The precipitation mode of Mn in Cryogenian sedimentary manganese carbonate deposits and its environmental implications

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Black shales deposited during the Cryogenian interglacial period in the Nanhua Basin, South China contain economically important manganese carbonate resources. However, the processes that led to their metallogenesis are poorly understood. Studies have suggested that Mn^{2+} enrichments were generally attained in an O_2-stratified basin [1]. In this scenario, Mn oxyhydroxide precipitated above the redox-cline and sank into deeper water, after which reductive dissolution occurred, releasing Mn^{2+} to the water column. Mn carbonates (rhodochrosite)—hosted in black shales and organic-rich carbonates—are thought to form by diagenetic reaction of this dissolved Mn^{2+} with organically derived bicarbonate in the anoxic zone [2]. Mn carbonates formed by this processes are expected to have significant differences in geochemical characteristics compared to Mn carbonates that derived from Mn^{2+} and CO_3^{2-} directly. In order to study the precipitation mode of Mn in Cryogenian interglacial strata of South China, we measured trace elements and rare earth elements in Mn carbonates. Our results not only provide information on the processes that lead to Cryogenian Mn metallogenesis in South China, but also provide a window into marine redox conditions during the Cryogenian interglacial period. Metazoans are likely to have their roots in the Cryogenian period [3,4], and thus the marine O_2 level during the Cryogenian period is important for understanding the relationship between environmental conditions and the subsequent emergence and expansion of early animals.

Reference: [1] Calvert and Pedersen (1996), Economic Geology 91 : 36–47. [2] Roy (2006), Earth-Science Reviews 77 (4): 273–305. [3] Erwin, et al. (2011), Science 334:1091–1097. [4] Love, et al. (2009), Nature 457, 718–721.