

The Timing and Extent of the Last Surface Rupture Event on the Himalayan Frontal Thrust in Central Nepal around Butwal

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The 2015 Gorkha earthquake ruptured only the deeper northern part of the thrust during the Mw 7.8 earthquake, but did not rupture the surface and shallow portion of the Himalayan Frontal Thrust (HFT) in south. Since then, the evaluation of the potential of the future surface rupture event on the HFT in central Nepal in south of 2015 rupture became an important task for paleoseismology. Mishra et al. (2016), Bollinger et al. (2016), and Wesnousky et al. (2017) proposed respective 1100 CE, 1344 CE and/or 1408 CE, and 1221 CE to 1262 CE (possibly 1255 CE) for the timing of the last surface-rupture event. Each report eliminates the timing of earthquake proposed by the other authors. Therefore, it is necessary to think over the possibility of multiple events in short (less than 100 km) segments or of misleading radiocarbon dates. Also, the existence and the east termination of 1505 CE Indian central seismic gap event (Malik et al., 2017) are not certain yet. In order to solve the rupture history and rupture extents in central and western Nepal, we excavated two trenches across the HFT around the city of Butwal. One is at 12 km west of Butwal at Sorauli (27.70°N 83.36°E) and another is at 60 km ESE of Butwal at Susto (27.48°N 83.86°E). Around the Sorauli trench site there is no clear continuous scarp along the Siwalik hill front, but ~100 m wide zone of alluvial surface adjacent to the foot of the hills tilt toward south and juxtaposed to flat alluvial surface. The boundary between the tilted surface and the flat plain is continuous and looks like the active front of a flexure scarp. The trench across a small scarp on the tilted surface did not expose any fault, but a fine sand layer was tilted towards the boundary. An Bayesian model of radiocarbon dates indicates the timing of tilting is between 1328 CE and 1435 CE. This period coincides with the 1344 CE earthquake (Bollinger et al., 2016). The Susto trench in the east of Butwal was dug into the foot of ~20 m high fault/flexure scarp below an uplifted terrace surface. In this trench also, 13° south-dipping fine sand layers appeared but the fault was below the water table and not exposed. The timing of the tilt in Susto trench as well as results from investigation in further west in the boundary area between 1344 CE and 1505 CE event will be reported.

Keywords: Himalayan frontal thrust, paleoseismology, trenching study