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Was the Enclosed Qaidam Basin in the Tibetan Plateau Accumulative or Erosive during the Late Quaternary: An Case Study on the Shell Bar?

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A geological feature in the Qaidam Basin known as the "Shell Bar" contains millions of freshwater articulated clam shells buried in-situ. Since the 1980s this feature in the now hyper-arid basin has been interpreted to be lake deposits that provide evidence for a warmer and more humid climate than present during late Marine Isotope Stage 3 (MIS 3) (Bowler et al., 1986). However, the global climate during late MIS 3 and the Last Glaciation Maximum (LGM) was cold and dry, with much lower sea levels.

We have re-investigated the feature geomorphologically and employed Optical Stimulated Luminescence (OSL) methods to devise a new chronology for the sediments. We interpret the Shell Bar to be a remnant of a river channel formed by a stream flowing across an exposed lake bed following a regressive phase lake cycle (Lai et al., 2014; Mischke et al., 2014). Deflation of the surrounding earlier fine-grained lacustrine deep water deposits has left the fluvial channel sediments topographically inverted. Luminescence ages dating to MIS 5 (~100 ka), place the formation of the Shell Bar much older than previously radiocarbon ages of <40 ka BP, but place the climatic sequence more in accord with other regional and global climate proxy records (Lai et al., 2014).

According to previous study (Huang and Chen, 1990), the B/M boundary (with an age of 780 ka) in the core CK-6 was at the depth of ~850 m. As a result, the deposition rate was 108.9 m per 100 ka. The age of 100 ka for the shell bar indicate that the sediments in the last 100 ka have been eroded, i.e. the basin is erosive.

Where have the eroded sediments gone? The basin is enclosed with no river flowing out. The only possible means of erosion is by wind deflation. The Yardangs in the western part of the basin indicate strong wind erosion (Kapp et al., 2011; Pullen, et al., 2011). Geochemical data showed that the deflated dust from the lacustrine sediments of the basin could be the source of the loess in the Chinese Loess Plateau (An et al., 2012). The simulation, using classical mechanics and the relation between wind speed and the grain size of loess, showed that the dust deflated in the basin could be transported to the Loess Plateau by air circulation (Wang and Lai, 2014).

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