Testing primary origin and duration of the largest negative $\delta^{13}C$ excursion in the Ediacaran ocean: Insight from South China

M. ZHU[1], M. LÜ[1], Y. SHEN[2], G. SHIELDS[3] AND J. ZHANG[1]

[1]LPS, Nanjing Institute of Geology and Palaeontology, CAS, Nanjing, China (myzhu@nigpas.ac.cn)
[2]Centre GEOTOP, Université du Québec, Montréal, Canada (yananshen@gmail.com)
[3]Department of Earth Sciences, University College London, London, UK (g.shields@ucl.ac.uk)

The largest ever negative $\delta^{13}C$ excursion (nadir of -12‰) has been reported from mid-Ediacaran carbonates in Australia, Oman, Norway, Scotland, Siberia, South China and western USA. It was proposed to result from the rapid oxygenation of the Ediacaran atmosphere and ocean which may have triggered the evolution of macroscopic multicellular life and subsequent diversification of animals. However, the primary origin and duration of the excursion remain under debate, thus challenging the model for the Neoproterozic carbon cycling and oxygenation.

The excursion in South China, termed as the DOUNCE event, occurs at the top of the Doushantuo Formation with an age of 551 Ma for its termination. New results thought high-resolution stratigraphic investigations of the uppermost Doushantuo Formation of South China reveal that the DOUNCE event always occurs within the transgressive systems tract of a sequence, and represents a widespread isochronous $\delta^{13}C$ excursion with decreasing gradient of $\delta^{13}C$ and $\delta^{18}O$ values from the platform interior to slope and basinal facies, suggesting stratification of seawater. In general, $\delta^{13}C$ values within the DOUNCE excursion range from -10‰ to -7‰. High-resolution C and O isotope and petrographic analyses of laminated carbonate samples within the DOUNCE excursion indicate that $\delta^{13}C$ and $\delta^{18}O$ values show constant positive covariation between the limy and dolomitic laminae with constant deviations (1.3‰ for $\delta^{13}C$ and 5.8‰ for $\delta^{18}O$). Similar deviations of $\delta^{13}C$ and $\delta^{18}O$ have been detected between the limestone and dolomite at the same horizon from different sections. Such systematic mineralogical control on $\delta^{13}C$ and $\delta^{18}O$ values is a good indication of a primary seawater signal, as it likely represents an original isotope fractionation possibly superimposed by periodic changes in ocean temperature, primary productivity or salinity of ocean. Present data reinforce the notion that the DOUNCE event represents a primary global ocean signal with a duration of less than 10 Ma.

Unravelling the exhumation history of the Precambrian bssement rocks in the northern Tarim through apatite fission track theomochronology

W.B.ZHU*, Z.Y.ZHANG AND L.S.SHU

State Key Laboratory for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, Nanjing 210093, P.R. China (*correspondence: zwb@nju.edu.cn)

The Kuruktag Uplift is located to the north of the Tarim basin where the Precambrian crystalline basement rocks are widely crop out. An Archean complex occurs near Qingir village, and the Neoproterozoic strata occur in Xingdi, Xishankou, Xinger and Saimashan areas in the western Kuruktag, which unconformably overlie the Paleoproterozoic to Mesoproterozoic gneisses, amphibolites and schists and are unconformably overlain by the Early Paleozoic rocks. Thus, it is perfect place for understanding the thermal evolution of the Precambrian basement of the Tarim Basin.The purpose of this study is to detect that: 1.when were the basement rocks exhumed to the surface initially? 2.did the basement rocks of the Tarim craton experience reburial and re-exhumation? and 3.the history of thermotectonic evolution of the basement rocks respond to the different tectonic events occurred at Tarim continental margins .In order to obtain information about the exhumation history and processes of cooling in the northern Tarim, fission track methods on apatite were used. Ten apatite-bearing samples were collected from two sides of the Xingdi fault in the Kuruktag Uplift. Pooled ages range from 146.0 ± 13.4 to 67.6 ± 6.7 Ma. Mean track lengths range from 11.79 ± 0.14 to 13.89 ± 0.27μm. These samples can be divided into three groups depending on their ages and structural position. Group A will refer to samples F2-F3-F4-F5 and F8 with AFT apparent ages about 100-110 Ma., generally associated with areas undeformed by the faults. Group B will refer to samples F7-F9 and F10 with AFT apparent ages lower than 80Ma, mostly structurally associated with hanging wall situations close to the faults. Group C will refer to sample F11 which has the oldest apparent age of 146.0 ± 13.4Ma. The thermal history modeled result shows four periods of exhumation in the Kuruktag uplift occurred in late Early Jurassic (180Ma), Late Jurassic-Early Cretaceous (144-118Ma), early Late Cretaceous (94-82Ma) and Late Cenozoic (about 10Ma). These uplift events recorded by the apatite fission track data in the Kuruktag are assumed to be in response to the result of far-field effects from the multi-stage collisions and accretions of terranes in the south Asian continental margin.