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Tectonic Morphology of the Hustai Fault (Northern Mongolia)

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Beside the famous series of M 8 earthquakes that struck western Mongolia in the first half of the 20th c., the Hustai fault presents a more directly concerning picture. With its northeastern tip located ∼10 km from the city of Ulaanbaatar (1 M inhabitants), the 92-km-long fault may produce consequential M 7+ earthquakes. It displays continuous microseismicity with five M 4+ since 1974 and a M 5.4 event in that same year. Most events occur in the shallow crust.

We present preliminary results of a multi-disciplinary study of the Hustai Fault, northern Mongolia. By combining high-resolution satellite images, digital elevation models, magnetic mapping, geomorphology and trenching, we provide a detailed morphotectonic map of the fault as well as insight on its recent episodes of surface faulting.

The Hustai Fault is more than 100 km long and divided into four segments. The northernmost segment is 18 km long and oriented N 70; the northern central segment is 26 km long and oriented N 65; and the southern central segment is 34 km long and oriented N 55 and the southernmost segment is at least 34 km long and oriented N26. The active trace runs at the foot of the Hustai Range and is outlined by a clear composite scarp, tilted chert slabs, contrasts in water content, left-laterally offset alluvial fans and releasing step-overs (pull-apart basins and negative flower structures). Stream bed profiles show a systematic uplift of the NW block by ∼10 m and high-resolution satellite images document lateral offsets in the range of 10-50 m, thus suggesting a transtentional regime.

Exploratory trenches located along the central section of the active trace reflect the transtentional nature of the fault with mixed normal and strike-slip faulting geometries. Surface ruptures affect the modern soil and suggest an undocumented M 7+ earthquake occurred recently along the Hustai fault.

Overall, our first results suggest that the Hustai fault is presently active under a transtentional regime that reflects its intermediate location between large sinistral strike-slip faults of the Gobi-Altai in the southwest and major normal faults of the Baikal Rift in the north.