High temperature in the upper mantle beneath Cape Verde as a possible cause for the oceanic lithosphere rejuvenation inferred from Rayleigh-wave phase-velocity measurements.

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Cape Verde is an intraplate archipelago located in the Atlantic Ocean about 560 km west of Senegal, on top of a ~130 Ma sector of the African oceanic lithosphere. Until recently, due to the lack of broadband seismic stations, the upper-mantle structure beneath the islands was poorly known. In this study we used data from two temporary deployments across the archipelago, measuring the phase velocities of Rayleigh-waves fundamental-modes in a broad period range (8–250 s), by cross-correlating teleseismic earthquake data between pairs of stations. Deriving a robust average, phase-velocity curve for the Cape Verde region, we inverted it for a shear-wave velocity profile using non-linear gradient search.

Our results show anomalously low velocities of ∼4.2 km/s in the asthenosphere, indicating the presence of high temperatures and, eventually, partial melting. This temperature anomaly is probably responsible for the thermal rejuvenation of the oceanic lithosphere to an age as young as about 30 Ma, which we inferred from the comparison of seismic velocities beneath Cape Verde and the ones representing different ages in the Central Atlantic.

The present results, together with previously detected low-velocity anomalies in the lower mantle and relatively He-unradiogenic isotopic ratios, also suggest a hot plume deeply rooted in the lower mantle, as the origin of the Cape Verde hotspot.

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