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Paleoseismic events within the Himalayan belt: Some outstanding issues

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Here we analyze the available historical and geological database to understand the trends in the occurrences of large earthquakes in the Himalayan arc. The central Himalaya, generally believed to be a prominent 'seismic gap', is generally believed to be the most vulnerable segment, due for a great plate boundary earthquake (M >8). Two spatially separated significant historical earthquakes are known to have occurred in this region during A.D. 1505 and 1803. We analyze the macroseismal data from the Central Himalaya and the Gangetic Plains, and suggest that the neither of these earthquakes can be qualified as a plate-boundary-type event, with estimated size not exceeding Mw 7.8. Our studies further indicate that the central Himalayan frontal thrusts may be undergoing a quiescence of >1000 years in terms of generation of great earthquakes. The spatial and temporal clustering as well as the long-term quiescence seems to be a characteristic of the earthquake occurrence in the Himalayan arc. A typical example is the source zone of the 1934 Bihar-Nepal earthquake where two large previous events occurred in an interval of 100 years. The great earthquakes (M >8) appear to be relatively infrequent along the Himalayan front. It is likely that the high level thrusts accommodate most of the seismogenic slip in the Himalaya, leading to large/moderate earthquakes, and the rest of the strain could possibly be expended on passive folding. The trends in earthquake distribution give us some pointers and also raise some important questions on the seismogenic processes of the Himalayan arc. Is there a uniform pattern of locking along the length of the Himalaya or are their variations from one segment to another? Is the detachment in the sedimentary wedges (MBT and HFT) too weak to store energy to generate large earthquakes? How much of the flexural compression is taken up by aseismic creep or passive folding? Are the leading edges of the frontal thrusts in at least some segments creeping aseismically? Reliable hazard models can be generated only if the above questions are resolved first.