

Climate and tectonics

The closure of the Central American Seaway

Reconstructing intermediate- and deep-water connections

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Introduction The tectonic closure of the Central American Seaway (CAS), between 14 and 2 million years ago, caused a major reorganisation of deep-ocean circulation (Figure 1). Different studies have reached conflicting conclusions about whether the closure caused a warming or cooling of global climate, mainly through its influence on the Gulf Stream and Atlantic Meridional Overturning Circulation (AMOC). It has also been proposed that closure was a necessary precursor to Northern Hemisphere Glaciation. Of critical importance to all these hypotheses is the timing of closure relative to other global changes.

Method We use radiogenic isotopes of Nd and Pb in various ocean sediments to reconstruct in detail the history of intermediate and deep-water connections between the Caribbean Sea and the eastern Equatorial Pacific Ocean from 5.0 to 2.0 million years ago.

On-going investigation Ocean circulation models indicate that the last few hundred meters of CAS shoaling would have produced a significant increase in the strength of AMOC. We test this hypothesis by producing highly time- resolved ϵ_{Nd} records for episodes of short term CAS closure and opening.

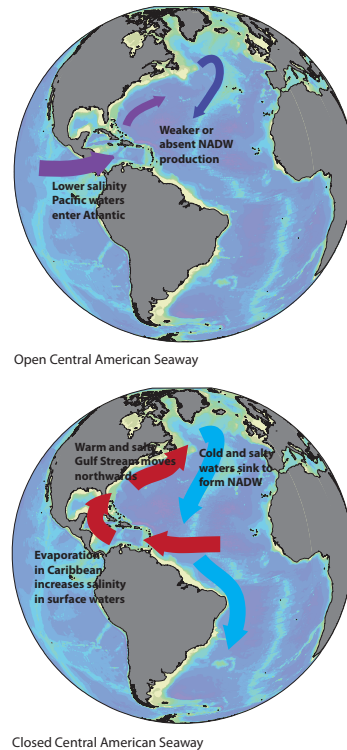


Figure 1. Closure of the CAS caused major changes in ocean circulation

Results The major shift in Caribbean intermediate and deep water ϵ_{Nd} away from Pacific compositions occurred before ~ 7 Ma (Newkirk and Martin, 2009) but a continued trend towards less radiogenic ϵ_{Nd} compositions during the Pliocene indicate increasing strength of AMOC (Figure 2).

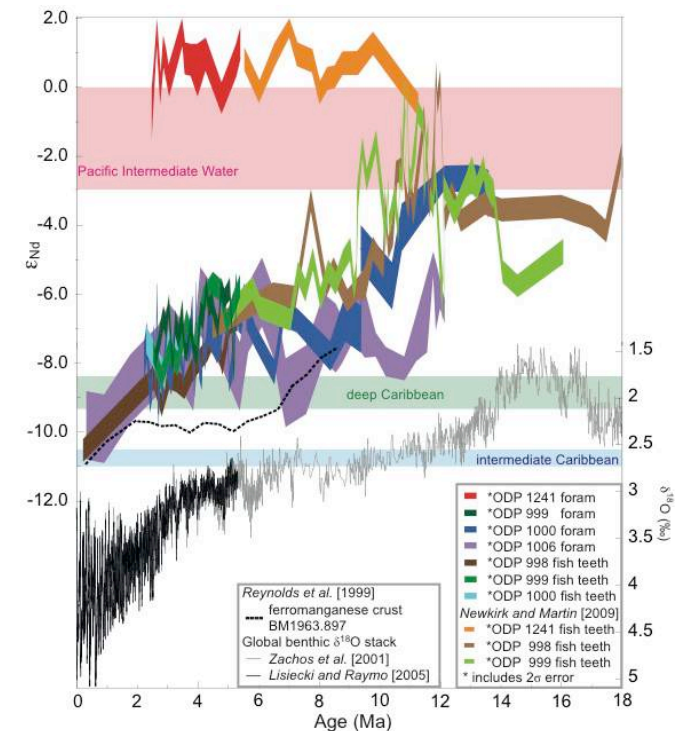


Figure 2. Compilation of ϵ_{Nd} data for Pacific ODP Site 1241 and Caribbean ODP Sites 998, 999, 1000 and 1006.