

Below is described the metadata for rock and then for stream sediment and soil geochemical data presented in the Maniitsoq mapsheet ArcGIS project and webmap

Maniitsoq Rock Geochemistry Metadata

Rock samples from the Maniitsoq mapsheet area have been collected and chemically analysed since the early geological reconnaissance by GGU (The Geological Survey of Greenland) and early mineral exploration by Kryolitselskabet Øresund A/S. The compiled geochemical data comprise archived GGU-GEUS data and data acquired by MMR (The Ministry of Mineral Resources) in 2016 and 2017.

Samples from each rock sampling campaign have been analysed according to the purpose of the campaign and analytical method available at the time. The number of elements and oxides determined as well as the data quality varies between sample batches and therefore each set of analytical data is presented individually in excel files, one per batch. Batches are numbered 1 to 16 for GGU-GEUS data and 20 for MMR samples. The excel files include coordinates, collector name, year of collection, lithological group and given name or description.

The view shows the 1142 analysed samples with symbols reflecting the lithological group. Each point is linked to the excel-file containing the analytical data.

The campaign and data for each batch are described briefly in the following. Links to pdfs of GGU-GEUS publications may be found at http://maps/greenmin.gl/geusmap/?mapname=greenland_portal&

Analytical methods

Major element oxides are generally determined by X-ray fluorescence spectrometry (xrf) in batches 1 to 16, and by inductively coupled plasma spectrometry (icp) in batch 20. In some batches a few major element oxides are determined by energy dispersive plutonium-isotope excited X-ray fluorescence (plu), denoted by a suffix to the oxide.

Trace elements are determined by plu, energy dispersive cadmium-isotope excited X-ray fluorescence (cd), instrumental neutron activation analysis (ina) or inductively coupled plasma spectrometry (icp). Platinum group elements (PGE) and Au may be determined using fire assay methods in the processing (FA). The method is indicated with a suffix to the element name in the tables. More information may be sought in the referenced papers.

Oxides are given in %, trace elements in ppm or in ppb (Au, PGE).

Batch 1.

The small Archean carbonatite complex named Tupertalik was mapped and sampled in 1981, see

Larsen LM, Pedersen AK, 1982. A minor carbonatite occurrence in southern West Greenland: the Tupertalik intrusion. Rapport Grønlands Geologiske Undersøgelse, 110, 38–43.

Geochemical analyses and rock types for 12 samples are provided by L.M. Larsen, and sample localities were digitised based on a field map. Major and trace elements were determined by xrf.

Batch 2.

Samples (mainly supracrustal rocks) were collected as supplement to stream sediment samples with main interest in base metals. Archived GEUS data, not previously reported.

Batch 3.

Samples (mainly orthogneiss) were collected during reconnaissance geochemical exploration 1993. Archived GEUS data, not previously reported.

Batch 4.

Samples were collected during exploration for base metals in mafic rocks in the Maniitsoq Norite Belt and surroundings, and they comprise amphibolite and metanorite. All samples were later additionally analysed for Au, Pt and Pd (Secher, 2001), many for base metals and some for major components. Archived GEUS data, rock description and data reported in:

Secher K, 2001. The Pd + Pt dispersion in noritic and undifferentiated mafic rocks of the Archaean craton east of Maniitsoq, southern West Greenland. Rapport Grønlands Geologiske Undersøgelse 2001/12, 22 pp.

Batch 5.

Samples from 1986–1987 were collected in connection with geological mapping of the 1:100,000 scale Fiskefjord map sheet (Garde, 1989). Archived GEUS data reported in:

Garde AA, 1997. Accretion and evolution of an Archaean high-grade grey gneiss-amphibolite complex: the Fiskefjord area, southern West Greenland. Geology of Greenland Survey Bulletin 177, 114.

Batch 6.

Four samples from 2004 of sulphidic mafic metavolcanic rocks were collected during follow-up of gold targets. Archived GEUS data, reported in:

Stensgaard BM, 2008: Gold favourability in the Nuuk region, southern West Greenland: results from fieldwork follow-up on multivariate statistical analysis. Mineral resource assessment of the Archaean Craton (66° to 63°30'N), SW Greenland Contribution no. 9. Grønlands Geologiske Undersøgelse Rapport 2008/8, 74 pp.

Batch 7.

Three samples from 2006 of sulphidic mafic metavolcanic rocks were collected during follow-up of gold targets (Stensgaard, 2008, see above). Archived GEUS data.

Batch 8.

Four samples were collected during kimberlite exploration from a site with alkali-metasomatised orthogneiss. The alteration was related to the intrusion of the Qaqarssuk carbonatite. The fifth sample is diorite from another site. Archived GEUS data, not previously reported.

Batch 9.

Ten of the samples collected by Secher (1982) (batch 4) were reanalysed for REE and PGE and other elements in a new study of the norites, see:

Garde AA, McDonald I, Dyck B, Keulen N, 2012. Searching for giant, ancient impact structures on Earth: The Mesoarchaeon Maniitsoq structure, West Greenland. *Earth and Planetary Science Letters* 337–338, 197–210. Supplementary file.

Kokfelt TF, Garde AA, McDonald B, 2013. Ni-mineralised norites and post-kinematic diorites in the Maniitsoq structure, southern West Greenland: Evidence for impact-related intrusion and source modification. In: AA Garde, LL Sørensen (Eds): *Current nickel and base metal exploration in Greenland: the Copenhagen lectures, September 2013.*, Danmarks og Grønlands Geologiske Undersøgelse Rapport 2013/97, 15–28.

Batch 10.

During geological reconnaissance in 2011, ca 30 samples were collected within the Finnefjeld complex and analysed. Four of the analyses have been published. The remaining are not yet publicly available.

Garde AA, Dyck B, Esbensen K, Johansson L, Möller C, 2014. The Finnefjeld domain, Maniitsoq structure, West Greenland: Differential rheological features and mechanical homogenisation in response to impacting? *Precambrian Research* 255, 791–808.

Batch 11.

Samples of the Palaeoproterozoic Kangâmiut dolerite dyke swarm were collected and chemically analysed for petrogenetic studies. Archived GEUS data, reported in:

Mayborn KR, Leshner CE, 2006. Origin and evolution of the Kangâmiut mafic dyke swarm, West Greenland. *Geological Survey of Denmark and Greenland Bulletin* 11, 61–86.

Batch 12.

Neoproterozoic kimberlite dykes in the Maniitsoq region were sampled and analysed for petrogenesis and evaluation of the diamond potential. Archived GEUS data, reported in:

Jensen SM, Secher K, Rasmussen TM, Schjøth F, 2004b. Diamond exploration data from West Greenland: 2004 update and revision. *Danmarks og Grønlands Geologiske Undersøgelse Rapport* 2004/117.

Batch 13.

Samples from the Jurassic Qaqarssuk carbonatite complex collected 1977 and 1979. Archived GEUS data, many samples lack description.

Batch 14.

Samples from within and a few outside the Qaqarssuk carbonatite complex collected 1979. Archived GEUS data, many samples lack description.

Batch 15.

Selected samples from batches 13 and 14 together with more archived and new samples collected 1984 (194 in total) in the Qaqarssuk carbonatite complex were analysed for major and trace elements by xrf and reported in:

Knudsen C, 1991. Geology and geochemistry of the Qaqarssuk carbonatite complex, southern West Greenland. In: G. Friedrich (Ed.) SGA, Monograph Series on Mineral Deposits 29. Berlin, Gebrüder Borntraeger. 110 pp.

Batch 16.

Samples of Mesozoic-Palaeogene alkaline dykes collected by geologists from GGU and Kryolitselskabet Øresund A/S (KØ) were analysed for major and trace elements and reported in:

Larsen LM, 2006. Mesozoic to Palaeogene dyke swarms in West Greenland and their significance for the formation of the Labrador Sea and the Davis Strait. Danmarks og Grønlands Geologiske Undersøgelse Rapport 2006/34, 118 pp.

In the ArcMap project, the initial K in sample-IDs has been replaced by the digit 9 for technical reasons.

Batch 20.

Rock samples collected by MMR in 2016 and 2017 were analysed at ALS for major and trace elements by ICP-MS on fused beads (Li borate). Not previously reported.

Maniitsoq Stream Sediment and Soil Geochemistry Metadata

Exploration geochemistry has been widely applied in Greenland and many samples of stream sediment and 'soil' (regolith) have been collected within the mapsheet area by GEUS and exploration companies. The surveys include both regional coverage and local exploration for specific targets. Samples from each campaign have been treated and analysed differently as described in the following. The topography over the mapsheet area is suited for stream sediment sampling. Soil sampling has been conducted where the bedrock is covered by thin regolith (residual soil and till) or alluvial deposits.

Analytical data

Analytical data are accessible in 7 excel files linked to the sample locality via a batch number. The excel files also contain sample type, coordinates, collector name, year of collection, survey name and survey character. Abbreviations for analytical methods are given as suffixes to the element name. Oxide concentrations are given in weight %, trace elements in ppm or in ppb (Au, PGE). In some files, zeros are used to indicate values below the detection limit, otherwise < value is used.

Samples of stream sediment and soil contain variable amounts of organic material that are lost during the fusion as illustrated by the values for loss on ignition. Therefore, to express the compositional variation in the mineralogenic component of the stream sediment, major element oxides are calculated as volatile-free percentages in batches 21, 22 and 24.

The data are from GEUS surveys except those of batch 25.

Stream sediment surveys

Batch 21. Geochemical atlas

The chemical data represent analysis of the <0.1 mm grain size fraction of samples of sediment collected systematically in low order streams at a nominal density of 1 per 30 km². The low-density coverage of West Greenland with stream sediment samples has been accomplished during many sampling campaigns as reported in:

Steenfelt A, 1999. Compilation of data sets for a geochemical atlas of West and South Greenland based on stream sediment surveys 1977 to 1997. Danmarks og Grønlands Geologiske Undersøgelse Rapport 1999/41.

Steenfelt A, 2001. Geochemical atlas of Greenland – West and South Greenland. Danmarks og Grønlands Geologiske Undersøgelse Rapport 2001/46, 96 pp.

In the Maniitsoq mapsheet area, samples were collected in 1982 (65V2) and 1993 (65V1) with slight overlap between the two sample sets. The latter campaign is described in:

Steenfelt A, Petersen A, and Dam E, 1994. Reconnaissance geochemical mapping of the Aasiaat region (68° to 68°45'N, to 52°45' to 54°W), West Greenland.: Open File Series Grønlands Geologiske Undersøgelse, 94/6, 59 pp.

Batch 22. Steenfelt 1981.

Samples of rock and stream sediment were collected in coastal areas where rust-coloured weathering suggested sulphide mineralisation. Sample localities are clustered along the north shore of Isortoq,

peninsulas NW of Alannua, and inner Kangia fjord. Samples analysed at Risø National Laboratory by delayed neutron counting (dnc) and isotope excited X-ray fluorescence (plu) and later by GGU for major elements and Actlabs for trace elements by ina.

Batch 23. Stensgaard 2006.

The two samples collected during follow-up of a statistical analysis of geodata targeted at prospective areas for gold. Most of the sites visited are south of the Maniitsoq mapsheet. Results discussed in:

Stensgaard BM, 2008. Gold favourability in the Nuuk region, southern West Greenland: results from fieldwork follow-up on multivariate statistical analysis. Mineral resource assessment of the Archaean Craton (66° to 63°30'N), SW Greenland Contribution no. 9. Grønlands Geologiske Undersøgelse Rapport 2008/8, 74 pp.

Batch 24. Sorensen 1977.

Samples were collected within the Qaqarssuk carbonatite complex during follow-up of regional uranium exploration, see:

Secher K, 1980. Distribution of radioactive mineralisation in central West Greenland. Rapport Grønlands Geologiske Undersøgelse 100, 61–65.

Samples were analysed at Risø National Laboratory for radioactive elements by gamma-spectrometry and dnc. eTh and eU denote equivalent (modelled) Th and U values.

Batch 26. Sand 2004

Ten stream sediment samples were collected in the mapsheet area during a study of the dispersal of kimberlite indicator minerals and elements around kimberlite dykes. Analysed and reported together with soil samples, see Batch 26 next section.

Soil surveys

Batch 25. Platinova till.

Commercial companies contracted by Platinova A/S undertook a systematic sampling of “till” (used in a non-specific sense to comprise overburden of glacial, glaciofluvial and residual soil character and here termed soil) and stream sediment across the Archaean craton in the search for diamond-hosting kimberlites. Besides recovery of kimberlite indicator minerals from the coarse grain size fraction, the <0.177 mm fractions were submitted for major and trace element analysis. Au was determined by Fire assay and icp, while the remaining 32 elements were determined by ICP-AES after Aqua regia digestion. Sampling and data are reported in company reports archived as 21502, 21505, 21508, 21568, 21569, 21570 at the Greenland portal (http://maps/greenmin.gl/geusmap/?mapname=greenland_portal&).

Batch 26. Sand 2004.

Regolith samples were collected in a study of dispersal of minerals and elements ‘down-ice’ from known kimberlite dykes. The < 0.1 mm grain size fraction of 500 g samples were analysed for major and trace elements at Activation Laboratories by ICP-MS on fused beads. Kimberlite indicator minerals were recovered from the < 6.3 mm (4 mesh) grain size fraction of 20-kg samples. Results are discussed in:

Steenfelt A, Jensen SM, Sand KK, 2005. Distribution of kimberlite indicator minerals in till within the Neoproterozoic Sarfartoq—Maniitsoq province of kimberlite and ultramafic lamprophyres, southern West Greenland. *Danmarks og Grønlands Geologiske Undersøgelse Rapport 2005/68*, 109–113.

Batch 27. Jensen 1982.

Soil samples were collected from the upper 10-40 cm of the overburden in a 12.5 m spaced regular grid over a Cu-Ni mineralised norite body at Fossilik with the objective of testing the suitability of soil as medium for base metal prospecting in this area. Sampling described in:

Jensen V, Secher K, 1983. A soil sampling programme near a sulphide mineralised norite body, Sitdligisitssanguit nunât, Sukkertoppen district, central West Greenland. *Rapport Grønlands Geologiske Undersøgelse 115*, 34–37.

The <0.1 mm grain size fractions of 50 g samples were digested in nitric acid and analysed for Ni, Cu, Co, Zn and Pb by atomic absorption spectrometry (aas). Powders of selected samples were also analysed at Risø National Laboratory by isotope excited X-ray fluorescence (plu and cd). Results are discussed in:

Secher K, Stendal H, 1989. Weathering products of sulphides in the Arctic - with a case history on a Cu-Ni-sulphide occurrence in West Greenland. In: Barto- Kyriakidis, A. (ed.): *Weathering: Its Products and Deposits 2*, 499–522. Athens: Theophrastus Publications S.A.