Carbonate Fluorescence and Carbonate Stable Isotopes Footprint around Ferrobamba Cu-Skarn, Southern Peru

M. AMOS GARAY[1*], BENJAMIN ANDREW[2], DAVID R. COOKE[1], SHAUN BARKER[2].

[1]TMVC Research Hub, University of Tasmania, Australia. (*correspondance: magaray@utas.edu.cu)
[2]University of Waikato, Hamilton, New Zealand.

Skarns in the Las Bambas district of southern Peru, are hosted by marine sedimentary sequences deposited during the Cretaceous. These sedimentary rocks were intruded by the Andahuaylas-Yauri batholith in the Eocene-Oligocene [1]. A series of plutons, stocks and dikes emplaced into limestones generated skarn alteration and copper mineralization at three main porphyry-skarn mineralization centres: Ferrobamba (1,351 Mt @ 0.62%Cu), Chalcobamba (315 Mt @ 0.57%Cu) and Sulfobamba (184Mt @ 0.62%Cu) [2].

Calcite veins around Ferrobamba have three different short-wave ultra-violet fluorescent colours: blue, pink, and bright white. Carbon and oxygen isotope analyses have shown that the fluorescent response of calcite varies systematically with its isotopic compositions.

Blue fluorescent calcite has high $\delta^{13}C$ and high $\delta^{18}O$, similar to the isotopically unaltered limestones and marbles. Pink fluorescent calcite has low $\delta^{13}C$ and low $\delta^{18}O$, consistent with carbonate veins derived from magmatic-hydrothermal fluids. A continuous array of carbonate isotope composition from depleted C^{13} and O^{18} at the centre of Ferrobamba, to enriched C^{13} and O^{18} on the margins of the deposit, defines an isotopic halo 5 x 3 km in size around Ferrobamba.

This broad zoned pattern is disrupted by bright white fluorescent calcite, which has anomalous low $\delta^{13}C$ and high $\delta^{18}O$ values. This variety of calcite is related to late breccias with low-temperature smectite alteration.

The high $\delta^{13}C$-high $\delta^{18}O$ to low $\delta^{13}C$-low $\delta^{18}O$ trend is the result of the interaction between magmatic water and the limestones. Whereas, the low $\delta^{13}C$-high $\delta^{18}O$ signature is the product of a cooling magmatic-hydrothermal fluid that didn't undergo water-rock interaction.

[1] Perelló et al. (2003) *Economic Geology* 98, 1575-1605.
[2] www.mmg.com.