Oxygenation of Deep continental basins and colonization of complex marine biotas during Cambrian Age 4 (~514-509 Ma) in South China

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Rising atmospheric-oceanic oxygen levels are widely considered to be a primary driver of the "Cambrian Explosion" [1], but geochemical evidence in support of this hypothesis remains elusive. Recent study indicates that improved ventilation of shallow waters resulted in replacement of small shelly faunas by complex arthropod-dominated biotas (e.g., the Chengjiang Biota) during the transition from the Fortunian Age/Age 2 to Age 3 [2]. Further increases in ocean ventilation could have then led to expansion of complex biota similar to the Chengjiang Biota (e.g., the Balang Fauna) into deep continental basins during Cambrian Age 4. In order to test this idea, we conducted a high-resolution Fe-C-trace element geochemical study on two slope sections (Wuhe and Geyi) and one basinal section (Zhalagou) from the Yangtze Block of South China. Our results suggest that intermediate waters were dominantly ferruginous, although punctuated by episodes of euxinia, from Cambrian Age 2 to 4, and shifted to dominantly oxic conditions during Cambrian Age 4.

Comparison of the redox history of the Yangtze Block with its record of fossil life suggests that progressive oxygenation of deeper waters was coupled with the appearance of the Balang Fauna in intermediate waters and of trilobites in deep waters during Cambrian Age 4. our studies thus support the hypothesis that changes in oceanic redox conditions played an important role in the evolution of early animals and their adaptive invasion of deep-water habitats.

References: [1] Knoll and Carroll (1999), Science 285, 2129-2137. [2] Jin et al. (2016), EPSL. in press.