Variations in the osmium isotopes record during the Azolla phase (IODP Expedition 302)

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We report on a reconstruction of the seawater 187Os/188Os ratios in organic-rich and anoxic sediments of the Lomonosov Ridge (IODP Expedition 302) from the Azolla event (49.3-48.1Ma) [1] and compare it with a newly reconstructed 187Os/188Os record from an open ocean site (ODP Site 1263). The Azolla phase is a stratigraphic marker in the Arctic and surrounding seas and indicates strong salinity-stratification and limited exchange with the open ocean. If we assume that the Os isotopic composition of the Arctic Ocean is homogeneous and represents a mixture of unradiogenic dissolved Os from hydrothermal and extraterrestrial (187Os/188Os \(\sim 0.13\)) and radiogenic from continental sources (187Os/188Os \(\sim 1.4\)), the Re-Os isotope system can be used as a proxy to estimate the ventilation of the Arctic Ocean. We have measured Os and Re using both bulk fusion-leachates and Carius Tubes digestion methods to calculate the initial 187Os/188Os and compare methods. Significant authigenic enrichment of Re-Os suggests that these organic-rich sediments have the potential to record the Os isotopic composition of the Middle Eocene Arctic Sea. Measured 187Os/188Os ratios range from 1.2 to 1.6. This is indicative of significant in-situ decay of 187Re to 187Os. During the Azolla time interval where multiple analyses yield initial 187Os/188Os close to 0.8, with two post-Azolla samples yielding values as high as 1.2. These ratios are significantly larger than contemporaneous values of seawater 187Os/188Os ratios measured in Site 1263 (0.45-0.5). Thus we interpret these data as supportive of a highly restricted Arctic Ocean at this time.