Biogeochemical processes in continental slope sediments of the Dongsha Area, South China Sea

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Serving as an indicator or fluid seepage from seabed sediments, cold seeps are ubiquitous along continental margins worldwide. In this study, a 14 m long sediment core (# 973-4) from the Dongsha Area on the northern continental slope of the South China Sea, was investigated to trace the cold seep activity and sedimentary paleo-environmental changes and its consequence for sediment mineralogy, contents of major and trace elements, total organic and inorganic carbon and total TRIS (total reducible inorganic sulfur) and δ³⁴S of sulfide minerals. In addition, planktonic foraminifera were selected for accelerator mass spectrometer carbon 14 (AMS¹⁴C) dating [1]. Furthermore, we identified the strength and effects of cold seep activity and its impact on the underlying seawater redox condition, and finally elucidated the derived force and paleoenvironment constraints of cold seep activity. C-S-Fe geochemistry, δ³⁴S of sulfide minerals and major and trace elements suggest that anaerobic oxidation of methane (AOM) occurred at 619-900 cmbsf (centimeters below seafloor). The δ³⁴S enrichments (up to 23.6 ‰), abundant TRIS contents, high S/C ratios close to the seawater, together with high enrichments of Mo indicate temporal sulfidic methane seep events. Lithological distribution and AMS¹⁴C dating of planktonic foraminifera show that a turbidite (~35ka) is related to a foram-rich interval (440-619 cm) and increased carbonate productivity during the Last Glacial Maximum (LGM). An enrichment of Mo and U was observed accompanied by low contents of other trace and major (Al, Ti, V, Ni, Fe, Mn and Cu) in this interval. The foram-rich interval of cold seep sediments was probably linked to the phenomenon of inconsecutive sedimentary sequence due to the turbidites, which resulted in the lack of Fe, Mn and Ba. Based on the new results, it can be speculated that this area has experienced several episodes of methane seep activity and aerobic oxidation occurring alternatively in the last glacial period which may have been caused by fluctuating non-steady conditions. Further exploration of AOM should focus on the impact of rapid deposition, especially the impact of turbidites on sedimentary biogeochemical processes.

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