

Dolomitization process and its effect on the behavior of trace elements in carbonate rocks

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The origin of dolomite has been considered to be a long-standing enigma in sedimentary geology. It has been accepted that dolomitization of limestone by solutions with high Mg²⁺/Ca²⁺ ratio is one of the most important mechanisms to produce dolomite. Therefore, understanding the geochemical behaviors of major and trace elements during dolomitization is vital towards deciphering the mysterious "dolomite problem".

An example section is selected in this study of Geshan profile of the middle Triassic age in the Lower Yangtze area, China. This outcrop develops various carbonate rocks ranging from limestone, through dolomitic limestone and calcareous dolomite, to dolomite. The carbonate series represent a gradual increase in dolomitization degree.

The geochemical signatures of these carbonate rocks are well preserved as supported by two folds of evidence: (a) most of the dolomites are micritic or fine-grained with planar-s in fabric, and (b) the Mn/Sr ratios of these samples are generally less than 1. The average Sr concentrations of limestone, dolomitic limestone, calcareous dolomite and dolomite are 1357.7 ppm, 271.2 ppm, 121.8 ppm and 99.9 ppm, respectively; whereas the average Mn concentrations are 15.37 ppm, 17.46 ppm, 27.85 ppm and 44.09 ppm, respectively. Therefore, the Sr concentration of carbonate rocks decreases with increasing dolomitization processes. However, the Mn concentration shows an opposite variation trend.

Previous studies suggest that, in the dolomite lattice, Sr mainly substitutes Ca sites. However, our observations show that the Sr concentration exhibits a non-linear decrease along with the decrease of CaO content during dolomitization. This reflects that, apart from the substitution of Ca, Sr exists in dolomite in other forms, such as in the crystal defects, or in fluid inclusions. In addition, compared with the published Sr concentration in microbial dolomite precipitated in culture experiments, our results ruled out the possibility of bacterial origin for the dolomite in this report.

Carbon and Oxygen Isotopic Compositions: How to Respond the Lacustrine Environmental Factors in Northwestern and Northeastern China

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The sediments, that 28 closed-lake sediments from Hoh Xil, 24 from Northeastern China, 99 surface sediments from Lake Bosten, 31 from Ulungur and 26 from Heihai were collected to determine the $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values and discussed the impacting factors to the $\delta^{13}\text{C}$ - $\delta^{18}\text{O}$. The closure and residence time of lakes can influence the correlation between $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$. Mg/Ca in the bulk sediment indicates the characteristic of residence time, Sr/Ca and Fe/Mn infer the salinity of lakes. Carbonate forming and types can influence the $\delta^{13}\text{C}$ - $\delta^{18}\text{O}$ correlation. When carbonate content is less than 30%, there is no relationship both $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$, and no relationship between $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$. But more than 30%, carbonate content highly co-varies to $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$, and has high correlation between $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ also. Vegetation condition and primary productivity of lakes can influence the characteristic of $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$, and their co-varying. Organic matter content (TOC) in the sediments is higher with more terrestrial and submerged plants filling. When organic matter comes from endogenous floating organisms and algae (C/N<6), $\delta^{13}\text{C}$ value is heavy. $\delta^{13}\text{C}$ is in -4~0‰. $\delta^{13}\text{C}$ is in the range of -4~8‰ as organic matter comes from diatom (C/N=6~8). $\delta^{13}\text{C}$ is in the range of -8~4‰ as organic matter from aquatic and terrestrial plants (C/N>8).