# Caribbean carbonate crash and the initiation of the modern global thermohaline ocean circulation

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An important result of ODP Leg 165 in the Caribbean Sea was the recognition of sharply reduced carbonate accumulation at the middle/late Miocene transition (between 12.4 and 10.6 Ma) in the bathyal depths of the Colombian Basin (Site 999) and the Yucatan Basin (Site 998), and in the subthermocline depths of Pedro Channel Site 1000 (Figure [*Sigurdsson et al.,* 1997]). This interval of low carbonate accumulation at the middle/late Miocene transition in the Caribbean basins appears to be about synchronous with a well established minimum carbonate accumulation interval in the central and eastern equatorial Pacific referred to as the late Miocene "carbonate crash" by Lyle et al. [1995]. At a similar time, low carbonate accumulation rates are also observed on the Ceara Rise in the equatorial Atlantic [*Curry, Shackleton, Richter, et al.,* 1995]. The carbonate crash at the middle to late Miocene transition appears to be also contemporeanous with the initial full blown production of North Component Deep Water in the North Atlantic [*Wright and Miller,* 1993].

Haddad and Droxler [1996] demonstrated that late Quaternary intervals of intense carbonate dissolution in the Caribbean, from subthermocline to bathyal depths, are characterized by high input of Antarctic Intermediate Water (southern sourced intermediate water) into the Caribbean, part of the return flow of the global thermohaline circulation and correspond to times of high production of North Atlantic deep Water (NADW). In analogy with these late Quaternary findings, the Caribbean carbonate crash at the middle to late Miocene transition could well be linked to the initial deflection within the Caribbean basins of southern sourced and [$CO_3^{=}$] poor intermediate waters into the high latitudes of the North Atlantic due the contemporaneous partial closing of the Central American Seaway [*Duque-Caro,* 1990]. These intermediate waters in the Caribbean became, therefore, part of the return flow of a newly initiated "modern" thermohaline oceanic circulation. Moreover, the partial closing of the Central American Seaway at the middle to late Miocene transition also partitioned the bathyal depths of the equatorial oceans. In that context, the carbonate crash in the bathyal depths of the eastern equatorial Pacific could be explained by the location of the eastern equatorial Pacific at the very end of the deep water thermohaline conveyor belt.

References:

Curry, W.B., Shackleton, N.J., Richter, C., *Proc. ODP, Init. Results, 154,* 1995.

Duque-Caro, H., Neogene stratigraphy, paleoceanography and paleobiogeography in the northwest South America and the evolution of the Panama sea-way, *Paleogeogr., Paleoclimatol., nd Paleoecol., 77,* 203-234, 1990.

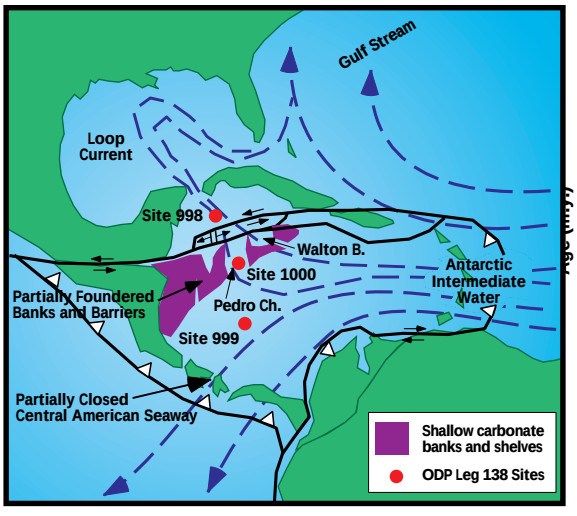
Haddad, G.A. and Droxler, A.W., Metastable CaCo3 dissolution at intermediate water depths of the caribbean and western North Atlantic: Implications for intermediate water circulation during the past 200,000 years, *Paleoceanography, 11:6,* 701-716, 1996.

Lyle, M., Dadey, K.A., and Farrell, J.W., The late Miocene (11-8 Ma) eastern Pacific carbonate crash: evidence for reorganization of deep-water circulation by the closure of the Panama gateway. In, Pisias, N.G., Mayer, L.A., Janecek, T.R., Palmer-Julson, A., and van Andel, T.H., (Eds.), *Proc. ODP, Sci. Results, 138,* 821-838, 1995.

Sigurdsson, H., Leckie M., Acton, G., and shipboard scientific party, *Proc. ODP, Init. Results, 165,* 1997.

Wright, J.D., and Miller, K.G., Southern Ocean influences on Late Eocene to Miocene deep-water circulaton. *In* Kennett, J.P., and Warnke, D.A. (Eds.), The Antarctic Paleoenvironment: A Perspective on Global Change, *Am. Geophys. Union Antarct. Res. Ser., 60,* 1-25, 1993.

## Late-Middle Miocene, 12-8 Ma Caribbean Paleo-Reconstruction

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