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H02: Beyond Steady State: The Dynamics of Transient Landscapes
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Detrital Thermochronology as a Tool for Studying the Evolution of Transient Landscapes

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In an evolving orogen, changes in climatic or tectonic forcing can drive changes in rates and patterns of rock erosion and exhumation. As a landscape responds to this forcing, topographic relief and drainage patterns may be expected to evolve towards a configuration that reflects the new exhumation regime. One way to study the spatial and temporal timescales over which a landscape's transient response occurs involves the $^{40}Ar/^{39}Ar$ thermochronology of detrital mineral samples. The distribution of $^{40}Ar/^{39}Ar$ cooling ages in a detrital sample is sensitive to the long-term thermal history recorded in the bedrock it represents. However, unlike a bedrock sample's cooling age, a sediment sample's cooling age signal also potentially reflects transient topography and sediment delivery that may vary on diurnal to millennial timescales for a particular sampling site. Sediment samples from modern river systems are particularly useful in this regard because complementary bedrock studies, large numbers of single-grain analyses, and the hypsometry of the contributing area may be used to deconvolve the catchment's cooling history from the effects of transient erosion, transport, and deposition. When applied to ancient river sediment stored in terraces or foreland basin deposits, this approach can be used to examine erosional signals through time. For example, if favorable comparison of a catchment's hypsometric curve and modern detrital cooling age signal suggests that it is undergoing uniform, steady-state erosion, it should be possible to track the signal through time using stored deposits to determine how long the catchment has been at steady state or the timescale of recovery from some perturbation. We use examples from the central Nepalese Himalaya to explore how the method might be applied to active orogenic systems.