Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19787

Reassessment of the Drake Passage opening using Nd and Sr isotope systematics of shark teeth from La Meseta Formation

GABRIEL DE SOUZA FRANCO[1], MICHAEL BIZIMIS[1], HOWARD SCHER[1], SORA L. KIM[2] AND THOMAS MORS[3]

[1]University of South Carolina
[2]University of California Merced
[3]Swedish Museum of Natural History

Presenting Author: GFranco@seoe.sc.edu

The opening of the Drake Passage between South America and Antarctica and the initiation of the Circumpolar Antarctic Current prevented warm equatorial waters from reaching Antarctica and is believed to be one of the main factors for the glaciation of Antarctica. Still, the age of the opening of Drake Passage is poorly constrained, with dates from 41 [1] to 34 Myr [2].

To better constrain when Drake passage opened, we analyzed neodymium isotopes and trace element concentrations from 94 fossil shark teeth from five distinct members of the La Meseta Formation (TELM), which straddles said age interval. We also analyzed eleven TELM 2 teeth for strontium isotopes to better constrain the age of these units.

Our results show that most εNd values are between -4 and -7, between the present day values of Pacific and Atlantic waters and quite different from Weddell Sea waters (Fig.1a). The maximum εNd value decreases from TELM 2 to TELM 3 and increases back towards TELM 5. The maximum value decreases again for TELM 6. The rare earth element (REE) patterns have no cerium or europium anomalies and display variable medium REE (MREE) enrichment with respect to the light (LREE) and heavy (HREE) (Fig.1b). The $^{87}Sr/^{86}Sr$ values are nearly invariant, from 0.707748 to 0.707763 (Fig.2).

If the shark teeth εNd values reflect those of seawater, the data indicates mixing between Pacific and Atlantic water masses by the time TELM 2 was deposited. However, the teeth REE patterns resemble those of porewaters as opposed to seawater, raising questions as to the effect of diagenesis on the Nd isotope systematics. The Sr isotope data could correspond to 55, 46.8, 41.8, or 36.5 Myr because the $^{87}Sr/^{86}Sr$ curve oscillates during the Eocene. Sediment Nd analyses are underway to further test the effect of diagenesis on the fish teeth Nd systematics

[1] Scher & Martin (2006) Science, 312, 428-430.
[2] Zachos et al. (2001) Science, 292, 686-693.

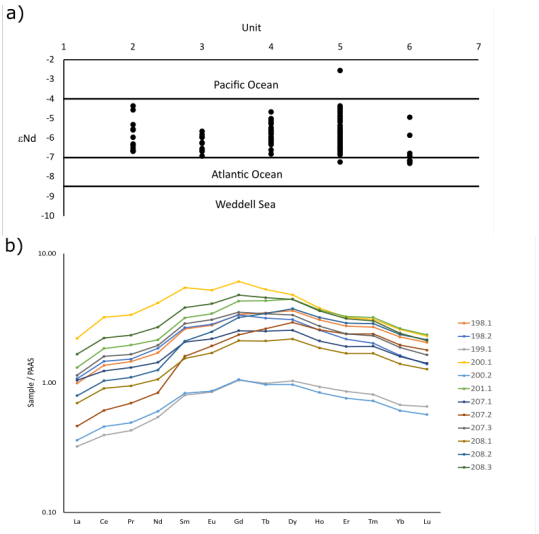

Figure 1: a) εNd obtained for TELMs 2 to 6 with the Atlantic, Pacific and Weddell Sea seawater domains. b) REE patterns for TELM 2 samples.

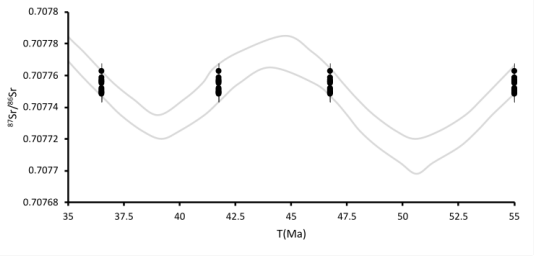

Figure 2: Sr isotopic data obtained for TELM 2 plotted at different ages according to the Eocene seawater compositions.