

Seismic imaging of subduction of continental crust beneath the Pamir

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Exhumation of ultra-high pressure metamorphic rocks testifies that the continental crust can subduct to significant depth into the mantle despite its buoyancy. However, direct observation of ongoing subduction of continental crust is rare. The Pamir is regarded as a possible place of active continental subduction because of the intermediate-depth seismicity, crustal xenoliths and estimates of crustal shortening versus convergence rates. The Pamir and Hindu Kush mountain ranges are located northwest of Tibet, where the Indian plate indents deeply into Asia. This region of intense deformation and frequent large and destructive earthquakes is underlain by a deep seismic zone, whose origin and significance has been debated by generations of Earth scientists. Starting in 2008, the GFZ and partners in the region undertook several seismological campaigns. As one of the scientific outcomes, a subducted Eurasian continental crust has been observed beneath the Pamir by different methods, including receiver functions, local earthquake tomography, attenuation tomography and guided waves. The subducted crust is characterized by a southerly dipping low-velocity zone (LVZ) with a thickness of 10-15 km. The LVZ accurately follows the intermediate-depth seismic zone extending from 50 km depth near the base of the crust to more than 150 km depth with a dip angle increasing to subvertical. Our observations imply that the complete arcuate intermediate depth seismic zone beneath the Pamir traces a slab of subducting Eurasian continental lower crust.