Patti Territoriali
per l'Alta Formazione delle Imprese

WATER-ROCK INTERACTION IN THE POLLINO MASSIF, BASILICATA: ENVIRONMENTAL GEOCHEMICAL MODELING

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INTRODUCTION

The Pollino Massif constitutes a geodynamically significant sector of the southern Apennines (Fig.1), where the Frido Unit crops out with metasedimentary sequences and an ophiolitic complex dominated by serpentinites[1]. These ultramafic lithologies act as natural reservoirs of potentially toxic elements, whose mobility is governed by weathering and water–rock interaction processes[2]. The project aims to develop a geochemical model describing the dissolution and ion-exchange mechanisms that control PTE mobility and to identify the areas characterized by higher geochemical reactivity.

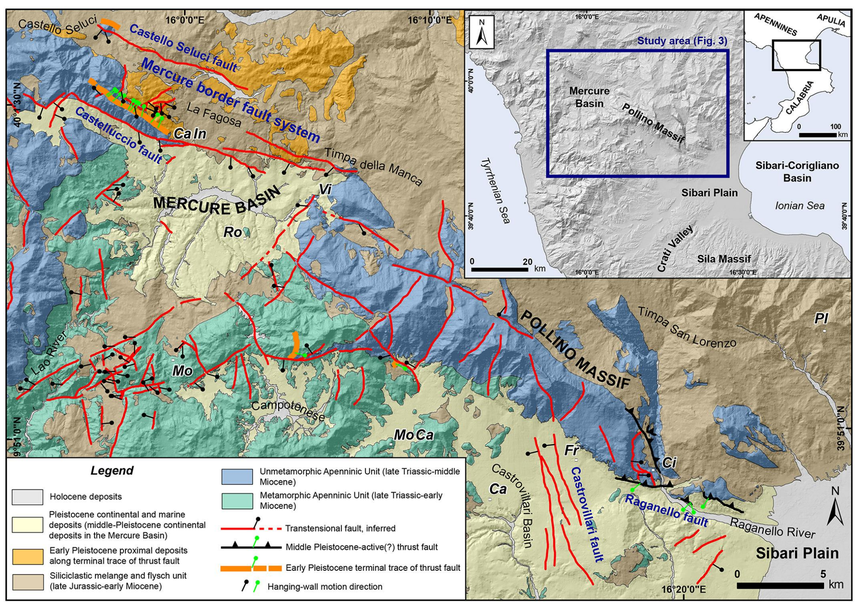

Fig.1 The Culmination of an Oblique Time-Transgressive Arc Continent Collision: The Pollino Massif between Calabria and the southern Apennines. After Filice (2019) [3]

METHODS

Solid matrix

Soil sampling was carried out on serpentinite outcrops in the Iacolinei and Cerri di Luzio areas, where four weathering profiles were selected for detailed study. Analytical work includes thin-section optical microscopy, SEM–EDS, XRPD and ICP–MS to characterize mineralogy, microstructures and elemental composition.

Liquid matrix

Seasonal sampling of 25 springs from the same areas was performed to investigate groundwater chemistry. Analyses include ion chromatography, ICP–OES, ICP–MS and isotopic measurements, providing information on major chemistry, metal speciation, water provenance and redox processes.

RESULTS

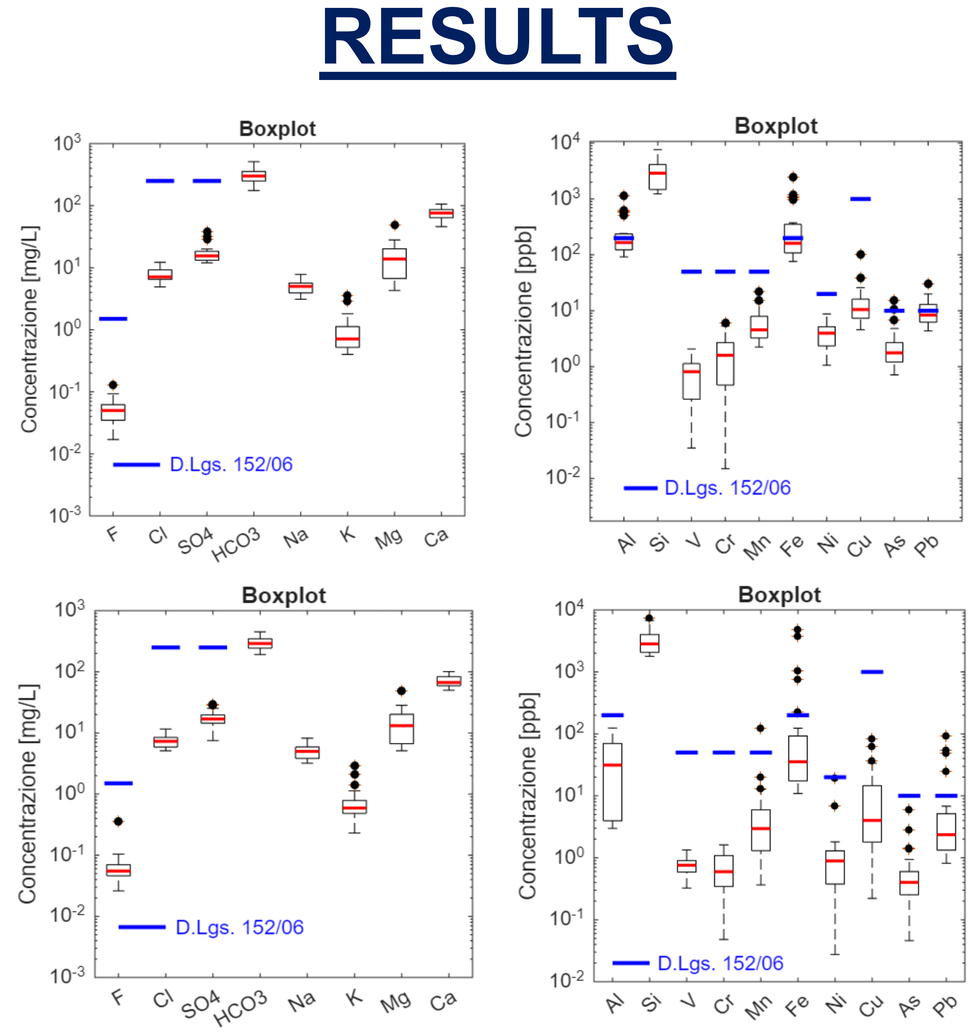

Fig.2 Boxplots of major ions (left) and PTEs (right) for the first sampling campaign (top) and the second sampling campaign (bottom). The blue line represents the threshold values established by D.Lgs. 152/06 for groundwater quality assessment.

Preliminary hydrogeochemical data from the two seasonal sampling campaigns (autumn 2024 and spring 2025) indicate that the waters predominantly belong to the HCO_3–Ca–Mg facies.

The diagrams (Fig.2) show the distribution of major ions and PTE concentrations measured in the 25 springs during both campaigns. Comparison with the threshold values established by D.Lgs. 152/06, adopted as the regulatory reference for groundwater quality assessment, indicates that all major ions fall below the legal limits in both seasons. For the PTEs, the boxplots highlight exceedances for Fe and Mn, together with Pb anomalies above the threshold in both campaigns and a single As outlier in the first campaign, while all other elements remain within the regulatory limits.

CONCLUSIONS

The integration of mineralogical, microchemical and hydrogeochemical datasets will allow the definition of a coherent framework of water–rock interaction processes in the serpentinites of the Pollino Massif, providing the basis for the development of the geochemical model of the system. The geochemical model developed will finally describe in a predictive way the behaviour of PTE, along natural geochemical gradients, providing useful indications for the evaluation of potential environmental issues and for the sustainable management of water resources in ophiolitic contexts.

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