The Growth of the Australian Continent

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How and when the continental crust formed remain controversial with apparently contradictory conclusions drawn from the igneous and sedimentary rock records. Detrital zircons provide a more representative sample of igneous events than the exposed geology and their Hf isotope ratios give model ages for the timing that the zircon source magmas separated from the mantle. To better understand the evolutionary history of the Australian continental crust, an in-situ U-Pb, Lu-Hf and O isotopic study of detrital zircons from major rivers and sand dunes in Australia has been carried out. One thousand five hundred U-Pb ages of Australian detrital zircons showed six major periods of zircon crystallization, 0.1-0.35 Ga, 0.4-0.8 Ga, 0.85-1.4 Ga, 1.5-2.1 Ga, 2.5-3.1 Ga and over 3.3 Ga. The O isotopic data are consistent with the secular evolution of O isotope trend of Valley et al. (2005). The variable O isotope of zircons is an indicator of sedimentary source component in the zircon magma source, which constrains its $^{176}Lu/^{177}Hf$ ratio reducing the uncertainty of the calculated model ages. The arc mantle evolution curve of Iizuka et al. (2013) was adopted to calculate the Hf model ages of detrital zircons. Major periods of continental crust generation can be recognized in the Hf model age distributions weighted by both basement area and the U/Pb zircon age fraction. Both show four major intervals of crustal generation: 0.3-0.5 Ga, 1.1-2.7 Ga, 3.0-3.4 Ga, 3.7-3.8 Ga. At the 95% confident interval, the Hf model age growth curve, calculated for this study, agrees with the Nd continental growth curves proposed by Champion (2013) and McCulloch (1987), based on igneous rocks. These curves indicate that at least 20% of the presented Australian continental crust was formed before 2.5 Ga and the crustal growth was fastest between 1.7 Ga and 2.5 Ga, especially between 2.3 Ga and 2.5 Ga, which corresponds with the timing of supercontinent Kenorland fragmentation. This study suggests that major peaks of crustal growth of the Australian continent may not be global and peaks in crustal growth may differ from continent to continent.

[1] Champion D.C (2013) *Geoscience Australia*. [2] Iizuka *et al* (2013) *Geochim. Cosmochim. Acta* **107**, 96-120. [3] McCulloch M (1987) *Proterozic Lithospheric Evolution* **17**, 115-130. [4] Valley J (2005) *Contributions to Mineralogy and Petrology* **150**, 561-580.