

MEDICAL AND FORENSIC GEOLOGY SESSION

Sema Tetiker, Murat Topbaş, Fatma Toksoy Köksal, Mustafa Gürhan Yalçın

The upper crust of the lithosphere, with which humans interact directly, contains mineralogical, geochemical, and structural features that not only shed light on the geological evolution of the Earth but also provide critical indicators that directly affect human health, public safety, and judicial processes. The thematic session entitled "Medical and Forensic Geology: Earth Sciences for Future Societies" has been designed to highlight these multidisciplinary connections and to make the analytical and methodological data generated through Earth science research available for the benefit of the public and the judicial system.

The interaction between the Earth and human beings will be addressed along two main axes. Increasing anthropogenic pressures and environmental stress factors associated with the climate crisis are disrupting the delicate balance between the lithosphere and biosphere, triggering emerging geogenic health risks and environmental disputes with legal implications.

Within the framework of Medical Geology, the session will focus on the impacts of the natural environment on human and public health. Key topics include respiratory diseases and malignancies, particularly malignant mesothelioma (MM) and pulmonary pathologies associated with exposure to fibrous minerals such as erionite and asbestos; the transport mechanisms of arsenic, fluoride, boron, and heavy metals enriched in drinking and domestic water through hydrogeochemical processes; radon gas accumulation originating from granitoid bodies along active fault zones; and trace element anomalies within soil–food systems. One of the strategic objectives of this session is to promote the integration of geogenic risk maps into urban microzonation studies, safe settlement planning, and preventive healthcare practices.

In contrast, the relationship between Forensic Geology and the justice system focuses on adapting analytical methods used in Earth sciences to criminal investigations, forensic medicine, criminalistics, and environmental law disputes. Within this framework, X-ray diffraction (XRD), scanning electron microscopy coupled with energy-dispersive X-ray spectroscopy (SEM-EDS), and optical microscopy are employed to characterize the distinctive properties of soil, sediment, and mineral particles. These characteristics can serve as geological fingerprints, providing an evidence-based means of linking crime scenes with suspects and/or victims. In this context, ensuring that Earth science data acquire the status of forensic evidence in accordance with international standards can influence the course of environmental litigation and provide a robust scientific foundation for the right to a fair trial.

Furthermore, the detection of illegal excavations, unauthorized waste disposal, and buried hazardous waste sites, as well as the identification of pollution sources in water and soil contamination cases through isotope geochemistry, can generate scientifically substantiated evidence of causation and environmental impact for use in legal proceedings. Today, the integration of artificial intelligence-supported spatial analyses and large datasets is bringing about an unprecedented methodological transformation in the early detection of geogenic risks and the generation of high-precision forensic evidence.

The sessions aim to foster genuine interdisciplinary synergy that extends beyond theoretical discussions and translates into practical applications in the field and decision-making processes. Adopting inter-, multi-, and transdisciplinary approaches, the sessions seek to bring together academics working in health and medical sciences—including toxicology, public health, forensic medicine, biochemistry, dentistry, pharmacy, and health management—as well as Earth sciences, water sciences, environmental engineering, chemistry, biology, hydroclimatology, and agricultural sciences. The intended participants also include legal professionals, forensic science experts, public and private sector representatives, municipalities, industrial stakeholders, aquaculture producers, thermal spa operators, professionals involved in geological and environmental quality monitoring, and representatives of non-governmental organizations.

Ultimately, the objective is to transform scientific evidence provided by the Earth into lasting policies that protect our collective future while contributing to the formulation and implementation of justice.