

## Multi-proxy study of shallow- and deep-water Doushantuo carbonates, Yangtze Platform, South China

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The wide distribution of shallow and deep-water sedimentary facies has established the Yangtze Platform in South China as a key site for the study of ocean oxidation and Ediacaran animal evolution following the Marinoan glaciation. We have studied mineralogy, textures, major and trace elements and Sr-C-O isotopic compositions of carbonates of the Doushantuo formation from shallow- (Xiaofenghe, Hubei Province) and deep-water (Yanwutan, Hunan Province) sections in order to distinguish diagenetic overprint from primary signatures and to constrain compositional variations of Ediacaran seawater in space and time. Carbonate rocks from the lower part of Yanwutan section show elevated <sup>87</sup>Sr/<sup>86</sup>Sr (0.7099 to 0.7220) and high Mn/Sr. Negative correlation of <sup>87</sup>Sr/<sup>86</sup>Sr with  $\delta^{18}\text{O}_{\text{carb}}$  in the upper part of the section indicates meteoric fluid-rock interaction. At Xiaofenghe, <sup>87</sup>Sr/<sup>86</sup>Sr in cap carbonates (D1) is near 0.713, dropping to seawater-like ratios upsection (0.7079 in D3). REE+Y patterns of deep water slope facies carbonates at Yanwutan reveal preservation of seawater signatures, cap carbonates show no Ce anomalies, but high Eu/Eu\* (1.9) and enrichment in MREE, which, given the high <sup>87</sup>Sr/<sup>86</sup>Sr, may reflect strong hydrothermal overprint. In contrast, the upper part of the section displays HREE enrichment, negative Ce, and variable positive Eu anomalies, indicating oxidizing conditions of deep water during this time interval. REE+Y patterns of carbonates at Xiaofenghe section are flat to variable HREE enriched, with Y/Ho<sub>PAS</sub> (>2.1), indicating the presence of a seawater signature. While the cap carbonates have no Ce anomalies, D2 and D3 carbonates show strongly negative Ce anomalies, indicating precipitation from an oxidized water column. A main conclusion from the data is that deep water of the Yangtze basin was oxidized as early as the middle Doushantuo, with likely anoxic conditions before that time. Fluid-mobile elements in deepwater sections are more overprinted than in shallow water sections, presumably by hot reducing fluids of variable origin. Although fluid-mobile elements (Ba, Sr, Ca, Mg) commonly show evidence for modification by post-depositional fluid flow, REE+Y in these rocks often preserve seawater signals.

## Decay constants for dating

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Two generations ago, the International Union of Geological Sciences (IUGS), through a sub-committee, recommended values for reporting isotopic data. A quarter century ago, the International Union of Pure and Applied Chemistry (IUPAC) recommended values for half-lives (decay constants) for a series of long-lived nuclides, many of which could be used for dating materials. The IUGS and the IUPAC recommendations differed in many cases. More than a decade ago, geochronologists began writing articles suggesting that updates should be made to the original IUGS recommendations because of the existence of more recent data on the original isotopic information that had been presented and because of the absence of any uncertainties that were associated with that data.

A few years ago, an inter-Union Task Group of members of IUGS and IUPAC was formed to make 'Recommendations for Isotopic Data in the Geosciences' and was approved by their Executive Boards. The rationale was similar, there were new data now available and the associated uncertainties need to be added to all recommended values.

The procedure for any recommendation of isotopic data would involve a re-evaluation of the measurement uncertainty budgets for each experiment, especially for the 'type-B' or non-statistical uncertainties, before combining the overall uncertainties and determining a recommended value. A number of isotopes will be discussed.