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Quantitative prediction and evaluation of seafloor hydrothermal sulfide resources in the Indian Ocean

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Seafloor hydrothermal sulfide resources have attracted significant attention as a potential seabed mineral resource due to their high grade of precious metal elements, such as Cu, Zn, Pb, Au, and Ag. In 2011, the China Ocean Mineral Resources Research and Development Association and International Seabed Authority signed a contract for exploration 10,000 km^2 of a hydrothermal sulfides area located on the Southwest Indian Ridge, and only 25% of the area will be permitted to retain in 2021(Hannington et al; Tao et al). The best approach for rapidly and accurately searching for seafloor hydrothermal sulfide resources has become a top priority.

According to the quantitative prediction theory and the exploration status of seafloor sulfides, we systematically proposes a quantitative prediction evaluation process of oceanic hydrothermal sulfide resources and divides it into three stages: prediction in a large area, prediction in the prospecting region, and the verification and evaluation of targets(Ren et al). This paper mainly focuses on the first stage and select the Indian Ocean to be the prediction area.

Indian Ocean, the youngest oceans on earth, is located between Asia, Oceania, Africa and Antarctica, accounting for about 20% of the world's total area of the sea. It belongs to super slow spreading mid-ocean ridge(Dick and Schouten). The dynamic volcanic and tectonic activity in some segments make it possible for hydrothermal systems to have heat and fluid flow channels. Ore-forming factors are collected from topography, geology, geophysics, and several other related aspects. We obtain the key prediction factors that exhibit the greatest relevance to the formation of sulfide deposit to derive a favourable metallogenic combination. By employing the method of weights-of-evidence, the prediction result suggests that the SWIR and the junction of trigeminal ridges yield a relatively high value, which can be selected as a promising prospecting region. Known hydrothermal areas such as Mt. Jourdanne, area A , Edmond and Kariei are all located in the areas with high posterior probability value. It also illustrates that the predicted result possesses a superior reliability. The Chinese contract area is located in the central SWIR, where the value of posterior probability is significant; this finding indicates superior prospecting potential and an accurate and meaningful selection of its location. By narrowing the exploration area and improving the exploration accuracy, the prediction will provide a basis for the further exploration of seafloor hydrothermal sulfide resources.

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