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Testing the application of in-situ Sm-Nd isotopic analysis on detrital apatites: a provenance tool for constraining the timing of India-Eurasia collision

Alex Henderson (1), Gavin Foster (2), and Yani Najman (1)

(1) Lancaster Environment Centre, Lancaster University, LA1 4YQ, United Kingdom , (2) Bristol Isotope Group, Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's Road, Bristol, BS8 1RJ, UK.

Provenance tools are applicable to many problems in sedimentary geology as they help unravel the tectonic and metamorphic history of the hinterland and provide insights into the erosional pathways and origins of sediments. In many cases it is more appropriate to use single grain approaches as opposed to bulk sediment methods in order to discover the precise input of the contributing geological terranes since the input of subordinate sources may not be detectable in bulk rock studies. Using a selection of modern river sediments we characterise the Sm-Nd isotopic composition of individual detrital apatites from the main Himalayan geological terranes. Our analyses allow us to effectively distinguish between apatites derived from the Eurasian Plate (relatively high Nd values and low 147Sm/144Nd ratios), from those derived from the Indian Plate (low to high Nd values and moderate to high 147Sm/144Nd ratios). We then apply this approach to Tertiary Indus Basin sedimentary rocks to attempt to better determine the timing of India-Eurasia collision. We find that detrital apatites in the Tertiary Indus Basin have been sourced solely from Eurasia, lacking a mixed India-Eurasia provenance input which would document the India-Eurasia collision. This study illustrates the use of this relatively novel provenance tool and provides a sound framework for similar studies in the future concerning the tectono metamorphic-erosional evolution of the Himalaya.