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Exploring new frontiers in fluids processes in subduction zones
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Vp/Vs ratio of the subducting oceanic Nazca plate & implications for fluid processes

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Precise measurements of seismic P and S wave arrival times of local earthquakes are used to determine the P- to S-wave velocity ratio, Vp/Vs, within the oceanic mantle of the Nazca plate at $\sim 21^\circ S$. Compared to the well-known seismic tomography method, the here applied approach is more sensitive to the local structure of the earthquake sources.
We find a particularly high value of $Vp/Vs \sim 2.0$ at around 50 kilometres depth which is not explicable by a simple solid lithology, but calls for the presence of fluid filled pore space and deep hydration of the oceanic mantle.
We consider the petrology of the subducting oceanic mantle, compute elastic rock properties, model the effect of fluid-filled pores and quantify the effect of anisotropy to predict the P- to S-wave velocity ratio in the given subduction system.
Our conclusion is that the observed elevated P- to S-wave velocity ratio is in agreement with a vein- or crack-like geometry of the pore space and a relatively small value for the pore volume (less than 1%). The veins are probably interconnected and build a compliant network which provides an efficient pathway for slab dehydration. This concept is coherent with previous observations from field surveys and results from laboratory experiments and thermodynamic modeling.