

Seismicity and tectonics in the Hindukush mountains, Sulaiman and Kirthar ranges in the light of plate tectonics theory

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ABSTRACT

A seismicity map of the Pakistan-Afghanistan region that lies between the latitudes 28° & 38° N and longitudes 66° & 75°E is given using all available data for the period 1890-1972. The earthquakes of magnitude 4.5 and above were considered in preparation of this map. A strain-energy release map for the same period was prepared following the method used by Allen *et al.* (1965). On the basis of these two maps, it is observed that the seismicity pattern over the well-known Hindukush region is quite complex. Two prominent mutually orthogonal seismicity lineaments, namely, the northwestern and the northeastern trends characterize the Hindukush area. The northwestern trend appears to extend from the Main Boundary Fault of the Kashmir Himalaya on the southeast to the plains of the Amu Darya in Uzbekistan on the northwest beyond the Hindukush. The Sulaiman and Kirthar ranges of Pakistan are well defined zones of intermontane seismicity exhibiting north-south alignment.

Thirty-two new focal mechanism solutions for the above mentioned region have been determined. These, together with the results obtained by earlier workers suggest the prevalence of thrust as well as strike-slip faulting in the area. The Salt range; the Sulaiman wrench zone, the Kirthar wrench zone as well as the supposed extension of the Murray ridge upto the Karachi coast appear to be mostly undergoing strike-slip movements. In the Hindukush region, thrust as well as strike-slip faulting are found to be equally prevalent. Almost all the thrust type mechanisms belonging to the Hindukush area have both the nodal planes in NW-SE direction for shallow as well as intermediate depth earthquakes. The dip of *P*-axes for the events indicating thrust type mechanisms rarely exceeds 35°. The direction of seismic slip vector obtained through thrust type solutions is always directed towards the northeast. The epicentral pattern together with these results suggest a deep-seated fault zone paralleling the northwesterly seismic zone underneath the Hindukush. This NW-lineament has a preference for thrust faulting, and it appears to extend from the vicinity of the Main Boundary Fault of the Kashmir Himalaya on the southeast to Uzbekistan on the northwest through the Hindukush. Almost perpendicular to this NW-seismic zone, there is a NE-seismic lineament in which there is a preference for strike-slip faulting.

The above results are discussed in the light of convergence between the Indian and Eurasian plates predicted by plate tectonics theory.