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Study of past megathrust and intraplate earthquakes using sediment records from Lakes Maninjau and Singkarak, West Sumatra

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The 2004 Sumatra-Andaman earthquake revealed that communities in West Sumatra (Indonesia), particularly the area around Padang, the region's capital, are at risk of suffering large subduction-zone earthquakes. Besides these often high-magnitude earthquakes (Mw>8), the area inland of Padang is also regularly affected by earthquakes occurring along the Great Sumatra Fault, a large strike-slip fault running parallel to the subduction zone across the entire island. As historical earthquake records in the region are not long enough to obtain statistically relevant recurrence rates, detailed paleoseismological studies are required to unravel the seismic history of the region.

Previous research has mainly focussed on subduction-zone paleoseismology, but similar studies of the Great Sumatra Fault are currently lacking. The last significant earthquake inland occurred in March 2007, which consisted of a doublet earthquake with two Mw>6 events only 2 hours apart. Historical records showed similar events that occurred in AD 1943 and 1926, both consisting of doublet earthquakes on different – but adjacent – fault segments. All three events took place in the vicinity of Singkarak, a tectonically formed lake located on the Great Sumatra Fault. Hence, Lake Singkarak could be an ideal location for paleoseismic studies of the Great Sumatra Fault. Apart from crustal earthquakes, Lake Singkarak may be affected by seismic shaking from large megathrust earthquakes along the Sunda subduction trench. Therefore, we performed a reconnaissance campaign on the lake in September 2017 in which we collected high-resolution seismic data (3.5 KHz) and short sediment cores. Moreover, we also surveyed Lake Maninjau - a crater lake at a small distance of the Great Sumatra Fault.

Here, we present preliminary results of our paleoseismic reconnaissance campaign, which includes interpretation of seismic profiles and study of sediment cores by means of CT-scans, multi-sensor core logging and radionuclide dating. These analyses indicate that the sedimentary infill of both lakes contains multiple mass-wasting events, erosive surfaces and turbidites, which may be triggered by seismic shaking. Thus, Lake Singkarak and Maninjau have great potential as sensitive earthquake recorders and might be favourable locations for future paleoseismological studies of the Great Sumatra Fault and/or the Sunda megathrust.