Editorial

Engineering geosciences, geotechnics and functional geomaterials: new trends on GIS mapping, geotechnologies and design with geohazards

Helder I. Chaminé[1,2] · Ana Pires[3] · Isabel Fernandes[4] · Richard Přikryl[5] · Atiye Tuğrul[6] · H. Şebnem Düzgün[7] · Luis I. González de Vallejo[8,9]

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Ever since of dawn of civilization, society has taken advantage of soils and rocks. Tools for hunting and defence, fortifications, houses, tunnels, monuments, sculptures, crypts and graves are markers of using geological materials. Since humankind's first excavations and buildings were carried out, construction and mining methods were decisive socio-economic transformative drivers concerning the technologies employed. Therefore, in geotechnics, rock engineering, mining and geomaterial studies, the contribution of geology is of utmost importance. Alongside technical and sociological developments, large engineering projects are a practice in which the soundness of scientific-technical design, safety issues, sustainability, environment and economy are fundamental aspects to which the geologist and engineer decisively contribute. In addition, comprehensive studies of Earth systems shall be performed with sustainable management, planning, and geoethics [1]. Currently, that approach is critical in designing with nature, society and geohazards (e.g., [2–4]).

It is of topical importance in geological sciences and engineering geology to have a sound understanding of geological processes, as well as their characterization, assessment and modelling methods and techniques (e.g., [5–8]). In fact, that includes techniques and methods of engineering geological mapping, in situ geological and geotechnical investigations, geological and geotechnical testing techniques and modelling methods (e.g., [9–12]).

Přikryl et al.[10] defined geomaterials as "inorganic raw materials derived from the Earth's crust and used in construction after appropriate processing to make a genetically and functionally varied group of mineral resources". The use of geomaterials in construction is based on sustainability and functionality concepts for the primary mineral raw materials exploitation, processing and employment by society [13]. Thus, geomaterials are functional geological materials and are artificially processed for most of the activities developed by society (e.g., [5, 10, 14]). The geomaterials might comprise rock, clay, granular materials, treated soils, and some industrial (mainly construction) waste.

The topical collection (TC) on "Engineering geosciences, geotechnics and functional geomaterials: new trends on GIS mapping, geotechnologies and design with geohazards" includes over 22 selected contributions in engineering geology, geotechnical engineering, geomechanics, geomaterials and applied mapping.

✉ Helder I. Chaminé, hic@isep.ipp.pt | [1]Laboratory of Cartography and Applied Geology (LABCARGA), Department of Geotechnical Engineering, School of Engineering (ISEP), Polytechnic of Porto, Porto, Portugal. [2]Centre GeoBioTec|UA, Aveiro, Portugal. [3]Centre for Robotics and Autonomous Systems (CRAS) and Autonomous Systems Laboratory (LSA), School of Engineering (ISEP), INESC TEC, Polytechnic of Porto, Porto, Portugal. [4]IDL and Department of Geology, Faculty of Sciences, University of Lisbon, Lisbon, Portugal. [5]Institute of Geochemistry, Mineralogy and Mineral Resources, Faculty of Sciences of the Charles University, Prague, Czech Republic. [6]Department of Geological Engineering, Engineering Faculty, Istanbul University-Cerrahpasa, Istanbul, Turkey. [7]Mining Engineering Department, Colorado School of Mines, Golden, CO, United States of America. [8]Volcanological Institute of Canary Islands, Tenerife, Spain. [9]Faculty of Geological Sciences, Complutense University of Madrid, Madrid, Spain.

The TC underlines developing research topics in applied geosciences, engineering, characterization of geomaterials, and natural hazards. The thematic volume comprises case study regions that outline the scope of the topic, mostly in Asia (China, India), the Middle East (Iran, Turkey), Africa (Cameroon, Egipt, Ethiopia, Ghana, Nigeria), America (Trinidad and Tobago), and Europe (Greece, Hungary, Portugal). Hence, the volume is important to academics and experts in engineering geology, geotechnical engineering, rock engineering, mining engineering, military engineering, soil mechanics, geomechanics, and geohazards.

There is a complete range of purposes and challenges for engineering geosciences, geotechnics and functional geomaterials, as presented in this themed volume. The article set highlights key techniques and methodologies, namely: (i) papers tackling soil mechanics, geotechnical testing and ground behaviour issues (triaxial and pressuremeter test results in undrained shear strength clays, numerical investigation using pressuremeter test in unsaturated soils, artificial neural network analysis for predicting the liquefaction potential of soil layers, clays failure study using uncertainty analysis, hydraulic conductivity modelling of soils by artificial neural network techniques, wavelet analysis for soil liquefaction occurrences, seepage studies inside the clay core of an earth-fill dam, slope failure analysis owing to liquefaction-induced lateral deformation); (ii) some articles interrelated to GIS and geomatic technologies for geoenvironmental and geotechnical assessment (mapping and modelling soil salinity using remote sensing sensors, spatial estimation of physico-chemical characteristics of soil using GIS-based mapping, management of land cover in a tropical island using the enhanced vegetation index mapping); (iii) case studies focused on geomechanics, geotechnical modelling and applied geophysical techniques for ground behaviour (geotechnical stability analysis of jointed rock slope, geomechanical parameters evaluation for enhanced reservoir characterization, semi-empirical approach for oil reservoirs with a limited dataset, engineering geology assessment of clay deposits for waste landfill purposes, estimating the electrical resistivity of microbial-induced calcite precipitate on a lateritic soil, barrier of pile-soil structure system for seismic surface waves); (v) other papers highlighting several applications of functional geomaterials in civil construction and transportation geotechnics (potential use of alluvial clays in ceramics by adding feldspar material, physicomechanical studies of the cemented sand-gravel in dam materials, stabilization of expansive subgrade soil for producing geogrid material, geochemistry and physicomechanical characterization of clay mixtures to be used as construction material, geosynthetic reinforcement influences the bearing capacity of strip footing on sandy soils).

This TC enriches useful information on engineering geology and geotechnics regarding functional geomaterials, geotechnologies and geohazards. This approach includes all aspects of mapping, assessment, characterization, monitoring and management within a sustainable and eco-responsible approach aiming for better multidisciplinary knowledge and engineering design with geohazards.

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