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The hydrothermal CH4 and δ^3He anomalies along the Southwest Indian Ridge between 49°E to 56°E

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Hydrothermal activities along the global mid-ocean ridge system play an important role in transferring energy and carbon from the Earth's interior to the ocean. The hydrothermal fluid is distinctly different from the background seawater on its physical and chemical properties and thus it forms hydrothermal plume after it emanated from seafloor. The detection of hydrothermal plume has been an effective method to trace hydrothermal venting sites and discover the associated hydrothermal sulfide deposits.

During Chinese DY21 cruise Leg 7, we conducted five CTD (with methane and turbidity sensors integrated) Toyo profiles between 49°E and 56°E on the Southwest Indian Ridge to detect hydrothermal plumes. Fourteen water samples were selected to analyze helium and neon isotopes. In this paper, we present the concentrations and isotopic compositions of helium of deepwater samples collected during this cruise. Our results show that the 4He concentration varies between 6.59×10^{-7} 2.4×10^{-8}cm^{3}STP/ml and ^{3}He/$_4$He value varies between 1.002Ra 1.492Ra. The maximum δ^3He of 49.2% was found at 49.412°E/37.927°S in the water depth of 2140 m (100 m above the seafloor). Almost all of the δ^3He anomalies correspond to elevated methane concentrations, except for CTD 3. According to the distribution pattern of δ^3He and methane anomalies, it is suggested that at least 6 hydrothermal plumes exist in the investigation area, and an active hydrothermal venting site presents near 49.412°E/37.927°S. This is the first data set of helium isotope for the hydrothermal plume obtained from the SWIR.