

Unravel the Earth's oxygenation history with molecular organic sulfur geochemistry

CHUNJIANG WANG^{1*}, TIMOTHY W. LYONS²,
ANDREY BEKKER², GORDON LOVE² AND NOAH J.
PLANAVSKY³

¹ College of Geosciences, China University of Petroleum,
Beijing 102249, China. (*corresponding author:
wchj333@126.com)

² Department of Earth Science, University of
California–Riverside, Riverside, California 92521, USA

³ Department of Geology and Geophysics, Yale University,
New Haven, Connecticut 06511, USA.

The rise of oxygen in Earth's early ocean and atmosphere has been well studied in recent years [1]. These studies are mostly based on isotope and trace-element geochemistry. In this study, we try to use the molecular organic sulfur proxy (the relative concentration of DBTs) to evaluate the sea-floor redox and the ocean and atmosphere oxygenation during the Earth's Precambrian history.

The results show that 1) the DBTs in the Mesoproterozoic black shales is very low; 2) the DBTs increases dramatically (about one order of magnitude, in average) at the end of the Neoproterozoic, and the high values are persistent in the Phanerozoic, even though with large fluctuations; 3) the Archaean black shales show a medium level of the DBTs.

Based on the geochemistry of organic sulfur-containing compounds, we interpret this evolution of DBTs as mainly a result of marine sulfate concentration change. It means that sulfate concentration is 1) very low during Mesoproterozoic; 2) dramatically enhanced in late Neoproterozoic and Phanerozoic; 3) moderate level in some times of Archaean. In addition, this long-term DBTs evolution is very similar to that of the redox-sensitive elements and the isotopes, such as that Mo, U.....

Thus, the Earth's oxygenation history could be well unravelled by the molecular organic sulfur geochemistry.

[1] Lyons et al. (2014) *Nature* **506**, 307–315.