Geophysical Research Abstracts, Vol. 7, 05397, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05397

Constraining the Lower Cambrian marine redox environment on the Yangtze Platform with carbon and sulphur isotopes

T. Goldberg (1), Q. Guo (2) and H. Strauss (1)

(1) Geologisch-Paläontologisches Institut, WWU, Münster, Germany, (2) Institute of Geochemistry, Chinese Academy of Sciences, Guiyang, China, (tgold@uni-muenster.de)

Carbon, sulphur and iron abundances and carbon and sulphur isotopes were measured in shales, cherts and carbonates from two Lower Cambrian (Nemakit-Daldynian to Atdabanian) sections on the Yangtze Platform, South China. The Shatan section in the NE of the Sichuan province reflects deposition in a shelf environment, whereas the Songtao section in eastern Guizhou province is a deeper-water basinal facies deposit. The objective of our study was to constrain the marine redox conditions for these sedimentary environments immediately preceding the rapid diversification of metazoans.

High DOP (>0.75) and low δ^{34}S (-16 to 0‰) values for pyrite and organic sulphur in the lower Tommotian, indicate bacterial sulphate reduction not only in the sediment but also in an anoxic, possibly euxinic water column. δ^{13}C of kerogen is consistently low throughout this period (-36 to –34‰). We interpret these low organic carbon isotope values as a reflection of organic matter recycling through sulphate reducing bacteria, superimposed on the temporal evolution of the global carbon cycle. This could be accomplished by an oceanographic situation in which the chemocline was situated within the photic zone (photic zone anoxia). The apparent isotope fractionation between organic and carbonate carbon is $>$ 32‰ in the upper Nemakit-Daldynian and lower Tommotian, suggesting an input of chemoautotrophic biomass which is in agreement with the record of previously published organic carbon isotope data (Hayes et al., 1999) and consistent with the proposed sulphidic ocean (Canfield, 1998).

In the upper Tommotian, low DOP values suggest that the water column became oxic. δ^{34}S values for iron sulphide and organic sulphur rise to ca. +20‰. This suggests that bacterial sulphate reduction occurred primarily in the sediment and no longer in the

water column. Positive sulphur isotope values further indicate that sulphate limitation was soon established. Organic carbon isotope ratios increase to around -30‰ and carbonate carbon to 0‰, reflecting open marine conditions. Looking at the deeper water Songtao section, anoxic conditions were still present or re-established in the basinal region. In the lower Atdabanian δ^{34}S is variable, but mostly high, with DOP indicating an oscillation between oxic and dysoxic conditions. Kerogen and carbonate carbon isotope values are around -30 and 0‰, respectively.

Our geochemical data are consistent with a postulated stagnant anoxic basin during Lower Cambrian on the Yangtze Platform (Steiner, 2001). It remains open whether Early Cambrian deposits of the Yangtze Platform reflect open marine global conditions. Alternatively, the facies regime described above could have developed in a semi-closed basin that was somewhat isolated from the global ocean.

0.0.1 References:

Steiner, M. (2001) Freib. Forsch., C 492, 1-26.

Hayes, J.M., Strauss, H. & Kaufman, A. J. (1999) Chem. Geol., 161, 103-125