Petrofabric and seismic anisotropy of hydrous minerals in subduction channels

JUNFENG ZHANG, CHUJIAN LIU, WENLONG LIU

State Key Laboratory of GPMR, School of Earth Sciences, China University of Geosciences, Wuhan, 430074, China Email: jfzhang@cug.edu.cn

Dehydration of subducting slabs can generate hydrous fluids to metasomatize mantle wedge and cause the formation of hydrous minerals (serpentine, chlorite, amphibole, etc) in subduction channels. These hydrous minerals are of great importance for understanding the physical mixing and exhumation processes in subduction channels. Here we report petrofabrics of antigrite, chlorite, and amphibole within the ophilolite complex from the Monviso area of Italy and the San Francisco complex from the central coast area of California, USA. Our results show that hydrous minerals are strongly shear deformed with strong preferred orientations. Antigorite develops strong fabrics with the (001) planes parallel to foliation and the [010] axes parallel to lineation. Chlorite develops the strongest fabrics with the (001) planes parallel to foliation and a great girdle for the [100] and [010] axes in the foliation plane. Amphibole develops fabrics of an intermediate strength with the (100) planes parallel to foliation and the [001] axes parallel to lineation. These results are consistent with experimentally deformed samples. Chlorite has the highest bulk rock and shear wave anisotropy while amphibole has the lowest anisotropies. Our results imply that: 1) The low mechanical strengths of hydrous minerals provide lubrications and channelized network for the exhumation of HP/UHP blocks in subduction zones; 2) The low densities of hydrous minerals provide the buoyancy required for exhumation in the subduction channel; 3) The trench parallel faster shear wave polarization in front of the continental and oceanic subduction zones can be best explained by the deformation of serpentine and chlorite in low temperature subduction channel with high subduction angles (60-90°) and by the deformation of amphibole in high temperature subduction channel with low subduction angles (<60°), respectively.