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No evidence of Hadean granitic crust from monazites

Tsuyoshi Iizuka[1*], Oliver Nebel[1], Malcolm McCulloch[1]

[1]Australian National University

The oldest identified terrestrial materials are Hadean (>4.0 Gyr ago) detrital zircons from Mount Narryer and Jack Hills metasediments in the Narryer Gneiss Complex, Western Australia, that potentially contribute to our understanding of the evolution of the early Earth. The zircons have been documented to contain inclusions of muscovite, quartz, K-feldspar, biotite and monazite. The hydrous, peraluminous inclusion assemblage has been taken as evidence that the zircons crystallized from granitic (sensu stricto) melts, with implications for the existence of plate boundary interaction and sedimentary recycling in the Hadean era. However, neither monazite inclusions in the zircons nor detrital monazites from the metasediments have U-Pb ages older than 3.6 Gyr, requiring either that the inclusions are not primary origin but grew along cracks in the zircons or that Hadean igneous monazites were preferentially recrystallized during later metamorphism. Here we present micrometre-scale, in situ Sm-Nd isotopic ratio measurements of the detrital and metamorphic monazites from the Mount Narryer and Jack Hills metasediments. The data reveal that older monazites are source of light rare earth elements for younger metamorphic monazite formation and, therefore, that monazite could inherit its primary Sm-Nd isotopic signature during the recrystallization processes. These findings, combined with the U-Pb and Sm-Nd isotope systematics of the detrital and metamorphic monazites, indicate that no igneous monazites older than 4.0 Gyr were recrystallized to form the monazites. Our results therefore suggest that the source rocks of >4.0-Gyr-old detrital zircons contained few monazites and the inclusions are secondary origin, eliminating the evidence for Hadean granitic crust.