| ESRF | **Experiment title**<br>**Anisotropy of slow-spreading oceanic crust and mantle from the Atlantic Ocean** | **Experiment number**:<br>ES 611 |
|---|---|---|
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## Report:

Oceanic crust and mantle rocks from slow spreading mid-oceanic ridges can yield a high amount of hydrated phases due to fluid infiltration and alteration along faults. As crystallographic preferred orientations (textures) of hydrated mineral phases cannot be determined by neutron diffraction due to high neutron absorption in water, synchrotron diffraction is the most suitable method to measure textures of representative volumes of our highly complex samples. We used the experimental setup provided at beamline ID 22. It consisted of an X-Y-Z-stage and an omega-rotation stage. This set-up was appropriate to record diffraction data with a Perkin Elmer 1611 detector in a sample-detector distance of 1401 mm. A step width in omega of 5° and an omega-range of 0 – 175° was applied providing full pole figure coverage. The cylinder axes of the samples were mounted parallel to the Y-direction of the sample holder, so that the sample geometry was constant during rotation around omega and a geometrical correction has not to be applied. The beam energy was adjusted to 70 keV and the beam size to 1 mm x 1 mm. We successfully measured all scheduled samples of the different lithologies during the proposed beam time.

To ensure that we consider possible sample heterogeneities as well as coarse grain sizes of the natural material and to improve statistical data representation to its best, especially for the mineral phases of low proportion, we run three to 20 texture measurements per sample at different positions, i.e. different slices, along the cylinder axis. The results of the different measurements are summed up. The textures are calculated from the data with MAUD (Material Analysis Using Diffraction [1]), a Rietveld-based code. First results of the Quantitative Texture Analysis (QTA) yield medium to strong textures (see Figures 1 & 2) for the analyzed samples. Hence, these samples indicate distinct anisotropies of physical properties, for example elastic or seismic anisotropies, and the exact anisotropies will be calculated on the basis of the QTA data. The data sets are complete, but the QTA by means of MAUD are extremely time consuming, not only due to long computer calculation times, but also due to elaborate input data preparation. This task will be completed within the next year. First results of the QTA are already part of conference contributions [e.g., 2].

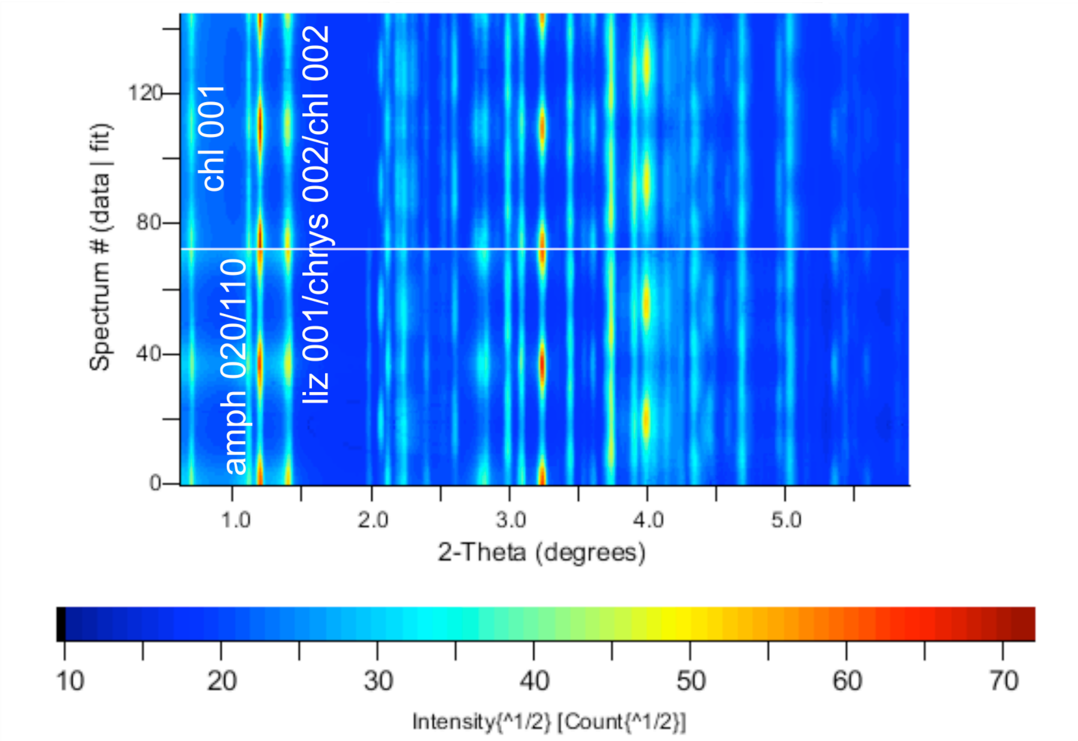


*Figure 1. Exemplary 2d plot of a measured serpentinite sample with relevant peaks indicated within the Rietveld-based software program MAUD. It illustrates the textures of the mineral phases within the sample and the good agreement of measured spectrum (lower part)and data fit (upper part).*

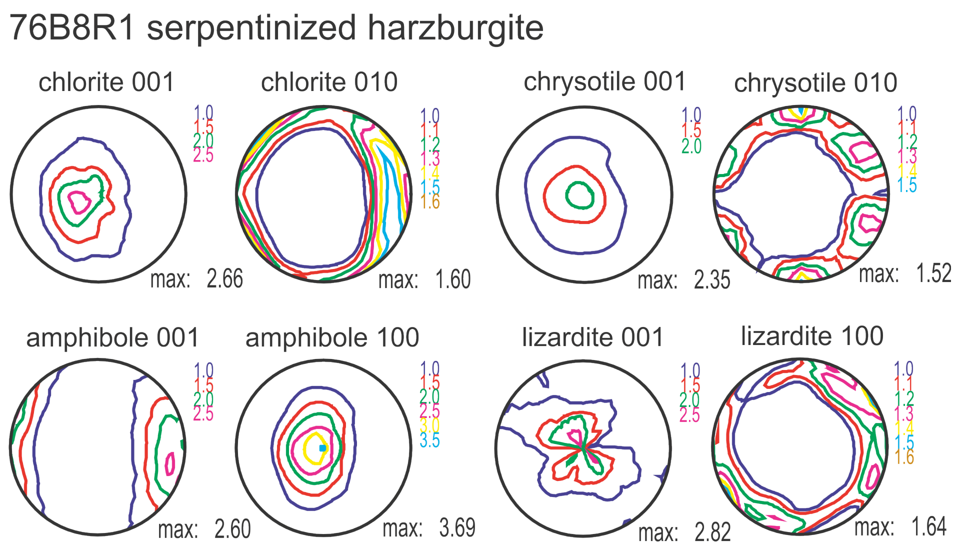


*Figure 2. Recalculated pole figures from the Quantitative Texture Analasis for a serpentinite sample showing foliation-parallel crystallographic preferred orientations. Equal area, lower hemisphere projection. Maxima in multiples of random distribution.*

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