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Seismites in slowly deforming regions – evidence for diffuse seismicity in the northern Ejina Basin (Gaxun Nur Basin)

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Past earthquakes leave various types of evidence on the Earth's surface. Seismic waves in water-saturated sediments lead to the deformation of original bedding, unconformities and event layers. The term "seismite" was introduced to describe the various co-seismic effects of earthquakes on sediments that range from principally brittle deformation (e.g., neptunian dykes, hydrofracturing) to soft-sediment deformation (e.g., liquefaction, convolution, seismoslumps).
The Gobi belt of left-lateral transpression between the active deformation zones of the Tibetan Plateau – driven by the India-Eurasian continental collision, and the Gobi-Altai mountain ranges – showing large-scale faulting as far-field responses of above-named collision, exhibits large and remote desert environments with rugged and low topography that are overprinted by strong eolian erosion by competing wind systems.
The Ejina Basin (Gaxun Nur Basin, Inner Mongolia) has been extensively studied and shows evidence for neotectonic faulting (indirectly dated by affected lacustrine sediments) through detected lineaments, morphotectonic investigation and geophysical reconnaissance. The instrumental seismicity is low. Different modes of faulting are discussed, with both WSW-ENE and conjugate trending strike-slip faulting with associated pull-apart basins, as well as far-field-induced NW-SE trending thrusts, being found. The basin is a huge endorheic delta built by the Hei River (chin. Heihe, mong. Ruoshui) and comprises Quaternary sedimentary successions up to 300 m in thickness, which overlie Neogene and Mesozoic sedimentary bedrock. The Quaternary sedimentary successions consist of changing intercalations of eolian and fluvial sands, lacustrine silts and clays and playa evaporites. Positive landforms, such as yardangs (wind-sculpted clay terraces) in the lower reaches of the Hei River (northern Ejina Basin) serve as valuable outcrops for paleoseismic investigation. They exhibit units of deformed sediments interpreted as of co-seismic origin.
We have studied two sites in the northern Ejina Basin. The main site is located 43 km east of Ejina city at the northern margin of the Juyanze paleolake (desiccated 14th century). Numerous yardangs of lake deposits exhibit presumably seismically deformed soft-sediments showing flame structures and convoluted bedding, which are underlain and covered by undisturbed horizontal strata. The event horizons are of several decimeters thickness and of Late Pleistocene-Holocene age. Seismic sources can be assigned to the deformed sediments because of not only a recently discovered normal fault in lacustrine sediments younger than c. 35 ka BP in a construction pit less than 2 km away but also through the consideration of far-field seismic sources. Known faults and mapped lineaments extend over several tens of kilometers and are capable of inducing liquefaction even over greater distances. Other possible deformation sources such as landslides and periglacial cryoturbation can be dismissed, since the landslide susceptibility is low and the study area was not influenced by any glaciation in the considered time frame. Here, we are able to narrow down the time frame of related seismic activity to the very end of LGM (Alleröd/Younger Dryas) and Early Holocene.