Tecniche di analisi geostatistica per applicazioni avanzate di ingegneria mineraria

Geostatistical analysis tools for advanced mining engineering applications

RESPONSABILE DELL'ATTIVITA': Prof. Ing. Roberto Bruno

Periodo dell'attività di ricerca: 01/07/2022 – 30/06/2023

Obiettivi della ricerca:

A major pillar of the European strategy to secure the supply of critical raw materials is to foster sustainable exploration and excavation in the European territory. Access to mineral deposits, excavations, processing and post-mining in Europe but also globally, need to be developed as efficiently as possible towards the green mining approach. One of the main tools in this path is the geostatistical modeling. Geostatistical approaches are born to salve mining engineering challenges from exploration of raw materials and mineral mapping to the mining wastes and post-mining management. To reach a green mine target, many tools and information should be used and integrated, such as satellite images, representative samples, mineralogical, geochemical analysis, etc. A robust approach is needed to integrate samples from different sources and different supports for spatial structural analysis. Then, based on the spatial variability behavior, an appropriate model should be adapted and used for characterization of the target variable(s).

Potential: Geostatistical techniques can contribute to successfully characterize and identify mineral potential at different scales and to provide solutions for impact monitoring of mining activities. With the help of different types of information (satellite images, geochemistry samples, mineralogy data, etc.), the potential of mineral exploration and mining wastes managements can be discussed with respect to Green Deal in Europe's raw material supply. Identified strengths and potential of Earth Observation (EO) technologies are the reduced need for in situ personnel, improved working conditions, the global coverage at short time intervals between observations and the elimination of the need to access unsafe, remote and rugged places. The objective is to highlight the potential of Geostatistical Techniques, in particular in line with the Green Deal European Program, by providing methods that lead to promote the characterization in applications throughout the mining life cycle, from exploration and operations to post-closure environmental management. In this scenario, the Research Activity focuses on the following specific objectives:

- Multiply the benefit of Geostatistical approaches for multi-scale characterizations,
- Grade mapping of raw materials and uncertainty for raw materials source evaluations;
- Advanced investigation of the Geostatistical tools with Earth Observation tools for detection and critical raw materials exploration.

WP ACTIVITIES

WP	ACTIVITIES	MONTHS					
		1-2	3-4	5-6	7-8	9-10	11-12
1	Literature review	🟨	🟨	🟨	🟨		
2	Spatial variability analysis		🟨	🟨			
3	Integration of EO data and in situ data for green mining			🟨	🟨	🟨	
4	Characterization of minerals using multivariable geostatistical approaches			🟨	🟨	🟨	🟨
5	Communication and dissemination			🟨	🟨	🟨	🟨