Direct insights into the role of deep crustal magma differentiation in determining magma fertility for magmatic-hydrothermal ore genesis

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Context

Storage and differentiation of magmas at deep crustal levels at convergent plate margins is thought to play an important role in determining magma fertility for magmatic hydrothermal ore genesis. Processes occurring in the lower crust; however, are most commonly inferred based on geochemical systematics observed in arc volcanics. Unique circumstances are required for direct sampling of the crystallization products of arc magmas formed in the deep crust as they either have to be tectonically exposed or transported to the surface in the form of xenoliths. This project will focus on the Mercaderes xenolith suite in Colombia, which provides perhaps the greatest diversity of mantle and lower crustal rocks in a recently active continental arc segment. The main goals are to assess the key characteristics of magmatic sulfide saturation in the lower crust and the subsequent fate of such sulfide phases and their metal budget, as well as to evaluate how this impacts the chalcophile metal and volatile element budget of derivative magmas. For this purpose, magmatic sulfide and silicate melt inclusions will be investigated in mafic to ultramafic cumulate xenoliths and in their metamorphosed counterparts. The results will help understand how deep crustal magma differentiation affect key variables that regulate ore fertility such as volatile element and ore metal abundances, as well as magma redox state.

Aims and Methods

Careful selection of the best-suited xenoliths will be followed by detailed petrographic and *in situ* geochemical investigation to determine their origin, and to locate magmatic sulfides and potentially also silicate melt inclusions. These will subsequently be analyzed for volatile (S, Cl), chalcophile and highly siderophile element concentrations by Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS). The data will be interpreted by using model calculations to understand how much of the chalcophile and highly siderophile element budget of the magma was controlled by magmatic sulfides, and what fraction of these sulfide phases was retained in the lower crust. Furthermore, it will be assessed if sulfides and their metal budget may be subsequently remobilized during reheating and partial melting and/or metamorphic recrystallization.

References

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Website

http://minresunige.ch/

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Prerequiste

None.