Using Scanning Electron Microscope-Based Automated Mineralogy to Better Understand Magnetic and Conductive Anomalies in Ni-Cu-Co-PGE Exploration Targets in W-Greenland

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The West Greenland Basalt Province hosts economically significant exploration targets for Ni-Cu-Co-PGE mineralization. Bluejay Mining PLC is actively exploring in the province and funded the current study. The presence of magnetic and conductive minerals (native iron, pyrrhotite, graphite, and magnetite) in the volcanic rocks complicates the understanding of the origins of magnetic and conductive anomalies observed in data from geophysical surveys.

Detailed optical and electron microscopical and petrophysical studies were carried out on drill core material from Qullissat on the north of Disko Island intersecting an intrusion and over- and underlying sedimentary sequences. The body consists of two basaltic blocks with distinct mineralogical and petrophysical signatures that could explain observed geophysical anomalies. On the same samples, automated mineralogy (ZEISS Mineralogic) and petrophysical properties (magnetic susceptibility, remanence, resistivity, and induced polarization) were acquired.

Minerals of interest for conductive and magnetic properties include native iron, magnetite, pyrrhotite, and graphite, as well as Ni-Co-Cu-mineral phases (NiFeCo-phosphides, pentlandite, chalcopyrite). The Ni-Co-Cu-minerals are predominantly observed in the lower block.

The results of this study demonstrate that a) stronger magnetic anomalies observed in the lower block are a result of magnetite and not, as initially thought, caused by the presence of native iron; b) native iron and slightly higher occurrences of pyrrhotite in the upper block explain its more conductive behavior compared to the lower block; c) graphite disseminated throughout both blocks, previously thought a major cause for conductivity, does not appear to have any significant influence on the electric properties; and d) Ni-Co-Cu-bearing minerals occur in higher quantities in the lower block and correlate also with higher amounts of Ti-bearing minerals, which therefore, may represent a set of minerals with potential as indicator minerals.

Automated mineralogy, therefore, can complement petrophysical measurements and geophysical surveys to better define and characterize potential exploration targets for Ni-Cu-Co-PGE mineralization.