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Sulfur isotopic composition of hydrothermal sulfide from Duanqiao hydrothermal filed, the Southwest Indian Ridge: Implications for ore genesis

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The Southwest Indian Ridge (SWIR) extends from the Bouvet Triple Junction(54°50′S, 00°40′W) in the South Atlantic Ocean to the Rodrigues Triple Junction (25°30′S,70°00′E) in the Indian Ocean with a distance of about 8000km, representing more than 10% of the total length of global. It separates the African and Antarctic plates. It is an ultraslow-spreading ridge with a full spreading rate of ∼13-16 mm/yr. The Duanqiao hydrothermal field is situated between the Indomed and Gallieni fracture zones at the central volcano on the Southwest Indian Ridge. Previous studies had suggested the presence of partial melt accompanied by an unusually thick crust (∼9.5 km).
Sulfur isotopes of sulfide in hydrothermal deposits can be used to trace the source and provide important information regarding the mineralization environment and the transport, enrichment and precipitation mechanism of metallic elements. Hydrothermal sulfides were collected by TV grab during the China Ocean Mineral Resources Research and Development Association (COMRA) cruises (DY115-20 and DY125-34) in 2008 and 2015. Fifty-nine subsamples separated from the hydrothermal chimneys show variable δ34S values ranging from +2.42 to +7.97‰ which is more widely than those from the massive sulfides (+4.95 to +5.62‰. The datas are obvious higher than MORB(δ34S=±0‰ and lower than the seawater(δ34S=±21‰. From the inner to outer wall of chimneys, the δ34S value does not show an obvious change. And the sulfur isotope compositions of the Duanqiao hydrothermal filed show no correlation with mineralogy reflect that the S in the sulfide samples is derived mainly from the associated igneous rocks, and a relatively small proportion (11.5-37.9%) of seawater sulfur incorporated into these sulfides during mixing between seawater and hydrothermal fluid. The δ34S values of sulfides are +6.48‰ to +7.96‰ for Longqi hydrothermal filed, -1.38% to +6.02% for Yuhuang hydrothermal filed. Compared with Yuhuang, bacteria-derived sulfur which is calculated to be 10%–25% of the total sulfur component. While in Duanqiao, there is no bacteria-derived sulfur.
Keywords: Hydrothermal sulfide; S isotopes; Duanqiao hydrothermal field; Southwest Indian Ridge