

EPFL

The Laloui Group

2017
ANNUAL REPORT

2021
ANNUAL
REPORT

Forward

Prof. Lyesse Laloui

Member of the Swiss Academy
of Engineering Sciences

“

COVID-19 has highlighted the need to work together as a global society to solve cross-border emergencies. If we are to solve the existential threats of the 21st century we must continue to challenge our current social norms and, through research and innovation, push advanced and next-generation technologies.

”



Welcome to our
Annual Report
2021

Global energy demand and storage, as well as climate change mitigation and adaptation, are the greatest challenges of our time and solving them will require a combined, multi-disciplinary approach. Through our ongoing work here at The Laloui Group, I believe we can make a significant contribution to this approach across all facets of our research, education, and innovation.

2021 has once again challenged our team yet I am proud to say that we have adapted and risen to the occasion: congratulations to our successful Ph.D. candidates who completed outstanding theses; thanks to the continued inspiration and leadership shown by our educators to our students and the efforts of our scientists and researchers with limited lab access and social interactions; last but not least, a special acknowledgement to my leadership team in these challenging times.

I'm proud that we continue to be a world-leading research and development lab. Please enjoy the results of these efforts in the following pages.

I wish you insightful reading,
Respectfully yours,

Prof. Lyesse Laloui
Director of the Soil Mechanics Laboratory **EPFL**

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WHO ARE WE?

OUR MISSION

The Laloui Group seeks to develop and provide geotechnical solutions for a sustainable future. Based in the School of Architecture, Civil and Environmental Engineering at EPFL, Switzerland we use cutting-edge approaches in research, education, and technology transfer to ensure our environment and society has the tools and technology needed to adapt and thrive in the 21st century.

WE CONTRIBUTE TO THE UN SUSTAINABLE DEVELOPMENT GOALS

7 AFFORDABLE AND CLEAN ENERGY



For over 20 years, we have been a pioneer in the development, testing and mastering of energy geostructures.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



The Laloui Group develops novel ways to reduce the carbon footprint of our built environment.

11 SUSTAINABLE CITIES AND COMMUNITIES



The field of Civil Engineering and the construction industry lacks innovation. Our Research Group is committed to reshuffling the codes of practice with innovative, performant and environmentally-friendly solutions.

12 RESPONSIBLE CONSUMPTION AND PRODUCTION



Through the development of methods, tools, and solutions, our Research Group actively engages in sustainable and resilient practices for the future of our built and natural environment.

13 CLIMATE ACTION



The Laloui Group focuses on the development of safe geo-energy production methods and CO₂ sequestration technologies, reducing greenhouse gases in and our atmosphere and the risk of environmental pollution.

WE HAVE DEVELOPED OUR EXPERIMENTAL AND MODELLING RESOURCES

TO UNDERSTAND, INVESTIGATE AND PREDICT THE POTENTIAL FOR NEW GEO TECHNOLOGIES. WE EXPLORE THE FIELDS OF GEOENERGY, CO2 SEQUESTRATION, BIO IMPROVED SOILS, SOIL STABILIZATION, AND NUCLEAR WASTE STORAGE WHILST ASSESSING THE POTENTIAL ENVIRONMENTAL IMPACTS OF THESE NEW TECHNOLOGIES.



RESEARCH & DEVELOPMENT

At The Laloui Group we are focused on turning cutting-edge research into geotechnical solutions aimed at addressing the global challenges of the 21st century.

More on page 18



EDUCATION

Our team's passion for sharing our knowledge and ideas with others extends across a range of undergraduate, Master's, Ph.D., and post-doctoral topics. Our graduates have gone on to make their own impacts here and across the world.

More on page 28



INNOVATION & TECHNOLOGY TRANSFER

Switzerland is renowned as a country for innovation and our research group is no different. Here at The Laloui Group, we have developed practical and cost-effective technologies aimed at delivering environmental and energy production and storage solutions for the challenges of today and the future.

More on page 34

2021

CONSTRUCTION & ENVIRONMENTAL BIOCEMENTATION IN REAL WORLD APPLICATIONS

A new Proof of Concept project started in 2021 under the BIOGEOS Advanced ERC Grant.

More on page 22

SNSF GRANT

This new project is aimed at improving our mechanical understanding of the behavior of compacted expansive clays as engineered barriers.

More on page 24

SPARK SNSF GRANT

This new project has begun exploring the impact of CO₂ on the caprock formation in deep sedimentary CO₂ storage reservoirs.

More on page 25

PROF. LYESSE LALOUI

elected as the Vice President, Europe of ISSMGE (International Society for Soil Mechanics and Geotechnical Engineering).

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INNOSUISSE PROJECT

In conjunction with Amberg engineering and funding from Innosuisse, a new project is assessing the interaction between ventilation and geothermal systems in energy tunnels.

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ENERDRAPE TECHNOLOGY TESTING UNDERWAY

Our spin-off has begun assessing its panels to utilize the heat from underground parking lots to warm nearby apartments.

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6 NEW TEAM MEMBERS!



OUR TEAM

MANAGEMENT



PROF. LYESSE LALOUÏ LEADER

Dr Lyesse Laloui is a Chaired Professor and Director of The Laloui Group at the Swiss Federal Institute of Technology, EPFL, Lausanne, a major research group in the areas of Soil Mechanics, Geo-energy and CO₂ sequestration. He is also Director of EPFL's Civil Engineering Section as well as Adjunct Professor at Duke University, USA. Prof.

Laloui is Vice President for Europe of the International Society for Soil Mechanics and Geotechnical Engineering (ISMMGE), a member of the Swiss Academy of Engineering Sciences, and recipient of a 6-year research grant from the European Research Council (ERC).

Founder and editor-in-chief of the international journal *Geomechanics for Energy and the Environment*, he is active in the fields of geomechanics, sustainability and geo-energy. He has written and edited more than ten books and published more than three hundred scientific articles. He has received the Award of Excellence from the International Association for Numerical Methods in Geomechanics, the Roberval Prize at the French Academy of Sciences and the RM Quigley Award from the Canadian Geotechnical Society.



ALESSIO FERRARI RESEARCH ASSOCIATE

Dr Alessio Ferrari is a Research Associate at The Laloui Group at the Swiss Federal Institute of Technology, EPFL, Lausanne, as well as being Associate Professor of Geotechnical Engineering at the Università degli Studi di Palermo (Italy). His current research interests are in Geomechanics for geo-energy systems, fundamental Soil Mechanics with a particular focus on unsaturated soils, the development of advanced

testing facilities for multiphysical testing of soils and shales, bentonite-based engineered barriers, experimental and constitutive analysis of the thermo-hydro-chemomechanical

behaviour of complex geomaterials, and natural hazard assessment. He teaches the course "Slope Stability and Experimental Geomechanics" at EPFL and serves on the board of the Doctoral School in Mechanics (EDME). Dr Ferrari is also Vice Chair of the Technical Committee TC-308 "Energy Geotechnics" of the International Society of Soil Mechanics and Geotechnical Engineering, and acts as member of the editorial boards of the journals "Geomechanics for Energy and the Environment", "Acta Geotechnica", and "Géotechnique".

SENIOR RESEARCHER



DIMITRIOS TERZIS

SENIOR SCIENTIST

Dimitrios is a Scientist and Lecturer at the EPFL. He obtained his Ph.D. in Mechanics from EPFL in 2017 and has co-authored more than ten peer-reviewed publications focusing on research and development around soil bio-cementation. He is the co-inventor of three patents which introduce niche elements towards efficient upscaling, environmental and economic applications of bio-geo-technical systems. He is the recipient of innovation grants and awards of over a million CHF. In 2018 he co-founded the EPFL spin-off MeduSoil, which designs and delivers real-world systems based on bio-cementation to serve mainstream geotechnical projects. Since 2019 he has been the principle lecturer and organizer of the course "Innovation for construction and the environment" which is taught in the Civil Engineering Section of EPFL.

ACADEMIC GUESTS



ALICE DI DONNA

ASSISTANT PROFESSOR, GRENOBLE ALPES UNIVERSITY, FRANCE

Dr Alice Di Donna was an academic guest with The Laloui Group in 2021. She arrived from the University Grenoble-Alpes (France), where she is an Assistant Professor teaching soil mechanics, and geotechnical structures. Her main research activities are related to energy geotechnics and Thermo-Hydro-Mechanical couplings in geomaterials, both from an experimental and numerical point of view. She obtained her Ph.D. at EPFL on the thermo-mechanical behavior of energy piles and was later involved as a post-doc at the Politecnico di Torino (Italy) in the development of energy tunnels technology. While with us, she presented her latest research on the contribution of swelling to self-sealing of claystone studied through x-ray and neutron tomography.



ALESSANDRO F. ROTA LORIA

ASSISTANT PROFESSOR, NORTHWESTERN UNIVERSITY, USA

Professor Rotta Loria is the head of the Mechanics and Energy Lab at the Northwestern University. His group works at the intersection of geomechanics, energy, and environmental sustainability. In this context, he develops with his group theoretical and experimental investigations to understand, characterize, and predict the impact of energy transfers on the structure, properties, and behavior of geological materials: soils, rocks, concrete, and systems thereof. Rotta Loria's overarching goal is to understand geological materials at their most fundamental – structural – level and to investigate the essential features of their properties and behavior (e.g., thermo-hydro-chemo-mechanical). Dr Rotta Loria completed his Ph.D. at the Laboratory of Soil Mechanics at EPFL.



IULIA PRODAN

UNIVERSITY LECTURER, TECHNICAL UNIVERSITY CLUJ-NAPOCA, ROMANIA

Iulia Prodan joined us from the Technical University of Cluj-Napoca (TUCN), Romania, and has spent her time developing activities related to the celebration of the 250th anniversary of the contribution of Augustin Coulomb to the foundation of soil mechanics. She graduated with an engineering BSc, and MSc degree in civil engineering in 2009 from Technical University of Cluj-Napoca and after completing her Ph.D. in Geotechnical Engineering (2012) at the same university, she held a position of Researcher in our group in 2014-2015, where she focused her activities on experimental analysis of soil-concrete interface thermo-mechanical behavior in unsaturated conditions. She is co-editor of two books on Soil Mechanics (in Romanian) and her research activities focus mainly on the experimental and numerical analysis of thermal and thermo-mechanical behavior of soils and soil-concrete interface, as well as the thermal and thermo-mechanical behavior of energy geostructures.

POST-DOCTORAL RESEARCHERS



JOSE ANTONIO BOSCH LLUFRIU

SCIENTIST

Jose is conducting research on numerical methods to analyze the application of biologically-induced soil improvement techniques. His main interests include multiphysical modelling of geological systems, mechanical behavior of geomaterials and transport in porous media. In 2021, he concluded his Ph.D. thesis at The Laloui Group which focused on the mechanical evolution of bentonite clays in the context of nuclear waste disposal, as part of the European project BEACON. Prior to joining The Laloui Group he worked as a research assistant at the Technical University of Catalonia (UPC, Spain) within the Hydrogeology Group. He holds a MSc in Geotechnical Engineering (2017) and a BSc in Civil Engineering (2015), both from UPC.



ELEONORA CRISCI

SCIENTIST

Eleonora studies nuclear waste storage technologies here at The Laloui Group. She supported the Swiss National Cooperative for Radioactive Waste Disposal (NAGRA) in the planning, analysis, and evaluation of a large experimental campaign involving several laboratories around the world. The objective was to study several sites under consideration for the underground disposal of radioactive waste. In this context, she ran research activities on the viscous response and scale effect of shales. Her other research interests involve the metaphysical behavior of porous media. Since September 2021 she has worked at Nesol Numerical Engineering Solutions, a consulting company spinoff of The Laloui Group, where she oversees geomechanical engineering activities.



ALEXANDRA CLARÀ SARACHO

SCIENTIST

Alexandra was a Postdoctoral Researcher in the ERC-funded BIOGEOS Project working on the development of hydrogel-based approaches to engineer novel bio-cementation delivery strategies for soils. She was also the creator and organizer of The Laloui Group Webinar Series; a platform designed to broaden and engage in multi-disciplinary discussions that meet the interests of today's geotechnical engineering community. Before joining The Laloui Group, Alexandra studied Civil Engineering at the Universitat Politècnica de Catalunya in Barcelona and earned her MRes and Ph.D. in Geotechnical Engineering at the University of Cambridge within the framework of an EPSRC International Doctoral Scholar Award. Alexandra completed her work at The Laloui Group in May 2021 and is now developing her career as a Research Fellow at University of Cambridge.



ROBA HOUHOU

NEW MEMBER!

SCIENTIST

Roba is a Postdoctoral Researcher in the ERC-funded BIOGEOS Project working on soil crack remediation through the use of the microbially induced calcite precipitation. She has been working on the preparation of a review paper celebrating the 30th volume of the Geomechanics for Energy and the Environment journal of which Prof. Laloui is the Editor-in-Chief. Prior to joining The Laloui Group in May 2021, Roba earned her Ph.D. in Geotechnical Engineering at the American University of Beirut, during which she worked on the design of a novel in-situ testing setup to measure the strength of the interface between offshore pipelines and the seabed.



ALDO MADASCHI

SCIENTIST

Aldo worked on several projects concerning the numerical modeling of coupled problems related to nuclear waste disposal supported by NAGRA. He is now supervising Ph.D. works and master student projects and is involved in teaching activities. He is also, the director of the consultancy company Nesol (www.nesol.net), offering support to the design and analyze geomechanical systems which employ state-of-the-art numerical tools and dedicated experimental procedures.



ELENA RAVERA

SCIENTIST

Elena is involved in the energy geostructures activities of the lab. In 2021 she obtained her Ph.D. in Mechanics from EPFL based on the project "Cyclic thermo-mechanical behavior of energy piles." Currently, she is investigating the thermo-mechanical behavior of energy barrettes and the use of energy geostructures in arid and semi-arid areas. Elena is also engaged in teaching activities and supervision of master student projects. Prior to joining The Laloui Group, she obtained her Master's degree from Politecnico di Torino, where she also worked as a research assistant. Elena is also collaborating with GEOEG, an international consulting firm whose core expertise is geoenergy.



ELENI STAVROPOULOU

 SCIENTIST

Eleni is leading the Carbon Capture and Storage (CCS) activities of The Laloui Group and is involved in the management of different projects and the development of innovative technologies at both national and international scale. As lead of the SNSF Spark scheme, Eleni introduced systematic x-ray imaging during live testing of caprock materials to CO₂ injection and visualized and quantified the localized coupled response of this complex material. Her experimental and analytical work aims to tackle engineering challenges by means of fundamental science and “out of the box” approaches.



CHARLES THOUMYRE

NEW
MEMBER!

 SCIENTIST

Dr Charles Thoumyre Lecomte joined our lab in February bringing his expertise on thermal and material sciences to our team. He obtained his Ph.D. in 2016 at the Institut National Polytechnique de Grenoble (France) within the Centre of Excellence of Multifunctional Architected Materials. His doctoral dissertation is titled “Optimization of architected structures for harnessing, storage and release of thermal energy”. He holds a M.Sc. in Engineering (Mechanics, Energetics, Numerical Simulation) from Ecole Centrale de Nantes (France, 2013) and he studied Energetics and Environmental Sciences at EPFL as an exchange student (2012).



ANGELICA TUTTOLOMONDO

 SCIENTIST

Angelica is a Postdoctoral Researcher here at our lab. She works on the mechanics of saturated and unsaturated active clays, undrained processes, scale effects, and methodologies for estimating the in-situ effective stress. In 2021, she was awarded her Ph.D. in Geomechanics with a thesis entitled “Effective stress for unsaturated active clays and in-situ effective stress estimation methodology” which was partially funded by NAGRA. Since November, she has been involved in a new Swiss National Science Foundation (SNSF) funded project called “New insights in the analysis and prediction of the mechanical behavior of compacted expansive clays as engineered barriers”. Before joining The Laloui Group, Angelica graduated with honors in Civil Engineering at Università degli Studi di Palermo in Italy and was a Research Student at University College Dublin in Ireland. Angelica is interested in porous media subjected to mechanical, hydraulic, chemical, and thermal actions.

Ph.D. STUDENTS



ARIADNI ELMALOGLOU

 DOCTORAL ASSISTANT

Ariadni is developing a framework for the investigation of the effect of pore-scale heterogeneity on the chemical conversion efficiency of reactants in microbially induced calcite precipitation from meter-long microfluidics to idealized 3D porous media and soils. Her research is part of the European Research Council (ERC) funded Project BIOGEOS, in which she also handles the communication activities through various digital platforms.



HÉLOÏSE FUSELIER

 DOCTORAL ASSISTANT

Héloïse is working on the modelling of the thermo-mechanical behavior of the Callovo-Oxfordian claystone, in collaboration with ANDRA (Agence Nationale pour le gestion des Déchets Radioactifs). Her work tackles experimental testing of the claystone in various stress and temperature conditions, and the development of a new approach in the modeling of its response in the context of nuclear waste storage. Prior to joining The Laloui Group, Héloïse completed her Master's degree at EPFL after the successful defense of her master thesis carried out at the University of Minnesota (USA). In addition to her research project, Héloïse is actively involved in The Laloui Group teaching activities.



CRISTIANO GARBELLINI

 DOCTORAL ASSISTANT

Cristiano's research focused on soil-structure interaction with structural foundations, ranging from surface footings to thermoactive piles. Within The Laloui Group, he was responsible for semester projects and master thesis coordination in geotechnics. After completing his Ph.D. thesis titled “Advances in the Soil-Structure Interaction Analysis from Surface Footings to Thermoactive Deep Foundations” he joined the company De Cérenville Géotechnique whilst working as a Construction Assistant at EPFL.



RAY HARRAN

 DOCTORAL ASSISTANT

Ray is working on the mechanics and upscaling of Microbially-induced calcite precipitation (MICP) in the context of the ERC-funded BIOGEOS project. He tackles laboratory experiments exploring the different mechanical behaviors of bio-cemented soils and their constitutive modeling and runs field-scale experiments in one of the world's largest pilot sites. Before joining our research group, Ray obtained his Master's degree in Civil Engineering at EPFL, following the successful defense of his master thesis carried out at MIT (USA). In addition to other teaching activities, laboratory, and site works, he is the current editor of The Laloui Group website.



JINWOO KIM

DOCTORAL ASSISTANT

Jinwoo is working on developing an effective stress framework for partially saturated gas shales, in collaboration with Chevron Energy Technology Co., USA. Jinu is also responsible for teaching activities in "Geomechanics" and "Slope Stability", both graduate courses offered at EPFL. Prior to joining The Laloui Group, he obtained a Master's degree in Geotechnical Engineering from Cornell University (USA), and also completed a joint Master's degree program in Conservation Engineering at the University of Minho (Portugal) & the University of Padova (Italy).



TAEHEON KIM

DOCTORAL ASSISTANT

At The Laloui Group, Taeheon is working on characterizing and quantifying the effect of mineral dissolution on the mechanical behaviour of geomaterials. Current work is focused on exploring the chemo-mechanical response of granular materials using analogue materials. Tae is also engaged in teaching activities for the Civil engineering Master's courses. Prior to joining our Research Group, he completed his Master's thesis on the "Interplay between interparticle friction, dilation and strength" at Imperial College London using discrete element methods, PFC."



QAZIM LLABJANI

DOCTORAL ASSISTANT

Qazim is currently working on a research project aiming to improve our understanding of gas transport processes and their impact on barrier integrity and repository performance within radioactive waste repositories as part of the European Joint Programme on Radioactive Waste Management (EURAD). Qazim is also responsible for teaching activities for EPFL Master's courses, such as Geomechanics and Slope Stability. Prior to joining The Laloui Group, he obtained a Master's degree at EPFL in 2019 and worked as a geotechnical engineer in a consulting company.



YOU WANG

NEW
MEMBER!

DOCTORAL ASSISTANT

You joined our BIOGEOS project where he is involved in a numerical and experimental study on dynamic behaviors of Microbially Induced Calcium Carbonate Precipitation (MICP) treated soils. His work aims to construct a constitutive model to accurately predict the cyclic responses of bio-cemented soils and to further incorporate the model into numerical software for large geotechnical simulations. You completed his Master's degree in Geotechnical Engineering at Tongji University in 2021 where he worked on the evaluation of the long-term performance of jacked piles considering soil creep effects.



MATTHIAS WOJNAROWICZ

DOCTORAL ASSISTANT

Shortly after completing his Master's degree in Geotechnical Engineering at EPFL, Matthias joined The Laloui Group, where he is involved in the assessment of coupled THM interactions in the framework of deep nuclear geological repositories. He is working in collaboration with NAGRA on the FE-M Taskforce which consists of modeling a full-scale experiment mimicking the construction, emplacement and operation of a nuclear waste repository. Matthias is also involved in supervising the exercises in the soil mechanics course and master students projects.

RESEARCH ASSISTANTS



LORENZO LUCHERINI

SCIENTIFIC ASSISTANT

Lorenzo joined our group in 2020 after completing a joint MSc in Nanotechnology from Politecnico di Torino, INP Grenoble, and EPFL. Lorenzo is exploring novel routes for CO₂ recycling and sustainable materials for soil reinforcement. In particular, he is investigating the electrocatalysis of CO₂ for the production of value-added chemicals and bio-derived materials for the delivery of Microbially Induced Calcium Carbonate Precipitation (MICP) treatments for soil reinforcement by leveraging his expertise in electrochemistry and materials characterization techniques. In August 2021 Lorenzo left LRG to start his Ph.D. with the group of Soft Materials in the Faculty of Materials Science and Engineering at EPFL.



MARGAUX PELTIER

SCIENTIFIC ASSISTANT

Margaux is an engineer and science-based entrepreneur hosted at The Laloui Group. Holding a MSc in Civil Engineering from EPFL, she joined the group in 2018 to support research and technology transfer activities in the domain of geo-energy. She is the recipient of innovation grants and awards worth half a million CHF. Margaux co-founded the Enerdrape startup project supported by SNSF Bridge Proof-of-concept, EPFL Startup Launchpad and Switzerland Innovation Tech4impact. Enerdrape is developing the first worldwide available geothermal panel that turns any kind of underground infrastructure into renewable heat sources.



SOFIE TEN BOSCH

NEW
MEMBER!

SCIENTIFIC ASSISTANT

In March 2021 Sofie joined us as a scientific assistant, where she supports projects including energy geostructures and the BIOGEOS project among others. She greatly values the interdisciplinary aspect of the research topics at The Laloui Group. Prior to joining the Research Group Sofie obtained her MSc degree in Geo-Engineering from Delft University of Technology, after completing her Master's thesis on land subsidence in the Netherlands.

TECHNICAL STAFF



PATRICK DUBEY

TECHNICAL MANAGER

Patrick is in charge of our testing laboratory for all of our team and the private sector. Patrick has more than 20 years of laboratory experience and is an invaluable resource to our newest team members and our experienced members alike, he willingly sharing his knowledge and patience with the team. He is also in charge of the training of apprentice laboratory assistants in physics.



LUC MORIER-GENOUD

TECHNICAL ASSISTANT

For three years Luc was our laboratory technician in charge of setting up and managing our experiments and provided support to the researchers and participates in the practical training of apprentices. Before joining The Laloui Group, he trained as a physics laboratory technician in the field of microtechnology also at EPFL. In June 2021 Luc left our team in order to explore new professional challenges.



NATACHA ROMANENS

TRAINEE

Natacha joined our team in 2019 to complete a 4-year long training as a physics laboratory assistant. Currently she divides her time between theoretical classes and practical work at the laboratory. Natacha is very passionate about her training program and is always eager to learn.

ADMINISTRATIVE STAFF



MARIA LAURA DE CESARE

NEW MEMBER!

ADMINISTRATIVE ASSISTANT

Laura joined our group in April this year. Brought up in Argentina, Laura spent the first part of her career in sales and administrative roles within the medical industry, before switching to logistics and accountancy. Laura provides financial management and administrative support to the LRG's research projects jointly funded by private enterprises, the Helvetic Confederation, and the European Union.



BARBARA TINGUELY

SECRETARY

Barbara is an administrative assistant with 10 years of experience at The Laloui Group. In our team, Barbara provides administrative support to both the management and team members and ensures the efficient operation of the office environment. She takes care of the invoicing, hiring of trainees and travel arrangements for all the collaborators and guests of The Laloui Group at EPFL. When the epidemiological situation allows it again, she is also our event organizer.



ROSA ANA TURIELLE

ADMINISTRATIVE ASSISTANT

Rosa Ana was The Laloui Group administrative assistant for almost 20 years!

With over 30 years of experience at EPFL, Rosana has ensured the smooth running of our Group, the various research projects and engagement with our diverse funders. She has been the welcoming face for new members and a constant for much of the lab's recent existence. Rosana retired in May and plans to enjoy traveling the world and exploring foreign cultures. We would like to thank her for all her contributions over the years and wish her the best in her retirement.

WE ARE VERY GRATEFUL TO HAVE HAD ROSANA WITH US! WE WOULD LIKE TO THANK HER FOR DOING A FANTASTIC JOB AND HELPING OUR TEAM REACH THEIR GOALS!

COMMUNICATIONS STAFF



WIOLETTA KUCHARSKA

COMMUNICATIONS ASSISTANT

Wioletta joined The Laloui Group almost three years ago as a communications assistant. She takes care of designing and modifying communication materials for print and digital display. Wioletta also provides assistance in building the laboratory's website and improving its visibility. Outside of that, she has recently completed her Master's degree at the University of Lausanne in Digital Humanities and Slavic Languages.



BRENDAN SMITH

NEW MEMBER!

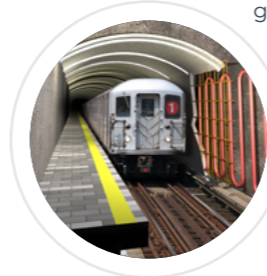
EDITOR

Brendan joined our team this year as an editor providing English language expertise for published content including journal articles, news stories and internal communications. Prior to joining us, Brendan worked as an environmental consultant and as news content producer. He has an Environmental Science degree in Geology and Ecology and an Arts Degree in Media.

2 RESEARCH & DEVELOPMENT

RESEARCH LINES

ENERGY GEOSTRUCTURES



The basis of our work consists of observing, measuring, understanding, and predicting how energy geotechnical structures behave from a metaphysical perspective. Special attention is put on cyclic thermo-mechanical behavior as well as heat extraction. This work is targeted at developing practical tools for design and conceptualization.

It has been a productive year for energy geotechnical structures research in The Laloui Group with the completion of Cristiano Garbellini's Ph.D. Thesis entitled "Advances in the Soil-Structure Interaction Analysis - from Surface Footings to Thermoactive Deep Foundations." Elena Ravera also completed her Ph.D. thesis entitled "Cyclic thermomechanical behavior of pile-soil interface and design methods for energy pile foundations." Congratulations to both.

2021 saw the completion of a long-term project "Cyclic thermo-mechanical behavior of energy piles" which generated several papers and indicated a good thermal and shear tolerance by energy pile materials. Our team now begins the next phase of work "Assessing and exploiting the interaction between ventilation and geothermal systems in energy tunnels" which will be led by Sofie Ten Bosch.

THE TEAM:



PROF. LYESSE LALOUI
Full Professor



DR ALESSIO FERRARI
Senior researcher



DR ELENA RAVERA
Scientist

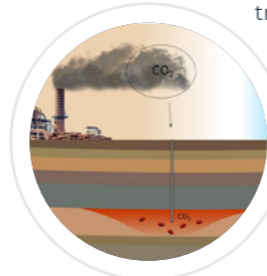


MARGAUX PELTIER
Scientific Assistant



SOFIE TEN BOSCH
Scientific Assistant

CO2 STORAGE AND ENHANCED GEOTHERMAL SYSTEMS (EGS)



Capture and Storage (CCS) is an emerging and promising technology in assisting carbon-free energy transition and climate change mitigation. CO2 can be captured directly from large emitters, pressurized, and stored underground in deep porous geological reservoirs which are capped by an overlying impermeable stratum (caprock) that acts as a natural hydromechanical barrier that prevents the mitigation of the stored CO2 to the surface.

We have built up expertise on caprock characterization and this year, the work done by Dr Eleni Stavropoulou has allowed us to reveal for the first time, the localized kinematics that occurs to the caprock material when CO2 breakthrough takes place by using high resolution live x-ray tomography. At the same time, Kim Taeheon has been exploring the effect of mineral dissolution on the mechanical behavior of granular materials. His work has shown the dissolution

of mineral grains significantly impacts the mechanical response of granular materials. He is planning to observe the micromechanical behavior of the granular materials experiencing grain dissolution in 2022.

THE TEAM:



PROF. LYESSE LALOUI
Full Professor



DR ELENI STAVROPOULOU
Scientist



TAEHEON KIM
Doctoral Assistant

BIO-IMPROVED SOILS



The team investigates novel soil improvement strategies inspired by the natural process of biologically driven crystal mineralization. The research aims to develop a geo-mechanical model to describe the enhanced behavior of the bio-treated soil, to optimize the process, and enhance the practical applicability of this technique which spans from laboratory to field scales.

This year, they conducted two large-scale experiments, including a comprehensive chemical monitoring campaign for the characterization of carbonate mineralization and the successful demonstration of Dynamic Cone Penetrometer (DCP) PANDA as an effective monitoring technique of the in-situ resistance of biomineralised soils.

They also explored biogrouting which is an emerging technology that has many advantages over conventional soil improvement techniques. The technology is based on several physical phenomena including groundwater flow, bacterial transport, chemical reactions and increases in soil strength. Through the BIOGEOS Project, the team developed several numerical models and computer codes to assist in planning and predicting the impact of different injection strategies on the distribution of subsurface cementation.

THE TEAM:



PROF. LYESSE LALOUI
Full Professor



DR DIMITRIOS TERZIS
Senior researcher



DR CHARLES THOUMYRE
Scientist



DR ROBA HOUHOU
Scientist



ARIADNI ELMALOGLOU
Doctoral Assistant



RAY HARRAN
Doctoral Assistant



YOU WANG
Doctoral Assistant



SOFIE TEN BOSCH
Scientific Assistant

BEHAVIOUR OF SHALES



Shales are extremely complex geomaterials and often pose many challenges for the extraction industry.

Our research on shales, therefore, is multidisciplinary, often overlapping with other research topics such as our work in nuclear waste and CO2 storage projects. This year we have built on the experience and knowledge gained from our research into nuclear waste storage and focused on exploring the extraction of gas from shales. This work is being undertaken by Jinoo Kim in partnership with Chevron.

THE TEAM:



PROF. LYESSE LALOUI
Full Professor



PROF. ALESSIO FERRARI
Senior researcher



DR ANGELICA TUTTOLOMONDO
Scientist



JINWOO KIM
Doctoral Assistant



HÉLOÏSE FUSELIER
Doctoral Assistant

NUCLEAR WASTE STORAGE



Disposal in deep clay geological formations is the most promising way of disposing of high-level radioactive wastes. Both experimental testing and numerical modeling are conducted in order to understand and predict the complex thermo-hydro-mechanical (THM) behavior of materials, as well as that of the storage facilities.

2021 has been a year of transition for our Nuclear Waste Storage research. For several years, the focus has been the exploration of the properties and characteristics of Opalinus Clay, a shale that has suitable characteristics for use as a barrier in nuclear waste repositories.

Today, the properties of Opalinus Clay are well understood by the team and our research has shifted to understanding its long-term behavior (hundreds to thousands of years). We are now exploring how gas flows through this material (Qazim Llabjani) and its long-term hydration and homogenization (Jose Bosch). We are also expanding our engagement beyond Switzerland as nuclear agencies from around the world seek our expertise, including the French (Héloïse Fuselier), Finnish (Dr Alessio Ferrari), and Japanese (Qazim Llabjani) nuclear agencies.

Here in Switzerland work has begun with the Swiss Nuclear Agency NAGRA to explore potentially suitable locations for nuclear waste repositories. This involves carefully drilling down to a depth of one kilometer to obtain a sample of material using nondestructive techniques. These unique, extremely rare, and expensive samples are now being analyzed in our lab.

THE TEAM:



PROF. LYESSE LALOUI
Full Professor



PROF. ALESSIO FERRARI
Senior researcher



DR ANGELICA TUTTOLOMONDO
Scientist



DR JOSE BOSCH
Scientist



QAZIM LLABJANI
Doctoral Assistant



HÉLOÏSE FUSELIER
Doctoral Assistant



MATTHIAS WOJNAROWICZ
Doctoral Assistant

LANDSLIDE ANALYSIS



As heavy rains sweep across Europe with growing frequency, landslides are becoming increasingly prevalent in areas susceptible to the phenomena. This year, the key research area of focus has been the development of modeling tools to predict landslides in clay.

The work has been led by Matilde Metral as part of her Master's thesis which she successfully completed this year.

Partnering with the Norwegian Geotechnical Institute (NGI), which is known around the world for its expertise in clay soils Matilde was able to identify where the deposition areas were for historical events in Norway and calculate the likely time interval for the landslides. She presented her results at the EPFL ENAC general assembly in December.

THE TEAM:



PROF. ALESSIO FERRARI
Senior researcher

PROJECTS

BIOGEOS PROJECT: ERC ADVANCED GRANT & ERC PROOF OF CONCEPT GRANT (POC)



European Research Council
Established by the European Commission

BIOGEOS: BIOmediated **GEO**material **Strengthening** (2018-2024) focuses on bio-mediated, nature-inspired ground reinforcement and explores multi-physical and highly-applicable processes in geotechnics. From engineering novel geo-materials at multiple scales, to controlling and mastering bio-inspired soil strengthening, BIOGEOS aims to establish a new paradigm in research and development for geotechnical applications.

CEBREWA: Construction & Environmental Biocementation in Real World Applications (2021-2022) is an additional ERC PoC grant that aims to develop and master a complete, industrial-scale system which will result in ground bio-cementation applications that are fast and

reproducible. The PoC is expected to result in IP consolidation, the scaling-up of production through outsourcing and added value for end-users.

The ERC-funded project is driven by its mission to design, test and ultimately standardize innovative solutions.



Funding



BIOGEOS is funded by a 6-year European Research Council (ERC) Advanced grant awarded to Prof. Laloui under the European Union's Horizon 2020 research and innovation program in 2018.



@BiogeosH2020



Biogeos H2020 Project

Visit
our website
for more
information
biogeos.epfl.ch



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BIOIMPROVED SOILS



Tech Transfer



Over the last year, our team conducted two large scale experiments, including a comprehensive chemical monitoring campaign for the characterization of carbonate mineralisation and the successful demonstration of Dynamic Cone Penetrometer (DCP) PANDA as an effective monitoring technique of the in-situ resistance of biomineralised soils.

Publications



Amongst other publications the BIOGEOS research team published their findings in October 2021 on the development of a new method to control the location and timing of Microbially Induced Calcite Precipitation (MICP) reaction and the structure and properties of the resulting carbonate mineral. The method uses novel hydrogel encapsulation of bacteria for on-demand release of MICP in soils.

ASSESSING AND EXPLOITING THE INTERACTION BETWEEN VENTILATION AND GEOTHERMAL SYSTEMS IN ENERGY TUNNELS: INNOSUISSE

Innosuisse - Swiss Innovation Agency



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Energy tunnels are a type of underground energy infrastructure that show a promising future as a potential source of passive energy. Current studies do not consider the interaction with ventilation systems installed in the tunnel, however, as most tunnels are equipped with a ventilation system, which often represents a major environmental and economic factor in the tunnel construction and operation, there is significant potential to optimize of the system to achieve more operational efficiencies.



Together with Amberg Engineering, a leading engineering provider in underground infrastructure and a specialist in civil engineering and ventilation, The Laloui Group at EPFL will collaborate in an innovation project funded by Innosuisse that will target our understanding of the synergies of heat exchangers with the ventilation system in these tunnels.

The project will investigate for the first time the potential of the interaction between the geothermal and ventilation system to enhance the already proven benefits of energy tunnels as renewable energy providers.



ENERGY GEOSTRUCTURES

NEW INSIGHTS IN THE ANALYSIS AND PREDICTION OF THE MECHANICAL BEHAVIOR OF COMPACTED EXPANSIVE CLAYS AS ENGINEERED BARRIERS: SNSF

Compacted expansive clays have a high density and significant physicochemical interactions with water. They have a remarkable swelling capacity and swelling pressure, a self-healing capacity upon wetting, and very low permeability which makes them suitable for engineering applications such as geosynthetic clay liners and nuclear waste geological storage.

In order to ensure their correct design as engineered geological barriers, knowledge of their mechanical behavior and corresponding modeling tools are crucial. Despite this, experimental investigations and reliable predictive models are still limited.



Through this research project, we hope to provide (i) access to a comprehensive understanding of the mechanical behavior of these geomaterials for their use as engineered geological barriers and (ii) suitable corresponding modeling tools for more reliable design which will lead to an increased confidence in the environmental protection systems in place.



NUCLEAR WASTE STORAGE

RADIOACTIVE WASTE MANAGEMENT: EURAD



Gas generation and transport through a radioactive waste repository is an important issue for the geological storage and disposal of radioactive waste. Improving our understanding of gas transport through low permeability porous materials such as clay materials is therefore considered a high priority research area.

This project is funded by the European Union (EU) and the Swiss National Cooperative for the Disposal of Radioactive Waste (NAGRA). As part of the scope of the European Joint Programme on Radioactive Waste Management (EURAD), The Laloui Group aims to contribute a mechanistic understanding of the hydro-mechanical phenomena and processes associated with the gas-induced impacts upon clay barriers.



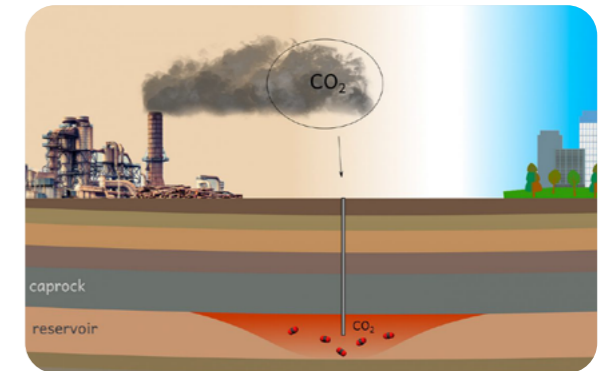
To do so, advanced and complex experiments are required to ensure well-defined hydro-mechanical conditions during gas/water injection. These precise conditions allow accurate data to be sampled which in turn can be used in the development and testing of numerical process models.

VISUALISING THE IMPACT OF CO₂ ON THE MICROSTRUCTURE OF AN ARGILLACEOUS CAPROCK SEQUESTRATION OF CO₂: SNSF SPARK

This project is exploring the impact of CO₂ on the caprock formation that ensures CO₂ storage safety in deep sedimentary reservoirs.



For the first time the coupled THMC (Thermo-Hydro-Mechanical-Chemical) response of the caprock has been analysed with in-situ x-ray tomography.



CO₂ STORAGE AND EGS

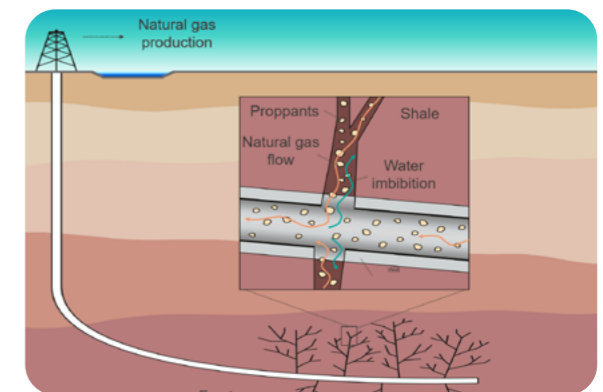
Studied at the micro-scale using in-situ 3D imaging, precious insights into the structural modifications of the caprock can be gained non-destructively and in real-time, while advanced image analysis can reveal the localized response of the heterogeneous caprock material and eventually CO₂ breakthrough through crack opening/closing. Funded by the Swiss National Science Foundation (SNSF) Spark, 3D characterization of caprocks opens the way for the development of representative models that can contribute to safe and successful upscaling to real-field applications.

DEVELOPING AN EFFECTIVE STRESS FRAMEWORK FOR PARTIALLY SATURATED GAS SHALES: CHEVRON

The Laloui Group is extending its expertise in hydro-mechanical testing of shales to investigate the volumetric behavior of gas shales in partially saturated conditions.



Organic rich shale samples cored from unconventional clays are tested under controlled suction to study their mechanical responses and the relevant water retention mechanisms.



BEHAVIOUR OF SHALES

Using this new experimental data, the effective stress framework will provide insights into the swelling and shrinkage of gas shales. With our industrial partner Chevron, a leading expert in the energy industry, we aim to improve our understanding of complex shale behaviour and promote more efficient natural gas extraction in the field.

PUBLICATIONS

2021

Citations of our
group members
from Scopus
database

1630

New journal
publications

17

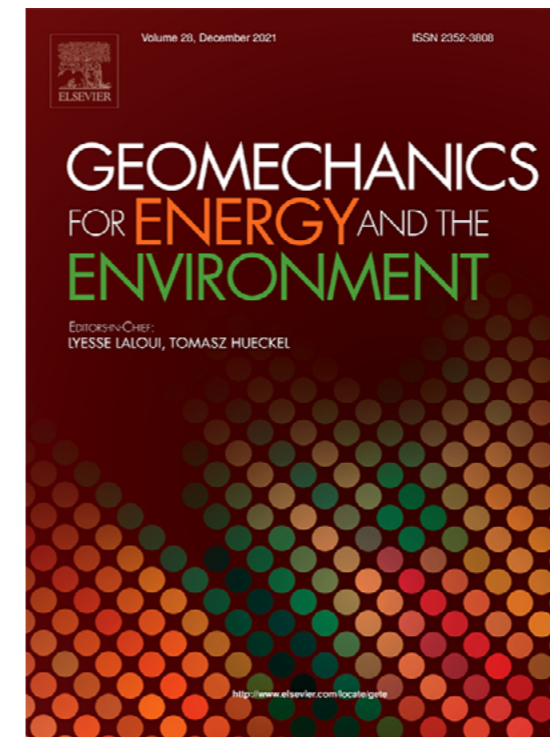


Most cited journal papers published since 2017:

- Rotta Loria, Alessandro & Laloui, Lyesse. (2017). **Thermally induced group effects among energy piles.** Géotechnique 67, No. 5, 374–393. 10.1680/jgeot.16.P.039
- Terzis, Dimitrios & Laloui, Lyesse. (2018). **3-D micro-architecture and mechanical response of soil cemented via microbial-induced calcite precipitation.** Scientific Reports. 8. 10.1038/s41598-018-19895-w.
- Terzis, Dimitrios & Laloui, Lyesse. (2019). **A decade of progress and turning points in the understanding of bio-improved soils: A review.** Geomechanics for Energy and the Environment. 19. 10.1016/j.gete.2019.03.001.
- Favero, Valentina & Ferrari, Alessio & Laloui, Lyesse. (2018). **Anisotropic Behaviour of Opalinus Clay Through Consolidated and Drained Triaxial Testing in Saturated Conditions.** Rock Mechanics and Rock Engineering. 51. 10.1007/s00603-017-1398-5.
- Zhou, Hang & Kong, Gang-Qiang & Liu, Hong & Laloui, Lyesse. (2017). **Similarity solution for cavity expansion in thermoplastic soil.** International Journal for Numerical and Analytical Methods in Geomechanics. 42. 10.1002/nag.2724.

JOURNAL

GEOMECHANICS FOR ENERGY AND THE ENVIRONMENT



GETE will publish its 30th volume in early 2022 and to celebrate the journal will be looking back on its seven-year history exploring the work published and advances made in geomechanics over the period.

Editors-in-Chief



Prof. Lyesse Laloui



Prof. Tomasz Hueckel

The journal has focused on the research topics of energy geostructures, geological storage of CO₂, nuclear waste disposal, hydrocarbon and geothermal reservoirs, and unsaturated soils and has made significant contributions to our understanding of these areas since it first published in 2015.

Cite Score

5.8 → 6.3
(2020) (2021)*

Impact Factor

2.1 → 2.8
(2019) (2020)

Acceptance Rate

57% → 23%
(2019) (2020)

*As of 4th Dec 2021.
Complete Cite Score for 2021 will
be announced in May 2022.

Elsevier
official



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03 EDUCATION

..... COMPLETED Ph.Ds

This year saw two of our candidates receive their Ph.Ds after successfully defending their theses. We would like to acknowledge the hard work and dedication they have shown to their areas of research and congratulate them on their achievement. We wish them both the best in their future academic endeavors.



ELENA RAVERA

CYCLIC THERMO-MECHANICAL BEHAVIOUR OF ENERGY PILES SUPPORTED BY SWISS NATIONAL SCIENCE FOUNDATION

ENERGY GEOSTRUCTURES

Energy piles are geothermal systems that combine the energy role of a heat exchanger with the structural role of conventional foundations. This research work was driven by the need to convey scientifically based answers with the practical needs of the thermomechanical design of energy piles. Two main challenges were part of this thesis: (i) the understanding of the mechanisms that govern the behaviour of energy pile-soil interface and (ii) the development of theoretical methods for design purposes. The multifunctional roles of this technology required to study new thermomechanical effects related to cyclic temperature variations, the thermally induced effects on the behaviour of piles and soil, as well as structure-pile-soil interaction. The failure mechanism at the pile-soil interface subjected to cyclic thermal loads was investigated from an experimental and constitutive perspective. Experimental procedures and constitutive models for more advanced design analyses were proposed to help develop reliable, long-term predictions of the behaviour and performance of energy pile groups. The utility of developing theoretical methods enabled the examination of complex practical problems in a systematic, albeit approximate, way for routine design. The interaction factor method and the load transfer method were mathematically formulated to expand and enrich the framework of available analytical and semi-analytical methods.



JOSE BOSCH

STUDIES ON THE MECHANICAL EVOLUTION OF COMPACTED BENTONITE SUBJECTED TO ENVIRONMENTAL ACTIONS SUPPORTED BY EUROPEAN PROJECT "BEACON"

Deep geological disposal is currently the most feasible option for the long-term isolation of radioactive waste, by emplacing the waste into tunnels or drifts excavated at great depths in suitable geological formations. The use of bentonite, a highly expansive clay, is considered in many repository designs as backfill and sealing material because of its favorable properties. Throughout the lifetime of a repository, the bentonite will be subjected to a series of environmental actions, mainly heating, as a result of the decaying radioactivity of the waste, and hydration from the groundwater flow of the surrounding rock. The thesis aimed to advance the understanding of the mechanical behaviour of bentonites subjected to environmental actions by means of a coupled hydro-mechanical modelling framework.

NUCLEAR WASTE STORAGE

EDUCATION

ACADEMIC YEAR 2020/2021



1 Bachelor course

- Soil mechanics and Groundwater seepage



7 Master courses

- Geomechanics
- Risk analysis and management
- Energy geostructures
- Engineering geology for geo-energy
- Slope Stability
- Geology for construction and environment
- Innovation for construction and the environment



3 Extra courses

- A Resilient Future: Science and Technology for Disaster Risk Reduction
- Experimental Geomechanics (Mechanics Doctoral program)
- Energy Geostructures: Analysis and Design - continuing education

MASTER PROJECTS



6 Master projects

Helping engineers better predict clay landslides: Mathilde Metral

Thermo-hydraulic behaviour of Energy barrettes: Youssouf Lebar

Energy performance of high BHEs density at district scale: Lisa Cassina

Tunnel in urban site - Lausanne Metro M3 Section Caserne-Blécherette: Loïc Bonny

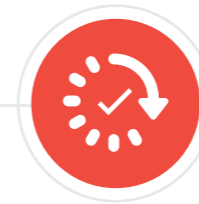
Assesing the effect of pore-scale heterogeneity on glass beads treated microbially induced calcite precipitation: Paolo Gandolfi

Numerical modeling and analysis of complex geomechanical problems with thermo-hydro-mechanical coupling: Charbel Yazbeck

Pre-studies to Master project:
Design of an Energy Tunnel: Annik Schaufelberger

Caractérisation thermique d'un système de captage et valorisation de chaleur fatale en milieu souterrain: Christopher Tomcik

Ph.D. THESES



8 ongoing Ph.D. theses

Geomechanical Response Of Geomaterials To Chemical Reaction With CO2: Taeheon Kim

Mechanical Performance And Upscaling Of Bio-Improved Soils (in the context of BIOGEOS): Ray Harran

An Effective Stress Framework For Partially Saturated Gas Shales: Jinwoo Kim

Process Efficiency Optimization Of Bio-Cementation Via Multi-Scale Experiments (in the context of BIOGEOS): Ariadni Elmaloglou

Performance assessment of FEM models to simulate THM effects in the rock around the FE-tunnel: Matthias Wojnarowicz

Thermo-Hydro-Mechanical Behavior of the Callovo-Oxfordian Claystone Under Thermal Loading: Héloïse Fuselier

Gas-Induced Impacts on the Barrier Integrity of Deep Geological Repository of Radioactive Wastes (a contribution to the EURAD-Gas project): Qazim Llabjani

Dynamic behaviors of soils treated by MICP (Microbially-induced calcite precipitation): You Wang



3 Internships completed

Paolo Gandolfi completed an internship working on Micro-scale investigation of MICP treated soils

Ziad Sahlab completed his internship working on shear strength and failure envelopes of bio-cemented sands

Judith Gouin completed her intership within CEBREWA (Construction & Environmental Biocementation in Real World Applications) project in the context of BIOGEOS project

ENERGY GEOSTRUCTURES INTENSIVE COURSE: ANALYSIS AND DESIGN

This course is aimed at professionals and scientists who want to acquire knowledge on the energy, geotechnical and structural performance of energy geostructures. Organised by Prof. Lyesse Laloui (EPFL) and Prof. Alessandro F. Rotta Loria (Northwestern University).

INVITED SPEAKERS

Mr. Tony Amis

Energy expert, GI-Energy, U.S.A.

Mr. Didier Mülhauser

Contractor expert, Marti SA, Switzerland

Mr. Luis de Pereda Fernández

Architect, ENERES, Spain

● **NEXT EDITION:
FEBRUARY 21 - 23
2022!**

The course overview:

**PART
A**

Introduction to
energy geostructures

**PART
B**

Energy aspects

**PART
C**

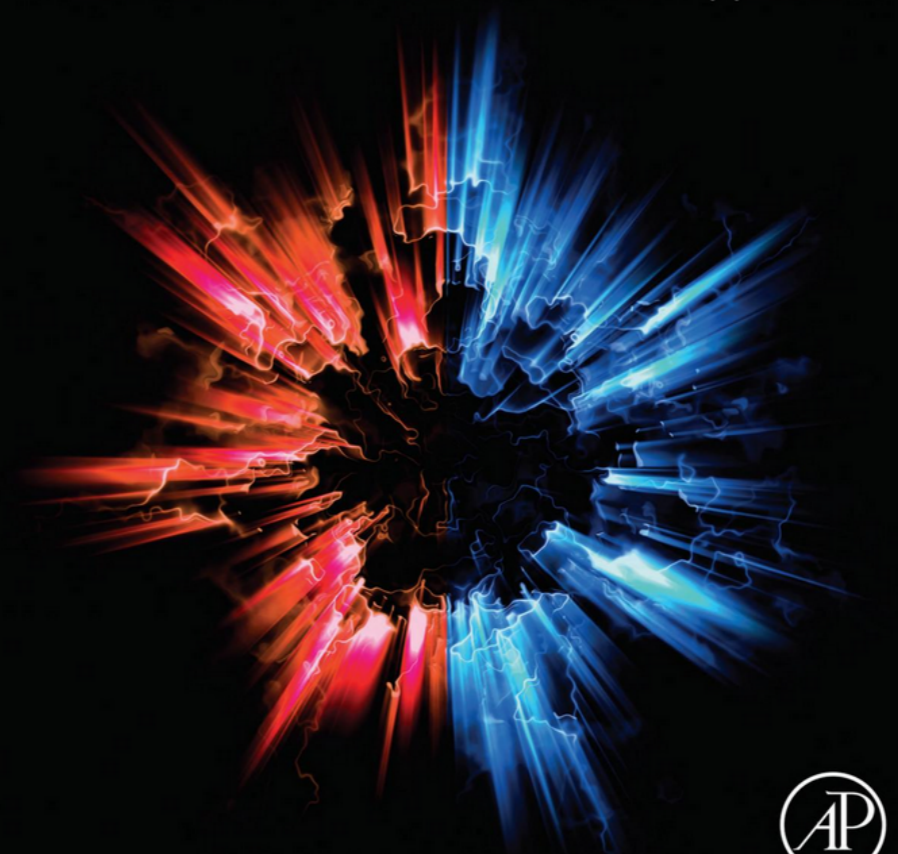
Geotechnical and
structural aspects

**PART
D**

Integrated energy,
geotechnical and
structural design

Analysis and Design of Energy Geostructures

Theoretical Essentials and Practical Application



Lyesse Laloui and Alessandro F. Rotta Loria



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Prof. Lyesse Laloui



*Alessandro F. Rotta
Loria*

The book provides an interdisciplinary introduction to key concepts and project applications of energy geostructures.



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4+

INNOVATION & TECH TRANSFER

ENERDRAPE



Enerdrape has developed an innovative technology that allows latent heat to be exploited from existing underground infrastructure. The spin-off uses modular geothermal panels which can be easily installed in existing buildings such as parking lots, train stations and tunnels.



Pilot project, Lausanne

The Laloui Group spin-off has had a busy year exploring how existing buildings can save energy and reduce their greenhouse gas emissions.

Enerdrape Team



Margaux Peltier
(co-founder)



Prof. Lyesse Laloui
(co-founder)



Prof. Alessandro Rotta Loria
(co-founder)

Pilot project launched

Piloting of Enerdrape panels in a parking lot in Lausanne's Sébeillon district. The full scale installation might supply up to a third of the heating energy needs of 60-odd apartments above.

Start-Up 10th Edition

Winners of the 10th annual Start-up Champions Seed Night, competing against 19 others promising startups. Pitching the Enerdrape concept in under 90 seconds CEO of Enerdrape, Margaux Peltier beat the field.

Venture Kick winner

Winners of the final kick of the Venture Kick competition in August. The seed funding prize of CH150,000 allowed the start-up to close partnership deals, expand the team and support its continued growth. Enerdrape is now raising a further CHF2.2 million to accelerate product dev and go to market.

Hello Tomorrow Global Challenge Track Winner

Winners of the 'Mobility & Urban Sustainability' track sponsored by Leonard within Hello tomorrow's Global Challenge!



05

ACHIEVEMENTS, MEDIA & EVENTS

PERSONAL ACHIEVEMENTS AND AWARDS



.....

PROF. LALOUI EUROPEAN VICE PRESIDENT-ELECT OF ISSMGE

Prof. Lyesse Laloui was elected as the European Vice President of the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE) this year. He will commence his new role in 2022 after an inauguration at the 20th International Conference of ISSMGE in Sydney, Australia this May. He looks forward to working toward a true European geotechnical identity with European society members.



.....

MARGAUX PELTIER WINS START UP CHAMPION COMPLETION

The CEO of Enerdrape, Margaux Peltier won this year's 10th annual Start-up Champions Seed Night, competing against 19 others promising startups. The event organized by EPFL and Venturelab, gives 90 seconds to each participant to pitch their innovation to a jury and audience of 500 people.

Margaux pitched Enerdrape, an LRG innovation spin-off, is a cleantech startup, developing modular geothermal panels which can harvest the heat from the underground constructions such as metro tunnels or parking lots, and then use the harnessed energy to heat surrounding buildings and is currently being trialed in Lausanne, Switzerland.



PROF LYESSE LALOUI DELIVERS THE PRESTIGIOUS VIENNA TERZAGHI LECTURE

Professor Laloui has been awarded the Vienna Terzaghi Lecture. The combined lecture and award have been given biennially to internationally renowned geotechnical engineers. Named in honor of Karl von Terzaghi, who is considered the founding father of soil mechanics. Laloui will present his lecture titled "Tailor-made soil properties by bio-geochemical means" at the Austrian Geotechnical Conference in January 2022.

MEDIA PRESENCE



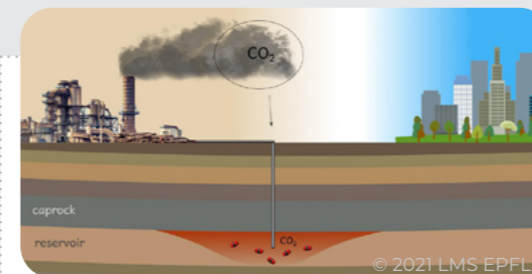
Will Switzerland store CO2 underground?

Tribune de Genève and 24heures

In order to achieve carbon neutrality by 2050, Switzerland will have to choose between exporting carbon dioxide or storing it underground. In the article published by Tribune de Genève and 24heures the experts including Prof. Laloui share their opinions around possible solutions. Carbon dioxide can be converted into various products, but in large quantities, the only solution seems to be injecting and storing it underground. The Laloui Group is contributing to the research on CO2 capture and storage currently carried out in the Mont Terri Laboratory in the Swiss Jura region.



Scan to read whole interview



Promising findings on the potentials of CO2 sequestration

SCCER SoE

This Swiss Competence Centre for Energy Research – Supply of Electricity (SCCER-SoE) story highlights the success to date of the ongoing experiments on geological sequestration of carbon dioxide CO2 as part of the European ELEGANCY project. The story highlights the important role the LRG has played in the success to date.



Scan to read whole interview



Landslides, how to prevent the ground from collapsing

Heidi News

© 2021 Keystone / Alessandro della Valle

Six to eight percent of Switzerland is affected by landslides and this is likely to increase as we see more disruption to precipitation cycles and the melting of glaciers and permafrost. Dr Alessio Ferrari explains the underlying causes, future trends and potential solutions.



Scan to read whole interview



Bacteria to stabilize soils

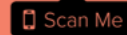
Entreprise Romande

© 2021 Entreprise Romande

Prof. Laloui and Dr Terzis introduce the concepts of MeduSoil in an interview with l'Entreprise Romande. They describe how a start-up from The Laloui Group, aims to replace polluting soil stabilization practices, with a fast, economical and more ecological solution which instead of relying on traditional cement slurries for soil improvement, MeduSoil uses microorganisms to create a natural cement instead.



Scan to read whole interview



“In Switzerland, the potential of surface geothermal energy is enormous”

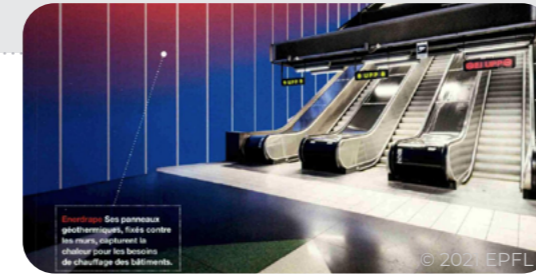
Le Temps

© 2021 Keystone / Jean-Christophe Bötter

Prof. Laloui discusses Switzerland's geothermal energy possibilities in Le Temps. He believes that geoenery remains largely underexploited and while challenges remain the potential benefits should not be ignored.



Scan to read whole interview



The new gold rush

Bilan Magazine

© 2021 EPFL

The Laloui Group spin-off Enerdrape was featured in Bilan Magazine as part of an article addressing CO2 mitigation. Enerdrape CEO Margaux Peltier explains how it not only adds a new dimension for sourcing renewable thermal energy for the heating and cooling needs of buildings, but also fosters and enables access to renewable heat sources in urban and built environments, where options are limited.



Scan to read whole interview



Start-ups propose solutions for building energy renovation.

AGEFI

© AGEFI

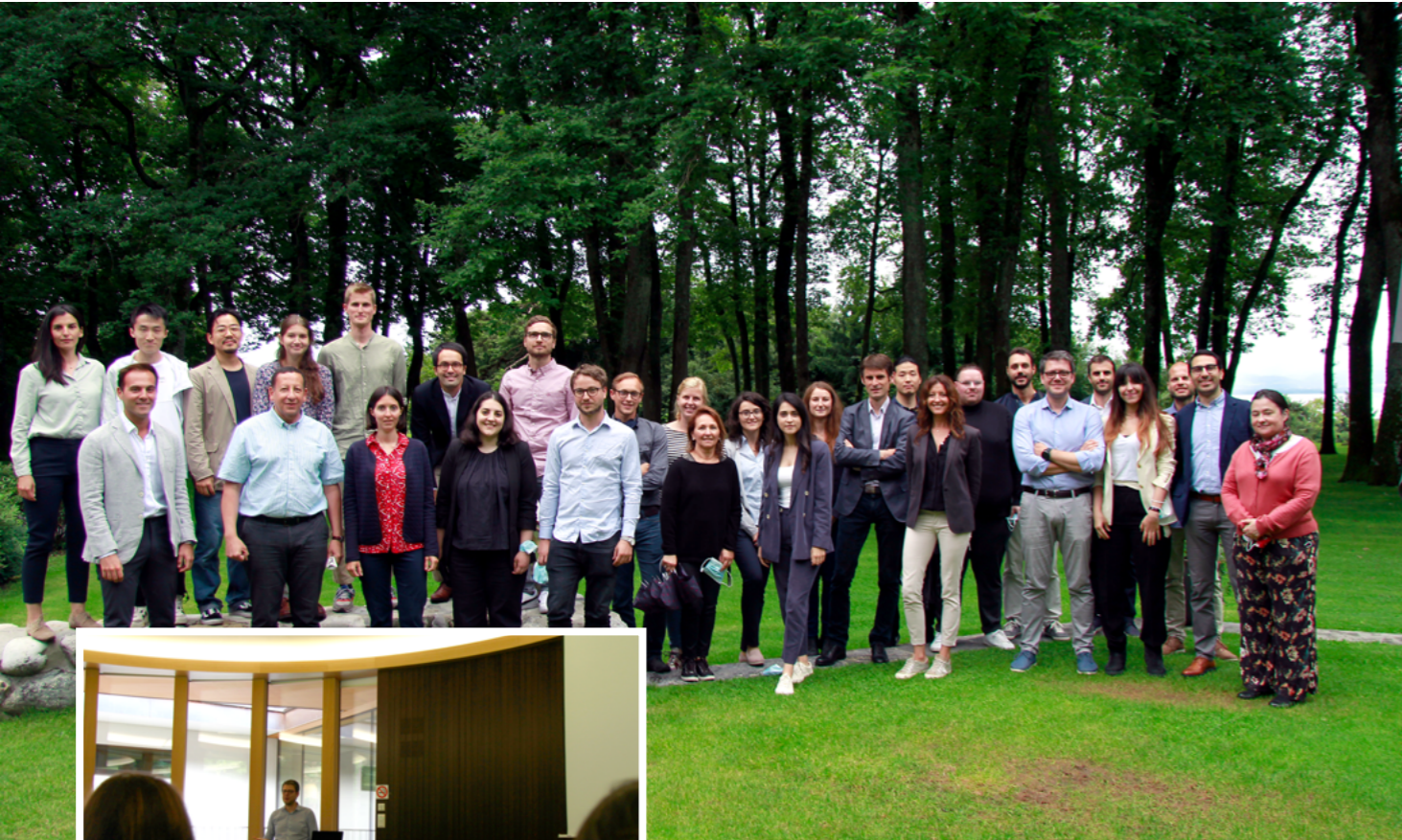
Green building energetics was a major topic of discussion at the Rent Fair, a melting pot of Swiss real estate professionals and stakeholders held in September. The demand for clean energy in the real-estate sector is rising. Prof. Laloui was joined by The Laloui Group clean-tech start-ups Geoeg and Enerdrape where they caught AGEFI and the public's eye with their innovative solutions for the cooling and heating of buildings.



Scan to read whole interview



AFTER HOURS...



ANNUAL MEETING

This year's Annual Meeting was held at the beautiful Bois Chamblard on the shores of Lake Geneva in July of this year.

The day commenced with Prof. Lyesse Laloui presenting some of the highlights of our activities to date, followed by presentations from team members on some of our latest developments and perspectives on our research into shales, our ERC Project BIOGEOS, and our progress on CO2 Sequestration.



Alessio Ferrari introducing shales topic



Scientific trends in Geomechanics at Northwestern University and North America - Alessandro Rotta Loria



The assembly learned about the latest scientific trends in geomechanics from our guest, Prof. Alessandro Rotta Loria from Northwestern University in North America, followed by a cocktail dinner and evening festivities.

It was a welcome opportunity for the team to reacquaint and relax with each other, our supporters, and collaborators after the recent challenges of COVID-19 restrictions.

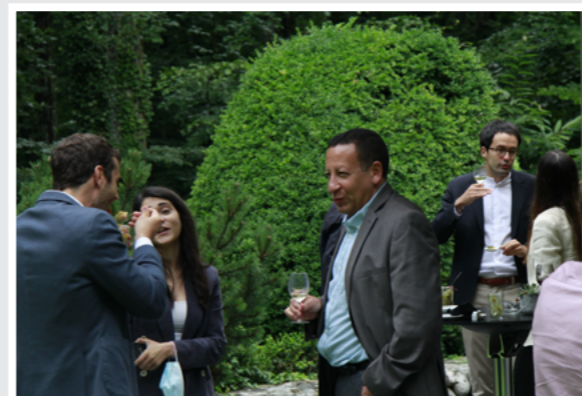
A thoroughly enjoyable day was had by all.



Eleni Stavropoulou speaking about CO2 Sequestration



Dimitrios Terzis presenting BIOGEOS ERC Project



Apéro

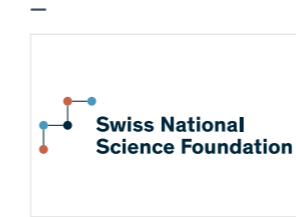


Apéro

OUR PARTNERS

WE WOULD LIKE TO EXPRESS OUR GRATITUDE TO OUR PARTNERS FOR ALL THE SUPPORT THAT WE HAVE RECEIVED. THANK YOU FOR SHOWING SO MUCH TRUST IN US!

SWISS NATIONAL SCIENCE FOUNDATION



CHEVRON



CONFÉDÉRATION SUISSE



EU



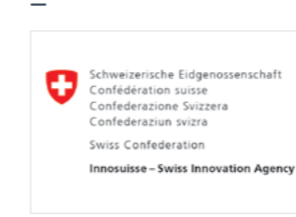
ERC



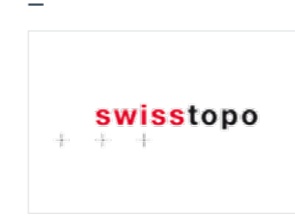
MONT TERRI



INNOSUISSE



SWISSTOPO



NAGRA



POSIVA



JAEA



ANDRA



AMBERG ENGINEERING





Document prepared by: Wioletta Kucharska and Brendan Smith

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Ecole Polytechnique Fédérale de Lausanne (EPFL)

2022



HOW TO REACH US:



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