



## **ENVIRONMENT PROTECTION AND SUSTAINABLY MANAGING OF NATURAL RESOURCES AND GEOMATERIALS**

The research group of Applied and Environmental Geology is engaged for years in research related to environmental protection and sustainable management of natural resources. In particular, the following topics are addressed:

### **Water**

Hydrogeological research topics cover a wide range, including : water resource management under complex, multi-stressor conditions; groundwater resources assessment; water management and protection; groundwater contamination by anthropogenic activities (in particular connected to diffuse pollutant); aquifers vulnerability evaluation; groundwater-surface water interaction; protection areas of drinking water catchments; characterization and risk analysis of contaminated sites; study of the recharge areas of deep aquifers; springs and mineral waters.

### **Quarries and mines**

Quarrying and mining exploitation is strictly linked to the EU principles of “Resource preservation” and “waste recovery”. In this field it is possible to study: the management of mining and quarrying yards; the systematic treatment and recovery of secondary raw materials, by-products and/or potential new products from quarry and mining waste; the environmental impact connected to quarrying and mining activities (air, soil and water); innovative protocols for quarry and/or mining dumps reclaim.

### **Geomaterials**

Geomaterials are used all over the world because they are useful for many applications. However, they may be harmful for humans (and animals too) in certain circumstances. Therefore, it is very important to know their characteristics, i.e. their physic-chemical properties and behavior where they spread in the environments (air, water, soils, and organism systems). Different techniques and approaches need to acquire this knowledge which is necessary to understand how treat geomaterials.

### **Rock masses characterization**

Characterization of rock masses with advanced survey methods. FEM and DEM modelling for stability analysis. Risk analysis of underground and surface excavations.

Slope stability evaluation by experimental and numerical methods. Hazard mapping of slopes

### **Energy**

The research group has undertaken research for years in the production of electricity from medium enthalpy geothermal resources with innovative techniques. In this field we worked with

foreign universities (Germany and Switzerland) and with Italian research centers (CNR and INGV) in order to optimize the processes of zero emission - total reinjection. In the field of energy saving and integration between renewable sources, we have developed a living lab for the study of the storage of thermal energy from solar energy in the ground through a system of vertical geothermal probes.