

EGU2020-20765

<https://doi.org/10.5194/egusphere-egu2020-20765>

EGU General Assembly 2020

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

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Geologic mapping in arctic regions faces demanding challenges, from accessibility to weather, light and infrastructure conditions. Field expeditions need to cover substantial area, and mostly are supported by satellite and airborne data. While named methods offer large-scaled insights, they often lack the required resolution for precise ground investigations. The rise of unmanned aerial systems (UAS) as new state-of-the-art platform in geoscience provides the means needed to close that scale gap.

Fieldwork within the frame of the EIT project MULSEDRO focused on the Paleocene flood basalt province of Disko Island (West Greenland). On the example of the Qullissat area, we demonstrate how UAS can bring new insights into strategies for magmatic Ni-PGE exploration in the area. Mineralization is associated to basalt sills of the Asuk Member, emplaced locally in coal-bearing cretaceous sandstones. We conducted photogrammetric outcrop modelling, interpretation of orthoimagery, multi- and hyperspectral based lithological classification and analysis of magnetic data. While magnetics give the location, orientation and subsurface extension of the basaltic sills, spectral imaging, in particular with focus on the iron absorption feature, reveals mineral proxies due to sulphide weathering. A total of 216 line-km for magnetics and 18.5 km² of multi- and hyperspectral data was covered.

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 in the first vertical derivative of the magnetic data 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. Conclusively, the study solidifies UAS as highly valuable tool for exploration.