EGU21-3695
https://doi.org/10.5194/egusphere-egu21-3695
EGU General Assembly 2021

Magnetostratigraphic evidence for post-depositional distortion of osmium isotopic records in pelagic clay: implications for mineral flux estimates

Yoichi Usui[1] and Toshitsugu Yamazaki[2]
[1]Research Institute for Marine Geodynamics, Volcanoes and Earth's Interior Research Center, Japan Agency for Marine-Earth Science and Technology, Yokosuka, Japan (yoichi@jamstec.go.jp)
[2]Atmosphere and Ocean Research Institute, The University of Tokyo, Tokyo, Japan

Deep-sea sediment sometimes lacks biostratigraphic or radiometric age constraints. Chemical stratigraphy and magnetostratigraphy is useful for dating it. Oxic pelagic clay contains Fe-Mn oxyhydroxides that can retain seawater $^{187}Os/^{188}Os$ values, and its age can be estimated by fitting the isotopic ratios to the seawater $^{187}Os/^{188}Os$ curve. On the other hand, the stability of Fe-Mn oxyhydroxides is sensitive to redox change, and it is not clear whether the original $^{187}Os/^{188}Os$ values are always preserved in sediments. However, due to the lack of independent age constraints, the reliability of $^{187}Os/^{188}Os$ ages of pelagic clay have never been tested. Magnetostratigraphy is often unsuccessful for pelagic clay older than a few Ma, which has been attributed to diagenesis. Here we report multiple polarity reversals in ca. 35 Ma pelagic clay around Minamitorishima Island, which is inconsistent with a $^{187}Os/^{188}Os$ age model. In a ~5 m thick interval, previous studies correlated $^{187}Os/^{188}Os$ data to a brief (<1 million years) isotopic excursion in the late Eocene. Paleomagnetic measurements revealed at least 12 polarity zones in the interval, indicating a >2.9 – 6.9 million years duration. Quartz and feldspars content showed that while the paleomagnetic chronology gives reasonable eolian flux estimates, the $^{187}Os/^{188}Os$ chronology leads unrealistically high values. These results suggest that the low $^{187}Os/^{188}Os$ signal has diffused from an original thin layer to the current ~5 m interval, causing an underestimate of the deposition duration. The preservation of the polarity patterns indicates that a mechanical mixing such as bioturbation cannot be the main process for the diffusion, so diagenetic re-distribution of Fe-Mn oxyhydroxides and associated Os may be responsible. The paleomagnetic chronology presented here also demands reconsiderations of the timing, accumulation rate, and origins of the high content of rare-earth elements and yttrium in pelagic clay around Minamitorishima Island. It is also indicated that old oxic pelagic clay can be a faithful paleomagnetic recorder, and success of magnetostratigraphy depends on sedimentation rate and polarity length rather than diagenesis.

Usui, Y., Yamazaki, T. *Earth Planets Space* **73,** 2 (2021). https://doi.org/10.1186/s40623-020-01338-4