Geophysical Research Abstracts
Vol. 18, EGU2016-3486, 2016
EGU General Assembly 2016

Establishing criteria to distinguish oil- from methane-seep carbonates

Daniel Smrzka (1), Jennifer Zwicker (1), Wolfgang Bach (2), Gerhard Bohrmann (2), and Jörn Peckmann (3)

(1) Department of Geodynamics and Sedimentology, Center of Earth Sciences, University of Vienna, Althanstraße 14, 1090 Vienna, Austria, (2) MARUM Center for Marine Environmental Sciences and Department of Geosciences, University of Bremen, Klagenfurter Str., 28359 Bremen, Germany, (3) Institut für Geologie, Universität Hamburg, Bundesstraße 55, 20156 Hamburg, Germany

Hydrocarbon seeps harbor biota depending on chemosynthesis that is preserved in the fossil record as part of authigenic carbonate deposits. Seep environments are characterized by emanation of methane-rich fluids, yet an increasing number of seeps have been discovered in recent years that are typified by seepage of crude oil. Fluid composition is an important factor governing the composition and diversity of seep-dwelling fauna at modern seeps, as different species have differing tolerances and requirements with regard to the emitted compounds. In this regard, oil seepage has a profound influence on the diversity and distribution of seep-endemic macrofauna and microbial communities. Despite current efforts to better understand oil seeps and their ecology, the confident identification of oil seeps in the geologic record still poses fundamental problems. We present new geochemical data that allow for a more reliable identification of oil seepage during the Phanerozoic. Clear, fibrous aragonite cements of modern and putative ancient oil- and methane-seep deposits were analyzed for their rare earth element (REE) content. This cement is common in seep limestones and represents a product of the anaerobic oxidation of methane and higher hydrocarbons. Clear aragonite is particularly pure and virtually free of detrital inclusions, making it an ideal mineral for comparative geochemical analyses. Its REE composition reveals that oil-seep deposits are significantly enriched in REEs compared to methane- seep deposits. Furthermore, bulk total organic carbon (TOC) measurements suggest that modern and putative ancient oil seep carbonates are enriched in organic carbon. The combined data serve as a promising tool for identifying oil seepage in the fossil record. Our results provide the foundation for an improved understanding of the adaptation of chemosynthesis-based life to oil as an energy source.