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# Comparing OSL and CN techniques for dating fluvial terraces and estimating surface process rates in Pamir

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The quantification of surface process rates is crucial for understanding the topographic evolution of high mountains. Spatial and temporal variations in fluvial incision and basin-wide erosion enable to decipher the role of tectonic and climatic drivers. The Pamir is peculiar in both aspects because of its location at the western end of the India-Asia collision zone, and its position at the edge of two atmospheric circulation systems, the Westerlies and the Indian Summer Monsoon. The architecture of the Panj river network indicates prominent variations across the main tectonic structures of the Pamir. The trunk stream, deflects from the predominantly westward river orientation and cuts across the southern and central Pamir domes before doubling back to the west and leaving the orogen.

Optically stimulated luminescence (OSL) dating of fluvial terraces reveals short-term sedimentation along the trunk stream during the last ∼25 kyr. The agreement of OSL results to new exposure ages based on the cosmogenic nuclide (CN) 10Be confirms accurate terrace age modelling and treatment of incomplete bleaching. The consistent terrace sedimentation and exposure ages suggest also fast terrace abandonment and rapid onset of incision. Considerable differences in terrace heights reflect high spatial variations of fluvial incision, independent of time interval, change in rock type or catchment increase. Highest rates of (5.9 $\pm$ 1.1) mm/yr to (10.0 $\pm$ 2.0) mm/yr describe the fluvial dynamic across the Shakhdara Dome and that related to the Darvaz Fault Zone. Lower rates of (3.9 $\pm$ 0.6) mm/yr to (4.5 $\pm$ 0.7) mm/yr indicate a transient stage north of the Yazgulom Dome. Fluvial incision decreases to rates ranging from (1.7 $\pm$ 0.3) mm/yr to (3.9 $\pm$ 0.7) mm/yr in graded river reaches associated to southern dome boundaries. The pattern agrees to the interpretation of successive upstream river captures across the southern and central Pamir domes inferred from morphometric analyses of river and valley profiles.

Basin-wide erosion rates based on 10Be concentrations in modern fluvial sediments yield relatively consistent rates between (0.61 $\pm$ 0.1) mm/yr and (0.75 $\pm$ 0.14) mm/yr along the Panj. The increasing Panj catchment averages variations of tributary basins, but minor variations in erosion rates of along-stream sub-basins resemble the pattern of OSL-based incision rates. In contrast, basin-wide erosion rates of tributary basins clearly differentiate between plateau-related sub-basins of (0.05 $\pm$ 0.01) mm/yr to (0.17 $\pm$ 0.03) mm/yr, and plateau margin-related sub-basins of (0.38 $\pm$ 0.06) mm/yr to (1.43 $\pm$ 0.26) mm/yr. The differentiation in plateau-related and marginal sub-basins and the northward increase in erosion rates correlate with the 75-percentile of the slope distribution within respective basins and to a minor degree to cumulative annual precipitation.