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The evolutionary tempo during the Ediacaran-Cambrian transition

CHUAN YANG

Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences

Presenting Author: chuanyang19@outlook.com

The rise and radiation of complex macroscopic life occurred during the Ediacaran-Cambrian transition, an interval that witnessed large-scale disturbances to biogeochemical systems [1]. To develop robust global correlation schemes and test hypotheses for the role of biogeochemical cycling in the evolution of complex life, a chronostratigraphic framework of sufficient resolution for the Ediacaran-Cambrian transition is required. Facilitated by advanced chronometers such as zircon U-Pb and black shale Re-Os, the age constraints on key fossil assemblages and large-magnitude carbon cycle perturbations during the Ediacaran-Cambrian transition have been determined [2, 3].

The new age constraints on the large-magnitude carbon cycle perturbations such as WANCE, DOUNCE/Shuram, and ZHUCE provide the scaffold for wider correlation and integration. These data calibrate the evolutionary tempo during the Ediacaran-Cambrian transition characterized by intervals of tens of millions of years of increasing ecosystem complexity, interrupted by biological turnovers that coincide with large perturbations to the carbon cycle. These perturbations have been interpreted as records of pulsed oceanic oxygenation events [4, 5], implying that oxygen exerted an important control on the timing and tempo of evolution during the Ediacaran-Cambrian transition.

[1] Bowyer et al. (2022), Earth-Science Reviews 225, 103913; [2] Yang et al. (2021), Science Advances 7, eabi9643; [3] Yang et al. (2023), Palaeogeography, Palaeoclimatology, Palaeoecology 616, 111477; [4] Shields et al. (2019), Nature Geoscience 12, 823-827; [5] He et al. (2019), Nature Geoscience 12, 468-474.