Oceanography of the Western Interior Seaway during OAE 2 using Nd isotopes

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During the greenhouse climate of the mid-Cretaceous, the Western Interior Seaway (WIS) experienced semi-restricted conditions with poor water-column ventilation, leading to the accumulation of black organic-rich mudstones. In the Maverick Basin, the southernmost extent of the WIS, the main phase of organic matter deposition occurred in the early to late Cenomanian, before Oceanic Anoxic Event 2 (OAE 2). A sea-level rise prior to the event may have caused the basin to become better ventilated during the Cenomanian–Turonian transition, and ocean circulation likely played a major role on productivity and the preservation of organic matter. Widely different regimes of ocean circulation are suggested to have operated, with alternating incursions of water masses from both the north and the south. Foraminiferal assemblages suggest that during the early phase of OAE 2, Tethyan waters were drawn northward into the WIS (ELDERBAK & LECKIE, 2016), whereas dinocyst occurrences indicate an influx of boreal surface waters into the Maverick Basin (ELDRETT et al., 2014). This cooler episode correlates with the so-called Plenus Cold Event, recognized in northern Europe by southward invasion of boreal faunas.

Here we present neodymium-isotope records (ε_{Nd}) of fish teeth and bulk sediments from the Eagle Ford Formation that record the presence of distinct water masses at depth and allow testing of suggested mechanisms of ocean circulation. Mid- to late Cenomanian values of ε_{Nd} around -3 (this study) are unusually radiogenic compared to coeval open ocean ε_{Nd} records from the North Atlantic, where values typically lie between -4 and -10 (MARTIN et al., 2012, ROBINSON & VANCE, 2012) and may reflect a strong influence of regional volcanism close to the WIS and/or weathering of mafic volcanic rocks in the water-mass source area. Comparison of ε_{Nd} values from different depths within the Maverick Basin with records from further north in the WIS and from the Gulf of Mexico, will allow determination of the direction of watermass exchange in the southern WIS during the Cenomanian–Turonian transition. Deciphering the role of physical oceanography in organic-matter deposition and preservation will improve our understanding of ocean-climate dynamics influencing the Earth's carbon cycle.

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