

Distinguishing carbonatite from sedimentary carbonate rocks in the Dong Pao REE deposit, NW Vietnam

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The Dong Pao rare earth element (REE) deposit in northwest Vietnam demonstrates mineralization of REE-fluorocarbonates, barite and fluorite. Although it has been proposed that carbonatite might have contributed to the ore formation [1], carbonatite has not yet been differentiated from the regional sedimentary carbonate rocks for analyses.

This study made the first attempt to finely categorize the wide variety of carbonate rocks at the Dong Pao deposit according to their mineral assemblages. We employed multiple tools, including mineral association, carbonate geochemistry and carbon-oxygen isotopes along with geochemistry of accessory apatite, to constrain their origins.

Calcite in a calcite-barite-tainiolite assemblage shows high Sr content (SrO~3 wt. %), elevated REE (Σ REE+Y~1400 ppm) and relative enrichment of LREE over HREE (chondrite-normalized La/Lu~130). The assemblage also contains an accessory amount of pyrochlore and apatite with high Sr content (SrO~3.5 %wt) and Sr/Mn ratio (>100:1). Carbon-oxygen isotopic analyses conducted on the calcite give $\delta^{13}\text{C}$ values -4.7~-2.7‰VPDB and $\delta^{18}\text{O}$ values +9.3~+12.5‰VSMOW, with half of the analyses clustered between -4.7~-4.4‰VPDB and +9.3~+9.8‰VSMOW. Combining the evidence from mineralogy, geochemistry and isotopic composition, such carbonate is distinct from the regional sedimentary carbonates and is likely to represent a carbonatitic component in the deposit.

[1] Fujii *et al.* (2010). *Shigen-Chishitsu* **60**, 59-70. (In Japanese with English abst.).