Paper Number: 258

Neo-tectonic activity in Sarpang Re-entrant, frontal Bhutan Himalaya, Kokrajhar District, Assam, India constrain from Geological, Geomorphological and GPS surveys.

Tanay Dutta Gupta[*], Basab Mukhopadhyay[**], Sujit Dasgupta[#] and Sujit Roy[$]

[*]Monitoring Division, GSI, 27 J.L. Nehru Road, Kolkata-700016, India. tanaydg01@gmail.com

[**] Map and Cartography Division, GSI, 29 J.L. Nehru Road, Kolkata-700016, India. basabmukhopadhyay@gmail.com

[#] Formerly in Geological Survey of India, Kolkata, India.

[$] Geophysics Division, Eastern Region, GSI, Bhubijnan Bhawan, Sector II, Salt lake City, Kolkata 700091, India.

Active tectonic deformation in the frontal zone of Himalaya has been observed with the occurrences of uplifted-tilted late Pleistocene - Holocene fluvial terraces and alluvial fan surfaces, with prominent fault scarps ranging in height from 5 to 50 m resulted from ongoing active deformation along Himalayan Frontal Thrust (HFT) and Main Boundary Thrust (MBT). Similar crustal movement along an E-W trending 30 km long active Frontal Back Thrust (FBT) within the Raidak-Ai interfluve (Sarpang Re-entrant) in the Bhutan Himalayan foothills region, Kokrajhar District, Assam, India has been quantified by campaign mode GPS survey carried out for three consecutive years (2008 - 2010) along with field studies by Geological Survey of India. The rate of change in baseline length between the local stations like Bangalpara (BNGP) - Diglipara (DGPR) and BNGP - Karigaon (KRGN) segments are -4.58 and -3.32 mm/yr, and between the BNGP- Ultapani (ULTP) and BNGP - Bansbari (BSBR) with minor shortening values of -1.38 and -0.85 mm/yr respectively. These values attest southward movements of the Himalayan wedge in the frontal zone. Decrease in the shortening is however non-linear. In the light of the GPS survey results and extensive field studies; the neo-tectonic activity has been modeled by an active thrust with incipient Dun (structural valley bounded by faults) formation in its propagation front. In this model, Frontal Back Thrust (FBT) is characterised by a north moving backthrust, originated at ~ 3 km depth (basement depth 2.0-2.5 km, deep-resistivity-sounding; GSI, pers. Com) from the south verging basal Himalayan Decollement in response to

the advancing Himalayan wedge. Field evidences like geomorphic scarps, exposed active thrust in the river section, natural damming of rivers, gentle folding of strata, formation of north and south bound scarp faces are indicative of an episodic rise or stick-slip kind of movement along the thrust. The baseline shortening indicates statistically insignificant strain accumulation in the foreland Bhutan Himalaya. The present day low seismicity of the Bhutan Himalaya region is thus corroborating to the low convergence rate reported by our GPS data. In light of this data, FBT is presently accompanying insignificant horizontal movement. But, in contrary, occurrences of three morphogenic earthquakes of magnitude ~ 6.9 rupturing the entire FBT during late Pleistocene-Holocene time has already been reported [1] (Dasgupta et al., 2013). The change in seismic pattern is thus a very recent phenomenon as low seismicity of Bhutan Himalaya coincides with stress shadow zone of the Great 1897 Shillong Plateau Earthquake (see, [2]).

References:

[1] Dasgupta, S., Mazumdar, K., Moirangcha, l. H., Dutta Gupta, T. and Mukhopadhyay, B. (2013) Seismic Landscape from Sarpang Re-entrant, Bhutan Himalaya Foredeep, Assam, India: Constraints from Geomorphology and Geology. Tectonophysics, v. 592, pp. 130–140**,** DOI: 10.1016/j.tecto.2013.02.021.

[2] Gahalaut, V.K., Rajput, S. and Kundu, B. (2011) Low seismicity in the Bhutan Himalaya and the stress shadow of the 1897 Shillong Plateau earthquake. Physics of the Earth and Planetary Interiors, v. 186, pp. 97–102.