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The effects of later oxidation and weathering process on the seafloor hydrothermal sulfide: Constrains from Cu isotope

Xiaohu Li, Jianqiang Wang, Fengyou Chu, Hao Wang, and Zhenggang Li

Key Laboratory of Submarine Geosciences, Second Institute of Oceanography, State Oceanic Administration, Hangzhou, China (xhli@sio.org.cn)

Abstract: Significant Cu isotope fractionation occurs during the mineral deposit and oxidative weathering processes of modern seafloor hydrothermal sulfides. In this study, we report the new Cu isotope compositions of Cu-rich and Zn-rich sulfides and oxidation products collected from hydrothermal fields along the South Mid-Atlantic Ridge 13-15°S for the first time. The results show that the δ65Cu value of the sulfides and oxidation products range from -0.58‰ to +1.36‰ and averages δ65Cu=+0.31±0.04‰ (n=17, 2sd). The Cu-rich sulfides have a slightly light Cu isotope composition with average δ65Cu=+0.37±0.05‰ (n=5, 2sd), whereas the Zn-rich sulfides are relatively enriched in heavy Cu isotope with average δ65Cu=+0.80±0.03‰ (n=6, 2sd). Comparing with Cu-rich and Zn-rich sulfides, the oxidation products are most enriched in light isotopes with average δ65Cu=-0.23±0.03‰ (n=6, 2sd). The significant enrichment of the light Cu isotope in the oxidation products indicates that Cu isotope fractionation during the subsequent leaching alteration of seawater, whereas the relatively high δ34S value (up to 14.5‰ of oxidation products also reflect the relatively large contribution of sulfate reduction S coming from the seawater. We think that the light Cu isotope composition of the oxidation products indicate the significant effects of seawater weathering processes on the Cu isotope composition. The sulfide and oxidation products from the seafloor hydrothermal fields with a significant light Cu isotope composition also could be a light output sink to explain the heavy Cu isotopic composition of the oceans.