



# EUROCLAY

## — 2023 —

International Conference of European Clay Groups Association  
Villa Romanazzi Carducci Conference Centre  
24-27 July, 2023 | BARI, Italy

### **LIST OF SESSIONS**

last update: 14 December, 2022

[www.euroclay.aipea.org](http://www.euroclay.aipea.org)

abstracts & registration platform:

[clays.absmanager.com](http://clays.absmanager.com)

# APPLICATIONS & VALORIZATION

## AV01 - SEPIOLITE, Palygorskite and Bentonite: Geology, Properties and Applications

Special clays formed by 2:1 clay minerals (e.g. bentonite, sepiolite and palygorskite) are materials with outstanding properties (e.g. sorptive and rheological) that make them exceptional from an industrial and technological point of view because of their large number of applications, including their use as nanomaterials. These clays are made up of clay minerals that form rare deposits (sepiolite) or not very abundant ones (palygorskite, smectites), which properly treated acquire a high added value and therefore economic significance. This session focuses, on the one hand, on the geological aspects that include: description of the deposits, petrography, mineralogy and geochemistry all them of usefulness in palaeo-environmental reconstructions and genesis of these special clays. Also included are the technological processes used to enhance certain properties and also their industrial, environmental and health-related applications. All contributions within this broad spectrum are welcome.

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## AV02 - CALCINED CLAYS AS ALTERNATIVE IN HYDRAULIC BINDERS

The reduction of portland cement clinker in the production of cement is of highest interest in order to fulfill CO<sub>2</sub> reduction goals. Therefore alternative materials are necessary. The usage of calcined clays is one of the most popular items in this discussion. Both the availability and the performance of suitable clays have to be considered.

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## **AV03 - ALKALI ACTIVATION OF CLAY-BASED MATERIALS: ECO-FRIENDLY ROOM TEMPERATURE SOLIDIFICATION**

Alkali activation of clay, meta-clay, clayey wastes produces a number of soluble  $\text{Si}^{+4}$  and  $\text{Al}^{+3}$  ions in the alkaline solution. These dissolved species are hydrated and can form a polymeric Si-O-Al-O 3D network at room temperature to produce a ceramic-like solids. These alkali-activated materials, known also as “geopolymer”, present a typically amorphous structure that retains the undissolved mineral species of the aluminosilicate precursors and present novel crystalline phases, such as crypto zeolites. The excellent mechanical properties, chemical and physical durability combined with thermal stability of the final consolidated products qualifies them as eco-friendly building materials.

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# CHEMISTRY & MINERALOGY

## CM01 - SYNTHESIS EXPERIMENTS TO UNDERSTAND NATURAL PROCESSES

Clay minerals and related materials including zeolites, hydroxides and others, are polyfunctional materials with a number of applications in environment, nanotechnology, health science, and more. Synthesis experiments give a better understanding of several processes involved in genesis and stability of minerals under natural conditions. In addition, they provide new choices to produce analogs of natural minerals as well as new materials with specific properties for advanced applications in science and technology. Experiments may be performed under room and hydrothermal conditions, in pure inorganic systems or including organic matter, polymers, etc.

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## CM02 - THE IMPORTANCE OF CLAYS IN MINERAL EXPLORATION AND GEOMETALLURGY

Clay minerals occur across various geological settings and are the ubiquitous products of hydrothermal alteration and weathering processes. Understanding spatial variations, abundance and elemental compositions of clay minerals can provide useful vectors aiding mineral deposits discovery. Accurate identification of swelling clays is also important for ore processing. This session aims to bring together presentations summarizing the important role of clay minerals in mineral exploration and recovery. We encourage submissions addressing traditional and cutting-edge analytical techniques used to identify and characterize the clay mineralogy and chemistry relevant to mineral exploration and geometallurgy.

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### **CM03 - VERSATILITY OF USING CLAY MINERALS IN DIAGENETIC AND VERY-LOW TO LOW GRADE STUDIES - 5<sup>TH</sup> FREY-KÜBLER SYMPOSIUM**

With composition and crystallography highly susceptible to thermo-barometric changes, clay minerals represent an important line of investigation in fundamental and applied research. All contributions, which look into clay mineral indices and geo-chemistry, are welcome. Examples may include but are not limited to geothermal and hydrothermal studies, hydrocarbon and clay mineral research in sedimentary basins, clay-mineral evolution in meta-sedimentary rocks, provenance of clay-mineral bearing rocks in archaeometry and cultural heritage preservation studies and all other geoscientific fields which necessitate precise diagenetic and very-low to low-grade metamorphic determinations.

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### **CM04 - CHEMICAL REACTIVITY AT THE CLAY/WATER INTERFACES**

Even though many macroscopic experimental data are available, as sorption isotherms or dissolution rates based on bulk solid or solution chemical analysis, detailed process understanding at the water/clay interfaces remain to be better constrained in order to propose predictive models notably in the compacted state. Different questions, especially implying charged clay particles, remain to be resolved as: (i) how particle morphology or crystal-chemistry influence these interactions and (ii) how to properly couple chemical properties with transport mechanisms, inherent to natural environments. We therefore welcome all contributions which further our knowledge of these interfaces' reactivity.

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## **CM05 - CLAYEY MATERIALS IN RADIOACTIVE WASTE REPOSITORIES**

Clays are widely used as engineered and natural barriers in radioactive waste disposals. To guarantee the safety of these disposal systems in the long-term, the mechanical, thermal, mineralogical and physicochemical properties of these barriers must be analysed in depth, under different scales. All the processes that may significantly modify the clay barrier performance (chemistry, temperature, irradiation, erosion) must be investigated to strengthen the Safety Case. Within this context, is also especially relevant the analysis of radionuclide/clay interactions, and the geochemical and thermodynamic modelling needed to predict radionuclide migration under variable environmental conditions.

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## **CM06 - RADIOACTIVE WASTE DISPOSAL: HIGH TEMPERATURE IMPACT ON BENTONITE BARRIER SYSTEMS**

The basic requirement for radioactive waste disposal is to attenuate the release of radionuclides to the environment by means of both engineered and natural barriers. In the last decades, concepts are revised with respect to the maximum temperature at the interface canisters-barriers, with a special focus on bentonites. This session seeks contributions to help understanding high temperature (>100 °C) effects on bentonite buffer materials. Studies focused on mineral transformation, interfacial interactions, and other processes related to the performance of bentonite barriers, performed in lab or in field, are welcome.

Scientific Committee

# GEOLOGY & ENGINEERING

## GE01 - CLAY ROCKS IN CONTAMINATED SITES & RADIOACTIVE WASTE DISPOSAL

Clay minerals are ubiquitous in soils, sediments, and sedimentary rocks, where they strongly influence groundwater hydrology, transport processes, and isolation/retention potential. Clay barriers are widely used for isolation of landfills and contaminated sites. Clay-rich rock formations and clay-based materials also play key role as host rocks and engineered barriers in radioactive waste disposal concepts. This session focusses on modelling studies of coupled multi-physics processes within clay-rich materials, experimental studies related to barrier properties and long term evolution of clayey materials, and analogue studies regarding the above mentioned applications of clayey materials.

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## GE02 - GEOTECHNICAL BEHAVIOUR OF CLAYEY GEOMATERIALS

Clays are used in a wide range of geotechnical applications and in civil engineering. They are used in slurry cut-off walls, landfill sites, closure structures for underground repositories, soil improvement, geosynthetic clay liners, grouts and sealants for drilling industry. The particular size and structure of clay minerals condition their rheological properties, adsorption/desorption characteristics and swelling/shrinkage processes, among others. These in turn affect the hydro-mechanical and physico-chemical behaviour of clays and clay rocks. In particular, this session welcomes works investigating the connection between the properties of clay minerals at the nano- and meso-scales (“micro-scale”) and the macroscopic properties, as well as the chemical effects. Both experimental and modelling works will be considered.

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# HEALTH & ENVIRONMENT

## HE01 - CLAYS IN APPLIED LIFE SCIENCES

This session calls for studies of clays with relevance in human health. It is focused on use of natural or modified clays in biomedical sciences. Interaction of clays with biological systems, use of clays in the design of medicinal products and medical devices as well as agricultural practice, clay based foods and cosmetics are welcome.

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## HE02 - ZEOLITE-BASED COMPOSITE MATERIALS FOR HEALTH AND ENVIRONMENTAL APPLICATIONS

Zeolite are particularly suitable for high-value technological applications based on ion exchange and selective adsorption of organic molecules. Their functionality and technological performance can be improved by means of modifying agents such as surfactants, metals, nanoparticles and polymers.

In this session, investigations dealing with the occurrence, the mineralogical and chemical-physical characterization of new zeolite resources, modeling studies, new functionalization methods, evaluation of technological performance, as well as any other topic related to the most recent insights on the use of natural zeolites for health and environment is welcome.

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## **HE03 - GEOCHEMISTRY OF MICROSIZED MINERALS FOR HUMAN HEALTH PROBLEMS: ADVERSE EFFECTS AND POTENTIAL APPLICATIONS**

Human beings and minerals share plenty of major, minor, and trace elements considered essential not only for life and wellness of humans but also for mineral formation.

This session invites abstracts for studies focused on geochemical characterization of micro-sized minerals and environmental matrices (soil, water, air) with relevant implications for improving our understanding on their potential impact on human health. Studies using this approach to track sources of micro-sized minerals, to characterize their migration in the environment or their health impacts are welcome.

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# MATERIALS SCIENCES

## **MS01 - KAOLIN GROUP MINERALS: FROM TRADITIONAL APPLICATIONS TO ADVANCED FUNCTIONAL NANOMATERIALS FOR INDUSTRY AND ENVIRONMENTAL PROTECTION**

The session will highlight recent developments concerning modifications of kaolin group minerals including mainly kaolinite and halloysite. In particular focus will be put on intercalation, surface and interlayer grafting as well as preparation of (nano)composites with other materials including polymers. Such approaches enable to induce different functionalities e.g.: adsorption and catalytic properties. The obtained materials are possible candidates for use in industrial applications and environmental protection. The scope of this session will also include topics devoted to characterization techniques and challenges in traditional applications of kaolin group minerals.

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## **MS02 - CLAY-BASED MATERIALS IN CULTURAL HERITAGE: FROM THE PAST TO THE PRESENT**

Ancient clay-based materials, comprising ceramics, bricks, mudbricks and tiles are very widely attested in archaeological sites and cultural heritage buildings. Defining the provenance of the clays used on the basis of the mineralogical, petrographic or geochemical markers, their firing technology through the mineralogical and microstructural transformations the clays underwent during firing, as well as the state of conservation, represents the main aims of most of the researches. This session welcomes archaeometric studies dealing with such topics, discussing the key role that these clay-based materials has to disclose ancient societies and their material knowledge and how such data can be transferred to clay-based materials currently produced to optimize selected physical properties.

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## **MS03 - ORGANIC-INORGANIC HYBRID PIGMENTS BASED ON CLAY MINERALS**

Since the discovery of Maya blue, clay minerals have been considered significant substrates of stable organic-inorganic hybrid pigments due to their distinctive nanostructures and physical characteristics. This session highlights the recent progress of hybrid pigments based on clay minerals and organic dyes, including the archaeology of ancient pigments (e.g., Maya blue) and new hybrid pigments. The topic covers the synthesis, surface interactions, properties, and applications of organic-inorganic hybrid pigments, such as Maya blue-like pigments, photochromic pigments, fluorescent pigments, temperature-sensitive pigments, pH-sensitive pigments, and other functional hybrid pigments.

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## **MS04 - INDUSTRIAL APPLICATION OF CLAY MINERALS IN SILICATE CERAMICS**

The silicate ceramic industry represents a world-wide industrial sector that moves considerable economic fluxes and involves huge amounts of clays and clay minerals.

This session will focus on the current and emerging strategies being adopted in the production of silicate and clay-based ceramics. Contributions are welcome about but not limited to raw materials, processing, properties and higher added-value products. A particular emphasis is expected on:

- the selection of new clays potentially usable in the ceramic field;
- raw materials constraints and alternatives, including industrial waste;
- the interaction waste-clays, the technological effects on products.

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## **MS05 - SYNTHESIS OF LAYERED COMPOUNDS: LATEST ADVANCES**

The development of different synthesis methods has allowed to create novel materials inspired by natural layered materials but with tailored chemical composition and surface properties. This session is dedicated to the latest advances in the field of synthesis of layered materials : clay minerals, layered double hydroxides and inorganic-organic hybrid materials by hydrothermal, co-precipitation, sol-gel and other methods, as well as their characterization and properties.” Particular attention will be paid to the influence of the synthesis processes on the structure-properties relationship of the obtained compounds

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## **MS06 - CLAY/POLYMER/METAL COMPOSITES: SYNTHESIS, PROPERTIES, AND APPLICATIONS**

With characteristic physical and chemical properties, combination of clay minerals and polymer/metal to form composites offers clay minerals a wider range of applications, such combination can be made by intercalation, pillaring, inclusion and encapsulation and hierarchical assembly. Especially, the size of metal and polymer components on the nanometer scale can be confined to the nanospace in the structure of layered clay minerals or in the structure of house-of-cards of exfoliated clay nanolayers. Such composites have continuously attracted considerable interest due to their unique properties and their applications in various fields such as drug delivery systems, biosensors, catalysts, nanocomposites, agriculture, environment, and so on. In this session we welcome contributions on new methods, strategies for the synthesis of new clay/polymer/metal nanoparticles, as well studies on the properties and applications of novel clay/polymer/metal composites.

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## **MS07 - ELECTRONIC AND MECHANICAL FUNCTIONS OF CLAYS AND RELATED LOW-DIMENSIONAL INORGANICS**

Based on clays and related low-dimensional nanostructures, advanced materials with excellent electronic and mechanical functions have been recently developed and have contributed to enrich clay sciences. A good example is layered double hydroxides and their nanosheets as (photo/electro)catalysts. Also, thanks to successful macroscopic self-organization of nanosheets and tubules as liquid-crystal mesophases, the design of functionalities has become more diverse. This session aims at the discussions on (Photo/electro)catalytic applications of clays and related inorganics; Multi-scale ordering of these materials; Advanced characterization techniques and theoretical studies on these materials.

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## **MS08 - FUNCTIONALIZED HYBRID MATERIALS OF CLAY MINERALS AND RELATED MATERIALS WITH OPTICAL, PHOTOPHYSICAL, AND PHOTOCHEMICAL PROPERTIES**

Optical and photofunctional materials belong to the most developing topics of current modern research. It is quite surprising how the interaction of clay particles can affect some important properties of photoactive molecules in their hybrid systems. The section can include studies focused on any hybrid systems based on clay minerals and related inorganic carriers. In terms of functionality, hybrid systems can include photoactive molecules such as organic dyes, inorganic ions, coordination compounds, polymers, nanodots, and other nanoparticles. From the point of view of functionality, the subjects include any photophysical and photochemical phenomena and properties, such as light energy conversion and electron transfer, dye aggregation, optical anisotropy, photochromic properties, nonlinear optical properties, optical sensors and probes, photocatalysis, photosensitization, and photodisinfection

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# SOILS & SEDIMENTS

## SS01 - CLAYS FOR CARBON CAPTURE IN SOILS

Achieving the goal of zero carbon emissions will require strategies to remove carbon dioxide from the atmosphere. One way to achieve this goal is through negative emission technologies such as enhanced rock weathering, in which soil is amended with crushed basalt and other silicate rocks. To demonstrate their effectiveness, it is necessary to quantitatively evaluate the potential for carbon dioxide and organic carbon capture in negative emission technology. The roles of clay and clay minerals are probably important but remain elusive in the evaluation. In this context, this session will provide a broad and comprehensive discussion of the role of clays and clay minerals carbon dioxide and organic carbon capture in negative emission technology.

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## SS02 - PALEOCLIMATE AND PALEOWEATHERING PROCESSES: CLAY MINERALS AS PROXIES

Clay minerals have been widely used for paleoclimate reconstructions in combination with geochemical tools and/or sedimentological evidences. In this session, we invite contributions dealing with any aspect of chemical and physical weathering processes in relation to climate and more generally the forcing mechanisms (tectonics, watershed geology, erosion intensity) that govern the formation of clay minerals and their transport in continental or marine environments. We also invite all contributions that develop new methodological approaches on clays and/or new geochemical proxies to decipher climatic conditions

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## **SS03 - CLAYS IN THE PEDOGENIC ENVIRONMENT**

Clay minerals in soils are products of weathering in the process of soil development. The neoformation and transformation of clay minerals are closely related to pedogenesis. The type and abundance of clay minerals is extremely important for most soil properties and the delivery of soil ecosystem services. Soil clay mineralogy can provide important data in relation to environmental/paleoenvironmental interpretations of soils/palaeosols.

We invite contributions on all aspects (such as, structural and chemical composition, mineral quantification, surface properties, mineral-water interface processes, weathering pathways) of soil clay minerals including Fe/Al/Mn oxides.

Scientific Committee

# THE UNIVERSE OF CLAYS

## UC01 - THE ROLE OF MICRO AND NANOMINERALS IN THE ORIGIN OF LIFE

This session focuses on the interactions of micro and nanominerals with organic and inorganic compounds that could lead to synthesis of biomolecules, formation of biopolymers, as well as confinement of prebiotic systems. Soil scientists, geochemists, mineralogists, planetary scientists, exobiologists can provide pieces of knowledge to such a cutting-edge topic.

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## UC02 - OPEN SESSION

This symposium covers any other topic not included in the thematic sessions.

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## UC03 - CLAY MINERALS IN SOLAR SYSTEM

Identification and characterization of clay minerals hold important clues into the evolution of celestial bodies such as aqueous alteration and processes that may allow life to develop. Clay minerals in solar system have been identified by sample-based studies in meteorites, by remote sensing of the surface of Mars, dwarf planet Ceres, Jupiter's moon Europa and by direct X-ray diffraction observations by MSL Curiosity rover, and through terrestrial analog studies on Earth. This session includes mission observations, laboratory-based, field-analogue and theoretical studies aimed to understand clay minerals and their role in biosignature preservation in meteorites and on Solar System bodies.

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