Detecting fluid flow through the margin of Great Bahama Bank

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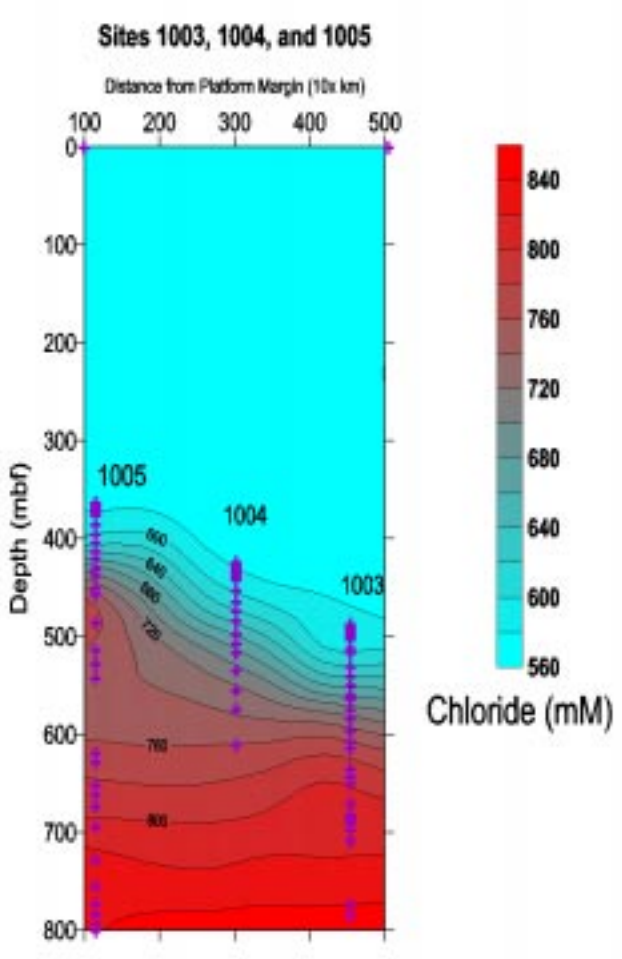
Results from ODP Leg 166 have for the first time identified the recharge of modern seawater into a shallow carbonate platform. It is well known that sediments in such platforms become lithified and are frequently converted a Mg-rich carbonate called dolomite. Such processes are important as they are ultimately responsible for the generation of porosity which governs whether rocks ultimately become reservoirs suitable for holding gas and oil. While various workers have suggested active fluid flow through the margins of such platforms may be responsible for controlling porosity, there have been no cases where this has been documented and the mechanisms identified.

In an attempt to investigate processes of recharge and diagenesis in the subsurface of the Bahamas, a series of closely spaced holes were drilled during Leg 166 at right angles to the margin of Great Bahama Bank [*Eberli et al.,* 1997]. Chemical compositions of pore water and thermal measurements are consistent with non-steady state conditions in each hole. This condition was manifested as an interval with essentially no change in the temperature or water chemistry in the depth range of 30 to 50 m, suggesting bottom water was being drawn into the sediments. Close to the platform we have identified a zone of less saline water being drawn into the platform (see figure). The precise mechanisms that are involved in the active advection of seawater are not known, but the observations are consistent with the mechanism of Kohout convection in which circulation is being driven by large temperature difference between the platform and adjacent seaways. These results are important as they not only document for the first time that circulation of seawater is taking place in the margin of a carbonate platform, but they identify a mechanism whereby seawater is being provided to sediment, and this seawater actively enhances cementation and dissolution processes. Such information has important implications in the search for economically important gas and oil deposits.



Contour map of chloride concentrations in the upper portion of Sites 1003, 1004, and 1005, close to Great Bahama Bank. Note the isochemical profile in the upper portion of the profile and the penetration of less saline water into the platform.

Reference:
Eberli, G.P., P.K. Swart, M. Malone, et al., *ODP Proc., Init. Repts., 166,* 1997.