Paleomagnetic study in high latitude oceans for understanding of geomagnetic behavior within the tangent cylinder.

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Abstract

Available paleomagnetic data from high latitudes (within tangent cylinder: > ca. 70°N and S) show unique patterns in geomagnetic behavior. However data are still insufficient to understand its nature, then further study is required. Sampling and research strategies should be carefully considered to study the high latitude data. Precise dating on sediment cores is the most important key to compare with a global geomagnetic behavior.

Introduction

Spaciotemporal paleogeomagnetic records have been detailed to understand the origin of the Earth's magnetic field. This information for the last 2-3 million years has been rapidly accumulated by marine sediment studies in the last two decades. This type approach is more steady-going and necessary for further understanding. However, those global data acquisitions have been concentrated in the lower latitude areas (~ 40° N or S). It is mainly due to difficult accessibilities to high-latitude areas (e.g. sea ice coverage or high sea condition). But IODP has shed light on the high latitude research by ACEX successful challenging

Discussions

Available paleomagnetic data from the high latitude (> ca. 70°N) reveal more frequent geomagnetic excursions (e.g. Nowaczyk and Frederichs, 1999) than general global observations at the lower latitude areas. Paleomagnetic records in the Lomonosov Ridge show a unique pattern that no excursion in the upper duration of Brunhes interval, and the longer and more frequent excursion-like events were reported in the lower duration, although these excursion-like events are not fully interpreted in ACEX record (O'Regon et al., 2008). These paleomagnetic properties in the high latitude seem to be characterized by distinct excursions (in duration and frequency). If it is true, it is possible that the geomagnetism in the higher latitude is strongly affected by the undocumented factor such as fluid dynamics within the inner core tangent cylinder,

although the major geomagnetic field of the Earth is produced by the fluid flow in the outer core. Because unfortunately we don't have enough data in the high latitude (within the tangent cylinder) to verify this idea so far, data acquisition through IODP drilling around the area is necessary work.

Proposed Strategy

Detail age control on paleomagnetic records is crucial for understanding of spaciotemporal variations. Because it was difficult to obtain precise age data from ACEX cores due to lack of carbonate components and microfossils, another dating technique may be required for the Arctic sediment. Optically stimulated luminescence (OSL) dating has a high potential for this purpose. A traverse coring from the lower site (ca. 60°N) to inside the tangent cylinder sites is a possible way to obtain age controls. The lower latitude site is designed to obtain more reliable age model. Site by site correlation among traversed sites will bring age information to the higher latitude paleomagnetic record from the lower. Additionally transecting records will provide the opportunity to document the magnetic field variation around outside and inside the tangent cylinder. It is considered that these approaches can be applied to both Arctic and Antarctic areas around the tangent cylinder (e.g Chukchi Sea, and Ross Sea).