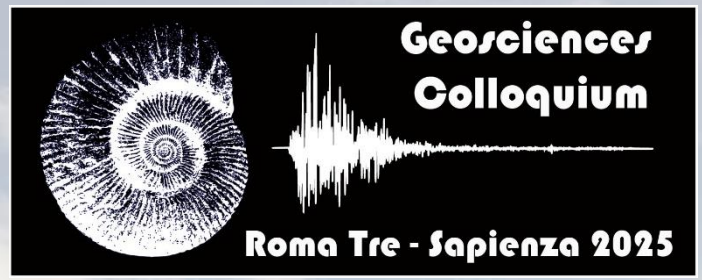
Roma Tre




SAPIENZA
UNIVERSITÀ DI ROMA

**Danilo Di Genova**

*CNR-ISSMC, National Research Council of Italy-*
*Institute of Science, Technology, and Sustainability for Ceramics*

# How materials science unlocks magma and volcanic dynamics

***06.05.2025, Room B1, h:16:30 and on Teams***

SCIENZE
Dipartimento di Eccellenza

*For information: paolo.ballato@uniroma3.it or marco.romano@uniroma1.it*

DOTTORATO DI RICERCA
IN SCIENZE DELLA TERRA

# ABSTRACT

The behaviour of magma during volcanic eruptions has traditionally been studied mainly through the lens of fluid dynamics, petrology and geochemistry. However, recent advances in materials science, particularly in glass science, reveal that processes occurring at the nanoscale can significantly influence magma properties and eruptive behaviours. Among these discoveries, nanocrystals have emerged as critical components in both natural magmas and laboratory silicate melts, challenging our conventional understanding of magma dynamics.

In this talk, I will explore the intersection between materials science and volcanology, highlighting how nanoscale processes in magmas can trigger macroscale volcanic processes. I will present how nanocrystals, forming within milliseconds to minutes under conditions previously assumed characteristic of pure liquids, can dramatically increase melt viscosity and promote high-density bubble nucleation; two key factors controlling eruptive style.

I will showcase cutting-edge experimental approaches, combining in-situ and ex-situ methodologies, including synchrotron-based high-pressure and high-temperature studies, spectroscopic techniques, and laboratory measurements of the physical and chemical properties of magmatic systems. Special attention will be given to insights emerging from the ERC-funded NANOVOLC project, aimed at understanding the role of nanoscale processes in controlling magma behaviour.

By comparing new observations with established findings, I will identify critical knowledge gaps, discuss the challenges in measuring magma properties under realistic conditions, and propose future research directions. I will conclude by emphasizing how multidisciplinary collaboration between Earth and materials scientists can foster a new, more predictive paradigm for understanding volcanic eruption dynamics on a probabilistic basis.