SIMS U-Pb zircon ages and Ni-Mo-PGE geochemistry of the Lower Cambrian Niutitang Formation in South China: Constraints on Ni-Mo-PGE mineralization

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In comparison with previous studies on the Ni-Mo-PGE ore deposits within the deep water Lower Cambrian black shales of the Niutitang Formation around Hunan and Guizhou provinces, this study focused on the shallow water Ni-Mo-PGE enriched layer of the Niutitang Formation around Hubei Province by means of an integrated geochronological, PGE, REE and trace element geochemical study. The results suggest the Ni-Mo-PGE enriched layer has a dominant seawater origin, whereas the Ni-Mo-PGE ore deposits have mixed seawater, hydrothermal and terrigenous origins. Trace metals precipitated from ambient seawater under anoxic-suboxic settings at exceedingly slow sedimentation rates with episodic injections of fresh oxidized seawater.

Organic matter played an important role in sourcing, transporting and precipitating trace metals. However, decay of organic material by means of sulfate reducing reactions and/or fluid reworking overprinted primary relationships with PGE contents. However, the positive linear relationships are clearly shown between organic carbon and trace metal contents. Measuring PGE contents in the sulfate reducing bacteria induced formation of pyrite is expected to explain the nonlinear relationships between organic carbon and PGE contents. New SIMS U-Pb ages constrained the depositional age of the Ni-Mo-PGE enriched layer to be 532-527 Ma, which argues against previous assumption that the anoxic event recorded in the Ni-Mo-PGE took place at the Ediacaran–Cambrian boundary.