Seismic visibility of hydrous subduction slabs inferred from the elasticity of dense hydrous phase A

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Abstract

Dense hydrous magnesium silicates (DHMS) play an important role in transporting water into deep Earth through subduction process. Among those phase A [$Mg_7Si_2O_8(OH)_6$] is of particular interest, as it forms after the breakdown of antigorite serpentine in cold subducted slabs and may be the dominant hydrous phase within the upper mantle conditions. In this study, we measured the compressional (*P*) and shear (*S*) wave velocities of phase A at conditions up to 11 GPa and 1073 K using a hot-pressed polycrystalline sample. The resulting *P* and *S* wave velocities at upper mantle conditions are compared to those of the dominant upper mantle minerals (e.g., San-Carlos olivine, clinopyroxene), and these results were used to evaluate the hydration effect on the velocities of cold subduction zones with a harzburgite lithology across the depth range where phase A is the thermodynamically stable hydrous phase. Our calculations show that hydration increases both *P* and *S* wave velocities of harzburgite, resulting in velocity contrasts up to ~1.5% between harzburgite with 0 to 5 wt% water. More details about the velocity perturbations in the cold subducting system and the seismic visibility of hydrous harzburgite lithologies with various water contents will be presented.