

Unique authigenic mineral assemblages and planktonic foraminifera reveal dynamic cold seepage in the Southern South China Sea

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## **Abstract**

Many cold seeps and gas hydrate areas have been discovered at the Southern South China Sea (SCS) in recent years,. However, the characteristics and history of

cold seep areas are poorly studied in the southern SCS. Here, we present the authigenic minerals and stable carbon and oxygen isotopes of planktonic foraminiferal from sediment core 2PC, recovered from the gas hydrate zone in the Nansha Trough of the Southern South China Sea, in order to reveal the dynamic cold seepage in the past. We suggest that the occurrence of authigenic gypsum crystals and pyrite concretions and anomalously negative  $\delta^{13}\text{C}$  values of planktonic foraminiferal can reflect activities of paleo-methane seepage. Two major methane release events were recognized according to remarkable  $\delta^{13}\text{C}$  excursions of foraminifera at depth of 1.5-2.5m and 3.5-3.7m, respectively. The euhedral gypsum crystals and tubular pyrite concretions occurred at the position of the extremely negative  $\delta^{13}\text{C}$  values of planktonic foraminifera, indicating the shift of the sulfate methane transition zone (SMTZ) and the change of methane flux in the past. Overall, these data suggest that authigenic mineral assemblages and the  $\delta^{13}\text{C}$  values of planktonic foraminifera provide a valuable tool to reveal the characteristics of dynamic methane seepage in a marine environment.

**Keywords:** Authigenic gypsum; planktonic foraminifera; Southern South China Sea