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Seismic anisotropy of the upper mantle under Lanzarote (Canary Islands): an EBSD approach

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The geodynamic setting and crust/mantle characteristics of the Canary archipelago have been heavily debated during the last decades. We present here the first petrophysical results obtained from upper mantle xenoliths of the Canary Islands. The analyzed samples consist mainly of harzburgite and dunite nodules, 5 to 15 cm in size, showing a typical protogranular to porphyroclastic texture. They were collected in the Holocene alkali basalt fields (Serie IV) of the island of Lanzarote. Previous geothermobarometry on these xenoliths gave an equilibration temperature range of 750 to 1290˚C and a pressure estimate of about 6-8 kb, corresponding to 18 to 26 km depth. Seismic studies have estimated the Moho to be at 11 to 19 km under Lanzarote, corroborating the mantellic origin of the xenoliths.

The lattice preferred orientation (LPO) of olivine, orthopyroxene and clinopyroxene has been measured using the Electron Backscatter Diffraction (EBSD) technique. Olivine shows a typical clustering of the [100], [010] and [001] poles, whereas orthopyroxene and clinopyroxene display a weaker but significant texture. The LPO has been used to calculate the seismic anisotropy of the xenoliths and to infer the average anisotropy of the upper mantle. Maximal velocity of P waves averages 8.4 [km/s] along the lineation, whereas minimal velocity is on the order of 7.6 km/s normal to the foliation. Anisotropy of the S waves reaches 6.61 % for the average sample. These results are in good agreement with the interpretation of Dañobeitia and Canales (2000), based on a NNE-SSW seismic transect.