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## A review of petrological monitoring procedures: suggestion of best practice protocols for eruption monitoring

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Volcano monitoring is commonly performed through acquisition and interpretation of real-time signals able to track changes in the magmatic system and the eventual migration of magma toward the surface. Petrological monitoring, in particular, focus on magma history in terms of depth of storage zones, transport pathways, mechanisms of differentiation, and timescales of involved processes with aim to extrapolate information about the trigger of magma ascent and the eruptive behaviour, and its possible variation over the course of an eruption.

In the present study, conducted in the framework of the EUROVOLC project, we developed a questionnaire that aims to survey the most common petrological monitoring procedures performed by volcano monitoring institutions, in order to identify prevailing techniques and most critical issues, and to rate the suitability of specific investigations in terms of costs versus benefit. The final goal is to identify essential and mandatory petrologic techniques to accomplish for an efficient petrological monitoring during ongoing eruptions, so that can be assessed the minimum logistic requirements (e.g., facilities, infrastructures, operators) and can be defined operative best practices protocols to achieve petrologic results in a timeframe short enough to be well of use for monitoring purposes.

The surveyed information, which resulted from a sample of eighteen interviewed institutions that deal with monitoring of active volcanoes with a variety of eruptive behaviour, provide insights about the whole steps of petrologic monitoring including sampling, sample preparations and analyses, data interpretation and dissemination. The survey reveals that efforts have been made to organize petrological monitoring with standardized procedures similarly to the other monitoring disciplines. For example, some institutions suffer lack of dedicated staff that can be operative with short forewarning. The objects of petrological investigation include all the types of volcanic products from lava to pyroclastic and there are attempts to deal with fixed sampling schedule. Moreover, there is consciousness that the capability to acquire and to interpret the most valuable analytical results at *in situ* institutions provide a quick image of ongoing eruptive processes and improve the interaction with other disciplines. Therefore, concerning the analytical procedures, which is the core of petrological monitoring, an important results is the cross correlation between the analyses that are easy to acquire (in terms of resources, equipment and time availability) and their effective role for the petrological monitoring.

The expectations include an augmented perception of the benefits that petrologic monitoring brings in the comprehension of eruptive processes. Filling the gap of the primary needs required to accomplish the identified best practices within a short timeframe is a compelling need to lead advancement of the volcano monitoring science.