Rapid growth of mineral deposits at artificial seafloor hydrothermal vents

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Seafloor massive sulfide deposits are potential resources for base and precious metals (Cu-Pb-Zn±Ag±Au), but difficulties in estimating precise reserves and assessing environmental impacts hinder exploration and commercial mining. Here, we report petrological and geochemical properties of sulfide chimneys less than 2 years old that formed where scientific boreholes vented hydrothermal fluids in the Iheya-North field, Okinawa Trough, in East China Sea [1,2]. One of these infant chimneys, dominated by Cu-Pb-Zn-rich sulfide minerals, grew a height of 15 m within 25 months [2,3]. Portions of infant chimneys are dominated by sulfate minerals. Some infant chimneys are sulfide-rich similar to high-grade Cu-Pb-Zn bodies on land, albeit with relatively low As and Sb concentrations [3]. The high growth rate reaching the 15 m height within 25 months is attributed to the large hydrothermal vent more than 50 cm in diameter created by the borehole, which induced slow mixing with the ambient seawater and enhanced efficiency of sulfide deposition [2,3].

These observations suggest the possibility of cultivating seafloor sulfide deposits and even controlling their growth and grades through manipulations of how to mix and quench hydrothermal fluids with the ambient seawater. We are now planning to install the "*Kuroko-ore cultivation appratus*" equipped with sensor loggers for pressure, tempersutre, flow rate and precipitation weight at two hydrothermal sites in the Okinawa Trough during the CK16-01 Cruise by D/V Chikyu.

[1] Takai, K. et al. (2012) *Sci. Drill.*, **13,** 19-27.
[2] Kawagucci, S. et al. (2013) *Geochem. Geophys. Geosys.*, **14,** 4774-4990
[3] Nozaki, T. et al. (*in press*) *Sci. Rep.*, **xx,** xxx-xxx.