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# Preliminary Insights from the Fe Isotope Compositions of Garnets in the Tibes Skarn, Puerto Rico

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Iron (Fe) is abundant in Earth's crust and is crucial in supporting the transition towards green technology. Iron is extracted from many ore deposits including skarns, which form through metasomatic processes when a magmatic body intrudes permeable host rocks like carbonate. Iron isotope fractionation can be caused by the processes that take place during skarn formation, such as redox changes, fluid exsolution, mineral precipitation, and more. Therefore, Fe isotopes have been a useful tool to illuminate ore-forming processes in skarns and to determine the source of Fe ore. However, little work has been done using the Fe isotope composition of garnets, a common mineral in skarns. The geochemical behavior of trace elements in garnets is well established to reflect the evolution of fluids during crystal mineralization, and the application of Fe isotopes in garnets could provide an additional tool for investigating ore formation processes and conditions. The objective of this study is to assess whether the Fe isotope composition of garnet can serve as a tool to understand fluid conditions and evolution during skarn formation by analyzing well-characterized garnets from the Tibes skarn in Puerto Rico.

We present bulk Fe isotope compositions of 17 garnets from across the Tibes skarn to characterize variation within (intra) and between (inter) samples. Intrasample variation was assessed by analyzing garnets of varied grain sizes within a single sample. The data shows no significant variation in the bulk $\delta^{56}$Fe values. Intersample variation was assessed by analyzing garnets from three populations within the Tibes skarn: garnet associated with magnetite ore, marble, and hornfels. The variation in bulk garnet $\delta^{56}$Fe (relative to IRMM-14 ±2SD) across these populations ranged from -0.12 ±0.03‰ to +0.12 ±0.06‰. Garnet associated with magnetite has relatively higher $\delta^{56}$Fe values compared to the garnet associated with marble and hornfels host rock. These data present an initial look at the Fe isotope compositions of garnets of the Tibes skarn and suggest that bulk $\delta^{56}$Fe values of garnets can trace fluid-rock interaction during skarn formation. To further test this hypothesis, ongoing work includes trace element geochemistry, isotope analysis (bulk and microdrilled), petrography, and field work.