A detailed record of the Brunhes-Matuyama transition from marine clay of a 1700-m from Osaka Bay, southwestern Japan

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The Brunhes-Matuyama (B/M) reversal transition has been the focus of many studies for being the most recent and most accessible reversal. Marine clay layers of the Osaka Basin are suitable for detailed transitional field reconstruction, because of their small locking-in depths, high accumulation rates, and homogeneity ofthe marine clay layer that accommodates B/M transition fields. Here, we report a detailed B/M transition-field record obtained from a marine clay layer (Ma4) of a 1700-m drilling core in the northern part of the Osaka Bay.

Around the B/M boundary, 157 samples were collected for a succession of 25-m length.

Natural remanent magnetization (NRM), low field susceptibility (k),isothermal remanent magnetization (IRM), and anisotropy ofmagnetic susceptibility (AMS) were measured.

To isolate a characteristic remanent magnetization (ChRM) direction, samples were mainly subjected to progressive demagnetization in AF, and only 5 samples were subjected to thermal demagnetization. Out of 157 samples, ChRM directions of 137 samples mainly extracted by principal component analysis were considered and the rest were discarded for not giving reliable remanent directions.

IRM acquisition curves showed typical and identical nature to reach saturation around 300 mT. Therefore, it is evident that the dominant carrier of remanent magnetization is magnetite. AMS result indicates the sedimentary conditions are quiet (i.e., not disturbed) and the remanence record represents true geomagnetic phenomena.

The vertical plot of inclination data shows that the B/M reversal is accompanied by 5 short geomagnetic reversal episodes:three predating and two postdating the reversal.

In our study, normalized intensity NRM10 mT/ARM10 mT was considered for paleointensity estimation.

For an accumulation rate of 1.4 mm/yr near the drilling site,the mid ages of the episodes before the reversal (durations) are 3100(420), 800(143), 340(130), -370 (90),and -1200(220)yr, respectively. The two episodes before the reversal in our study have great similarity with the two predating short episodes of Boso Peninsula (Okada and Niitsuma, 1989) when they are compared on a depth scale. The accumulation rate (3.7 mm/yr)estimated in their studyleads to confusion when the rate in their studied section is calculated taking the age of the B/M boundary and of the volcanic ash ku6C (0.85±0.03 Ma). Although the level of ku6C is not shown in the columnar section of Fig. 2 in Okada and Niitsuma (1989), it must be between the ku5 and the lower boundary of the Kokumoto Formation. Therefore, the upper and lower limits of accumulation rate can be estimated to be 2.6 and 1.9 mm/yr, respectively. For an accumulation rate of 1.9 mm/yr, the ages of the two predating episodes (3000 and 1000 yr) of Boso match greatly with the two predating episodes in our study. Minimum field intensity both in this study and Boso happens about 2000 yr before the B/M reversal.Therefore, the time scale for the Boso data should have to be reconsidered.

Distinct features of field behavior for the B/M reversal transition have been captured with 5 short reversal episodes. Intensity decayed to minimum of 10 - 20 % of the original value at about 3 m of the reversal and recovered after 1.6 m of the reversal with 50 % at the boundary. For an accumulation rate of about 1.4 mm/yr, the mid-ages of the episodes are 3100, 800, 340 yr, -370 and -1200 yr after the B/M boundary. Intensity decayed to minimum about 2.1 kyr before the reversal and recovered after 1.2 kyr of the reversal.