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# Relationships between microstructure, texture, seismic properties and geochemistry in the oceanic lithospheric mantle above the Kerguelen plume

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The interpretation of seismic observations such as seismic tomography and anisotropy measurements is dependent of our knowledge of rock seismic properties. Xenoliths sampled by alkaline magmas reveal that the oceanic mantle is affected by microstructural, mineralogical and geochemical modifications due to the interaction between the lithospheric mantle and the upwelling plume. In order to better understand the effect of petrogenetic processes on the seismic properties, we have coupled microstructural and geochemical studies, and model the 3D seismic properties from Crystallographic Preferred Orientation measurements in mantle xenoliths from the Kerguelen Islands (Indian Ocean). Originally located near to the South East Indian Ridge, $\sim$40 Ma ago, the Kerguelen Islands are currently in intraplate position in the Antarctic plate. The large diversity of peridotite xenoliths record evidence of a high degree of partial meting followed by significant melt percolation above the Kerguelen plume. Previous petrological and geochemical studies have shown that the evolution from protogranular spinel- and clinopyroxene-bearing harzburgites to poikilitic spinel- and clinopyroxene-bearing harzburgites and finally to dunites corresponds to increasing metasomatism at higher melt/rock ratio. Protogranular harzburgites are characterized by millimetric olivine (and enstatite) porphyroclasts and dunites display recrystallised and equigranular microstructures. The forsterite content of the olivine varies from $Fo_{91.7}$ in protogranular harzburgites to $Fo_{86.6}$in dunites.

Textural analysis is based on the Crystallographic Preferred Orientation (CPO) measurements on olivine and pyroxene using the electron backscattered diffraction technique in a scanning electron microscope (SEM-EBSD). The first results show that the evolution from harzburgites to dunites is characterised by a large decrease of the olivine fabric strength ($J_{index}$) that ranges from 12.1 in protogranular harzburgites to 3.8 in dunites. Different populations of mantle xenoliths are recognised based on their textural characteristics (e.g., distinct crystallographic axes patterns of olivine). These various groups of xenoliths match quite well the groups defined on geochemical grounds. A clear olivine CPO (axial-a or orthorhombic type) is preserved in dunites although it is weaker than in other types of xenoliths. Using CPO measurements and single crystal elastic properties of minerals forming peridotite, rock seismic properties (P and S-waves velocities and anisotropies) have been calculated taking into account modal variations and forsterite content in olivine. Increase in modal enstatite contents and iron enrichment in olivine result in lower seismic velocities for P and S-waves. The seismic anisotropy degree is controlled by the CPO of minerals. The calculated seismic anisotropies remain large (AVp $>$ 5%) in spite of significant petrological and geochemical modifications of the original lithospheric mantle by large volumes of melts from the Kerguelen plume.