Actively forming Kuroko-type VMS mineralization at Iheya North, Okinawa Trough, Japan: new geochemical, petrographic and δ34S isotope results

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In 2010, Integrated Ocean Drilling Program (IODP) Expedition 331 drilled five sites in the Iheya North hydrothermal field in the central Okinawa Trough back-arc basin, Japan. Hydrothermal alteration and sulfide mineralization is hosted in a geologically complex, mixed sequence of coarse pumiceous volcaniclastic and fine hemipelagic sediments, overlying a dacitic to rhyolitic volcanic substrate. At site C0016, located adjacent to the foot of the actively venting North Big Chimney (NBC) massive sulfide mound at a depth of 985 metres below sea level (mbsl), massive sphalerite-(pyrite-chalcopyrite±galena)-rich sulfides were recovered (to 30.2 % Zn, 12.3 % Pb, 2.68 % Cu, 33.1g/t Ag and 0.07 g/t Au). Sulfide mineralization shows clear evidence of formation through a combination of surface detrital and subsurface chemical processes, with at least some sphalerite precipitating into void space in the rock.

Mineralization and alteration assemblages are consistent with the Iheya North system representing a modern analogue for Kuroko-type VMS mineralization. Fluid flow is focussed laterally along pumiceous volcaniclastic strata (compartmentalized between impermeable hemipelagic sediments), and vertically along faults. The abundance of Fe-poor sphalerite and Mg-rich chlorite is consistent with the lower Fe budget of felsic-hosted hydrothermal systems worldwide. $\delta_{34}S$ values in pyrite are similar to NBC vent fluids, decreasing systematically away from the main hydrothermal mound in Mg-chlorite altered lithologies. No systematic variation in $\delta_{34}S$ was observed with depth, other than in the uppermost (i.e. least altered and coolest) levels at site C0014, where the influence of hydrothermal activity is considered to be minimal.