Unraveling the evolution of atmosphere oxygenation from Ediacaran to early Cambrian, evidenced from Cr isotope

WEI WEI[1*], HONGFEI LING[1], ROBERT FREI[2], DA LI[1], GEOFFREY GILLEAUDEAU[2], GUANGYI WEI[1]

[1]School of Earth Sciences and Engineering, Nanjing University, Nanjing 210023, China
[2]Department of Geosciences and Natural Resource Management, University of Copenhagen, Øster Voldgade 10, 1350 Copenhagen, Denmark
(*correspondence: lightvv@qq.com)

Chromium isotope is an emerging and excellent proxy to trace atmospheric oxygenation evolution. In this study, we analyzed coherent chromium isotopic compositions from the Doushantuo and Dengying formations in the Yangtze Gorges area and the Dengying and Zhujiaqing formations in the Xiaotan section for the first time. After excluding the detrital effects on Cr isotope, we obtained authigenic Cr concentrations and Cr isotopic compositions. Additionally, in DST-III, Daibu and Zhongyicun members, samples with relatively high authigenic Cr concentrations always have low δ^{53}Cr values within or approaching the δ^{53}Cr values of BSE [1].

Results indicate that from Ediacaran to early Cambrian, there are three primary atmospheric oxygenation in Earth surface: first occurred in middle Ediacaran (δ^{53}Cr up to 0.97‰), resulting in the Shuram/Wonoka event together with an anoxia event in surface seawater; Second occurred in late Ediacaran as well as oxidation in shallow seawater (δ^{53}Cr ranging from 0.81‰ to 0.96‰), related to the appearance of Ediacaran biota; Third occurred in Ed-C transition (δ^{53}Cr up to 1.15‰), related to first appearance of Cambrian animals (SSFs). The fluctuation of δ^{53}Cr values in DST-III, Daibu and Zhongyicun members is derived from the dilution of unfractionated Cr (III) which accumulated in water column by complexation with dissolved organic matter under high chemical weathering rate (high ^{87}Sr/^{86}Sr values) and subsequently was released from the the dissolved organic matter which is oxidized by enhanced oxidative weathering input of sulfate [2].

[1] Schoenberg et al. (2008) *Chem. Geol.* **249**, 294–306. [2] McFadden et al. (2008) *Proc. Natl. Acad. Sci. USA* **105**, 3197–3202