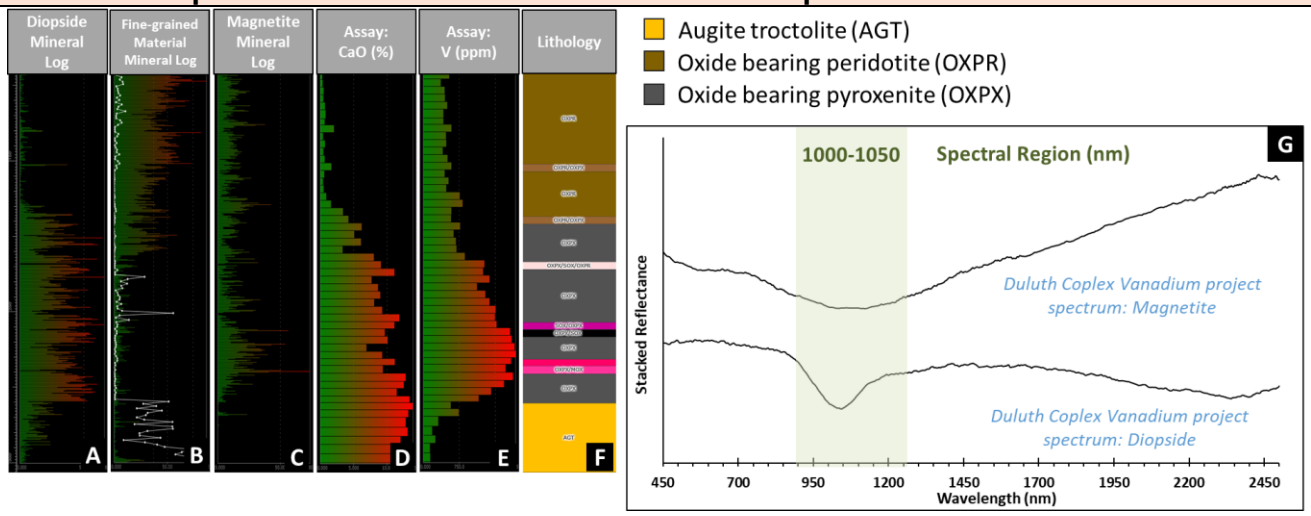
MnDNR Corescan Project

Duluth Complex Vanadium Core – Example Results



Log downhole plot of mineralogy (A, B and C with the bright fine-grained mineral logs in white line graph type), alongside assay results (provided by MnDNR, D and E) and compiled lithology (Provided by MnDNR, F) of DDH LNG-003-2010. Strong correlation is visible between the presence of magnetite and higher V grade; the diopside unit and the OXPX unit; the presence of 'bright fine-grained material' corresponds with the AGT unit (bottom of lithology panel). Note the presence of distinct crystal field absorption feature related to Fe^{2+} in both diopside and magnetite spectra (G)

Hyperspectral-detected Mineralogy	These cores are from the Longnose Deposit, which is located in the Superior Province of the Canadian Shield. Mineralization is hosted by Oxide-bearing Ultramafic Intrusions that intruded into layered series intrusions of the Duluth Complex. Many minerals/mineral groups found in the Duluth Complex can be identified in the VNIR-SWIR range (Horgan, 2014), including a range of ferrous minerals (olivines, pyroxenes), iron oxides (hematite, goethite, magnetite), phyllosilicates (white mica, chlorite, talc), smectites (montmorillonite, saponite), serpentines, sulphides, sulphates, amphiboles, carbonates, and calcium-aluminium silicates (epidotes, prehnite). See associated Mineral Key for full list of identified mineralogy with the Corescan HCI-3 system.
Results	The drill core included in this study demonstrates correlations between the geochemistry, lithology, and the hyperspectral mineralogy. For example, the *aspectral* unit can be interpreted as feldspar (plagioclase), and *bright fine-grained material* class represent an olivine/feldspar mixture, which is corroborated by the Ca (pct) and Al2O3 (pct) logs and corresponds with the troctolite unit. High V grades seem to correspond with the highest magnetite zones. Also, *fine-grained* and *dark fine-grained material* seem to correlate with the OXPR zones, and it appears that these Ol-bearing peridotites are heavily serpentinized (typical oceanic serpentinization with lizardite mesh texture). There is significant diversity in the minerals identified in the Duluth Complex Vanadium project, and speciation based on mineral composition was possible for olivines (Fe and Mg rich end-members), pyroxenes (ortho- and clinopyroxene, and diopside), phyllosilicates (chlorite, prehnite, saponite, serpentine, talc and white mica). Magnetite is a hyperspectral detectable mineral, but further research could verify if the V content in magnetite influences its spectra. There is a paucity of ilmenite spectra in the literature, so it would be beneficial to collect hyperspectral data on pure ilmenite samples in the future.

Reference:

***Horgan, B. H.**, Cloutis, E. A., Mann, P., & Bell III, J. F., 2014. Near-infrared spectra of ferrous mineral mixtures and methods for their identification in planetary surface spectra. Icarus, 234, 132-154.*

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