

# Diamond exploration in Greenland

The distribution of potentially diamondiferous rocks in West Greenland shows a concentration within the area from 60°N to 69°N. Outside this area occurrences are scarce. In total nearly one thousand localities with kimberlitic rocks in West Greenland have been recorded, of which nearly 2/3 are found within a major alkaline province in the region around 66°N. The density of occurrences appears to partly reflect the uneven degree of investigation of different areas, and partly the fact that the rocks often occur in swarms. The commercial exploration carried out in West Greenland from 1992–2003 has mainly focused on the major alkaline province. The investigations of the remaining part of southern West Greenland has been of more regional character.

## Exploration history

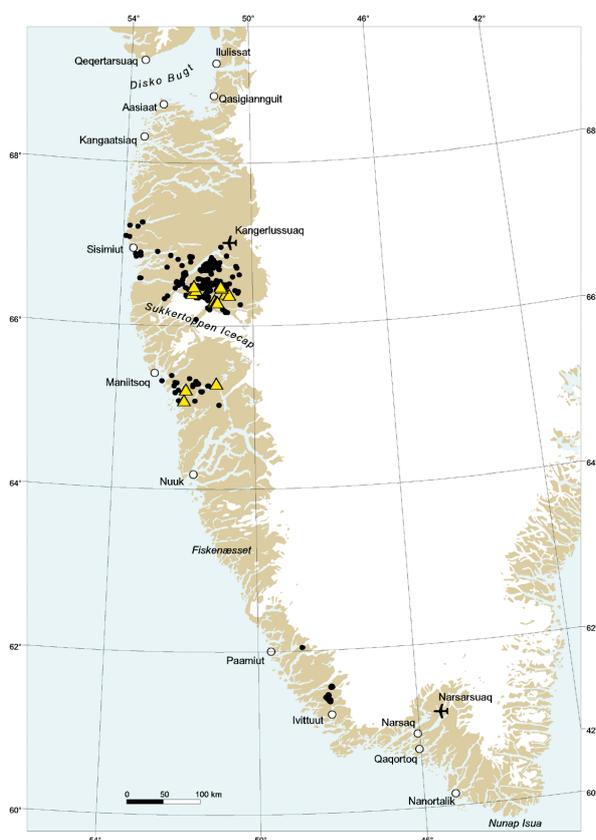
Greenland has seen several campaigns of diamond exploration since the early 1970s. Inspired by reports of kimberlite dykes at several locations in southern West

Greenland, Renzy Mines Ltd. investigated occurrences in the Pyramidefjeld area north of Ivittuut in South-West Greenland and recovered two microdiamonds and one macrodiamond from kimberlitic samples. Early regional kimberlite prospecting covering large parts of West Greenland resulted in two microdiamonds extracted from bulk stream sediment samples in the large Arnangernup Kuaa ('Sarfartoq') valley.

Industrial field campaigns from 1994 onwards have been dedicated to regional till and stream sediment sampling programmes with a view to locate kimberlite indicator minerals. More than 13.000 sites have been sampled and more than 100.000 suspected indicator minerals analysed. Next followed airborne magnetic and electromagnetic surveys and drilling for possible diatremes on frozen lakes. The first diamonds from in situ kimberlite was reported from the area east of Maniitsoq in 1997 by Platinova A/S. One sample (792 kg) of a large dyke yielded 25 microdiamonds (<0.5 mm) and 16 macrodiamonds (all <1 mm).

The largest number of microdiamonds recovered was from a field of large boulders of a suspected dyke or sill that returned 474 microdiamonds and 5 macrodiamonds. Another striking discovery was of a very large dyke that is traceable by geophysical means over a length of 5 km with a width of 20 m confirmed by two inclined drill holes. In 2002, GEUS and BMP conducted an airborne hyperspectral survey over the Sarfartoq region in order to assess this remote sensing technique for detecting kimberlitic rocks and weathering material associated with them.

Survey fieldwork in 2001 and 2002 has been focused on the spatial distribution of kimberlitic dyke rocks in areas with limited previous information, and detailed studies on mantle xenoliths from the kimberlitic dykes. In 2003, GEUS and BMP commenced a programme to test mini-bulk samples of kimberlitic dykes for diamond content by caustic fusion dissolution, and to determine and characterise their indicator mineral populations and chemistries. Concurrently, research on selecting further targets is conducted including a new comprehensive age dating programme, pet-



Map showing the occurrences of kimberlitic rocks (black dots) and diamond finds (yellow triangles).



Kimberlite dyke (2m) near Maniitsoq.

several decimetres. Ubiquitous kimberlitic or lamproitic boulders ranging in size from a few centimetres to 2 metres across are often concentrated in clusters or trains that may number hundreds of boulders, and be many hundreds of metres long.

rography and studies on regional uplift and thermal history of West Greenland.

### Geological environment

Southern West Greenland hosts a major alkaline province with a variety of ultramafic alkaline rocks. The alkaline province includes swarms of dykes described as kimberlites and lamproites, and these rock types are widely distributed in the Sisimiut–Sarfartoq–Kangerlussuaq region, as well as the region just south of Sukkertoppen Icecap. Lamproitic dykes in the Sisimiut region are around 1.2 Ga old and the kimberlitic dykes in both the Sarfartoq and Sisimiut regions have ages of around 0.6 Ga. A precise spatial relationship between the intrusive events resulting in kimberlitic rocks and the 0.6 Ga Sarfartoq carbonatite complex has not been established. The 170 Ma Qaqaarsuk complex, located in the area south of Sukkertoppen Icecap, represents the youngest alkaline magmatic event.

The kimberlitic intrusions are often flat-lying sheets, rarely over 1 m wide, and traceable for a few tens of metres, while others are subvertical, 1–2 m wide, and traceable for many hundreds of metres. The dykes often contain numerous mantle xenoliths ranging in size from a few millimetres to

### Concluding remarks

Most of the approximately 600 diamonds reported to date are from just two areas, both located in the unworked Archaean craton. All in situ diamond occurrences fall within areas outlined by the diamond-favourable indicator minerals from till and stream sediment samples. On a local scale, however, kimberlite tracing using indicator minerals from till samples is not straightforward, probably due to complex glacial dynamics. The most diamond-favourable indicator minerals are distributed far beyond the areas with known diamonds. This observation, together with a regional structural control, suggests that the potential appears to exist on either side of the boundary between reworked and unworked Archaean basement.

### Key references

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*Exploration companies have produced a large volume of data relevant to diamond exploration since 1995. The data include mineral analyses of heavy minerals recovered from till samples, dyke and boulder distribution maps, geophysical surveys, results of diamond testing of mini-bulk sampled dykes, drill logs, etc. A recent digital compilation on DVD provides a comprehensive overview of company and Survey data available to the mining industry (Jensen et al. 2003).*



Bureau of Minerals and Petroleum (BMP)

Government of Greenland  
P.O. Box 930  
DK-3900 Nuuk  
Greenland

Tel: (+299) 34 68 00  
Fax: (+299) 32 43 02  
E-mail: bmp@gh.gl  
Internet: www.bmp.gl



GEUS

Geological Survey of Denmark  
and Greenland (GEUS)  
Øster Voldgade 10  
DK-1350 Copenhagen K  
Denmark

Tel: (+45) 38 14 20 00  
Fax: (+45) 38 14 20 50  
E-mail: geus@geus.dk  
Internet: www.geus.dk

Author: S.M. Jensen & K. Secher  
Editor: K. Secher  
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