Zinc potential in Greenland

Greenland was once host to two Zn-Pb mines – the Blyklippen Mine and the Black Angel Mine. The discovery of the Citronen Fjord Zn-Pb deposits – one of the world's largest undeveloped zinc resources – puts Greenland back on stage for zinc.

Geological environments for zinc

Traces and showings of zinc mineralisation are numerous in Greenland, especially in the Palaeozoic Franklinian Basin, which extends for more than 2,500 km E–W through the Canadian Arctic Islands and northern Greenland. Other parts with known zinc mineralisations are within the Archaean and Palaeoproterozoic environments of West and East Greenland.

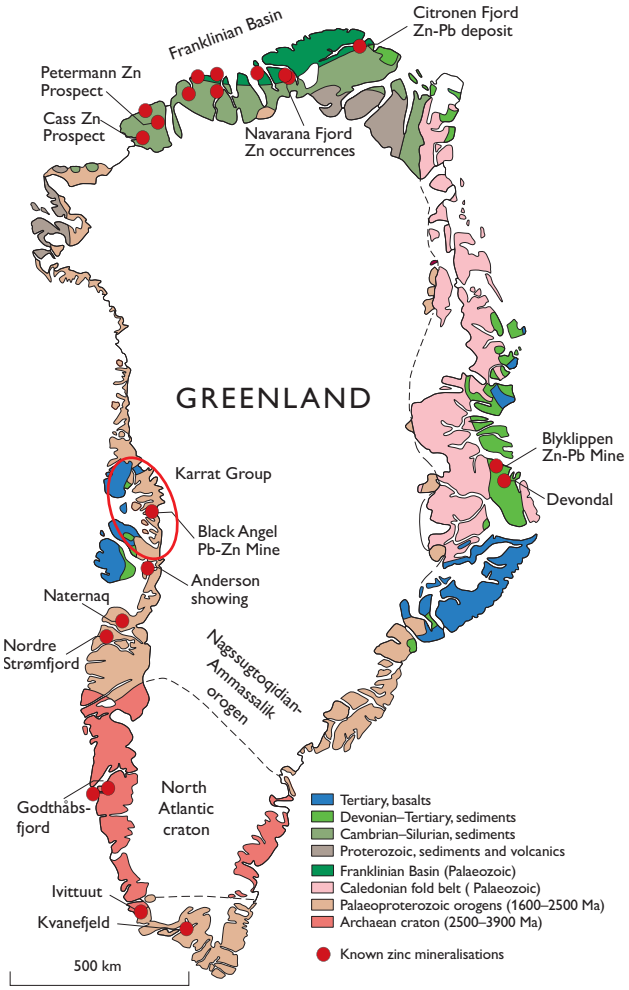
Types of mineralisation

Volcanic massive sulphides (VMS)

Zn-Cu-Pb mineralisation affiliated with volcanic massive sulphide is known from several areas within the Archaean and Palaeoproterozoic parts of central and southern West Greenland. However, so far only smaller, uneconomic occurrences have been found. One example is the Naternaq massive sulphide deposit. The deposit consists of semi-massive to massive sulphide lenses which occur as 0.5-1 m thick parallel zones. The zones can be followed up to 100 m along strike. The deposit mainly contains pyrrhotite, with minor chalcopyrite and sphalerite. Chemical analyses have yielded up to 2.7% Cu and 3.75% Zn. The deposit is roughly estimated to contain up to 4.8 Mt of ore (indicated) and another 16.2 Mt of ore as inferred resource. Other localities with known volcanic-associated massive sulphide systems are the Anderson Cu-Zn showing and areas of Nordre Strømfjord and Godthåbsfjord. Several exploration campaigns have been conducted over these areas.

Sedimentary-exhalative and Mississippi Valley-type mineralisation

The Paleoproterozoic Karrat Group covers some 10 000 km^2 in northern West Greenland. Only restricted parts have seen detailed exploration campaigns and many known anomalies and indications of base metal mineralisation within the Karrat Group are still under-explored and remain open for further exploration. The Karrat Group hosts a great number of carbonate-hosted Zn-Pb mineralisations, particularly in the Mârmorilik Formation. The most famous is the Black Angel Mine, which comprised several ore bodies, totalling 13.6 Mt at 12.3% Zn, 4.0% Pb and 29 ppm Ag. It has been debated



Geological map of Greenland with the distribution of known zinc mineralisations.

whether the deposit represents sedimentary-exhalative or later stage Mississippi Valley-type processes. The other known Zn-Pb mineralisations within the same stratigraphical settings remain to be investigated in further detail. New occurrences have recently been found in grounds formerly covered by the Inland Ice. Zinc occurrences are also known from the Nûkavsak Formation within the Karrat Group, hosted within marbles, pelites and cherts, and these occur intermittently over a strike-length of some 9 km. The best outcrop so far located is a 15–35 cm thick horizon of massive, dark brown sphalerite assaying 41% Zn, but this appears to be of limited lateral extent.

In North Greenland the Palaeozoic Franklinian Basin is recognised to host several Zn- mineralisations, of which the Citronen Fjord Zn-Pb deposit is the best known. This deposit occurs within the deep-water clastic trough sediments of the basin. The global resource of the

The Navarana Fjord escarpment marks shelf and trough facies shift in the Franklinian Basin. This facies border is believed to be one of the guiding controls on the formation of zinc mineralisations in North Greenland. Several zinc occurrences and stream-sediment zinc anomalies are associated with the structure.

Citronen deposit is expected to be 101.7 Mt at 4.7% Zn+Pb at a 2% Zn cut-off (Jan. 2011). The mineralisation is hosted in three levels within a 200 m thick sequence of Ordovician black shales and chert. The mineralisation is considered to be of a SEDEX-style zinc type. Also the shallow-water platform, shelf and slope facies of the Franklinian Basin are known to host several mainly carbonate-hosted zinc occurrences of the Mississippi Valley-type, e.g. the Petermann Prospect, the Cass Prospect and the Navarana Fjord occurrences; none of these have been investigated in detail. The facies-border and structures that most likely have a guiding control on the mineralising systems within the basin in North Greenland can be observed for several hundred kilometres and may represent an excellent target for Zn-Pb exploration.

At Devondal in East Greenland, a significant Cu-Ag-Pb-Zn-Ba mineralisation occurs within Upper Permian limestone over some 1,000 m strike length. This occurrence is interpreted to be of the Irish-type Zn-Pb-Ba mineralisation.

Hydrothermal vein-hosted occurrences

Fault-controlled epithermal Zn-Pb vein occurrences are abundant over some 300 km^2 in the Mesters Vig area, central East Greenland. Of these, the Blyklippen Zn-Pb Mine, which was in production between 1956 and 1962, is the best known. The Blyklippen orebody was a sulphide lens in a quartz vein hosted in Lower Permian sandstones and arkoses. Production totalled nearly 0.55 Mt at 9.3% Pb and 9.9% Zn. The area still holds a potential for discovery of new Zn mineralised vein systems.

Intrusive related zinc occurrences

A zinc resource has long been known from the Kvanefjeld REE-U deposit within the Ilímaussaq alkaline intrusion. Zinc was also exploited between 1856–1987 as a by-product from the alkaline granite stock of the Ivittuut Cryolite Mine. Both are located within the Mesoproterozoic Gardar Province of South Greenland.

Concluding remarks

Greenland has unique potential for discoveries of zinc deposits of world-class scale. Especially the under-explored Franklin Basin is believed to be an excellent target for zinc-lead exploration as well as the Karrat Group, which hosts the Black Angel Mine.

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