Metal fluxing in a large-scale intra-arc fault: Insights from the Liquiñe-Ofqui Fault System in southern Chile

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High-enthalpy geothermal systems and epithermal Au deposits are genetically linked to active volcanism and shallow magmatic reservoirs, overlying hydrothermal circulation cells, and structural meshes that permit vertical migration of fluids. In the Andean Cordillera of Southern Chile (37-46ºS), the volcanic and hydrothermal activity is controlled by the 1,200 km long NNE-trending intra-arc dextral strike-slip fault Liquiñe-Ofqui Fault System (LOFS), with second-order intra-arc anisotropies of overall NE-SW (extensional) and NW-SE (compressional) orientation. Although it has been recognized that volcanism in this segment is controlled by the regional-scale tectonic stress field, the structural controls on magma degassing and metal fluxing remains poorly constrained. Furthermore, this segment is characterized by a relative paucity of occurrence of hydrothermal ore deposits, compared with the northern and central part of the Chilean Andes (~19-34ºS).

The goal of the study is to test the structural and tectonic controls on the source and transport of volatile components, noble and base metals and metalloids in geothermal fluids from active systems along this segment. For this purpose, we coupled the major and trace element geochemical data of goethermal fuids and volcanic fumarole condensates with isotopic ratios of noble gases (He, Ar) and stable isotopes of C and N isotopes of 25 thermal manifestations occurring along extensional and compressional structures of the LOFS.

The helium isotopic ratios, defined as R/Ra, range between 3.5 and 7.5 in the studied segment. Concentrations of Cu, As, Zn and Pd are significant in thermal springs along NWN-oriented systems (8.5 ppb, 3900 ppb, 210 ppb and 2 ppb respectively), showing that, increased metal budgets in this segment correlate with structures that also control the occurrence of high-enthalpgy geothermal reservoirs.