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Exploring new frontiers in fluids processes in subduction zones

Fluid release and seismicity at a transition between oceanic and continental subduction

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The Western Hellenic subduction zone is characterized by a transition from oceanic to continental subduction. In the southern oceanic portion of the system, abundant seismicity reaches intermediate depths of 100-190 km, while the northern continental portion rarely exhibits deep earthquakes. Our study aims to investigate how this oceanic-continental transition affects fluid release and related seismicity along strike. To address this question, we present results from local earthquake tomography and double-difference relocation in conjunction with high-resolution seismic images across western Greece. Our results show that, in the south, earthquake distribution and seismic velocities are consistent with the presence of a hydrated subducted crust that undergoes eclogitization and dehydration at ∼100 km depth. Below the arc, the fluids released from the slab are fluxed into the mantle wedge and cause partial melting. Below the oceanic-continental transition, released fluids appear instead to rise updip along the slab and flux into the overriding crust, where they precipitate silica. To the north, our results are consistent with subduction of dry metastable crust, where the absence of fluids causes subduction to take place nearly aseismically.