RELATIONSHIPS BETWEEN THE CARBON VALUES OF INORGANIC AND ORGANIC MATERIAL FROM THE MALDIVES, BAHAMAS AND THE NICARAGUAN RISE

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PROJECT OBJECTIVES

- To determine the nature of the changes in the $\delta^{13}C$ values of organic material relative to $\delta^{13}C$ values in carbonate sediments.

PROJECT RATIONALE

A positive covariance between the $\delta^{13}C$ values of inorganic ($\delta^{13}C_{carb}$) and organic carbon ($\delta^{13}C_{org}$) has long been suggested to be proof that such signals were original and indicative of changes in the global carbon cycle (Knoll et al., 1986). However, not only do the relationships between $\delta^{13}C_{carb}$ and $\delta^{13}C_{org}$ values vary depending upon whether carbonates are pelagic, peri-platform, or mainly platform derived (Oehlert et al., 2012), but both meteoric and marine diagenesis can also alter the covariance (Oehlert, 2014; Oehlert and Swart, 2014). The purpose of this work is to examine controls on the relationship between $\delta^{13}C_{carb}$ and $\delta^{13}C_{org}$ and to ascertain under what circumstances covariance reflects variations in the global carbon cycle and other factors which may alter the covariance.

SCOPE OF WORK

As the initial work on this problem was carried out using samples drilled off the margin of Great Bahama Bank during Ocean Drilling Program Leg 166 (Eberli et al., 1997), we intend to examine material collected from cores drilled in sediments surrounding other carbonate systems. For this study we will concentrate on two carbonate buildups, The Nicaraguan Rise, drilled during ODP Leg 165 (Sigurdsson et al., 2000) and The Maldives (Betzler et al., 2016), drilled during IODP Expedition 359. In the Maldives a set of well-dated cores were collected which extend from the Modern to the late Oligocene. We have already performed a high-resolution study of the $\delta^{13}C$ values of the carbonate component (Swart et al., 2019) in four of the cores from the Maldives as well as completing measurements of the $\delta^{13}C_{carb}$ and $\delta^{13}C_{org}$ values on samples from Site 1000 situated on the Nicaraguan Rise. While samples from both the Maldives and the Nicaraguan Rise show changes in the $\delta^{13}C_{carb}$ values which appear to be synchronous with changes in the global carbon cycle during the Monterey Event as recorded in the benthic record of Zachos et al. (2001), the record from the Maldives may be reflecting varying contributions from the adjacent platforms in a mechanism similar to that proposed in the Bahamas (Swart and Eberli, 2005). As of yet we have not carefully examined the data from Site 1000 to see if similar processes are in effect. We intend to use the same samples from the Maldives to conduct a high resolution study of the variations in the $\delta^{13}C_{org.}$ If the changes in the $\delta^{13}C_{carb}$ values in the Maldives are related to the Monterey Event, then we should see similar changes in the $\delta^{13}C_{org}$

values and therefore ascertain whether our original hypothesis regarding the origins of the isotopic variations in the $\delta^{13}C$ values of these samples was correct. The data from the Maldives will then be compared with data from the Bahamas and the Nicaraguan Rise.

SIGNIFICANCE

The study of variations in the $\delta^{13}C$ values of carbonates and organic material has been vital in understanding the global carbon cycle and allowing such variations to be used as a stratigraphic tool. However, there has been a fundamental misinterpretation regarding the meaning of many of the changes observed. The proposed research will help to clarify and decipher some of this unresolved confusion.

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