

Chronology and provenance of alluvial fills in the dry valley environment of the lower Molopo River, southern Kalahari

Arne Ramisch (1), Oliver Bens (2), Marie Eden (1), Kerstin Hürkamp (1,3), Daniel Schwindt (1), and Jörg Völkel (1)

(1) Technische Universität München, Science Center Weihenstephan, Geomorphologie und Bodenkunde, Freising-Weihenstephan, Germany (arne.ramisch@tum.de), (2) Helmholtz Centre GFZ German Research Centre for Geosciences, Potsdam, Germany, (3) HelmholtzZentrum München German Research Center for Environmental Health, Institute of Radiation Protection, Neuherberg, Germany

The dry valleys of the Molopo-Kuruman and the Nossob-Auob system form the largest drainage basin of the southern Kalahari, with a total drainage area of over 100.000 km². The South-Kalahari drainage system is connected to the perennial Orange River by the lower Molopo valley which is therefore the only potential fluvial outlet for sediments originating from the southern Kalahari. Despite its key geomorphological position, little is known about Late Quaternary landscape dynamic in the lower Molopo section. To estimate the timing of fluvial sedimentation phases near the Molopo-Orange confluence, we sampled alluvial fills within the narrow trench of the Molopo canyon. The chronology was established using a total of 15 Optical Stimulated Luminescence (OSL) samples from key profiles within the canyon. The results suggest that landscape development was dominated by two phases of valley infill during a) the Mid Holocene and b) the Late Holocene. To gain insight into sediment dynamics during these intervals, we carried out a provenance analysis on the fine fraction (< 2 mm) of fluvial sediments. Sediment source areas were estimated by analyzing the elemental and mineralogical composition of 93 tributaries and 32 dune deposits throughout the reaches of the lower Molopo via X-ray fluorescence (XRF) and X-ray diffraction analysis (XRD). The appliance of a fuzzy cluster algorithm on the elemental and mineralogical composition of reference samples revealed three major sediment source areas: i) The Molopo canyon, ii) fluvial source areas north of the canyon and iii) eolian sands covering the recent lower Molopo valley in its upper reaches. A similarity analysis between fluvial sediments of the Molopo canyon to the previously identified source areas suggests that alluvial fills mainly originate from the canyon itself, suggesting short-distance sediment mobilization as the driving mechanism behind aggradation. Thereby, both Holocene intervals differ in the mean distance of sediment mobilization, with the Late Holocene showing an increased catchment area of fluvial sediments. However, there is no evidence for a contribution of southern Kalahari sediments to the Molopo canyon fills during both Holocene intervals. Therefore, we suggest that sediment dynamics of the southern Kalahari are decoupled from the morphodynamics of the lower Molopo since at least 6 ka. Our findings have important implications for paleoenvironmental reconstructions and the interpretation of the terrestrial sediment contribution to oceanic settings of the south Atlantic.