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Paleoenvironmental evolution and Asian monsoon variability on the southern Tibetan Plateau during the late Quaternary: A comparison of two lake records

Nicole Börner (1), Lailah Gifty Akita (2), Klaus Peter Jochum (3), Birgit Plessen (4), Peter Frenzel (2), Liping Zhu (5), and Antje Schwalb (1)

(1) TU Braunschweig, Institut für Geosysteme und Bioindikation, Braunschweig, Germany (nicole.boerner@tu-bs.de), (2) Friedrich-Schiller-Universität Jena, Institut für Geowissenschaften, Jena, Germany, (3) Max Planck Institute for Chemistry, Mainz, Germany, (4) Helmholtz-Zentrum Potsdam, Deutsches Geoforschungszentrum (GFZ), Potsdam, Germany, (5) Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, China

The Tibetan Plateau affects the global atmospheric circulation and is thus a key region to study the Asian monsoon system. It is also one of the most sensitive areas to global climate change as, for example, the temperature rise is twice the global average (0.4°C per decade [1]). To understand the recent climate change and predict future climate scenarios it is necessary to investigate past climate changes. The comparison of high-resolution multi-proxy records from Nam Co (4719 m a.s.l., 30°40'N, 90°50'E) and Tangra Yumco (4549 m a.s.l., 31°13'N, 86°43'E) aims to infer long term variations in strength and extent of the Asian monsoon system on the southern Tibetan Plateau. Multi-proxy analysis, including the oxygen and carbon isotope signatures of bulk sediments and the chemical composition of ostracod shells (stable isotopes, trace elements), were carried out on two long cores (10.4 m and 11.5 m), covering the past 24,000 years and 18,000 years, respectively, in order to reconstruct lake level changes and related environmental parameters, i.e. salinity, temperature and productivity.

The records from Nam Co and Tangra Yumco show high similarity throughout the late Quaternary with small temporal differences in onset and duration of climatic changes. The Last Glacial Maximum is dominated by dry and cold conditions and is followed by gradually increasing temperatures and moisture, only interrupted by a dry phase, which coincides with the "Heinrich 1 event" in the North Atlantic region. A significant transition to wetter conditions and rising lake levels is indicated around 15,500 cal years BP, suggesting a strengthening of summer monsoon precipitation. The Bølling/Allerød is characterized by increased meltwater input, followed by cold and arid conditions during the Younger Dryas. The early Holocene is marked by increasing temperatures and precipitation, being the wettest period within our record, characterized by the highest lake levels, lake stratification and increased productivity. The mid and late Holocene shows a slight decrease in monsoonal precipitation and temperature. Nevertheless, during the Holocene high lake levels support a stable lake system in both lakes resulting in a lower sensitivity to climate variations as the larger lake volume attenuates the influence of short-term monsoon fluctuations. An intense shift to dry conditions occurs ∼2000 cal years BP resulting in rapidly decreasing lake levels, caused by weakened monsoon intensity. In the Nam Co area these conditions persist until today, whereas in Tangra Yumco the trend is reverse since the Little Ice Age. Wetter conditions and an increase in lake level may suggest an intensified westerly precipitation, which doesn't reach Nam Co in the east.

[1] Qiu, J., 2014. Double threat for Tibet. Nature 512, 240-241.