Evidence for transient deep-water oxygenations in early Cambrian Nanhua Basin (South China)

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Many late Neoproterozoic to early Cambrian fossils of multicellular eukaryotes, even those of benthic animals, are found preserved in anoxic and even euxinic bottom water conditions [e.g., 1], which is contradictory to the consensus that oxygen is essential to eukaryotes. To investigate this apparent contradiction, we carried out an integrated study of Mo isotope (δ^{98}Mo), iron speciation and redox-sensitive trace elements (RSTEs) on the stone coal beds of the Lower Cambrian Hetang Formation (535-520 Ma) at Lantian, South China, where abundant sponge fossils have been preserved [2]. All iron speciation data point to ferruginous or euxinic environments, although sponge-bearing beds generally show higher RSTE/TOC and lower δ^{98}Mo (+0.13‰ to +1.22‰) relative to non-sponge-bearing beds (relatively constant δ^{98}Mo around +1.7‰). Interval with high δ^{98}Mo may reflect perisistent euxinic condition while intervals with lower and variable δ^{98}Mo reflect the interrupt of euxinic conditions, possibly by oxic conditions. Accordingly, we suggest a repeating, transient inflow of oxic waters into the Nanhua Basin during this period, which brought more RSTEs to the basin and interrupted the earlier persistent anoxia in the basin, thus providing a transiently oxic environment for colonization by sponges. Our study indicates that the apparent contradiction between the fossil records and the geochemical records likely reflects limitattions of geochemical proxies for detection transient perturbations of watermass redox conditions.

[1] Yuan et al. (2011), Nature 470, 390-393. [2] Xiao et al. (2005), PPP 220, 89-117.