



Dating diagenesis using authigenic titanite

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In non-fossiliferous rocks, the age of sedimentary deposition is typically constrained by a combination of youngest detrital grain ages in a series of stratigraphic units and/or from igneous rocks within the stratigraphic successions. These age constraints often leave large uncertainties, hindering tectonic interpretations as age constraints may span multiple tectonic events.

Alternatively, authigenic minerals can be used to provide near-depositional ages and are increasingly being utilised. In arkosic rocks that contain detrital ilmenite, authigenic titanite appears to form willingly, creating an avenue for constraining diagenetic ages. Here we present results from two separate studies, where depositional ages and titanite chemistry are obtained from in-situ analysis of authigenic titanite using laser ablation–inductively coupled plasma–mass spectrometry (LA–ICP–MS). The first example comes from the Bunger Hills, East Antarctica, where moraine-hosted sedimentary rocks deposited on 1180 Ma granulites forming part of the vast Albany-Fraser orogenic system have been derived from erosion of an inland sub-glacial basin. Geophysical interpretation suggests the basin formed during Cretaceous rifting of Australia and Antarctica (e.g. Maritati et al 2016). However, authigenic titanite cement between detrital ilmenite grains formed within error of the age of granulite metamorphism, indicating basin formation was synchronous with the granulite facies metamorphism. In a second example, authigenic titanite in syn-orogenic sediments deposited in the foreland of the intraplate Petermann Orogeny of central Australia give an age of ca. 600 Ma, significantly older than the bulk of ages derived from the orogenic hinterland, providing insights into the early erosional history of the orogen. In sedimentary rocks of suitable composition, titanite provides a relatively straightforward avenue for determining the ages of diagenesis.

References:

Maritati, A., Aitken, A.R.A., Young, D.A., Roberts, J.L., Blankenship, D.D. and Siegert, M.J., 2016. The tectonic development and erosion of the Knox Subglacial Sedimentary Basin, East Antarctica. *Geophysical Research Letters*, 43(20).