Neodymium isotopes as a tracer for past ocean circulation – the Pliocene closure of the Central American Seaway.

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The Nd isotopic composition of seawater is controlled by inputs from the continental crust and can be used as a quasi-conservative tracer of ocean mixing. Over the past three decades, the Nd composition of first ferromanganese nodules and then early diagenetic sediment coatings have been employed to study changes in deep water circulation at ever increasing temporal resolution. More recently, it has been demonstrated that planktonic foraminfera can record the Nd isotopic composition of surface waters.

A classic use for these techniques has been the study of major tectonic upheavals and, of these, much has been published on the closure of the Central American Seaway during the Pliocene. An early hypothesis was that this closure led directly to the initiation of the Gulf Stream and the development of Northern Hemisphere Glaciation. However, the timing of changes in deep water circulation show a lag of at least 800,000 years between closure to deep water and the inception of major ice sheets. In this study samples from both sides of the Isthmus of Panama are used to constrain the timing of closure to deep, intermediate and surface water, and to test the hypothesis that Pacific waters continued to have a significant influence on the Caribbean beyond 4.5 Ma.

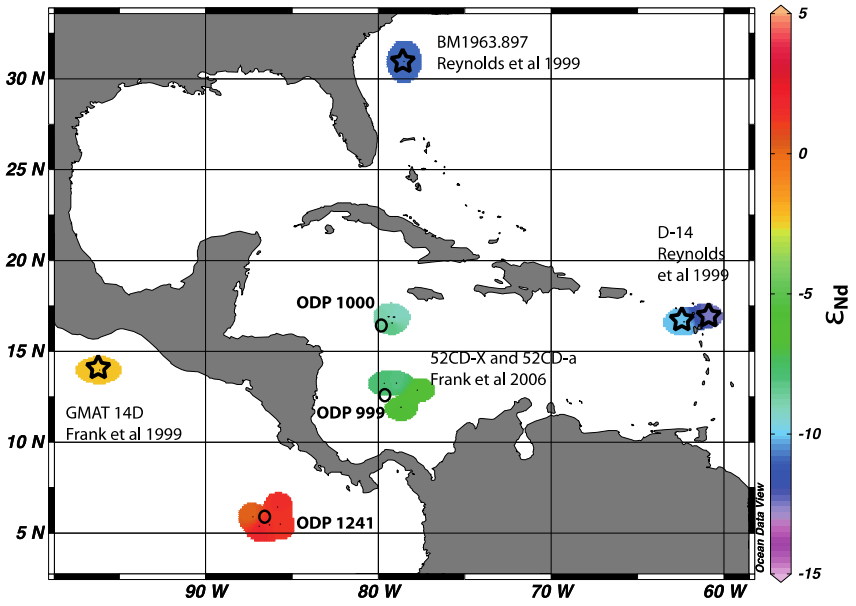

Figure 1: Map showing the location of the three ODP sites in this study and the Nd isotope composition of surface sediment coatings, as well as published data from ferromanganese crusts. Today there is a difference of at least 6 epsilon units between Pacific and Caribbean surface samples.