MAGM-4: Magmatismo fértil y estéril en los Andes: descubrimientos recientes

Assessing magma fertility through platinum group geochemistry from Polo Sur and Penacho Blanco porphyry copper deposits, Centinela District, Northern Chile

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The Centinela District, located in northern Chile, is part of the Middle Eocene to Early Oligocene metallogenetic belt[1]. It is host of several mineralized porphyries, including both Cu-only and Cu-Au deposits dated between 39-45 Ma[2]. This study mainly focusses in Polo Sur and Penacho Blanco porphyry copper deposits with the objective to assess the fertility of Cu and Au of magmas that are related to their formation using platinum group elements (PGE). Recent advances in PGE geochemistry are allowing analysis of these elements at the ultra-low concentrations[3] in which they are found in felsic rocks. These elements have been demonstrated to be sensitive indicators of sulfide saturation due to their high partition coefficient into sulphide melts and low mobility in hydrothermal fluids[4,5]. If a parent magma reaches early sulphide saturation, an immiscible sulfide melt will form, that will extract chalcophile metals (as Cu and Au) and trap them in the bottom of the chamber so that they cannot enter the volatile ore-forming phase. In contrast, if the sulfide saturation occurs close to the time of volatile saturation, most of the metals will be available to enter the fluid phase and form an economic Cu or Cu-Au deposit. This work comprises the analysis of 30 samples from porphyries and intrusives related with the mineralization, mainly taken from Polo Sur and Penacho Blanco areas, which were analysed for major and trace elements. A subset of samples, selected according to their composition, are being analysed for PGE geochemistry to identify at what point in the evolution of the magma sulphide saturation occur. Future work will include zircon geochemistry by LA-ICP-MS to identify the conditions of the magmas during their evolution. This study seeks to contribute to the understanding of how Cu and Au behave during the magmatic evolution and which factors control the formation of economic porphyry copper deposits. This may help to distinguish between fertile and barren system at an early stage of exploration. [1] Sillitoe, R.; Perelló, J. 2005. 100th Anniversary Volume: 845-890. [2] Mpodozis, C.; Cornejo, P. 2012. Economic geology. Special Publication 16: 329-360. [3] Park, J.; Hu, Z.; Gao, S.; Campbell, I.; Gong. H. 2012. Geochimica et Cosmochimica Acta. Vol. 93: 63–76. [4] Mungall, J.; Brenan, J. 2014. Geochimica et Cosmochimica Acta. Vol. 125: 265-289. [5] Park, J.; Campbell, I.; Kim, J. 2016. Geochimica et Cosmochimica Acta. Vol. 174: 236–46.