

Constraints on the emplacement of the Fortuna Granodiorite, Chuquicamata Mine, ChileAlexandra M. Arnott¹, M.C. Graves², P. Reynolds¹ and M. Zentilli¹¹*Department of Earth Sciences, Dalhousie University, Halifax, Nova Scotia B3H 3J5, Canada*²*Cuesta Research Limited, 154 Victoria Road, Dartmouth, Nova Scotia B3A 1V8, Canada*

Chuquicamata, Chile, is the largest open-pit porphyry copper mine in the world. A near-vertical regional fault (Falla Oeste) sharply truncates the mineralization within the Chuquicamata pit. West of Falla Oeste is the Fortuna Granodiorite. Nearly one-third of the rock mined from the pit is the Fortuna Granodiorite, a relatively unaltered, unmineralized granitoid, the origin of which is debated. It has been proposed that the Fortuna Granodiorite represents the uplifted root of the Chuquicamata porphyry system. Other workers have referred to it as a co-magmatic precursor for the Chuquicamata mineralized porphyries.

In an attempt to understand any relationships between the Fortuna Granodiorite and Chuquicamata porphyries an integrated study of geochronology, geobarometry and geochemistry has been initiated. The detailed step-wise degassing of ³⁹Ar and ⁴⁰Ar from K-feldspar and hornblende indicates that the mineralized Chuquicamata porphyry is 2 to 4 mil-

lion years younger than the Fortuna Granodiorite exposed in the pit.

Amphibole geobarometry shows the Fortuna Granodiorite was intruded at depths of less than 6 km. Whole-rock geochemistry shows the Fortuna Granodiorite and Chuquicamata porphyries have similar compositions, which is expected since the rocks formed in a similar tectonic environment and they are of similar ages. However, the Fortuna Granodiorite is enriched in LREEs with slightly elevated HREEs compared to the Chuquicamata porphyry.

The Fortuna Granodiorite is not a root zone nor a co-magmatic precursor intrusion for the Chuquicamata porphyry copper system. This is consistent with recent work by others suggesting that the motion along Falla Oeste was strike-slip with tens of kilometres of displacement.