CONTROL ID: 1806461

TITLE: Evidence for deeply subducting Asian lithosphere beneath the Pamir-Hindu Kush region from teleseismic tomography

AUTHORS (FIRST NAME, LAST NAME): Sofia-Katerina Kufner[1], Bernd Schurr[1], Xiaohui Yuan[1], Felix Schneider[1], Anatoly Ischuk[2], Shohruhk Murodkulov[2], Marcelo Bianchi[3, 1], Christian A Haberland[1], Christian Sippl[4, 1], James Mechie[1]

INSTITUTIONS (ALL): 1. Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences, Potsdam, Germany.
2. Academy of Sciences of the Republic of Tajikistan, Dushanbe, Tajikistan.
3. University of Sao Paulo, Sao Paulo, Brazil.
4. Australian National University, Canberra, ACT, Australia.

ABSTRACT BODY: The Pamir – Hindu Kush mountain ranges are located north of the western syntax of the Indian-Eurasian collision system. The Pamir has been displaced at least 300 km to the north relative to Tibet based on e.g. the correlation of the offsets of major tectonic structures. The Pamir hosts a peculiar south-dipping intermediate depth (~80-250 km depth) earthquake zone that has been linked to subduction of Eurasian lithosphere. Under the Hindu Kush deep earthquakes also occur in steeply dipping compact and very active cluster. The Pamir and Hindu Kush seismic zones abut at the shallowest level, just below the Moho, but are clearly separated by a seismic gap deeper down. However, their structural connection, formation history and provenience are still puzzling. Here, we use teleseismic P-wave travel times from three temporary seismic networks and additional permanent seismic stations covering a significant part of the central Asian mountain zone for a regional tomography to illuminate their deep structure. Utilizing approx. 800 earthquakes at epicentral distances between 25 to 95 degree recorded from mid-2008 until now at more than 160 regional stations. Because the Hindu Kush in NE Afghanistan has no station coverage, we take advantage of station-receiver reciprocity, and supplement our data set with frequently occurring Hindu Kush earthquakes, recorded at teleseismic stations, there. For this purpose we extracted travel times for about 400 well located earthquakes between 1970 and 2006 from a global catalog.
In the resulting tomographic model, the Pamir and the western Hindu-Kush are underlain by high velocity zones (HVZ) at shallow mantle depths. A pronounced low velocity anomaly separates both features. At depths below 300 to 400 km this low velocity zone diminishes allowing the regions of high velocity to connect beneath the Hindu-Kush. Associated with this, the orientation of the Pamir high velocity structure changes to be aligned in west-east direction at depths of 600 km. The shallow Pamir HVZ is connected to this deep structure only at its westernmost tip.
The shape and orientation of these different high-velocity fragments suggest that they were once connected. As the Pamir started to shift towards the north, the already then southward subducting lithosphere was stretched and eventually started to break at the points where the stress was most intense or the lithosphere was weakest. Considering the high velocity anomalies in our model, the lithosphere could have ruptured at the transition between Pamir and Hindu-Kush and at depth in the eastern Pamir near its boundary with Tarim. If this assumption is true, it would possibly imply a longer history of one-sided lithospheric subduction in the Pamir-Hindu Kush region than was thought before, to account for the whole length of the imaged high velocity structures.

KEYWORDS: 7270 SEISMOLOGY Tomography, 8108 TECTONOPHYSICS Continental tectonics: compressional, 8104 TECTONOPHYSICS Continental margins: convergent, 8138 TECTONOPHYSICS Lithospheric flexure.

(No Image Selected)

(No Table Selected)

Additional Details

Previously Presented Material:

Contact Details

CONTACT (NAME ONLY): Sofia-Katerina Kufner

CONTACT (E-MAIL ONLY): kufner@gfz-potsdam.de

TITLE OF TEAM:
