Isotopic evidence for shallow-water carbonate dissolution and reprecipitation

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In shallow water carbonate sediments of the Bahama Banks, distinct differences in pore water $\delta^{13}C$-dissolved iroganic carbon (DIC) profiles in the upper 20 cm of sediment were observed at dense and intermediate density seagrass sites and in bare (no seagrass) ooitic sands.

Isotope mass balance calculations were used with these results to estimate the $\delta^{13}C$ of the DIC being added to these pore waters. At intermediate seagrass sites and in bare ooitic sands, these results indicate that there is a 1:1 mixing of DIC from the coupling of organic matter (OM) remineralization and sediment carbonate dissolution ($CH_2O + O_2 + CaCO_3 \rightarrow Ca^{2+} + 2HCO_3^-$). These isotope results also indicate that the source of OM undergoing remineralization is seagrass OM at the intermediate seagrass sites and is detrital OM in the bare ooitic sands.

In contrast, similar calculations for dense seagrass sites suggest that the DIC being added to these pore waters is too heavy, having a $\delta^{13}C$ value of +2.4±0.3‰. Based on the reaction above this predicts that the OM undergoing remineralization has a $\delta^{13}C$ value of +0.5±0.6‰, a value that is inconsistent with any known sediment OM sources.

However, these data may be explained if carbonate re-precipitation occurs along with OM remineralization and carbonate dissolution. Since metastable high-Mg calcite appears to be the dominant phase dissolving in these sediments, reprecipitation of more stable low-Mg calcite or aragonite may occur along with dissolution of high-Mg calcite. Since the reprecipitated carbonate is isotopically lighter than the original carbonate that dissolves, the DIC added from OM remineralization and net dissolution (dissolution minus reprecipitation) becomes heavier.

Simple closed system calculations with a reprecipitation/net dissolution ratio of ~7 (consistent with field results from Florida Bay) predict a value for the $\delta^{13}C$ of the DIC being added to pore waters (in a net sense) that is consistent with our results from dense seagrass sites.

The occurrence of this type of recrystallization has important impacts in terms of understanding sediment diagenetic processes and their impact on the evolution of carbonate platforms such as the Bahama Banks. These results may also be important in terms of the interpretation of the $\delta^{13}C$ paleoceanographic records on such platforms.

Carbon and oxygen isotopic characteristics of carbonate rocks of carboniferous-permian in Jiangshan, Zhejiang Province, China

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The studied carbonate rocks were collected from Chuanshan Formation and Qixia Formation at the Shitoushan section in Jiangshan, Zhejiang Province, China. Variation range of $\delta^{13}C$ and $\delta^{18}O$ are respectively -5.4‰–4.4‰, -12.2‰–-5.6‰, and their average are 0.49‰ and -8.37‰, respectively. No obvious shift of δ13C and δ18O is found near the borderline between Carboniferous and Permian. The carbon isotopes curve of the strata coincides with the variation curve of sea level inferred from sedimentary facies. The deepening of sea-water conforms to the peak of $\delta^{13}C$ value. Varation rule of sea water in the section is from shallow, middle, deep to middle, accordingly the evolution curve of $\delta^{13}C$ is from trough, relatively flat with sub fluctuation, wave peak to flat. The sea level evolution curve inferred from strata record in the studied area rises gradually and doesn't coincide with the global change curve of sea level [1], which is probably the result of settlement of Zhejiang - Anhui sea basin. The phenomenon is proved also by record of carbon isotope. Value of $\delta^{13}C$ rose gradually, and then decreased slightly in the last from the late of Late Carboniferous to the early of Early Permian. The evolution curve of carbon isotopes doesn't coincide with that from Veizer *et al*. (1986) [2]. Therefore, the evolution curve can reflect the evolution of regional crust in some degree.

References

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