FORC-PCA analyses of red clay in the Pacific

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Red clay is widely distributed in deep-sea in mid-latitudes, and potentially preserves long-term paleoceanographic changes, although lack of calcareous and siliceous microfossils and extremely slow sedimentation with numerous hiatuses limit resolution. We conducted a rock magnetic study of some red clay cores in the North and South Pacific in order to identify magnetic mineral components and estimate paleoenvironmental changes. Three piston cores (MR13E02-PC1, KR1402-PC4, and KR1302-PC6) collected from near Minamitorishima Island in the northwestern Pacific and IODP Site U1365 cores in the South Pacific were used in this study. Principal component analyses of FORC diagrams (FORC-PCA) revealed that core KR1302-PC6 contains three main magnetic components (endmembers EM1 through EM3). Two of them, EM2 and EM3, show the features of non-interacting SD, which are interpreted to be biogenic magnetites with lower and higher coercivity, respectively. Combined with TEM observation, EM2 is dominated by magnetofossils of equant ochtahedral shape, while the proportion of bullet-shape magnetofossils is larger in EM3. The other endmenber EM1 showing interacting SD/PSD/MD is interpreted to be a terrigenous component. EM1 contribution suddenly increased upcore at about 3 m in depth, which suggests a significant increase of eolian dust input caused by a global cooling event. The age of this event can roughly be estimated as Oligocene to Eocene from lithostratigraphic correlation with a nearby core having age estimation based on Os isotope ratios (Nozaki et al., 2019; Tanaka et al., submitted). The results of cores MR13E02-PC1 and KR1402-PC4, whose ages are estimated to be Miocene and younger, suggest that eolian input has been kept enhanced since the event observed in PC6. An increase of bullet-shape magnetofossils at a certain depth interval of PC6 suggests that the core had the oxic-anoxic transition zone (OATZ) (Yamazaki et al., 2019), although the core is totally oxidized now and there is no OATZ. The less oxic environment might have been caused by higher biogenic productivity near the equator; the paleoposition of PC6 site calculated with GPlates software suggests that the site was within 5 degrees from the equator between about 70 and 85 Ma. FORC-PCA results of core U1365 show two endmembers, terrigenous (EM1) and biogenic (EM2), respectively. The coercivity distribution of EM2 of Site U1365 is similar to that of EM2 in the North Pacific, while EM1 of Site U1365 includes particles with finer SP grain. Site U1365 also shows a sudden upcore increase of the EM1 component, and its age was roughly estimated to be Oligocene (Shimono and Yamazaki, 2016). Although there are large uncertainties in age estimations, the eolian input increases in the both hemispheres might be a coeval global event. A possible candidate of such an event is the global cooling known to have occurred at the Eocene-Oligocene boundary.

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