A unique carbon isotope excursion across the P-Tr boundary in shallow platform, South China: constraining the 2nd phase of the P-Tr biocrisis?

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Whether the Permian-Triassic (P-Tr) mass extinction is single catastrophe or two-phase crisis has long been debated. The first phase (or main) extinction is marked by a 2–4% negative shift of $\delta^{13}C$ worldwide. Afterward, the carbon isotopic excursions either remained stable around a low value or underwent a further negative shifting followed by a positive shift across the 2nd extinction horizon in many sections, coinciding with the *Isarcicella staescheri* conodont zone. The 2nd phase of the P-Tr crisis didn't see a remarkable negative shifting excursion of $\delta^{13}C$, and thus has long been questioned. Here, we report one new P-Tr boundary section located at the eastern margin of the Upper Yangtze Platform (eastern Sichuan Province, South China), in which the uppermost Permian bioclastic limestone is overlain by microbialites that is capped with one 3 cm-thick clay ash bed followed by alternation of marlstone and mudstone of earliest Triassic. The $\delta^{13}C$ values declined 2.3‰ from 2.02‰ to -0.27‰ across the 1st extinction horizon, then further decreased -1.4‰, down to -1.67‰ at the middle of microbialites, then followed by a positive shift, surging to 0.12% in the top of the microbialites. Another dramatic decline of 3.38‰ from 0.12‰ down to -3.26‰ occurred across the possible 2nd extinction horizon constrained by the *I. staescheri* conodont zone. Combining biotic and other geochemical data and correlations with other coeval $\delta^{13}C$ excursions, we suggest that the 2nd, even more dramatic, negative shift of $\delta^{13}C$ was likely caused by volcanism rather than a decrease in biomass.