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Shear-velocity structure, tectonics and volcanism of the Tyrrhenian Sea: mantle (de)hydration of a back-arc basin

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The Tyrrhenian Sea in the Mediterranean formed as the result of roll-back of the Adriatic and Ionian subducting plates. It is mostly underlain by strongly thinned continental lithosphere, but contains two small oceanic basins in the southern Tyrrhenian, the youngest of which is located just behind the active, magmatic arc. Employing the dense station coverage of the region, we determined a high-resolution, 3-D shear-velocity model of the Tyrrhenian Sea and its surrounding onshore areas from interstation Rayleigh-wave dispersion measurements.The tomographic model, extending to a depth of approximately 160 km, displays a pronounced, nearly ring-shaped, low shear-velocity zone between 70 and 110 km depth which surrounds the older oceanic Vavilov Basin. The sharp velocity decrease at 70 km depth can be explained by the transition from a relatively dry lithospheric mantle to more hydrous asthenospheric mantle material. The tectonic evolution of the region and the correlation of the low-velocity anomaly with subduction-related volcanism indicate that the low-velocity anomaly reflects hydrous mantle material in (present or former) mantle wedge regions. We suggest that the absence of the low-velocity zone beneath the oceanic Vavilov basin is due to mantle dehydration caused by the creation of MORB crust.