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Stable carbon and nitrogen isotopes and amino acids in Holocene sediments of Lake Lonar, central India

Philip Menzel (1), Birgit Gaye (1), Martin Wiesner (1), Nathani Basavaiah (2), Sushma Prasad (3), Martina Stebich (4), Ambili Anoop (3), and Nils Riedel (4)

(1) Institute of Biogeochemistry and Marine Chemistry, University of Hamburg, Hamburg, Germany, (2) Indian Institute of Geomagnetism, Navi Mumbai, India, (3) German Research Centre for Geosciences (GFZ), Potsdam, Germany, (4) Senckenberg Research Station of Quaternary Palaeontology, Weimar, Germany

Investigations on surface sediments and a sediment core from Lake Lonar in central India were carried out within the framework of the HIMPAC (Himalaya: Modern and Past Climate) programme. The aim was to understand recent productivity, sedimentation, and degradation processes and to reconstruct variations in Holocene lake conditions on the basis of biogeochemical analysis on a 10 m long sediment core retrieved from the centre of Lake Lonar. Located in India's core monsoon zone, Lake Lonar offers valuable information about the climate development of the whole region. The lake is situated at the floor of a meteorite impact structure on the Deccan plateau basalt. The modern lake is characterised by brackish water, high alkalinity, severe eutrophication, and bottom water anoxia. The lake is about 6 m deep and fed by rainfall during the SW monsoon season and three perennial streams. Since no out-flowing stream is present and no seepage loss occurs, the lake level is highly sensitive to the balance of precipitation and evaporation.

Here we present C/N, carbon and nitrogen isotope, and amino acid data of bulk organic matter from modern lake and Holocene core sediments. Modern conditions are mainly related to human activity which started to have persistent influence on the biological and chemical lake properties at $\sim$1200 cal a BP. The distribution of δ^{13}C in the modern sediments is driven by the ratio between terrestrial and aquatic organic matter, while δ^{15}N seems to be influenced by redox conditions at the sediment-water-interface with elevated values at shallow oxic stations. Differences in the amino acid assemblages of oxic and anoxic surface sediment samples were used to calculate an Ox/Anox ratio indicating the redox conditions during organic matter degradation.

The onset of the monsoon reconstructed from the sediment core occurred at ca. 11450 cal a BP. The early Holocene core sediments are characterised by low sedimentation rate, low aquatic productivity, and predominantly anoxic conditions. A gradual lowering of the lake level started at around 6350 cal a BP and culminated in the precipitation of carbonate crystals between 4660 and 3890 cal a BP. The late Holocene sediments indicate a low lake level and oxic conditions until anthropogenically induced eutrophication caused high aquatic productivity and persistent bottom water anoxia.