A Tonian seawater strontium isotope curve

Y. ZHOU[1], C. J.MANNING[2], D. LI[3], H. LING[3], M. ZHU[4], G.A. SHIELDS[1]

[1]Department of Earth Sciences, University College London, Gower Street, London, WC1E 6BT, UK (y.shields-zhou@ucl.ac.uk)

[2]Department of Earth Sciences, Royal Holloway, University of London, Egham, Tw20 OEX, UK

[3]State Key Laboratory for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, Nanjing 210093, China

[4]State Key Laboratory of Palaeobiology and Stratigraphy, Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, Nanjing, 210008, China

The Tonian Period (1000 - c.720 Ma) followed a long interval of relative stasis, in terms of climate, carbon isotopes and biological evolution, and led into the Cryogenian Period of environmental extremes and instability. Despite its pivotal situation, the Tonian Period is still relatively understudied, and this is partly due to the lack of robust age constraints in key Proterozoic successions around the world. The fossiliferous Neoproterozoic strata of the North China craton were until recently thought to be of Ediacaran age. However, fossil finds and zircon ages have combined to show that most of the 'Qingbaikou' System, which reaches a great thickness in some areas, was deposited between c. 950 and c. 920 Ma. The isotopic signature of these strata confirms the Tonian age, showing the typical moderately high $\delta^{13}C$ values together with low $^{87}Sr/^{87}Sr$ ratios, <0.7065. Another characteristically Tonian feature of the North China craton is the unusually widespread abundance of molar-tooth early diagenetic calcite microspar. In this study we compare low-Mg MT samples with their surrounding 'bulk' matrix 1) to demonstrate their propensity to preserve a primary seawater isotopic signature; and 2) to reconstruct, together with published and unpublished data, the strontium (and carbon) isotopic evolution of Tonian seawater. Second-order fluctuations of less than ~0.001 are found to be superimposed on a general $^{87}Sr/^{87}Sr$ rise from ~0.7052 to ~0.7063 by c. 920 Ma, accompanied by a profoundly negative carbon isotope excursion. Increased weathering has been linked with both climatic and carbon isotope instability, and this study indicates an earlier beginning to this possible connection.