Copper and Zn isotope compositions of altered oceanic crust from IODP Site 1256 at the East Pacific Rise

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High-precision Cu and Zn isotope analyses have been carried out on 44 altered basalts and gabbros from the IODP Site 1256. These samples cover six sections of the altered oceanic crust (AOC) at the East Pacific Rise and have variable Cu (13-200 ppm) and Zn (27-238 ppm) concentrations.

The AOC display heterogeneous Cu and Zn isotope compositions, with δ^{65}Cu ranging from -0.50 to 0.90‰ and δ^{66}Zn from -0.09 to 0.55‰, respectively. Specifically, the altered basalts that experienced low-temperatuure (<250 ºC) hydrothermal alteration, have mantle-like δ^{65}Cu (0.08 ± 0.10‰, 2SD, n = 29) and δ^{66}Zn (0.26 ± 0.11‰, 2SD, n = 27) values. By contrast, the altered basalts and gabbros at the lowermost sheeted dike and upper plutonic section, which suffered high-temperature (>250 ºC) hydrothermal alteration, show large variations in δ^{65}Cu (-0.50 to 0.90‰) and δ^{66}Zn (0.21 to 0.55‰) values. These results suggest that Cu and Zn isotope fractionation is limited during hydrothermal alteration of oceanic crust at low temperatue, while alteration of oceanic crust by high temperature hydrothermal fluids can result in prominent Cu and Zn isotope fractionation. The lack of correlation between Cu and Zn isotopes suggests that the variations in δ^{65}Cu values could be partialy attributed to Cu isotope fractionation during redox reactions associated with high temperature hydrothermal alteration of oceanic crust.