

Carbon isotope variations through Neoproterozoic Doushantuo and Dengying Formations, South China: Implications for paleoenvironmental change

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Primary carbon isotope evolution recorded in marine carbonate rocks is particularly useful for Neoproterozoic chemostratigraphic correlation and paleoenvironment reconstruction. Differences exist between the published carbonate C-isotope profiles from the Neoproterozoic Yangtze platform and the global C-isotope record through the equivalent time window. It is obviously needed to obtain more C-isotope profiles for the Yangtze platform where excellently preserve pre-Ediacarian animal fossils. We studied C, O and Sr isotope compositions and Mn-Sr concentrations of two sections of the Neoproterozoic Doushantuo Formation and Dengying Formation in Guizhou and Zhejiang provinces. The observations of most Mn/Sr <10 suggest that most of the C-isotope compositions studied were not significantly modified by diagenesis. However, most of the $^{87}\text{Sr}/^{86}\text{Sr}$ ratios are above 0.709, higher than the contemporaneous seawater values, a result of diagenesis and possible leaching of clay detritus. The $\delta^{18}\text{O}$ profiles exhibit more fluctuation than the $\delta^{13}\text{C}$ profile, indicating oxygen isotopes being more sensitive to diagenesis. Both $\delta^{13}\text{C}$ profiles in Zhejiang and Guizhou show negative excursions to -3 ~ -4‰ at the Doushantuo cap carbonate overlying the Nantuo (Marinoan) diamictite and at the Doushantuo-Dengying boundary, and positive shifts to +3 ~ +4‰ in the main Doushantuo and Dengying periods. We suggest that oceanic overturn was responsible for the negative $\delta^{13}\text{C}$ excursion at the Doushantuo cap carbonate. We interpret the negative $\delta^{13}\text{C}$ excursion at the Doushantuo-Dengying boundary also as a result of oceanic overturn. However, the mechanisms for the two overturn events are different. The former overturn occurred under high temperature and high evaporation of surface seawater after thaw of the Marinoan Snowball Earth which had resulted in the stagnant and stratified ocean under sea ice. The Doushantuo period witnessed long term high bioproductivity, accumulating organic matter sinking-burial and $\delta^{13}\text{C}$ stratification, CO_2 drawdown and cooling to high latitudinal glaciation, which finally resulted in vigorous thermohaline circulation and oceanic overturn at the end of this period. This latter overturn released CO_2 to atmosphere and raised the temperature thus stopped further cooling and subsequently high productivity revived in the Dengying period.