Great Earthquakes Recurrence Times in the Eastern Himalayas

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Contrary to consensus, the two great Himalayan earthquakes of the mid-20th century were not blind. In eastern Nepal, the surface rupture of the Mw ≈ 8.4, 1934 "Bihar-Nepal" earthquake, unambiguously exposed in the region of Bardibas, probably extended at least 150 km along the Main Frontal Thrust (MFT). In Arunachal Pradesh, we recently discovered unmistakable field evidence for the surface rupture of the great, Mw ≈ 8.7, 1950 Assam earthquake. Both ruptures bound hanging walls with spectacularly uplifted fluvial terraces.

In the easternmost part of Nepal, the penultimate great event was the AD 1255 earthquake. Given preliminary observations of characteristic slip, the hanging-wall of the Patu thrust – one of two overlapping strands of the MFT near Bardibas - likely recorded 3 more great events in the last 3650 ± 450 years. Each would have accommodated 15 ± 2.5 m of slip on the 25° ± 5° dipping thrust, in keeping with an uplift rate of 8.5 ± 1.5 mm/yr and with the shortening deficit accumulation rate (≈ 18 mm/yr) derived from cGPS measurements. In the past 4500 ± 50 years, up to 7 events appear to have been recorded on the other local MFT strand, the Bardibas Thrust. Hence, since the mid-Holocene, the average return time of great MFT earthquakes in eastern Nepal has probably been between 750 ± 150 and 875 ± 250 years.

In Arunachal Pradesh, along a remarkably fresh thrust rupture found near Wakro, the bedrock and strath terrace co-seismic uplifts are ≈ 7 m, with nearly identical surface throw in the penultimate event. The rupture, most likely that of the 1950 earthquake, continues northwards along the Mishmi thrust, then eastwards along the MFT past Pasighat after a high-angle bend at the Dibang valley outlet. The ≈ 90 km-wide, ≈ 350 km-long source of the great Assam earthquake was thus composed of two nearly orthogonal patches, with perhaps similarly oriented slip-vectors along an intersection near 95°30' E. Dating of uplifted terraces is still in progress, but the average return time of mega-thrust earthquakes around the Arunachal syntaxis may turn out to be longer than in eastern Nepal.

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