

EGU21-12660

<https://doi.org/10.5194/egusphere-egu21-12660>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Elastic anisotropy of oceanic serpentinites – influence of CPO and microstructure

Rebecca Kühn¹, Jan Behrmann², Rüdiger Kilian¹, Bernd Leiss³, and Michael Stipp¹

¹Martin-Luther-Universität Halle Wittenberg, Institut für Geowissenschaften & Geographie, Halle, Germany

(rebecca.kuehn@geo.uni-halle.de)

²GEOMAR Helmholtz Centre for Ocean Research Kiel, Marine Geodynamics, Kiel, Germany

³Geoscience Center of the Georg-August-Universität Göttingen, Department of Structural Geology and Geodynamics, Göttingen, Germany

Physical properties of rocks are mainly controlled by the modal composition, crystallographic preferred orientation (CPO) and microstructure of a rock. One of the most relevant physical properties related to the interpretation of seismic data are the elastic properties of a mineral aggregate. Changes of elastic properties - and hence changes in our interpretation of the tectonic architecture of certain regions - can be related to mineral reactions and deformation.

In order to explore the impact of mineral reaction and deformation on elastic anisotropy, we study oceanic serpentinites formed at low-grade metamorphic conditions by hydration of peridotites. Samples are obtained from the Atlantis Massif, which is an Oceanic Core Complex located at 30°N, Mid-Atlantic Ridge. During IODP Expedition 357, oceanic serpentinites were recovered from drill cores along the southern wall of the Massif. Fully serpentinitized samples displaying variable microstructures were analyzed regarding the influence of microstructure and CPO on the overall elastic anisotropy. Microstructure analysis was based on optical microscopy and large area micro X-ray fluorescence mapping. For CPO analysis synchrotron high energy X-ray diffraction in combination with the Rietveld method was applied and the derived CPO was used to compute seismic properties.

Serpentinites with a typical mesh microstructure are interpreted to represent undeformed samples and show a close to uniform CPO. The increase in fabric anisotropy of vein-like magnetite aggregates is interpreted as an increase in deformation. Samples show a single c-axis-maximum and enhanced CPO. Calculated seismic anisotropies show up to >5% anisotropy for compressional waves (V_p) and shear wave splitting up to 0.15 km/s in the deformed samples. Hence, such an anisotropy can be used to differentiate deformed from undeformed zones in seismic data sets using the elastic anisotropy data.