Geophysical Research Abstracts
Vol. 12, EGU2010-6534-1, 2010
EGU General Assembly 2010
© Author(s) 2010

Pyrite formation and trace metal enrichment patterns reflect past environmental conditions on the Peru-Chile continental margin

Philipp Böning (1), Michael E. Böttcher (2), and Hans-Jürgen Brumsack (1)

(1) ICBM, Microbiogeochemistry, University of Oldenburg, Germany (p.boening@icbm.de), (2) IOW, Geochemistry and Stable Isotope Geochemistry, Warnemünde, Germany

The stable sulfur isotopes of pyrite and porewater sulfate as well as data on porewater sulfate/H2S and trace metals (e.g. Mn, Co, Mo) were used to deduce information about paleo-depositional conditions and early diagenesis in two long cores (0-5 m) from within and below the oxgen minimum zone off Huacho (Peru) and three long cores from the bay and shelf off Concepcion (Chile). These cores were retrieved on cruises with R/Vs Vidal Gormaz, Kay Kay, and Sonne.
The shallow Peruvian core (127 m water depth) and the Chilean cores (24 - 88 m water depth) are fine-grained organic-rich sediments and show almost complete sulfate depletion within the first meter of sediment. The turbiditic deep core off Peru (1278 m depth) comprises coarse phosphorite-rich sediments deposited on an organic-rich section. Only in the latter, net sulfate depletion is significant and Mo is extremely enriched (140 ppm on average). Such high Mo values are only attained within the OMZ, hence, this section must represent a former downslope event. In cores off Peru, the Mn and Co depletion hints to the dissolution of Mn-oxides and to a substantial release of Mn and Co from particles settling through the OMZ before reaching the sediment surface.
Sulfate reduction leads to a depletion of 34S in pyrite compared to bottom water sulfate of up to 53 per mil (shallow Peruvian and Chilean cores) and 67 per mil (turbiditic core). Isotopic variation with sediment depth for the shallow Peruvian core is small (–32$\pm$2 per mil on average) indicating pyrite formation close to the sediment-water interface and control by sedimentation and corresponding microbial activity during the Holocene. For the phosphorite-rich section of the deep core the extreme isotope discrimination (–45 per mil on average) is due to processes in the oxidative part of the sulfur cycle in addition to sulfate reduction. However, in the deep organic-rich section d34Spyrite of –15 per mil represents a mixture of a pre- and post sedimentation source. In-situ sulfur fractionation is significantly decreased due to high amounts of reactive OM and possible reservoir effects. This indicates control of isotope discrimination by heterotrophic bacterial activity in this deep sediment section.
The long cores off Concepcion may indicate two episodes of sea level lowstand. This is reflected by the rather positive d34S signature of pyrite (up to 0 per mil) in sandy layers which is typical of the depletion of 32S in a closed system. The continuous decrease in d34S values of pyrite from 0 to –35 per mil indicates relative sea level changes.