Deformation, metasomatism and seismic anisotropy in the lithospheric mantle beneath Taiwan straits, southeast Asian margin: constraints from mantle xenoliths

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Here we explore the relationship between deformation, seismic anisotropy and melt-percolation through lithospheric mantle xenoliths from Penghu Islands, Taiwan, which experienced strong heterogeneities in their chemical compositions, microstructures and crystallographic preferred orientations (CPO). Chemical compositions and microstructures allow us to divide Penghu peridotites equilibrated at 879 to 1127°C into three groups: group 1 (depleted peridotites with only cryptic metasomatized), group 3 (enriched peridotites with modal and stealth metasomatized) and group 2 an intermediate group between the previous two. The group 1 with some of group 2 are usually porphyroclastic, their olivine grains have [100]-axial pattern symmetries. In contrast, the most group3 with some of group2 show fine-grained equigranular microstructures and their olivine grains have [010]-axial pattern symmetries. The presence of olivine [010]-axial pattern only in highly-metasomatized and enriched peridotites favors that the continuous variation in olivine CPO symmetry from [100]-axial pattern to [010]-axial pattern in Penghu peridotites result from the combination of recovery by subgrains rotation and deformation in the presence of melt. Combination of microstructural observation, CPO data with petrological and geochemical information's suggests that: (1) the group 1 peridotites are relic of an old lithosphere that preserved microstructural and chemical characteristics inherited probably from the Proterozoic, and (2) the group 2 and 3 peridotites record localized Miocene deformation associated with wall-rock heating and metasomatism related to melt circulation into dykes and subordinate porous-flow channels. (3) As observed in previous studies, the change in olivine CPO from [100]-axial pattern to [010]-axial pattern by deformation in presence of variable melt fraction can change the physical properties of the mantle rocks.