Seismic velocities of subducted serpentinites through the Lizardite-Antigorite transition

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Résumé

The formation of the various types of serpentinites depends mainly on the metamorphic pressure and temperature conditions related to geodynamic contexts. The Vp/Vs ratio is the widely used tool to discriminate serpentinite rocks from other mantle rocks and to quantify the amount of serpentinization. However, the effect of serpentine mineral transition from low- to high-metamorphic grade (lizardite/antigorite transition) on seismic velocity is not taken into account. In the internal zone of the Western Alps, we sampled several blueschist and eclogitic serpentinite rocks which record the lizardite/antigorite transition. The ultrasonic velocity of the samples was measured at ambient and confining pressure (up to 70 MPa) environments. The measured velocity increases and the Vp/Vs ratio decreases with the increasing metamorphic condition. The 2D thin sections and 3D X-ray tomography provide the petrological interpretation for the velocity anisotropy variation and insignificant pressure dependency of velocity. The new datasets expand the widely-used Vp-Vs crossplot based on the low-grade metamorphic serpentinites, allowing for discrimination of the different types of serpentinites. Our data can calibrate the field seismic velocity data to study the serpentine mineralogical transition and its associated subduction dynamics.

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