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Upper mantle structure of the southern Arabian margin: insights from teleseismic tomography

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We image the lithospheric and upper asthenospheric structure beneath the central and eastern parts of the northern Gulf of Aden rifted continental margin with 59 broadband stations to evaluate the role of transform fault zones on the evolution of magma-poor continental margins. We use teleseismic tomography to compute a relative P wave velocity model in eastern Yemen and southern Oman down to 400 km depth. Our model shows low velocity anomalies located in the vicinity of five major fracture zones and regions of recent volcanism. These low velocity anomalies are likely caused by localized asthenospheric upwelling and partial melting, caused by small-scale convection promoted by gradients in LAB (lithosphere-asthenosphere boundary) topography near the fracture zones. In addition, low velocities underlie regions of elevated topography in between major sedimentary basins. We suggest locally buoyant mantle creates uplift and dynamic topography on the rift mar- gin that impacts the course of seasonal rivers and the sedimentation at the mouth of those rivers. Our new P wave velocity model suggests that the dynamic topography and recent volcanism in the central and eastern Gulf of Aden could be due to small-scale convection at the edge of the Arabian plate and/or in the vicinity of fracture zones.