Crustal Evolution of the Jack Hills Zircon Source and Episodic Loss of Hadean Crust

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Detrital zircons from Jack Hills, Narryer Gneiss Complex (Yilgarn craton), are the best yet known resource for investigating the Earth's first few hundred million years. Previous Lu-Hf investigations of these zircons suggested that continental-like (low Lu/Hf) crust formation began by ~4.4-4.5 Ga and continued for several hundred million years[1]. The most isotopically primitive crust represented in the Jack Hills population was preserved until at least ~4 Ga. However, evidence for the involvement of Hadean materials in later crustal evolution is sparse, and even in the Jack Hills zircon population, the most unradiogenic, ancient isotopic signals have not been identified in the younger (<3.9 Ga) rock and zircon record. We present new Lu-Hf results from <4 Ga Jack Hills zircons that indicate a significant transition in Yilgarn crustal evolution between 3.9 and 3.7 Ga. The Jack Hills zircon protolith evolves largely by internal reworking through the period 4.0 to 3.8 Ga, and both the most ancient and unradiogenic components of the crust are missing from the record after ~4 Ga. New juvenile additions to the crust at ca. 3.9-3.8 Ga are accompanied by the disappearance of unradiogenic crust ca. 3.9-3.7 Ga. Additionally, this period is also characterized by a restricted range of $\delta^{18}O$ and an overall shift in several zircon trace element characteristics after ca. 3.9-3.8 Ga. The simultaneous loss of ancient crust accompanied by juvenile crust addition can be explained by a mechanism similar to subduction – which effects both processes on modern Earth. Other geochemical information, although less sensitive to processes like crustal recycling, also supports a transition in zircon formation environment in this period. Comparison of Jack Hills zircons with detrital zircons from modern drainages in the Yilgarn craton (from [2]) suggests that much of the Hadean crust is no longer sampled in the Yilgarn after ca. 2.6 Ga. Better understanding the fate of Hadean crust sampled by the Jack Hills zircons may allow for estimates of early crust longevity for comparison to other Archean terranes.

[1] Harrison, Schmitt, McCulloch, Lovera (2008), *Earth Planet. Sci. Lett.* **268**, 476–486 [2] Griffin, Belousova, Shee, Pearson, O'Reilly (2004) *Precam. Res.* **131**, 231-282