Submitted Abstract

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Abstract

The Tibetan plateau is one of the highest contiguous high-elevation terrains on earth and has a long history of human exploration and occupation, extending at least into the Late Pleistocene. Here we present an integrated earth surface process and paleoenvironmental study from the Tingri graben and the archaeological site of Su-re, located on the southern rim of the Tibetan plateau, spanning the past ca. 30 000 years (30 ka). The study area is characterized by cold climate earth surface processes and aridity due to its altitude and location in the rain shadow of the Mount Everest–Cho Oyu massif and is thus sensitive to climatic and anthropogenic perturbations.

Cosmogenic nuclide and OSL dating in combination with geomorphic mapping, suggests (i) a glacial advance and (ii) highly intensified permafrost and periglacial hillslope processes causing fluvial aggradation of the valley floors of ≥12 m, both broadly coinciding with the last glacial maximum.

We observe formation of a thick (≥50 cm) pedo-complex starting at ca. 6.7 ka before present (BP) and erosional truncation at ca. 3.9 ka BP. Widespread landscape instability and erosion characterize the region subsequent to 3.9 ka and intensifies in the 15th century AD. Several lines of (geo)archaeological evidence, including the presence of pottery sherds, sling-shot projectiles and hammer stones within the sedimentary record, indicate human presence at Su-re since ca. 3.9 ka BP. Merging our Holocene landscape reconstruction with the geoarchaeological evidence, we speculate that the combined effect of Little Ice Age (LIA) cooling and an anthropogenic overuse of the landscape led to climatically induced landscape degradation and ultimately to an anthropogenically triggered ecological collapse in the 15th century. Such a scenario is in-line with regional historical data on declining monastery construction and migration of the ethnic group of the Sherpas.

From an earth surface dynamics perspective, we find that transient landscape processes on the southern rim of the Tibetan plateau are strongly linked to millennial scale changes in the ISM intensity and duration. We identify three types of unidirectional non-linear ISM-landscape interactions. Given that the Tibetan plateau is the largest high-altitude landmass on our planet and our limited understanding of several of the key earth surface processes on the plateau, we pinpoint the need for more long-term (Quaternary scale) empirical data particularly on permafrost and periglacial processes and human-environment interactions.