IR spectra of thin film water sandwiched between two mineral plates

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Physicochemical behaviours of water sandwiched between minerals are important to understand water-rock interactions including rock quality degradation by water. In order to examine these properties, pure water sandwiched between two mineral plates was measured by transmission infrared (IR) microspectroscopy.

Pure water is sandwiched between two mineral plates (Fig.1) and its thickness is monitored by the absorbance at 1643.5 cm^{-1}. The measurement area (100x100 μm^2) is selected to be occupied totally with water. This procedure is repeated to obtain IR transmission spectra for different pure water thicknesses.

The measured spectra include effects of reflection at air/plate/water interfaces. These effects were removed and the absorption index k was calculated.

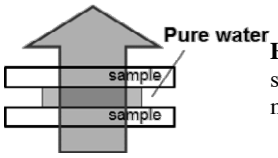

Figure 1 Pure water sandwiched between two mineral plates.

The extracted k spectra of thin film water sandwiched between two CaF_2 plates for different thicknesses from 20 nm to 1 μm were successfully obtained with high signal to noise ratio (Fig.2). These spectra match globally the k spetrum for different thicknesses within 5%.The k spectra of thin film water between different mineral plates such as Al_2O_3 and SiO_2 plates will be measured and compared.

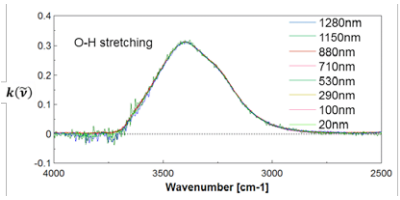

Figure 2 The absorption index k spectra of pure water with different thicknesses between two CaF_2 plates.

The sub-Arctic upper mantle, from Jan Mayen to Molloy Fracture Zone

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In recent years, sub-kilometer scale studies have revealed that regional mantle heterogeneity is generally better preserved in oceanic basalts where the melt supply is low. The Mohns and Knipovich ridges in the Norwegian Greenland Sea are among the slowest spreading mid-ocean ridges (15-17mm/yr) and present extremely low melting rates. This region is therefore a favorable location to study the different scales of geochemical mantle heterogeneity.

We present new Sr, Nd, Pb and Hf isotopic data from samples collected along Mohns and Knipovich ridges, during 4 differents cruises of the SUBMAR program (1999-2004). Our new dataset (≈ 90 samples) together with published data (60 samples), represent a dense sampling of the sub-Arctic upper mantle and allow us to look at regional variations as well as fine-scale, intra-segment, heterogeneity. A first order observation of geochemical variations along the ridge axis is a progressively decreasing influence of the Jan Mayen hotspot (71°N) toward the north (73°N). The rather large geochemical variations measured in samples from the northern part of Mohns ridge (73-75°N) and along Knipovich ridge (75-78°N), are unlikely related to hotspot-ridge interaction. The local upper mantle is influenced by the recent continental breakup and the presence of residual subcontinental lithosphere could therefore contribute to the observed geochemical variability.

Previous study of this region have documented an atypical radiogenic εHf values for a given εNd [1], which appears to be very comparable to the mantle signature discovered recently along the Mid-Atlantic Ridge near the Azores [2]. The origin of this mantle component is still a mater of debate. Our new dataset, together with published data from [1] is used to produce a detailed petrogenetic model for basalts erupted north of Jan Mayen and brings new constraints on the structure and nature of upper mantle components present in this area.

[1] Blichert-Toft, J. *et al*, 2005. *Geochem. Geophys. Geosyst.*, 6(1): Q01E19. [2] Hamelin, C. *et al*, 2013. *Chemical Geology*, 341(0): 128-139.

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