



## Active faults system and related potential seismic events near Ulaanbaatar, capital of Mongolia.

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The region of Ulaanbaatar lies several hundred kilometers from large known active faults that produced magnitude 6 to 8+ earthquakes during the last century. Beside the Hustai fault, which displays a clear morphological expression, no active fault was previously described less than 100 km from the city. In addition, no large historical (i.e. more recent than the 16th c.) earthquakes are known in this region. However, since 2005 a very dense seismic activity has developed over the Emeelt Township area, a mere 10 km from Ulaanbaatar. The activity is characterized by numerous low magnitude events ( $M < 2.8$ ), which are distributed linearly along several tens of kilometers where no active fault has been identified. This raises several questions: Is this seismicity associated to a –yet- unknown active fault? If so, are there other unknown active faults near Ulaanbaatar?

Hence, we deployed a multi-disciplinary approach including morpho-tectonic, near-surface geophysical and paleoseismological investigations. We describe four large active faults west and south of Ulaanbaatar, three of them are newly discovered (Emeelt, Sharai, Avdar), one was previously known (Hustai) but without precise study on its seismic potential.

The Emeelt seismicity can be mapped over 35 km along N150 and corresponds in the field to a smoothed, but clear, active fault morphology that can be mapped along a 10-km-long section. The fault dips at  $\sim 30^\circ$  NE (GPR and surface morphology observations) and uplifts the eastern block. The age of the last surface rupture observed in trenches is about 10 ka (preliminary OSL dating). Considering a rupture length of 35 km, a full segment rupture would be comparable to the 1967 Mogod earthquake with a magnitude as large as Mw 7. It has to be considered today as a possible scenario for the seismic risk of Ulaanbaatar.

The 90-km-long Hustai Range Fault System, oriented WSW-ENE and located about 10 km west of Ulaanbaatar, displays continuous microseismicity with five light to moderate ( $M 4 - 5.4$ ) earthquakes over the last 40 years. The last surface-rupturing earthquake occurred about 1000 years ago (OSL dating). Alluvial fans affected by the fault suggest the rate of deformation (left lateral with normal component) along the main segment ranges from 0.3 to 0.4 mm/year for the last 120 000 years. Hence, the average recurrence interval for a full-segment M 7-7.5 is likely in the order of 10 ky. However, if the Hustai fault also releases strain during partial ruptures along its strongly segmented trace, a Mw 6.5 event may be expected anytime. However, only the main central fault segment has been investigated in terms of paleoseismicity.

The Sharai and Avdar faults, oriented NNE-SSW, were mapped along  $\sim 50$ -km-long sections. Each of these faults was the site of earthquakes of magnitude 6 and more in the past as suggested by morphology and trench observations. Full-segment-ruptures could produce events as large as M 7.2.

The precise relationship and interactions between these faults as well as associated earthquakes have to be clarified by collecting more data. They are the key of the seismic hazard and risk of Ulaanbaatar.