Mo-isotopes as tracers of Cretaceous ocean anoxia

Conference or Workshop Item

$\delta^{13}C$ evidence of conodont evolution as a response to bioproduction perturbations

O.P. IZOKH

Sobolev Institute of Geology, and Mineralogy SB RAS, Novosibirsk, Russia (izokhop@gmail.com)

Usually $\delta^{13}C$ variations in marine sediments are related to the mass extinction in the Earth's past, and explained as reflection of the changes in primary bioproduction of the paleooceans, but sometimes the $\delta^{13}C$ excursion coincide with important evolutionary changes in biosphere. One of examples is radiation of polygnathid conodonts at the lower Emsian (Devonian), where negative $\delta^{13}C$ excursion (from +2 to -0.7 ‰) is aligned with the appearance of well-developed Pa element of the *Polygnathus kitabicus*, *Pol. pannonicus* and *Pol. sokolovi*.

Apart of bioproduction decrease, carbonates secondary changes also may cause negative excursion. To exclude the diagenetic nature of these isotopic signals, investigations of geochemical criteria of primary carbonate material safety (Fe/Sr and Mn/Sr) have been done. Together with the petrographic studies they are very effective for allocation of diagenetically altered samples.

All studied lower Emsian samples from Zinzilban section (Zeravshan Ridge, Kitab State Geological Reserve, Uzbekistan) are characterized by the low concentration of Fe (<100 ppm) and Mn (<22 ppm) with Sr contents from 150 to 400 ppm. Thus, Fe/Sr and Mn/Sr not exceed 0.5 and 0.07 accordingly, that evidence absence of carbonate material alteration. Also, it was controlled by petrographic studies. Thus, $\delta^{13}C$ negative excursion with high probability is a primary signal and the correlation of this event with the complication of conodont Pa element can reflect changes in their nutrition type, induced by the decreasing of the simple food.

Mo-isotopes as tracers of Cretaceous ocean anoxia

G.J. IZON[1]*, A.S. COHEN[1], A.L. COE[1], S.W. POULTON[2] AND T. WAGNER [2]

[1]Department of Earth and Environmental Sciences, The Open University, Milton Keynes, MK7 6AA, UK. (*correspondence: G.Izon@open.ac.uk)
[2]School of Civil Engineering and Geosciences, Newcastle University, Newcastle upon Tyne, NE1 7RU, UK.

Recent observations and modelling have shown that ocean warming and stagnation, driven by global climate change, may lead to widespread ocean deoxgyenation with direct impacts on marine biogeochemistry and ecosystems. Measurements of marine oxygen levels extend back no more than *c*. 50 years, whilst accurate predictions of future deoxgyenation trends are difficult and uncertain. In contrast, the geological record of past abrupt global warming events can provide insights into the entire earth system response - the mechanisms, extent, duration and consequences of - seawater deoxgyenation that are associated with CO_2-induced global warming.

The Cretaceous oceans were particularly susceptible to transient widespread deoxygenation, containing as many as 6 discrete intervals known as Ocean Anoxic Events (OAEs). Of these, OAE 1a (~120 Ma) and OAE 2 (~93 Ma) may have been global in extent and are marked by a sudden increase in organic C accumulation in conjunction with broad positive carbon isotope excursions.

We present new Mo-isotope, trace element and Fe-speciation analyses of samples from OAE 1a (the Selli event) and OAE 2 (the Bonarelli Event). Mo-isotope data can, under certain circumstances, provide quantitative estimates of how the extent of seawater anoxia may have fluctuated in the past. Our data from Gorgo a Cerbera, Italy, indicate that local conditions became progressively more reducing during OAE1a. $\delta^{98/95}Mo$ ratios show pronounced stratigraphic variations, consistent with diminished oxic sedimentation globally. Laminated sediments from Demerara Rise are enriched in redox sensitive trace metals (RSTM) throughout much of the Cenomanian. However, OAE 2 is marked by relatively low levels of RSTM consistent with the global expansion of anoxic sedimentation and the drawdown of the RSTM inventory. Our sample specific Fe-speciation data show that the water column was periodically euxinic, allowing us to use Mo-isotope data to critically test ideas on the timing, extent and duration of one of the most prounced deoxgyenation events of the Mesozoic.