THE GEOCHEMICAL EXPRESSION OF SEQUENCE BOUNDARIES

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OBJECTIVE

- To examine the geochemical expression of sequence boundaries.
- Complete the stable C and O isotopic and XRD analysis of the carbonates.
- Conduct stable C isotopic analysis of the organic material from the Bahamas Transect (ODP Sites 1003-1007) and the Clino and Unda cores.

KEY POINTS AND PROJECT DESCRIPTION

Sequence boundaries record changes in sediment/rock related to changes in sediment source and/or diagenetic history. As such, sequence boundaries can have varying geochemical expressions as regards their C and O isotopic composition and mineralogy. The Bahamas transect offers a valuable opportunity to test these expressions and we will focus on increasing the resolution of the existing geochemical analyses. An important consideration is to obtain a high enough spatial resolution of samples and although over 10,000 samples have been taken from the five Ocean Drilling Program (ODP) sites (1003-1007) and the Clino and Unda cores which form the Bahamas Transect, only ~ half of these have been analyzed for $\delta^{13}C$ and $\delta^{18}O$ of the carbonate and a much lesser amount for the $\delta^{13}C$ of the organic material. This project aims to complete these analyses and apply the results to understanding the geochemical expression of the boundaries.

PRELIMINARY RESULTS

We have completed the $\delta^{13}C$, $\delta^{18}O$ and X-ray diffraction analyses of the Unda and Clino cores. Much of these data have already been published (Melim et al., 2001; Oehlert et al., 2012; Oehlert and Swart, 2014; Swart and Oehlert, 2019). Recently completed analysis of the $\delta^{13}C$ values of the organic material from the Unda core will be presented at the 2021 annual meeting. While the initial study of the $\delta^{13}C$ variations in the Leg 166 samples showed similarities between the $\delta^{13}C$ values of the individual sequences between the various sites (Swart and Eberli, 2005), the resolution of the sampling was insufficient in some cases to clearly identify geochemical signatures at the boundaries. We are in the process of adding a significant number of C and O isotope analyses in all the cores and will add XRD analyses and measurements of the $\delta^{13}C$ of organic material in the upcoming year. An example of the increased resolution of the analyses can be seen in Figure 2 which compares the database used in Swart and Eberli (2005) (red symbols) with the additional samples which we have analyzed (blue) for Site 1003. The grey bars indicate the position of the sequence boundaries (Eberli, 2000). Based on the known occurrence of negative $\delta^{13}C$ values along disconformities, these new data will allow the position of the boundaries to be more accurately defined. These high-resolution data and the geophysical logs used in conjunction with rolling window regression will improve interpretation and understanding of diagenetic events and the formation of sequence boundaries.

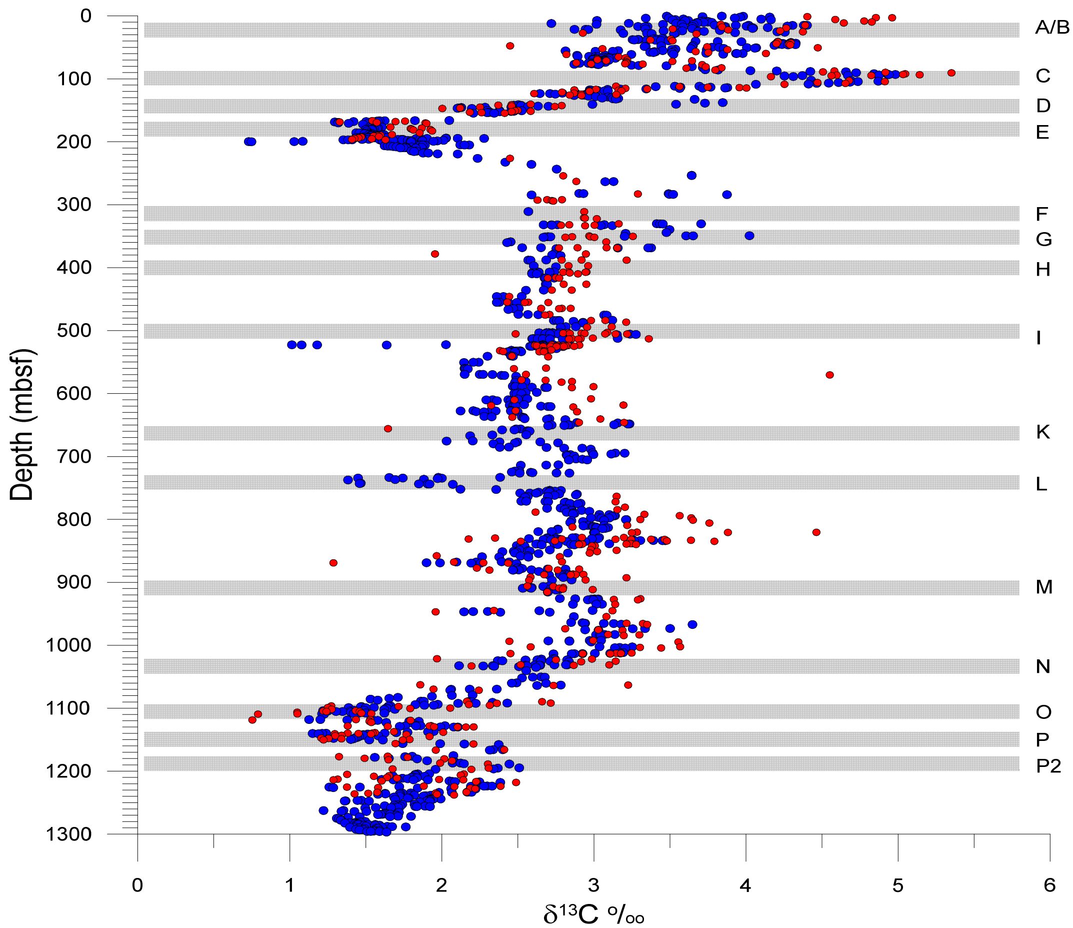

Figure 1: Data from Site 1003 previously published (Swart and Eberli, 2005) (red) and recently analyzed data (blue) together with the sequence boundaries (Eberli, 2000) which below 400 mbsf coincide with negative changes in the $\delta^{13}C$ values. Additional data allows the repositioning of several sequence boundaries.

References

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