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360° Hyperspectral Drill Core Scanning

Friederike Koerting
Helmholtz Center Potsdam, Germany

An ever growing depository of drill cores from different projects in the scientific and industrial community are calling for a time-efficient qualitative mineral analysis which also allows for a high turn-over rate. In the course of the Collisional Orogeny in the Scandinavian Caledonides Project (COSC), a 2.5 km drill core was conducted, crossing the Seve Nappe in Sweden. In order to investigate mountain building processes, parts of that core were analysed by the hyperspectral imaging spectrometer HySpex, a sensor system combining the range of the VNIR and SWIR in two instruments. Five core samples of depths ranging from 1682 m to 2469 m were analysed. In order to verify the mineral analyses for the 360° measurement of a core surface, laser induced breakdown spectrometer (LIBS) measurements of a core were compared directly and pixel-wise to the HySpex measurements. The hyperspectral imagery allowed for a resolution of 0.22 mm/ pixel which resembles the resolution of the LIBS measurements. An un-split core sample from 1682 m was used to develop an approach of a hyperspectral measurement of the un-rolled, complete 360° core surface. A step-wise rotation was followed by a mosaicking that lead to the rectification of the core surface. The determination of precise key points allowed for the stitching of several core images, even with taking into account the homogenous, very fine-grained characteristics of the rock. The measurements of the whole core surface with overlapping surface frames amounted to 22 h/ m of core and resulted in a hyperspectral mosaic of the core mantle surface. Relative to the approximately 550 h needed to measure 1 m of core with the LIBS, the hyperspectral method seems fair and feasible. The succeeding mineral mapping with EnGeoMap proved to be very precise when detecting the abundance of single minerals, when mapping multiple minerals, a bias towards a few minerals was found. This bias due to mineral-dependent fit value tresholds of the algorithm has to be investigated further in the future. When applying EnGeoMap, it proves a valuable tool to evaluate mineral content and their spatial distribution over the course of a drill core, especially to highlight changes in mineral assemblages. This can be seen as the beginning of the development of a stand-alone hyperspectral drill core scanner.

Biography:

Friederike Körting finished her Master's Degree in Geology in 2016. She started working with Hyperspectral Imaging Remote Sensing in 2012, since then she has been part of a work group concentrating on theintersection of Geology and Remote Sensing in the nearfield and in the laboratory for samples and drill cores. Her work concentrates on the applicabilty of imaging sensors for mineralogical analyses. In her on-going PhDwork, she investigates the potential of hyperspectral approaches for ore grade vectorization in open pitmining.