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Multi-method investigation of cushion peatlands („bofedales“) on the Peruvian Altiplano – high-resolution terrestrial archives for palaeoenvironmental reconstructions

M. Forbriger, K. Schittek, B. Höfle, C. Siart, and B. Eitel
University of Heidelberg, Institute of Geography, Heidelberg, Germany (markus.forbriger@geog.uni-heidelberg.de)

This study presents a multi-method and multi-proxy approach for palaeonvironmental investigations in the western andean cordillera of southern Peru (Lucanas province, 14° S) using cushion peatlands as terrestrial geoarchives.
The region stretching between the Altiplano and the Peruvian desert in the lowland shares a long term settlement history, in which local cultures adapted to climate change in many different ways. Being one of the most outstanding human remains, the abri below Cerro Llamoca, 4.450 m a.s.l. in the uppermost ranges of the Llamoca peatland catchment area further reveals an occupation history of almost 10.000 years, as revealed by latest archaeological investigations.
In remote and highly elevated regions such as the central Andes, cushion peatlands basically represent the only high resolution terrestrial archives suitable for geoarchaeological and palaeoenvironmental studies. Characterized by high accumulation rates, they ideally document environmental changes, particularly at small time intervals.

Within the multidisciplinary project 'Andean Transect – Climate Sensitivity of pre-Columbian Man-Environment-Systems' several sediment cores with depths up to 11.5 m b.s. were recovered from the Llamoca peatland. Based on almost 100 AMS 14C-datings they provide a chronology of 8000 years and, thus, offer profound insights into climatic and environmental changes in the study area.
While nearly homogeneous peat layers record stable environmental conditions, the heterogeneous granulometric composition of intercalated sediment layers documents several periods of intense geomorphodynamic activity. Due to high resolution geochemical analyses of peat layers (1 cm interval; humification degree, CNS measurements, XRF-scanning), the existence of slight and short-term trends of landscape development during these phases can be identified. Additional pollen, charred particles and plant macrofossil analyses confirm these findings and help reconstructing local vegetation history.

High-resolution digital elevation models derived from terrestrial laser scanning (TLS) provide important input data for geomorphologic analyses on current geomorphic processes that can be transferred to former times. Detailed subsurface information obtained by geophysics (electrical resistivity tomography ERT) helped identify the most suitable sampling sites. Information about peat thickness, stratigraphy and depth to bedrock was combined with topographical elevation data, chronometrical outcomes and palaeoenvironmental parameters to generate subsurface models of the study site. The findings allow reconstructing and visualizing the ancient landscape and the stages of peat development, which coincide with pre-Columbian cultural eras.