

Paleomagnetism of Archean igneous rocks from the Pilbara craton, Australia: implications for the Pilbara APWP

Arata Yoshihara[1]; Nagisa Machii[2]; Kayoko Haraguchi[2]; Hideo Sakai[3]; Yozo Hamano[4]

[1] Dept. of Earth Sciences, Toyama Univ.; [2] Dept. Earth Sci., Toyama Univ.; [3] Earth Sci., Toyama Univ.; [4] Dept. Earth & Planetary Physics, Univ. of Tokyo

Reconstruction of apparent polar wander paths (APWPs) during Archean and Proterozoic eras can play a crucial role describing large-scale tectonic processes of the early Earth. We report results of paleomagnetic and rock magnetic investigations using the middle Archean pillow basalts (Apex basalt, ca. 3.5 Ga), two sets of late Archean flood basalts (the Mount Roe and Kylenea basalts, ca. 2.8 Ga), and the Black Range dike suite (ca. 2.8 Ga) from the Pilbara craton, Western Australia.

A positive fold test for the Mount Roe samples collected from the Marble Bar Basin strongly suggest that their characteristic remanences are primary origin. The mean direction obtained, however, is obviously different from the previous reports from the Mount Roe units exposed in other areas in Pilbara. This observation supports the interpretation by Strik (2003) that the so-called Mount Roe basalt consists of two major units: the well-known upper unit whose paleomagnetic direction has been well-determined and the lower unit observed only in the Marble Bar Basin with much different declinations from the upper one, to which our Mount Roe samples correspond. Paleodirectional data for the Kylenea basalt and the Black Range dikes are consistent with those from previous works interpreted as primary based on positive reversal, fold, and baked contact tests (e.g. Strik et al., 2004; Embleton 1978). The mean paleomagnetic direction for the 3.5 Ga Apex pillow basalts does not conflict with the mean directions of ChRM components of the Marble Bar Chert Member which underlies the Apex units (Suganuma et al., 2006). Detailed rock magnetic experiments revealed that the main carriers of ChRM are Ti-free magnetites presumed to be in the PSD to MD states for the Mount Roe and Kylenea basalts, and with the PSD grain size for the Black Range dikes and the Apex lavas.

For four igneous rock sets, virtual geomagnetic pole (VGP) positions were calculated, and an apparent polar wander path (APWP) from ca. 3.5 to 2.0 Ga for the Pilbara craton was reconstructed with VGPs previously reported. There is a lack of geochronological control for the lower unit of the Mount Roe basalt, and it can therefore not be excluded that our paleodirectional results for the Mount Roe samples are even significantly older records than those from the upper unit. The VGP position for the lower unit of the Mount Roe falls on the APWP between the poles for ca. 3.5 Ga Pilbara Supergroup and the ca. 2.8 Ga Fortescue Group.