

Oceanic Ba removal improved marine habitability for the oldest-known animals at ca. 600 Ma

WEI WEI¹, PEISHAN SUI², SHAO-BING ZHANG² AND
FANG HUANG¹

¹University of Science and Technology of China

²School of Earth and Space Sciences, University of Science and Technology of China

The early Ediacaran witnessed the rise of complex macroscopic eukaryotes in the ecosystem including the naissance of metazoans, which may have been triggered by the Neoproterozoic Oxygenation Event. However, *local* anoxia and/or euxinia likely persisted and dominated in deep waters and restricted environments during this period. Whether and how marine redox changes were related to this evolutionary event remains elusive. In this study, we present Fe speciation, Ba contents, and Ba isotope compositions of black shales from the Lantian Formation on the lower Yangtze Block, which preserved the oldest-known macroscopic fossil assemblage of morphologically differentiated algae and animal affinities. The Fe speciation data show that the Lantian black shales were mainly deposited in ferruginous and euxinic environments. However, the considerable Ba enrichments relative to the upper continental crust suggest that the oceanic sulfate was surplus after the microbial sulfate reduction to remove dissolved Ba from the *locally* ferruginous/euxinic deep seawater as barite. The Ba isotope data reflect a major drawdown of dissolved Ba reservoir by barite precipitation in response to oceanic sulfate increase on a *global* scale. Since high levels of dissolved Ba are deleterious to marine organisms, we propose that the removal of toxic Ba, corresponding to increase in oceanic sulfate concentration (oceanic oxygenation), could have promoted marine habitability for the diversification of macroscopic eukaryotic algae and the appearance of early animals during the early Ediacaran. Additionally, this study demonstrates that the Ba isotope system can serve as a novel tool to estimate *global* oceanic sulfate concentration (oxygenation extent).