Geophysical Research Abstracts
Vol. 19, EGU2017-3403, 2017
EGU General Assembly 2017

Stable carbon, nitrogen and sulfur isotopes in non-carbonate fractions of cold-seep carbonates

Dong Feng (1), Yongbo Peng (2), Jörn Peckmann (3,4), Harry Roberts (5), and Duofu Chen (6)

(1) Key Laboratory of Marginal Sea Geology, South China Sea Institute of Oceanology, Chinese Academy of Sciences, Guangzhou 510301, China, (2) Department of Geology and Geophysics, Louisiana State University, Baton Rouge, LA 70803, USA, (3) Institute of Geology, University of Hamburg, 20146 Hamburg, Germany, (4) Department of Geodynamics and Sedimentology, University of Vienna, 1090 Vienna, Austria, (5) Coastal Studies Institute, Department of Oceanography and Coastal Sciences, Louisiana State University, Baton Rouge, Louisiana 70803, USA, (6) Hadal Science and Technology Research Center, College of Marine Sciences, Shanghai Ocean University, Shanghai 201306, China

Sulfate-driven anaerobic oxidation of methane (AOM) supports chemosynthesis-based communities and limits the release of methane from marine sediments. This process promotes the formation of carbonates close to the seafloor along continental margins. The geochemical characteristics of the carbonate minerals of these rocks are increasingly understood, questions remain about the geochemical characteristics of the non-carbonate fractions. Here, we report stable carbon, nitrogen and sulfur isotope patterns in non-carbonate fractions of seep carbonates. The authigenic carbonates were collected from three modern seep provinces (Black Sea, Gulf of Mexico, and South China Sea) and three ancient seep deposits (Marmorito, northern Italy, Miocene; SR4 deposit of the Lincoln Creek Formation and Whiskey Creek, western Washington, USA, Eocene to Oligocene). The δ^{13}C values of non-carbonate fractions range from $\sim$-25‰ to -80‰ VPDB. These values indicate that fossil methane mixed with varying amounts of pelagic organic matter is the dominant source of carbon in these fractions. The relatively small offset between the δ^{34}S signatures of the non-carbonate fractions and the respective sulfide minerals suggests that locally produced hydrogen sulfide is the main source of sulfur in seep environments. The δ^{15}N values of the non-carbonate fractions are generally lower than the corresponding values of deep-sea sediments, suggesting that organic nitrogen is mostly of a local origin. This study reveals the potential of using δ^{13}C, δ^{15}N, δ^{34}S values to discern seep and non-seep deposits. In cases where $\delta^{13}C_{carbonate}$ values are only moderately low due to mixing processes and lipid biomarkers have been erased in the course of burial, it is difficult to trace back AOM owing to the lack of other records. This problem is even more pronounced when authigenic carbonate is not available in ancient seep environments.

Acknowledgments:

The authors thank BOEM and NOAA for their years' support of the deep-sea dives. Funding was provided by the NSF of China (Grants: 41422602 and 41373085) and the "Hundred Talents Program" of CAS.