Ce anomaly evidence for a persistent anoxic Upper Cambrian central Missouri intrashelf basin during the development of SPICE event

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The Upper Cambrian Steptoean Positive Carbon Isotope Excursion (SPICE, ca. 497 to 493 Ma) is characterized by a globally observed positive $\delta^{13}C_{carb}$ excursion with the magnitude range from ~2‰ to ~6‰. Examination of cores across a paleodepth gradient in the Upper Cambrian central Missouri intrashelf basin (United States) reveals a time-transgressive, facies-dependent nature of the SPICE. However, the environmental background behind the SPICE event is uncertain. Here we present Ce anomaly data for carbonates from cores in the Upper Cambrian central Missouri intrashelf basin in order to place constraints on the environmental background for the development of SPICE event. These core samples have previously been characterized for $\delta^{13}C_{carb}$[1]. A total of 142 samples have been analyzed for REE and Ce anomalies. For each sample, we tested two different sample digestion methods: 0.5M HCl and 0.05M HCl. The four cores from the basin margin (TE-1) to the deep basin (LS-1 and HM-1) and to the platform edge (1EE) give average Ce anomalies of 1.23±0.12, 1.21±0.09, 1.14±0.08, and 1.13±0.09, respectively. There is no statistical difference in Ce anomalies across the paleodepth gradient indicating that the central Missouri intrashelf basin was persistently anoxic during the development of the SPICE event. Integrating the $\delta^{13}C_{carb}$ and Ce anomalies data from the four cores, we show that redox condition was not a factor controlling temporal and spatial variations of the SPICE in the central Missouri intrashelf basin. The SPICE event is also associated with a trilobite extinction; our Ce anomaly data suggest the marine anoxia might be an important factor driving this extinction event. We're currently studying $\delta^{238}U$ to characterize the global marine redox conditions behind the SPICE event.

[1] Schiffbauer et al. (2017) Sci. Adv. 3, e1602158.