UAS-based hyperspectral and magnetic mineral exploration targeting Ni-PGE mineralization on Northern Disko Island, West Greenland.

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Introduction
Geologic mapping in arctic regions faces demanding challenges, from accessibility to weather, light and infrastructure conditions. In this study, we conducted UAS-based (unmanned aerial system) photogrammetric outcrop modelling, interpretation of orthophotos, multi- and hyperspectral based lithological classification and analysis of magnetic data. While magnetics give the location, orientation and subsurface extension of basaltic intrusion (sills/ dykes) spectral imaging, in particular with focus on the iron absorption feature, reveals mineral proxies caused by sulphide weathering.

Test area
Fieldwork within the frame of the EIT project MULSEDRO focused on the Palaeocene flood basalt province of Disko Island (West Greenland). The Quillissat survey area at the Vaigat (Bullersuaq) Strait, connecting with the Baffin bay, lies on the north coast of Disko Island.

Regional setting
On the example of the Quillissat area, we demonstrate how UAS can bring new insights into strategies for magnetic Ni-PGE exploration in the area. Mineralization is associated to Palaeocene basalt sills of the Asuk and Ordlingassooq members,emplaced locally in coal-bearing Cretaceous sandstones.

Methodology
UAS-based magnetic survey was conducted with custom-build Radial fixed wing drones. Multispectral UAS survey was flown with the Parrot elbee fixed-wing and detailed hyperspectral mapping was conducted with a Thulec octocopter. Ground truthing was comprised of handheld spectroscopy, magnetic susceptibility and traditional geologic mapping.

Results
A total of 216 line-km for magnetics and 18.5 km² of multi- and hyperspectral data was covered during the expedition. First results show that integration of drone-borne spectroscopic and magnetic data highlights potential local mineralization. Based on our results, possible indications for mineralization are linear features and sharp contact boundaries in magnetic data products and specific iron absorptions in the spectral data. Resulting maps are validated using handheld spectroscopy, ground magnetics, susceptibility measurements, combined with geochemistry and mineralogy of rock samples examined in the laboratory.

Conclusion
Based on collective data interpretation of fixed-wing magnetics, multispectral imaging and high resolution digital surface models, we support a geologic interpretation having basaltic intrusions covered by sandstone formations and quaternary rock and soil. Observations of weathering and distinct magnetic anomalies leads geologist to new target areas for following ground sampling during subsequent field season. Conclusively, the study solidifies UAS as highly valuable tool for exploration.

References

Additional Information
https://eitrawmaterials.eu/project/mulsedro
https://www.isaflik.org/mulsedro-multi-sensor-drones

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