

Apatite and Epidote as Geochronometers for Mineralization in the Sanchez Porphyry Cu(-Au-Mo) Deposit, Safford District, Arizona

Casey Tackett^{1,2}, Marta Codeço¹, Mark Barton¹, Jason Kirk¹, Simone Runyon²

¹The University Of Arizona, Tucson, United States, ²Freeport-McMoRan, Tucson, United States

The Sanchez Cu(-Au-Mo) deposit forms part of the Safford District, a major porphyry district that also includes the Dos Pobres, San Juan, Lone Star, Horseshoe, and Red Dyke deposits. The Sanchez deposit is hosted by Cretaceous andesitic rocks (73.3-67.6 Ma) that are crosscut by Paleocene quartz monzonite porphyry dikes dated at 56-55 Ma. Although the mineralization is associated with the Laramide porphyry intrusion, its age remains unknown.

We characterized samples along a transect of five drill holes from the Sanchez using optical microscopy and scanning electron microscopy (SEM) and identified hydrothermal apatite and epidote grains for trace-element and U-Pb isotope measurements via in situ laser ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS). Our preliminary results show that in mineralized samples, apatite and epidote exhibit higher U concentrations than in unmineralized samples. The ages obtained yielded $\sim 51.2 \pm 3.6$ (n=49) Ma for epidote and $\sim 52.7 \pm 4.3$ (n=90) Ma for apatite, placing mineralization contemporaneous or shortly after the quartz monzonite porphyry dikes intruded the andesite host.

Although no TIMS-dated epidote standards yet exist, allanite from the Tucson Mountains was used as a primary standard (LA-ICP-MS U-Pb ages on allanite and associated zircons with a mean age of 73.5 ± 0.1 Ma, which was used for matrix-matched U/Pb corrections). Given the appreciable uranium content in many of these samples, epidote U-Pb LA-ICP-MS has strong potential for geochronology, especially in porphyry deposits where epidote is a widespread alteration mineral. Furthermore, the distinct overlap between apatite and epidote confirms the method's robustness and its potential as a new geochronometer for understanding the temporal evolution of the Sanchez deposit and of porphyry deposits more broadly.