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Magnetic property changes across the Fe redox boundary in a sediment core from the Ontong-Java Plateau

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A rock-magnetic and paleomagnetic study was conducted on gravity-core NGC86, taken from the Ontong-Java Plateau (1-00N, 160-03E, water depths 2420m), in order to clarify magnetic property changes across the Fe redox boundary. The sediments consist of calcareous ooze, and the Fe redox boundary occurs at a depth of 1.6 m (ca 120 ka), which is recognizable as a color change from tan to olive gray. Decomposition of IRM acquisition curves revealed that above the boundary the remanence is carried dominantly by two components; a low coercivity component with a mean coercivity of ca 40 mT and a higher coercivity component with a mean coercivity of ca 100 mT. Below the boundary, the higher coercivity component disappears. Low-temperature magnetometry indicates that the Verway transition is suppressed above the boundary whereas it is recognized below the boundary. Mossbauer spectroscopy shows that sediments just above the boundary contain magnetites and maghemites, but maghemites do not occur in sediments just below the boundary. All these observation indicate that reduction of maghemite to magnetite occur at the Fe redox boundary.

Yamazaki (2009, G-cubed) carried out an environmental magnetic study using two sediment cores from the Ontong-Java Plateau with the Fe redox boundary deeper than the bottom of the cores. It was shown that changes in the relative contribution of biogenic magnetite and terrigenous maghemite can be estimated from the ratio of ARM to SIRM, based on the proportion of interacting to non-interacting components inferred from FORC diagrams, the decompositon of IRM acquisition curves, and S ratios. Variations in the ARM/SIRM ratio of core NGC86 coincide with the regional pattern of Yamazaki (2009) even below the Fe redox boundary. This suggests that the estimation of the relative abundance of biogenic and terrigenous components is still possible below the boundary from the ARM/SIRM ratio, although both components are magnetites in this case. Paleointensity variations of core NGC86 agree well in general with other cores in this region, which suggests that fortunately the Fe redox boundary does not strongly affect paleomagnetic signals.

Keywords: Fe redox boundary, rock magnetism, maghemite, magnetite, Ontong-Java Plateau