcitic gel-textures to be iron-poor (<1 mol % FeS) compared to most other sphalerites from the ore samples (7–11 mol % FeS) thereby lending support to a unique origin of these textures.

Laminated sulphides consisting of framboidal pyrite with interstitial sphalerite, quartz, clay minerals and carbonate occur distal to the sulphide mounds at Citronen Fjord. These sulphides show sedimentary and diagenetic textures such as graded bedding, cross laminations, dewatering textures and diagenetic overgrowth by colloform pyrite.

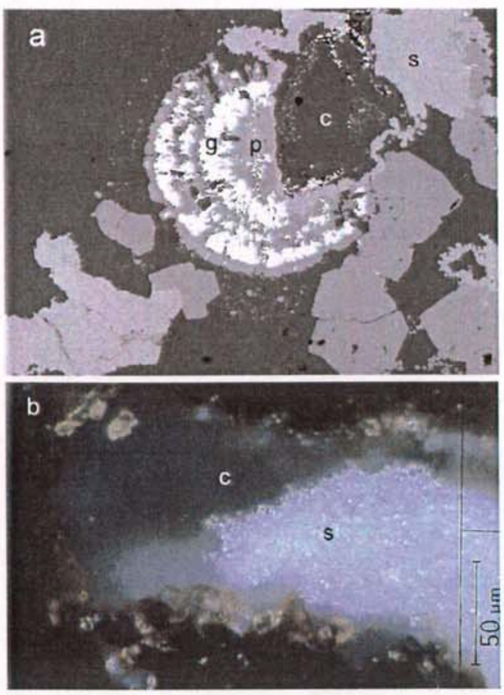


Figure 1. *a) SEM-picture of composite sphere consisting of pyrite (p), carbonate (c), galena (g) and sphalerite (s). Picture c. 1.5 mm across. (from Kragh (1997a)). b) Fine-grained calcite (c)-sphalerite (s) 'gel' (reflected light, crossed nicols) (from Fougt (1998b)).*

Palaeoenvironment

In order to investigate the palaeoenvironment at the time when the sulphides were deposited on the seafloor, a 263 m drill core was sampled for sulphur isotope and geochemistry analyses (Fig. 2). The drill core (CF94-53) was kindly provided by Platinova A/S, and represents a relatively unmineralised section through the Lower Palaeozoic mudstones and carbonate-debris flows.

Bulk analyses of sulphur isotopes in pyrite separates from different levels of the drill core as well as detailed laser studies of sulphur isotopes on selected samples were conducted at the Scottish Universities Research and Reactor Centre (SURRC) (Appendix 7). Together with Th/U- and V/(V+ Ni)-ratios on whole rock samples these analyses can be used as palaeo-redox indicators. The following trends are revealed (Fougt 1998b):

a) Two distinct palaeoenvironments existed, separated by the more than 60 metres thick *Middle Debris Flow*. The *Middle Mudstone* unit with many small silty turbidites and graphitic layers was deposited in times of euxinic bottom water conditions in a closed basin environment with generally heavy sedimentary pyrite having $\delta^{34}S$ values ranging from +10 to +49 ‰ (v-CDT). In the overlying *Footwall Shale* sedimentary and diagenetic pyrite with $\delta^{34}S$ values of -28 to +9 ‰ (v-CDT) was deposited under anoxic conditions in very uniform black shales. It is suggested that the heavy sulphur isotope values encountered in the *Middle Mudstone* results from active exhalation of hot, saline fluids in an anoxic to euxinic restricted basin, leading to very high bacteriogenic sulphate reduction rates and thereby little fractionation. A more open anoxic basin model has been applied to explain the lighter $\delta^{34}S$ values found in the *Footwall Shale*.

b) The generally high $\delta^{34}S$ values found in the large debris flows are thought to reflect closed system fractionation of S-enriched water being squeezed out of the mudstones and through the debris flows during burial, or addition of heavy sulphur to the debris flows from a remote source.

Temperature of mineralising fluids

Fluid inclusion microthermometry was conducted at the Geological Survey of Canada (Kragh in prep), Ottawa and oxygen and carbon isotopes were analysed at GG-Hatch isotope laboratories, University of Ottawa. Heating-freezing measurements on inclusions in sphalerite indicate that the mineralising fluids have been highly saline, with moderate temperatures ranging from 80° to 160°C (Fig 3; Appendix 13). This suggests that the fluids have acted as dense brines on the seafloor, from which part of the sulphides have precipitated.

Oxygen isotope ratios (Appendix 12) from calcite give temperatures between 50° and 100°C if the isotopic composition of Standard Mean Ocean Water (SMOW) is used for the calculations. Temperature calculations based on oxygen isotope ratios from dolomite give slightly higher temperatures between 90° and 150°C, comparable to the temperatures gained from fluid inclusions in the sphalerite.

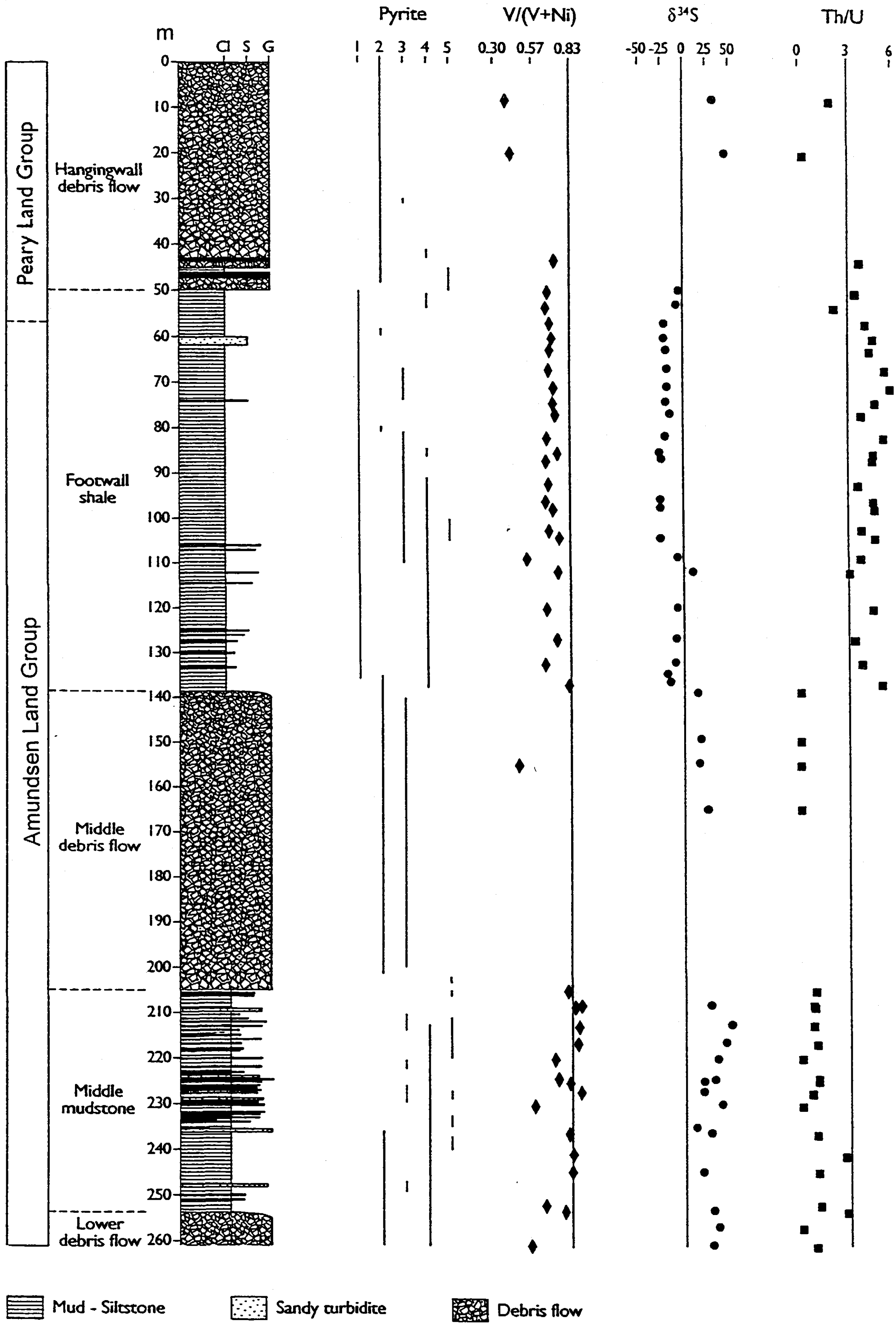


Figure 2. *Drill core log (CF94-53) with pyrite textures, sulphur isotopes, V/(V+Ni) and Th/U ratios. Pyrite textures are as follows: 1) fine-grained, framboidal pyrite (1–20 µm); 2) Coherent areas with fine-grained pyrite; 3) Disseminated, coarser-grained pyrite (up to 2 mm); 4) Laminated pyrite; 5) Semi-massive to massive pyrite. From Fougt (1998b).*

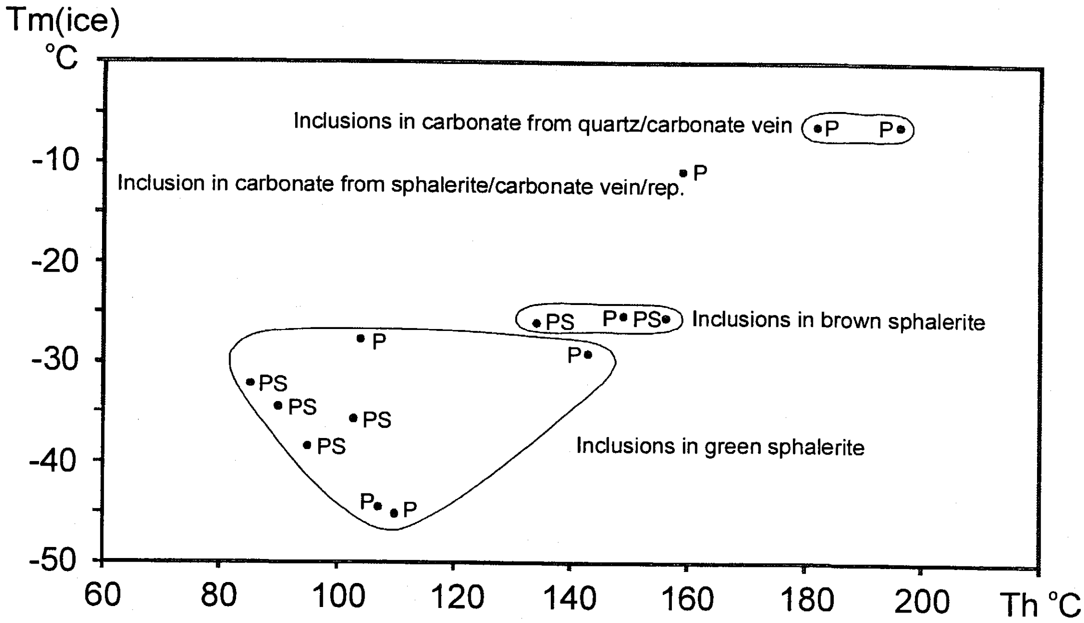


Figure 3. *Ice melting temperatures versus homogenisation temperatures of inclusions in sphalerite and carbonate from the Citronen Fjord ore. P, primary inclusions; PS, pseudo-secundary inclusions.*

Sulphide-forming processes

In order to gain knowledge of sulphur sources and sulphide-forming processes, sulphur isotope ratios were analysed in ore samples. An initial study of sulphide separates revealed large disparity of sulphur isotopes (Appendix 8) and detailed sampling using a laser extraction technique was consequently applied (Appendix 9). Eight sulphide-bearing polished blocks from sulphide mounds at Citronen Fjord, as well as two mineralised drill core samples were selected to study relationships between textures and sulphur isotopes.

The sulphur isotope ratios ($\delta^{34}S$) in samples from the sulphide mounds range from +6 to +50 ‰ (v-CDT). The lowest $\delta^{34}S$ value of +6.4 ‰ is from early formed framboidal pyrite, and there is a tendency for this type of pyrite to be lighter than other sulphides within individual samples irrespective of the exact $\delta^{34}S$ value.

In a laminated drill core sample a systematic decrease in $\delta^{34}S$ of more than 10 ‰ over 2 cm is believed to reflect a rapid change in sulphur isotopic composition of seawater sulphate. Diagenetic sulphides within this sample (mainly pyrite) are found to be heavier than synsedimentary pyrite (framboidal) and thereby consistent with a closed system model.

Late sphalerite, pyrite, galena from widespread replacement of early textures were also analysed and a hydrothermal sulphur isotope signature of 10.1–19.1 ‰ was determined. Attempts were made to establish formation temperatures using the Ohmoto & Rye (1979) sulphur isotope geothermometer, but few realistic temperatures were obtained, probably due to disequilibrium precipitation and replacement (Fougt 1998a).

Sulphur isotope fractionation and the relation to bacteriogenic sulphate reduction rates have been reviewed and it is tentatively suggested that rapid bacteriogenic reduction at elevated temperatures such as seen at the recent seafloor sulphide deposit forming in the Guayamas Basin (Elsgaard *et al.* 1994) will result in relatively small fractionation of sulphur isotopes, e.g. in the order of 5–20 ‰. Accepting a small degree of fractionation during rapid reduction of seawater sulphate leads to a new way of explaining the sulphur isotopic compositions found at Citronen Fjord and ultimately other SEDEX deposits such as Rammelsberg, Navan and H.Y.C. without involving a remote sulphur source.

The role of bacteria in present-day degradation of sulphides at Citronen Fjord

As a part of the research project, microbiological studies were conducted on the Citronen Fjord deposit to investigate the role bacteria might play in oxidation of massive sulphides. At Citronen Fjord, oxidation of exposed sulphides has produced impressive, vividly coloured gossans. Low pH values (1.9-2.5) and high concentrations of dissolved metals and sulphate (Fe -10 000 mg l-1; Zn -650 mg l-1; Pb -16 mg l-1 and SO_4^{2-} -50 000 mg l-1) were determined in porewater and small streams draining the gossans. The extreme environmental condition is in agreement with the oxygen consumption rates measured at the gossan surface, which is surprisingly high and comparable to rates obtained from mining areas at lower latitudes. Activity of mineral-oxidising bacteria was determined in gossan material from the Citronen Fjord area. High rates of sulphide oxidation were observed even at temperatures around 0°C due to the activity of an indigenous population of *Thiobacillus ferrooxidans*. Furthermore, the data indicate that sulphide oxidation occurs at measurable rates at subzero temperatures. These data were supported by results obtained from studies of novel Arctic strains of *Thiobacillus ferrooxidans* isolated from the gossan material of Citronen Fjord. Our results, obtained with the pure cultures show that the strains of *Thiobacillus ferrooxidans* are capable of growing exponentially at -1°C with ferrous iron as electron donor. Also, activity of ferrous iron oxidation at -3°C was still approximately 40% of the maximum recorded. This is the first study describing significant rates of ferrous iron oxidation by *Thiobacillus ferrooxidans* at temperatures below 2°C.

The present study indicates that microbes can be almost omnipresent, even in environments like the gossans in the Citronen Fjord area that we instinctively consider devoid of life. The diversity and distribution of acidophilic bacteria were determined in a High Arctic gossan environment using MPN-analysis (most probable number), plate counts, enrichments, plate isolations and ISR-region (intertranscribed spacer region) polymorphism analysis. The numbers of mineral-oxidising bacteria reaches up to 4 x 10^4 per cm^3, which is comparable to the numbers found in mining areas in temperate latitudes. Surprisingly, the highest numbers of bacteria were found just above the permafrost layer at a temperature of 1 to 2°C. The number of bacteria decreased by a factor of around 10 close to the gossan surface. In small acid streams draining the gossans, the bacterial number of acidophilic iron oxidisers was in the same order of magnitude as the numbers in the gossan material. However, in streams unaffected of the heavy sulphide oxidation at the gossans, low numbers of acidophilic iron oxidisers were detected.

ISR-region analysis of water and gossan samples indicated that the bacterial diversity was very low. The ISR amplification product profile obtained from either isolated strains of *Thiobacillus ferrooxidans* or from a gossan samples and a small acid stream showed that *Thiobacillus ferrooxidans* was the significant bacterial species in the area.

The results obtained, thereby prove the potential significance of *Thiobacillus ferrooxidans* also in High Arctic areas where low temperatures instinctively are considered as being too low for bacterial sulphide and iron oxidation.

The studies, furthermore revealed the presence of a novel yeast strain, which was isolated, characterised and partly identified. The yeast strain was acidophilic and psychrophic with optimum pH and temperature of 3–4 and 14°C, respectively. The yeast strain was capable of growing at several substrates including polymeric substances. Also, the yeast strain tolerated (heavy) metals in high concentrations. Presently, the yeast strain is described as a novel psychrophilic and acidophilic strain of *Cryptococcus albidus var.* albidus exhibiting high metal tolerance, however, ongoing genetic sequencing may reveal that this is a previously undescribed species.

Discovery of a new zinc-lead-silver occurrence in Washington Land

As a result of regional correlation of the North Greenland part of the Franklinian Basin with metal provinces in its continuation on the Canadian side of Nares Strait, Washington Land was pin-pointed as a potential target area for mineral occurrences. During field work in 1997, a new promising zinc-lead-silver occurrence was discovered (Jensen & Schønwandt 1998; Jensen 1998a).

Geology of the occurrence

Washington Land is made up of Cambrian – Lower Silurian carbonate platform and Lower Silurian reef belt successions of the Franklinian Basin. The new zinc-lead-silver occurrence was discovered in eastern Washington Land during helicopter reconnaissance, c. 8 km west of Petermann Gletscher (Fig. 4). The surface expression of the mineralisation is a train of rusty weathering patches on a gently sloping plain covered by soliflucted mud and frost-heaved blocks. Dolomitic boulders variably mineralised with sphalerite, galena and pyrite were found within the rusty weathering patches. The mineralised samples collected are strongly dolomitised and show very variable sulphide parageneses. Both pyrite-dominated, sphalerite-galena-dominated and pyrite-sphalerite-galena-rich mineralised rocks were found within most patches.

Zinc mineralisation was revealed in the field either by visible sphalerite (or zinc carbonate) or a strong Zn spot test reaction. The sphalerite occurs most commonly as large (0.5–5 cm) aggregates, but can also be found fine-grained and disseminated. The colour varies from dark brown to honey. Galena is often present as large (5–10 mm), relatively fresh euhedral grains. Pyrite occurs with a range of textures, from very fine-grained and massive to colloform-banded or coarse-grained aggregates. Bitumen with vitreous lustre was found in a few mineralised samples near the stream, occupying vugs in coarse-grained, sparry dolomite.

Judging from outcrops along the stream, the sulphide mineralisation is associated with a pervasively dolomitised horizon of 6–8 m thickness. Sulphide-rich pods occur very irregularly, and appear to be concentrated in the upper parts of the dolomitised horizon. The exact stratigraphic position of the mineralisation remains to be established, but is possibly the upper evaporitic part of the Lower Ordovician Nygaard Bay Formation of the Ryder Gletcher Group (Jensen & Schønwandt 1998).

Multi-element neutron activation (INAA) and inductively coupled plasma emission (ICP) analyses of a number of samples (Appendix 4) have indicated several anomalous Ag values, with a maximum of c. 170 ppm.

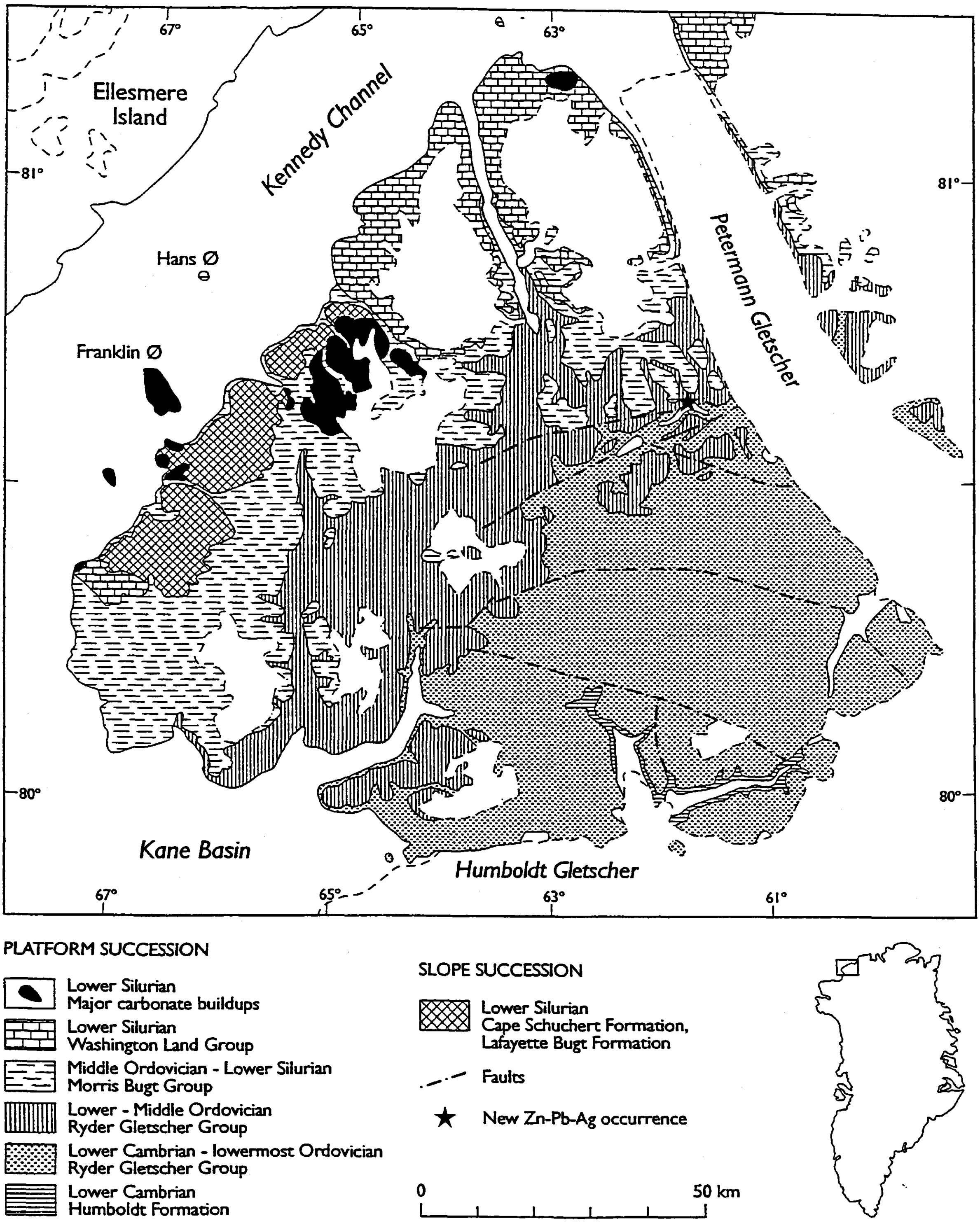


Figure 4. *Geological map of Washington Land, modified after Jepsen et al. (1983) and Bengaard & Henriksen (1991). The location of the new Zn-Pb-Ag occurrence is indicated by a star symbol. From Jensen & Schønwandt (1998).*

Tentative mineralisation model

The new Zn-Pb-Ag occurrence is hosted by the partly evaporitic, Lower Ordovician part of the carbonate platform succession. One can speculate that hydrothermal fluids carrying metals in solution migrated up along fault planes and that sulphides precipitated where dolomitisation created open space and sulphur was available. The sulphur was perhaps derived from the evaporite beds. For this sulphur to have been incorporated into sulphides, a mechanism to reduce SO_4^{2-} to S^{2-} must have been available. The presence of bitumen in some of the sulphide-mineralised samples suggests that thermochemical sulphate reduction may have taken place, at least very locally. The source of metals is suggested to have been the underlying Lower Cambrian siliciclastic sequence (Humboldt Formation) or perhaps the crystalline basement.

Regional lead isotope investigations in the Franklinian Basin

More than 130 lead isotope analyses on galena and pyrite from various parts of the Franklinian Basin have been made in order to define a 'plumbostratigraphy' (Appendix 14). Individual zinc-lead occurrences have relatively homogeneous lead isotope signatures, but large variations exist between individual occurrences (Fig. 5). The Citronen Fjord deposit and the newly discovered zinc-lead-silver occurrence in Washington Land have the most radiogenic lead isotope ratios (W.L. not on Fig. 5) and differ markedly from all known minor mineralisations in the basin. The lead in these major occurrences is probably derived from a lead source in the crust that underlies the sedimentary rocks in the basin. The lead in the minor mineralisation on the other hand is more likely derived by local remobilization. On this basis it is suggested that favourable conditions for the formation of large zinc-lead deposits exist around deep crustal lineaments where there is easy access to the underlying crystalline basement.

In the case of the large Canadian zinc-deposits Nanisivik and Polaris the preliminary interpretation of the lead isotopes point to the Mesoproterozoic sedimentary rocks in the Borden Basin as the source of metals. The Nanisivik deposit is hosted by the rocks of the Borden Basin and was formed c. 1000 Ma ago, while Polaris lies within the Lower Palaeozoic Franklinian Basin and was formed c. 365 Ma ago. Despite this difference in age of formation, the lead isotopes suggest that both occurrences were formed from hydrothermal fluids which have circulated through - and remobilized zinc and lead from - the oldest sediments in the Borden Basin.

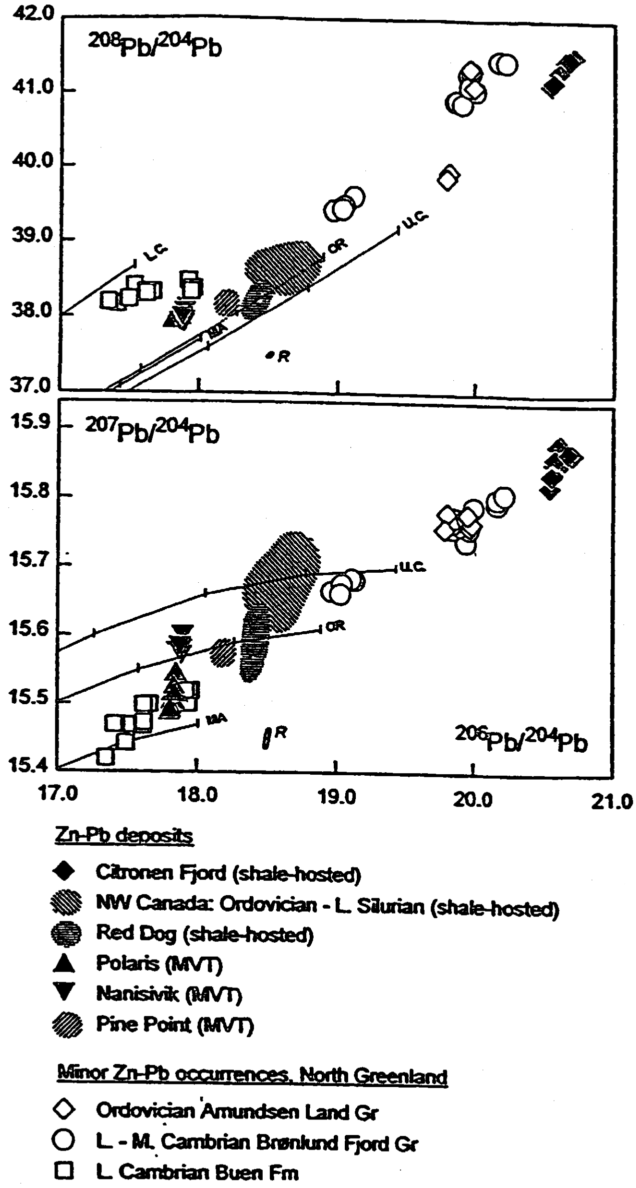


Figure 5. *Lead isotope diagrams for galena from zinc-lead occurrences in North Greenland, Canada and Alaska. Data for Pine Point from Cumming et al. 1990). Data for Ordovician and Lower Silurian shale-hosted deposits (including Howard's Pass), Yukon and Northwest Territories from Godwin & Sinclair (1982). Data for the Red Dog shale-hosted deposit, Alaska from Young (1995). R= Reproducibility (0.10 %, 2σ). 'Plumbotectonic' growth curves from Zartman & Doe (1981): MA = Mantle; OR = Orogene; U. C. = Upper crust; L. C. = Lower crust. From Jensen (1997c).*

Investigation of zinc and lead occurrences in the Upper Permian Ravnefjeld Formation, central East Greenland

Kupferschiefer-type base metal occurrences in the Upper Permian Ravnefjeld Formation were first reported from Wegener Halvø by Nordisk Mineselskab A/S in 1968 (Harpøth *et al.* 1986). Bituminous mud shales of the Ravnefjeld Formation are in this area mineralised with zinc, lead and copper within a c. 50 km^2 area (Fig. 6; Pedersen 1997). A number of samples were studied in order to constrain the timing and genesis of the mineralisation and to elucidate the relations to copper and barium (plus lead and zinc) occurrences in underlying carbonate build-ups of the Wegener Halvø Formation.

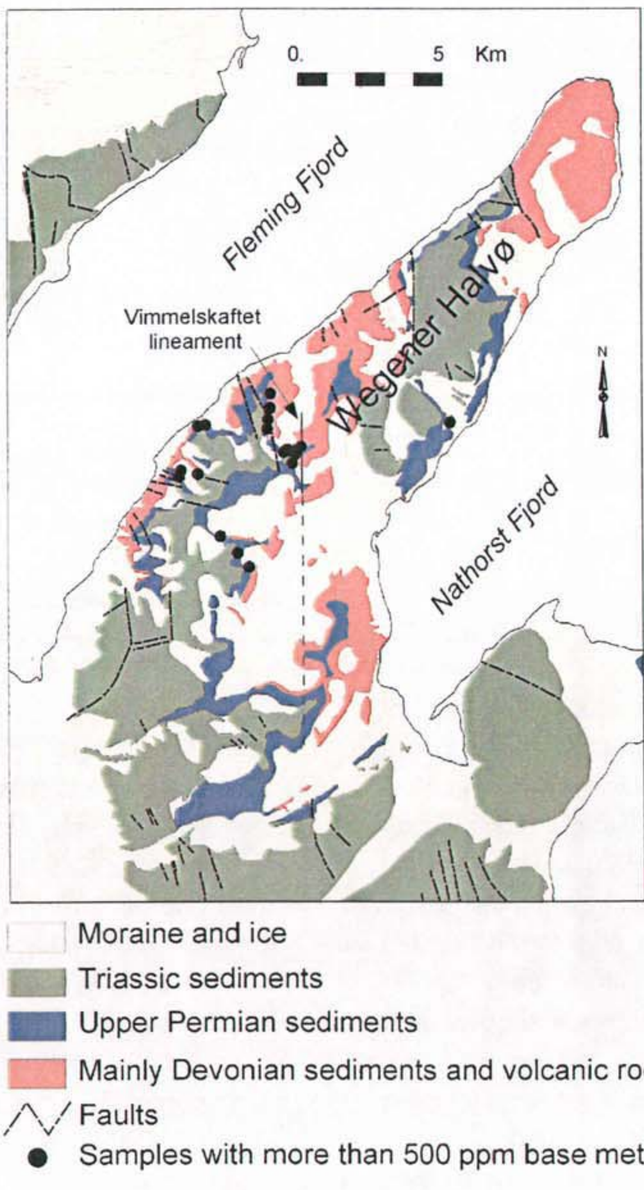


Figure 6. *Simplified geological map (redrawn from Perch-Nielsen et al. (1978–81)) of the Wegener Halvø area showing the locations of mineralised Ravnefjeld Formation samples.*

Ore textures

The main sulphide minerals in mineralised samples from Wegener Halvø are sphalerite and galena. Chalcopyrite is also present in some samples, especially in the north-western part of the area. Sulphide minerals are in most localities confined to the lowermost metres of the Ravnefjeld Formation. An exception to this is a highly mineralised locality on Lille Ravnefjeld where a considerable vertical distribution of ore minerals can be observed around a N-S trending lineament (named the Vimmelskaftet lineament).

Base metal sulphides are often found to replace shell fragments in beds of resedimented build-up material where hydrothermal solutions may have had easy access due to high porosity. Normal Ravnefjeld Formation mud shales are also sulphide-enriched in many localities. Mineralised horizons are usually more lithified than the surrounding shales due to secondary calcite cementation and silification that may have accompanyed base metal introduction (Nielsen & Pedersen 1998).

The occurrence of base metal sulphides in concretions lithified prior to compaction of the shales suggests an early introduction of base metals (Fig. 7).

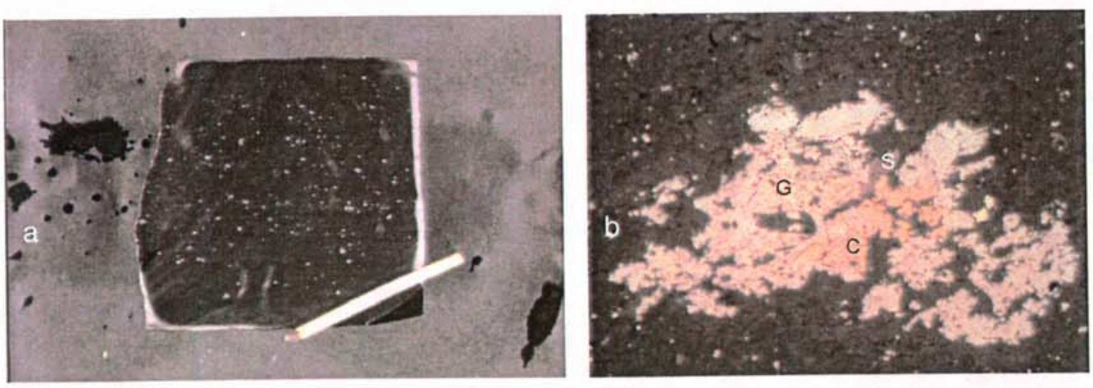


Figure 7. *a) Cut surface in mineralised concretion. Light, dispersed dots are composite sulphide aggregates. b) Microscope picture (reflected light) of a composite sulphide aggregate from sample shown in a. G, galena; C, chalcopyrite; S, sphalerite. Picture is c. 2 mm across.*

Lead isotope results

Very homogeneous lead isotope signatures of galena and sphalerite from the Ravnefjeld Formation ($^{206}Pb/^{204}Pb$: 18.440–18.466; $^{207}Pb/^{204}Pb$: 16.554–16.586; $^{208}Pb/^{204}Pb$: 38.240–38.326) indicate that all base metals were introduced to the shales during one single hydrothermal event (Fig. 8; Appendix 17; Pedersen *et al.* in prep). The lead isotope signatures of carbonate-hosted galena from the underlying Wegener Halvø Formation are relatively heterogeneous compared to those of the shale-hosted sulphides. The observed relations indicate a shared lead source for the two types of mineralisation, but different degree of homogenisation during mineralisation. This suggests that lead was introduced to the carbonates and black shales during two separate events.

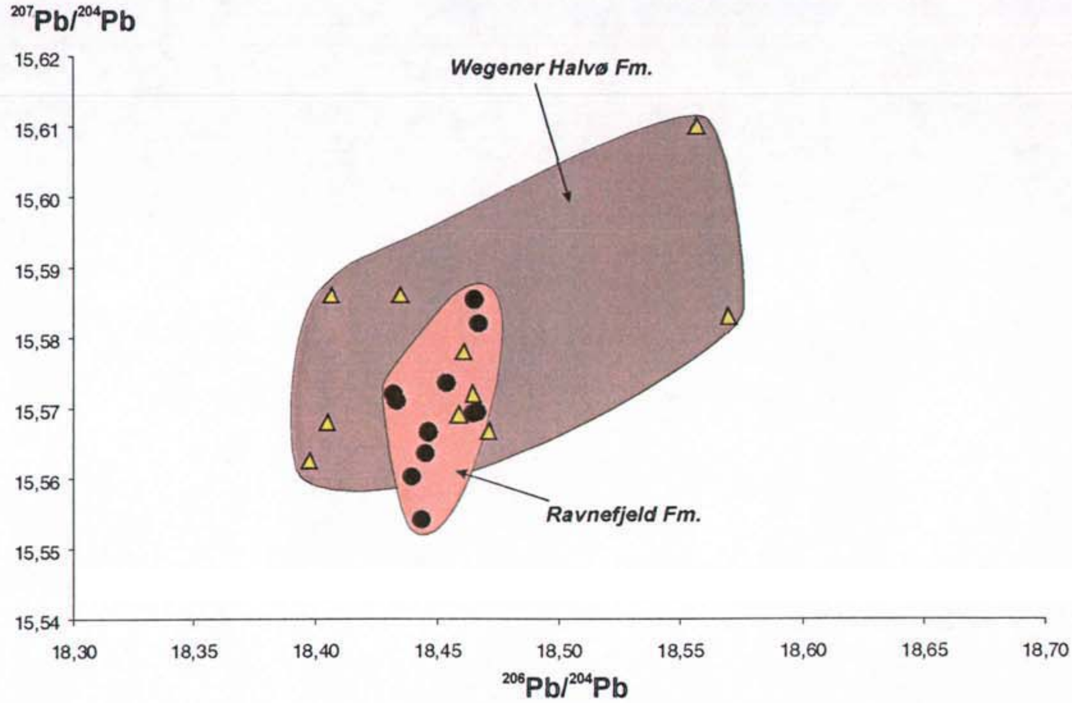


Figure 8. *Lead isotope composition of galena from the Ravnefjeld and Wegener Halvø Formations. Data from this study and Jensen (1994).*

Sulphur isotope results

δ^{34}S-values (v-CDT) of base metal sulphides in the Ravnefjeld Formation lie between -12 and -4 (Fig. 9; Appendix 18), while primary and diagenetic framboidal pyrite in unmineralised shales in general have δ^{34}S between -29 and -17 ‰ (J.K. Nielsen, pers. comm.). The sulphur in the base metal sulphides is believed to represent sulphide-dominated pore water, enriched in ^{34}S due to preferential removal of ^{32}S by sulphate-reducing bacteria and precipitation of diagenetic pyrite in the near-seafloor environment. The proposed model envisages that the sulphide-dominated pore water was trapped in the shale formation prior to introduction of base metal-bearing fluids through fractures in the underlying carbonates, and that sulphide precipitated when the two fluids met (Pedersen & Boyce 1998; Pedersen & Fougt 1998).

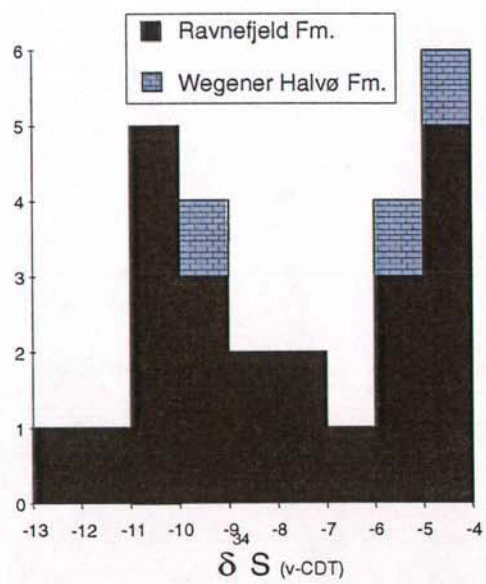


Figure 9. *Sulphur isotope compositions of galena and sphalerite in the Ravnefjeld and Wegener Halvø Formations.*

Sulphur isotope ratios of the sulphides in carbonates of the Wegener Halvø Formation fall within the same range as the shale-hosted. The relationship between barite and sulphides and evidence for pre-mineralisation entrapment of liquid hydrocarbons in the carbonates, suggest that the sulphide in this case is derived by in-situ thermochemical sulphate reduction. Fractionation factors between sulphide and sulphate range from 18.5 to 23.4 ‰, in accordance with low-temperature (c. 100°C) thermochemical sulphate reduction (Machel *et al.*, 1995).

Vitrinite reflectance results

The vitrinite reflectance in mineralised shale samples was measured to determine the thermal effect on the shales of the hydrothermal event (Appendix 19). All values are between 1.7 and 2.0 % except for samples taken close to a Tertiary dyke giving c. 3.0 %. Vitrinite reflectance data are comparable to previously published data from unmineralised shale samples in the area and could not be proven to correlate with the degree of mineralisation This indicates that any early hydrothermal effect has been overprinted later, probably during deep burial in the Late Cretaceous to Early Tertiary as proposed by Christiansen *et al.* (1990).

Bibliography

Elberling, B. & Langdahl, B.R. in press: Natural heavy metal release by sulphide oxidation in the High Arctic. Canandian Geotechnical Journal.

Fougt, H. 1997: Preliminary sulphur isotope data from the Citronen Fjord SEDEX zinc deposit, North Greenland. In: Hall, A.J., Boyce, A.J., Naden, J. & Stanley, C.J. (eds): Mineral Deposits Studies Group Annual General Meeting incorporating AGM of IGCP 356 Carpatho-Balkan metallogeny, Glasgow University, January 8–11, 1997, 24–25.

Fougt, H. 1998a: A laser combustion sulphur isotope study of sulphides from the Citronen Fjord deposit, North Greenland. 23. Nordiske Geologiske Vintermøde, Århus, Denmark, 13–16 January, 1998. Abstract volume, 74 only.

Fougt, H. 1998b: The Citronen Fjord mineralisation, North Greenland - a sulphur isotope and geochemical study of the Lower Palaeozoic sediments hosting the Zn-Pb mineralisation and a detailed sulphur isotope and textural study of the mineralisation. Unpublished Ph.D thesis, University of Copenhagen, Denmark, 125 pp.

Jensen, S.M. 1997a: Exploration in Greenland, 1997. Northwest Mining Association 103rd Annual Meeting, Spokane, Washington, 1–5 December, 1997. Convention Proceedings, 8 pp.

Jensen, S.M. 1997b: Greenland. Northwest Mining Association 103rd Annual Meeting, Spokane, Washington, 1–5 December, 1997. Abstract book, 7 only.

Jensen, S.M. 1997c: Range of zinc-lead mineralisation in North Greenland and the Canadian Arctic archipelago. In: Hendry, J.P., Carey, P.F., Parnell, J., Ruffel, A.H. & Worden, R.H. (eds): GEOFLUIDS II '97. Contributions to the Second International Conference on Fluid Evolution, Migration and Interaction in Sedimentary Basins and Orogenic Belts, The Queen's University of Belfast, 10–14 March, 1997, 183–186.

Jensen, S.M. 1998a: Carbonate-hosted Zn-Pb-Ag mineralisation in Washington Land, western North Greenland. Geology of Greenland Survey Bulletin **180**, 67–72.

Jensen, S.M. 1998b: Tertiary mineralization and magmatism, East Greenland: lead isotope evidence for remobilization of continental crust. Chemical Geology **150**, 119–144.

Jensen, S.M. in prep: Non-remobilisation of massive sulphides into cross-cutting veins: lead isotope evidence from the Citronen Fjord zinc deposit, North Greenland.

Jensen, S.M. in prep: Plumbostratigraphy of the Lower Palaeozoic Franklinian Basin, North Greenland.

Jensen, S.M. & Schønwandt, H.K. 1998: A new carbonate-hosted Zn-Pb-Ag occurrence in Washington Land, western North Greenland. Danmarks og Grønlands Geologiske Undersøgelse Rapport **1998/3**, 31 pp.

Jensen, S.M., Steenfelt, A., Dam, E. & Kalsbeek, F. 1995: Reconnaissance geochemical mapping of Kronprins Christian Land and Mylius Erichsen Land (79°40' to 81°20'N, 14° to 28°W), eastern North Greenland. Open File Series Grønlands Geologiske Undersøgelse **95/7**, 20 pp.

Kontak, D.J., Jensen, S.M., Dostal, J., Archibald, D.A. & Kyser, K. 1998: Petrological study of Late Cretaceous (ca. 90 Ma) lamprophyric dykes from North Greenland. GAC/MAC Annual Meeting, Quebec, 1998.

Kragh, K. 1996: Geologisk setting og teksturelle undersøgelser af Citronen Fjord ekshalative sulfidforekomster, Nordgrønland, 62 pp., Unpublished report, Geologisk Institut, Aarhus Universitet, Denmark.

Kragh, K. 1997a: Primary and diagenetic textures - signs of rapid growth of sulphide and carbonate in the Citronen Fjord sedimentary-exhalative zinc-lead deposit, North Greenland. In: Hall, A.J., Boyce, A.J., Naden, J. & Stanley, C.J. (eds): Mineral deposits studies group, Annual general meeting incorporating AGM of IGCP 356 Carpatho-Balkan metallogeny, Glasgow University, January 8–11, 1997, 41–42.

Kragh, K. 1997b: Sedimentary and diagenetic textures in the Citronen Fjord zinc-lead deposit, North Greenland. Abstract in Formation and metamorphism of massive sulphides. Frank M. Vokes 70 Year Anniversary Symposium. Norwegian University of Science and Technology (NTNU) Trondheim, Norway, March 16th–19th, 1997.

Kragh, K. in prep: A fluid inclusion study on the shale hosted zinc-lead deposit at Citronen Fjord, North Greenland.

Kragh, K., Jensen, S.M. & Fougt, H. 1997: Ore geological studies of the Citronen Fjord zinc deposit, North Greenland: project "Resources of the sedimentary basins of North and East Greenland". Geology of Greenland Survey Bulletin **176**, 44–49.

Langdahl, B.R. & Elberling, B. 1997: The role of bacteria in degradation of exposed massive sulphides at Citronen Fjord, eastern North Greenland: Project Resources of the sedimentary basins of North and East Greenland. Geology of Greenland Survey Bulletin **176**, 39–43.

Langdahl, B.R. & Ingvorsen, K. 1997: Temperature characteristics of bacterial iron solubilisation and 14C assimilation in naturally exposed sulphide ore material at Citronen Fjord, North Greenland (83°N). FEMS Microbiology Ecology **23**, 275–283.

Langdahl, B.R. & Ingvorsen, K. submitted: Novel Arctic strains of Thiobacillus ferrooxidans showing psychrophilic characteristics. Applied and Environmental Microbiology.

Langdahl, B.R. Ingvorsen, K. & Ramsing, N.B. in prep: Characteristics of a novel psychrophilic and acidophilic strain ofCryptococcus albidus var. albidus isolated from High Arctic sulphide ore material. Canadian Journal of Microbiology.

Langdahl, B.R., Ingvorsen, K. & Ramsing, N.B. in prep: Diversity and enumeration of acidophilic bacteria in a High Arctic gossan environment revealed by MPN-analysis, plate counts, isolations and ISR-region polymorphism. Applied and Environmental Microbiology.

Langdahl, B.R., Jensen, S.M., Kragh, K. & Elberling, B. 1998: "Naturlig forurening" ved Citronen Fjord i Nordgrønland og bakteriers rolle i forvitring af metalsulfidholdige bjergarter. Naturens Verden **2**, 61–69.

Nielsen, J.K., Nielsen, B.M. & Pedersen, M. 1998: Carbonate concretions in the Upper Permian Ravnefjeld Formation. Unpublished express report, Danmarks og Grønlands Geologiske Undersøgelse, København.

Nielsen, J.K. & Pedersen, M. 1998: Hydrothermal activity in the Upper Permian Ravnefjeld Formation of central East Greenland - a study of sulphide morphotypes. Geology of Greenland Survey Bulletin **180**, 81–87.

Pedersen, M. 1997: Investigation of ore potential in black shales of the Upper Permian Ravnefjeld Formation in Scoresby Land and on Traill Ø, central East Greenland. Danmarks og Grønlands Geologiske Undersøgelse Rapport **1997/124**, 17 pp.

Pedersen, M. 1998: Lead isotope analysis of sedimentary rocks - a tool for tracing ore lead sources in the Jameson Land basin, central East Greenland. In: Wilson, J.R. (ed.): 23. Nordiske Geologiske Vintermøde, Aarhus, Denmark, 13–16 Januar, 1998. Abstract volume, 234 only.

Pedersen, M. in prep: CD-Rom. Danmarks og Grønlands Geologiske Undersøgelse Rapport.

Pedersen, M. submitted: Lead isotope domains in the Caledonian crystalline terrain of central East Greenland : evidence from post-Caledonian sediments. Geology of Greenland Survey Bulletin.

Pedersen, M. submitted: Lead isotope signatures of sedimentary rocks as a tool for tracing ore lead sources: A study related to base metal and barite occurrences in the Jameson Land basin, central East Greenland. Mineralium Deposita.

Pedersen, M. & Boyce, A. 1998: Insight into origin of black shale-hosted lead and zinc occurrences in the Upper Permian Ravnefjeld Formation, central East Greenland. III International Conference on Arctic Margins (ICAM III), abstracts, 142 only.

Pedersen, M., Boyce, A., Fallick, A.E., Jensen, S.M. & Nielsen, J.K. in prep: Timing and genesis of base metal mineralisation in black shales of the Upper Permian Ravnefjeld Formation, East Greenland. Mineralium Deposita.

Pedersen, M. & Fougt, H. 1998: Mineralisation diversity in an area of intense crustal thinning: S-isotope evidence from base metal occurrences in East Greenland. Mineral Deposits Studies Group, 22nd Annual Winter Meeting, University of St. Andrews, Scotland, 14th–15th December 1998, Programme and Abstracts, 13–14.

Stemmerik, L., Jensen, S.M., Korstgård, J., Schønwandt, H.K., Surlyk, F., Clausen, O.R., Fougt, H., Kragh, K., Langdahl, B.R. & Therkelsen, J. 1996: Resources of the sedimentary basins of North and East Greenland – an integrated petroleum and ore geolocial research project. Bulletin Grønlands Geologiske Undersøgelse **172**, 32–36.

Stemmerik, L., Jensen, S.M, Pedersen, M. 1997: Hydrocarbon-associated mineralisation of Upper Permian carbonate buildups, Wegener Halvø, East Greenland. In: Hendry, J.P., Carey, P.F., Parnell, J., Ruffel, A.H. & Worden, R.H. (eds): GEOFLUIDS II '97. Contributions to the Second International Conference on Fluid Evolution, Migration and Interaction in Sedimentary Basins and Orogenic Belts, The Queen's University of Belfast, 10–14 March, 1997, 485–487.

Other references cited in the text

Bengaard, H.-J. & Henriksen, N. 1991: Geological mapof North Greenland. In: Peel, J.S. & Sønderholm, M. (eds): Sedimentary basins of North Greenland. Bulletin Grønlands Geologiske Undersøgelse **160**.

Christiansen, F.G., Piasecki, S. & Stemmerik, L. 1990: Thermal maturity of the Upper Permian succession in the Wegener Halvø area, East Greenland. Rapport Grønlands Geologiske Undersøgelse **148**, 109–114.

Coleman, M.L. & Moore, M.P. 1978: Direct reduction of sulphate to sulphur dioxide for isotopic analysis. Analytical Chemistry **50**, 1594–1595.

Cumming, G.L., Kyle, J.R. & Sangster, D.F. 1990: Pine Point: a case history of lead isotope homogeneity in a Mississippi Valley-type district. Economic Geology **85**, 133–144.

Elsgaard, L., Isaksen, M.F., Jørgensen, B.B., Alayse, A.M. & Jannasch, H.W. 1994: Microbial sulfate reduction in deep-sea sediments at the Guayamas Basin hydrothermal vent area: Influence of temperature and substrates. Geochimica et Cosmochimica Acta **58**, 3335–3343.

Friedman I. & O'Neil J.R. 1977: Compilation of stable isotope fractionation factors of geochemical interest. In M. fleischer, ed., Data of Geochemistry, sixth ed. US. Geol. Survey proff. Paper **440-kk**, 12p. and 49 figures.

Godwin, C.I. & Sinclair, A.J. 1982: Average lead isotope growth curves for shale-hosted zinc-lead deposits, Canadian Cordillera. Economic Geology **77**, 675–690.

Goldstein, R.H. & Reynolds, T.J. 1994: Systematics of fluid inclusions in diagenetic minerals. SEPM Short Course **31**, 199 pp. Tulsa, OK, United States: Society of Sedimentary Geology.

Harpøth, O., Pedersen, J.L., Schønwandt, H.K. & Thomassen, B. 1986: The mineral occurrences of central East Greenland. Meddelelser om Grønland, Geoscience **17**, 139 pp.

Jensen, S.M. 1994: Lead isotope systematics of ore deposits and mineral occurrences in East and North-East Greenland, 161 pp. Unpublished Ph.D. thesis, University of Aarhus, Denmark.

Jepsen, H.F., Henriksen, N., Hurst, J.M. & Peel, J.S. 1983: Geology, 1:250 000, Washington Land and Daugaard-Jensen Land. Copenhagen: Geological Survey of Greenland.

Kelley, S.P. & Fallick, A.E. 1990: High precision spatially resolved analysis of $\delta^{34}S$ in sulphides using a laser extraction technique. Geochimica et Cosmochimica Acta **54**, 883–888.

MacDonald, A.J. & Spooner, E.T.C. 1981: Calibration of a Linkam TH600 programmable heating-cooling stage for microthermometric examination of fluid inclusions. Economic Geology **76**, 1248–1258.

Machel, H.G., Krouse, H.R. & Sassen, R. 1995: Product and distinguishing criteria of bacterial and thermochemical sulfate reduction. Applied Geochemistry **10**, 373–389.

McCrea, J.M. 1950: On the isotope chemistry of carbonates and a paleotemperature scale, Jour. Chem. Pysics **18**, pp. 849–857.

Ohmoto, H. & Rye, R.O. 1979: Isotopes of Sulphur and Carbon. In: Barnes, H.L. (ed.): Geochemistry of hydrothermal ore deposits, 2nd edition, 509–550. New York: John Wiley & Sons, Inc.

Perch-Nielsen, K., Henriksen, N. & Stemmerik, L. 1978–81: Geological map of Greenland, 1:100 000, Fleming Fjord, 71 Ø.1 Nord. Copenhagen: Geological Survey of Greenland.

Robinson, B.W. & Kusakabe, M. 1975: Qualitative preparation of sulphur dioxide for $^{34}S/^{32}S$ analyses from sulphides by combustion with cuprous oxide. Analytical Chemistry **47**, 1179–1181.

Roedder, E. 1984: Fluid inclusions. Reviews in Mineralogy **12**, 644 pp. Washington DC, United States. Mineralogical Society of America.

Rosenbaum, J. & Sheppard, S.M. 1986: An isotopic study of siderites, dolomites and ankerites at high temperaures. Geochimica et Cosmochimica Acta **50**, 147–1150.

Sharma, T. & Clayton, R.N. 1965: Measurement of $^{18}O/^{16}O$ ratios of total oxygen of carbonates. Geochimica et Cosmochimica Acta **29**, 1347–1353.

Shepherd, T.J. 1981: Temperature-programmable, heating-freezing stage for microthermometric analysis of fluid inclusions. Economic Geology **76**, 1244–1247.

van der Stijl, F.W. & Mosher, G.Z. 1998: The Citronen Fjord massive sulphide deposit, Peary Land, North Greenland: discovery, stratigraphy, mineralization and structural setting. Geology of Greenland Survey Bulletin **179**, 40 pp.

Young, L.E. 1995: Empirical applications of common lead-isotope ratios to exploration. Society of Economic Geologists Newsletter **22**, 7–12.

Zartman, R.E. & Doe, B.R. 1981: Plumbotectonics – the model. Tectonophysics **75**, 135–162.

Appendix 1- analysis methods

All data collected in relation to the project are listed in the Appendix. A few sets of data were not discussed in the previous section, but have been used in some of the publications listed in the bibliography. Other data sets are not yet published and have therefore not been discussed. Almost all samples used in the present study have been collected during field work in the period from 1995 to 1997 and have GEUS numbers. A few North Greenland samples have kindly been provided by Platinova A/S and a number of East Greenland samples are from Nordisk Mineselskab A/S. The following sections specify details concerning the analytical methods.

Geochemistry

The geochemical data listed in appendix 2, 3, 4 and 13 were analysed at Actlabs by ICP, INAA, ICP/MS and Leco, whereas a few XRF analyses on stream sediments from North Greenland have been conducted at GEUS. The detection limits and analyses methods are given in the respective tables.

Sulphur isotopes

Sulphur isotopic compositions of sulphides and sulphates in both North and East Greenland samples were measured at the Scottish Universities Research and Reactor Centre (SURRC). Samples were run by either the conventional technique or the laser combustion method. Conventional analyses were conducted on either hand-picked sulphide grains or on sulphide concentrates separated out of samples by heavy liquid separation. Conventional sulphate and sulphide analysis were performed following the standard technique of Coleman & Moore (1978) and Robinson & Kusakabe (1975) respectively. The Laser combustion technique of Kelley & Fallick (1990) was used in detailed studies and in cases where there was need to separate fine-grained sulphides very accurately. The method utilises a Nd-YAG laser beam, which is focussed through a microscope. A beam diameter of c. 60 µm allowed coexisting sulphides to be separated out of the samples accurately. Sulphide sulphur was converted to SO_2 by reaction with a controlled amount of O_2, which was let into the sample chamber before combustion. The gases evolved during combustion were let into a small-scale standard-type sulphur line, where CO_2 and non-condensable gases were removed. The purified SO_2 was let into a VG SIRA II mass spectrometer and analysed. Raw data were corrected for mineral-dependent fractionation factors following Kelley & Fallick (1990). All sulphur isotope data is given in standard delta notation ($\delta^{34}S$) relative to troilite from the Canyon Diablo meteorite (v-CDT). The error of reproducibility for both laser and conventional techniques was ± 0.2 ‰, based on repeat analyses of standard materials (including combustion).

Lead isotopes

Lead isotopic compositions of East Greenland samples were analysed by Geochron Laboratories using a VG 54 multi-collector mass spectrometer. Before shipment, the galena was separated from the samples under a binocular microscope by drilling single grains out of cut, cleaned surfaces. The samples were dissolved in HCl + HNO_3 and the Pb separated using standard HBr ion-exchange chemistry. Fractionation correction has been determined from multiple runs of the NBS 981 standard and is 0.12 %/amu ± 0.015.

Lead isotopic compositions of 130 North Greenland samples were analysed at Institut für Geowissenschaften und Lithospärenforschung der Justus-Liebig-Universität, Gießen, Germany and another 50 samples have been analysed at the Danish Centre for Isotope geology, Geological Institute, University of Copenhagen by Dr. Robert Frei.

Carbon and oxygen isotopes

The carbon and oxygen isotopic composition of carbonates from Citronen Fjord samples was determined by analysing the CO_2 generated by the reaction with 100% phosphoric acid (McCrea 1950). The calcite samples were exposed to phosphoric acid at 25˚C for 4 hours before the gas was extracted. The combined calcite and dolomite samples were exposed to the phosphoric acid at 25°C for 2 hours before the gas was extracted. Afterwards, the remains were reacted overnight at 25°C and the gas was removed. The restite material was subsequently heated to 50°C and reacted overnight and the gas was extracted. The CO_2 was analysed on a triple collector VG SIRA 12 mass spectrometer. The routine precision (2σ) is 0.10 ‰.

The O fractionation factors (α) used for the carbonate-H_3PO_4 reactions are 1.01025 for calcite at 25˚C (Friedman & O'Neil 1977; Sharma & Clayton 1965) and 1.01065 for dolomite at 50˚C (Rosenbaum & Sheppard 1986).

Fluid inclusions

Fluid inclusion microthermometric measurements were made on 100 µm thick doubly polished thin sections. Homogenisation temperatures and freezing point depressions were determined with a Linkam TH600 fluid inclusion stage (Shepherd 1981). For the observation a 100x Nikon objective and a 10x ocular were used. Calibrations for the high temperature range were made before and for the low temperature range after the measurements using pure substances, Merck® chemical standards and SYNFLINC Synthetic Standards 1 to 4. A calibration curve was constructed from the standard results and all temperatures were corrected accordingly (Macdonald & Spooner 1981). The accuracy of the temperature measurements are estimated to be within 5°C between 75° and 250°C and ±0.5°C below 0°C. Reproducibility is ±3°C between 75° and 250°C and ±0.5°C in the negative temperature range. Samples were first heated to observe the temperature of homogenisation (Th). For chips with several fluid inclusions, the fluid inclusions with low Th were measured before those with higher Th. The Th measurements were repeated to control if the inclusion had been stretch during the heating. The fluid inclusions were subsequently frozen to -110°C or cooler until completely frozen and then slowly heated (0.5°C/min) to record the temperature at which the last crystal of ice melted (Tm(ice)). Tm(ice) was determined by the "cycling" technique described by Goldstein & Reynolds (1994). All measurements of Tm(ice) were taken in the presence of a vapour phase to avoid metastable melting (Roedder 1984). The results are listed in table 1.

Vitrinite reflectance

Maturity of organic matter in East Greenland samples was petrographically determined by random reflectance measurements on the vitrinite by Carsten Guvad, GEUS. The equipment was a Leitz MPV-SP system, which was calibrated against a standard of 1.667 % R_o. Between 32 and 115 measurements were conducted per sample in monochromatic light and oil immersion.

Appendix 2

List of samples, North Greenland (HF, KK, SMJ)

Sample #	*Longitude*	*Latitude*	*Type*
388701	-42.6752707	82.5774855	Stream sediment
388702	-42.6823184	82.5770961	Stream sediment
388703	-42.6719554	82.5787998	Stream sediment
388704	-42.6316579	82.5847597	Stream sediment
388705	-42.6096565	82.5840652	Stream sediment
388706	-42.3205377	82.6046939	Stream sediment
388707	-42.3171635	82.6054502	Stream sediment
388708	-42.3211815	82.6050264	Stream sediment
388709	-42.3036613	82.6006759	Stream sediment
388710	-42.2905507	82.5990559	Stream sediment
388711	-42.2767105	82.5935252	Stream sediment
388712	-42.2416004	82.5823295	Stream sediment
388713	-42.2350343	82.5886435	Stream sediment
388714	-42.2325399	82.5888367	Stream sediment
388715	-28.5556838	83.1515757	Stream sediment
388716	-28.613425	83.1513865	Stream sediment
388717	-28.6701565	83.1544739	Stream sediment
388718	-28.2323959	83.0809683	Stream sediment
388719	-28.2588638	83.0851525	Stream sediment
390801	-42.6752707	82.5774855	Heavy mineral concentrate
390802	-42.6752707	82.5774855	Heavy mineral concentrate
390803	-42.6823184	82.5770961	Heavy mineral concentrate
390804	-42.6823184	82.5770961	Heavy mineral concentrate
390805	-42.6719554	82.5787998	Heavy mineral concentrate
390806	-42.6719554	82.5787998	Heavy mineral concentrate
390807	-42.6316579	82.5847597	Heavy mineral concentrate
390808	-42.6316579	82.5847597	Heavy mineral concentrate
390809	-42.6096565	82.5840652	Heavy mineral concentrate
390810	-42.6096565	82.5840652	Heavy mineral concentrate
390811	-42.5940503	82.5857209	Heavy mineral concentrate
390812	-42.3205377	82.6046939	Heavy mineral concentrate
390813	-42.3171635	82.6054502	Heavy mineral concentrate
390814	-42.3211815	82.6050264	Heavy mineral concentrate
390815	-42.3036613	82.6006759	Heavy mineral concentrate
390816	-42.2905507	82.5990559	Heavy mineral concentrate
390817	-42.2767105	82.5935252	Heavy mineral concentrate
390818	-42.2416004	82.5823295	Heavy mineral concentrate
390819	-42.2350343	82.5886435	Heavy mineral concentrate
390820	-42.2325399	82.5888367	Heavy mineral concentrate

Sample #	*Longitude*	*Latitude*	*Type*	
390821	-28.5556838	83.1515757	Heavy mineral concentrate	
390822	-28.613425	83.1513865	Heavy mineral concentrate	
390823	-28.6701565	83.1544739	Heavy mineral concentrate	
410203			Rock	drill hole CF 94-10
410204			Rock	drill hole CF 94-11
425901	-28.1334224	83.0740322	Rock	
425902	-28.1666657	83.0771595	Rock	
425903	-28.1666657	83.0771595	Rock	
425904	-28.1660166	83.076253	Rock	
425905	-28.1660166	83.076253	Rock	
425906	-28.1866212	83.0803944	Rock	
425907	-28.1866212	83.0803944	Rock	
425908	-28.1866212	83.0803944	Rock	
425909	-28.1866212	83.0803944	Rock	
425910	-28.1866212	83.0803944	Rock	
425911	-28.1835742	83.0752445	Rock	
425912	-28.1835742	83.0752445	Rock	
425913	-28.1835742	83.0752445	Rock	
425914	-28.1835742	83.0752445	Rock	
425915	-28.177727	83.0752177	Rock	
425916	-28.1783547	83.0753035	Rock	
425917	-28.1744387	83.075003	Rock	
425918	-28.1744387	83.075003	Rock	
425919	-28.1744387	83.075003	Rock	
425920	-28.2130035	83.0799652	Rock	
425921	-28.2097634	83.078109	Rock	
425922	-28.2097634	83.078109	Rock	
425923	-28.2097634	83.078109	Rock	
425924	-28.2097634	83.078109	Rock	
425925	-28.2107557	83.0774385	Rock	
425926	-28.2107557	83.0774385	Rock	
425927	-28.2097634	83.078109	Rock	
425928	-28.1088962	83.0661357	Rock	
425929	-28.1466296	83.0758613	Rock	
425930	-28.1440922	83.077578	Rock	
425931	-28.1347044	83.0825937	Rock	
425932	-28.1276609	83.082996	Rock	
425933	-28.0627569	83.0822934	Rock	
425934	-28.1663867	83.0768108	Rock	
425935	-28.1753024	83.080389	Rock	
425936	-28.1754042	83.0805017	Rock	
425937	-28.1598046	83.0774438	Rock	
425938	-28.1571706	83.0763495	Rock	
425939	-28.1572404	83.0753088	Rock	
425940	-28.1897166	83.1150485	Rock	

Sample #	Longitude	Latitude	Type
425941	-28.2236519	83.1118888	Rock
425942	-28.1396666	83.136211	Rock
425943	-28.1302734	83.1344677	Rock
425944	-28.1024107	83.1304014	Rock
425945	-28.105538	83.1280894	Rock
425946	-28.1107952	83.1274457	Rock
425947	-28.1365606	83.126083	Rock
425948	-28.1770082	83.1092174	Rock
425949	-28.1770082	83.1092174	Rock
425950	-28.1796476	83.1098825	Rock
425951	-28.1267759	83.1046253	Rock
425952	-28.4756453	83.1477445	Rock
425953	-28.4961374	83.1475085	Rock
425954	-28.5739698	83.1511563	Rock
425955	-28.564566	83.150062	Rock
425956	-28.5662235	83.1492573	Rock
425957	-28.5677739	83.1491019	Rock
425958	-28.5721298	83.1485653	Rock
425959	-28.5721298	83.1485653	Rock
425960	-28.5765609	83.1470097	Rock
425961	-28.575783	83.1471223	Rock
425962	-28.5835024	83.1448532	Rock
425963	-28.5839798	83.1449015	Rock
425964	-28.5953631	83.1436247	Rock
425965	-28.5976537	83.1424982	Rock
425966	-28.5976537	83.1424982	Rock
425967	-28.7164112	83.1565315	Rock
425968	-28.6893208	83.1499655	Rock
425969	-28.6893208	83.1499655	Rock
425970	-28.560135	83.1508935	Rock
425971	-28.560135	83.1508935	Rock
425972	-28.52201	83.1266624	Rock
425973	-28.5178419	83.1207992	Rock
425974	-28.4846522	83.12221	Rock
425975	-28.4799369	83.1218345	Rock
425976	-28.4505239	83.1215662	Rock
425977	-28.4799369	83.1218345	Rock
425978	-28.3691081	83.0908014	Rock
425979	-28.3694567	83.090914	Rock
425980	-28.3081414	83.0805767	Rock
425981	-28.2191189	83.0800027	Rock
425982	-28.2191189	83.0800027	Rock
425983	-28.2191189	83.0800027	Rock
425984	-28.2284584	83.0805767	Rock
426601	-34.5665934	83.2945206	Rock

Sample #	Longitude	Latitude	Type
426602	-34.2166029	83.2009811	Rock
426603	-34.3167939	83.2988172	Rock
426604	-34.3167939	83.2988172	Rock
426605	-34.3167939	83.2988172	Rock
426606	-34.3414272	83.3008237	Rock
426607	-34.3347648	83.2981897	Rock
426608	-34.3450376	83.2961353	Rock
426609	-34.3322917	83.2949336	Rock
426610	-34.6153022	83.2804817	Rock
426611	-34.6025617	83.2784756	Rock
426612	-34.5684817	83.2774561	Rock
426613	-34.5520397	83.2760186	Rock
426614	-34.4798561	83.2665128	Rock
426615	-34.4869264	83.2650697	Rock
426616	-34.4862934	83.2642759	Rock
426617	-34.4862934	83.2642759	Rock
426618	-34.4862934	83.2642759	Rock
426619	-34.5306678	83.2617492	Rock
426620	-34.5306678	83.2617492	Rock
426621	-34.5500228	83.2656761	Rock
426622	-34.5500228	83.2656761	Rock
426623	-34.5500228	83.2656761	Rock
426624	-34.5693989	83.2639756	Rock
426625	-34.5327334	83.2622159	Rock
426626	-34.4850006	83.2735939	Rock
426627	-34.5500228	83.2656761	Rock
426628	-34.0982636	83.299005	Rock
426629	-34.1228917	83.2969611	Rock
426630	-34.126652	83.2959367	Rock
426631	-36.2475928	82.9443473	Rock
426632	-36.073319	82.985852	Rock
426633	-36.0892084	82.9952611	Rock
426634	-36.0829912	82.9182281	Rock
426635	-36.0170623	82.9303945	Rock
426636	-36.0170623	82.9303945	Rock
426637	-36.2540623	82.943575	Rock
426638	-36.3897714	82.9315853	Rock
426639	-36.3206131	82.9386289	Rock
426640	-36.3206131	82.9386289	Rock
426641	-36.3404778	82.9360914	Rock
426642	-36.3404778	82.9360914	Rock
426643	-36.341422	82.9352064	Rock
426644	-36.341422	82.9352064	Rock
426645	-36.341422	82.9352064	Rock
426646	-36.340145	82.933962	Rock

Sample #	*Longitude*	*Latitude*	*Type*
426647	-36.3375434	82.932712	Rock
426648	-36.3375273	82.9316875	Rock
426649	-36.3352476	82.9319125	Rock
426650	-36.3361701	82.9325725	Rock
426651	-36.3404348	82.9330336	Rock
426652	-28.2199075	83.0789459	Rock
426653	-28.2199075	83.0789459	Rock
426654	-28.2199075	83.0789459	Rock
426655	-28.1783386	83.0752231	Rock
426656	-45.4406336	81.4593209	Rock
426657	-45.4351028	81.4590903	Rock
426658	-45.4232689	81.4576795	Rock
426659	-45.4170517	81.4581139	Rock
426660	-45.3995314	81.4586773	Rock
426661			Rock
426662	-46.7976542	81.5091081	Rock
426663	-46.8187094	81.5119886	Rock
426664	-46.8246158	81.5138234	Rock
426665	-46.8248303	81.5111947	Rock
426666	-48.9039125	81.6591884	Rock
426667	-48.9039125	81.6591884	Rock
426668	-48.5560622	81.6295714	Rock
426669	-48.5560622	81.6295714	Rock
426670	-48.5560622	81.6295714	Rock
426671	-48.5560622	81.6295714	Rock
426672	-47.7203128	81.4836109	Rock
426673	-49.2370589	82.4243314	Rock
426674	-49.2304392	82.4250825	Rock
426675	-49.2304392	82.4250825	Rock
426676	-49.2328587	82.4218853	Rock
426677	-49.2293237	82.420882	Rock
426678	-49.2300692	82.420952	Rock
426679	-49.2436356	82.4175775	Rock
426680	-49.2400792	82.4173898	Rock
426681	-49.3000909	82.4143109	Rock
426682	-49.3420406	82.407675	Rock
426683	-49.3420406	82.407675	Rock
426684	-49.3420406	82.407675	Rock
426685	-45.8136645	82.1413583	Rock
426686	-28.1802323	83.07481	Rock
426687	-28.1807203	83.0748797	Rock
426688	-28.1807203	83.0748797	Rock
426689	-28.2191189	83.0800027	Rock
427201	-28.68139	83.15528	Rock
427204	-28.68389	83.15194	Rock

Sample #	*Longitude*	*Latitude*	*Type*
427205	-28.52	83.12055	Rock
427208	-28.21916	83.07917	Rock
427209	-28.21472	83.07722	Rock
427211	-28.21472	83.07722	Rock
427214	-28.21472	83.07722	Rock
427505	-28.18129	83.07505	Rock
434247	-28.21716	83.07917	Rock
434257	-28.21275	83.07779	Rock
434262	-28.21275	83.07779	Rock
434267	-28.21275	83.07779	Rock
435701	-42.6108868	82.5806022	Rock
435702	-42.6108868	82.5806022	Rock
435703	-42.6011881	82.5811225	Rock
435704	-42.5742694	82.5761927	Rock
435705	-42.5942304	82.5850922	Rock
435706	-42.609122	82.5842179	Rock
435707	-42.4990334	82.5753344	Rock
435708	-42.4981161	82.573312	Rock
435709	-42.487398	82.5745459	Rock
435710	-42.4844207	82.575549	Rock
435711	-42.5601127	82.593863	Rock
435712	-42.4808427	82.5756939	Rock
435713	-42.4808427	82.5756939	Rock
435714	-42.4829294	82.5756777	Rock
435715	-42.4847802	82.575919	Rock
435716	-42.4875267	82.5759298	Rock
435717	-42.4875267	82.5759298	Rock
435718	-42.4875267	82.5759298	Rock
435719	-42.4875267	82.5759298	Rock
435720	-42.4875267	82.5759298	Rock
435721	-42.4875267	82.5759298	Rock
435722	-42.5320622	82.5786014	Rock
435723	-42.5188067	82.5788857	Rock
435724	-42.5188067	82.5788857	Rock
435725	-42.5160172	82.5862778	Rock
435726	-42.5063397	82.5858487	Rock
435727	-42.5072732	82.5860095	Rock
435728	-42.5072732	82.5860095	Rock
435729	-42.498631	82.585693	Rock
435730	-42.493626	82.5856717	Rock
435731	-42.491094	82.5853068	Rock
435732	-42.491094	82.5853068	Rock
435733	-42.5321426	82.5848187	Rock
435734	-42.5321426	82.5848187	Rock
435735	-42.5339397	82.5854355	Rock

Sample #	Longitude	Latitude	Type
435736	-42.5291868	82.586251	Rock
435737	-42.5291868	82.586251	Rock
435738	-42.5275561	82.5862295	Rock
435739	-42.6750058	82.5742878	Rock
435740	-42.6819332	82.5743205	Rock
435741	-42.7094152	82.5686825	Rock
435742	-42.713932	82.5680174	Rock
435743	-42.7277775	82.571236	Rock
435744	-42.7274772	82.5715954	Rock
435745	-42.7274772	82.5715954	Rock
435746	-42.6628627	82.5879943	Rock
435747	-42.6533516	82.5874633	Rock
435748	-42.6598319	82.5872755	Rock
435749	-42.6196899	82.5841427	Rock
435750	-42.1830692	82.6031435	Rock
435751	-42.1830692	82.6031435	Rock
435752	-42.3205271	82.6055897	Rock
435753	-42.3216589	82.6056165	Rock
435754	-42.3216589	82.6056165	Rock
435755	-42.3157742	82.6059277	Rock
435756	-42.3175284	82.6051767	Rock
435757	-42.2275724	82.5892175	Rock
435758	-42.2251155	82.589947	Rock
435759	-42.3248293	82.6051552	Rock
435760	-42.3248293	82.6051552	Rock
435761	-42.3248293	82.6051552	Rock
435762	-42.3248293	82.6051552	Rock
435763	-42.3248293	82.6051552	Rock
435764	-42.3265674	82.605198	Rock
435765	-42.3257842	82.6053912	Rock
435766	-42.3365935	82.6058418	Rock
435767	-42.3423764	82.6061262	Rock
435768	-42.2169831	82.5895555	Rock
435769	-42.2169831	82.5895555	Rock
435770	-42.2169831	82.5895555	Rock
435771	-42.2060074	82.5905425	Rock
435772	-42.1914699	82.5901562	Rock
435773	-42.1914699	82.5901562	Rock
435774	-42.1687569	82.5897969	Rock
435775	-42.1658279	82.5903494	Rock
435776a	-42.2898801	82.5921088	Rock
435777	-42.1911104	82.5997694	Rock
435778	-42.1478572	82.595467	Rock
435779	-42.1478572	82.595467	Rock
435780	-42.23166	82.5919319	Rock

Sample #	*Longitude*	*Latitude*	*Type*
435781	-42.2818925	82.5895877	Rock
435782	-42.2818925	82.5895877	Rock
435783	-42.3036667	82.6006652	Rock
435784	-42.2436389	82.5815732	Rock
435785	-42.2330065	82.5831235	Rock
435786	-42.2330065	82.5831235	Rock
435787	-42.2234204	82.5827105	Rock
435788	-42.2258075	82.582807	Rock
435789	-42.2269072	82.5830645	Rock
435790	-42.2236081	82.5827587	Rock
435791	-42.219177	82.5828285	Rock
435792	-42.2200569	82.5829893	Rock
435793	-42.2916987	82.595644	Rock
435794	-42.2916987	82.595644	Rock
435795	-42.2916987	82.595644	Rock
435796	-42.2848591	82.5996727	Rock
435797	-42.2746612	82.5988199	Rock
435798	-42.2376844	82.5881822	Rock
435799	-42.2529622	82.5887347	Rock
435809	-42.48805	82.57389	Rock
435823	-42.72389	82.57083	Rock
435827	-42.31833	82.60528	Rock
435831	-42.22694	82.58972	Rock
435846	-42.25055	82.58083	Rock
435857	-28.18916	83.08	Rock
435860	-28.18916	83.08	Rock
435861	-28.18916	83.08	Rock
435862	-28.17888	83.07499	Rock
435863	-28.17888	83.07499	Rock
435864	-28.18083	83.07499	Rock
435865	-28.18055	83.07583	Rock
435867	-28.13305	83.07361	Rock
435868	-28.15194	83.07445	Rock
435869	-28.1525	83.07416	Rock
435871	-28.15	83.07445	Rock
435872	-28.15583	83.07499	Rock
435873	-28.15583	83.07499	Rock
435876a	-28.21361	83.07777	Rock
435879	-28.20444	83.08222	Rock
435881	-28.19694	83.08139	Rock
435882	-28.19694	83.08139	Rock
435884	-28.17555	83.10833	Rock
435893	-28.4975	83.14889	Rock
435894	-28.56361	83.15027	Rock
435895	-28.56361	83.15027	Rock

Sample #	*Longitude*	*Latitude*	*Type*
435896	-28.57111	83.14861	Rock
435897	-28.57611	83.14694	Rock
435898	-28.58222	83.14472	Rock
447001	-67.0818331	80.3951383	Rock
447002	-67.3011951	80.3601517	Rock
447003	-66.8265084	80.3968817	Rock
447004	-66.7301686	80.46273	Rock
447005	-66.667582	80.5180478	Rock
447006	-66.667582	80.5180478	Rock
447007	-66.3840725	80.5459323	Rock
447008	-66.8423119	80.6164956	Rock
447009	-66.8423119	80.6164956	Rock
447010	-66.0565426	80.6040286	Rock
447011	-65.9985478	80.6594914	Rock
447012	-65.2261523	80.7899864	Rock
447013	-65.2261523	80.7899864	Rock
447014	-65.2245964	80.6364031	Rock
447015	-65.217327	80.7882461	Rock
447016	-65.217327	80.7882461	Rock
447017	-65.217327	80.7882461	Rock
447018	-61.6240634	80.6477703	Rock
447019	-64.3980167	80.3298833	Rock
447020	-61.1889333	80.6529834	Rock
447021	-61.6434237	80.6479956	Rock
447022	-61.6425923	80.6475019	Rock
447023	-61.6425923	80.6475019	Rock
447024	-61.6436489	80.6471103	Rock
447025	-61.6400604	80.6467189	Rock
447026	-61.6414228	80.6472392	Rock
447027	-61.636112	80.6473089	Rock
447028	-61.6310425	80.6474431	Rock
447029	-61.6241387	80.6482853	Rock
447030	-61.6215528	80.6482637	Rock
447031	-66.1647375	80.651772	Rock
447032	-66.1500497	80.6490095	Rock
447033	-61.7317275	80.6361081	Rock
447034	-61.7317275	80.6361081	Rock
447035	-61.721712	80.6375137	Rock
447036	-61.6862265	80.6431461	Rock
447037	-61.6609061	80.6460053	Rock
447038	-61.6553381	80.6471159	Rock
447039	-61.6464331	80.6458231	Rock
447040	-61.6334298	80.6431353	Rock
447041	-61.6417444	80.6477864	Rock
447042	-61.6417444	80.6477864	Rock

Sample #	Longitude	Latitude	Type
447043	-61.6609061	80.6460053	Rock
447044	-61.6310425	80.6474431	Rock
447045	-61.6414228	80.6472392	Rock
447046	-61.6215528	80.6482637	Rock
447047	-61.6240634	80.6477703	Rock
500101	-34.3167939	83.2988172	Stream sediment
500102	-34.2902722	83.2853045	Stream sediment
500103	-34.6153022	83.2804817	Stream sediment
500104	-34.6025617	83.2784756	Stream sediment
500105	-34.5520397	83.2760186	Stream sediment
500106	-34.4850006	83.2735939	Stream sediment
500107	-34.4635214	83.2681328	Stream sediment
500108	-34.1228917	83.2969611	Stream sediment
500109	-34.1605014	83.2764853	Stream sediment
500110	-36.073319	82.985852	Stream sediment
500111	-36.0936017	82.9173267	Stream sediment
500112	-36.0949967	82.9194994	Stream sediment
500113	-36.0588511	82.9249603	Stream sediment
500114	-36.0588511	82.9249603	Stream sediment
500115	-36.0170623	82.9303945	Stream sediment
500116	-35.9745386	82.9324867	Stream sediment
500117	-36.3897714	82.9315853	Stream sediment
500118	-36.3794556	82.9389239	Stream sediment
500119	-36.3673856	82.9458011	Stream sediment
500120	-36.3486531	82.9507686	Stream sediment
500121	-36.29959	82.9583809	Stream sediment
500122	-36.2537351	82.9652147	Stream sediment
500123	-36.1724159	82.964555	Stream sediment
500124	-36.233227	82.9528875	Stream sediment
500125	-36.2876703	82.9478878	Stream sediment
500126	-36.335462	82.9366656	Stream sediment
500127	-46.8897131	81.4639931	Stream sediment
500128	-46.8897131	81.4639931	Stream sediment
500129	-46.960947	81.4800973	Stream sediment
500151	-34.3167939	83.2988172	Heavy mineral concentrate
500152	-34.2902722	83.2853045	Heavy mineral concentrate
500153	-34.6153022	83.2804817	Heavy mineral concentrate
500154	-34.6025617	83.2784756	Heavy mineral concentrate
500155	-34.5520397	83.2760186	Heavy mineral concentrate
500156	-34.4850006	83.2735939	Heavy mineral concentrate
500157	-34.4635214	83.2681328	Heavy mineral concentrate
500158	-34.1228917	83.2969611	Heavy mineral concentrate
500159	-36.073319	82.985852	Heavy mineral concentrate
500160	-36.3897714	82.9315853	Heavy mineral concentrate
500161	-36.29959	82.9583809	Heavy mineral concentrate

Sample #	*Longitude*	*Latitude*	*Type*	
500162	-36.2537351	82.9652147	Heavy mineral concentrate	
500163	-36.1724159	82.964555	Heavy mineral concentrate	
500164	-36.233227	82.9528875	Heavy mineral concentrate	
500165	-36.2876703	82.9478878	Heavy mineral concentrate	
500166	-36.335462	82.9366656	Heavy mineral concentrate	
500501	-67.0818331	80.3951383	Stream sediment	
500502	-67.3011951	80.3601517	Stream sediment	
500503	-66.8265084	80.3968817	Stream sediment	
500504	-66.9222792	80.4204208	Stream sediment	
500505	-66.7301686	80.46273	Stream sediment	
500506	-66.667582	80.5180478	Stream sediment	
500507	-66.3840725	80.5459323	Stream sediment	
500508	-66.1168923	80.562165	Stream sediment	
500509	-66.1168923	80.562165	Stream sediment	
500510	-66.8423119	80.6164956	Stream sediment	
500511	-66.0565426	80.6040286	Stream sediment	
500512	-65.9985478	80.6594914	Stream sediment	
500513	-61.6464331	80.6458231	Stream sediment	
500514	-61.6334298	80.6431353	Stream sediment	
500551	-67.0818331	80.3951383	Heavy mineral concentrate	
500552	-67.3011951	80.3601517	Heavy mineral concentrate	
500553	-66.8265084	80.3968817	Heavy mineral concentrate	
500554	-66.9222792	80.4204208	Heavy mineral concentrate	
500555	-66.7301686	80.46273	Heavy mineral concentrate	
500556	-66.667582	80.5180478	Heavy mineral concentrate	
500557	-66.3840725	80.5459323	Heavy mineral concentrate	
500558	-66.1168923	80.562165	Heavy mineral concentrate	
500559	-66.1168923	80.562165	Heavy mineral concentrate	
500560	-66.8423119	80.6164956	Heavy mineral concentrate	
500561	-66.0565426	80.6040286	Heavy mineral concentrate	
500562	-65.9985478	80.6594914	Heavy mineral concentrate	
500563	-61.6464331	80.6458231	Heavy mineral concentrate	
500564	-61.6334298	80.6431353	Heavy mineral concentrate	
94-15*			Drill core	
94-17*			Drill core	
94-53*			Drill core	
f080302*	54056	916274	Rock	UTM zone 22
g072405*	46528	918632	Rock	UTM zone 24
g073101*	54141	916124	Rock	UTM zone 22
g080301*	54006	916431	Rock	UTM zone 22
g0809md*	49663	912450	Rock	UTM zone 21
g0809md*	49621	912437	Rock	UTM zone 21
r072901*	52417	915170	Rock	UTM zone 22
r080606*	50180	912584	Rock	UTM zone 21
r081002*	45884	911312	Rock	UTM zone 24

* Platinova samples

Sample #	Longitude	Latitude	Type	
r081201*	45999	911387	Rock	UTM zone 21
r081303*	50176	912568	Rock	UTM zone 21
s072304*	46555	918689	Rock	UTM zone 24
s072806*	51848	918365	Rock	UTM zone 23
z080901*	49321	912381	Rock	UTM zone 21

* Platinova samples

Appendix 3a

Geochemical data, Citronen Fjord, drill core CF94-53 (HF)

Depth	*SiO_2*	*Al_2O_3*	*Fe_2O_3*	*MnO*	*MgO*	*CaO*	*Na_2O*	*K_2O*	*TiO_2*	*P_2O_5*	*LOI*
(Unit)	%	%	%	%	%	%	%	%	%	%	%
(Det. lim.)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
(Method)	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP
8.0	13.05	3.16	6.77	0.04	1.52	39.03	0.03	1.17	0.13	0.01	27.36
19.8	2.86	1.15	2.43	0.04	2.02	49.57	0.02	0.41	0.04	0.67	39.54
43.2	42.49	12.18	6.65	0.03	3.65	11.97	0.08	4.55	0.55	0.09	14.26
50.0	32.71	10.29	4.64	0.06	3.67	23.19	0.21	3.3	0.44	0.09	20.01
53.0	29.86	8.55	5.08	0.06	2.99	26.55	0.18	2.7	0.37	0.07	22.13
56.9	45.75	13.73	5.77	0.06	4.72	10.09	0.18	4.69	0.59	0.1	13.43
60.0	51.15	15.04	5.91	0.05	4.46	6.03	0.46	4.59	0.68	0.11	10.28
62.9	50.55	14.24	6.05	0.05	4.28	7.00	0.36	4.62	0.65	0.11	10.65
67.0	47.45	13.68	6.08	0.06	4.08	9.41	0.23	4.37	0.61	0.15	12.59
71.0	40.25	11.34	4.67	0.05	3.61	15.57	0.13	3.59	0.5	0.08	15.69
74.0	44.55	13.35	5.12	0.04	3.61	12.67	0.29	4.34	0.58	0.10	12.63
76.7	46.75	13.29	5.08	0.05	4.59	10.52	0.25	4.31	0.62	0.11	13.07
81.9	46.60	13.8	5.75	0.04	4.02	9.21	0.20	4.38	0.61	0.11	12.18
85.4	44.89	12.85	6.34	0.04	4.04	11.80	0.22	4.09	0.60	0.09	13.61
86.8	44.31	13.19	7.12	0.04	4.14	11.45	0.19	3.90	0.60	0.09	13.77
92.1	44.04	13.15	6.33	0.05	4.30	10.90	0.14	4.22	0.58	0.09	13.48
95.9	42.45	12.96	7.10	0.05	4.17	11.74	0.18	4.20	0.56	0.10	13.79
97.7	46.99	14.09	5.95	0.05	4.60	9.32	0.20	5.21	0.63	0.11	12.34
102.2	24.43	6.77	26.39	0.03	2.57	9.46	0.05	2.06	0.31	0.04	14.21
104.0	46.55	12.66	6.24	0.06	4.86	9.83	0.20	4.62	0.58	0.09	13.04
108.7	40.19	12.51	8.34	0.06	5.32	12.66	0.20	3.99	0.54	0.08	14.77
111.8	41.92	11.94	5.47	0.09	4.90	13.91	0.08	4.31	0.55	0.17	16.06
119.9	44.01	12.62	5.76	0.10	4.84	11.86	0.06	4.71	0.63	0.09	14.55
126.8	44.87	12.89	5.02	0.06	5.22	11.14	0.10	4.40	0.59	0.10	14.64
132.0	41.32	10.53	4.09	0.07	6.01	14.11	0.05	4.34	0.51	0.12	18.45
136.7	42.53	12.95	9.61	0.06	5.79	10.96	0.06	2.99	0.58	0.53	12.09
138.6	1.28	0.21	5.71	0.09	2.20	46.81	0.01	0.07	0	0	33.48
149.1	2.52	0.55	10.00	0.06	1.89	42.94	0.02	0.20	0.01	0	32.18
154.6	2.28	0.29	10.47	0.05	0.62	41.88	0.01	0.10	0	0	24.58
164.7	4.17	1.45	11.14	0.07	1.36	43.48	0.02	0.58	0.06	0	28.89

Depth	SiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	LOI
204.9	24.85	1.84	26.62	0.05	0.76	15.58	0.02	0.67	0.08	0.01	9.49
208.0	65.02	4.33	2.90	0.03	1.17	11.67	0.03	1.63	0.19	0.02	11.63
208.6	36.75	3.27	5.96	0.07	1.07	25.52	0.03	1.20	0.15	0.24	18.08
212.6	52.21	2.10	3.10	0.06	0.69	20.33	0.02	0.78	0.09	0.08	15.66
216.7	39.59	2.18	8.84	0.09	1.51	21.36	0.02	0.80	0.10	0.03	16.06
219.9	9.88	0.17	3.84	0.12	1.77	44.06	0	0.08	0	0	35.04
224.4	11.14	0.38	14.29	0.08	1.23	30.5	0	0.13	0.01	0.02	13.29
225.0	29.98	1.95	9.60	0.09	1.44	26.44	0.03	0.77	0.08	0.04	12.39
227.5	39.13	1.55	5.95	0.08	1.35	25.56	0.02	0.53	0.06	0.42	15.12
230.2	10.43	0.30	18.55	0.09	2.23	29.23	0	0.11	0	0	9.65
236.4	30.66	1.83	8.66	0.08	4.77	22.99	0.02	0.63	0.08	0.32	13.45
240.9	28.42	7.65	8.66	0.18	7.39	18.16	0.03	2.94	0.37	0.14	25.48
244.7	45.47	2.90	5.67	0.08	2.49	19.01	0.02	1.10	0.13	0.79	14.20
252.1	12.98	1.45	14.38	0.16	8.28	24.17	0.03	0.50	0.06	0.04	16.73
253.2	39.42	10.12	6.68	0.11	5.84	11.82	0.04	3.89	0.45	0.12	16.52
256.9	1.33	0.27	12.84	0.10	1.07	42.56	0.02	0.11	0	0	16.27
261.0	11.56	2.57	17.93	0.20	9.68	18.92	0.09	0.78	0.11	0	16.66

Appendix 3b

Depth	*Ag*	*As*	*Au*	*Ba*	*Be*	*Bi*	*Br*	*C*	*Cd*	*Ce*	*Co*
(Unit)	ppm	ppm	ppb	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
(Det. lim.)	(0.4)	(2)	(5)	(2)	(1)	(5)	(10)	(0.01)	(0.5)	(3)	(10)
(Method)	ICP	INAA	INAA	ICP	ICP	ICP	INAA	LECO	ICP	INAA	INAA
8.0	0	6	0	101	0	0	0	8.6	0	16	6
19.8	0	5	0	33	0	0	0	11.2	1.4	8	5
43.2	0	13	0	337	2	0	0	3.75	5.7	51	10
50.0	0	16	0	262	2	0	0	5.64	1.7	56	24
53.0	0	12	0	219	2	0	0	6.89	0.7	52	20
56.9	0	8	0	355	2	0	0	3.42	0	65	14
60.0	0	14	0	431	3	0	0	2.5	0.5	64	17
62.9	0.5	14	10	370	2	0	1	2.68	0.6	64	17
67.0	0	8	0	348	3	0	0	3.29	1.3	67	16
71.0	0	10	0	286	2	0	0	4.4	0.9	57	14
74.0	0	6	0	345	2	0	0	3.63	2	63	16
76.7	0	5	6	337	2	0	0	3.38	0	70	14
81.9	0	10	6	369	3	0	0	3.08	0.7	65	17
85.4	0	13	0	305	2	0	0	3.47	1.6	64	19
86.8	0	15	5	311	2	0	0	3.42	1.1	64	19
92.1	0	16	9	312	2	0	0	3.31	0.7	67	20
95.9	0.7	11	11	310	2	0	0	3.59	2.2	64	20
97.7	0.5	9	8	361	2	0	0	2.96	0.8	68	18
102.2	0.8	55	8	164	1	0	0	2.98	15.8	37	9
104.0	0	12	6	322	2	0	0	3.48	2.6	63	11
108.7	0	24	0	278	2	0	0	4.35	0.6	65	56
111.8	0	12	0	318	2	0	0	4.27	0	65	12
119.9	0	0	0	333	2	0	0	3.77	0	65	15
126.8	0	10	14	321	2	0	0	3.93	0	61	12
132.0	0	7	0	298	2	0	0	4.87	0	55	11
136.7	0.5	3	6	259	2	0	0	2.81	0	63	10
138.6	0	6	0	14	0	0	0	10.6	40.3	8	15
149.1	0	0	0	29	0	0	1	9.73	0	5	1
154.6	0	5	0	13	0	0	0	8.49	0.8	5	2
164.7	0	6	11	53	0	6	0	9.35	0	13	5

Depth	Ag	As	Au	Ba	Be	Bi	Br	C	Cd	Ce	Co
204.9	1.5	30	15	44	0	0	2	4.39	3.6	14	3
208.0	0	12	0	109	2	0	0	5.32	0	19	8
208.6	2.6	55	0	82	2	0	0	7.18	0	27	8
212.6	1.4	15	0	51	2	0	0	5.53	0	11	4
216.7	1	12	0	50	2	0	0	6.01	5.7	15	3
219.9	0	4	0	9	0	0	0	10.4	1	10	0
224.4	1.1	8	0	9	0	0	2	7.33	35.5	9	1
225.0	3.1	25	0	37	1	0	1	7.38	6.3	13	4
227.5	1.1	46	0	27	2	0	0	6.86	0.5	11	3
230.2	1.8	15	0	14	0	0	0	7.42	0	7	2
236.4	0.7	31	0	36	1	0	0	7.24	0	10	6
240.9	0	0	0	319	5	0	0	7.13	0	38	3
244.7	1.3	90	0	90	2	0	0	6.41	0	28	5
252.1	1.7	35	0	60	0	0	3	8.13	0	15	5
253.2	1.1	29	6	433	3	0	0	5.11	0	45	7
256.9	0.8	3	0	18	0	0	1	9.32	0	8	0
261.0	0.6	7	0	112	1	0	3	7.95	0	5	4

Appendix 3c

Depth	*Cr*	*Cs*	*Cu*	*Eu*	*Fe*	*Hf*	*Hg*	*Ir*	*La*	*Lu*	*Mo*
(Unit)	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm
(Det. lim.)	(10)	(0.5)	(1)	(0.1)		(0.5)	(1)	(5)	(0.5)	(0.05)	(5)
(Method)	INAA	INAA	ICP	INAA		INAA	INAA	INAA	INAA	INAA	INAA
8.0	25	1.3	35	0.2	6.77	0.8	0	0	8.2	0.09	0
19.8	8	0	13	0.2	2.43	0	0	0	4.6	0	0
43.2	64	5.2	27	0.4	6.65	3.1	0	0	26.7	0.22	0
50.0	62	3.8	55	0.7	4.64	2.3	0	0	27.5	0.29	0
53.0	50	2.2	60	0.8	5.08	2	0	0	26.3	0.32	0
56.9	67	5.1	31	1	5.77	3.3	0	0	34.6	0.32	0
60.0	75	5.7	34	0.9	5.91	3.3	0	0	34	0.29	0
62.9	71	5.1	48	0.9	6.05	3.1	0	0	34.1	0.34	0
67.0	66	4.6	79	1	6.08	3	0	0	33.6	0.34	0
71.0	67	4.3	26	1.1	4.67	2.3	0	0	30.9	0.3	0
74.0	64	5.3	45	1	5.12	3.2	0	0	34	0.33	0
76.7	73	4.9	22	0.9	5.08	3.3	0	0	36.7	0.38	0
81.9	68	5.7	49	1.1	5.75	3.1	0	0	34.6	0.32	0
85.4	69	5.8	35	1.1	6.34	3.1	0	0	34.4	0.36	0
86.8	69	6.2	44	1	7.12	3.1	0	0	32.4	0.31	0
92.1	69	5	23	1.1	6.33	3.1	0	0	35.2	0.39	0
95.9	74	5	84	1.2	7.1	3	0	0	34.3	0.33	0
97.7	73	5.6	76	1	5.95	3.4	0	0	36.1	0.33	0
102.2	37	2.8	64	0.7	26.39	1.7	0	0	19.7	0.26	0
104.0	62	5.5	39	0.9	6.24	3.2	0	0	31.9	0.35	0
108.7	71	3.5	200	0.9	8.34	2.3	0	0	34.4	0.35	0
111.8	63	4.4	27	1	5.47	3.1	0	0	33.4	0.38	0
119.9	73	4.9	37	1	5.76	3.3	0	0	32.4	0.38	0
126.8	68	4.5	44	0.9	5.02	3	0	0	32.1	0.33	0
132.0	58	4.1	54	0.9	4.09	3.1	0	0	28.8	0.33	0
136.7	63	3.3	43	1.1	9.61	2.8	0	0	35.3	0.31	0
138.6	7	0	71	0.2	5.71	0	0	0	5.2	0.06	0
149.1	6	0	24	0.2	10	0	0	0	3.9	0	0
154.6	10	0	6	0.1	10.47	0	1	0	3.6	0	0
164.7	11	0	50	0.2	11.14	0	0	0	6	0.05	0

Depth	*Cr*	*Cs*	*Cu*	*Eu*	*Fe*	*Hf*	*Hg*	*Ir*	*La*	*Lu*	*Mo*
204.9	37	0	62	0.3	26.62	0.6	0	0	7.3	0.08	13
208.0	71	1.4	19	0.4	2.9	1	0	0	11.4	0.15	8
208.6	99	1.1	24	0.6	5.96	0.6	0	0	15.7	0.24	0
212.6	53	0	18	0.4	3.1	0	0	0	8.2	0.15	5
216.7	39	0	16	0.4	8.84	0	0	0	11.5	0.16	5
219.9	13	0	4	0.3	3.84	0	0	0	7.8	0.05	0
224.4	13	0	23	0.3	14.29	0	0	0	4.4	0.06	0
225.0	30	0	71	0.3	9.6	0	0	0	8.4	0.08	7
227.5	52	0	27	0.4	5.95	0	0	0	9.6	0.11	6
230.2	31	0	29	0.3	18.55	0	0	0	5	0.07	0
236.4	64	0	28	0.4	8.66	0.5	0	0	6.1	0.18	0
240.9	41	1.6	65	0.7	8.66	2.1	0	0	24.2	0.26	0
244.7	110	0	46	0.7	5.67	0.7	0	0	19.4	0.24	0
252.1	40	1.3	45	0.5	14.38	0	0	0	10.8	0.14	0
253.2	70	2.2	28	0.7	6.68	2.5	0	0	24.5	0.23	0
256.9	21	0	4	0	12.84	0	0	0	7	0	0
261.0	26	0	54	0	17.93	0.8	0	0	4.8	0.07	6

Appendix 3d

Depth	Nd	Ni	Pb	Rb	S	Sb	Sc	Se	Sm	Sr	Ta
(Unit)	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(5)	(1)	(5)	(20)	(0.01)	(0.2)	(0.1)	(3)	(0.1)	(2)	(1)
(Method)	INAA	ICP	ICP	INAA	LECO	INAA	INAA	INAA	INAA	ICP	INAA
8.0	7	27	375	40	4.6	0.8	2.9	0	1.2	149	0
19.8	0	14	149	0	1.54	0.5	1.1	0	0.6	192	0
43.2	23	30	177	121	3.55	2.5	11	0	3.3	63	0
50.0	20	39	78	108	1.77	1.4	9.1	0	4.2	127	0
53.0	22	42	152	99	2.01	1.4	7.7	0	4.2	145	0
56.9	27	34	48	138	0.908	0.7	13	0	5.1	76	0
60.0	26	39	60	154	1.28	1.5	13	0	4.8	53	0
62.9	24	42	58	158	1.65	1.8	12	0	5	60	0
67.0	26	44	96	125	1.46	0.6	12	0	5.2	92	0
71.0	21	33	54	97	1.13	0.7	11	0	4.8	137	1
74.0	29	33	53	124	1.02	0.4	12	0	4.9	113	0
76.7	31	33	10	131	0.347	0.5	13	0	5.4	96	0
81.9	26	45	88	106	1.24	0.7	12	0	4.8	84	0
85.4	26	29	87	148	2.21	1.8	12	0	5.2	108	0
86.8	29	41	108	136	2.01	1.3	12	0	5	101	0
92.1	26	38	46	141	1.56	1.1	13	0	5.3	92	0
95.9	26	52	265	134	2.42	1	12	0	5.1	110	0
97.7	23	35	102	134	1.46	0.4	13	0	5.1	86	0
102.2	19	28	1356	59	19.5	5.8	6.7	0	3	83	0
104.0	23	29	225	122	1.91	0.8	11	0	5	83	1
108.7	24	89	222	126	2.45	0.9	11	0	4.9	87	0
111.8	23	28	19	115	0.122	0.4	11	0	5	117	1
119.9	28	42	61	127	0.425	0.6	12	0	4.9	106	0
126.8	29	39	64	134	0.598	0.5	12	0	4.8	83	0
132.0	21	38	23	103	0.233	0.4	10	0	4.4	108	0
136.7	25	25	13	80	0.705	0.3	11	0	5	133	0
138.6	0	15	180	0	4.52	1.3	0.5	0	0.9	156	0
149.1	0	5	314	0	5.03	0.3	0.7	0	0.4	131	0
154.6	0	7	404	0	16.5	0.7	0.5	0	0.4	127	0
164.7	7	16	195	0	5.34	0.4	1.8	0	0.9	127	0

Depth	Nd	Ni	Pb	Rb	S	Sb	Sc	Se	Sm	Sr	Ta
204.9	6	19	897	0	19.1	2.2	2.3	0	1	61	0
208.0	11	34	103	34	1.96	1.8	5.2	0	1.7	57	0
208.6	16	37	342	0	4	3.5	4.1	4	3.3	101	0
212.6	7	21	216	0	2.25	2.8	2.6	0	1.4	84	0
216.7	7	20	818	0	4.81	1.6	2.5	6	2	93	0
219.9	6	4	49	0	2.42	0.4	0.5	0	1.1	135	0
224.4	5	10	531	0	6.77	1	0.5	0	0.9	110	0
225.0	6	28	230	0	6.75	2.7	2.4	5	1.3	112	0
227.5	11	17	130	0	3.98	2	2	0	1.5	109	0
230.2	0	16	172	0	16.6	4.3	0.6	0	0.8	107	0
236.4	8	27	185	0	5.48	1.4	2.4	0	1.4	112	0
240.9	17	15	28	60	0.852	0.2	7	0	3.1	163	0
244.7	17	38	151	0	3.13	2.4	3.7	0	3.3	156	0
252.1	11	27	333	0	6.25	2.2	1.8	0	1.7	98	0
253.2	21	33	62	100	2.84	1.7	9.4	0	3.7	68	0
256.9	9	5	107	0	6.15	0.6	0.5	0	0.4	116	0
261.0	0	69	351	32	6.74	1.2	2.1	0	0.5	54	0

Appendix 3e

Depth	*Tb*	*Th*	*U*	*V*	*W*	*Y*	*Yb*	*Zn*	*Zr*
(Unit)	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(0.5)	(0.5)	(0.5)	(5)	(3)	(2)	(0.1)	(1)	(1)
(Method)	INAA	INAA	INAA	ICP	INAA	ICP	INAA	ICP	ICP
8.0	0	2	1	17	0	7	0.6	74	18
19.8	0	0.7	3	10	0	6	0.3	531	0
43.2	0.8	8.2	2.1	79	0	9	1.3	2408	112
50.0	0.7	6.9	1.9	81	0	18	2	890	89
53.0	0	5.6	2.5	83	0	22	2	188	71
56.9	0	9.3	2.2	77	0	22	2.1	47	109
60.0	0	10	2.1	94	0	23	2.1	76	122
62.9	0	8.6	1.9	94	0	23	2.2	60	132
67.0	0	8.8	1.6	97	0	25	2.2	357	118
71.0	0	7.6	1.3	85	0	22	2.2	302	89
74.0	0	8.8	1.8	82	0	23	2.2	539	116
76.7	0.9	9.8	2.5	91	0	24	2.4	59	118
81.9	0.6	9.2	1.7	91	0	24	2.1	205	143
85.4	0.8	9	1.9	85	0	24	2.5	684	115
86.8	1.1	8.4	1.8	81	0	23	2.2	501	114
92.1	0.9	9.4	2.5	81	0	25	2.5	430	113
95.9	0.7	9	1.9	102	0	24	2.5	858	107
97.7	1	9.6	2	87	0	24	2.4	371	156
102.2	0.5	5.1	1.3	61	0	17	1.4	7245	65
104.0	0.9	8.3	1.7	91	0	25	2.4	1023	132
108.7	0.7	7.8	2	97	0	21	2	320	97
111.8	0.9	8	2.5	82	0	25	2.5	125	120
119.9	0	8.1	1.8	82	0	24	2.2	98	111
126.8	0	8	2.3	108	0	23	2.2	50	110
132.0	0	7.1	1.8	72	0	22	2.1	39	122
136.7	0	8.4	1.6	113	0	22	1.9	145	109
138.6	0	0	0	0	0	8	0.6	12124	0
149.1	0	0	0	0	0	3	0.2	196	8
154.6	0	0	0	6	0	4	0.1	482	6
164.7	0	0.8	0	0	0	9	0.4	38	30

Depth	*Tb*	*Th*	*U*	*V*	*W*	*Y*	*Yb*	*Zn*	*Zr*
204.9	0	1.1	1.3	81	0	7	0.5	2308	21
208.0	0	2.6	3.6	314	0	10	0.8	96	32
208.6	0	2.5	3	233	0	19	1.4	99	30
212.6	0	1.3	1.8	170	0	12	1	86	17
216.7	0	1.6	1.7	144	0	14	1	2758	21
219.9	0	0	0	10	0	9	0.4	583	1
224.4	0	0.5	0.5	28	0	7	0.4	20438	4
225.0	0	1.7	1.7	130	0	11	0.6	2702	20
227.5	0	1	1.6	155	0	13	0.7	236	12
230.2	0	0	0.7	21	0	8	0.4	18	6
236.4	0	1.2	1.3	120	0	15	1.1	264	23
240.9	0	5.2	1.9	81	0	17	1.8	74	77
244.7	0	2.4	2.4	200	0	25	1.7	22	34
252.1	0	0.8	0.7	49	4	16	1	30	20
253.2	0	6.3	2.2	122	0	15	1.7	25	88
256.9	0	0	0	0	0	4	0	81	14
261.0	0	1.9	2.2	83	0	5	0.3	97	41

Appendix 4a

Geochemical data, Washington Land (SMJ)

Sample #	*Ag*	*Al*	*As*	*Au*	*Ba*	*Bi*	*Br*	*Ca*	*Cd*	*Ce*	*Co*
(Unit)	ppm	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm
(Det. lim.)	(0.4)	(0.01)	(0.5)	(2)	(50)	(5)	(0.5)	(0.01)	(0.5)	(3)	(1)
(Method)	ICP	ICP	INAA	INAA	INAA	ICP	INAA	ICP	ICP	INAA	INAA
447001	0	0.25	8.5	0	110	0	5.6	24.98	0	10	2
447003	0.5	0.13	3.3	0	0	0	9.2	24.25	6.7	0	0
447004	0	0.08	0.9	0	0	6	6.1	25.56	15.8	0	0
447005	0	0.14	1.8	0	2300	5	2	26.77	1.7	0	2
447008	6.5	0.03	10	3	210	0	1.3	47.16	8.1	5	5
447010	0.5	1.61	22	0	2200	0	2.4	6.95	4.1	31	5
447011	0.4	3.04	7.2	0	440	7	5.7	5.82	0.5	40	6
447012	0.9	0.01	28	0	70	0	2.7	43.3	2.7	0	1
447013	36.7	0.03	310	0	290	0	0	9.24	443.5	0	18
447014	0	0.47	2.9	2	0	0	2.3	45.47	0.7	8	2
447016	6.6	0.44	250	0	370	0	4.5	26.95	0	10	44
447017	5	0.24	150	0	130	0	3.8	22.79	0	7	17
447018	30.9	0.05	1.2	0	0	0	8.8	23.34	88.5	6	1
447021	1.6	0.02	0	0	0	6	10	19	23.3	10	7
447022	1.4	0.21	0	0	450	0	4.5	9.36	4.9	6	8
447023	18	0.04	0	0	0	0	0	6.94	145	4	0
447024	0.4	0.04	2.1	0	0	0	2.5	3.02	2.2	0	0
447025	0.5	0.02	0.9	0	52	0	13	25.42	0	7	0
447026	0.4	0.04	1.2	0	0	0	11	23.32	1.2	16	0
447027	0	0.01	2	0	0	0	0	15.01	375.6	8	0
447028	4.4	0.01	0.9	0	0	0	9.1	22.37	10.1	7	1
447029	2.5	0.02	1.6	0	0	0	7.6	18.01	19.6	4	0
447030	3.7	0.01	0	3	0	0	8.9	24.06	5.1	4	0
447031	0.5	0.42	10	0	53	0	0.8	38.69	0	12	2
447032	0	0.16	5.2	0	100	0	1	33.26	0	8	1
447033	167	0.02	0	0	0	5	0	5.8	840.6	4	1
447034	1.3	0.26	0	0	67	0	3	12.52	2.4	6	1
447035	1.6	0.02	0	3	0	0	3.6	23.6	50.7	4	0
447036	2.3	0.02	1.4	0	0	0	5.6	17.34	13.1	0	0
447037	0.9	0.01	0	0	0	0	6.4	23.56	9.7	15	0
447038	0.7	0.04	1.1	0	0	0	3.2	7.88	3.3	0	0
447040	1.4	0.07	1.2	0	0	0	8.1	11.83	2.6	4	2
447043	0	0.06	0	0	0	0	3.5	9.06	20.9	4	0
447044	0	0.04	0	0	160	0	0	2.66	2.2	0	0
447045	0	0.03	1.4	0	100	0	0	1.13	0	0	0
447046	0	0.05	0	4	0	0	6.5	10.73	0	8	1
447047	0	0.04	1.3	0	0	0	2.9	6.5	0	0	0

Appendix 4b

Sample #	***Cr***	***Cs***	***Cu***	***Eu***	***Fe***	***Hf***	***Hg***	***Ir***	***K***	***La***	***Lu***
(Unit)	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	%	ppm	ppm
(Det. lim.)	(5)	(1)	(1)	(0.2)	(0.02)	(1)	(1)	(5)	(0.01)	(0.1)	(0.05)
(Method)	INAA	INAA	ICP	INAA	INAA	INAA	INAA	INAA	ICP	INAA	INAA
447001	6	0	32	0.2	0.77	0	0	0	0.18	8.5	0.08
447003	0	0	24	0	0.26	0	0	0	0.11	1.9	0
447004	0	0	17	0	0.11	0	0	0	0.07	2.4	0
447005	10	0	15	0	0.19	0	0	0	0.08	2.4	0
447008	6	0	182	0	0.11	0	0	0	0.03	3.8	0
447010	42	2	72	1	12.5	2	0	0	0.66	22	0.31
447011	63	2	111	1.1	3.8	2	0	0	1.59	29	0.39
447012	0	0	19	0	1.46	0	0	0	0.01	1.5	0
447013	0	0	276	0	24	0	4	0	0.01	2.3	0
447014	8	0	7	0.4	0.54	0	0	0	0.09	16	0.11
447016	13	0	149	0.3	12.1	0	0	0	0.32	9.2	0.11
447017	16	0	271	0.3	9.05	0	0	0	0.14	8.7	0.08
447018	5	0	36	0	2.4	0	2	0	0.03	2.8	0
447021	0	0	25	0	12.1	0	0	0	0.02	4.6	0
447022	9	0	17	0	22.6	0	0	0	0.04	2.7	0
447023	0	0	7	0.2	24.8	0	26	0	0.02	2.1	0
447024	10	0	2	0	34.7	0	0	0	0.03	0	0
447025	0	0	3	0	2.09	0	0	0	0.01	2.9	0
447026	0	0	3	0	4.44	0	0	0	0.02	4.7	0.08
447027	0	0	2	0	6.89	0	11	0	0.01	4	0
447028	0	0	12	0	6.71	0	0	0	0.01	2.5	0
447029	0	0	8	0	9.8	0	1	0	0.02	1.6	0
447030	0	0	13	0	1.76	0	0	0	0.01	1.7	0
447031	8	0	2	0.3	1.35	0	0	0	0.29	8.6	0.09
447032	5	0	2	0	2.95	0	0	0	0.1	5.6	0.06
447033	0	0	80	0	4.96	0	47	0	0.01	0.6	0
447034	9	0	2	0	18.2	1	0	0	0.19	2.8	0
447035	0	0	22	0	1.35	0	17	0	0.02	1.9	0
447036	0	0	2	0	15.2	0	0	0	0.01	1.5	0
447037	0	0	2	0	5.29	0	0	0	0.02	5	0
447038	11	0	2	0	33.6	0	0	5	0.02	0.8	0
447040	11	0	2	0	25.4	0	0	0	0.03	2.2	0
447043	8	0	2	0	32.7	0	2	0	0.03	2.2	0
447044	13	0	2	0	42.9	0	0	0	0.03	0	0
447045	11	0	2	0	37.2	0	0	0	0.02	0	0
447046	8	0	2	0	27.1	0	0	0	0.03	1.9	0
447047	10	0	2	0	30	0	0	0	0.02	0	0

Appendix 4c

Sample #	Mg	Mn	Mo	Na	Nd	Ni	P	Pb	Rb	Sb	Sc
(Unit)	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm
(Det. lim.)	(0.01)	(1)	(2)	(0.01)	(5)	(1)	(0.001)	(4)	(15)	(0.1)	(0.1)
(Method)	ICP	ICP	ICP	INAA	INAA	ICP	ICP	ICP	INAA	INAA	INAA
447001	9.38	240	2	0.04	6	28	0.068	0	0	0.8	1.2
447003	10	54	2	0.04	0	12	0.009	12	0	0.7	0.4
447004	9.99	68	0	0.03	0	7	0.007	1964	0	0.1	0.4
447005	0.29	51	0	0.02	0	7	0.003	29	0	0.1	0.4
447008	0.3	68	117	0.02	0	15	0.006	297	0	0.3	0.5
447010	0.36	55	18	0.19	19	54	0.677	58	47	5.4	3.3
447011	0.75	123	5	0.27	24	65	0.631	38	48	2.5	5.9
447012	0.1	100	4	0.03	0	35	0.003	66	0	0.2	0.1
447013	0.04	147	153	0.02	0	145	0.005	12534	0	26	0.2
447014	0.12	117	0	0.02	10	4	0.013	19	0	0.3	1.2
447016	0.22	75	76	0.11	0	206	0.048	703	0	20	1.1
447017	0.14	56	27	0.04	10	83	0.019	448	0	5.8	0.9
447018	9.48	762	0	0.02	0	3	0.005	26164	0	0	0.1
447021	7.91	632	2	0.02	6	13	0.006	1826	0	0	0
447022	4.29	394	2	0.02	0	69	0.009	272	0	0	0.3
447023	3.24	220	0	0.01	0	2	0.004	133	0	0.8	0
447024	1.33	66	0	0.01	0	2	0.005	102	0	0	0
447025	9.46	670	0	0.02	0	2	0.005	13	0	0	0.1
447026	9.68	775	0	0.02	10	2	0.005	6432	0	0	0.2
447027	7.01	415	2	0.02	0	2	0.005	3419	0	0	0
447028	9.06	781	0	0.02	5	5	0.005	586	0	0	0.1
447029	7.85	697	0	0.01	0	5	0.005	26892	0	0	0
447030	9.4	1044	0	0.02	0	2	0.005	164	0	0	0.1
447031	1.62	134	2	0.06	7	4	0.015	173	0	1.7	1.4
447032	0.19	146	0	0.04	0	2	0.01	19	0	0.8	0.6
447033	2.49	627	11	0.01	0	2	0.006	24962	0	2.1	0
447034	4.06	482	0	0.02	0	2	0.008	308	0	0	0.5
447035	9.85	400	0	0.03	0	2	0.006	80	0	0	0.1
447036	8.16	488	0	0.02	0	2	0.005	236	0	0	0
447037	9.4	672	2	0.02	9	2	0.005	38	0	0	0.2
447038	3.7	240	0	0.01	0	2	0.004	83	0	0	0.1
447040	5.6	432	0	0.01	0	27	0.007	1830	0	0	0.1
447043	4.6	325	0	0.01	0	4	0.004	127	0	0	0.2
447044	0.65	60	0	0.01	0	2	0.002	132	0	0	0
447045	0.09	7	0	0.01	0	2	0.002	49	0	0	0
447046	5.13	423	0	0.02	0	4	0.005	89	24	0	0
447047	2.91	230	2	0.01	0	2	0.003	75	0	0	0

Appendix 4d

Sample	Se	Sm	Sn	Sr	Tb	Th	Ti	U	V	Y	Yb	Zn
(Unit)	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(3)	(0.1)	(0.01)	(1)	(0.5)	(0.5)	(0.01)	(0.5)	(2)	(2)	(0.2)	(1)
(Method)	INAA	INAA	INAA	ICP	INAA	INAA	ICP	INAA	ICP	ICP	INAA	ICP
447001	0	0.9	0	63	0	0.6	0.01	2.3	17	11	0.5	2
447003	0	0.2	0	30	0	0	0.01	2.1	10	6	0	475
447004	0	0.3	0	57	0	0.3	0.01	1.1	6	8	0.3	5533
447005	0	0.2	0	202	0	0.2	0.01	0.8	3	6	0.2	1511
447008	0	0.4	0	300	0	0	0.01	12	7	10	0.3	744
447010	4	3.6	0	180	0	2.9	0.08	4.2	117	29	1.7	486
447011	0	4.4	0	160	0.8	4.5	0.15	5.9	306	41	2.4	294
447012	0	0.2	0	82	0	0	0.01	0.5	137	7	0	147
447013	16	0.2	0	36	0	0	0.01	0	66	5	0	52264
447014	0	1.5	0	98	0	0.6	0.02	0	8	19	0.7	73
447016	0	1.1	0	145	0	0.8	0.02	4.2	54	17	0.7	51
447017	0	0.9	0	131	0	0.4	0.01	4.6	40	13	0.6	16
447018	0	0.5	0	28	0	0	0.01	0	7	4	0	25464
447021	0	0.9	0	27	0	0	0.01	0	3	4	0	9791
447022	0	0.5	0	22	0	0.3	0.01	0	6	4	0	1975
447023	4	0.4	0	11	0	0	0.01	2.2	6	2	0	84400
447024	0	0	0	7	0	0	0.01	0	3	2	0	656
447025	0	0.7	0	30	0	0	0.01	0.6	8	4	0	127
447026	0	2.9	0	26	0	0	0.01	0	6	7	0.4	368
447027	0	0.6	0	19	0	0	0.01	0	6	2	0	152000
447028	0	0.7	0	21	0	0	0.01	0	6	4	0	2463
447029	0	0.3	0	22	0	0	0.01	0	5	2	0	4405
447030	0	0.5	0	30	0	0	0.01	0	4	2	0	1299
447031	0	1.1	0	146	0	0.9	0.02	1	7	12	0.6	51
447032	0	0.5	0	141	0	0.3	0.01	0	4	8	0.4	10
447033	0	0	0	112	0	0	0.01	0	4	2	0	287000
447034	0	0.8	0	22	0	0.8	0.01	1	4	4	0.2	669
447035	0	0.6	0	20	0	0	0.01	0.8	3	4	0	27615
447036	0	0.3	0	18	0	0	0.01	0	5	2	0	4680
447037	0	2.3	0	27	0	0.2	0.01	0.8	8	6	0	2700
447038	0	0.2	0	12	0	0	0.01	0	8	2	0	1644
447040	0	0.4	0	18	0	0	0.01	0	7	2	0	1089
447043	0	0.3	0	8	0	0	0.01	0	6	4	0	5807
447044	0	0	0.02	4	0	0.5	0.01	0	3	2	0	696
447045	0	0	0	2	0	0	0.01	0	2	2	0	106
447046	0	0.4	0	24	0	0	0.01	0	7	4	0.2	55
447047	0	0	0	11	0	0	0.01	0	6	2	0	277

Appendix 5a

Geochemical data, stream sediments, North Greenland (SMJ)

Sample	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Volat.
(Unit)	%	%	%	%	%	%	%	%	%	%	%
(Det. lim.)	(0.01)	(0.002)	(0.05)	(0.0015)	(0.001)	(0.05)	(0.0007)	(0.1)	(0.003)	(0.002)	
(Method)	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	XRF	
388701	51.61	0.48	9.29	3.54	0.06	5.07	10.76	0.49	2.93	0.21	14.73
388702	48.95	0.51	10.51	4.06	0.06	5.49	10.24	0.46	3.63	0.16	14.86
388703	48.48	0.74	8.04	3.93	0.07	5.77	12.61	0.64	2.46	0.35	15.90
388704	47.34	0.50	7.32	3.11	0.05	6.70	12.76	0.44	2.56	0.27	17.82
388705	48.77	0.60	7.19	2.98	0.05	4.83	14.90	0.77	1.84	0.15	17.04
388706	36.79	0.47	7.58	3.46	0.09	9.73	14.62	0.24	3.23	0.34	21.77
388707	37.21	0.48	7.76	3.45	0.09	9.63	14.48	0.23	3.31	0.34	21.46
388708	32.74	0.43	5.73	2.71	0.08	11.38	16.32	0.15	2.95	0.34	25.41
388709	49.74	1.09	11.14	5.04	0.10	5.62	8.81	0.42	3.31	0.32	13.31
388710	45.99	0.78	17.44	5.04	0.04	4.87	5.88	0.12	6.19	0.09	12.16
388711	49.60	0.96	11.10	4.92	0.06	5.22	9.60	0.58	3.42	0.26	13.69
388712	48.26	0.49	9.47	4.13	0.04	4.63	12.98	0.55	2.48	0.15	15.65
388713	45.10	0.81	8.59	4.67	0.08	6.80	10.84	0.40	3.44	0.47	16.54
388714	49.89	1.16	8.27	5.81	0.07	5.22	10.87	0.72	2.29	0.53	13.44
388715	48.03	0.45	8.16	6.70	0.10	4.72	11.84	0.52	1.96	0.20	14.67
388716	59.55	0.53	8.95	4.64	0.09	3.46	7.85	0.80	1.85	0.18	10.21
388717	51.90	0.51	11.01	6.08	0.13	3.90	9.98	0.61	1.89	0.17	12.72
388718	63.06	0.51	8.00	3.21	0.04	2.45	9.10	0.91	1.78	0.12	9.84
388719	61.71	0.52	7.59	2.98	0.04	2.57	9.98	0.88	1.66	0.12	10.70
500101	57.68	0.51	9.64	4.22	0.06	2.31	9.22	0.61	2.06	0.25	12.30
500102	62.96	0.56	9.92	4.34	0.06	3.01	5.42	0.73	2.39	0.30	8.73
500103	60.60	0.64	13.00	5.95	0.12	3.22	3.55	0.82	2.74	0.41	7.29
500104	63.87	0.57	11.41	5.12	0.09	3.99	3.19	0.87	2.79	0.41	6.39
500105	64.39	0.61	11.04	4.93	0.09	4.71	2.46	0.83	2.86	0.40	6.08
500106	61.51	0.74	14.13	6.88	0.14	2.90	2.08	0.96	2.89	0.49	6.21
500107	55.76	0.87	20.42	8.43	0.17	2.46	1.07	1.12	3.26	0.31	5.55
500108	62.63	0.57	9.60	4.19	0.06	2.56	6.58	0.95	2.22	0.18	8.96
500109	62.39	0.66	11.07	4.81	0.07	3.44	5.30	1.07	2.57	0.21	7.75
500110	50.20	0.82	9.67	5.42	0.15	3.36	12.50	1.06	2.01	0.38	13.09
500111	55.94	0.59	9.68	4.06	0.07	3.67	9.81	0.76	2.37	0.31	11.88
500112	61.91	0.64	11.40	4.55	0.06	3.22	4.30	0.54	3.04	0.63	8.33
500113	55.05	0.54	9.28	4.29	0.07	3.75	10.51	0.75	2.28	0.27	12.38

Sample	*SiO$_2$*	*TiO$_2$*	*Al$_2$O$_3$*	*Fe$_2$O$_3$*	*MnO*	*MgO*	*CaO*	*Na$_2$O*	*K$_2$O*	*P$_2$O$_5$*	*Volat.*
500114	62.09	0.69	10.14	4.36	0.08	3.76	4.53	0.67	3.05	0.57	8.49
500115	54.94	0.64	10.74	5.14	0.10	3.60	9.03	0.91	2.37	0.29	11.30
500116	57.08	0.50	9.15	3.93	0.06	3.76	9.81	0.67	2.45	0.30	11.66
500117	61.70	0.62	11.34	5.47	0.07	2.59	3.37	0.71	2.81	0.61	8.22
500118	50.81	0.70	13.48	7.29	0.14	4.70	6.43	0.95	2.80	0.20	10.85
500119	40.69	0.48	8.61	3.75	0.05	4.55	18.81	0.77	1.84	0.13	19.67
500120	50.27	0.60	11.25	5.15	0.09	4.26	10.76	0.82	2.58	0.18	13.34
500121	70.70	0.58	8.78	4.00	0.08	3.02	2.59	0.60	2.73	0.50	5.38
500122	69.78	0.49	8.22	3.31	0.07	3.65	3.06	0.50	2.69	0.46	6.18
500123	66.89	0.47	9.77	3.33	0.05	3.05	2.08	0.41	3.47	0.40	8.85
500124	62.52	0.56	10.28	4.34	0.06	3.36	2.84	0.55	3.38	0.49	9.74
500125	48.37	0.63	9.97	4.23	0.06	4.35	12.52	0.76	2.38	0.20	14.87
500126	55.59	1.00	12.83	6.90	0.12	3.84	3.56	1.07	2.73	0.44	10.09
500127	75.92	0.60	10.31	2.04	0.03	0.84	1.27	1.39	4.52	0.14	2.12
500128											
500129	76.45	0.56	9.24	1.60	0.03	1.14	1.74	1.26	4.29	0.12	2.08
500501	51.45	0.37	6.45	2.10	0.03	2.84	15.73	0.76	2.07	0.18	16.85
500502	38.62	0.29	4.94	1.75	0.03	5.34	21.91	0.50	1.73	0.11	23.90
500503	45.37	0.37	6.61	2.28	0.04	3.07	17.85	0.61	2.05	0.21	20.40
500504	45.06	0.36	5.83	1.80	0.03	3.05	19.23	0.83	1.78	0.14	19.69
500505	42.91	0.34	5.53	1.71	0.03	2.97	21.31	0.74	1.82	0.08	20.72
500506	70.02	0.48	9.29	2.88	0.04	1.64	4.43	1.38	2.71	0.09	6.01
500507	75.43	0.44	8.81	2.49	0.03	1.32	2.69	1.24	2.74	0.07	3.84
500508	77.36	0.42	8.13	2.03	0.03	1.18	2.68	1.31	2.51	0.06	3.68
500509	69.92	0.40	7.59	2.16	0.04	2.22	5.59	1.04	2.48	0.09	7.41
500510	18.00	0.17	3.27	1.10	0.03	3.65	36.67	0.35	0.93	0.14	34.86
500511	77.47	0.41	7.74	2.04	0.03	1.10	2.75	1.28	2.52	0.07	3.74
500512	67.82	0.49	10.02	3.22	0.05	1.98	5.09	1.50	2.60	0.10	6.27
500513	18.39	0.19	2.38	1.18	0.03	12.09	28.33	0.16	1.07	0.05	35.29
500514	17.81	0.17	2.50	1.13	0.03	12.28	28.37	0.19	1.10	0.04	35.60
382151	66.96	0.48	13.92	4.09	0.07	2.77	4.41	3.70	1.79	0.19	1.07
382251	66.28	0.43	13.69	4.49	0.08	3.59	3.24	3.70	2.33	0.12	1.58
382351	61.82	0.98	12.83	6.34	0.09	5.08	5.41	3.23	2.10	0.21	1.02
382551	51.27	1.48	13.51	10.63	0.15	8.13	6.45	1.50	0.99	0.15	5.38

Appendix 5b

Sample #	Ag	As	Au	Ba	Be	Bi	Br	Cd	Ce	Co	Cr
(Unit)	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(0.4)	(4)	(2)	(1)	(2)	(5)	(0.4)	(0.5)	(3)	(1)	(1)
(Method)	ICP	INAA	INAA	INAA	ICP	ICP	INAA	ICP	INAA	INAA	INAA
388701	0.5	12	0	1500	0	0	0	1.1	67	13	70
388702	0.6	20	17	1300	0	0	2.4	0	71	10	65
388703	0.6	10	3	2100	0	0	0	0.7	69	10	60
388704	0.6	11	0	1900	0	0	0	1.4	54	10	58
388705	0	6	0	680	0	0	0	0	64	10	68
388706	0.8	15	5	2700	0	0	3.1	1.2	50	12	61
388707	1.1	13	0	2400	0	0	0	1.3	43	10	51
388708	0.6	14	0	2600	0	6	0	1.4	38	9	39
388709	0.8	10	8	1800	0	5	0	0.8	100	15	63
388710	0	10	0	940	0	0	0	0	130	13	110
388711	0	11	8	1400	0	0	0	0.9	98	12	79
388712	0.7	15	10	1000	0	0	0	2.2	58	12	69
388713	0.4	16	6	3800	0	0	0	1.5	68	15	53
388714	1.3	18	12	2000	0	0	0	3.1	62	19	60
388715	0.5	14	0	390	0	0	0	0.9	82	11	56
388716	0.6	8	6	300	0	0	0	0	78	12	63
388717	0.5	15	0	390	0	0	0	0.7	76	15	74
388718	0	6	4	210	0	0	0	0	77	8	64
388719	0.7	9	0	340	0	0	0	0	77	8	66
500101	1.0	16	19	650	0	0	0	1.8	65	11	100
500102	0.7	15	16	690	0	0	2.9	1.5	80	13	88
500103	0.7	26	15	2000	0	0	0	1	110	21	85
500104	0.8	18	10	1700	0	5	0	0.8	100	17	64
500105	0.7	16	10	1800	0	0	0	1.1	84	17	60
500106	0.6	30	16	1400	0	0	0	1.2	130	23	100
500107	0.5	29	5	1200	0	6	0	0	120	29	130
500108	0.4	14	0	540	0	0	0	0.9	78	14	83
500109	0	17	10	880	0	0	0	0	96	18	88
500110	0.4	14	13	670	0	0	0	0	67	15	79
500111	0.7	12	0	590	0	0	0	0.9	57	11	73
500112	1.4	14	17	1100	0	0	0	2	61	14	73
500113	0.5	12	9	390	0	0	0	0.6	63	12	79

Sample #	*Ag*	*As*	*Au*	*Ba*	*Be*	*Bi*	*Br*	*Cd*	*Ce*	*Co*	*Cr*
500114	1.4	16	20	840	0	0	0	1.7	61	14	73
500115	0.8	13	11	-50	0	0	0	1.1	57	15	93
500116	0.4	10	12	520	0	6	1.5	0.7	51	9	65
500117	1.5	26	24	1600	0	0	0	6.4	61	20	78
500118	0.4	18	15	600	0	0	0	1.1	69	62	99
500119	0	10	3	240	0	0	0	0	53	11	73
500120	0.8	17	13	520	0	0	0	0.6	64	16	91
500121	0.7	10	10	1100	0	0	0	0.9	56	10	48
500122	0.5	11	10	780	0	0	2.2	1.0	49	8	45
500123	0.9	14	13	860	0	0	7.7	0.8	49	9	53
500124	0.9	19	30	1000	0	0	7.5	1.1	65	13	79
500125	0.6	11	0	450	0	0	1.6	0.6	58	12	75
500126	1.2	18	20	530	0	0	6.3	2.0	66	19	100
500127	2.6	0	0	810	0	0	5.2	0	140	6	81
500128	3.7	0	10	760	0	0	0	0	230	5	91
500129	1.9	0	15	690	0	0	0	0	120	4	53
500501	0.5	6	5	430	0	0	9.5	0.7	29	6	46
500502	0.5	5	7	280	0	0	13.0	0	35	6	31
500503	0.6	8	4	390	0	0	28.0	1.3	42	6	53
500504	0	5	2	880	0	0	7.0	0.7	31	5	44
500505	0	5	11	680	0	0	0	0	36	6	38
500506	0.4	4	4	710	0	0	5.6	0	42	7	38
500507	0	3	0	520	0	0	0	0	48	6	28
500508	0	4	0	500	0	0	0	0	43	4	29
500509	0	5	0	500	0	0	4.4	0	38	7	32
500510	0	13	7	530	0	0	42.0	0.5	18	7	27
500511	0	3	7	620	0	0	0	0	40	6	28
500512	0	3	0	690	0	0	0	0	46	9	48
500513	0	3	0	110	0	0	4.9	0	30	4	57
500514	0	3	8	110	0	0	5	0	28	4	55

Appendix 5c

Sample #	Cs	Cu	Eu	Hf	Hg	Ir	La	Lu	Mo	Nb	Nd
(Unit)	ppm	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(0.5)	(1)	(0.2)	(2)	(1)	(5)	(0.5)	(0.05)	(2)	(2)	(5)
(Method)	INAA	ICP	INAA	INAA	INAA	INAA	INAA	INAA	ICP	XRF	INAA
388701	3	35	1.1	7	0	0	35	0.38	6	0	25
388702	3	26	1	6	0	0	35	0.34	4	0	23
388703	3	31	1.2	8	0	0	33	0.39	6	0	26
388704	2	37	1.1	5	0	0	26	0.3	7	0	20
388705	2	15	1.3	9	0	0	30	0.41	0	0	25
388706	3	35	1	5	0	0	25	0.29	9	0	19
388707	3	34	0.8	4	0	0	22	0.26	8	0	15
388708	2	34	0.9	3	0	0	19	0.25	18	0	15
388709	3	27	1.6	11	0	0	49	0.45	6	0	40
388710	4	19	1.6	10	0	0	67	0.46	0	0	52
388711	2	26	1.8	10	0	0	47	0.45	5	0	33
388712	4	39	1.1	5	0	0	28	0.38	11	0	24
388713	4	45	1.6	5	0	0	34	0.3	26	0	31
388714	3	60	1.5	5	0	0	28	0.44	16	0	36
388715	3	22	1.4	8	0	0	39	0.49	0	0	36
388716	1	20	1.3	10	0	0	37	0.47	0	0	31
388717	2	27	1.2	6	0	0	37	0.38	2	0	31
388718	3	14	1.2	9	0	0	34	0.38	0	0	34
388719	2	16	1.3	14	0	0	35	0.48	0	0	32
500101	4	68	0.9	5	0	0	33	0.44	7	0	22
500102	3	96	1.4	6	0	0	41	0.58	7	0	32
500103	4	93	1.4	7	0	0	58	0.55	8	0	37
500104	4	84	1.4	7	0	0	52	0.48	7	0	43
500105	4	92	1.4	7	0	0	45	0.39	7	0	29
500106	5	129	2.1	8	0	0	66	0.58	9	0	54
500107	6	73	1.8	6	0	0	63	0.52	5	0	53
500108	4	58	1.3	9	0	0	37	0.5	6	0	29
500109	5	44	1.6	10	0	0	44	0.53	2	0	42
500110	3	55	1.7	4	0	0	30	0.4	0	0	19
500111	3	57	0.9	5	0	0	28	0.38	3	0	26
500112	4	146	1.1	6	0	0	31	0.44	11	0	27
500113	3	49	1.2	7	0	0	29	0.46	2	0	22

Sample #	Cs	Cu	Eu	Hf	Hg	Ir	La	Lu	Mo	Nb	Nd
500114	3	98	1.3	8	0	0	30	0.43	8	0	29
500115	3	93	1	5	0	0	27	0.43	3	0	19
500116	3	49	0.9	5	0	0	24	0.3	3	0	19
500117	5	268	1.1	5	0	0	31	0.5	23	0	21
500118	5	238	1.6	5	0	0	32	0.51	2	0	29
500119	3	22	0.8	4	0	0	23	0.35	0	0	20
500120	4	60	1.2	5	0	0	29	0.41	0	0	28
500121	4	68	1.1	10	0	0	26	0.29	4	0	24
500122	3	65	1.1	8	0	0	24	0.28	4	0	18
500123	4	55	0.9	8	0	0	26	0.34	4	0	24
500124	5	102	1	7	0	0	31	0.47	7	0	21
500125	4	38	0.9	5	0	0	28	0.32	2	0	20
500126	5	125	1.5	5	0	0	30	0.55	4	0	32
500127	0	6	1.5	28	0	0	75	0.57	0	0	48
500128	2	7	2.4	51	0	0	120	0.8	0		83
500129	0	7	1.4	24	0	0	65	0.49	0	0	51
500501	2	19	0.7	4	0	0	17	0.26	2	0	17
500502	2	12	0.7	3	0	0	17	0.24	0	0	15
500503	2	29	0.9	3	0	0	23	0.29	3	0	17
500504	2	19	0.8	4	0	0	16	0.26	2	0	11
500505	2	17	0.7	4	0	0	17	0.25	2	0	12
500506	2	15	0.8	5	0	0	21	0.31	0	0	18
500507	2	9	0.9	5	0	0	23	0.32	0	0	26
500508	2	7	0.7	6	0	0	21	0.3	0	0	16
500509	3	11	0.9	4	0	0	21	0.33	0	0	22
500510	1	15	0.4	2	0	0	10	0.14	6	15	0
500511	2	9	1	7	0	0	19	0.29	0	0	15
500512	3	15	0.9	5	0	0	22	0.36	0	0	18
500513	1	4	0.3	4	0	0	14	0.1	0	0	13
500514	2	6	0.3	3	0	0	13	0.1	0	7	11

Appendix 5d

Sample #	Ni	Pb	Rb	Sb	Sc	Se	Sm	Sn	Sr	Ta	Tb
(Unit)	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
(Det. lim.)	(1)	(4)	0.01)	(2)	(2)	(3)	(0.1)	(0.01)	(1)	(0.5)	(0.5)
(Method)	ICP	ICP	INAA	INAA	INAA	INAA	INAA	INAA	ICP	INAA	INAA
388701	44	18	89	2	9	0	5.4	0	113	0	0
388702	33	24	88	2	8	0	5.3	0	118	0	0
388703	35	16	29	2	8	0	6.2	0	155	0	0
388704	43	9	38	3	7	0	4.5	0	133	1.1	0
388705	24	13	66	0	7	0	5.6	0	135	0	0.8
388706	44	19	71	3	8	0	4.1	0	129	0	0
388707	43	18	72	3	7	0	3.6	0	127	0	0
388708	46	17	54	3	6	0	3.3	0	136	0	0
388709	39	23	94	2	10	0	7.6	0	142	0	0
388710	38	30	140	0	13	0	8.3	0	74	1.6	0
388711	39	21	97	2	11	0	7.4	0	148	0	0
388712	66	19	74	4	9	0	4.7	0	143	0	0
388713	59	47	73	4	9	0	5.9	0	160	0	0.9
388714	69	23	59	6	10	0	6.5	0	212	0	0
388715	33	189	44	0	8	0	6.7	0	100	0	0
388716	28	63	70	0	8	0	6.8	0	79	1.1	0
388717	42	39	66	0	9	0	6.3	0	100	0	0
388718	25	20	56	0	7	0	6	0	77	0	0.8
388719	24	24	86	0	7	0	6.1	0	80	0	0.9
500101	79	13	81	4	9	0	5.4	0	337	0	0
500102	70	15	54	4	10	0	6.6	0	222	0	0
500103	54	20	97	3	12	0	8.1	0	191	0	1.1
500104	46	21	72	3	9	0	7	0	144	1.8	0
500105	51	19	77	3	9	0	6	0	123	0	0
500106	70	28	130	3	13	0	10	0	173	1.2	0
500107	69	28	170	2	17	0	8.9	0	155	0	0
500108	55	18	110	3	10	0	7	0	218	1.4	1.1
500109	48	20	77	2	12	0	8.1	0	111	0	0.9
500110	57	15	86	2	10	0	6.4	0	180	0	1.2
500111	45	15	83	2	9	0	5.2	0	155	0	0
500112	59	17	79	4	10	0	5.2	0	159	0	0
500113	41	14	58	2	9	0	5.5	0	150	0	0

Sample #	Ni	Pb	Rb	Sb	Sc	Se	Sm	Sn	Sr	Ta	Tb
500114	51	19	100	4	9	0	5.3	0	141	0	0
500115	61	14	62	3	10	0	5.5	0	155	0	0
500116	40	20	86	2	7	0	4.5	0	149	0	0
500117	95	31	95	11	10	0	5.3	0	205	0	0
500118	204	20	110	2	13	0	7.3	0	123	0	1
500119	41	14	89	0	9	0	4.7	0	188	0	0
500120	61	19	100	2	11	0	5.6	0	145	0	0
500121	35	22	67	2	7	0	4.5	0	118	0	0
500122	33	27	75	2	6	0	4.2	0	103	0	0
500123	32	21	78	2	7	0	4.1	0	92	0	0
500124	43	24	100	3	9	0	5	0	125	0	0
500125	45	14	74	0	9	0	5.1	0	155	0	0
500126	72	17	98	3	12	0	6.1	0	144	0	0
500127	17	24	65	0	8	0	10	0	176	0	0
500128	15	19	71	0	9	0	17	0	142	0	0
500129	13	18	52	0	7	0	9.6	0	161	0	0
500501	25	9	84	0	5	0	3.2	0	414	0	0
500502	15	8	36	0	4	0	3.1	0	414	0	0
500503	31	16	66	2	6	0	4.3	0	217	0	0
500504	23	5	45	0	4	0	2.9	0	544	0	0
500505	21	9	63	0	4	0	3.3	0	456	0	0
500506	21	13	110	0	6	0	3.9	0	124	0	0
500507	14	11	82	0	5	0	4.6	0	133	0	0
500508	12	9	57	0	5	0	4	0	132	0	0
500509	14	14	74	0	5	0	4	0	110	0	0
500510	20	56	34	0	3	0	1.9	0	191	0	0
500511	13	9	73	0	5	0	3.6	0	115	0	0
500512	22	11	95	0	7	0	4.1	0	218	0	0
500513	8	8	33	0	3	0	2.4	0	240	0	0
500514	8	7	39	0	3	0	2.1	0	208	0	0

Appendix 5e

Sample #	Th	U	V	W	Y	Yb	Zn	Zr
(Unit)	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(0.2)	(0.5)	(2)	(1)	(2)	(0.2)	(1)	(2)
(Method)	INAA	INAA	ICP	INAA	ICP	INAA	ICP	XRF
388701	11	5	167	0	20	2.2	129	193
388702	11	3	105	0	19	1.9	67	187
388703	9	3.7	157	0	24	2	104	229
388704	7.6	5	225	0	19	1.8	156	147
388705	9.3	2.6	68	0	18	2.2	52	220
388706	6.9	6.9	213	0	19	1.7	157	119
388707	6.4	4.7	207	0	18	1.5	115	115
388708	4.4	7.1	263	0	18	1.4	269	85
388709	17	4.8	188	0	25	2.8	115	356
388710	24	3.6	98	0	22	2.8	55	281
388711	16	5.5	180	0	24	2.9	110	263
388712	9	7.4	226	0	24	2.4	266	133
388713	8	12	355	0	25	2	562	125
388714	6	7.7	395	0	28	2.5	313	143
388715	9.2	3.2	68	0	18	2.6	287	233
388716	10	0	49	0	17	2.6	97	287
388717	9.4	2.1	59	0	16	2.3	183	203
388718	8.3	2.4	48	0	17	2.8	99	262
388719	9.1	3.1	43	0	17	2.9	105	352
500101	8.1	5.6	207	0	18	2.6	170	126
500102	9.8	4.5	197	0	18	2.9	171	170
500103	16	6.1	203	0	17	3.3	134	186
500104	14	7.1	175	0	18	2.6	130	207
500105	13	5.1	187	0	20	2.3	131	216
500106	19	6.8	200	0	19	3.7	186	196
500107	19	5.7	158	0	12	3.3	154	167
500108	11	5.1	157	0	18	3.4	101	201
500109	13	2.5	121	0	16	3.5	85	238
500110	7.2	3	119	0	28	2.5	105	119
500111	8.7	4.7	136	0	23	2.3	112	149
500112	10	8.3	285	0	29	2.2	243	178
500113	9.8	3.5	115	0	24	2.2	92	177

Sample #	***Th***	***U***	***V***	***W***	***Y***	***Yb***	***Zn***	***Zr***
500114	11	7.2	239	0	25	2.5	188	227
500115	8.7	4.1	161	0	29	2.7	145	142
500116	7.8	3.2	123	0	24	1.8	92	178
500117	10	15	404	0	31	2.7	782	170
500118	10	4.9	121	0	36	3.4	279	120
500119	7.9	0	68	0	22	2.2	54	102
500120	9.7	3.8	127	0	26	2.7	94	145
500121	8.7	4.5	157	0	23	1.8	127	295
500122	8.5	4	158	0	20	1.8	131	237
500123	11	4.9	166	0	22	1.9	103	253
500124	12	7	222	4	26	2.4	125	164
500125	9	2.3	99	0	23	2.3	76	130
500126	9.3	5.3	230	0	34	3	245	114
500127	38	4.4	47	0	37	3	20	923
500128	69	7.7	42	0	43	4.8	17	
500129	34	4.3	36	0	32	2.6	17	748
500501	5.3	3.1	114	0	18	1.8	61	115
500502	4.8	2	55	0	16	1.3	32	91
500503	6.5	4.3	169	0	23	1.8	95	110
500504	5.1	3.2	98	0	18	1.6	49	96
500505	5.4	3.1	63	0	17	1.4	40	97
500506	6.1	1.6	56	0	18	1.9	51	121
500507	6.8	2.4	36	0	18	1.8	33	157
500508	6.1	2.2	32	0	16	2.2	29	166
500509	6.7	0	47	0	18	1.5	50	129
500510	3.6	3.7	46	0	13	0.7	99	43
500511	6.2	1.7	35	0	14	1.7	29	173
500512	7	1.1	53	0	17	1.9	46	140
500513	5	1	19	0	8	0.6	15	96
500514	4.3	1	17	0	8	0.6	18	73

Appendix 6a

Geochemical data, heavy mineral concentrates, North Greenland (SMJ)

Sample #	***Ag***	***As***	***Au***	***Ba***	***Br***	***Ca***	***Cd***	***Ce***	***Co***	***Cr***	***Cs***
(Unit)	ppm	ppm	ppb	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(0.2)	(2)	(5)	(200)	(5)	(1)	(0.5)	(3)	(5)	(10)	(2)
(Method)	ICP	INAA	INAA	INAA	INAA	INAA	ICP	INAA	INAA	INAA	INAA
390801	0.9	36	0	58000	0	9	0.8	73	41	70	0
390802	0	13	0	8500	0	9	1.2	65	15	71	0
390803	1	150	73	84000	0	4	1.2	42	71	82	0
390804	0	64	49	41000	0	7	1.4	62	46	130	0
390805	0	10	0	11000	0	5	0	46	60	130	0
390806	0	9	0	8500	0	10	1.6	59	44	110	0
390807	0	14	0	9100	0	8	4.9	47	20	48	0
390808	0	19	0	13000	0	10	1	63	22	73	0
390809	0	23	11	3000	0	17	0	54	25	89	0
390810	0	14	8	2800	0	10	0	38	26	83	0
390811	0	19	0	13000	0	7	3.4	54	37	81	0
390812	0	22	0	31000	0	8	3.6	46	29	58	0
390813	0	13	0	19000	0	9	1.2	50	19	41	2
390814	0	9	0	12000	0	11	2.1	53	22	60	0
390815	0	13	0	15000	0	3	0	57	92	160	0
390816	0	9	0	26000	0	5	0	85	18	56	0
390817	0	12	7	31000	0	7	0	67	45	200	0
390818	0.6	27	0	39000	0	9	6.9	45	10	59	0
390819	0	17	8	31000	0	6	3.3	24	44	70	0
390820	0	10	10	6700	0	3	0	12	88	97	0
390821	0.4	59	0	1500	0	10	0.8	97	24	110	0
390822	1.2	34	0	380	0	4	1	72	23	73	3
390823	0.9	26	0	1000	0	5	1.1	77	29	120	0
500151	0.6	9	5	330	0	16	2.3	53	6	68	0
500152	0.4	14	12	1200	0	7	1.3	59	13	80	0
500153	0.6	29	13	4100	0	0	0.5	130	40	70	4
500154	0.2	12	0	2500	0	0	0	97	24	89	4
500155	0	19	15	2000	0	0	0.4	83	19	110	4
500156	0	11	6	1900	0	0	0	130	27	98	5
500157	0.2	23	0	4100	0	0	0	100	74	99	4
500158	0.3	8	0	620	0	0	0.5	45	13	64	0
500159	0	6	0	1300	0	5	0	48	33	35	0

Sample #	Ag	As	Au	Ba	Br	Ca	Cd	Ce	Co	Cr	Cs
500160	0.7	73	30	8000	0	3	2.1	49	31	58	2
500161	0	81	77	4500	0	2	1.2	51	35	33	0
500162	0	19	10	870	0	4	0.6	53	9	46	0
500163	0.5	13	9	980	0	1	0.5	18	0	0	0
500164	0.5	21	46	1400	0	0	0.7	47	11	39	3
500165	0	13	0	1800	0	10	0	48	16	57	3
500166	0	4	9	1500	0	10	0.8	47	53	100	0
500551	0.3	6	5	2000	0	20	0.9	54	6	36	0
500552	0.2	3	0	240	0	29	0	25	0	29	0
500553	1.2	25	0	300	6	26	1.8	46	8	32	0
500554	0.3	5	0	2100	0	21	0.5	37	0	27	0
500555	0.7	7	0	1500	0	23	1.3	27	0	26	0
500556	0.6	18	0	14000	0	36	0	32	6	22	2
500557	0	8	0	10000	0	16	0	78	7	29	0
500558	0.7	18	0	1300	0	21	1	51	7	80	0
500559	0.3	10	0	12000	0	14	0	50	7	19	0
500560	0.3	11	0	1600	0	39	0	9	0	11	0
500561	0.3	7	0	2200	0	20	0	57	0	29	3
500562	0	5	12	1300	0	9	0	55	13	84	4
500563	0	6	0	210	0	13	0	71	10	190	0
500564	0	6	0	540	0	16	0	130	9	370	0

Appendix 6b

Sample #	Cu	Eu	Fe	Hf	Hg	Ir	La	Lu	Mn	Mo	Na
(Unit)	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(1)	(0.2)	(0.02)	(1)	(5)	(50)	(1)	(0.1)	(2)	(20)	(500)
(Method)	ICP	INAA	INAA	INAA	INAA	INAA	INAA	INAA	ICP	INAA	INAA
390801	44	1.2	8.27	0	0	0	46	0.3	453	0	2030
390802	20	1.2	3.64	0	0	0	38	0.3	325	0	2440
390803	38	0.5	27.1	9	0	0	24	0	500	0	1280
390804	103	0.5	13.2	11	0	0	35	0.3	395	0	3270
390805	28	1.5	24.3	11	0	0	22	0.5	659	0	2930
390806	47	1.7	17.6	10	0	0	28	0.5	747	0	3970
390807	33	1.1	4.51	4	0	0	27	0.2	304	0	1860
390808	21	1	6.19	7	0	0	31	0.4	364	0	2240
390809	14	1.4	11	7	0	0	23	0.4	254	0	4400
390810	14	0.9	8.93	7	0	0	20	0.3	325	0	3000
390811	37	1.2	11.7	8	0	0	30	0.4	459	0	2490
390812	33	1.6	11.6	3	0	0	26	0.2	785	0	2280
390813	66	1.1	6.94	6	0	0	29	0.3	632	0	2390
390814	22	1.3	5.92	0	0	0	32	0.2	465	0	3140
390815	65	1.4	25	12	0	0	32	0.3	1699	0	3490
390816	48	1.2	7.12	20	0	0	47	0.4	293	0	902
390817	16	2.3	19.4	17	0	0	35	0.4	785	0	4700
390818	113	0.5	4.18	7	0	0	25	0.3	185	0	2420
390819	97	1.2	15.6	9	0	0	18	0.3	753	0	2630
390820	110	1	30.6	8	0	0	8	0.3	1317	0	2600
390821	78	1.8	27.4	6	0	0	43	0.3	491	0	1550
390822	152	1.1	9.57	6	0	0	39	0.2	838	0	2810
390823	81	1.3	7.47	4	0	0	45	0.2	1209	0	3010
500151	41	0.9	1.72	2	0	0	29	0.3	339	0	2240
500152	81	1.3	3.34	4	0	0	30	0.7	441	0	3690
500153	133	2	6.45	4	0	0	81	1.1	893	0	6140
500154	45	1.7	5.22	4	0	0	58	1	547	0	7910
500155	66	1.5	5.14	6	0	0	42	0.5	545	0	7230
500156	53	1.7	5.15	4	0	0	78	0.4	606	0	7990
500157	47	1.7	6.28	4	0	0	63	0.6	944	0	7580
500158	44	0.7	2.37	3	0	0	24	0.3	377	0	4320
500159	128	2.5	14.1	5	0	0	21	0.5	1053	0	5190

Sample #	Cu	Eu	Fe	Hf	Hg	Ir	La	Lu	Mn	Mo	Na
500160	70	1	12.8	4	0	0	26	0.3	1040	0	1970
500161	153	1.8	20.7	7	0	0	20	0.3	1128	0	2920
500162	37	1.4	4.45	3	0	0	25	0.3	1914	0	2260
500163	35	0.3	1.44	2	0	0	11	0	102	0	0
500164	107	0.7	3.54	4	0	0	27	0.4	196	0	2160
500165	62	1.1	3.67	5	0	0	25	0.3	314	0	3560
500166	49	2.3	14.6	5	0	0	21	0.5	717	0	11400
500551	16	0.9	1.89	3	0	0	27	0.2	160	0	4140
500552	6	0.6	0.9	1	0	0	16	0.1	163	0	1940
500553	37	1	3.18	1	0	0	27	0.3	301	0	2310
500554	13	0.8	1.16	2	0	0	22	0.2	150	0	3110
500555	13	0.6	1.26	2	0	0	16	0.2	158	0	2940
500556	17	0.7	2.3	4	0	0	18	0.1	207	0	1690
500557	15	1.8	2.98	6	0	0	39	0.4	479	0	5380
500558	29	0.8	4.02	7	0	0	26	0.3	311	0	1770
500559	14	1.1	2.8	6	0	0	31	0.3	448	0	4920
500560	2	0	0.35	0	0	0	7	0	88	0	1020
500561	13	1.1	1.84	6	0	0	30	0.4	351	0	4760
500562	32	1	3.71	4	0	0	28	0.5	384	0	8400
500563	5	0.8	3.25	14	0	0	38	0.3	141	0	1640
500564	4	0.8	6.71	26	0	0	65	0.6	97	0	1510

Appendix 6c

Sample #	Nd	Ni	Pb	Rb	Sb	Sc	Se	Sm	Sr	Ta	Tb
(Unit)	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
(Det. lim.)	(10)	(1)	(2)	(50)	(0.2)	(0.1)	(20)	(0.1)	(0.2)	(1)	(2)
(Method)	INAA	ICP	ICP	INAA	INAA	INAA	INAA	INAA	INAA	INAA	INAA
390801	0	37	444	0	4.4	11	0	4.7	0	0	0
390802	33	28	110	79	1.6	9	0	4.5	0	0	0
390803	20	51	161	0	7.8	6.2	0	2.2	0	0	0
390804	0	34	141	0	2.9	10	0	3.8	0	0	0
390805	22	28	23	0	1.6	29	0	4	0	6	0
390806	15	30	27	80	1.5	22	0	4.7	0	5	0
390807	0	29	66	0	2.5	8.8	0	3.5	0	0	0
390808	27	28	20	100	2.1	11	0	4.4	0	0	0
390809	24	21	20	51	1.3	18	0	4	0	0	0
390810	19	22	23	0	1.2	14	0	3.2	0	0	0
390811	0	43	48	0	4.9	19	0	4.3	0	2	0
390812	0	35	169	0	5.3	15	0	3.9	0	0	0
390813	31	37	20	0	4.3	11	0	4.1	0	0	0
390814	28	30	34	0	2.2	13	0	4.8	0	0	0
390815	0	45	722	0	0	30	0	4.5	0	0	0
390816	32	30	60	0	0.5	8.4	0	4.7	0	0	0
390817	22	33	93	0	1.4	27	0	4.6	0	0	0
390818	0	79	26	0	8	6	0	3	0	0	0
390819	0	26	179	57	0.7	18	0	2.3	0	3	0
390820	0	33	25	0	3.7	29	0	1.6	0	4	0
390821	39	42	2146	0	2.6	4.7	0	7.3	0	3	0
390822	24	33	1612	52	1.6	6.2	0	5.5	0	0	0
390823	30	39	2229	0	1.6	8.1	0	5.4	0	0	0
500151	19	43	9	0	2.1	5.8	0	3.7	0	0	0
500152	24	49	12	0	2.6	8.7	0	4.1	0	0	2
500153	53	71	30	0	2	14	0	8.1	0	0	0
500154	37	57	20	0	2	16	0	6.1	0	0	0
500155	24	49	20	120	1.9	15	0	5.1	0	3	0
500156	57	55	13	110	1.1	18	0	8.3	0	0	0
500157	34	62	30	0	0.7	17	0	6.1	0	0	0
500158	0	40	13	0	1.5	8.7	0	3.3	0	2	0
500159	29	20	10	0	0.9	39	0	6.1	0	4	0

Sample #	*Nd*	*Ni*	*Pb*	*Rb*	*Sb*	*Sc*	*Se*	*Sm*	*Sr*	*Ta*	*Tb*
500160	20	35	358	59	5.3	7.6	0	3.2	0	0	0
500161	25	45	39	0	4.4	24	0	4.4	0	2	0
500162	17	25	19	55	1.6	9.7	0	4	0	0	0
500163	0	14	13	0	1.2	1.5	0	1.4	0	0	0
500164	18	31	23	0	3.1	5.5	0	3.6	0	0	0
500165	0	39	16	79	1.2	11	0	3.8	0	0	0
500166	0	24	13	0	0	45	0	5.3	0	0	0
500551	20	18	8	0	1.4	4.6	0	3.7	0	3	0
500552	13	7	5	0	0.4	2.8	0	2.1	0	0	0
500553	21	31	28	0	5.9	3.9	0	3.6	0	0	0
500554	15	16	8	0	1	3.2	0	2.9	0	0	0
500555	0	16	9	0	1.2	3.3	0	1.9	0	0	0
500556	19	15	44	0	3.2	2.9	0	2.5	0	0	0
500557	34	19	16	0	0.9	7.1	0	5.9	0	0	0
500558	17	26	43	0	3.8	4	0	3.3	0	0	0
500559	23	14	14	55	1.4	5.2	0	4.5	0	0	0
500560	0	4	9	0	0.4	1.1	0	0.7	0	0	0
500561	19	14	8	0	0.8	5.4	0	4.4	0	0	0
500562	19	35	14	90	1.2	11	0	3.8	0	0	0
500563	22	7	34	0	0	7.7	0	3.5	0	0	0
500564	40	7	8	0	0	12	0	6.1	0	2	0

Appendix 6d

Sample #	*Th*	*U*	*W*	*Yb*	*Zn*
(Unit)	ppm	ppm	ppm	ppm	ppm
(Det. lim.)	(0.5)	(0.5)	(4)	(0.2)	(1)
(Method)	INAA	INAA	INAA	INAA	ICP
390801	9.4	4.2	0	2.6	125
390802	9	2.3	0	2	175
390803	5.6	0	8	1.2	182
390804	9.1	4.2	0	2.1	122
390805	3.5	0	0	2.7	142
390806	5.8	2.8	0	3	204
390807	5.7	3.2	0	1.5	416
390808	7.2	2.2	0	2	292
390809	4.5	1.7	0	1.8	143
390810	4.3	0	0	1.9	75
390811	4.3	0	0	2.8	400
390812	4	4.9	0	1.9	1792
390813	5.3	5.5	0	1.6	199
390814	6.1	5	0	1.7	694
390815	8.2	0	0	2.7	389
390816	18	0	0	1.7	52
390817	8.8	4.4	0	2.5	155
390818	5.4	4.6	6	1.8	599
390819	3.3	3.7	0	1.6	1265
390820	1.2	0	0	1.8	291
390821	6.5	0	0	2	288
390822	7.4	0	0	1.2	170
390823	7.4	1.5	0	1.5	327
500151	5.3	3.3	0	1.9	108
500152	8.4	4.6	0	3.9	125
500153	14	4.1	0	7.4	122
500154	14	4.2	0	6.8	116
500155	12	6.1	0	3.1	118
500156	15	0	0	2.8	116
500157	14	4.1	0	4.9	111
500158	6.6	2	0	2	70
500159	2.4	2.1	0	3.5	120

Sample #	*Th*	*U*	*W*	*Yb*	*Zn*
500160	6.8	5	0	1.7	120
500161	4.1	3.9	0	2.4	259
500162	5.1	2.8	0	1.7	63
500163	2.8	1.7	0	0.8	34
500164	8.6	3.8	0	2.3	63
500165	7.7	3	0	2	56
500166	3.2	1.4	0	3.5	149
500551	5.5	3.4	0	2	41
500552	3.1	2	0	1.1	16
500553	3.8	4	0	1.9	116
500554	4	3.4	0	1.5	38
500555	3.4	2.4	0	1.4	270
500556	2.3	2.7	0	1	102
500557	6.9	2.6	0	2.8	40
500558	7.8	2.3	0	1.7	300
500559	5.3	0	0	2.4	27
500560	1.6	3	0	0.5	15
500561	6	1.4	0	2.5	32
500562	8.9	2.3	0	2.3	93
500563	18	1.9	0	1.9	19
500564	34	3.6	0	3	14

Appendix 7

Sulphur isotopes, Citronen Fjord, drill core CF94-53 (HF)

Depth from	*Depth to*	*Sample description*	$\delta^{34}S$	*Th/U*	*V/(V+Ni)*
8.0	8.2	Massive pyrite in HWDF	33.06	2.00	0.39
19.8	20.0	Pyrite in matrix, HWDF	45.08	0.23	0.42
43.2	43.4	Carbonate clast		3.90	0.72
50.0	50.2	Pyrite in matrix, bottom of HWDF	-5.33	3.63	0.68
53.0	53.2	Silt turbidite with pyrite	-7.69	2.24	0.66
56.9	57.2	Mudstone with type 1 pyrite	-22.02	4.23	0.69
60.0	60.3	Mudstone with type 4 pyrite	-21.98	4.76	0.71
62.9	63.1	Mudstone with type 3 pyrite	-20.26	4.53	0.69
67.0	67.3	Mudstone with type 1 + 4 pyrite	-18.97	5.50	0.69
71.0	71.3	Mudstone with type 1+3+4 pyrite	-18.88	5.85	0.72
74.0	74.2	Mudstone with type 1+4 pyrite	-19.95	4.89	0.71
76.7	77.0	Mudstone with type 1+4 pyrite	-15.27	3.92	0.73
81.9	82.3	Mudstone with type 1+4 pyrite	-20.82	5.41	0.67
85.4	85.7	Mudstone with type 1+4 pyrite	-27.21	4.74	0.75
86.8	87.1	Mudstone with type 1+4 pyrite	-25.34	4.67	0.66
92.1	92.3	Mudstone with type 1+4 pyrite		3.76	0.68
95.9	96.2	Mudstone with type 1+4 pyrite	-26.44	4.74	0.66
97.7	98.0	Mudstone with type 1+4 pyrite	-26.77	4.80	0.71
102.2	102.4	Mudstone with type 1+4 pyrite		3.92	0.69
104.0	104.2	Mudstone with type 1+4 pyrite	-26.25	4.88	0.76
108.7	108.8	Mudstone with type 1+4 pyrite	-8.07	3.90	0.52
111.8	112.1	Mudstone with type 1+4 pyrite	8.87	3.20	0.75
119.9	120.2	Mudstone with type 1+4 pyrite	-7.43	4.50	0.66
126.8	127.1	Mudstone with type 1+4 pyrite	-9.42	3.48	0.73
132.0	132.2	Mudstone with type 1+4 pyrite	-9.90	3.94	0.65
134.9	135.0	Pyrite layer in mudstone	-19.61		
136.7	136.9	Mudstone with type 1+3+4 pyrite	-16.47	5.25	0.82
138.6	138.8	Pyrite in top of MDF	14.29		
149.1	149.4	Corse pyrite in matrix, MDF	16.86		
154.6	154.8	Pyrite in matrix, MDF	15.85		0.46
164.7	164.9	Corse pyrite in MDF	24.34		
204.9	205.1	Mudstone with type 1+4 pyrite		0.85	0.81
208.0	208.2	Mudstone with type 1+4 pyrite	26.64	0.72	0.90
208.6	208.8	Mudstone with type 1+4 pyrite		0.83	0.86
212.6	212.8	Silty turbidite with pyrite clast or concretion	48.87	0.72	0.89
216.7	216.8	Siltlayer with pyrite vein	43.55	0.94	0.88
219.9	220.2	Silt-gravel turbidite with pyrite 2,3,5	34.38		0.71

Depth from	*Depth to*	*Sample description*	*$\delta^{34}S$*	*Th/U*	*V/(V+Ni)*
224.4	224.6	Laminated pyrite in mudstone	31.53	1.00	0.74
225.0	225.3	Shearzone and boudinaged siltlayer	19.55	1.00	0.82
227.5	227.8	Siltstone with type 1+4 pyrite	19.51	0.63	0.90
230.2	230.4	Debris flow with pyrite	39.36	0.00	0.57
235.0	235.2	Mudstone and thin siltturbidite with pyrite	10.96		
236.4	246.6	Corsegrained pyrite in turbidite	26.87	0.92	0.82
240.9	241.1	Mudstone with type 1+4 pyrite		2.74	0.84
244.7	244.9	Nodular limestone with pyrite	17.98	1.00	0.84
252.1	252.3	Mudstone with type 1+4 pyrite		1.14	0.64
253.2	253.5	Mudstone and siltturbidite with pyrite	30.07	2.86	0.79
256.9	257.0	Pyrite in LDF 2,3,5	35.38		
261.0	261.2	Mudstone clast in LDF with pyrite 2,3,5	28.82	0.86	0.55

Appendix 8

Sulphur isotopes, Citronen Fjord, conventional analyses (HF)

Sample #	$\delta^{34}S$	***Mineral***
427201	30.96	pyrite
427204	23.36	pyrite
427205	29.97	pyrite
427208	15.47	pyrite
427211	9.61	sphalerite
427214	19.80	pyrite
435857	18.15	sphalerite
435857	7.48	pyrite
435860	12.82	pyrite
435861	11.28	pyrite
435862	17.23	pyrite
435862.5	16.65	sphalerite
435863	15.01	pyrite
435864	18.06	pyrite
435865	17.04	pyrite
435865.5	17.49	sphalerite
435867	29.07	pyrite
435868	25.00	pyrite
435869	22.39	pyrite
435871	19.37	pyrite
435872	23.34	pyrite
435873	18.28	pyrite
435879	20.18	chalcopyrite
435881	20.55	chalcopyrite
435882	9.39	pyrite
435884	49.16	pyrite
435893	16.55	pyrite
435894	27.66	pyrite
435895	24.52	pyrite
435896	10.13	pyrite
435897	22.96	pyrite
435898	20.60	pyrite

Appendix 9

Sulphur isotopes, Citronen Fjord, laser analyses (HF)

Sample #	***Texture***	***Mineral***	**$\delta^{34}S$**
427209	Masive to semi-massive pyrite, ghosts of original framboids	pyrite	15.4
	Pyrite framboids with adjacent sphalerite	pyrite	6.4
	Massive pyrite	pyrite	23.7
	Sphalerite from main sphalerite zone. Relict gel in margin.	sphalerite	11.7
	Subhedral pyrite from main sphalerite zone	pyrite	14.0
	Large euhedral pyrite on margin to mudstone	pyrite	12.8
435861	Sphalerite interstitiel to pyrite	sphalerite	11.0
	Pyrite from area with massive pyrite	pyrite	10.7
	Large bootshaped galena	galena	10.1
	Sphalerite adjacent to large bootshaped galena	sphalerite	10.4
	Pyrite adjacent to large bootshaped galena	pyrite	12.2
435862	Large sphalerite	sphalerite	22.9
	Massive pyrite	pyrite	20.9
	Left part of large sphalerite adjacent to mudstone	sphalerite	17.9
	Large sphalerite center	sphalerite	21.1
	Right part of large sphalerite	sphalerite	20.5
	Pyrite in partly pyrite replaced mudstone	pyrite	20.2
	Sphalerite on the margin between pyrite and late carbonate	sphalerite	17.2
	Pyrite in partly pyrite replaced mudstone	pyrite	21.2
435865	Massive pyrite	pyrite	15.3
	Massive pyrite	pyrite	17.4
	Sphalerite replacing pyrite and mudstone	sphalerite	11.0
	Subhedral pyrite adjacent to late carbonate vein	pyrite	20.1
	Sphalerite replacing gel	sphalerite	15.3
	Subhedral pyrite adjacent to late carbonate vein	pyrite	14.4
	Sphalerite from main sphalerite zone	sphalerite	19.1
	Large galena	galena	16.3
	Subhedral pyrite overgrowth	pyrite	18.0
	Sphalerite replacing gel	sphalerite	16.7

Sample #	Texture	Mineral	$\delta^{34}S$
435869	Spongy pyrite with very litle sphalerite	pyrite	26.9
	Spongy pyrite with 5 % galena	pyrite	26.8
	Early spongy pyrite	pyrite	25.2
	Diagenetic subhedral pyrite	pyrite	38.4
	Sphalerite replacing gel	sphalerite	28.2
	Overgrown stringers of framboids in mudstone	pyrite	31.0
	Diagenetic pyrite	pyrite	39.3
	Early finegrained pyrite spheres in mudstone	pyrite	29.0
435876	Massive pyrite replacing mudstone with ghost layering	pyrite	21.8
	Massive pyrite replacing mudstone with ghost layering	pyrite	21.5
	Massive pyrite adjacent to quartz veinlet	pyrite	18.7
	Massive homogeneous pyrite adjacent to quartz veinlet	pyrite	15.2
	Euhedral pyrite in mudstone	pyrite	32.2
435876a	Lamina (low) of framboidal pyrite	pyrite	14.8
	Lamina (middle) of framboidal pyrite	pyrite	17.8
	Lamina (top) of framboidal pyrite	pyrite	19.4
	Euhedral pyrite in crosscutting quartz vein near low lamina	pyrite	14.0
	Margin of euhedral pyrite in quartz vein	pyrite	13.0
	Low part of euhedral pyrite in quartz vein	pyrite	18.2
	Pyrite rich mudstone	pyrite	21.2
435882	Sphalerite on margin of late carbonate vein	sphalerite	14.0
	Pyrite adjacent to carbonate vein	pyrite	11.7
	Pyrite in pyrite replaced mudstone	pyrite	8.7
	Pyrite in pyrite replaced mudstone	pyrite	8.4

Appendix 10

Sulphur isotopes, regional Platinova samples, North Greenland (HF)

Sample #	***Locality***	***Formation***	***Mineral***	$\delta^{34}S$
s072806	East of Kap Wegener	Buen	pyrite	-13.57
s072304	Kap Lars Larsen	Brøndlund Fjord	pyrite	-7.63
g080301	5 km south of Kap Wohlgemut	Henson Breccia	sphalerite	-3.39
g0809md	Hand Bugt	Brøndlund Fjord/Polkorridoren	pyrite	0.03
z080901	North central coast, Nyboe Land		pyrite	0.20
g081309	west side of Hand Bugt	Brøndlund Fjord	galena	0.98
g073101	8 km south of Kap Wohlgemut	Henson breccia	galena	3.91
r081303	1.5 km east of Hand Bugt	Brøndlund Fjord	sphalerite	4.41
g072405	Kap Lars Larsen	Buen	pyrite	6.11
g072405	Kap Lars Larsen	Buen	pyrite	6.53
r081303	1.5 km east of Hand Bugt	Brøndlund Fjord	galena	6.57
f080302	NW Nares Land	Buen/Brøndlund Fjord	galena	12.19
r072901	West coast of Stephenson Island	Brøndlund Fjord	pyrite	21.10
r080606	Hand Bugt	Brøndlund Fjord	galena	23.36
r081201	West of Repulse Havn		galena	23.40
r081002	East of Hand Bugt		galena	26.55

Appendix 11

Sulphur isotopes, Navarana anticline samples

Sample #	*Mineral*	$\delta^{34}S$
435809	pyrite	-23.68
435823	pyrite	31.24
435827	pyrite	23.31
435831	sphalerite	-3.23
435846	pyrite	10.21

Appendix 12

Oxygen and Carbon isotopes, Citronen Fjord (KK)

Sample #	***Sample description***	***Mineral***	***Impurities***	$\delta^{18}O$ ***SMOW***	$\delta^{18}O$ ***PDB***	$\delta^{13}C$ ***PDB***
410203 (10A-03 60.3)	Coarse-grained carbonate, net sulphides	calcite		21.71	-8.92	-6.32
410203 (10A-03 60.3)	Coarse-grained carbonate, net sulphides	dolomite		21.61	-9.02	-6.17
410204 (10A-04 66.3)	Coarse-grained carbonate in sphalerite vein	calcite	sphalerite	19.99	-10.60	-5.66
410204 (10A-04 66.3)	Coarse-grained carbonate in sphalerite vein	dolomite	sphalerite	15.28	-15.16	-7.02
427505 - 1	Vein with sphalerite, pyrite and carbonate, white carbonate	calcite		20.10	-10.49	-6.66
427505 - 2	Vein with sphalerite, pyrite and carbonate, grey carbonate	calcite		20.13	-10.45	-7.24
427505 - 2	Vein with sphalerite, pyrite and carbonate, grey carbonate	dolomite		20.23	-10.36	-7.17
434247 A - 1	Coarse-grained carbonate, net sulphides	calcite		22.15	-8.50	-6.18
434247 A - 1	Coarse-grained carbonate, net sulphides	dolomite		21.46	-9.17	-6.16
434257 B - 1	Quartz/carbonate vein, coarse-grained carbonate	calcite		21.68	-8.95	-4.96
434257 B - 2	Coarse-grained carbonate in laminated sulphide	calcite		21.64	-8.99	-3.82
434257 B - 3	Fine-grained carbonate in laminated sulphide	calcite	pyrite	22.16	-8.49	-4.63
434257 B - 3	Fine-grained carbonate in laminated sulphide	dolomite	pyrite	20.05	-10.53	-5.33
434262 A - 1	Coloform laminated pyrite, coarse-grained carbonate	calcite		22.37	-8.28	-3.85
434262 A - 1	Coloform laminated pyrite, coarse-grained carbonate	dolomite		21.87	-8.77	-3.70
434262 B - 1	Coloform laminated pyrite, coarse-grained carbonate	calcite		22.60	-8.06	-4.04
434262 B - 2	Coloform laminated pyrite, coarse-grained carbonate	calcite		22.12	-8.52	-4.38
434262 B - 2	Coloform laminated pyrite, coarse-grained carbonate	dolomite		15.74	-14.72	-9.83
434262 C - 1	Coloform laminated pyrite, fine-grained carbonate	calcite	pyrite ?	20.69	-9.92	-6.37
434262 E - 1	Coloform laminated pyrite, fine-grained carbonate	calcite		17.04	-13.45	-7.72

Sample #	Sample description	Mineral	Impurities	δ18O SMOW	δ 18O PDB	δ 13C PDB
434267 A - 1	Coarse-grained carbonate, net sulphides	calcite		22.42	-8.24	-3.91
434267 A - 1	Coarse-grained carbonate, net sulphides	dolomite		16.93	-13.56	-6.22
434267 A - 2	Fine-grained carbonate, net sulphides	calcite	pyrite	21.65	-8.98	-7.16
434267 A - 3	Coarse-grained carbonate, net sulphides	calcite	pyrite	21.61	-9.02	-7.17
434267 A - 3	Coarse-grained carbonate, net sulphides	dolomite	pyrite	21.44	-9.19	-7.16
434267 C - 1	Coarse-grained carbonate, net sulphides	calcite		21.87	-8.76	-4.62
434267 C - 1	Coarse-grained carbonate, net sulphides	dolomite		21.78	-8.86	-4.22
CF94-15 38.13	Slumped calcarenite	calcite		19.56	-11.01	0.01
CF94-15 38.13	Slumped calcarenite	dolomite		22.45	-8.20	0.33
CF94-15 66.38	Calcarenite	calcite	quatz, pyrite	17.59	-12.92	-0.10
CF94-15 66.38	Calcarenite	dolomite		18.32	-12.21	-0.17
CF94-15 85.25	Calcite vein with minor sphalerite	calcite		18.63	-11.91	-2.76
CF94-15 85.25	Calcite vein with minor sphalerite	dolomite		17.31	-13.20	-3.45
CF94-15 85.47	Calcarenite	calcite	quartz, clay?	18.31	-12.22	-1.39
CF94-15 85.47	Calcarenite	dolomite		19.80	-10.78	-2.88
CF94-15 87.90	Debris flow with 2 mm clasts	calcite	quartz	17.75	-12.77	-1.65
CF94-15 87.90	Debris flow with 2 mm clasts	dolomite		19.85	-10.73	-2.76
CF94-15 90.50	Calcarenite	calcite	quartz, pyrite	21.40	-9.22	-2.25
CF94-15 90.50	Calcarenite	dolomite		20.90	-9.71	-2.19
CF94-15 90.51	Calcite/quarts vein with minor pyrite	calcite	quartz	18.36	-12.17	-3.65
CF94-15 90.51	Calcite/quarts vein with minor pyrite	dolomite		18.19	-12.34	-4.38
CF94-15 102.25	Coarse-grained carbonate, net sulphides	dolomite		18.90	-11.65	-11.97
CF94-15 102.54	Coarse-grained carbonate vein, net sulphides	calcite		21.39	-9.24	-9.13
CF94-15 102.54	Coarse-grained carbonate vein, net sulphides	dolomite		19.75	-10.83	-9.15
CF94-15 102.84	Coarse-grained carbonate, net sulphides	calcite		19.63	-10.94	-11.49
CF94-15 102.84	Coarse-grained carbonate, net sulphides	dolomite		18.42	-12.12	-11.79

Sample #	Sample description	Mineral	Impurities	δ18O SMOW	δ 18O PDB	δ 13C PDB
CF94-15 103.03	Coarse-grained carbonate, massive sulphide	calcite		21.23	-9.39	-9.41
CF94-15 103.03	Coarse-grained carbonate, massive sulphide	dolomite		20.34	-10.25	-9.43
CF94-15 105.95	Coarse-grained carbonate, massive sulphide	calcite	sphalerite	21.32	-9.30	-8.97
CF94-15 105.95	Coarse-grained carbonate, massive sulphide	dolomite		20.94	-9.67	-8.55
CF94-15 108.14	Calcite laminae in mudstone and laminated sulphide	calcite	quartz	19.00	-11.55	-5.86
CF94-15 108.14	Calcite laminae in mudstone and laminated sulphide	dolomite		18.58	-11.96	-6.11
CF94-15 108.15	Coarse-grained carbonate/ quartz vein in mudstoned, minor sphalerite and pyrite	calcite		18.23	-12.30	-6.53
CF94-15 108.15	Coarse-grained carbonate/ quartz vein in mudstoned, minor sphalerite and pyrite	dolomite		15.56	-14.89	-7.42
CF94-15 112.48	Coarse-grained carbonate/ quartz vein in mudstoned, minor sphalerite and pyrite	calcite	quartz	17.41	-13.09	-5.55
CF94-15 112.48	Coarse-grained carbonate/ quartz vein in mudstoned, minor sphalerite and pyrite	dolomite		16.49	-13.99	-5.84
CF94-15 129.42	Matrix in debris flow	calcite	clay?	22.05	-8.59	-4.18
CF94-15 129.42	Matrix in debris flow	dolomite		22.26	-8.39	-4.31
CF94-15 132.91	Carbonate in massive sulphides	calcite		21.91	-8.73	-3.96
CF94-15 132.91	Carbonate in massive sulphides	dolomite		21.19	-9.42	-3.87
CF94-15 148.78 - 1	Coarse-grained carbonate, vein with sphalerite	calcite		21.35	-9.27	-7.83
CF94-15 148.78 - 1	Coarse-grained carbonate, vein with sphalerite	dolomite		19.30	-11.26	-8.14
CF94-15 148.78 - 2	Coarse-grained carbonate, vein with sphalerite	calcite		20.49	-10.11	-5.10
CF94-15 148.82 - 1	Coarse-grained carbonate, vein with sphalerite	calcite	sphalerite	21.53	-9.10	-4.97
CF94-15 187.21	Coarse-grained carbonate, net sulphides	calcite		22.26	-8.39	-5.71
CF94-15 187.21	Coarse-grained carbonate, net sulphides	dolomite		21.03	-9.58	-6.07
CF94-15 187.37	Coarse-grained carbonate, net sulphides	calcite		22.79	-7.87	-5.47

Sample #	***Sample description***	***Mineral***	***Impurities***	***δ18O SMOW***	***δ 18O PDB***	***δ 13C PDB***
CF94-15 187.37	Coarse-grained carbonate, net sulphides	dolomite		21.17	-9.45	-5.55
CF94-15 190.25	Coarse-grained carbonate, net sulphides	calcite	quartz ?	18.58	-11.96	-6.99
CF94-15 190.26	Coarse-grained carbonate, net sulphides	calcite		21.87	-8.77	-5.98
CF94-15 190.26	Coarse-grained carbonate, net sulphides	dolomite		20.78	-9.83	-6.09
CF94-15 192.44	Coarse-grained carbonate, net sulphides	calcite		20.15	-10.43	-3.66
CF94-15 192.44	Coarse-grained carbonate, net sulphides	dolomite		21.37	-9.25	-5.12
CF94-15 209.29	Calcarenite	calcite	quartz, pyrite	22.57	-8.09	-6.94
CF94-15 209.29	Calcarenite	dolomite		22.84	-7.82	-6.94
CF94-17 185.98 - 1	Carbonate concretions in laminated framboidal pyrite	calcite	pyrite	22.58	-8.08	-12.79
CF94-17 185.98 - 1	Carbonate concretions in laminated framboidal pyrite	dolomite		17.15	-13.35	-15.57
CF94-63 130.57	Coarse-grained carbonate in laminated sulphide	calcite		22.97	-7.71	-7.96
CF94-63 130.57	Coarse-grained carbonate in laminated sulphide	dolomite		20.76	-9.84	-7.84
CF94-63 130.88	Coarse-grained carbonate in laminated sulphide with stalacmites	calcite		23.25	-7.43	-11.12
CF94-63 130.88	Coarse-grained carbonate in laminated sulphide with stalacmites	dolomite		23.21	-7.47	-11.06

Appendix 13

Fluid inclusion results, Citronen Fjord (KK)

Sample #	***Chip #***	***Mineral***	***Inclusion #***	***Type***	***Th (C)***	***Tm(ice) (C)***
410204	1	Sphalerite	0	PS	128	
	1	Sphalerite	3	PS	118	
	1	Sphalerite	4	PS	-31.8	
	1	Sphalerite	7	PS	108	
	1	Sphalerite	8	PS	103	-35.8
	1	Sphalerite	9	PS	85	-32.2
	1	Sphalerite	10	PS	95	-38.5
	1	Sphalerite	12	PS	113	
	1	Sphalerite	16	PS	108	
	1	Sphalerite	17	PS	113	
	1	Sphalerite	19	PS	113	
	1	Sphalerite	21	PS	85	
	1	Sphalerite	C	PS	118	
	1	Sphalerite	E	PS	90	-34.5
	4	Sphalerite	1	PS	134	-26.1
	4	Sphalerite	4	PS	156	
	4	Sphalerite	5	PS	141	
	4	Sphalerite	6	PS	156	-25.6
	4	Sphalerite	7	PS	138	
	4	Sphalerite	8	PS	141	
	4	Sphalerite	10	PS	138	
	4	Sphalerite	B	PS		
	4	Sphalerite	C	PS	141	
	4	Sphalerite	D	PS	141	
	11	Sphalerite	1	P	107	-44.6
	11	Sphalerite	2	P	110	-45.2
	12A	Sphalerite	1	P	143	-29.2
	12A	Sphalerite	3	P	143	
	12A	Sphalerite	4	P	143	
	12A	Sphalerite	5	P	133	
	12A	Sphalerite	9	P	111	
	12A	Sphalerite	12	P	149	
	12A	Sphalerite	13	P	104	-27.8
	13	Carbonate	1	P	159	-11.0

Sample #	Chip #	Mineral	Inclusion #	Type	Th (C)	Tm(ice) (C)
434257	2	Carbonate	1	P	196	-6.2
	2	Carbonate	2	P	182	-6.2
	2	Carbonate	3	P	180	
	7	Sphalerite	1	S	138	
	7	Sphalerite	3	S	133	
	7	Sphalerite	4	S	141	
	9	Sphalerite	1	P	149	-25.4
	13	Quartz	3	S	134	
	13	Quartz	4	S	172	
	13	Quartz	8	S	170	
	13	Quartz	11	S	197	
	15	Quartz	1	S	115	
	15	Quartz	3	S		
	15	Quartz	4	S	151	
	15	Quartz	5	S	142	
	18	Quartz	2	S	187	
	18	Quartz	3	S	169	
	18	Quartz	5	S	162	
	18	Quartz	7	S	133	
	18	Quartz	11	S	159	

Appendix 14

Lead isotopes, North Greenland (SMJ)

Sample #	*Locality*	*Mineral*	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
CF93-10A	66.3	galena	20.718	15.879	41.549
CF94-15B	85.09	galena	20.739	15.898	41.662
CF94-17	189.93	galena	20.726	15.897	41.637
CF94-21	97.38	galena	20.649	15.893	41.531
CF94-53	19.8	pyrite	20.245	15.807	40.898
CF94-53	56.9	pyrite	19.622	15.740	40.116
CF94-53	74	pyrite	19.514	15.736	40.017
CF94-53	86.8	pyrite	19.823	15.747	40.360
CF94-53	86.8	pyrite	19.904	15.782	40.509
CF94-53	97.7	pyrite	20.341	15.833	41.087
CF94-53	97.7	pyrite	20.241	15.818	40.957
CF94-53	126.8	pyrite	19.400	15.710	39.786
CF94-53	136.7	pyrite	20.180	15.772	40.541
CF94-53	164.7	pyrite	20.608	15.855	41.365
CF94-53	219.9	pyrite	20.067	15.800	40.755
CF94-53	219.9	pyrite	20.547	15.845	41.339
CF94-53	230.2	pyrite	20.475	15.894	41.398
CF94-53	244.7	pyrite	20.537	15.851	41.372
CF94-53	261	pyrite	20.699	15.878	41.699
CF95-64	183.35	galena	20.783	15.888	41.784
CF95-77	44.47	galena	19.667	15.790	39.424
CF96-96	58.3	galena	20.645	15.908	41.450
CF96-96	59.6	galena	20.650	15.893	41.437
CF96-97	73.2	galena	20.681	15.874	41.471
CF96-110	114.5	galena	20.732	15.881	41.582
425901	Citronen Fjord	galena	20.586	15.853	41.218
425902	Citronen Fjord	galena	20.592	15.849	41.229
425903	Citronen Fjord	galena	20.612	15.871	41.308
425903	Citronen Fjord	galena	20.620	15.882	41.348
425904	Citronen Fjord	galena	20.593	15.856	41.254
425908	Citronen Fjord	galena	20.650	15.861	41.454
425909	Citronen Fjord	galena	20.710	15.868	41.515

Sample #	Locality	Mineral	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
425909	Citronen Fjord	galena	20.721	15.885	41.562
425913	Citronen Fjord	galena	20.581	15.855	41.233
425913	Citronen Fjord	galena	20.589	15.874	41.289
425914	Citronen Fjord	galena	20.603	15.880	41.308
425918	Citronen Fjord	galena	20.564	15.840	41.174
425918	Citronen Fjord	galena	20.582	15.859	41.244
425922	Citronen Fjord	galena	20.680	15.870	41.471
425931	Citronen Fjord	galena	18.777	15.622	39.029
425931	Citronen Fjord	galena	18.769	15.626	39.040
425932	Citronen Fjord	galena	18.782	15.618	39.028
425933	Citronen Fjord	galena	19.095	15.663	39.443
425934	Citronen Fjord	galena	20.608	15.877	41.308
425940	Citronen Fjord	galena	17.416	15.470	38.164
425944	Citronen Fjord	galena	17.538	15.469	38.408
425945	Citronen Fjord	galena	17.356	15.421	38.192
425946	Citronen Fjord	galena	17.497	15.443	38.233
425947	Citronen Fjord	galena	17.616	15.468	38.331
425948	Citronen Fjord	galena	20.617	15.851	41.352
425951	Citronen Fjord	galena	20.489	15.839	41.234
425969	Citronen Fjord	galena	19.804	15.781	39.947
425978	Citronen Fjord	galena	18.029	15.555	37.929
425981	Citronen Fjord	galena	20.655	15.862	41.423
425982	Citronen Fjord	galena	20.616	15.860	41.377
425983	Citronen Fjord	galena	20.623	15.839	41.340
100825	J.C. Christensen Land s.l.	galena	19.452	15.717	39.943
422215	J.C. Christensen Land s.l.	pyrite	17.225	15.400	36.858
430232	J.C. Christensen Land s.l.	cc	18.656	15.546	37.790
430233	J.C. Christensen Land s.l.	cc	18.899	15.572	37.930
430235	J.C. Christensen Land s.l.	cc	18.292	15.558	37.724
430236	J.C. Christensen Land s.l.	cc	17.724	15.497	37.387
430470	J.C. Christensen Land s.l.	cc	17.862	15.525	37.542
427543	Navarana Fjord	galena	19.801	15.453	39.924
427545	Navarana Fjord	galena	19.043	15.676	39.503
435703	Navarana Fjord	pyrite	19.590	15.703	39.255
435704	Navarana Fjord	galena	18.441	15.616	38.903
435705	Navarana Fjord	pyrite	19.202	15.694	39.570
435739	Navarana Fjord	pyrite	19.802	15.698	39.179

Sample #	*Locality*	*Mineral*	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
435756	Navarana Fjord	galena	19.114	15.684	39.622
435777	Navarana Fjord	galena	17.624	15.499	38.302
435781	Navarana Fjord	pyrite	20.322	15.824	41.764
435785	Navarana Fjord	pyrite	19.245	15.619	39.522
435787	Navarana Fjord	pyrite	18.497	15.547	38.091
435788	Navarana Fjord	pyrite	18.607	15.592	37.921
435711 (1)	Navarana Fjord	galena	17.667	15.500	38.335
435764 (1)	Navarana Fjord	galena	18.966	15.666	39.440
S072704	Navarana Fjord	galena	19.138	15.682	39.635
F080302	Kap Wohlgemuth	galena	17.923	15.520	38.478
F080302	Kap Wohlgemuth	galena	17.893	15.490	38.401
G073101	Kap Wohlgemuth	galena	17.956	15.520	38.384
G080301	Kap Wohlgemuth	galena	19.906	15.772	40.764
F080506	N Nyeboe Land	galena	20.225	15.809	41.435
F080604	N Nyeboe Land	galena	19.902	15.764	40.870
F080606	N Nyeboe Land	galena	20.002	15.790	41.048
G080902	N Nyeboe Land	galena	19.857	15.775	40.952
G080904	N Nyeboe Land	galena	19.842	15.767	40.901
G081309	N Nyeboe Land	galena	19.861	15.768	40.909
R080603	N Nyeboe Land	galena	20.175	15.802	41.450
R080606	N Nyeboe Land	galena	20.173	15.795	41.443
R081004	N Nyeboe Land	galena	19.957	15.779	41.345
R081201	N Nyeboe Land	galena	19.988	15.766	41.095
Z080901	N Nyeboe Land	galena	19.847	15.759	40.897
R081002	N Nyeboe Land	galena	19.973	15.761	41.315
R081303	N Nyeboe Land	galena	19.952	15.775	41.103
Kap Brevoort	Gap Dal, N Nyeboe Ld	galena	19.969	15.758	41.307
R081402	Victoria Fjord	pyrite	19.381	15.699	39.877
R081404	Victoria Fjord	pyrite	25.218	18.157	40.331
447004	Washington Land	galena	19.347	15.706	39.884
447013	Washington Land	galena	19.344	15.699	39.784
447021	Washington Land	galena	20.329	15.837	44.255
447027	Washington Land	galena	20.492	15.829	43.626
447029	Washington Land	galena	20.292	15.789	44.087
447033	Washington Land	galena	20.286	15.789	44.111
P-760-194 (1)	Polaris	galena	17.807	15.492	37.938

Sample #	Locality	Mineral	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
P-820-232 (1)	Polaris	galena	17.826	15.508	38.019
P-820-232 (2)	Polaris	galena	17.818	15.498	37.994
P-850-212 (1)	Polaris	galena	17.822	15.510	38.010
P-850-212 (2)	Polaris	galena	17.835	15.522	38.052
P-850-212 (3)	Polaris	galena	17.854	15.548	38.141
P87-18B-108.5	Polaris	galena	17.826	15.507	38.012
P87-18B-127	Polaris	galena	17.842	15.529	38.087
P87-18B-158	Polaris	galena	17.844	15.506	38.005
P87-18B-180.5	Polaris	galena	17.819	15.500	37.994
P87-18B-202	Polaris	galena	17.845	15.518	38.040
P87-18B-223	Polaris	galena	17.814	15.495	37.982
P87-18B-226	Polaris	galena	17.851	15.544	38.132
P87-18B-237	Polaris	galena	17.837	15.522	38.066
P-880-210	Polaris	galena	17.826	15.512	38.013
P-900-F ramp (1)	Polaris	galena	17.868	15.517	38.031
P-900-F ramp (1)	Polaris	galena	17.828	15.511	38.029
P-900-F ramp (2)	Polaris	galena	17.824	15.510	38.024
P-North Pit (1)	Polaris	galena	17.819	15.508	37.991
P-North Pit (2)	Polaris	galena	17.828	15.519	38.029
N-02-08	Nanisivik	galena	17.868	15.576	37.926
N-10 (1)	Nanisivik	galena	17.894	15.579	37.942
N-10 (2)	Nanisivik	galena	17.892	15.571	37.909
N-29	Nanisivik	galena	17.901	15.600	38.060
N-29	Nanisivik	galena	17.881	15.577	37.987
N-Ocean View	Nanisivik	galena	17.883	15.584	37.995
N-West Pit	Nanisivik	galena	17.886	15.610	38.077

Appendix 15

List of samples, central East Greenland (MP)

Sample #	*Area*	*Longitude*	*Latitude*	*Year*
NM-3462*	Mesters Vig	-23.97826	72.18300	?
NM-5657*	Mesters Vig	-23.80978	72.07237	?
NM-8010152*	Mesters Vig	-24.00369	72.09211	1980
NM-8010186*	Mesters Vig	-24.00369	72.09211	1980
NM-8001.045*	Bredehorn	-24.58475	71.54391	1980
NM-8003.030*	Karstryggen	??		1980
403106	Karstryggen	-24.57655	71.56004	1994
403131	Mesters Vig	-23.92355	72.11732	1994
403147	Mesters Vig	-23.92391	72.12149	1994
403156	Mesters Vig	-23.88406	72.12774	1994
403163	Mesters Vig	-23.89855	72.14474	1994
403164	Mesters Vig	-23.89855	72.14474	1994
403165	Mesters Vig	-23.89855	72.14474	1994
403188	Mesters Vig	-24.01653	72.09759	1994
403197	Mesters Vig	-24.01653	72.09759	1994
403203	Mesters Vig	-23.93116	72.13268	1994
403223	Bredehorn	-24.01139	71.84901	1994
403228	Bredehorn	-24.00794	71.74937	1994
403233	Bredehorn	-24.00365	71.85833	1994
403234	Bredehorn	-24.00365	71.85833	1994
403258	Devondal	46150	290093	1994UTM
403260	Devondal	45970	289959	1994UTM
403267	Devondal	45682	289830	1994UTM
403270	Devondal	43995	288180	1994UTM
403272	Devondal	43850	288117	1994UTM
403279	Devondal	43250	286762	1994UTM
403291	Devondal	43230	286983	1994UTM
403506	Mesters Vig	-24.1636	72.18356	1994
403507	Mesters Vig	-24.1636	72.18356	1994
428201	Rubjerg Knude	-23.33584	72.69393	1996
428202	Rubjerg Knude	-23.32078	72.69482	1996
428203	Rubjerg Knude	-23.32078	72.69482	1996
428204	Rubjerg Knude	-23.32078	72.69482	1996
428205	Rubjerg Knude	-23.32078	72.69482	1996
428206	Rubjerg Knude	-23.40181	72.66801	1996
428207	Rubjerg Knude	-23.40075	72.67127	1996
428208	Rubjerg Knude	-23.34187	72.69451	1996
428209	Rubjerg Knude	-23.34036	72.69147	1996
428210	Rubjerg Knude	-23.33479	72.69125	1996

* Samples from Nordisk Mineselskab A/S

Sample #	*Area*	*Longitude*	*Latitude*	*Year*
428211	Rubjerg Knude	-23.33479	72.69125	1996
428212	Rubjerg Knude	-23.33479	72.69125	1996
428213	Rubjerg Knude	-23.33479	72.69125	1996
428214	Rubjerg Knude	-23.33479	72.69125	1996
428215	Rubjerg Knude	-23.33479	72.69125	1996
428216	Rubjerg Knude	-23.33479	72.69125	1996
428217	Rubjerg Knude	-23.33479	72.69125	1996
428218	Rubjerg Knude	-23.33479	72.69125	1996
428219	Rubjerg Knude	-23.33479	72.69125	1996
428220	Rubjerg Knude	-23.33479	72.69125	1996
428221	Rubjerg Knude	-23.33479	72.69125	1996
428222	Rubjerg Knude	-23.33479	72.69125	1996
428223	Rubjerg Knude	-23.33479	72.69125	1996
428224	Rubjerg Knude	-23.32967	72.69482	1996
428225	Rubjerg Knude	-23.32967	72.69482	1996
428226	Rubjerg Knude	-23.32967	72.69482	1996
428227	Rubjerg Knude	-23.32967	72.69482	1996
428228	Rubjerg Knude	-23.32967	72.69482	1996
428229	Rubjerg Knude	-23.32967	72.69482	1996
428230	Rubjerg Knude	-23.32967	72.69482	1996
428231	Rubjerg Knude	-23.32967	72.69482	1996
428232	Rubjerg Knude	-23.32967	72.69482	1996
428233	Rubjerg Knude	-23.3494	72.6916	1996
428234	Rubjerg Knude	-23.3494	72.69071	1996
428235	Wegener Halvø	-22.77294	71.68392	1996
428236	Wegener Halvø	-22.75631	71.68646	1996
428237	Wegener Halvø	-22.75000	71.68872	1996
428238	Wegener Halvø	-22.76433	71.6832	1996
428239	Wegener Halvø	-22.75631	71.68736	1996
428240	Wegener Halvø	-22.75631	71.68736	1996
428241	Wegener Halvø	-22.75631	71.68736	1996
428242	Wegener Halvø	-22.75631	71.68736	1996
428243	Wegener Halvø	-22.75631	71.68736	1996
428244	Wegener Halvø	-22.75631	71.68736	1996
428245	Wegener Halvø	-22.75631	71.68736	1996
428246	Wegener Halvø	-22.75631	71.68736	1996
428247	Wegener Halvø	-22.75631	71.68736	1996
428248	Wegener Halvø	-22.78154	71.69488	1996
428249	Wegener Halvø	-22.77982	71.69777	1996
428250	Wegener Halvø	-22.77982	71.69777	1996
428251	Wegener Halvø	-22.77724	71.70112	1996
428252	Wegener Halvø	-22.77724	71.70112	1996
428253	Wegener Halvø	-22.77724	71.70112	1996
428254	Wegener Halvø	-22.77580	71.70547	1996
428255	Wegener Halvø	-22.77666	71.70954	1996

Sample #	Area	Longitude	Latitude	Year
428256	Wegener Halvø	-22.77294	71.71189	1996
428257	Wegener Halvø	-22.7953	71.70185	1996
428258	Wegener Halvø	-22.81451	71.69216	1996
428259	Wegener Halvø	-22.81451	71.69216	1996
428260	Wegener Halvø	-22.83916	71.69642	1996
428261	Wegener Halvø	-22.83916	71.69642	1996
428262	Wegener Halvø	-22.84088	71.69732	1996
428263	Wegener Halvø	-22.84088	71.69732	1996
428264	Wegener Halvø	-22.84088	71.69732	1996
428265	Wegener Halvø	-22.84088	71.69732	1996
428266	Wegener Halvø	-22.84805	71.69723	1996
428267	Wegener Halvø	-22.84805	71.69723	1996
428268	Wegener Halvø	-22.75000	71.68872	1996
428269	Wegener Halvø	-22.75000	71.68872	1996
428270	Wegener Halvø	-22.75000	71.68872	1996
428271	Wegener Halvø	-22.75631	71.68646	1996
428272	Wegener Halvø	-22.76147	71.68773	1996
428273	Wegener Halvø	-22.76491	71.68782	1996
428274	Wegener Halvø	-22.76720	71.68736	1996
428275	Wegener Halvø	-22.75975	71.68374	1996
428276	Wegener Halvø	-22.60227	71.69279	1996
428277	Wegener Halvø	-22.60227	71.69279	1996
428278	Wegener Halvø	-22.53636	71.72766	1996
428279	Wegener Halvø	-22.56563	71.75225	1996
428280	Wegener Halvø	-22.56563	71.75225	1996
428281	Wegener Halvø	-22.51506	71.64775	1996
428282	Wegener Halvø	-22.75000	71.61261	1996
428283	Wegener Halvø	-22.75966	71.61072	1996
428284	Wegener Halvø	-22.75966	71.61072	1996
428285	Wegener Halvø	-22.75966	71.61072	1996
428286	Wegener Halvø	-22.75966	71.61072	1996
428287	Wegener Halvø	-22.85206	71.68239	1996
428288	Wegener Halvø	-22.87041	71.68202	1996
428289	Wegener Halvø	-22.86812	71.68383	1996
428290	Wegener Halvø	-22.87959	71.68193	1996
428291	Wegener Halvø	-22.83458	71.66247	1996
428292	Wegener Halvø	-22.83458	71.66247	1996
428293	Wegener Halvø	-22.83458	71.66247	1996
428294	Wegener Halvø	-22.80877	71.65252	1996
428295	Wegener Halvø	-22.80877	71.65252	1996
428296	Wegener Halvø	-22.81823	71.65351	1996
428297	Wegener Halvø	-22.81823	71.65351	1996
428298	Wegener Halvø	-22.81823	71.65351	1996
428299	Wegener Halvø	-22.81823	71.65351	1996

Sample #	*Area*	*Longitude*	*Latitude*	*Year*
428901	Wegener Halvø	-22.81909	71.65704	1996
428902	Wegener Halvø	-22.81909	71.65704	1996
428903	Wegener Halvø	-22.81909	71.65704	1996
428904	Mesters Vig	-24.00369	72.16723	1996
428905	Mesters Vig	-23.99457	72.16667	1996
428906	Mesters Vig	-24.09743	72.1468	1996
428907	Mesters Vig	-24.09743	72.1468	1996
428908	Mesters Vig	-24.09743	72.1468	1996
428909	Mesters Vig	-24.15258	72.17455	1996
428910	Mesters Vig	-24.15258	72.17455	1996
428911	Mesters Vig	-24.15258	72.17455	1996
428912	Mesters Vig	-24.15258	72.17455	1996
428913	Mesters Vig	-24.00369	72.09211	1996
428914	Mesters Vig	-24.00369	72.09211	1996
428915	Mesters Vig	-24.01653	72.09759	1996
428916	Mesters Vig	-24.01653	72.09759	1996
428917	Mesters Vig	-24.01653	72.09759	1996
428918	Mesters Vig	-23.96920	72.14605	1996
428919	Mesters Vig	-23.96920	72.14605	1996
428920	Mesters Vig	-23.96920	72.14605	1996
428921	Mesters Vig	-23.97101	72.13816	1996
428922	Mesters Vig	-23.97101	72.13816	1996
428923	Mesters Vig	-23.97101	72.13816	1996
428924	Mesters Vig	-23.97101	72.13816	1996
428925	Mesters Vig	-23.97283	72.13673	1996
428926	Mesters Vig	-23.96739	72.16009	1996

Appendix 16

Geochemical data, central East Greenland (MP)

Sample (Unit) (Det. lim.) (Method)	***Area***	***Ag*** ppm (0.2) ICP	***Cd*** ppm (0.5) ICP	***Cu*** ppm (1) ICP	***Mn*** ppm (2) ICP	***Ni*** ppm (1) ICP	***Pb*** ppm (2) ICP	***Zn*** ppm (1) ICP
428211	Traill Ø	0	1.3	51	350	46	21	88
428212	Traill Ø	0	0	7	41	2	0	8
428213	Traill Ø	0	0	4	52	2	2	1
428214	Traill Ø	0	0	3	158	3	0	11
428215	Traill Ø	0	0	28	27	23	13	5
428216	Traill Ø	0	0	5	147	3	2	5
428217	Traill Ø	0	0.6	29	173	21	5	26
428218	Traill Ø	0	0	7	28	4	2	3
428219	Traill Ø	0.2	0.6	8	151	12	3	13
428220	Traill Ø	0	0	2	76	3	0	3
428221	Traill Ø	0.3	0	3	154	2	0	9
428222	Traill Ø	0	0	8	222	8	3	16
428223	Traill Ø	0.2	0	5	71	4	0	3
428224	Traill Ø	0	0	48	281	83	27	72
428225	Traill Ø	0	0.7	10	126	12	2	21
428226	Traill Ø	0.2	0.6	20	448	63	19	57
428227	Traill Ø	0.2	0	9	105	9	0	9
428228	Traill Ø	0	0	18	223	16	20	19
428229	Traill Ø	0	0	45	206	31	36	58
428230	Traill Ø	0	1.1	32	347	65	40	99
428231	Traill Ø	0	0	48	663	59	21	84
428232	Traill Ø	0	0	9	627	19	11	35
428233	Traill Ø	0	0.7	19	350	37	11	48
428235	Wegener Halvø	0	0	1	6770	15	0	19
428239	Wegener Halvø	2.2	1.1	37	550	42	554	75
428240	Wegener Halvø	3	27.3	154	811	30	6650	3300
428243	Wegener Halvø	4.2	3.9	297	365	19	18000	594
428244	Wegener Halvø	3.5	1.3	120	569	44	699	118
428245	Wegener Halvø	1.9	1.6	261	1000	19	1490	143
428246	Wegener Halvø	2.6	1.1	46	1100	55	453	87
428247	Wegener Halvø	0.4	162	38	392	12	152	20900

Sample	Area	Ag	Cd	Cu	Mn	Ni	Pb	Zn
428248	Wegener Halvø	2.4	1.1	40	953	15	786	97
428249	Wegener Halvø	5.1	1.4	146	638	33	114	127
428250	Wegener Halvø	3.2	1.6	255	638	15	323	44
428251	Wegener Halvø	3.8	3.7	10	495	25	1270	625
428252	Wegener Halvø	5.5	5.7	25	407	54	4670	618
428253	Wegener Halvø	2.9	3	11	721	21	1210	483
428254	Wegener Halvø	5.1	184	26	433	13	9410	18300
428255	Wegener Halvø	0.2	0.7	1	186	7	16	64
428256	Wegener Halvø	0.2	2.5	9	695	25	39	383
428257	Wegener Halvø	0.3	0.9	5	1900	22	20	101
428261	Wegener Halvø	0	0	11	266	36	36	20
428262	Wegener Halvø	4.4	44.3	763	420	47	389	6120
428263	Wegener Halvø	5.2	37.1	1210	512	22	4260	4190
428264	Wegener Halvø	4.1	3	251	415	67	529	372
428265	Wegener Halvø	3.8	3.2	247	398	73	522	309
428266	Wegener Halvø	4.3	83.9	994	448	37	5390	10600
428267	Wegener Halvø	5.2	33.3	5280	372	43	1350	4280
428268	Wegener Halvø	8	243	60	573	15	192	21400
428271	Wegener Halvø	0.2	2.1	13	638	5	52	445
428272	Wegener Halvø	5	4.1	118	518	56	686	522
428273	Wegener Halvø	0	335	75	275	12	18100	31200
428274	Wegener Halvø	1.4	3.3	9	336	16	178	415
428275	Wegener Halvø	0	221	46	358	8	3660	21100
428276	Wegener Halvø	1.5	1.7	5	426	10	856	118
428277	Wegener Halvø	6.6	21.4	12	399	5	7530	4210
428278	Wegener Halvø	1.4	0.8	10	1640	14	88	55
428279	Wegener Halvø	0.4	0	8	1090	25	23	141
428280	Wegener Halvø	0	0	16	637	36	24	37
428281	Wegener Halvø	0	0	0	815	5	2	4
428282	Wegener Halvø	3	0	222	511	28	42	18
428283	Wegener Halvø	0	0	54	2830	65	12	62
428284	Wegener Halvø	0.7	2.3	71	12	3	758	118
428287	Wegener Halvø	1.8	12.1	40	526	36	2120	1950
428288	Wegener Halvø	2.7	1.3	1130	492	30	46	96
428289	Wegener Halvø	2.5	19.1	1030	355	21	345	2800
428290	Wegener Halvø	0.2	1.1	20	399	34	32	42
428291	Wegener Halvø	5.7	9.4	232	472	81	2630	1200
428292	Wegener Halvø	1.6	25.4	163	253	6	1390	3480
428293	Wegener Halvø	3.9	8.7	24	410	54	4450	1210

Sample	Area	Ag	Cd	Cu	Mn	Ni	Pb	Zn
428294	Wegener Halvø	4.9	10.5	28	439	69	7340	1460
428296	Wegener Halvø	0.2	0	10	955	3	15	12
428299	Wegener Halvø	1.5	0.8	23	1750	27	19	47
428901	Wegener Halvø	7.6	12	463	826	31	6150	2260
428902	Wegener Halvø	7.1	69.5	48	480	51	7170	11600
428904	Mesters Vig	0	2.6	36	236	88	80	275
428905	Mesters Vig	0	0.7	12	279	35	23	60
428918	Mesters Vig	0	0	34	325	62	46	91
428919	Mesters Vig	0	0	38	221	70	28	83
428920	Mesters Vig	0	0	21	213	47	37	89
428921	Mesters Vig	1.5	9.1	61	227	220	221	1920
428922	Mesters Vig	1.1	7.2	47	313	158	195	576
428923	Mesters Vig	0.2	1.5	15	644	32	31	74
428925	Mesters Vig	0	14.7	3	358	5	34	682

Appendix 17

Lead isotopes, Jameson Land (MP)

Sample #	***Area***	***Formation***	***Material***	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
403131	Mesters Vig	Mesters Vig	galena	18.290	15.558	38.205
403147	Mesters Vig	Mesters Vig	galena	18.374	15.571	38.294
403156	Mesters Vig	Mesters Vig	sphalerite	18.347	15.524	38.148
403163	Mesters Vig	Mesters Vig	galena	18.365	15.548	38.221
403164	Mesters Vig	Mesters Vig	galena	18.348	15.528	38.154
403165	Mesters Vig	Mesters Vig	galena	18.351	15.530	38.161
403188	Mesters Vig	Mesters Vig	galena	18.311	15.555	38.191
403197	Mesters Vig	Mesters Vig	sphalerite	18.349	15.532	38.171
403258	Devondal	Wegener Halvø	galena	18.471	15.567	38.306
403260	Devondal	Wegener Halvø	galena	18.487	15.683	38.610
403260	Devondal	Wegener Halvø	galena	18.454	15.617	38.421
403267	Devondal	Wegener Halvø	galena	18.407	15.586	38.285
403272	Devondal	Wegener Halvø	galena	18.398	15.562	38.215
403291	Devondal	Pingo Dal	galena	18.557	15.610	38.595
403507	Mesters Vig	Mesters Vig	sphalerite	18.342	15.547	38.214
428240	Wegener Halvø	Ravnefjeld	galena	18.465	15.569	38.288
428243	Wegener Halvø	Ravnefjeld	galena	18.454	15.574	38.296
428243	Wegener Halvø	Ravnefjeld	galena	18.487	15.605	38.394
428253	Wegener Halvø	Ravnefjeld	galena	18.446	15.567	38.266
428258	Wegener Halvø	Wegener Halvø	galena	18.468	15.592	38.368
428263	Wegener Halvø	Ravnefjeld	galena	18.466	15.570	38.307
428277	Wegener Halvø	Ravnefjeld	galena	18.445	15.564	38.256
428277	Wegener Halvø	Ravnefjeld	sphalerite	18.465	15.586	38.326
428291	Wegener Halvø	Ravnefjeld	galena	18.443	15.554	38.240
428294	Wegener Halvø	Ravnefjeld	galena	18.440	15.560	38.259
428901	Wegener Halvø	Ravnefjeld	galena	18.536	15.685	38.647
428901	Wegener Halvø	Ravnefjeld	galena	18.432	15.564	38.245
428906	Mesters Vig	Mesters Vig	galena	18.320	15.530	38.134
428909	Mesters Vig	Mesters Vig	galena	18.274	15.524	38.110
428911	Mesters Vig	Mesters Vig	galena	18.377	15.584	38.342
428912	Mesters Vig	Mesters Vig	galena	18.319	15.583	38.287
428912	Mesters Vig	Mesters Vig	galena	18.283	15.528	38.108
428914	Mesters Vig	Mesters Vig	galena	18.299	15.552	38.184
428915	Mesters Vig	Mesters Vig	galena	18.385	15.574	38.300
3462	Mesters Vig	Mesters Vig	galena	18.321	15.542	38.177
5657	Mesters Vig	Mesters Vig	galena	18.386	15.564	38.280
8010152	Mesters Vig	Mesters Vig	galena	18.321	15.565	38.229
8010186	Mesters Vig	Mesters Vig	galena	18.361	15.597	38.357

Appendix 18

Sulphur isotopes, Jameson Land (MP)

Sample #	*Area*	*Formation*	*Mineral*	$\delta^{34}S$	*Method*
403106	Karstryggen	Karstryggen	galena	-29.7	conventional
403106	Karstryggen	Karstryggen	galena	-21.8	conventional
403163	Mesters Vig	Mesters Vig	galena	11.8	laser
403163	Mesters Vig		galena	13.1	laser
403163	Mesters Vig		galena	13.7	laser
403163	Mesters Vig		sphalerite	10	laser
403164	Mesters Vig		galena	10	conventional
403188	Mesters Vig		chalcopyrite	8.8	conventional
403188	Mesters Vig		galena	7.3	conventional
403197	Mesters Vig		sphalerite	12.7	conventional
403203	Mesters Vig		barite	15.3	conventional
403223	Bredehorn		barite	10.9	conventional
403228	Bredehorn	Karstryggen	gypsum	11.4	conventional
403233	Bredehorn		barite	13	conventional
403234	Bredehorn		barite	15	conventional
403258	Wegener Halvø/Devondal	Wegener Halvø	galena	-5.6	conventional
403260	Wegener Halvø/Devondal	Wegener Halvø	galena	-4.8	conventional
403270	Wegener Halvø/Devondal	Wegener Halvø	barite	13.7	conventional
403272	Wegener Halvø/Devondal	Wegener Halvø	galena	-9.7	conventional
403279	Wegener Halvø/Devondal	Gipsdalen	gypsum	15.8	conventional
403291	Wegener Halvø/Devondal	Pingo Dal	galena	-8.9	laser
403507	Mesters Vig		sphalerite	10.9	conventional
428240	Wegener Halvø/Devondal	Ravnefjeld	galena	-10.9	laser
428240	Wegener Halvø/Devondal	Ravnefjeld	pyrite	-13.5	laser
428243	Wegener Halvø/Devondal	Ravnefjeld	pyrite	-15.7	conventional
428250	Wegener Halvø/Devondal	Ravnefjeld	pyrite	-10	conventional
428254	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-9.3	laser
428256	Wegener Halvø/Devondal	Ravnefjeld	pyrite	-18.8	laser
428268	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-12.2	conventional
428269	Wegener Halvø/Devondal	Ravnefjeld	galena	-10.2	laser
428269	Wegener Halvø/Devondal	Ravnefjeld	galena	-10.4	laser
428273	Wegener Halvø/Devondal	Ravnefjeld	galena	-9.7	laser

Sample #	Area	Formation	Mineral	$\delta^{34}S$	Method
428273	Wegener Halvø/Devondal	Ravnefjeld	galena	-9.2	laser
428273	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-8.9	laser
428273	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-4.4	laser
428273	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-4.6	laser
428277	Wegener Halvø/Devondal	Ravnefjeld	galena	-7.3	laser
428277	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-11.1	laser
428277	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-10.2	laser
428285	Wegener Halvø/Devondal	Wegener Halvø	barite	14.7	conventional
428288	Wegener Halvø/Devondal	Ravnefjeld	pyrite	1.7	laser
428288	Wegener Halvø/Devondal	Ravnefjeld	pyrite	-1.6	laser
428288	Wegener Halvø/Devondal	Ravnefjeld	pyrite	-9.3	laser
428291	Wegener Halvø/Devondal	Ravnefjeld	galena	-8.1	laser
428291	Wegener Halvø/Devondal	Ravnefjeld	galena	-7.2	laser
428291	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-10.6	laser
428901	Wegener Halvø/Devondal	Ravnefjeld	chalcopyrite	-4.9	laser
428901	Wegener Halvø/Devondal	Ravnefjeld	galena	-4.9	laser
428901	Wegener Halvø/Devondal	Ravnefjeld	galena	-6.1	laser
428901	Wegener Halvø/Devondal	Ravnefjeld	galena	-5.5	laser
428901	Wegener Halvø/Devondal	Ravnefjeld	galena	-5.9	laser
428901	Wegener Halvø/Devondal	Ravnefjeld	pyrite	-6	laser
428901	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-4	laser
428901	Wegener Halvø/Devondal	Ravnefjeld	sphalerite	-5.1	laser
428906	Mesters Vig		galena	4.6	conventional
428907	Mesters Vig		barite	11.4	conventional
428909	Mesters Vig		galena	3.6	conventional
428912	Mesters Vig		galena	3.4	conventional
NM8001-045	Bredehorn	Karstryggen	galena	7.4	conventional
NM8003-030	Karstryggen	Karstryggen	celestite	21.6	conventional
403506	Mesters Vig		galena	2.1	conventional

Appendix 19

Vitrinite reflectance and total organic content (TOC), Ravnefjeld Formation, Wegener Halvø, central East Greenland (MP)

Sample #	*Vit. ref. (%)*	*TOC*
428240	3.00	1.78
428240	2.98	1.78
428246	3.02	2.87
428253	1.72	1.23
428256	1.81	0.95
428266	1.85	1.25
428279	1.76	0.65
428282	1.69	1.22
428287	2.03	1.10
428291	1.88	3.98
428294	1.65	1.72
428901	1.67	1.94