Geochemical constraints on the origin of Neoproterozoic cap carbonates in the Helan Mountains, North China: Implications for mid-late Ediacaran glaciation

J. YANG[1,2*], T.W. LYONS[2], L.S. HU[1], K.O. ODIGIE[2], S. BATES[2], Z.X. ZENG[1]

[1] School of Earth Sciences, China University of Geosciences, Wuhan, 430074, China (*yangjiecug@qq.com)

[2] Department of Earth Sciences, University of California, Riverside, CA 92521, USA

To better understand the Neoproterozoic glacial events in North China, we investigated five sections along a north-south transect across the Helan Mountains capturing a transition from shelf margin to intrashelf basin. This effort revealed an excellent exposure of Neoproterozoic diamictite and an associated cap carbonate (Zhengmuguan Formation) on the western shelf margin of North China. Based on field observations and high-resolution geochemical analyses of major, trace, and rare earth elements; organic carbon isotopes ($\delta^{13}C_{org}$); and total organic carbon (TOC), we are able to interpret the depositional environments and the possible origin of the cap carbonate. The occurrence of late Ediacaran fossils in the overlying Tuerkeng Formation and variations in the carbonate and organic carbon isotope compositions of the cap carbonate imply that the Zhengmuguan Formation is related to the upper Doushantuo Formation (Member 4) in South China and may represent a mid-late Ediacaran glaciation, possibly postdating the Gaskiers glaciation and synchronous with the Shuram event. These age estimates remain speculative and require additional work. Our geochemical data suggest the Zhengmuguan cap carbonate was initially deposited via glacial meltwater with significant inputs from continental weathering subsequently overprinted by upwelling anoxic deep seawaters along an oxic continental margin. In summary, our data from a poorly known mid-late Ediacaran cap carbonate capture a high-resolution record of shifting climatic and oceanographic conditions of at least regional importance. Specifically, we describe mostly local, strongly continental controls linked to deglaciation that evolved over time to complexly mixed waters reflecting the global DIC expression of the Shuram and isotopically light local DIC from upwelling, anoxic waters impacted by hydrothermal inputs, and DIC from terrestrial inputs.