

High-precision U-Pb temporal constraints on the early Cambrian diversification of animal life from eastern Yunnan, China

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The Terreneuvian Epoch at the onset of the Cambrian marks the time of major biotic radiations and marine geochemical changes on the global scale. In order to understand the tempo of emergence of complex animal life as well as its interrelationships to the geologic environment, a robust correlation of the Terreneuvian intercontinental stratigraphic records is necessary. This correlation has been aided by long recognized patterns of perturbation in the ocean carbon cycle of presumed global extent. Here we report new high-precision U-Pb zircon geochronology (CA-ID-TIMS method) from interbedded volcanic ash beds in key stratigraphic sections of the eastern Yunnan Province in South China in order to calibrate the interval spanning the latest Ediacaran to the terminal Terreneuvian.

Samples from the top of the Ediacaran Dengying Formation and the base of the Cambrian Daibu Member of the Zhujiaping Formation in the chemostratigraphically constrained Xiaotan section provide the best estimate for the age of the basal Cambrian negative carbon isotopic excursion (BACE), as well as the Ediacaran-Cambrian boundary. The new U-Pb age constraints for the boundary are on the order of 2 myr younger than the currently accepted age. Preliminary analyses of previously dated boundary ash beds from Oman and Namibia appear to support a revision of the boundary age, pending more comprehensive examination of the corresponding successions.

Further up stratigraphically, new high-precision age results from the base of Dahai Member of the Zhujiaping Formation and the base of the Shiyantou Formation constrain the interval of the largest and most widely recognized positive carbon isotope excursion of the Terreneuvian, generally known as ZHUCE, to have occurred between ca. 527 Ma and ca. 526 Ma. Our new age results from the uppermost Dahai Member and basal Shiyantou Formation together constrain the beginning of the important negative carbon isotopic excursion known as SHICE. The latter also places maximum age limits on the first known appearance of trilobites and Chengjiang fauna. Our new calibration of the basal Cambrian biostratigraphy in South China places the base of Zone II (*Siphononchites triangularis*-*Paragloborilus subglobosus* Assemblage) and Zone III (*Heraultipegma yunnanensis* Assemblage) of the small shelly fossils at ca. 533 Ma and ca. 527 Ma, respectively, whereas the top of Zone III is constrained at ca. 526 Ma.

Keywords: U-Pb geochronology, Cambrian, Small shelly fossils, Biostratigraphy, Ediacaran-Cambrian boundary