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The sedimentary system of the Orog Nuur Basin on the northern margin of the Gobi Desert (S-Mongolia)

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Studies on dryland palaeoenvironmental evolution often focus on specific sedimentary archives in a given area (e.g., lakes, loess deposits). Reconstructing the pathway along which respective sediments are transported over millennial timescale is difficult, nonetheless a fundamental question for understanding the formation of palaeoarchives. Using chronological data of different archives together with a geomorphological-sedimentological perspective on the sediment cascade between mountains and basins, we investigate the palaeoenvironmental evolution of the Orog Nuur (lake) Basin in southern Mongolia. In order to understand the sedimentary, palaeoenvironmental evolution, we constrain the activity phases of the different archives in the basin.
The catchment is strongly asymmetric in elevation with a lowly inclined, ca. 200km long course of the Tuyn Gol (river) from the Khangai Mountains (at ca. 3500 m asl) southward to the Orog Nuur Basin (1200 m), immediately north of the Gobi Altai Mountains (at ca. 3900 m asl). Precipitation ranges from several hundred mm in the mountains to <100mm in the basin. Steep alluvial fans form the transition between the Gobi Altai range and the southern lake shore, representing thick sediment storages. Our results indicate fan aggradation during the cold stages, only subordinately disturbed by tectonic events. Several abandoned surfaces and incised channels indicate reworking of alluvial fans, presumably during cold-warm transitions and under interglacial conditions. Aeolian sandy silts are mantling the mountains in elevations >2200 m asl. OSL ages confirm their deposition under last full glacial conditions (<25 ka), suggesting sufficient moisture availability in higher elevations as a prerequisite for dust deposition and preservation. In the basin, aeolian sand formed dune systems of mainly Holocene age or is trapped in desert pavements. Beach ridges and lacustrine sediments indicate late Quaternary lake highstands dated to the MIS 5 and the mid Holocene.
In summary, under cold-dry conditions much debris is produced and stored in alluvial fans, while in basins, dried out lake beds provide material for deflation and deposition of silts in mountain areas. In contrast, interglacial/-stadial conditions support increasing lake levels shown among beach ridges, drill cores and sections. Additionally, such conditions allowed the evacuation of mountainous sediment storages (sediment-filled valley bottoms, alluvial fans) by enhanced fluvial activity and their transport into the basin.