Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.16145

Boron isotopes of cold-seep carbonates reveal methane seepage intensity in the past

MAOYU WANG[1,2], JOSEPH A. STEWART[2], LAURA F. ROBINSON[2], DONG FENG[3], TAO LI[4], XIN ZHANG[5] AND TIANYU CHEN[1]

[1]School of Earth Sciences and Engineering, Nanjing University
[2]University of Bristol
[3]College of Marine Sciences, Shanghai Ocean University
[4]Nanjing Institute of Geology and Palaeontology
[5]Center of Deep Sea Research, Institute of Oceanology, Center for Ocean Mega-Science, Chinese Academy of Sciences

Presenting Author: maoyu.wang@bristol.ac.uk

Cold seeps are methane-rich fluids released below the sediment-water interface at continental margins, playing a key role in the marine carbon cycle and thus have a significant impact on Earth's climate. However, records of methane seepage intensity in the past are lacking, making it difficult to assess the role of methane in global climate change. Cold-seep carbonate, a by-product of methane seepage activity, has the potential to archive the intensity of methane release. Here, we present boron, molybdenum, and carbon isotopic measurements of cold-seep carbonates from the South China Sea to explore their ability to document the methane seepage activity in the past. Pure aragonitic samples were selected for analysis to avoid mineralogical bias of sampling (e.g. calcite vs aragonite) and to minimise the influence of detrital silicates. We find a negative correlation between molybdenum and boron isotopes in cold-seep carbonates. This correlation combined with carbon isotopes likely reflects differing proportions of boron and molybdenum from seawater and porewater, and/or pH changes caused by anaerobic oxidation of methane. Both of these factors indicate the methane seepage intensity controls boron isotopic compositions in cold-seep carbonate. Therefore, the boron isotopic composition of cold-seep carbonates may provide new insights into the history of methane seepage that will allow us to assess their role in climate change in the past.