



Zinc and lead isotope variation in hydrothermal deposits from the Okinawa Trough: Insight into metal sources and mineralization characteristics

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The Okinawa Trough is an incipient back-arc basin generated by the subduction of the Philippine plate under the Eurasian continent. Since the first discovery of hydrothermal activity in the Middle Okinawa Trough in 1984, a large amount of hydrothermal fields had been reported gradually. The study of hydrothermal deposits from the Okinawa Trough is of important significance for understanding hydrothermal mineralization characteristics in incipient back-arc basins. Zinc and lead isotope compositions of the hydrothermal deposits from the Okinawa Trough were determined in this study, both of which show large variation. Mixing of Pb derived from local volcanic rocks and sediments in different proportions is the major cause of Pb isotope variation. Compared with the hydrothermal deposits from the Middle Okinawa Trough, samples from the Southern Okinawa Trough contain a larger proportion of sediment-derived Pb. Incorporation of continental crust into the hydrothermal circulation also affected the Pb isotope compositions of hydrothermal sulfides from the Okinawa Trough. The Zn in the Okinawa Trough hydrothermal deposits are mainly sourced from the local volcanic rocks. The data suggest that multiple Zn sources, precipitation temperature and phase separation are unlikely to be important controls on the Zn isotope compositions of hydrothermal deposits from the Okinawa Trough. We propose that the kinetic fractionation during the sphalerite precipitation is the primary control on Zn isotope variation. Zinc isotopes may be of potential use in ore exploration and discovery of new active hydrothermal vents.