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COMPUTATIONAL TOOLS FOR MINING INDUSTRY: FROM EXPLORATION TO EXPLOITATION

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ABSTRACT

The global transition toward a low-carbon economy depends critically on two interconnected pillars: modern tools for exploration of critical minerals and clean energy, and green and safe exploitation of the resources.

This mini-symposium proposes to address a new generation of tools for the exploration and exploitation in the mining industry. The session is conceived as a collaborative umbrella uniting numerical and technical methodologies in collaboration between academia and industry.

Contributions are invited across the full technological spectrum, from the mathematical and computational foundations of deep subsurface exploration — physics-informed artificial intelligence for seismic data reconstruction, adaptive numerical modelling of crustal fluid flows, probabilistic data fusion for geothermal reservoirs, and the use of reduced-order models (ROMs) to accelerate simulations— through to the applied engineering and "Mining 4.0" objectives of modern exploitation, including the deployment of real-time monitoring tools and computational control systems in active operations that enhance efficiency and provide early warnings.

By treating exploration and exploitation as a continuum rather than as separate concerns, the mini-symposium aims to make explicit the shared mathematical machinery that underpins both, and to accelerate the transfer of advanced computational methods from scientific research to industrial practice. The proposed format is intended to bring together international experts from academia and industry, encouraging the emergence of joint research directions and collaborative initiatives.