Geophysical Research Abstracts, Vol. 8, 07581, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07581

Improving interpretation of single detrital grain ages through combined geochemical and isotopic analysis

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Exhumation ages extracted from the detrital record are increasingly being used to help understand the growth history of an orogen. As an orogen progresses towards steady-state exhumation ages generally trend towards a restricted range that is close to the time of sedimentation. Under these circumstances it can be difficult in the sediment record to identify where a particular grain has come from. In the Himalayas apatite and zircon FT ages from Higher and Lesser Himalaya units are closely similar along the entire orogen and this is reflected in the detrital ages from recent Indus and Bengal fans fan sediments. In parts of West Bengal Pleistocene sands sourced from the Himalayas have suffered arsenic contamination of groundwaters. Differences between contaminated and non-contaminated aquifers are due to sediment depositional environment and provenance where depositional environment governs production and preservation of organic matter that is broken down by microbial action to produce a redox environment and sediment provenance governs the abundance of arsenic bearing micas. Detrital apatite and zircon FT ages from polluted and unpolluted sands suggest a similar provenance supported by aquifer mineralogy and present-day drainage which are consistent with High Himalayan sources. This can be directly tested using LA-ICPMS to measure ^{143}Nd / ^{144}Nd ratios and Hf and U-Pb isotopes on the dated grains, based on the knowledge that each tectonostratigraphic unit has a characteristic isotopic range. For the West Bengal sands this approach has confirmed High Himalayan units as the dominant source, but also revealed that some Lesser Himalayan grains are also present. This ability to gather high precision isotopic data from previously dated detrital grains has the potential to enhance future detrital studies seeking to reconstruct long-term orogenic exhumation history.