GLOBAL SYNCHRONOUS CHANGES IN THE CARBON ISOTOPIC COMPOSITION OF PLATFORM-DERIVED SEDIMENTS

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PROJECT OBJECTIVES

- To correlate the carbon isotopic composition of periplatform sediments from globally disparate locations.
- To ascertain the veracity of carbon isotopic archives in the ancient record using Modern and Neogene strata.

PROJECT RATIONALE

Platform-derived sediments are the major sedimentary archive of the early history of the Earth (> 200 Ma). Many studies have used the carbon isotopic composition ($\delta^{13}C$) of such sediments for correlative purposes as well as a means of understanding the global carbon cycle (Halverson et al., 2007; Husson et al., 2015; Swanson-Hysell et al., 2010). However, in order to understand the mechanisms operating to affect such variations, studies are necessary on Modern and Neogene sediments so that any changes related to processes such as diagenesis and source can be properly understood (Swart and Eberli, 2005; Swart et al., 2009). Such studies have suggested that periplatform sediments over the past 10 Myrs do not record the $\delta^{13}C$ values of open oceanic dissolved inorganic carbon (DIC), but rather reflect the varying input from platform-derived sediments relative to oceanic sediments. In this study, we intend to investigate $\delta^{13}C$ values in carbonates from widely separated carbonate platforms in order to ascertain whether the patterns documented in sediments over the past 10 Myr are also present in older portions of the record.

SCOPE OF WORK

Leg 166 of the Ocean Drilling Program drilled seven sites along two transects along the western margin of the Bahamas. The geochemical records in these cores have already been investigated in a number of studies (Higgins et al., 2018; Swart, 2008; Swart and Eberli, 2005). In addition to the Bahamas, we have material from the Nicaraguan Rise (ODP Site 1000)(Sigurdsson et al., 1997) and from the Maldives (IODP Sites U1466-U1471) (Betzler et al., 2016). We have already analyzed Sites 1000 and U1467 at high resolution and made a tentative correlation with Site 1006. This correlation, shown in Figure 1, appears to show striking similarities between the isotopic profile at each site. The upper 5 Myrs of each record shows a trend towards more positive values, a pattern previously interpreted as reflecting the influence of sedimentation from adjacent shallow-water carbonate platforms (Swart, 2008; Swart and Eberli, 2005). In the older portion of the record (> 5 Ma), the sediments may be more influenced by pelagic sedimentation, perhaps recording global changes in the $\delta^{13}C$ values of oceanic DIC. Evidence for this interpretation is given by the remarkably similar variations in the $\delta^{13}C$ values between the three

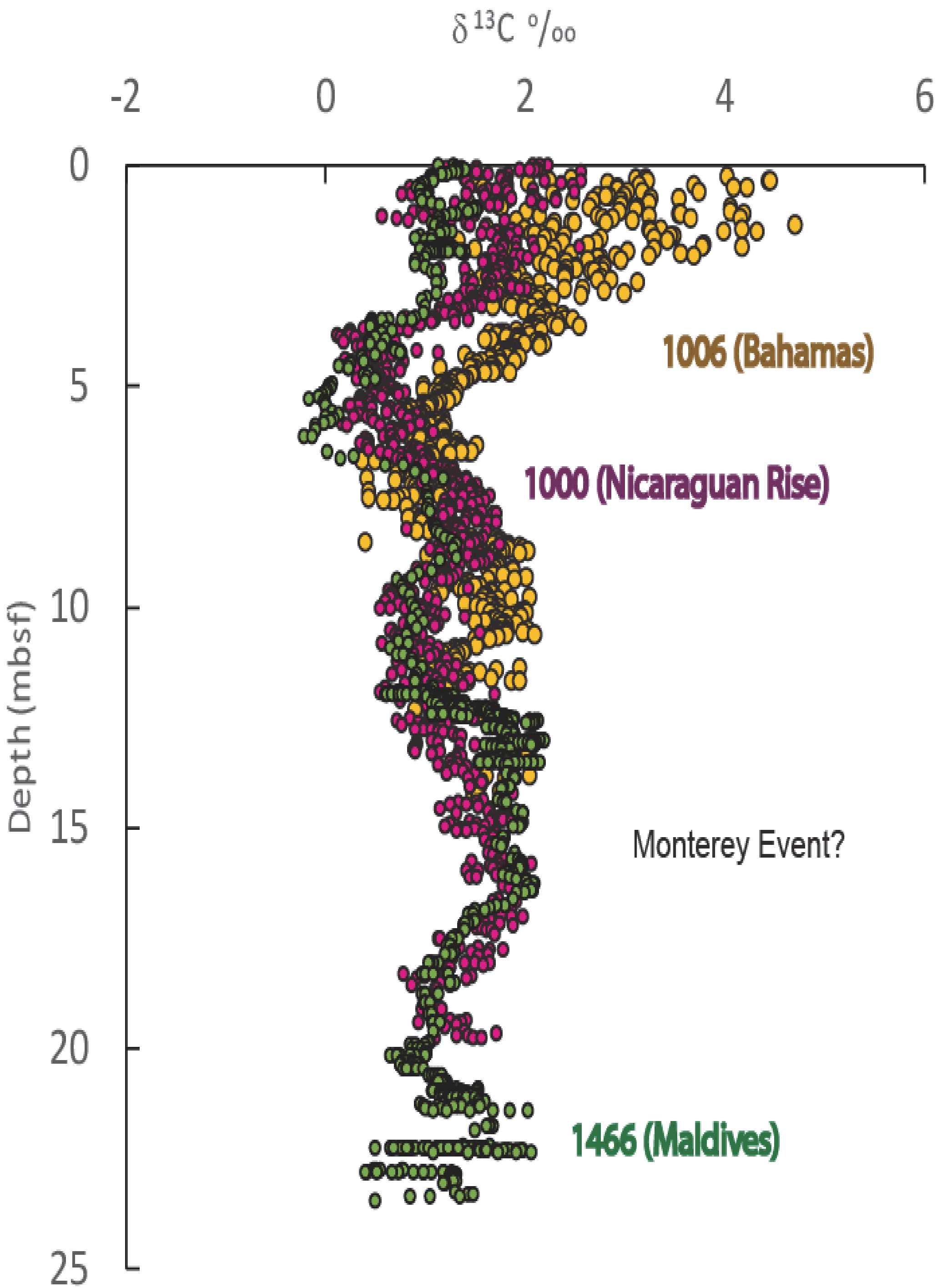

Figure 1: Changes in the $\delta^{13}C$ of the carbonate component in three cores from Bahamas, Maldives, and Nicaraguan Rise. The Monterey event (Berger and Vincent, 1986; Woodruff and Savin, 1991), an increase in the $\delta^{13}C$ values between 13 and 17Ma, is seen in Site 1000 and U1466.

sites despite their wide geographical separation. Slight differences between the records may be a result of inconsistencies in the sedimentation rate at each site and these discrepancies will be investigated during the course of this study.

We will also analyze the $\delta^{13}C$ values of the organic material from these cores and correlate these values with the values of the carbonates and between cores. One early indication that there may be a global signal in the older portions of these records is the observation of what appears to be a broad increase in the $\delta^{13}C$ values in all three cores between 13 and 17 Ma which may represent the Monterey carbon anomaly. The Monterey carbon isotopic anomaly is a series of six maxima in the $\delta^{13}C$ values between approximately 13 and 17 Ma, first recognized by Woodruff and Savin (1991). While Mutti (2000) has previously suggested that this anomaly could be recognized in Site 1000, it has not been seen in either the Bahamas or the Indian Ocean. Figure 2 shows a close up of the C isotopic record from U1466 between 10 and 20 Ma and possibly the six cycles in the $\delta^{13}C$ values can be seen in the record.

SIGNIFICANCE

The record of $\delta^{13}C$ values from periplatform sediments has been widely used, both for stratigraphic purposes and to reconstruct the global carbon cycle (Hayes et al., 1999). The proposed work will help ascertain the veracity of such archives in the ancient record.

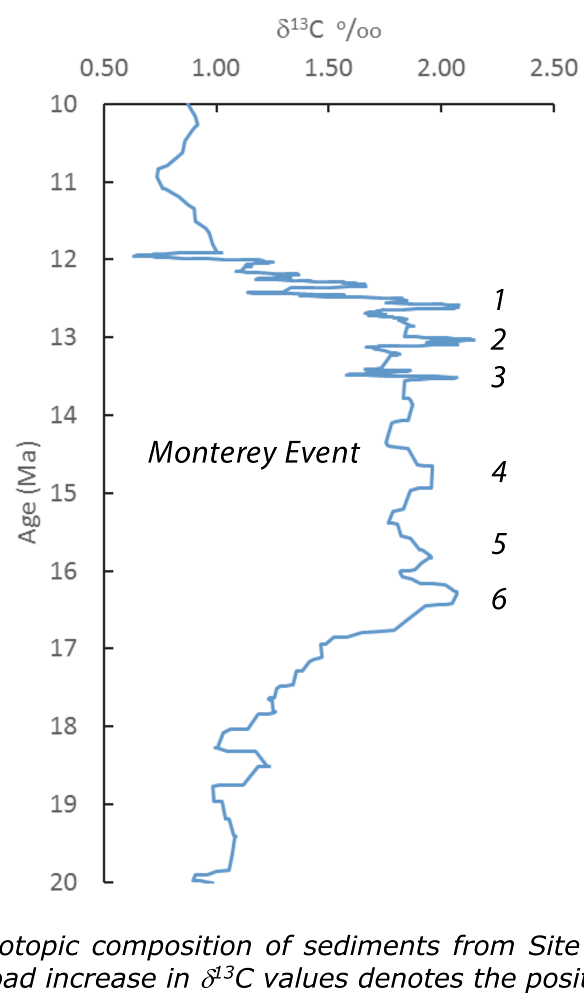

Figure 2: Carbon isotopic composition of sediments from Site U1466 between 10 and 20 Ma. The broad increase in $\delta^{13}C$ values denotes the position of the Monterey anomaly. Within the anomaly there have been six C isotopic anomalies identified.

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