



Re-Os Isotope Data Highlights Existing Problems With Interpretations of the Middle Lithological Units in Cores from the Central Arctic Ocean

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Integrated Ocean Drilling Program (IODP) Expedition 302 recovered good portions of a ~425 m-long sequence from Lomonosov Ridge at ~88°N latitude. This “ACEX record” comprises several depth intervals of different sediment composition, which have been designated as “lithological units”. The upper and lower units have straightforward origins and stratigraphies, at least at a basic level. By contrast, the middle units (1/4 – 1/6; 168-220 m below sea floor) have been problematic since cores were first opened and described. These problems have become magnified with recent publications, especially one offering a completely different age model based on Re-Os isotopes [Poirier and Hillaire-Marcel, GRL, 2009].

First, we emphasize three important aspects for this interval of the ACEX record:

- (1) Units 1/4 – 1/6 were deposited at a significantly slower rate than that of units above and below, as indicated by established age datums;
- (2) Unit 1/5 consists of reworked sedimentary material, as indicated by tilted cross-beds, and microfossils of Cretaceous-Oligocene age;
- (3) Unit 1/4 was deposited under oxygen-rich conditions, as indicated by color, organic carbon content, and metal abundances.

Second, we note three problems facing Re-Os interpretations for this interval:

- (1) Ages determined by Re-Os isochrons for Unit 1/5 need not conform to depositional age, given obvious reworking;
- (2) Ages cannot be determined by Re-Os isochrons for Unit 1/4, given very low $^{187}\text{Re}/^{188}\text{Os}$ and $^{187}\text{Os}/^{188}\text{Os}$ ratios in this oxidized sediment;
- (3) Comparisons of bulk sediment $^{187}\text{Os}/^{188}\text{Os}$ to the seawater record of $^{187}\text{Os}/^{188}\text{Os}$ are highly suspect for Unit 1/4, given probable contributions from terrigenous material; in any case, the measured 0.73-0.78 ratio could correspond to ages between 15 and 35 Ma.

The existing age model [Backman et al., *Paleoceanography*, 2008] indicates deposition of Unit 1/6 in the middle-early Eocene (>38 Ma), followed by a major hiatus, and deposition of Units 1/5 and 1/4 in the middle Miocene (<18 Ma). In our opinion, no data presented so far, including Re-Os isotopes, suggests the age model needs revision. We acknowledge, however, that a fully satisfactory explanation for deposition of these middle units remains elusive for several reasons, as discussed in recent papers and in this presentation.