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Slow slip rate and long return period of large earthquakes in the trace of the 1967 M7 Mogod earthquake (Mongolia)

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Mongolia was affected in the 20th century by four major strike-slip earthquakes (M8) with spectacular surface ruptures still fresh in the landscape. These ruptures happened along fault sections that presently help accommodate the extrusion of tectonic blocks North of the India Eurasia collision. These structures, however, were preexisting to those earthquakes and have a prior long standing polyphased tectonic history. In addition to these major earthquakes, a large event, the M7 1967 Mogod earthquake, happened off of what was considered the major tectonic structures at the margin of a tectonic setting usually considered as a stable continental region. This earthquake ruptured a 40 km-long stretch of faults between the Hangay dome and eastern Mongolia. The rupture is divided in 3 main fault strands, which show either evidence of left-lateral strike-slip or thrust motion. Despite the spectacular surface ruptures associated to the 1967 event, in most places no accumulated seismic scarp could be found, raising questions about the past history of this active fault, its seismogenic potential and associated seismic hazard .

We documented a paleoseismological trench through one of the 1967 rupture sections to unravel the past history of this active fault system. The excavation through the local reverse fault scarplet revealed at least 3 earthquakes that deformed and offset the superficial units by recumbent folding, drag folding and backthrusting. The chronology of the sequence is constrained by 7 OSL dates of sands sampled within the main units. The last surface rupture in 1967 CE was preceded by a similar event that happened between 20 and 40 ky and a third one around 50 ky.

These result suggests that this slow slipping intraplate fault has a seismic cycle generating M7 events with an inter- event time of about 25 ka, an activity rate consistent with a slip on the fault around 0.1 mm/yr.