Banded iron formation' (BIF) deposits

Sedimentary and chemical deposited iron formations (BIF), from which almost all iron is obtained, are one of the great iron sources in the world, and in Greenland. Here, deposits related to banded iron formations (BIF), mostly so-called Algoma type, are typical for Archaean greenstone belts formed in continental rifts or at continental margins.

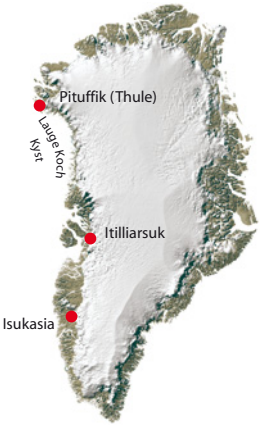
Regional distribution and age of Greenland BIF

In Greenland such deposits are located at Isukasia (~3.8 Ga) in southern West Greenland, at Itilliarsuk (~2.85 Ga) in central West Greenland, and in North West Greenland along the Melville Bugt BIF (~2.7 Ga). The deposits are all characterised by their large size, approaching gigantic dimensions.

The Isukasia BIF

The Isua Greenstone Belt (IGB), hosting the Isukasia deposit about 150 km north-east of Nuuk, is an up to 4 km wide and about 40 km long crescent with enclaves of greenstones, a few hundred metres wide and up to several kilometres long. Large ultrabasic bodies with lesser amount of mafic volcanic rocks and banded iron formation dominate these greenstone belts. BIF occurs mostly as layered quartz magnetite rocks (oxide facies), but silicate facies bands of alternating grunerite and magnetite are also common. Carbonate facies iron formation consisting of alternating bands of siderite and magnetite are rare. In oxide facies iron formation, small amounts of actinolite and pyrite occur. Silicate facies rocks with grunerite also contain pyrrhotite, chalcopyrite and locally small amounts of gold. In the easternmost part of the IGB a major body of oxide facies iron formation occurs. Two thirds of the body is concealed under the Inland Ice. The Isukasia (Isua) iron deposit is, with an age of around 3.8 Ga, probably the oldest banded iron formation in the world.

The Isukasia structure and deposit were first discovered by the Danish company Kryolitselskabet Øresund A/S ('The Cryolite Company') during field activity in 1962, and an iron resource of around 2 billion tons of ore averaging 32.9% Fe was estimated. A large number of diamond drillholes were made, some of them through the inland ice. Twenty years later, Rio Tinto took up a concession and had two campaigns of drilling. Rio Tinto aimed at finding high grade hematite lump ore, but was not satisfied with the results. In January 2006, IMC Group Consultants Ltd (IMC) estimated JORC indicated-inferred resources of 955 Mt averaging 34% Fe, including an indicated-inferred open pit resource of 181 Mt averaging 33.43% Fe, and the London Mining Plc. took over the concession of the area.



The Itilliarsuk BIF

The geotectonic setting of the Archaean supracrustal rocks of the area south of Nuussuaq Peninsula in central West Greenland represents a rift or continental margin environment with more metasediments intercalated in the volcanic sequences than in the island arc setting further south. The thickest succession of supracrustal rocks occurs in the Itilliarsuk area. The supracrustal sequence is at least 2.5 km thick and a banded iron formation deposit occurs 200 m above an often visible 'rust zone' within the supracrustals. The banded iron formation is an approximately 200 m wide sequence of 2–10 cm magnetite-rich cherty bands alternating with quartz-mica schists. A gradual transition zone between the iron formation and the adjacent rocks in the sequence is characterised by a garnet-hornblende-magnetite bed. The iron-rich beds gradually become poorer in magnetite and richer in garnet and hornblende. Cyclic repetition occurs between the magnetite-bearing bed, and the occurrence of garnet and hornblende in distinct beds can be traced over 500 m along strike. This indicates that the transition from iron oxide

1–2 m thick BIF horizon in a sequence of pelitic gneiss (rusty brown) and amphibolit (dark), south of Pituffik, North-West Greenland.

Boulder of banded hematite ore (23 x 53 cm), found along the ice margin at Isukasia, southern West Greenland.

Close-up of folded banded quartz-magnetite ore in a 1 m outcrop at Isukasia, southern West Greenland.

to iron silicates reflects a primary chemical gradation in the sediment.

The Cryolite Company initiated exploration in the Itilliarsuk area. NunaMinerals A/S later carried out exploration in the area, mainly targeted for gold. The company estimated that the iron-mineralised part was covering an area of 130 x 1000 m and that it has a resource of 150–200 Mt of ore grading 20% Fe. Renewed interest from other companies in the ore potential of the area has in 2007 resulted in new applications for exploration licences.

Iron occurrences in the Qaanaaq (Thule) region

The Qaanaaq (Thule) region of North-West Greenland exposes a high-grade Archaean– Palaeoproterozoic crystalline shield overlain by the intracratonic mainly Mesoproterozoic Thule Basin, which extends across Baffin Bay into Canada.

The southern part of the Qaanaaq region hosts a Neoarchaean iron province which spatially is the largest in Greenland. It forms a WNW–ESE-trending belt, traceable for more than 400 km from Kap Seddon in the south-east throughout the Lauge Koch Kyst to Wolstenholme Ø and Carey Øer. This belt correlates with the iron-rich rocks on northern Baffin Island, Canada. Iron in the form of magnetite and hematite occurs both as quartz-banded iron formation (BIF), massive lenses and layers, and disseminated, mainly in pelitic and mafic schists of the Lauge Koch Kyst supracrustal complex. BIF occurs in units of varying thickness, from less than a metre and up to 40 m, where iron concentrations typically are 30–35%. Furthermore, oxide facies BIF as well as silicate facies BIF with minor iron sulphides occur scattered in the northern part of the Qaanaaq region.

No systematic mineral exploration has been carried out in the North-West Greenland iron province, which is mainly known from the regional geological mapping carried out by the Greenland Geological Survey 1971–80. It is worth noticing that a similar occurrence in the northern Baffin Island of Nunavut in Canada, the Mary River iron ore project, has been explored recently and initiate mine construction is planned to take place in 2010.

Concluding remarks

The potential for iron resources of the BIF type in Greenland is promising, taken into consideration that a number of deposits are large and that they are located in accessible tracts. Recent exploration on more levels has demonstrated an increased interest in the occurrences.

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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

G E U S

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
H. Stendal, B. Thomassen, GEUS

Editor
K. Secher, GEUS

Layout
Henrik Klinge Pedersen, GEUS

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