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Pleistocene to Holocene river terraces in the Tropoja Basin (northeastern Albania) record tectonic and climatic fluctuations modulated by drainage integration processes.

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River terraces provide insight into the spatial-temporal patterns of transient tectonic and climatic forcings. The Tropoja Basin is located at the junction of the Dinaride-Albanide-Hellenide belt in north-eastern Albania and is part of the hanging wall of the Shkoder Peja Normal Fault (SPNF) system, which accommodated orogen-parallel extension since Early- to Mid-Miocene times. The basin features Plio-Pleistocene fill comprising lacustrine deposits (Pliocene) overlain by sub-horizontal layers of carbonate-rich conglomerates and marl that are interlayered by reddish clay. We found that this fill was incised by at least three generations of river terraces (T1-T3). The controls on river terrace formation within the area, i.e. faulting, climate events and drainage evolution, have been unclear so far. In this study, we date the river terraces within the Tropoja Basin with ^{36}Cl-cosmogenic-nuclide depth-profiles dating and combine these results with further fluvial geomorphic analysis of digital elevation models (DEM) to assess the process of terrace formation in the light of region-wide drainage basin reorganization.

^{36}Cl-depth-profiles dating yield ages of ~ 8.8 ka for the youngest terrace (T1) and ~ 15.4 ka for the intermediate terrace level (T2), indicating that both terraces formed after the Last Glacial Maximum (LGM). Imbrication of conglomeratic clasts in terrace T2 suggests that the paleo flow was southwest directed at the time of deposition followed by a high incision rate of ~7 mm/yr. Also, we checked for activity of the SPNF and its potential impact on terrace formation in the basin by calculating normalised channel steepness index (K_{sn}) for streams crossing the fault. We found that K_{sn}-values do not change across that part of SPNF, thus indicating inactivity of the fault in the late Pleistocene to Holocene times. Instead, Ksn-values correlate well with the upper limit of the ice sheet of the LGM of the Valbona Valley. Despite the recent inactivity of the SPNF, the fault might have controlled the spatial fluvial bedrock competence by emplacing carbonates in the footwall adjacent to ophiolites and mélange in the hanging wall forming the floor of the Tropoja Basin. Chi-values of the regional river network in the Tropoja Basin (includes the Valbona and Gashit Rivers, parts of the Drin River system) reveals that the basin was internally drained.

We conclude that the Pleistocene fill of the Tropoje Basin post-dates most, if not all normal faulting. The time difference between Mio-Pliocene normal faulting and Pleistocene filling of the basin suggests that sedimentation and incision were controlled directly by climate and basin

connectivity through the river network to the regional base-level of the Adriatic Sea. Internally drained, the basin led to lake formation prior the LGM where at times reconnected with regional base-level of the Adriatic Sea after via the Drin River system. This transient evolution of the river network was characterised by basin filling and potential river over-spilling leading to drainage integration events with increased headward erosion and river entrenchment.