

Palaeomagnetic evidence for unification of the North and West Australian Cratons by ca. 1.7 Ga: new results from the Kimberley Basin of northwestern Australia

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Abstract

A palaeomagnetic study of the Elgee Formation red siltstones and shales in the Palaeoproterozoic Kimberley Basin of northwestern Australia has been carried out. All seven sampling sites revealed an extremely stable magnetic remanence carried by hematite. The age of the formation is confined by precise SHRIMP U-Pb ages of early-diagenetic xenotime from rocks both above and below it to be 1704 ± 7 - 14 Ma, but this may represent a minimum age. The youngest detrital zircon grains in the underlying formation provide a maximum age of 1786 ± 14 Ma for the formation. The extreme stability of the remanence, the dissimilarity of the remanent direction from expected younger palaeomagnetic directions, and the lack of regional overprint in the 1790 ± 4 Ma Hart Dolerite just north of the study region, support a primary origin for the remanence. A marginally positive fold test also supports a primary origin. The mean-direction of $D = 92.2^\circ$, $I = 14.9^\circ$, $\theta_{95} = 6.4^\circ$ gives a palaeopole at (4.4°S , 210.0°E) with $dp = 3.3^\circ$, $dm = 6.5^\circ$. This pole, together with a previously reported palaeopole from the Hart Dolerite and ca. 1700 Ma overprint poles from the Pilbara Craton, all agree with palaeopoles of similar ages from the McArthur Basin of northern Australia. Palaeomagnetic results thus suggest that the North and West Australian Cratons were possibly together by ca. 1.7 Ga.