Seafloor Massive Sulfide Deposits on the Arctic Mid-Ocean Ridges: an Insight Into Ore-Forming Processes Along Ultraslow Spreading Ridges

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The Arctic Mid-Ocean Ridges (AMOR), an oceanic ridge system located north of the Arctic circle (66°N), consists of several slow and ultraslow spreading ridges associated with abundant hydrothermal activity. The ultraslow Mohns ridge segment of the AMOR hosts numerous seafloor massive sulfide (SMS) deposits and represents a natural laboratory to study recent hydrothermal ore-forming processes that drive their formation.

One of the main characteristics of the SMS deposits found along the Mohns ridge is their diversity in terms of mineral assemblages and metal contents. This study brings new lithology, mineral chemistry, stable isotope, and fluid inclusion data obtained from the selected types of SMS deposits.

The Loki's Castle active SMS deposit (73°34′N, 8°9′E; 2,400 m) is located near the summit of a 30-km-long and 800-m-high axial volcanic ridge (AVR). The deposit is characterized by a basalt-hosted sediment-influenced type of the Zn-Cu-Pb mineralization enriched in Au, Ag, and Tl. The Mohns Treasure inactive SMS deposit (73°N, 7°E; 2,600 m depth) is hosted by basalts. The mineralization can be subdivided to the Cu-, Zn-, and Au-rich types. The Fåvne active SMS deposit (72°45′N, 3°50′E; 3,000 m) occurs at the floor of the rift valley northwest of an AVR. The hydrothermal activity is strongly controlled by a normal NE-SW–trending fault that underlies the western portion of the field. The deposit is characterized as a basalt-hosted ultramafic rock-influenced type of the Zn-Cu-Co mineralization. The Gnitahei extinct SMS deposit is hosted by the footwall of the normal fault that underlies The Fåvne deposit. The mineralization is characterized by an enrichment in Au.

While their future role as a source of metals, including those from the critical raw materials (CRMs) list, remains uncertain, recent SMS deposits provide unique insights into the hydrothermal processes that may support both deep-sea and onshore exploration.