西オーストラリア、Thumbiana層 (27.4億年) の古地磁気

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Plaeomagnetism of the 2.74 Ga Tumbiana Formation, Western Australia

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Paleomagnetic study is done on the late Archean basalt in the 2.74 Ga Tumbiana Formation in the Pilbara craton,western Australia.

In summer 2004, the Archean Biosphere Drilling Project drilled a continuous 207 m long oriented core (ABDP#10) of Tumbiana Formation at the Meentheena area in the northeastern Pilbara. Lithology of the drilled core is divided into amygdaloidal terrestrial continental basaltic lava at the deeper level, and clastic sediments and tuffs with intercalated stromatolite layers at the shallower level. The core is metamorphosed to greenschist facies at 2.1 Ga. Over 200 specimens were selected mainly from the basaltic rocks, and partly from clastic sediments. A suit of rock magnetic experiments for selected specimens reveals an existence of small amounts of subhedral particles of multi-domain-sized magnetite, suggesting that the primary texture of magnetic mineral has remained.

Paleomagnetic study was conducted using the SQUID magnetometer and other equipments at the Center for Advanced Marine Core Research, Kochi University. The Curie temperature of almost all specimens is about 580 degrees. Stepwise alternating field demagnetization (AFD) reveals that the magnetite is easily demagnetized until the 10 mT step and remains is gradually demagnetized through following AFD steps up to 80mT. The remanent magnetization of basaltic rocks apparently defines two components; stable downward direction and meta-stable upward direction. The MAD values were mainly less than 5 degree. Although clastic sediments preserve only one component, the direction is upward direction, which is same with that of the meta-stable component of basaltic rocks, suggesting that the primary component at 2.74 Ga does not preserve in the clastic sediments. The similar tendencies were observed through stepwise thermal demagnetization (ThD) up to 600 degrees. However, the Fisher's error angles of the dataset after ThD treatment are apparently lower than those after AFD treatment.

The results suggest that the stable component of basaltic rock shows clustering paleomagnetic reversal direction of 2.74 Ga. Also the results might indicate that the meta-stable component of basaltic rocks and the component of clastic sediments show the secondary component which might preserve the paleomagnetic direction at the regional metamorphic stage of 2.1 Ga. The comparison with the paleomagnetism of 2.77 Ga Mt. Roe Basalt (Niitsuma et al, in prep.), the remagnetization in the Meentheena area is stronger than that in the Whim Creek area, related with the regional metamorphism, because the regional metamorphism in the central Pilbara craton is of prehnite-pumpellyite facies.