Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18159

Modes and impact of crustal contamination: Example of the Sondalo gabbroic complex (Central Alps, SE Switzerland - N Italy)

MÉRÉDITH MORIN, BENOIT PETRI AND MARC ULRICH

Institut Terre et Environnement de Strasbourg (ITES-UMR7063), Université de Strasbourg/EOST, CNRS

Presenting Author: meredithmorin@unistra.fr

Magmatic differentiation requires a variable combination of fractional crystallization and crustal contamination that influence the liquid line of descent and the final paragenesis of magmatic rocks. However, the vectors of crustal contamination and how they influence magmatic differentiation remain poorly constrained. Several processes have been already invoked in the literature: (1) small-scale diffusion; (2) energetically costly partial melting of crustal material coupled with magma hybridization; (3) dissolution of crustal rocks by reactive bulk assimilation. Instead of focusing on deepest crustal levels, we here explore crustal contamination processes active in intermediate continental crust. We use the example of the Sondalo gabbroic complex (SGC) that intruded the metasedimentary Campo unit, both exposed in Central Alps.

The SGC is a Permian intrusion initially of a tholeiitic affinity (troctolite and norite) that evolved towards calc-alkaline intermediate bodies (diorite and granodiorite). Mafic melts intruded the Campo unit composed of fertile amphibolite-facies micaschist and paragneiss, attesting of a pre-intrusion (presumedly Carboniferous) prograde metamorphism. The emplacement of the SGC caused a HT-contact metamorphism reaching partial melting of host rocks and forming in-situ granulite-facies restite composing large septa. Field and petrological observations coupled with geochemical bulk rock major and trace element analyses show the contribution of host-rock contamination, by: (1) mafic magmas of tholeiitic affinity becoming progressively calc-alkaline; (2) the increase in modal amount of garnet, biotite and cordierite in magmatic rocks around metasedimentary septa; (3) liquid line of descent departs from theoretically predicted compositions with enrichment in elements typical for crustal rocks (i.e., K_2O and Al_2O_3 at high Mg#).

Field observations and bulk rock major and trace element compositions highlight that crustal contamination is achieved through a combination of vectors having a variable spatial extent. However, their respective weight remains difficult to constrain. Middle crust seems to be the ideal location for crustal assimilation because host-rocks are fertile and mafic magmas benefit from a high and durable thermal regime that appears to favor physical and chemical interactions. Further constraints will be brought by in-situ trace element analyses and Sr-Nd isotopes to estimate their respective influence on hybridization.