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Copper isotope analysis of fore-arc basalt and boninite glasses from the Bonin fore-arc system, IODP Expedition 352.

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Copper (Cu) deposits related to subduction zones account for some of the largest and most abundant sources of Cu on the globe. The processes of forming these deposits through hydrothermal alteration, magmatism and later meteoric/sea water mobilisation are relatively well understood. However, the origins of the Cu before formation of a deposit are less clear, whether this is recycled from a down-going plate or taken from the upwelling mantle. Investigating the Cu isotope ratio of rocks which are thought to be progenitors of Cu deposits, may give insights into how Cu is first concentrated. Fore-arc basalts (FAB) and boninites from IODP Expedition 352, which drilled the Bonin fore-arc provide a case study for observing the potentially shifting origins of Cu during subduction initiation. Fresh volcanic FAB and boninite glasses from IODP Expedition 352 should retain a Cu isotope signature reflecting the origin of the Cu from either mantle (unfractionated $\delta^{65}Cu \approx 0$) or show a fluid related signature (expressing a wide range of $\delta^{65}Cu$ values). Previous work shows FAB lack obvious subduction signatures and have a large range of Cu concentrations (128 to 186 ppm,) the higher concentration of Cu unique as it is high despite sulphur saturation. FAB are mantle derived and have had little slab involvement, indicating that glass FAB $\delta^{65}Cu$ values should be within in a small range close to 0, however a variation from this may indicate a subducting plate influence. Boninites however have been shown to possess a smaller range of Cu (66 to 100 ppm) and elevated fluid mobile/immobile ratios compared to the FAB, indicating input of slab material and thus their $\delta^{65}Cu$ may reflect fluid transport from the down going slab. Performing Cu isotope analysis on the fresh volcanic glasses is key to avoiding alteration which can affect primary Cu isotope ratios. New analysis of Cu isotopes currently in progress will allow comparison of Cu isotopic compositions between FAB and boninite and along with economically viable ore deposits. This will be significant in assessing whether Cu is added to a subduction zone from a down going slab or ultimately a mantle feature.