Growth and reworking of Gondwana through time

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The timing of continental crust generation is dependent on the nature of the rock record. Juvenile igneous rocks from various continental segments usually show marked age peaks suggesting episodic growth [e.g. 1]; and fine-grained sediments, which provide an average of their igneous source terranes, provide smooth curves of crust generation [e.g. 2], which are more consistent with the continuous nature of crust formation at the level of destructive plate margins. Thus there are long-standing questions over (i) whether the age peaks of juvenile rocks are representative, or merely artefacts of selective preservation [3], and (ii) the extent to which the processes and rates of crust generation and recycling have varied with time.

We present an integrated U-Pb, Hf and O isotopes study on zircons from sedimentary deposits along ~2000 km of the eastern Australian coastline. The data establish that continental growth of Gondwana is continuous, with a significant inflection point in the rate of generation at around 3 Ga. This point marks the transition between (i) very rapid generation of continental crust in the first ~1.5 Ga of Earth history and (ii) lower volumes of preserved crust towards the present day. Such a fundamental change in the way the continental crust was generated and preserved can be linked to the onset of 'modern' plate tectonics, which may have been active since at least 3.1 Ga [4]. This is also consistent with the formation of Hadean/Early Archean crust in a tectonic environment different from modern plate tectonics [5].

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Soil closure ages from meteoric ^{10}Be, McMurdo Dry Valleys, Antarctica

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Understanding Neogene polar climate in the McMurdo Dry Valleys relies largely on evidence from landscape evolution, glacial modelling and stratigraphy. We provide new evidence from meteoric ^{10}Be for the onset of frozen, hyper-arid conditions in Dry Valley soils. A simple decay model for the co-occurrence of ^{10}Be and illuviated clay in two adjacent profiles indicates the clays were actively migrating down from the surface in a warmer climate until the system froze between 6 and 9 Ma. The model also suggests denudation rates of 0.02–0.06 m Myr^{-1} since closure. These data provide an independent test to glacial-stratigraphic evidence used to determine Antarctic paleoclimate.

Clays bound with meteoric ^{10}Be are prevalent in many Dry Valley soils to depths of over 4 m. These particles, which are now frozen in place, were illuviated by percolating water from the surface, during a previous 'wet period'. We use two adjacent profiles to take advantage of the ^{10}Be clock and determine when ^{10}Be was sealed or closed off from the surface. The two-profile method allows elimination of several variables and hence, calculation of how long ^{10}Be has been in the soil since freezing or closure. By sampling soils at a variety of altitudes and locations, we may build up a better picture of the transformation from sub-polar to polar conditions in the Dry Valleys.