

Researchers from Perugia University describe how AI can unveil the secrets of eruptions

GA, UNITED STATES, September 29, 2025 /EINPresswire.com/ -- The article examines how machine learning is revolutionizing igneous petrology and volcanology by automating tasks, enhancing models, and accelerating discoveries. At the same time, the authors warn of key challenges, including the need to understand what models actually learn and to ensure transparency, reproducibility, and interpretability. These concerns are especially critical for volcanic hazard assessment and crisis management. The study also addresses ethical risks and reviews evolving policies in the EU, US, and China.

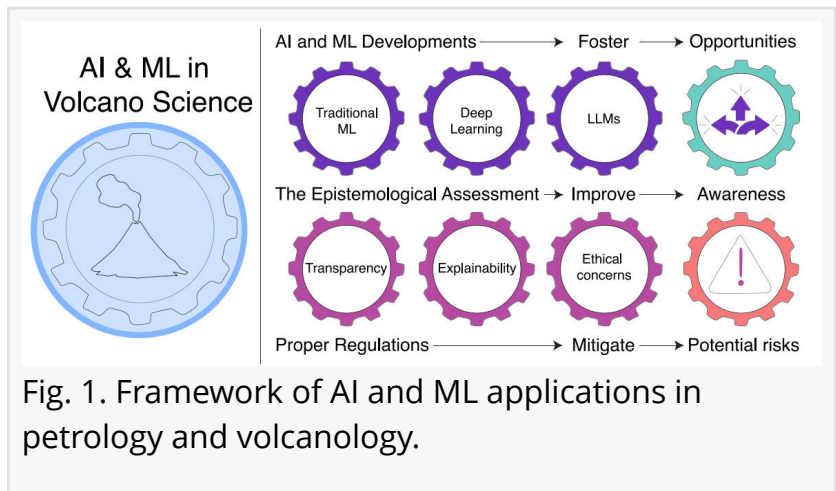


Fig. 1. Framework of AI and ML applications in petrology and volcanology.

Volcanoes are among the most powerful natural hazards on Earth, yet predicting their behavior remains one of the biggest scientific challenges. A new article published in Artificial Intelligence in Geosciences explores how machine learning ([ML](#)) can accelerate discoveries in volcano science, while also warning of potential pitfalls if ML is used without critical reflection.

The study, conducted by a duo of researchers from the University of Perugia, involved the analysis of current and emerging applications of artificial intelligence in volcanology.

“While ML tools can process massive amounts of seismic, geochemical, and satellite data far faster than traditional methods, opening up opportunities for earlier hazard detection and improved risk communication — it is not a silver bullet, says corresponding author Maurizio Petrelli. “We need to be aware of what models really learn and why transparency, reproducibility, and interpretability matter when decisions affect public safety in hazard assessment and crisis management.”

“AI can help us see volcanic systems in new ways, but it must be used responsibly,” says co-author Mónica Ágreda-López. “Our goal is not only to show both the opportunities and the risks but also to promote the understanding behind these tools, so that volcano science can benefit from machine learning without losing rigor and transparency.”

The authors call for careful epistemological evaluation, asking not just what AI can do, but how its methods align with scientific reasoning and the needs of society. The duo also stressed that building trust between AI developers, geoscientists, and at-risk communities is key to harnessing these technologies responsibly.

“Interdisciplinary collaborations and open data practices are essential steps to ensure AI contributes to safer, more resilient societies living with volcano hazards. We also need to consider ethics and evolving policies across the EU, China, and the US,” adds Ágreda-López.

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Lucy Wang

BioDesign Research

[email us here](#)

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