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Monsoon dynamics over the past millennium on the southern-central Tibetan Plateau

Marieke Ahlborn (1), Torsten Haberzettl (1), Thomas Kasper (1), Karoline Henkel (1), Stefan Doberschütz (1), Gerhard Daut (1), Bastian Reinwarth (1), Jianting Ju (2), Junbo Wang (2), Liping Zhu (2), and Roland Mäusbacher (1)

(1) Physical Geography, Institute of Geography, Friedrich-Schiller-University Jena, Germany (marieke.ahlborn@uni-jena.de), (2) Key Laboratory of Tibetan Environment Changes and Land Surface Processes, Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing 100085, People's Republic of China

The Tibetan Plateau has experienced abrupt climate change superimposed by a gradual weakening of the summer monsoon systems during the Holocene. Although lake sediment records from the Tibetan Plateau are considered to be particularly sensitive to climate variations a holistic picture of the spatial and temporal monsoon evolution is still lacking due to the interplay of different moisture-transporting wind systems (Indian summer monsoon, East Asian summer monsoon, Westerlies). Closing this data gap is important since the Tibetan Plateau is a key area for understanding the climate evolution and its impact on the availability of current and future water resources in Central Asia. Hence, well-dated and high-resolution records are essential to improve the understanding of the spatial and temporal monsoonal evolution.

To investigate the hydrological cycle indicating past monsoon variability on the southern-central Tibetan Plateau, records of several lakes were studied along an E-W-transect including Nam Co, Tangra Yumco, Taro Co and a small lake named TT Lake. In this study, a high-resolution sediment record from TT Lake (31.10° N, 86.57° E; 4,745 m asl) was investigated to reveal monsoonal dynamics and northern hemispheric climate oscillations over the past millennium.

The 9 m deep TT Lake has a surface area of ∼14,500 sqm and is located ∼1,500 m west and 205 m above the recent western shoreline of Tangra Yumco. Terraces of former lake level highstands indicate that the TT Lake was part of the Tangra Yumco, but the timing remains unknown.

Three sediment gravity cores, obtained in 2011 and 2012, were investigated with geochemical and sedimentological methods. By now a sedimentological core description, magnetic susceptibility data, radiocarbon age determinations, XRF scanning data, and grain size data are available. Further bio-geochemical as well as magnetostratigraphic analyses are in progress.

The sedimentological description of the 50 to 89 cm long cores revealed predominantly stratified, silty to fine sandy sediments with gray, grayish-brown to black color. Several sand layers with a fining-upwards trend are distinguishable, whereas the topmost one has a thickness of 18 cm and occurs in all three cores. This layer might be caused by a mudflow which occurred between 2004 and 2009 as indicated by the analysis of satellite images. The trigger of this mudflow remains unclear, but might be associated with a meteorological event or seismic activity. Radiocarbon age determinations revealed that the record, below the sand layer, covers a timespan from AD ∼1050 to AD ∼1620. Grain sizes are getting coarser towards the top pointing to a falling lake level. Ti, K, Rb, and Fe quantities, indicators for minerogenic input into the lake, show higher values before AD ∼1200 and low values thereafter. This sequence might correspond to the northern hemispheric climate oscillations of the Medieval Warm Period and the Little Ice Age as also documented in Nam Co (Frenzel et al., 2010, QI 218, 157-165; Günther et al., 2011, QI 236, 82-90.). These coinciding climatic variations in Nam Co and TT Lake might suggest a synchronous climatic pattern on the southern-central Tibetan Plateau during the past millennium.