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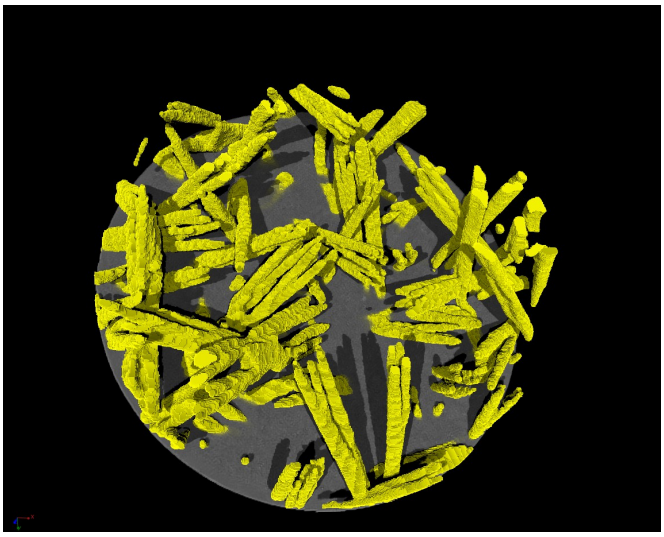
DIPARTIMENTO DI GEOSCIENZE

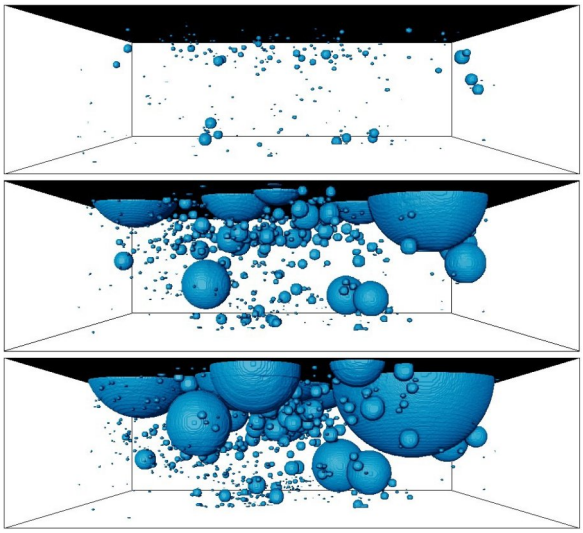
Seminario

In situ 4D crystallization and vesiculation in basaltic magmas: implications for magma mobility within the Earth's crust, fragmentation and eruptive style

Tuesday, 15 April 2025 – 16:30, Aula Arduino

Relatore: **Fabio Arzilli** – University of Camerino (Italy)





Basaltic eruptions are the most common form of volcanism on Earth and planetary bodies. Eruptions are controlled by magmatic processes, such as crystallization and vesiculation within sub-volcanic magma reservoirs and conduits. These processes affect magma mobility within the crust, magma ascent towards the surface and eruptive style. However, our understanding of the relationships between pre-eruptive reservoir conditions, conduit dynamics during magma ascent, and eruptive style remains limited as these processes occur hidden from view. Specifically, the relationships between crystallinity, rheology, eruptibility, and eruptive style remain unclear due to the challenges of observing dynamic magma crystallization and vesiculation in real time. In this study, I present in-situ 4D data on the kinetics of crystal and bubble growth, along with the textural evolution of trachybasaltic magmas during crystallization and vesiculation in high-temperature experiments conducted under water-saturated conditions at crustal pressures.

The integration of the 4D experiments on magma crystallization with results from dike-propagation modelling highlights the role of dendritic crystal growth on migration of basaltic magmas within the crust, since dendritic crystallization may affect magma viscosity and mobility, potentially freezing magma in a dike or reservoir within a few hours.

In situ experiments, coupled with a 1D numerical conduit model, reveal that the crystallization rates of plagioclase and clinopyroxene, along with the rates of bubble growth and coalescence in basaltic magmas, govern magma viscosity and fragmentation during ascent through conduits, ultimately influencing the eruptive style of basaltic magmas.

Proponente: **Michele Fondriest**