Geophysical Research Abstracts
Vol. 13, EGU2011-13459, 2011
EGU General Assembly 2011

Large-scale drainage shifts on the Indo-Gangetic plains: implications for reading mountain belt evolution from the sedimentary record

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Sedimentary records from foreland basins are commonly used to reconstruct the evolution of adjacent mountain belts, however the fidelity of these archives to accurately record long-term mountain belt evolution is not fully understood. Here we examine the issue of foreland basin drainage systems and sediment routing. How might changes in such drainage systems affect how we read the sedimentary record? We document late Quaternary palaeo-river channel changes in the Indo-Gangetic basin of western India. Using a combination of satellite remote sensing, subsurface geophysical analysis and detailed sediment coring, we analyse the large-scale planform geometry, and detailed sedimentary and stratigraphic nature of a major palaeochannel/valley fill in the shallow subsurface. This channel complex forms a very significant sediment body recording aggradation of multiple channel fills. Satellite remote sensing analysis indicates the trace of the buried channel complex and demonstrates that it exists in region of the Himalayan foreland where no major rivers are currently present. Thus it records the former drainage pathway of a major river, which has since been diverted. Provenence analysis based on U-Pb dating of detrital zircons and detrital apatite fission track ages indicate sediment sources in the High Himalayan Crystallines Series indicating that this palaeo-river channel system formed a major perennial river derived from the High Himalaya. We use optically stimulated luminescence dating techniques to develop an age model for the stratigraphic succession and hence constrain the timing of river channel existence and diversion. Our results indicate that on geologically relatively short time-scales, we observe dramatic alongstrike shifts in the location of major Himalayan rivers. This suggests that abrupt changes in sediment routing should be considered when reconstructing orogen evolution from detrital records.