

Changes of carbon cycle across the PC/C boundary reflecting biological productivity and redox condition

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Inorganic carbon isotope profile of the period from late Neoproterozoic to early Cambrian records distinct spikes reflected from global changes in climate, tectonic activity, ocean circulation, and animal evolution (Tucker, 1992; Guo et al., 2007). Previous studies have reported the profile of this period from various areas including South China (Zhou and Xiao, 2007), Sibelia (Brasier et al., 1994), Canada (Narbonne et al., 1994), Oman (Amothor et al., 2003) and Namibia (Hoffman et al., 2007) in order to reconstruct the environmental change and to correlate the stratigraphies. The factors causing the spikes of the inorganic carbon isotopic value have been interpreted differently, as changes in biological productivity (Hus et al., 1985; Lambert et al., 1987; Amother et al., 2003), the changes in burial and decomposition rate of organic carbon (Hayes et al., 1992) and the influence of upwelling (Kimura et al., 1997; Goldberg et al., 2007), and it was not easy to specified the factor form using the inorganic isotopic values alone.

Contents of organic carbon and its carbon isotopic value change with biological productivity and isotopic fractionation between carbon dioxide species and organisms, and provide useful palaeoceanographic information. However, the previous studies on organic carbon in Chinese Neoproterozoic to early Cambrian from Guizhou (Chen et al., 2006; Yang et al., 2007), Yunnan (Shen and Schidlowski, 2000) and Sichuan (Goldberg et al., 2007), indicated only fragmentary information from limited stratigraphic horizons. Therefore, we analyzed organic matter (carbon isotope, CHNS and biomarker) of the 51 samples collected from Shizhonggou section in southern Shaanxi Province, China, and reconsidered the meaning of the inorganic carbon isotopic fluctuations in the PC/C transitional period in the Yangtze Platform. Study section is located in shallow water setting on the northwestern platform, and exposes the upper Neoproterozoic Dengying and the overlying lowermost Cambrian Kuanchuanpu Formations, continuously (Steiner et al., 2004).

Inorganic carbon isotopic values ranged between 0.3 and -8.7 permille, and show a decreasing trend in the lower-middle section, positive and negative spikes in the uppermost section. Organic carbon isotopic values fluctuated from -27.8 to -37.8 permille, decreased in the lower section, and increased to the upper part of the Kuanchuanpu Formation. Total organic carbon (TOC) ranged between 0.15 and 1.19%, generally stayed constant in the lower section, increased in the middle section, and recovered a large positive spike in the uppermost section. Biomarker analysis recognized substances originated from algae, bacteria and archaea from the upper part of the section. Low Pr/Ph ratios (0.2 to 1.5) indicated disoxic to anoxic diagenetic environment.

These results led the following interpretations about the fluctuations of inorganic carbon values. 1) Decreasing trend in the uppermost Dengying and the lower Kuanchuanpu Formations was caused by upwelling and oxic decomposition of organic matter. 2) Decreasing trend in the middle Kuanchuanpu Formation was caused by gradual decrease of dissolved oxygen level and lowed biological productivity. 3) When during the deposition of the upper Kuanchuanpu Formation corresponding to the Nemakit-Daldynian/Tommotian boundary, the ocean became more disoxic. Sulfate reduction occurred in the sediments and caused the negative spike of inorganic carbon isotopic value.