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Indications of human activity from amino acid and amino sugar analyses on Holocene sediments from lake Lonar, central India

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The DFG funded HIMPAC (Himalaya: Modern and Past Climates) programme aims to reconstruct Holocene Indian Monsoon climate using a multi-proxy and multi-archive approach. First investigations made on sediments from a ca. 10 m long core covering the whole Holocene taken from the lake Lonar in central India's state Maharashtra, Buldhana District, serve to identify changes in sedimentation, lake chemistry, local vegetation and regional to supra-regional climate patterns.

Lake Lonar occupies the floor of an impact crater that formed on the $\sim$ 65 Ma old basalt flows of the Deccan Traps. It covers an area of ca. 1 km^2 and is situated in India's core monsoon area. The modern lake has a maximum depth of about 5 m, is highly alkaline, and hyposaline, grouped in the Na-Cl-CO_3 subtype of saline lakes. No out-flowing stream is present and only three small streams feed the lake, resulting in a lake level highly sensitive to precipitation and evaporation. The lake is eutrophic and stratified throughout most of the year with sub- to anoxic waters below 2 m depth.

In this study the core sediments were analysed for their total amino acid (AA) and amino sugar (AS) content, the amino acid bound C and N percentage of organic C and total N in the sediment and the distribution of individual amino acids. The results roughly show three zones within the core separated by distinct changes in their AA content and distribution. (i) The bottom part of the core from ca. 12000 cal a BP to 11400 cal a BP with very low AA and AS percentage indicating high lithogenic contribution, most probably related to dry conditions. (ii) From 11400 cal a BP to 1200 cal a BP the sediments show moderate AA and AS percentages and low values for the ratios of proteinogenic AAs to their non-proteinogenic degradation products (e.g. ASP/β-ALA; GLU/γ-ABA). (iii) The top part of the core ($<$ 1200 cal a BP) is characterised by an intense increase in total AA and AS, AA-C/C_{org} and AA-N/N_{tot}as well as in the ratio of proteinogenic to non-proteinogenic AAs. This indicates a strong increase in aquatic production which seems to be the result of eutrophication likely caused by human activity like forest clearance and agricultural land use. This hypothesis is corroborated by the dating of more than 10 temple ruins surrounding the lake, which were built in the 12^{th}century, indicating early urbanisation.