Geophysical Research Abstracts
Vol. 15, EGU2013-13358, 2013
EGU General Assembly 2013

Assessing processes and timescales of sandstone 'peak forest' formation at Wulingyuan (Hunan, China)

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Sandstone landscapes around the globe exhibit a surprising variety in terms of their landforms and formative processes. Ultimately, this reflects the wide range of geomorphic controls that dominate on regional scales, such as lithology, physical and chemical weathering, tectonics, and climate . At Wulingyuan, Hunan Province, China, a unique landscape has developed in Devonian sandstone over an area of ∼400 km2, the "Wulingyuan peak forest", which is characterized by sheer vertical sandstone pillars over 3000 m in relief, overlayed with a substructure of peaks and walls of up to 350 m height. Due to these spectacular features, the area has become a major tourist attraction, and has recently been declared an UNESCO Global Geopark. Uplift, a densely spaced joint pattern, and the uniformity of sandstone beds have been suggested as major prerequisites for the formation and preservation of the unique morphology around Wulingyuan. We aim to investigate the underlying processes and controls responsible for the "peak forest" by determining a chronological framework for its age, rate of formation and rates of surface erosion. The initiation of uplift $\sim$ 1 Ma ago and subsequent stepwise evolution of the "peak forest" has been inferred from cave sediments and surrounding alluvial terraces. No direct information, however, is available on the shorter-term evolution of the vertical sandstone walls, peaks and pillars. In this study , we (i) consider sampling strategies for applying surface exposure dating (SED) in this challenging morphological setting. (ii) present some first results, and (iii) discuss their significance in providing first estimates on rates of catchment-wide denudation, weathering, retreat of the vertical sandstone walls, and bedrock incision. In combination with a GIS-based assessment of sediment volumes stored in and eroded from the catchment, our data will help to elucidate the relative roles of fluvial, mass-wasting, and weathering processes in the longer-term, late Quaternary formation of the "peak forest".