

H₂O contents in primary arc magmas in the Alps (Adamello, Italy)

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Context

The Adamello massif in Northern Italy is the biggest pluton of Eocene age in the Alps and is characterized by calc-alkaline plutonic rocks and dikes. Recent studies showed that the primary magmas might be 'superhydrous', e.g. containing more than ~6wt% H₂O. This is controversial and the determination of primary H₂O contents in melts is analytically challenging. In this Masters thesis, we approach the problem from a different perspective, by analysing H₂O in near-primary minerals (olivine, cpx, plagioclase) in ultramafic cumulates such as olivine clinopyroxenite and wherlites. By using known experimental partitioning of H₂O between silicate melt and minerals, we will be able to determine the H₂O content of primitive magmas.

The outcrops of suitable rocks are between about 2200 and 2800 meters a.s.l. in a beautiful landscape in the Southern Adamello (Val Caffaro). There are two mountain huts (Rifugio Tita Secchi) in the vicinity of the outcrops. The terrain is rough but provides excellent exposures. Excellent geological maps exist. Eventually 2 Masters thesis on different subjects possible.

Objectives and Methods

The planned work will include field sampling (July to mid-september possible) on the relationships between ultramafic cumulates and surrounding olivine gabbros, and will include analytical work in the lab and petrologic modelling.

(1) Sampling in detail the ultramafic cumulates and olivine gabbros, establishing a petrological context, with special emphasis on field relations. (2) Thin section work, geochemical analysis (bulk rocks, mineral chemistry) (3) Study of olivine, cpx and plagioclase, detailed major and trace element chemistry by LA-ICP-MS, FTIR and SIMS (4) development of petrological models to understand the H₂O content of the minerals and the melts from which they crystallized, Impact on the deep Earth water cycle

Literature

Callegari and Brack (2002), Geol Map Adamello, Explanatory Notes. Mem Sci Geol. 54, 19-49. Ulmer et al., (1983) Mem Soc Geol.It 26, 171-222, Müntener et al. 2021 Elements 17/1

Ultramafic cumulates within gabbros



Olivine gabbros and anorthosite (Blumone)



Choice of orientation :

Orientation GATO (Geochemistry, Alpine tectonics, Ore Deposits): Modules: Magmatic Petrology, Volcanology, Isotope Geochemistry, Computational tectonics, Analytical Toolbox ...