

Geologic Architecture of the Flammefjeld Climax-Type Porphyry Mo System, East Greenland, Imaged by Airborne Magnetic and Natural EM Field Data

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The Flammefjeld prospect in East Greenland occurs at the margin of the Kangerlussuaq Alkaline Complex within the Paleoproterozoic Nagssugtoqidian Mobile Belt and comprises a composite intrusive center expressed at the surface as a breccia pipe (~500m × 800 m) intruded by quartz–feldspar porphyries and surrounded by intense hydrothermal alteration. Field and geochemical observations indicate stockwork molybdenum mineralization with Mo–W enrichment and wall-rock alteration styles consistent with quartz-sericite (phyllic), pyritic, and argillic assemblages, supporting a Climax-type porphyry Mo model. Existing geological models place the principal ore system ~400–600 m below surface as an cupola-shaped body ~800 m in diameter and ~200 m thick, with reported grades up to ~0.5% Mo.

To constrain the subsurface geometry of this mineral system in rugged terrain, a helicopter survey (193 line-km; ~31 km²) acquired total magnetic intensity (TMI) and natural EM field data using MobileMT system. Three-dimensional inversion of magnetic and MobileMT data provides a geologic framework that integrates intrusive architecture, alteration zoning, and structural controls. Magnetic data inversion delineates a coherent intrusive complex. Remanent magnetization is particularly diagnostic for imaging the concealed magmatic core, where induced-only susceptibility can be ambiguous. MobileMT data inversion resolves a resistive core interpreted as the intrusive center, flanked and locally capped by more conductive zones interpreted as altered and sulfide-bearing envelopes; this geophysical zonation matches the expected porphyry system pattern of a relatively resistive plutonic core surrounded by phyllic–argillic alteration and disseminated sulfides.

These integrated constraints refine the 3D geologic model of Flammefjeld and help prioritize drill targeting by linking mapped alteration and brecciation to a concealed intrusive-hydrothermal center.