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Styles and rates of knickpoint migration from cosmogenic Be-10 in a landscape of active normal faulting

D.C. Commins (1), **S. Gupta** (2), W. Phillips (3) and J. Schaefer (4)

(1) Lamont-Doherty Earth Observatory, NY 10964-1000 USA, (2) Imperial College, London, SW7 2BP UK, (3) University of Idaho, Moscow, USA, (4) Lamont-Doherty Earth Observatory, NY 10964-1000 USA,

Knickpoints are important elements in transient landscapes as they represent disequilibrium in a fluvial system. The upstream retreat of knickpoints is a primary mechanism for communication of base level fall through the landscape, and ultimately controls landscape response to change. We investigated knickpoints on streams crossing active normal faults within the Canyonlands Graben of SE Utah to constrain the processes and rates of knickpoint migration. We use cosmogenic 10Be to compare rates of knickpoint retreat with rates of bedrock erosion from overland stream flow in this semi-arid landscape. Our results show that knickpoints migrate upstream by processes of groundwater sapping that cause undercutting and eventual collapse of beds with thickness of greater than 1m; this process resets the cosmogenic isotope system permitting rates of knickpoint migration of ˜10 m/ka to be estimated. Bedrock erosion rates show that knickpoint zones are fundamentally transient features through which bedrock incision is accomplished.