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Late-Quaternary morphodynamics of Ejina Basin, Inner Mongolia, China: Quantification of neotectonic subsidence and palaeohydrological implications

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From space, the Ejina Basin (Gaxun Nur Basin) – enclosed by the Tibetan Plateau in the south and the Gobi –Tien Shan in the north – appears as the world's second largest inland delta of approx. 28,000 km2. Today, the crescent-shaped series of terminal lakes (Gaxun Nur, Sogo Nur and Juyanze) represent the endorheic erosion base for the Black River (Hei River) drainage system originating in the Qilian Mountains (>5,000 m asl.). The up to 300 m thick Quaternary basin fill of lacustrine and alluvial origin was deposited during the last approx. 250,000 yrs. Gobi gravel plains protecting Late Pleistocene fine sediments against deflation cover most parts of the basin. They are considered to be a unique sequence within the sediment stratigraphy of the entire basin. The slightly convex-shaped surface of the western basin resembles the prograding formation of an alluvial fan with clear evidence of local subsidence to the north and west, as indicated by the concave shaped surface there.

However, the recent terminal lake basins at the northern margin of Ejina Basin are structurally related to tectonic pull-apart basins that were active since Late Pleistocene. The rhomb-shaped Gaxun Nur basin is the most distinct pull-apart feature indicating a left-lateral strike-slip movement parallel to the continental Gobi-Tien-Shan Fault in the north. New radiocarbon dates of lacustrine sediments within a fossil cliff at the southern shore support the estimated subsidence rate of >0.8m per kyr (Hartmann et al. 2011) after the Last Glacial Maximum (LGM).

The more trapezoid fault system of the Juyanze pull-apart basin exhibits a more manifold set of tectonically induced geomorphological features. Whereas Hartmannn et al. (2011) assumed a W-E-striking fault by comparing dating inversions along yardangs of lacustrince chalks that host seismites. A nearby new railway construction pit revealed a normal fault that affected the lake sediments that are 35$\pm$1 kyr BP in age. The most impressive set of features related to young tectonic subsidence in Ejina basin resembles inverted channels south of western Juyanze. Radiocarbon dates of lacustrine sediments below the gravel cover suggest a reversal of surface gradient, conservation and dissection of gravel beds by subsidence that most likely occurred after 13.6 kyr BP. The continuation of the S-N-striking strike-slip-duplex of the Gurinai structure separates Juyanze in two basins by an impressive >20 m emerging cliff formed within remains of an isolated large alluvial fan. This fan should have been active after approx. 18 kyr BP.

Hence, a synopsis of at least 65 radiocarbon dates of lacustrine sediments from the margins and centres of the sub-basins suggests four times higher subsidence rates from the north-western (0.8 m/kyr) to the north-eastern (2-3.6 m/kyr) margin of Ejina Basin.

Considering the flat and spatially uncertain water divide to the depression of Wentugaole (and its continuation to the northwest), it seems likely that the basin has lost its endorheic character at least once.

Hence, the morphology of basin margins of this large intermontane foreland basin shows up with tectonically active margins and sensitive water divides.

Reference: Hartmann, K., Wünnemann, B., Hölz, S., Kraetschell, A., Zhang, H. (2011): Neotectonic constraints on the Gaxun Nur inland basin in north-central China, derived from remote sensing, geomorphology and geophysical analyses. - In: Gloaguen, R. & Ratschbacher, L. (eds.): Growth and Collapse of the Tibetan Plateau. – Geological Society of London Special Publications 353: 221-233.