Geomagnetic intensity as a tool for high resolution stratigraphy for marine sediments and ice cores

Yusuke Suganuma,
National institute of Polar Research

Recent progress in paleomagnetic studies of marine sediments has revealed long-term (10–100 kyr) variations in geomagnetic field intensity (relative paleointensity)(e.g., Suganuma et al., 2008). The accumulation of relative paleointensity records has enabled the development of a composite geomagnetic-field intensity stack for time intervals spanning the period from the last few tens of thousands of years to the last few millions of years, and has contributed to establishing an age model for marine sediments (e.g., Yamazaki and Oda, 2005). This technique is a powerful tool for synchronizing different geological archives, such as marine sediments and ice cores, by comparing the flux of cosmogenic nuclides. This synchronization is essential for understanding the initiation and propagation of changes in the Earth's climate system. However, there is some controversy concerning the limits of the use of relative paleointensity records in dating marine sediments. For example, uncertainty may be introduced into the synchronization by the lock-in of a paleomagnetic signal at some depth below the sediment–water interface in marine sediments through the acquisition of post-depositional remanent magnetization (PDRM) (Suganuma et al., 2010). This lock-in depth indicates that up to several tens of thousands years of age offset probably occurs when a paleomagnetic record is used for dating marine sediments, and the age of the M-B boundary should be revised to ca. 10 kyr younger, which is consistent with a younger ice core derived age of 770±6 ka (2σ). This presentation summarizes the current understanding of the PDRM process and provides examples of relative paleointensity-assisted correlation or dating in marine sediments (e.g., Suganuma et al., 2011). Possible sources of uncertainty and future prospects for the technique are also discussed in this presentation.

References

Suganuma Y., Yamazaki T., Kanamatsu T., Hokanishi T., Relative paleointensity record during the last 800 ka from the equatorial Indian Ocean: Implication for relationship between inclination and intensity variations, Geochemistry, Geophysics, Geosystems, 9, Q02011, doi:10.1029/2007GC001723, 2008.

Suganuma Y., Yokoyama Y., Yamazaki T., Kawamura K., Horng C. S., and H. Matsuzaki, Be-10 evidence for delayed acquisition of remanent magnetization in marine sediments: Implication for a new age for the Matuyama-Brunhes boundary, Earth Planetary Science Letters, 296, 443-450. 2010.

Suganuma Y., Okuno, J., Heslop, D., Roberts, A.P., Yamazaki, T., and Y. Yokoyama, Post-depositional remanent magnetization lock-in for marine sediments deduced from Be-10 and paleomagnetic records through the Matuyama-Brunhes boundary, Earth Planetary Science Letters, 311, 39-52, 2011.

Yamazaki T., and H. Oda, A geomagnetic paleointensity stack between 0.8 and 3.0 Ma from equatorial Pacific sediment cores, Geochemistry, Geophysics, Geosystems, 6, Q11H20, doi:10.1029/2005GC001001, 2005.