

Economic Geology

BULLETIN OF THE SOCIETY OF ECONOMIC GEOLOGISTS

VOL. 101

November 2006

No. 7

U-Pb Zircon Geochronology of Granitic Rocks from the Chuquicamata-El Abra Porphyry Copper Belt of Northern Chile: Excimer Laser Ablation ICP-MS Analysis*

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Abstract

This study reports the results of a comprehensive geochronological study of Tertiary plutonic rocks in the Chuquicamata-El Abra porphyry copper belt of northern Chile. Zircon U-Pb isotope ages of 22 intrusions from the composite Los Picos-Fortuna-Pajonal-El Abra igneous complex, Radomiro Tomic mine, and Opache prospect were determined by excimer laser ablation-inductively coupled plasma-mass spectrometry (ELA-ICP-MS). The dated samples from the Pajonal-El Abra complex show a continuous age range from 42.7 to 37.2 Ma, indicating that the intrusions were emplaced over a period of at least 5.5 m.y. Only the youngest of these, the El Abra mine porphyry, is ore bearing. The five units that were dated from the Los Picos-Fortuna complex range in age from 42.3 to 38.0 Ma and none host significant economic mineralization. An increase in the abundance of inherited zircons with decreasing age in the intrusive rocks is interpreted to indicate that magmatic activity in the source region of the Los Picos-Fortuna-Pajonal-El Abra igneous complex increased steadily from about 55 Ma.

The five dated units from the Los Picos-Fortuna igneous complex have the same age, within analytical uncertainty, as petrologically equivalent units in the Pajonal-El Abra complex to the north, supporting the correlation suggested by previous workers. Because these complexes are now on opposite sides of the West fissure and separated by 35 km, the correlation constrains the net sinistral displacement on the fault subsequent to ca. 33 Ma.

Ore-bearing porphyries at Chuquicamata, El Abra, Radomiro Tomic, and Opache span an age range of almost 5 m.y. from 37.9 to 33.3 Ma. The ore-bearing intrusions of the Chuquicamata Igneous Complex are 3.5 m.y. younger than the youngest intrusions of the Los Picos-Fortuna-Pajonal-El Abra igneous complex, which makes it unlikely that they are genetically related. The Opache porphyry, on the other hand, which is on the same side of the West fissure as the Los Picos-Fortuna complex and has the same age as the El Abra mine porphyry, could have formed during the final stages of crystallization of that complex.

*A digital supplement to this paper is available at http://segweb.org/EG/papers/Abs_101-7_files/CampbellAppendix.pdf.

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