

The Neoproterozoic carbon isotope excursions of the Doushantuo formation (South China) viewed from organic carbon isotope systematics

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The Neoproterozoic displays strong oscillations of the carbonate $\delta^{13}\text{C}$ record, most of which are concomitant with major glaciation episodes. The causal links between these carbonate isotopic oscillations and glaciation events are still poorly understood, nor is it clear if each isotopic excursion corresponds to a single glaciation event or is part of a more complex evolution. In a recent study [1], we have shown that the Neoproterozoic Doushantuo formation of the Yanjiaping section (Hunan province, South China) comprises two $\delta^{13}\text{C}$ dolomite negative excursions, one in the cap dolomite linked to the Marinoan Glaciation (dated at 635 Ma) and the other one located higher up in the section (between 600 and 555 Ma). No glaciation event has been demonstrated so far for this second carbonate isotope excursion.

In this study we performed a detailed organic matter $\delta^{13}\text{C}$ analysis ($\delta^{13}\text{C}_{\text{org}}$) of the same suite of samples of the Doushantuo formation. Results show that $\delta^{13}\text{C}_{\text{org}}$ are comprised between -20 and -32‰ and covary nicely with the dolomite $\delta^{13}\text{C}$ values. For most samples, the difference between $\delta^{13}\text{C}_{\text{dolomite}}$ [1] and $\delta^{13}\text{C}_{\text{org}}$ ($\Delta^{13}\text{C}_{\text{dol-org}}$) is $29 \pm 2\%$, indicating that the $\delta^{13}\text{C}_{\text{dolomite}}$ and $\delta^{13}\text{C}_{\text{org}}$ oscillations reflect perturbations of the global carbon cycle. Interestingly, both negative excursions show significant $\Delta^{13}\text{C}_{\text{dol-org}}$ departures from the mean value of $29 \pm 2\%$. In the cap dolomite excursion, lower $\Delta^{13}\text{C}_{\text{dol-org}}$ values down to 21‰, could arise from a low atmospheric PCO_2 at the time of the Marinoan deglaciation. In the younger excursion, highly scattered $\Delta^{13}\text{C}_{\text{dol-org}}$ values between 25‰ and 33‰ could reflect a diagenetic imprint. Dissimilar $\Delta^{13}\text{C}_{\text{dol-org}}$ patterns and values for each excursion support the view that processes other than those linked to (de)glaciation may account for negative carbonate isotope excursions during the Neoproterozoic.

References

[1] Macouin M. (2004) *EPSL* **224**, 387-398.