

Thermochronology and Landscape Evolution in the Basin Hinterland – Understanding Sediment Supply into Deep-Basin Environments

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Understanding the sources of sediment supply and how these have changed through time provide key insights into the evolution of basins and the hydrocarbon systems they contain. In the past, information about the source of sedimentary material has mostly been gleaned from the nature of the sediments themselves. Such materials, however, provide access to only part of the overall continuum from erosion of source material through to deposition of the ultimate products of this cycle. The application of low-temperature thermochronology to rocks from the basin hinterland can now provide powerful new insights into the evolution of the land surface itself, and hence into the nature of the sediments derived from it. Thermochronology by the fission-track and (U-Th)/He methods applied to apatites from outcropping basement samples can be used to reconstruct temperature histories from large areas over durations of up to hundreds of Ma. The past temperatures revealed can often be taken as a proxy for palaeodepth below an evolving land-surface, especially for the low-temperature environment of the upper few kilometres (<~120°C). Thermochronology in this low-temperature zone can therefore provide a unique record about rock movements towards the surface, and hence about the evolution of the land-surface itself, the emergence and destruction of topography, and the development of drainage. In this way, regional scale thermochronology of basement areas can provide new reconstructions of sediment supply at various stages of basin history. Initial applications of this approach to basins on the NW and SE margins of Australia are extremely promising.