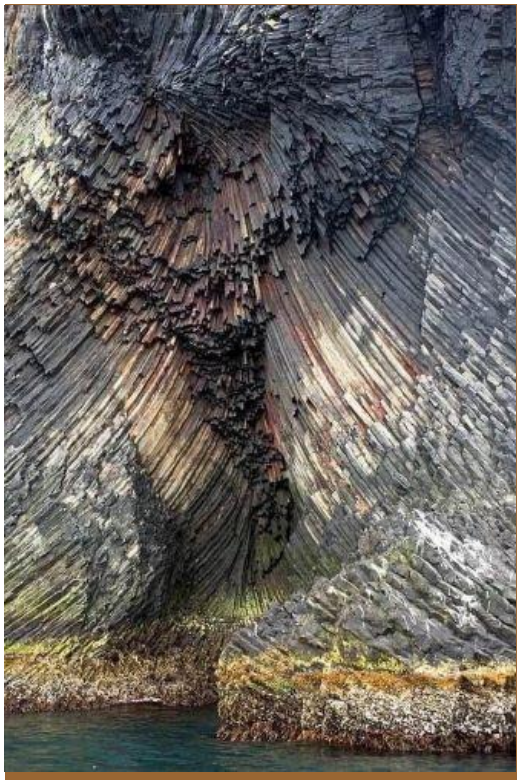

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Αρ. 171 – ΙΑΝΟΥΑΡΙΟΣ 2023

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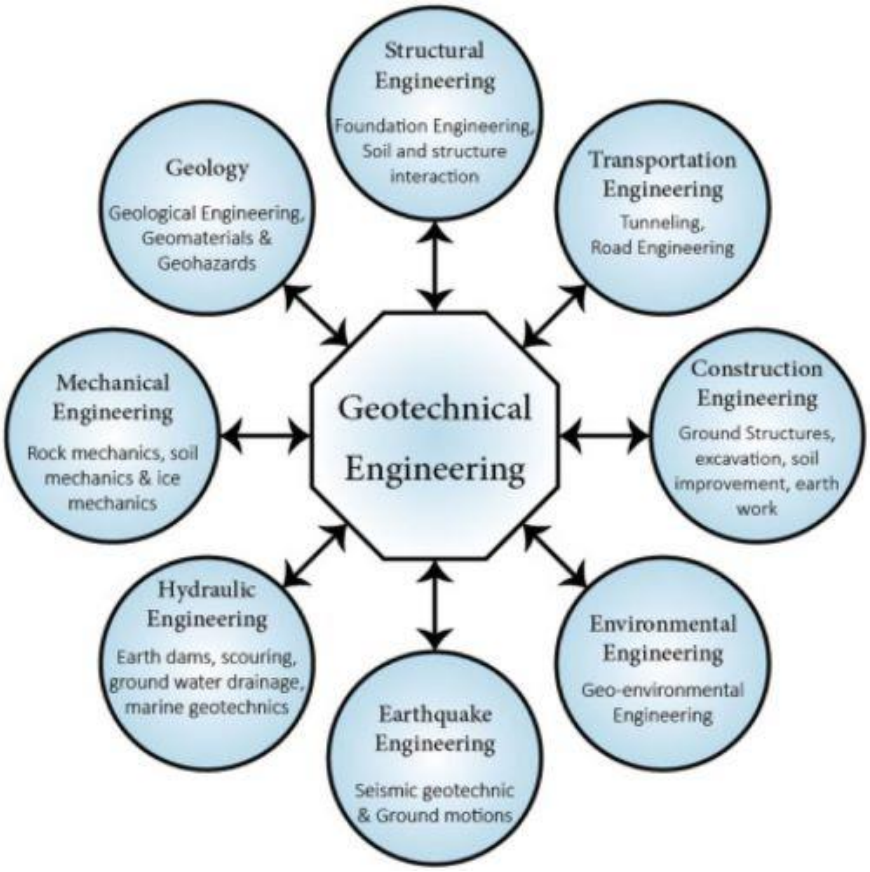
How geotechnical engineering overlap with other sciences



Abolfazl Eslami, Mohammad M. Eslami, in Piezocone and Cone Penetration Test (CPTu and CPT) Applications in Foundation Engineering, 2020

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Π Ε Ρ Ι Ε Χ Ο Μ Ε Ν Α

Make the most of educational opportunities, and then after you graduate, don't be afraid to take advantage of opportunities that come along that may not be exactly what you had in mind to start with. If everybody did exactly what they were trained for, there wouldn't be any advancement. Certainly my career was totally changed by a subway experience with Terzaghi, which wasn't planned at all. If I had missed that, my life would have been totally different.

Ralph B. Peck

ΑΡΘΡΑ

Exploring the Historical Development of Geotechnical Engineering
A Proposed Future Direction

Michael Bennett and Thomas Kennedy

Introduction and Study Origins

"History never repeats itself, but it often rhymes." The old aphorism reflects how the study of the past may, perhaps, be most widely valued when it can be used to improve current and future decision making. The education the authors received as geotechnical graduate students certainly impressed upon them the importance of recognizing that not all wisdom is necessarily new. Much of their graduate coursework involved reading technical papers that had introduced concepts of outstanding historical significance in the field, such as pore pressure coefficients, stress paths, and the stress history and normalized soil engineering model. These papers gave the authors both respect for and interest in the historical development of the field. After graduation, the authors furthered and deepened this interest by continuing to expand their knowledge of the profession through both experience in practice and the review of additional literature.

Existing Work on Geotechnical History

The authors' sustained interest in the history of their profession eventually led them to examine existing literature on the topic. Their preliminary review showed them that geotechnical engineers have long valued their shared professional heritage and have already published many case histories, literature reviews and articles on historical topics. Yet the search also indicated to the authors that systematic thinking, which is critical to the technical aspects of the geotechnical field, has largely been absent from studies of its development. It appeared to the authors that the overall lack of organization and synthesis of works on the history of the profession had kept the knowledge they contained from being distributed more widely, and that much of the geotechnical community had thus been left with a relatively limited knowledge of its past beyond a handful of anecdotes about a few founders. However, it also seemed evident to the authors that this status quo was unlikely to change unless the potential benefits of doing historical research on the development of geotechnical engineering could be made clear.

During their initial search, the authors encountered several databases of historical geotechnical literature in addition to the works themselves. Databases such as Google Scholar provide references for each work they include and map the connections between different works. While these sites represent powerful tools for historical research on geotechnical engineering, they only partially tell the story of how the discipline was developed. Accumulating sources and data such as those on the sites is a critical part of historical research. Creating the most useful history possible from some of these databases, though, would require considerable historical judgment to assess, analyze and contextualize the works and data cited by such sites in a more organized format, such as a narrative. The results of the authors' preliminary search indicated to them that only a few such studies in geotechnical engineering, most notably several done by Sir Alec Skempton, had been performed to date.

Objective and Motivation

The authors hypothesized that undertaking a more organized and systematic review of geotechnical history, to the extent they could, might benefit the technical side of the discipline by highlighting gaps in the body of knowledge of the profession. They based their hypothesis on the long-accepted nature of technical discovery and research, which esteemed civil engineer William Anderson explained well in an 1893 lecture to the Institution of Civil Engineers in London. "The history of scientific research," Anderson noted, "teems with instances of discoveries which at first seemed to have had no practical value, but which nevertheless have ultimately proved to be of the utmost importance to the engineer." This quote remains a guiding principle of research in all branches and subdisciplines of engineering, including the geotechnical field, 130 years after Anderson succinctly articulated it. Karl Terzaghi himself, widely considered the founder of geotechnical engineering, cited Anderson's remark in his own lecture to the Institution of Civil Engineers on the emerging science of soil mechanics in 1939.

> ***... geotechnical engineers have long valued their shared professional heritage and have already published many case histories, literature reviews and articles on historical topics.***

Exploring Geotechnical History, Part I

Once the authors had decided to start examining the history of the profession more systematically, they discussed their plan with several experienced geotechnical engineers, some in academia and others in practice. When these seasoned engineers all supported the idea, the authors got to work. They began their studies of geotechnical history by reviewing 15 articles and book chapters on geotechnical topics from the 19th and early 20th centuries, writing articles on the main points of each, and posting the articles on a website they had created. The chosen sources were selected from anthologies and bibliographies of vintage geotechnical works by engineers and groups who had previously examined the history of the profession. To avoid the pitfalls of trying to write a single overarching narrative on geotechnical history, the authors started their study by looking for observations from individual works, then gradually began considering potential connections between them.

The authors enjoyed reading each of the selected works from geotechnical history and writing and posting articles on them from the outset. For instance, several works reviewed early in the study showed the origins of various geotechnical principles including William Rankine's lateral earth pressure theory, the influence of relative density and stress history on the behavior of sands, the dilatancy of granular soils and negative pore pressures, and drained and undrained soil shear strengths. Yet the authors also found that their initial reviews were rewarding mainly as personal experiences that gave

them a sense of connection to the origins of their profession. By contrast, the works they initially reviewed indicated few if any remaining directions for potential future technical research in geotechnical engineering, such as overlooked ideas or underappreciated sources of potential error. While the authors appreciated that the works reviewed initially had already been pored over by generations of civil and geotechnical engineers, they remained somewhat disappointed to not find, at least initially, future such avenues of technical inquiry in their study.

The Institution of Civil Engineers library in London

By contrast, the authors found their work more fruitful as they began comparing the different works they had reviewed. Comparing these works led the authors to conclude that a serious rivalry existed until the early 20th century between civil engineers who mainly approached geotechnical problems theoretically and other civil engineers who tackled such problems primarily by using common field practices and rules of thumb. For example, while Rankine used pages of equations to derive his theory of lateral earth pressure in the U.K. in the 1850s, other British civil engineers in the 1880s harshly criticized overly precise calculations of earth pressure as being as worthless as weather forecasts in almanacs. This debate raged on in civil engineering circles until Karl von Terzaghi became prominent in the mid-1920s in part by realizing that the engineering behavior of soils was best described using a combination of the two approaches. He developed a series of semi-empirical procedures to help unite theory and practice in the new field of soil mechanics by allowing practitioners in the discipline to simultaneously consider both field data and theoretical considerations during the design process. For instance, Terzaghi and his mentee, Ralph Peck, developed an equation by which the settlement of sands could be estimated from their SPT N-values. In this regard, Terzaghi was once again following the example laid out by Anderson in his 1893 lecture. "The competent and successful engineer," Anderson had remarked, "is careful to make theory and practice walk side by side, the one ever aiding and guiding the other, neither asserting undue supremacy."

They began their studies of geotechnical history by reviewing 15 articles and book chapters on geotechnical topics from the 19th and early 20th centuries, writing articles on the main points of each, and posting the articles on a website they had created.

Exploring Geotech History, Part II

Once the authors had reviewed the aforementioned works from early geotechnical history, they decided to incorporate quantitative metrics into their selection process for future works to be reviewed. The authors chose to use how many times a work had been cited as a first-order approximation of its impact on geotechnical history. They reasoned that such a method would substantially improve upon simply choosing works from previous anthologies of historical geotechnical literature by helping them independently assess the significance of these works. Notably, the authors also recognized that such a citation-driven procedure for selecting literature for review would have limitations. The number of times a geotechnical work has been cited may reflect not its value to the profession overall but either its significance as judged by previous geoprofessionals or its timing of publication relative to the development of a subdiscipline of the field. However, the authors also reasoned that using an element of historical judgment in selecting geotechnical pieces for review could address these limitations at least partially and, furthermore, would tie the procedure to the rest of geotechnical engineering by making it semi-empirical.

The authors used their chosen metric of citation counts, coupled with historical judgment, to shed some new light on the disagreements between Terzaghi and his fellow geotechnical pioneer Donald Taylor. This tension, already described qualitatively by other geotechnical history sources, appears to be reflected quantitatively in the citation totals for three prominent textbooks in the field which appeared in the 1940s – *Theoretical Soil Mechanics* by Terzaghi, *Soil Mechanics in Engineering Practice* by Terzaghi and Peck, and *Fundamentals of Soil Mechanics* by Taylor. The references within Taylor's book include 12 citations of works authored or coauthored by Terzaghi. By contrast, the combined references in the two books Terzaghi wrote or cowrote include just one citation of work by Taylor. This disparity may partly be due to Taylor's and Terzaghi's respective research outputs as of 1948, by which time Taylor had authored 11 works compared to 184 by Terzaghi. Yet the citation counts suggest that, while Taylor held Terzaghi's work in high regard, the opposite may not have been true.

Future Plans

Moving forward, the authors will continue reviewing historical geotechnical works and writing and posting web entries on their findings. They have recently agreed to a partnership with the Geo-Institute (G-I) of the American Society of Civil Engineers through which the G-I will post and publicize new articles starting in early 2023. Looking further ahead, the authors will also make greater use of existing online tools with potential applicability to research on geotechnical history, most notably Google Scholar.

The authors also aim to recruit other geoprofessionals in both academia and practice to get involved as they are able in studying the history of geotechnical engineering. The authors hypothesize that having a larger geotechnical history community will allow increasing numbers of geoprofessionals to

start and contribute to discussions on which topics of investigation related to the history of the discipline may benefit the profession most. The authors are also currently pursuing support for geotechnical history endeavors through platforms provided by larger institutions in the discipline, such as DFI and G-I. If interest in geotechnical history proves sufficiently widespread, the authors, or perhaps their future colleagues in exploring the subject, may establish partnerships with international institutions in the profession, such as the Institution of Civil Engineers or the International Society for Soil Mechanics and Geotechnical Engineering.

Ultimately, the authors' main goal is to help make the study of geotechnical history robust and selfsustaining. They firmly believe that work on this topic has the potential to positively impact not only how the past of the profession is told but also, and perhaps even more importantly, where its future may lie.

(Deep Foundations, Jan/Fen 2023, pp. 87-90, https://www.nxtbook.com/dfi/DEEP-FOUNDATIONS/january-february-2023/index.php#/p/Intro)

How big is the largest possible earthquake?

The amount of energy released in an earthquake is controlled by how much of the crust breaks. The good news is, we're not likely to see a magnitude 10.

Khokana village in Kathmandu, Nepal, after a damaging earthquake. While the largest earthquakes release massive amounts of energy, even small temblors can do a lot of damage when they hit populated areas with buildings prone to collapse. (Image credit: Alison Wright, Getty Images)

On May 22, 1960, a devastating earthquake hit southern Chile. For 10 minutes, the ground shook so violently that people were unable to stay on their feet. Cracks opened in roads, and buildings collapsed. One man, quoted in a U.S. Geological Survey (USGS) report (opens in new tab) about surviving the quake and its subsequent tsunami, initially thought the Cold War had escalated into nuclear Armageddon.

The Valdivia earthquake, named after the town closest to its epicenter, was roughly a magnitude 9.5, the largest ever recorded before or since. But could quakes get bigger?

The answer, geoscientists say, is yes. However, the chances of a much larger quake are low. While a quake larger in magnitude than 9.5 could occur, it would require an enormous chunk of crust to break all at once — the movement of a fault both enormously deep and extraordinarily long. There aren't many places on Earth where that could happen, said Wendy Bohon, an earthquake geologist and science communicator. A 9.5 magnitude quake is probably right around the upper limit for what the planet can generate, Bohon told Live Science, and a magnitude 10 is extremely unlikely.

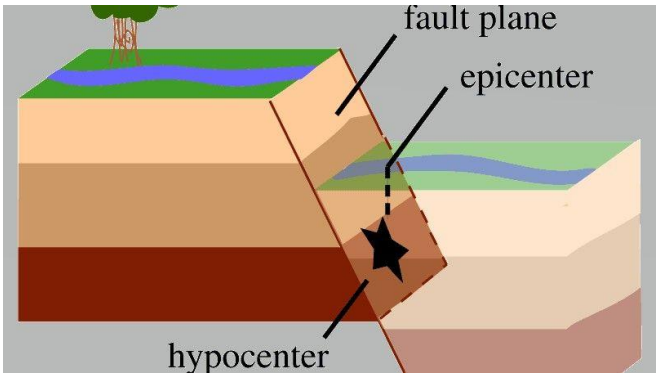
"It's great for Hollywood, but it's not realistic for the Earth, thank goodness," Bohon said.

Magnitude is a measurement of the amount of energy released in an earthquake. It's slightly different from how intense an earthquake feels, which can be influenced by someone's distance from the epicenter and the conditions of the ground. The same quake will feel stronger to someone standing on loose soil and sand than to someone standing on firm bedrock, Bohon said.

A quake's magnitude is dependent on the total area of a fault that breaks. This, in turn, depends on how deep the fault goes down into the crust and how long, horizontally, the segment is that breaks. There are physical limits to how big an area can break. The deepest faults are at subduction zones, where one tectonic plate pushes under another. Go deep enough, though, and the rocks are so warm that they're hot and gooey; instead of breaking, they bend. While quakes can sometimes occur as deep as 500 miles (800 kilometers) below Earth's surface, according to the USGS (opens in new tab), most deep quakes don't generate much shaking at the surface; it's the ones in the upper few tens of kilometers of crust that are most dangerous to people.

The faults most capable of setting off large, damaging earthquakes are dipping faults in subduction zones, said Heidi Houston (opens in new tab), an earthquake geologist at the University of Southern California. These dipping faults, so named because they're at an oblique angle rather than vertical, have the largest areas of rocks that can get stuck against one another, building up stress and then finally breaking.

"It's really the size of the dipping fault plane that is the biggest control on the maximum earthquake size, and those fault planes can get bigger in the subduction zone setting," Houston told Live Science.



A normal dip-slip fault showing the fault plane, or the area of a fault that breaks to cause an earthquake. (Image credit: USGS)

But there are also limits the length of a fault segment that can break. Even subduction zone faults don't break all at once, Bohon said. Typically, something gets in the way — a seamount (an undersea mountain), perhaps, or a change in the type of rock or the geometry of rock that makes one segment of a fault more resistant to stress than its neighbor.

Another factor feeding into earthquake magnitude is how much the fault moves, or slips, Houston said. As a rule, smaller areas of breaking fault slip less than larger ones. So, while a magnitude 5 quake can slip a few centimeters — a distance not likely to break the ground above — a magnitude 9 might slip 66 feet (about 20 meters) or more. The 1960 Chile quake actually increased the area of the country because of the way the ground stretched, Sergio Barrientos, a seismologist at the University of Chile who lived through the quake, told NPR in 2016 (opens in new tab).

Understanding magnitude

The earthquake magnitude scale can inadvertently obscure the difference between very large earthquakes. The scale isn't linear, but logarithmic: For every unit it goes up, the ground motion increases 10 times and the energy released goes up 32 times. Bohon likes to use the metaphor of breaking a bundle of spaghetti. If breaking one strand of spaghetti is the equivalent of a magnitude 5 earthquake, you'd have to break 32 strands to release the energy of a magnitude 6 quake. On this spaghetti scale, a magnitude 7 is like 1,024 strands breaking, a magnitude 8 is like 32,768 strands, and a magnitude 9 is like 1,048,576 strands.

As this example shows, the difference between a magnitude 8 and a magnitude 9 quake, in terms of energy released, is a lot more than the difference between a magnitude 5 and a magnitude 6. Thus, nudging up an earthquake's magnitude from 9.5 to 9.6 takes a lot bigger of an area fault breaking than going between a magnitude 5.5 and 5.6.

Due to uncertainty in the measurements, there is still scientific debate about whether the 1960 Chilean quake was exactly magnitude 9.5, Houston said. But to drive home the point about the massive differences in the size of seemingly small numbers on this end of the magnitude scale, a magnitude 9.5 quake is more than twice as strong as the next-largest quake ever recorded, a magnitude 9.2 that hit Alaska's Prince William Sound in 1964, Houston said.

There are, of course, planetary catastrophes that could theoretically lead to much more massive earthquakes: a collision with an asteroid, for example. (Some scientists think the end-Cretaceous asteroid impact that killed off the nonavian dinosaurs 66 million years ago triggered earthquakes with double-digit magnitudes, though pinpointing the size is tricky.) On timescales of billions of years, Earth could certainly see such a disaster, Houston said. But the chances of something larger than the mid-9s in magnitude within a human life span are very low, she said. The largest ancient quake that has been estimated based on geological evidence was also in Chile, approximately 3,800 years ago, and likely also measured about 9.5 in magnitude, according to 2022 research.

And size isn't always the most important factor in how deadly an earthquake is, at least not for humans, Bohon said. Smaller quakes have caused many, many deaths, just by virtue of hitting populated regions and areas with buildings prone to collapse. Whereas the 9.5 magnitude earthquake in Chile killed around 2,000, a quake with an estimated magnitude of 8 is thought to have killed some 830,000 people in Shaanxi, China, in 1556. In 2005, a magnitude 7.6 earthquake killed an estimated 79,000 people in Kashmir, and in 2010, a magnitude 7.0 quake killed approximately 220,000 people in Haiti. Even the 1994 Northridge earthquake, a mere magnitude 6.7 that occurred on a fault no one had even noticed before, killed 57 people, injured thousands, and caused billions of dollars' worth of damage because it impacted Los Angeles.

"So many potential faults could have damaging earthquakes," Bohon said. "But people only think about the big one."

(Stephanie Pappas / Live Science Contributor, 31 January 2023, https://www.livescience.com/largest-earthquake-possible)

The Benefits of Early Contractor Involvement

Robert Small, Ihab Allam, and Amshu Chappa

The Biosolids Digester Facilities Project (BDFP) is located in southeast San Francisco. The jobsite is bounded by active Caltrain and Union Pacific Railroad tracks on the west side and the existing Southeast Treatment Plant (SEP) on the north, south and east sides. The existing SEP was constructed in the 1950s and portions of the facility have reached their operational life. The $2 billion BDFP will replace and relocate the outdated existing solids treatment facilities with more reliable, efficient and modern technologies and facilities. In addition, the nearby Bayview and Hunters Point neighborhoods will benefit from the improved odor control.

Core Trade Partner

In 2017, the San Francisco Public Utilities Commission (SFPUC), the owner of the project, selected MWH/Webcor, a joint venture, as the construction manager general contractor (CMGC) for the project. As part of an alternate delivery method set forth in the prime contract, the CMGC was permitted to propose the use of a core trade subcontractor partner for the SFPUC's approval to provide preconstruction services. The CMGC identified three major scopes (electrical, mechanical and foundation) where a core trade partner would be able to assist the project in design build, design assist, value engineering and or other necessary preconstruction activities. In 2018, Malcolm Drilling Co., was approved by the SFPUC and brought on board as the foundation core trade partner.

Jobsite overview

The foundation partner participated in weekly meetings with the CMGC, SFPUC and the SFPUC's design team to provide value engineering on several major scopes of work. It proposed continuous flight auger (CFA) piles at certain structures, in lieu of the more traditional drilled shafts, which brought immediate schedule and cost savings to the project. In order to verify the capacities of the CFA piles and drilled shafts, the team performed an early-work onsite load test program, which gave the SFPUC design team confidence in the pile foundation selection.

Malcolm also provided guidance on the selection of temporary shoring systems to be utilized at the two major excavations (Facility 610 and Facility 600). Several cutter soil mix (CSM) shoring wall options utilizing deep soil mixing or even jet grouting plugs, as well as deeper secant pile walls, were considered. Initially, a 70 ft (21 m) deep CSM shoring wall was envisioned for both excavations, however after reviewing the available geotechnical information it was uncertain if the wall would be deep enough at the Facility 610 to provide effective groundwater cut-off. As part of another early-work onsite test program, the foundation team installed and performed a pump test program to provide the design team with more information about the groundwater conditions. It was discovered that two underground aquifers (one at 40-60 ft [12-18 m] below grade and another at 80-100 ft [24-30 m] below grade) were connected and that a 70 ft (21m) deep CSM wall would not provide an effective cutoff to control groundwater drawdown outside the excavation.

Shoring system with the excavation at full depth at Facility 610

Due to the close proximity of two nearby active railroad lines, the project could not utilize a shoring system that might allow uncontrollable drawdown outside the shored excavation. Options for a drilled secant shoring wall and a temporary diaphragm shoring wall were evaluated since they could both reach greater depths than the CSM wall option. Ultimately, a temporary diaphragm shoring wall was selected for the shoring system at Facility 610 due to the faster install time, greater depths it could penetrate and its ability to meet strict deformation criteria.

Existing Site and Subsurface Conditions

The project site is located within the Hunters Point Shear Zone. The project site is generally level at about elevation +3 ft (1 m) and the groundwater level was observed at a depth varying between 7-12 ft (2-4 m) below existing grade, although the piezometric head in the deeper soil strata is generally higher than the unconfined near surface groundwater level. In general, the geologic units encountered at the project site consisted of artificial fill extending to a depth ranging from 10-18 ft (3-5 m). The fill was underlain by young Bay mud, then upper layer sediments of interbedded sands and clays, which was underlain by old Bay clay, followed by older colluvium and then the Franciscan complex.

Design Considerations for Facility 610

The Facility 610 Anaerobic Digestion structure consists of five

digester tanks that extend from a lower basement level that is approximately 34 ft (10 m) below grade to maximum height of approximately 65 ft (19 m) above grade. Because the excavation is approximately 40 ft (12 m) deep with numerous site constraints, including two adjacent railroads that could not be impacted by the construction, a rigid shoring system was required. Excavation extended through the artificial fill and Bay mud and bottomed out in the upper layer sediments. To ensure bottom cutoff, the perimeter shoring wall was extended 160 ft (49 m) below grade to penetrate into the relatively impermeable old Bay clay for a bottom seal.

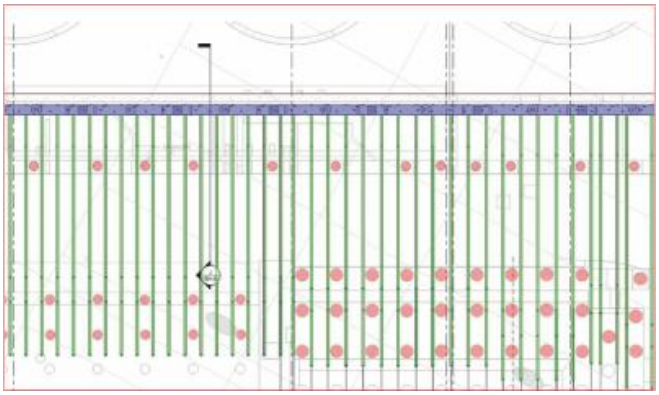
Level three tieback drilling

Excavation Support System

The design and construction of the shoring system navigated several site constraints to ensure the constructability of the tieback/bracing system and the ability to perform the excavation efficiently. The geometry of the excavation would have been ideal for an internally braced shoring system to avoid possible tieback conflicts beyond the structure. However, blockouts through the cast-in-place digester tanks were not allowed, and the size and shape of the tanks would have required excessively large spans for the internal bracing that could not meet the tight deformation criteria. Other challenges included: high groundwater levels (excessive drawdown outside the excavation was not permitted), very soft and compressible young Bay mud and protecting the active rail lines to the west. The support of excavation system had to be coordinated with existing and new adjacent structures including an existing sewer vault and a forest of piles for new structures and improvements surrounding the Facility 610 excavation.

The 41.5 ft (13 m) deep excavation is supported by a 3 ft (1 m) thick, rebar reinforced diaphragm wall (D-Wall), which is typically restrained by three levels of tiebacks.

Tiebacks were typically installed at 5 ft (1.5 m) on center and were installed at 30-degree angles with sufficient unbonded length such that bond zone reached the competent upper layer sediments that are below the young Bay mud. The tiebacks were installed through pipe block-outs that were pretied in with the diaphragm wall rebar cages.



The diaphragm wall (blue) and designed tieback locations (green) relative to existing pile foundations (red)

Drilling the level two and level three tiebacks below the groundwater table and risking excessive water and soil inflow to the excavation was a challenging part of the construction. However, the team used a wall mounted preventer system and developed cased drilling and grouting techniques to minimize the amount of soils and water that entered the excavation during the tieback install. Ultimately, hydroactive grout was pumped into the locked-off tieback wedge plate to stop the leaking water.

All tiebacks were either performance or proof tested prior to lock-off. To allow for future site build out all tiebacks were required to be detensioned.

It was very important that the drilled shaft foundation piles were installed first to avoid the risk of drilling through tensioned tiebacks. The diaphragm wall and the 100 ft (30 m) long tiebacks had to be drilled straight in order to miss the already existing pile foundations.

D-Wall installation

Because the construction sequence for the adjacent buildings was uncertain at the initial phase of the design, the Facility 610 system had to be designed such that all structures could be excavated at the same time, which was extremely challenging due to the complex interaction between the adjacent excavations.

Monitoring and Performance Criteria

Movement of the top of the slurry wall was monitored on a

weekly basis using optical survey techniques.

BC40 hydro cutter mounted on MC96 crane

The contract specifications set threshold horizontal deflection limits of the diaphragm wall at 0.5 in (12 mm) with a maximum movement limit of 1.0 in (25 mm). The baseline measurements were established prior to excavation, and monitoring will be continued until the structure is constructed to grade.

At the time of preparation of this paper, build-out of the basement was underway and lateral deflections had been limited to approximately 0.5 in (12 mm) or less. The as-built deflection numbers were comparable to estimates made during the design process.

Mobilization and Site Utilization

Logistics was a primary challenge for the construction of this project due to multiple concurrent activities to meet the project schedule. In addition to the diaphragm wall construction, the foundation partner also installed 290 each 3 ft (0.9 m) and 4 ft (1.2 m) diameter auger cast piles, 233 each 4 ft (1.2 m) diameter cased drilled shafts and 526 each 1 ft (0.3 m) diameter tie down anchors. For three shallower structure excavations (up to 26 ft [8 m] in depth), the foundation partner installed a temporary CSM shoring wall that was supported by one level of internal bracing. More than 50 dewatering wells were installed to manage and treat the groundwater at the various excavations.

Two hydro cutters and one hydraulic grab

The site configuration, including access/egress, installation sequence and support equipment layout, was carefully planned prior to mobilization. Onsite daily meetings included all drilling superintendents and subcontractors to plan the next day's activities, and a unique coordination map was created each day to reflect the new work areas. This level of coordination was required to manage the large site and ensure that spoils were efficiently off hauled and readymix concrete made on time deliveries to drilling locations. At the peak, 80 trucks of spoil were being loaded out while 80 trucks of concrete were being delivered to the jobsite daily.

Primary panel concrete placement with simultaneous excavation in background

The equipment used to install the diaphragm wall included a Bauer BC40 hydro cutter mounted on a Bauer MC96 crane, one hydraulic grab mounted on a MC64 crane, one mechanical grab mounted on Liebherr HS 885, one 300T support crane, one 150T support crane, a Bauer BE550 desander unit, a centrifuge, and twenty-two 21,000 gal (80,000 L) open top mixing tanks.

Diaphragm Wall Construction

Temporary reinforced concrete guide walls were constructed along the alignment of the diaphragm wall to be utilized as a guide for the excavation equipment and the setting of the rebar cages.

Quality control of the panel excavation is critical for the water tightness of the diaphragm wall system. Prior to concrete and rebar placement, the panel excavation is independently checked via a Koden drilling monitor, which uses ultrasonic waves to measure a precise profile of the panel excavation to confirm it meets dimensional tolerances.

Panel reinforcing cages were assembled horizontally on the ground at the project site and lofted to a vertical position for installation. Bracing embeds with shear studs and tieback blockout pipe sleeves were all installed in the rebar cage prior to lifting and installation.

Placement of the 5,000 psi (34,475,000 MPa) design strength concrete was achieved via tailgate placement into multiple gravity tremies. In total approximately 25,000 cu yd (19,000m^3) of structural concrete were placed for the slurry diaphragm wall.

Rebar cage installation in tandem with slurry wall excavation

Quality control of the concrete mix design is a critical factor for the slurry diaphragm wall system. An extensive preproduction trial batch program was implemented prior to mobilization for this project to develop a mix with local suppliers that met the required design strengths and workability parameters. During construction, continuous testing of the delivered concrete for flow, flow retention and segregation following the EFFC-DFI Guide for Tremie Concrete was implemented prior to the concrete going in the ground.

Conclusions

The early involvement of a core trade subcontractor proves successful to the design and construction of mega infrastructures that are complex and require intensive coordination between owner, CMGC, design team and contractors to overcome the many challenges a project like this presents.

In 2018 and 2019, the foundation partner spent many hours traveling to, and attending, in-person meetings with the design team and the CMGC, which were indeed necessary. With online meetings so commonplace now, this collaboration process only became more efficient as the project progressed.

For this megaproject, not only did the foundation team deploy nearly every type of drilling method in its arsenal, but also undertook many scopes that normally the general contractor handles. In addition, the foundation partner had to meet a local small business hiring goal for the project, which essentially meant that any subcontractor hired had to be a small business based in San Francisco. Through community outreach meetings, and partnering with local companies, the team successfully found and managed multiple local subcontractors for the following scopes of work: excavation, spoil off-haul/disposal, rebar cage fabrication, surveying, site security and dust control.

Many valuable lessons were learned on this project and while they don't come around often, Malcolm and Brierley are well suited to take on the next future challenging megaproject.

Acknowledgements

The authors would like to acknowledge the following organizations who were involved with the project and whose collaboration was valuable throughout design and construction: SFPUC, the SFPUC design team and the MWH/Webcor JV

(Deep Foundations, Jan/Fen 2023, pp. 79-84, https://www.nxtbook.com/dfi/DEEP-FOUNDATIONS/january-february-2023/index.php#/p/Intro)

Podcast: Geosynthetics – product types and applications

Yuli Doulala-Rigby on her recent visit to Sydney

Breaking Ground's latest episode discusses geosynthetics, including product types and applications, with Tensar chief civil engineer Chaido (Yuli) Doulala-Rigby.

In this episode of Breaking Ground, host Steve Hadley chats to Yuli Doulala-Rigby, who has previously represented the International Geosynthetics Society (IGS) on the Ground Forum. She will also finish her one year tenure as Institution of Civil Engineers (ICE) chair for the North West chapter in July.

They begin by talking about Doulala-Rigby's journey into geosynthetics. After starting out as a tunnel engineer working on the Jubilee Line extension, she moved to Hong Kong to work on slope stability projects. After 10 years there, she moved her family back to the UK and started working for Tensar.

It was at Tensar – which invented geogrids in 1978 – where Doulala-Rigby became fully immersed in the world of geosynthetics. Since then, she has become increasingly involved in the IGS, for which she was a chair between 2016 and 2018.

Doulala-Rigby is keen to promote geogrids as playing a key role in sustainable temporary and permanent works geotechnical solutions.

She explains that there are eight globally recognised functions of geosynthetics: separation, filtration, drainage, reinforcement, stabilisation, barriers, protection and erosion control.

Product wise, she says there are many types of geosynthetics. Apart from geogrids, there are geotextiles – woven or non-woven and permeable and impermeable, like geomembranes, which are thick plastic black liners that you would put at the bottom of landfills, for example. Thicker geotextiles can be used for installing around pipes for protection. These products are mostly made from polymer materials like polypropylene, polyethylene, polyester and fibre glass.

Doulala-Rigby concludes with the following message to the geotechnical sector: "All geosynthetics work and offer benefits but their performance in soil can vary dramatically. So, don't simply swap geogrids and geosynthetics in bespoke manufacturers' designs, but change the accompanying design accordingly too. And follow the design specifications."

She also goes on to bust some myths about women in engineering and offers an inspirational tale for others to follow.

You can listen to the latest episode of the Breaking Ground podcast here:

(Thames Menteth / GROUND ENGINEERING, 08 July, 2022, https://www.geplus.co.uk/news/podcast-geosynthetics-product-types-and-applications-08-07-2022

Η Γιούλη Δουλαλά-Rigby είναι Πολιτικός Μηχανικός (MSc, Civil Engineering and Rock Mechanics / Newcastle University), μέλος της ΕΕΕΕΓΜ, Council Member του Institution of Civil Engineers (ICE), Board Member της International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), Elected Member of Executive Committee της British Geotechnical Association, STEM Ambassadors.

Physics of disaster: How mudslides move

Researchers led by Penn's Douglas Jerolmack and Paulo Arratia used samples from the deadly 2018 Montecito mudslides to understand the complex forces at work in these disasters.

During the 2018 Montecito mudslides, powerful flows of debris pushed boulders out of creek-carved canyons toward homes, causing destruction and 23 deaths. New findings from a Penn-led team leveraged recent developments in physics to understand the forces that govern the mudslides.

In early December 2017, the Thomas Fire ravaged nearly 300,000 acres of Southern California. The intense heat of the flames not only killed trees and vegetation on the hillsides above Montecito, it vaporized their roots as well.

A month later, in the pre-dawn hours of Jan. 9, a strong storm pelted the barren slopes with more than half an inch of rain in five minutes. The rootless soil transformed into a powerful slurry, churning down a creek-carved canyon and picking up boulders in the rush before fanning out at the bottom and barreling into homes. Twenty-three people died in the disaster.

Could this tragedy have been avoided? What is the tipping point at which a solid slope begins to ooze like a liquid? New findings from a team led by Douglas Jerolmack of Penn's School of Arts & Sciences and School of Engineering and Applied Science in collaboration with Paulo Arratia of Penn Engineering and researchers from the University of California, Santa Barbara (UCSB), apply cutting-edge physics to answer these questions. Their study, published in the *Proceedings of the National Academy of Sciences*, performed laboratory experiments that determined how the failure and flow behavior of samples from the Montecito mudslides was related to material properties of the soil.

"We weren't there to see it happen," says Jerolmack, "but our idea was, 'Could we learn something about the process of how a solid hillside loses its rigidity by measuring how mixtures of water and soil flow when they're at different concentrations?'"

Melding the theoretical and the applied

During the winter of 2018, Jerolmack was on sabbatical and traveled to the Kavli Institute for Theoretical Physics at UCSB—but not to study mudslides. "It's a place to come and hammer out problems that are frontier topics in physics," he says. "I'm a geophysicist, but I wasn't there to do geoscience. I was there to learn about that frontier physics, especially about the physics of dense suspensions."

The Thomas Fire charred the hillsides above Montecito in late 2017, setting up conditions for mudslides in early 2018.

Three days after Jerolmack arrived, however, the debris flows occurred. About a month later, when it was safe to do so, Thomas Dunne, a geologist at UCSB and a coauthor on the paper, invited him to collect samples from Montecito.

Jerolmack joined Thomas Dunne (foreground) and Doug Burbank of University of California Santa Barbara to take samples from the field a month after the mudslides. The scientists used them to understand how the composition of mud influenced the forces required for it to lose its solidity.

It was a grim task. Some samples came from the devastated remains of homes, where mud flows from the hillside were strong enough to push massive boulders down creek beds all the way up to—and sometimes through—houses. "By the time we got near the mouth of the canyon, it was almost like

a phalanx of boulders," Jerolmack says. "Houses were buried to their roof lines; cars were pulverized and unrecognizable."

Taking the samples back to the lab, the researchers' goal was to model how the composition of the mud and the stresses it is subjected to influence when it begins to flow, overcoming the forces that lend substances rigidity, what scientists call a "jammed state."

It wasn't the first time that engineers and scientists have attempted this kind of modeling from field samples. Some studies had tried to simulate conditions in the field by placing shovelfuls of dirt and mud in large rheometers, a device that spins samples rapidly to measure their viscosity, or how their flow responds to a defined force. Typical rheometers, however, only give accurate results if a substance is homogeneous and well-mixed, not like the Montecito samples, which contained various amounts of ash, clay, and rocks.

More high-tech and sensitive rheometers, which measure the viscosity of tiny quantities, can overcome this drawback. But they come with another: samples that contain larger particles—say, rocks in mud—could clog their delicate workings.

"We realized we could take measurements that we knew to be reliable and precise if we used this exquisitely sensitive device," Jerolmack says, "even if it came at the cost of having to sieve out the coarsest material from our samples."

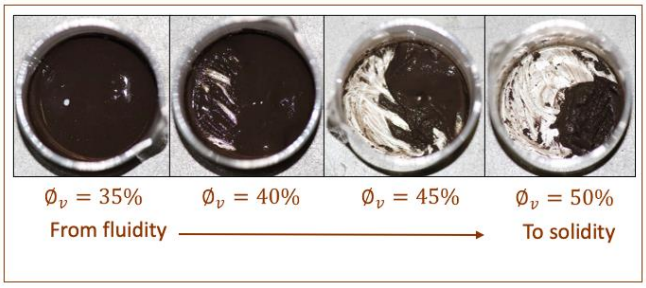
A clear signal from 'dirty' samples

The investigation relied on the expertise of each team member. UCSB postdoc Hadis Matinpour prepared, recorded, and plotted out the first samples and analyzed the composition of natural particles. Sarah Haber, at the time a research assistant at Penn, determined the chemical composition of the materials, including important quantities like clay content.

"We had all this raw data and were having trouble making sense of it," Jerolmack says. "Robert Kostynick, then a master's student at Penn, picked up the project for his thesis and put in a huge amount of legwork and thought to organize, interpret, and try to collapse a lot of the data."

Those contributions leaned on an understanding of cutting-edge physics related to the forces at work in dense suspensions. These include friction, as particles rub against one another; lubrication, if a thin film of water helps particles slide past one another; or cohesion, if sticky particles like clay bind together.

"We had the audacity, or maybe the naiveté, to try to apply some really recent developments in physics to a really messy material," says Jerolmack.



Researchers analyzed samples containing different percentages of solids to determine how these properties of materials related to their flow behavior.

Penn postdoc Shravan Pradeep, who has a deep background in rheology, or the study of how complex materials flow, also joined the team. He pinpointed precisely how the material properties of the soil—particle sizes and clay content—determined its failure and flow properties. His analysis showed that understanding particles' stickiness, measured as "yield stress," and how closely particles can pack together in the "jammed state," could almost entirely account for the results observed in the Montecito samples.

Yield stress can be envisioned by picturing toothpaste or hair gel, Jerolmack says. In a tube, these materials do not flow. Only when a force is applied to the tube—a firm squeeze—do they begin to flow. The jammed state can be thought of as the point at which particles are so crowded together that they are unable to move past one other.

"What we realized was with debris flows, when you're not pushing on them hard, their behavior is governed entirely by yield stress," says Jerolmack. "But when you're pushing very hard—the force of gravity carrying a debris flow down a mountainside—the viscous behavior comes to dominate and is determined by how far the particle density is from the jammed state."

In the lab, the researchers were not able to simulate failure, the point at which a solid soil, constrained by "jamming," transitioned into a moveable mud. But they could approximate the reverse, evaluating the muddy materials mixed with water at different concentrations to extrapolate the jammed state.

"The beauty of it is that, when you get samples from nature, they can be all over the place in terms of their composition, how much ash they contain, the location you collected from," says Arratia. "Yet in the end, all the data just collapsed into a single master curve. This tells you that now, you have a universal understanding that holds whether you're in the lab or you're on the mountains of Montecito."

The 2018 mudflows, which followed a fire and then heavy rain, were powerful and destructive. Here, the "mud line" marks how high they flowed into homes in Montecito, California.

With climate change, wildfire frequency and intensity are growing in many regions, as is the intensity of precipitation events. Thus, the risk of catastrophic mudslides isn't disappearing any time soon.

The new findings to predict yield stress and the jammed state can help inform modeling that federal and local governments do to simulate debris flows, the researchers say. "Say, if it rains this hard and I have this kind of material, how fast is it going to flow and how far," Jerolmack says.

And in a more general way, Jerolmack and his colleagues hope the work, which combined theoretical and empirical sciences, leads to more such interdisciplinary approaches. "We can take late-breaking discoveries in physics and actually relate them pretty directly to a meaningful environmental or geophysical problem."

Douglas Jerolmack is a professor in the University of Pennsylvania School of Arts & Sciences' Department of Earth and Environmental Science and the School of Engineering and Applied Science's Department of Mechanical Engineering and Applied Mechanics.

Paulo Arratia is a professor in Penn's School of Engineering and Applied Science's departments of Mechanical Engineering and Applied Mechanics and Chemical and Biomolecular Engineering.

Jerolmack and Arratia's coauthors on the study were Penn's Robert Kostynick, Sarah Haber, and Shravan Pradeep and the University of California Santa Barbara's Hadis Matinpour, Alban Sauret, Eckart Meiburg, and Thomas Dunne.

The study was supported by the Army Research Office (grants W911NF2010113 and W911NF-18-1-0379), National Science Foundation (grants 1720530 and 1734355), Petroleum Research Fund (Grant 61536-ND8), and the John MacFarlane Foundation.

(Penn Today, https://penntoday.upenn.edu/news/physics-disaster-how-mudslides-move)

ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ

International Society for Soil Mechanics and Geotechnical Engineering

ISSMGE News & Information Circular January 2023

www.issmge.org/news/issmge-news-and-information-circular-January-2023

1. ISSMGE INTERACTIVE TECHNICAL TALKS AVAILABLE FROM THE ISSMGE WEBSITE

ISSMGE Interactive Technical Talk Episode 1: Tailings and Mine Waste (TC221)

ISSMGE Interactive Technical Talk Episode 2: Geomechanics and Geotechnical Engineering for Nuclear Waste Disposal (TC308)

ISSMGE Interactive Technical Talk Episode 3: Energy Geostructures & Storage of Thermal Energy in the Ground (TC308)

2. ISSMGE BULLETIN

The latest edition of the ISSMGE Bulletin (Volume 16, Issue 6, December 2022) is available from the website.

3. ISSMGE FOUNDATION

The next deadline for receipt of applications for awards from the ISSMGE Foundation is the 31st January 2023. Click **here** for further information on the ISSMGE Foundation.

4. CONFERENCES

Member Societies, Technical Committees, Sister Societies and related organisation may add their events directly to the ISSMGE Events database via the link +SUBMIT EVENT at the top of the EVENTS page

For a listing of all ISSMGE and ISSMGE supported conferences, and full information on all events, including deadlines, please go to the Events page at https://www.issmge.org/events. For updated information please refer to that specific events website.

The following are events that have been added or amended since the previous Circular:

ISSMGE EVENTS

21ST SOUTHEAST ASIAN GEOTECHNICAL CONFERENCE AND 4TH AGSSEA CONFERENCE (SEAGC-AGSSEA 2023) - 25-10-2023 - 27-10-2023 Centara Grand & Bangkok Convention Centre, CentralWorld, Bangkok, Thailand; Language: English; Organiser: Thai Geotechnical Society and Southeast Asian Geotechnical Society; Contact person: Apiniti Jotisankasa ; Address: Department of Civil Engineering, Kasetsart University; Email: fengatj@ku.ac.th; Website: https://seagcagssea2023.com/; Email: seagc2023@gmail.com

8TH INTERNATIONAL CONFERENCE ON EARTHQUAKE GEOTECHNICAL ENGINEERING (8 ICEGE) - 07-05-2024 - 10-05-2024 Osaka International Convention Center, Japan; Language: English; Organiser: Japanese Geotechnical Society; Contact person: Secretariat of 8th International Conference on Earthquake Geotechnical Engineering; Email: Info8ICEGE@gmail.com; Website: https://confit.atlas.jp/guide/event/icege8/top?lang=en

NON-ISSMGE EVENTS

JOHN MITCHELL LECTURE 2023 - 24-01-2023 Institution of Civil Engineers, London, United Kingdom; Language: English; Organiser: British Geotechnical Association; Contact person: Jennifer Nicks (TC202); Email: jennifer.nicks@dot.gov; Website: https://www.ice.org.uk/events/latest-events/road-asset-socioeconomic-fatality-risk/

CONFERENCE ON FOUNDATION DECARBONIZATION AND RE-USE - 21-03-2023 - 23-03-2023 Royal Tropical Institute (KIT), Amsterdam, Netherland; Language: English; Organiser: KIVI, DFI; Contact person: Angelique van Tongeren; Address: P.O. Box 30424; Email: info@foundation-reuse.com; Website: https://foundationreuse.com/

89,184 paper downloads in 2022 for the ISSMGE International Journal of Geoengineering Case Histories!

ISSMGE IT Administrator / General / 10-01-2023

The ISSMGE International Journal of Geoengineering Case Histories is proud to announce that its papers were downloaded 89,184 times in 2022.

The International Journal of Geoengineering Case Histories is an official journal of the International Society for Soil Mechanics and Geotechnical Engineering, the premier scientific organization for geotechnical engineering worldwide. The Case Histories Journal covers the broad area of practice in geotechnical engineering (soils and rocks), including geotechnical earthquake engineering, environmental geotechnics and engineering geology, and energy geo-construction with a focus on careful documentation of case histories and emphasis on observations and data collected during and after project construction.

Papers published in this refereed journal are freely available in color and are accompanied by databases that include the electronic data presented in the paper as well as additional figures (as necessary). The locations of the case histories are also positioned in the IJGCH Geographic Database.

The platinum open access feature of the journal, i.e., the publication of papers without a cost to readers or authors, is aimed to better serve the professional and research geocommunity. All papers are immediately downloadable by visitors and accessed through Google Scholar and Georef index databases. The 89,000+ paper downloads in 2022 encourages us in our Mission and is indicative of the impact the

journal is having to the profession.

Below, you can find the list of the top 10 papers downloaded from the International Journal of Geoengineering Case Histories in 2022:

1. Xenaki, V., Doulis, G., Athanasopoulos, G. (2016). Geotechnical Design of Embankment: Slope Stability Analyses and Settlement Calculations. International Journal of Geoengineering Case Histories, Vol. 3, Issue 4, p.246-261. (3,036 downloads 14,487 downloads since 2017)

2. Jafari, N. H., Stark, T. D., and Merry, S. (2013). The July 10 2000 Payatas Landfill Slope Failure. International Journal of Geoengineering Case Histories, Vol.2, Issue 3, p.208-228. (2,142 downloads 13,664 downloads since 2017)

3. Burland J.B., Jamiolkowski M.B., Viggiani C., (2009). Leaning Tower of Pisa: Behaviour after Stabilization Operations. International Journal of Geoengineering Case Histories, Vol.1, Issue 3, p.156-169. (1,809 downloads 13,240 downloads since 2017)

4. Briaud J-L., Smith B., Rhee K-Y., Lacy H., Nicks J., (2009). The Washington Monument Case History. International Journal of Geoengineering Case Histories, Vol.1, Issue 3, p.170-188. (1,480 downloads 9,925 downloads since 2017)

5. Mayne, P.W., (2005). Unexpected but foreseeable mat settlements on Piedmont residuum, Geoengineering Case Histories, Vol.1, Issue 1, p.5-17. (1,267 downloads 8,803 downloads since 2017)

6. Lam, A. K., Lee, D. D. (2013). Combined Pile Foundation System for a Residential Complex. International Journal of Geoengineering Case Histories, Vol. 3, Issue 1, p.1-9. (1,164 downloads 6,448 downloads since 2017)

7. Rutherford C.J., Biscontin G., Koutsoftas D., Briaud J.L. (2007). Design Process of Deep Soil Mixed Walls for Excavation Support. International Journal of Geoengineering Case Histories, Vol.1, Issue 2, p.56-72. (1,070 downloads 11,399 downloads since 2017)

8. Dhar, A. S., Siddique, A., Ameen, S. F. (2011). Ground Improvement using Pre-loading with Prefabricated Vertical Drains. International Journal of Geoengineering Case Histories, Vol. 2, Issue 2, p.86-104. (1,052 downloads 9,812 downloads since 2017)

9. Shirode, N. P., Birid, K. C., Gandhi, S. R., Nair, R. (2017). Uplift of an Underground Tank in Northern Malabar Region, India. International Journal of Geoengineering Case Histories, Vol. 4, Issue 2, p.134-146. (1,050 downloads 6,070 downloads since 2017)

10. Alexandris, A., Abatiori, M., Griva, I. (2017). Rock Mass Characterization and Assessment of Ground Behavior for the Trikokkia Railway Tunnel (Central Greece). International Journal of Geoengineering Case Histories, Vol. 4, Issue 1, p.57-77. (1,005 downloads 7,154 downloads since 2017)

The open access scope of the Journal is supported by the following forward-looking organizations: DarGroup, Geosyntec Consultants, ConeTec and ENGEO. These organizations make possible the circulation of the journal to thousands of readers at no cost.

The ISSMGE International Journal of Geoengineering Case Histories is a great place to publish case histories and make sure professionals globally read them! We encourage you to consider the ISSMGE International Journal of Geoengineering Case Histories as a high impact means to disseminate your work.

The co-Editors in Chief,
Dimitrios Zekkos, University of California at Berkeley
Jean-Louis Briaud, Texas, A&M University

Special Issue on Scour and Erosion by ISSMGE TC213 Published

ISSMGE IT Administrator / TC213 / 17-01-2023

We are pleased to announce the Special Issue #4 of Volume #7 of the International Journal of Geoengineering Case Histories, an official Journal of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE).

This Special Issue of the ISSMGE International Journal of Geoengineering Case Histories, edited by Guest Editor Prof. Shinji Sassa, ISSMGE TC213 Chair, presents six well-documented case studies that covers a broad range of scour and erosion, from road embankment scour and erosion to river bridge scour with their countermeasures, coastal erosion, scour and internal erosion, and marine scour at/around offshore structures, from America, Europe, Asia, and Oceania.

Papers published in this refereed journal are freely available in color and are accompanied by databases that include the electronic data presented in the paper as well as additional figures (as necessary). The locations of the case histories are also positioned in the IJGCH Geographic Database.

Click the links below to download and read the papers of the latest issue of the journal and access the digital data.

Papers published in this journal are downloaded many thousands of times. Please consider the International Journal of Geoengineering Case Histories for the publication of well-documented case histories.

Paper Title: Foreword, pp. i
Authors: Jean-Louis Briaud Click to download

Paper Title: Scour and Erosion: A Global Perspective, pp. iiiii
Authors: Shinji Sassa Click to download

Paper Title: Bridge Abutment Remediation A Case Study, pp. 1-7
Authors: Mogana Sundaram, Jun Sugawara, Siva Sivakumar Click to download

Paper Title: Improving Scour Estimates with NextScour for the Lafayette Avenue Bridge Replacement Project, pp. 828
Authors: Haoyin Shan, James Pagenkopf, Chen Li, Nasi Zhang, Daniel Pastrich, Otto Wiblishauser, Chao Huang, Kornel Kerenyi Click to download

Paper Title: Emergency Bridge Scour Countermeasure in Marin County, California, United States, pp. 2938
Authors: Catherine M.C. Avila Click to download

Paper Title: Coastal Road Slope Collapses Behind a Retaining Wall Due to Scour and Erosion, pp. 39-49
Authors: Ryota Tsubokawa, Yasunari Iida, Yuji Ushiwatari, Tatsuya Matsuda, Masashi Ochi, Makoto Miyatake, Shinji Sassa Click to download

Paper Title: Probabilistic Assessment and Comparison of Scour Protections at Horns Rev 3 and Egmond aan Zee Offshore Wind Farms, pp. 5058

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Paper Title: Scour Prediction in Cohesive Marine Soils: A Hybrid Approach, pp. 5975
Authors: John M. Harris, Nikolas S. Tavouktsoglou, Amelia Couldrey, Richard J.S. Whitehouse, Jamie Klapper Click to download

About the journal and this announcement

The ISSMGE International Journal of Geoengineering Case Histories is an official journal of the International Society for Soil Mechanics and Geotechnical Engineering, focusing on the publication of well- documented case histories.

The truly open-source mission of the journal is funded annually by companies and organizations that have an action-based commitment to the advancement of the geoengineering profession. These organizations are acknowledged on our website and in every single paper of the journal. More information on our funding program can be found here. Send us an email if you are interested in being part of this unique publication.

IJGCH is proudly funded by Shamsher Prakash Foundation, Dar Group, Geosyntec Consultants, ConeTec and ENGEO. Our sponsors make possible the circulation of the journal to thousands of readers at no cost.

Coupled problems 2023

Francesca Ceccato / TC103 / 23-01-2023

Dear all,

TC 103 is organizing a special session in the COUPLED PROBLEMS conference that will be hold on 5-7 June 2023 in Greece.

https://coupled2023.cimne.com/area/d40eb1b3-2df5-11ed-8e5b-000c29ddfc0c

The deadline for presenting a one page abstract is 03 February, 2023.

TC105 Youtube videos on DEM in geotechnical engineering education

Kenichi Soga / TC105 / 28-01-2023

In 2022, TC105 hosted a webinar series on DEM in geotechnical engineering education. Here are the youtube videos and weblinks. Please distributed them to your colleagues, students and friends.

Lecture 1: **Teaching granular mechanics with Discrete Element Method** Francois Guillard and Benjy Marks (University of Sydney)
Youtube link - https://youtu.be/D6TRok1s_4g Website link - https://education.scigem.com/

Lecture 2: Virtual laboratory testing using DEM to understand soil behavior Benjy Marks and Francois Guillard (University of Sydney)
Youtube link - https://youtu.be/YwmGq7Rc5fA Website link - https://education.scigem.com/

Lecture 3: Let's code the discrete element method for a deeper understanding Vincent Richefeu (Université Grenoble Alpes)
Youtube link - https://youtu.be/n7NWEpIKbJE Website link - https://drive.google.com/drive/folders/1mCNFSJWajWOlzTh7QwlT9LOIxAgHynNo?usp=sharing

Lecture 4: Using open source DEM in teaching Shiwei Zhao (Hong Kong University of Science and Technology)
Youtube link - https://youtu.be/i3odF7qU7kk Website link - https://sudodem.github.io/

Lecture 5: Building a real-time interactive playground with in-situ viz and deep learning Krishna Kumar (University of Texas, Austin)
Youtube link - https://youtu.be/1q_S5THxhvs In situ viz code: https://github.com/tacc/galaxy Graph Network Simulator: https://github.com/geoelements/gns

Registration Now Open for the 9th International Offshore Site Investigation and Geotechnics Conference – 12 to 14 September 2023 – London UK

Katherine Lundy / TC209 / 30-01-2023

Early-bird registration is now open for the Society for Underwater Technology's (SUT) 9th International Offshore Site Investigation and Geotechnics (OSIG) Conference entitled '***Innovative Geotechnologies for Energy Transition'.***

The global conference will take place from the **12th to 14th of September 2023** at Imperial College London and will bring together international offshore Geotechnical, Geophysical & Geoscientific industry and academic communities to share the latest research, knowledge and expertise.

Details on Conference Themes, Keynote Speakers and how to register can be found here.

Of note is the 6th ISSMGE McClelland Lecture - this free event will see Prof. Richard Jardine present on ***Time-dependent vertical bearing behaviour of shallow foundations and driven piles*** in Imperial Colleges Great Hall on the evening of Tuesday 12th September 2023 at 1800hrs.

With over four hundred conference paper abstracts from the global community submitted to an international scientific committee comprised of 45 members OSIG 2023 can't be missed!

Video of Captivating Geotechnical Engineering News in 2022

Geoengineer.org is pleased to launch a video with a selection of the most captivating news that were posted in 2022. Big things happened in 2022 at the Geotechnical world as we posted a total of 241 interesting news.

Here's what you might have missed over the last 12 months or what we think is worth another look! Make sure you register and setup your notification settings to receive all next year's news that match your interests!

Click here to watch the video: LINK TO VIDEO

You can find below the list of all news included in the video:

January 2022

- At least 7 fatalities and 3 people missing after a cliff crashes on tourist boats in Brazil
- Tsunami hits South Pacific island of Tonga following a giant volcanic eruption: streets and buildings flooded
- NASA: Tonga eruption blasted enough water to fill 58,000 Olympic pools into the Earth's atmosphere
- An impressive cliff failure in Seri Kembangan, Kuala Lumpur, Malaysia

February 2022

- Brazil, Petrópolis: deadly landslides, at least 100 fatalities
- Geotechnical Engineers can now publish technical related content on GeoWorld, get DOIs, and reach thousands of geo-professionals

March 2022

- Peru landslide: at least 2 dead, including a one-month-old infant
- Rocscience | Introducing RocFall3 - Features and Applications

April 2022

- Philippines landslides, floods: at least 167 fatalities (Tropical Storm Megi)

May 2022

- ISSMGE honours PLAXIS innovation
- Alameda Marina Ground Improvement Project Wins the 2022 CalGeo Outstanding Project award

June 2022

- Extreme weather in southeast China triggers landslides and damage buildings leaving 6 people dead

July 2022

- Tourists hit by avalanche in Kyrgyzstan's Tian Shan mountains

August 2022

- Chile: a massive sinkhole just discovered
- New Zealand floods: 1,200 people displaced
- Inzwa Integrates with Ackcio Monitoring Solutions for Simplified Sensor Management
- Moorhead Area High School Support Column Loads of up to 530 kips Project

September 2022

- Heavy rains trigger landslides in Uganda: at least 16 fatalities
- Monticello High School Rehabilitation Project

October 2022

- Falcon pipeline construction: DEP fines Shell $670k for erosion
- Venezuela landslide: 22 fatalities, at least 52 missing

November 2022

- Deadly landslide on Italian island of Ischia
- Winner of Bentley Systems Going Digital Awards on Geotechnical Engineering - Material Reuse through geoBIM at HS2 Phase 1 – Area North Earthworks
- NASA records biggest ever 'Monster quake' on Mars, estimated to be magnitude 5

December 2022

- Colombia landslide: at least 34 fatalities
- Floods & lanslides in Kinshaha: At least 141 people dead
- Malaysia landslide: At least 16 fatalities and more missing

(Geoengineer.org, Jan, 03, 2023, https://www.geoengineer.org/news/video-of-captivating-geotechnical-engineering-news-in-2022?utm_source=twitter&utm_medium=social&utm_campaign=page_post)

ISRM International Society for Rock Mechanics and Rock Engineering

News

https://www.isrm.net

3rd European Rock Mechanics Debate - "Different approaches for tunnelling: empirical, observational, modelling" on 25 January 2023-01-16

The title of the debate is "*Different approaches for tunnelling: empirical, observational, modelling*". It will take place on 25 January, at 14:30 CET (13:30 GMT).

The debate will feature the participation of Nick Barton from Norway and Brazil and Yossef H. Hatzor from Israel and will be moderated by Philippe Vaskou from France.

A flyer with the contents and indicative rules of this debate can be downloaded here. In this flyer, you will find the Zoom link to register (maximum of 100 participants) and the ISRM YouTube channel link where it will be broadcast.

Leandro R. Alejano
ISRM VP for Europe

Deadline for submission of full papers to the 15th ISRM Congress in Salzburg extended to 28 February 2023-01-24

The deadline for submission of full papers to the 15th ISRM Congress in Salzburg extended to 28 February. For more information visit the Congress website: https://www.isrm2023.com/en/

Rocha Medal Award 2025 - Call for nominations 2023-01-27

An invitation is now being extended to the whole Rock Mechanics for nominations for the Rocha Medal Award in 2025.

Each nomination shall comply with the ISRM By-law No. 7, namely as concerns articles 2 and 3, and shall be received by the ISRM Secretary General not later than 31 December 2023.

You can find the award's announcement containing a list of the documents that shall compose the nomination package here.

ASSOCIATION INTERNATIONALE DES TUNNELS ET DE L'ESPACE SOUTERRAIN ITA AITES INTERNATIONAL TUNNELLING AND UNDERGROUND SPACE ASSOCIATION

Scooped by ITA-AITES #83, 3 January 2023

Construction progresses on Egypt's 13km Cairo Metro Line 4 Phase 1

Getting to know 'Ijo', the fifth longest tunnel in Java, built 135 years ago | Indonesia

New China highway with world's longest spiral tunnel opens to traffic

Future of Tunnelling | Why tunnelling projects are breaking new records

Mumbai's underground Metro Line-3 stations almost ready | India

Singapore national water agency explores underground space to protect island against rising sea levels

Hudson River Rail Tunnel construction to begin in 2023 with $292M grant | United States of America

Eastern Freeway to Marine Drive in 10 minutes; city's longest twin-tunnel is coming up in Mumbai | India

Llogara Tunnel nearing completion | Albania

Chinese-constructed section of Tel Aviv Light Rail Green Line starts tunneling | Israel

Scooped by ITA-AITES #84, 17 January 2023

Fire department gearing up for Green Line LRT tunnel construction | Canada

Seattle's huge sewage tunnel is halfway drilled. Take a look inside | United States of America

Thane-Borivali twin tunnel: Bids invited for project to connect east and west of Mumbai via A 6-lane road beneath Sanjay Gandhi National Park | India

TBM launched on Manila metro | The Philippines

Implenia, Stangeland Maskin win role on €2.6bn Boknafjord tunnel | Norway

Relief for Mumbaikars! India's first completely underground metro to be in service soon! | India

TBM set for major Brenner Base Tunnel dig | Austria

Company turns WWII-era bomb shelter into beautiful underground farm: 'What a fab way to use the space' | UK

Salzburg's underground rail can uplift the region in an economic downturn | Austria

Energy storage is going underground | United States of America

Scooped by ITA-AITES #85, 31 January 2023

'Amtrak Joe' Biden hails plans for big East Coast tunnel fix | United States of America

City of Amsterdam takes bicycle parking underground, and under water | Netherlands

Yamagata pins hopes on shinkansen tunnel, but faces roadblocks | Japan

Chinese corporation-led JV bags Bangladesh's first-ever micro tunnelling sewerage project

Fire department gearing up for Green Line LRT tunnel construction | Canada

Fehmarnbelt Tunnel: The megaproject that will transform european travel | Danemark/Germany

How 'micro-tunnelling' is keeping utilities on track during Delhi Metro work | India

Tunnelling of the Scarborough subway extension begins | Canada

€25billion 'Cleaner And Faster' Transport Plan Unveiled By The NTA | Ireland

Breakthrough achieved on Świnoujście Road Link | Poland

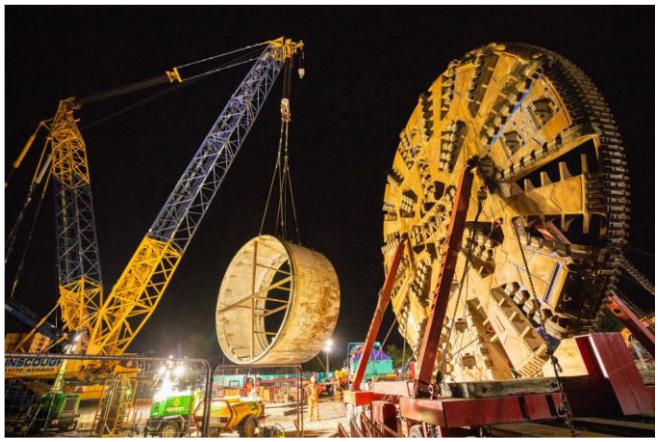
BRITISH TUNNELLING SOCIETY

HS2 Area North

An overview of activities at the Long Itchington Wood & Bromford Tunnels

Speakers: Guillaume Lefrere & Jules Arlaud

Thursday 19th January 2023 at 18:00 hrs [GMT]



In this presentation, Balfour Beatty VINCI will provide updates on two different tunnelling projects across HS2 Area North. The presentation will cover tunnelling activities at both the Long Itchington Wood Tunnel and the Bromford Tunnel.

2023 will be an important year for tunnelling at both sites, and the presentation will provide technical updates including the challenges faced by the tunnelling teams, innovate approaches used on site and some key learnings.

Note 1: This is an in-person lecture but will also be streamed live at: https://www.youtube.com/watch?v=eqghdw_tju8

BRITISH TUNNELLING SOCIETY YOUNG MEMBERS

BTSYM Workshop
Types of fibres in FRC (Fibres Reinforced concrete): Sustainable fibres concrete and low carbon solutions

Workshop Leader: Benoit De Rivaz

Thursday 19th January 2023 at 16:00 to 17:30 hrs

Workshop agenda:

1. The right fibre for the right use: which, how and why
2. Networking coffee break
3. Moving to low carbon lining: How to Build Sustainable Precast Segment Lining with Fibre Reinforced Concrete (carbon-counting & cases studies)

Booking Link: https://docs.google.com/forms/d/1scDniOY-whqeGNIyQ500WwjLSQariYWjEBlrwHFkMP4Q/viewform?edit_requested=true

INTERNATIONAL ASSOCIATION FOR ENGINEERING GEOLOGY AND THE ENVIRONMENT

President's first message

Dear members of IAEG, dear colleagues and friends,

I would really like to wish you a happy and safe new year. I also trust, with no doubt, that we will be able to meet again in person and internationally collaborate more actively for the future of our profession.

We, the International Association for Engineering Geology and the Environment Engineering Geology serve the "...science devoted to the investigation, study and solution of the engineering and environmental problems which may arise as the result of the interaction between geology and the works and activities of human-kind as well as to the prediction of and the development of measures for prevention or remediation of geological hazards" (text from IAEG Statutes).

Our new Executive Committee consists of highly experienced colleagues from the industry, Academia and research institutes. Practitioners in the field of engineering geology with deep knowledge of our International Association and its capacities; bearers of new visions. At this point, I would like to offer my great appreciation to the past Executive Committee for all their efforts in assisting and promoting IAEG during the past, very difficult, 4-year period.

Though these messages are more often focused on wishes and greetings, I would like to take advantage of this opportunity to highlight some of the essential plans and strategies for the next 4 years. In order to further support the IAEG towards its wide activity fields and continue the work of the previous office, I plan to take, together with the new Executive Office, actions on the following fields:

Revisiting Engineering Geology core values. What happens so often to the Geology in Engineering Geology? Where is the integration of Geology to Engineering as seen in the research papers or applied papers in journals? Cases are observed with departure from the common ground in Engineering Geology, Soil Mechanics and Rock Mechanics, sometime with Engineering Geology not even being standing with its intellectual merits, methods and procedures. Our competencies within the geoengineering community are founded on understanding "how is the ground" and "how the ground works". Apart from "putting numbers in Geology" we need to ensure that there is a sound understanding and knowledge of the processes and provide guidance and promotion for developing geological models and mechanisms; utilizing all the new technological tools and computer visual methods.

Education & Training: Our strategy must be decidedly targeted in education. We must provide our solid views on the matter within the relative JTC with our sister societies in the Federation of International Geo-Engineering Societies (FedIGS). Our Commission in Education must be reactivated, work very actively in this matter and provide assistance to the academia to secure the role of Engineering Geology in the geo-engineering teaching community. We also want to continuously address the new needs of the industry in engineering geology and accordingly support the MSc syllabi around the world. Another issue we have to examine and have a clear standpoint about it is who (with what background) teaches "Engineering Geology" in the relevant courses in the Universities.

"Why Become a member of IAEG?" - Support career development: This is a principal issue that must occupy the new Executive Office. We plan to create an international network of communication between professionals and academics in order to support career development. We must be able to convey to our members all new practices, trends, technologies and methods in engineering geology.

New fields in Engineering Geology: Promote and establish, under the IAEG umbrella, new fields in Engineering Geology, especially in the geohazard, environmental and climate change topics. Many young colleagues already working in this field. Engineering geologists can soundly collect, present, evaluate and interpret relevant data in these new fields.

Young Engineering Geology group (YEG): We will work with the YEG group to raise a core of YEG members in IAEG through national group membership. Our future! The organization of summer schools and field trips as well as YEG activities such as webinars, specialized workshops during the IAEG events and career days, will be both encouraged and supported.

Continuous interaction with our members: Conduct frequent online surveys and receive feedback from IAEG members with respect to the IAEG workshops and activities, membership and what more IAEG can offer but also getting new suggestions regarding the goals of IAEG future activities and engineering geology practices. Our website will be updated, while IAEG – Connector will always be a valuable tool of presenting IAEG activities and worldwide news.

IAEG activities: Create opportunities for Engineering Geologists to partake in and familiarize with the knowledge and the learnings that become available worldwide, by region and by country, through organizing and running of congresses, conferences, summer schools and field trips. This year we have our World Conference in Chengdu, China. We all hope that we will be able to participate in person. Also, we have our own IAEG Summer School. The 2nd Summer School will be organized in the Alps, Italy, next June.

IAEG Commissions: We will revisit all commissions from scratch so we can support and promote the active ones but also assist others by specifying rules and certain deliverables. Our intention is to monitor their progress, offer advocacy and provide motivation. FedIGS: We wish to strengthen the bonds with the sister societies and ensure our common goals in the geo-engineering community by co-organizing special workshops and paying particular attention to the Joint Technical Committees (JTCs) encouraging greater interaction among the geo-engineering parties.

Official Journal of IAEG – BOEG: We are generally very proud for our journal and its meters. However, we must address the risks regarding the official journal of the IAEG securing the engineering geological and international character. We also need to open the door of our journal to more practitioners. We certainly look for papers with innovations and new findings, but we have to consider very seriously the publications of good papers with remarkable case histories for phenomena, for behaviour, for the design/construction of important works. This is valuable material for the practitioners.

Two Executive meetings have been arranged for the 1st half of 2023: an on-line meeting on the 2nd of February and a two-day meeting in person 3rd and 4th of May.

All Past Presidents have contributed towards the same goals. I am convinced that I too, with the help of the Executive Office, the engineering geology community and the National Groups, will be able to meet the expectations of IAEG, of our members and promote their activities even further.

Vassilis P. Marinos
President of IAEG

(IAEG CONNECTOR NewsLetter, https://www.multi-briefs.com/briefs/IAEG/IAEG011623.php)

ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

Για τις παλαιότερες καταχωρήσεις περισσότερες πληροφορίες μπορούν να αναζητηθούν στα προηγούμενα τεύχη του «περιοδικού» και στις παρατιθέμενες ιστοσελίδες.

ATA GEOSYNTHETICS CONFERENCE, Feb. 5-8, 2023, Kansas City, MO USA, https://geosyntheticsconference.com

6-8 February 2023, Warsaw, Poland
https://kongresdrogowy.pl/en/v-international-tunnel-forum

It has become a tradition that the series of conferences of the Polish Road Congress begins each year with a Forum dedicated to tunnel construction and operation. We would like to invite you to the next, 5th International Tunnelling Forum. In this edition, we will also be hosting speakers from abroad representing best practice and knowledge in the subject matter of the event. The Tunnelling Forum's standing is confirmed by its patronage by the International Tunnelling and Underground Space Association ITA-AITES.

This time we are meeting in Warsaw, but for your convenience the meeting will be organised in a hybrid format. On the last day of the conference, you will have the opportunity to take part in a technical visit to a tunnel on the Warsaw Southern Ring Road.

During the Forum, we will discuss new challenges facing tunnel designers, builders and managers, we will delve into the operation and management of existing tunnels and we will discuss new solutions for tunnel construction and equipment, also in terms of ventilation, lighting and safety. During the Forum, one session will be dedicated to the construction and management of urban and heavy-traffic tunnels.

Polski Kongres Drogowy

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4th African Regional Conference on Geosynthetics – Geosynthetics in Sustainable Infrastructures and Mega Projects, 20-23 February 2023, Cairo, Egypt, www.geoafrica2023.org

International Conference on Advances in Structural and Geotechnical Engineering (ICASGE'23), 6 - 9 March 2023, Hurghada, Egypt, https://icasge.conferences.ekb.eg

ASIA 2023, 14 - 16 March 2023, Kuala Lumpur, Malaysia, www.hydropower-dams.com/asia-2023

3rd International Conference TMM_CH "Transdisciplinary Multispectral Modelling and Cooperation for the Preservation of Cultural Heritage: Recapturing the World in Conflict through Culture, promoting mutual understanding and Peace", 20-23 March 2023, Athens, Greece, www.tmm-ch.com

Conference on Foundation Decarbonization and Re-use, March 21-23, 2023, Amsterdam, Netherlands, www.dfi.org/2023-conference-on-foundation-decarbonization-reuse

88th ICOLD Annual Meeting & Symposium on Sustainable Development of Dams and River Basins, April 2023, New Delhi, India, https://www.icold2020.org

Rocscience International Conference 2023 Synergy in Geotechnical Engineering, April 24-26, 2023, Toronto, Canada, www.rocscience.com/events/rocscience-international-conference-2023

UNSAT 2023 - 8th International Conference on Unsaturated Soils, 2-5 May 2023, Milos island, Greece, www.unsat2023.org

World Tunnel Congress 2023 Expanding Underground Knowledge & Passion to Make a Positive Impact on the World, 12 - 18 May 2023, Athens, Greece, https://wtc2023.gr

2nd International Workshop on Complex Formations, 9th May 2023, Torino, Italy, agi@associazionegeotecnica.it

NROCK2022 - The IV Nordic Symposium on Rock Mechanics and Rock Engineering, 24 – 25 May 2023, Reykjavic, Iceland, www.nrock2023.com

Underground Construction Prague 2023, May 29 – 31, 2023, Prague, Czech Republic, www.ucprague.com

5th International Underground Excavations Symposium and Exhibition
Cities of the Future, Urban Tunnelling and Underground Excavations
5-6-7 June 2023, Istanbul, Turkey
https://uyak.org.tr

UYAK2023, the 5th International Underground Excavations Symposium and Exhibition, will be held in Istanbul on 5-6-7 June 2023, with the cooperation of the TMMOB Chamber of Mining Engineers Istanbul Branch and the Department of Rail Systems of Istanbul Metropolitan Municipality.

The theme of UYAK2023 has been determined as "Cities of the Future, Urban Tunnelling and Underground Excavations."

Symposium Topics

Project Design, Planning

- Design, planning and utilization of underground structures
- Field and laboratory investigations, soil and rock testing
- Geological, geophysics and geotechnical reporting
- Feasibility studies

Conventional Tunnelling and Mine Developments

- Sequential excavation, NATM
- Applications of umbrella arch and other pre-support methods
- Applications of shotcrete, wire mesh, steel support
- Drilling and blasting applications and vibrations in urbanized areas
- Drilling and blasting applications in underground operations
- Excavation, support, haulage, and drainage applications
- Probe drilling, ground-soil improvement, jet grouting, and dewatering
- Tunnelling and mining applications of conventional excavation methods

Mechanical Excavation Methods / Mechanical Tunnelling

- New (rapid) excavation technologies, selection-design-performance
- Full-face tunnelling machines (TBMs)
- Roadheaders and impact/hydraulic hammers
- Logistics-backup units in rapid excavation systems
- Soil-muck conditioning, slurry conditioning
- Post-excavation works, electro mechanics, signalization, fire monitoring
- Mining and tunnelling applications of mechanical excavation methods

Urban Tunnelling, Digitalization in Underground Excavations

- Digitalization in underground excavation projects' design and construction processes (IoT, building information modeling, data science, etc.)
- Sustainability practices in the construction and design of underground structures,
- Automatic Monitoring Systems,
- Urban tunnelling and underground excavations in densely populated areas.
- Urban construction site applications.
- Recycling and reuse of TBM wastes,
- Underground urbanism and underground excavations

Risk, Environment, Occupational Health and Safety, Other Topics

- Risk analysis and management, organization, tendering processes, costs
- Environmental effects, ground deformations, geotechnical measurements
- Health and safety in underground excavations
- Ventilation applications
- Maintenance and rehabilitation of underground structures
- Mega tunnel applications, mega-mining applications
- Microtunnelling

Contact Information

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17DECGE Danube – European Conference on Geotechnical Engineering, 7-9 June 2023, Bucharest, Romania, https://17decge.ro

SuperPile'23 Piling Design & Construction Conference, June 7-9, 2023, Atlanta, USA, www.dfi.org/superpile2023

3rd JTC1 Workshop on "Impact of global changes on landslide risk",7 – 10 June 2023, Oslo, Norway, https://jtc1-2023.com

Rapid Excavation and Tunneling Conference
June 11-14, 2023, Boston, USA
www.retc.org/index.cfm

Every two years, industry leaders and practitioners from around the world gather at the Rapid Excavation and Tunneling Conference (RETC), the authoritative program for the tunneling profession, to learn about the most recent advances and breakthroughs in this unique field.

Tunnels are getting larger, deeper and excavated in more challenging conditions. The expectation for the industry is to successfully complete these projects while meeting the other heavy construction challenges of sustaining quality, schedule, performance and safety.

This comprehensive conference helps practicing professionals keep up with the ever changing and growing tunneling industry. Stay on top of new trends and technologies as well as innovative concepts, new equipment, materials, management, financing, and design challenges.

Topics

The committee will consider all abstracts covering any/all aspects of the tunneling/underground construction industry including, but not limited to, the following topics:

- Contract Practices
- Project Planning
- Design
- Design/Build Projects
- Difficult Ground
- Drill and Blast
- Environment, Health and Safety
- Tunnel Rehabilitation
- Future Projects Geotechnical Considerations
- Ground Support and Final Lining
- Ground Control, Face Support and Monitoring
- Grouting and Ground Modification
- Hard Rock TBMs
- Large Span Tunnels and Caverns
- Microtunneling and Trenchless Tunneling
- International Projects
- Insurance
- Impacts of COVID-19 on Tunneling Industry
- New and Innovative Technologies
- Pressure Face TBM Case Histories
- Pressure Face TBM Technology
- Risk Management
- SEM/NATM
- Shafts and Mining
- Tunneling for Sustainability

ICOLD Annual Meeting 2023, 12th to 15th June 2023 Gothenburg, Sweden, https://icold-cigb2023.se

9th International Congress on Environmental Geotechnics Highlighting the role of Environmental Geotechnics in Addressing Global Grand Challenges, 25-28 June 2023, Chania, Crete island, Greece, www.iceg2022.org

DFHM8 TORINO 2023 8th International Conference on Debris Flow Hazard Mitigation, 26-29 June 2023, Torino, Italy, http://dfhm8.polito.it

NUMGE 2023 - Numerical Methods in Geotechnical Engineering 2023, 26 - 28 June 2023 Imperial College London, UK, www.imperial.ac.uk/numerical-methods-in-geotechnical-engineering

AFRICA 2023 - The Fourth International Conference and Exhibition on Water Storage and Hydropower Development for Africa, 10-12 July 2023, Lake Victoria, Uganda, www.hydropower-dams.com

S3: Slopes, Support and Stabilization Conference, August 8-10, 2023, Boston, USA, www.dfi.org/s32023

17ARC 17th Asian Regional Geotechnical Engineering Conference, 14-18 August 2023, Nur-Sultan, Kazakhstan, https://17arc.org

ISMLG 2023 – 4th International Symposium on Machine Learning & Big Data in Geoscience, 29 August - 1 September 2023, University College Cork, Ireland, www.ismlg2023.com

IS-PORTO 2023 8th International Symposium on Deformation Characteristics of Geomaterials, 3rd - 6th September 2023, Porto, Portugal, www.fe.up.pt/is-porto2023

12th ICOLD European Club Symposium "Role of dams and reservoirs in a successful energy transition", 5 to 8 September 2023, Interlakes, Switzerland, www.ecsymposium2023.ch

NGS 2023 10th Nordic Grouting Symposium, 11 - 13 September, 2023, Stockholm, Sweden www.ngs2023.se

SUT OSIG 9th International Conference "Innovative Geotechnologies for Energy Transition", 12-14 September 2023, London, UK, www.osig2023.com, www.sut.org

SAHC 2023 13th International Conference on Structural Analysis of Historical Constructions "Heritage conservation across boundaries", 12-15 September 2023, Kyoto, Japan, https://sahc2023.org/

XII ICG - 12th International Conference on Geosynthetics, September 17 – 21, 2023, Rome, Italy, www.12icg-roma.org

21 September 2023, London, U.K.
https://sustainability.geplus.co.uk/sustainability/en/page/home

Welcome to the inaugural GE Sustainability 2023 conference

As the construction industry makes a shift towards more sustainable practices, the geotechnical sector needs to play its part and take action.

This is why *Ground Engineering* is thrilled to launch this highly anticipated event, designed to bring together the brightest minds in the industry to explore how we can create a more sustainable geotechnical sector by reducing embodied carbon, implementing innovative solutions and taking care of the environment and our people.

It's imperative that companies working across the geotechnical supply chain are equipped with the right knowledge and tools to provide real value for money while still delivering sustainable results. Our conference will provide a unique opportunity for attendees to network, share insights and best

practices, and develop new ways of thinking about sustainability in geotechnics.

Join us at the GE Sustainability 2023 conference to gain unparalleled access to industry leaders, the latest research and innovations, and the chance to be a part of a community dedicated to driving sustainability forward.

Key themes and topics include:

- Combatting over conservatism within design
- Sustainable piling and foundation design and construction
- Best practice and innovation in sustainable geotechnical design
- Exploring the developments of low carbon materials and their uses
- Enabling a circular economy to optimise material/ foundation reuse in ground engineering projects
- Discovering the opportunities for decarbonising heavy construction plant, including carbon neutral and electric machinery
- Case studies from the latest ground engineering projects displaying key examples of sustainable principles from design to onsite construction.

Charles-Augustin COULOMB : A geotechnical tribute, 25 – 26 September 2023, Paris, France, www.cfms-sols.org/organisees-par-le-cfms/charles-augustin-coulomb-geotechnical-tribute

SEG23 Symposium on Energy Geotechnics, 3-5 October 2023, Delft, The Netherlands, https://seg23.dryfta.com

28th European Young Geotechnical Engineers Conference and Geogames
04 – 07 October 2023, Moscow, Russia

Organiser: Russian Society for Soil Mechanics, Geotechnics and Foundation Engineering

Contact person: PhD Ivan Luzin
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GROUND ENGINEERING BASEMENTS AND UNDERGROUND STRUCTURES

5 October 2023, London, U.K.
https://basements.geplus.co.uk/basements2023/en/page/home

Ground Engineering is delighted to bring you the 16th Basements and Underground Structures Conference

The only event which explores the design and delivery of underground spaces.

Whether you are interested in the infrastructure, commercial or residential sectors, the event will give you expert knowledge, best practice from major projects and networking with innovative clients, contractors and designers.

Over the course of the event, you will get updates on sustainability; climate change adaptation, resilience and risk management; ground improvement; urbanisation; and infrastructure development. You'll learn about the latest designs and solutions being employed, and participate in discussions on key issues such as retrofitting, carbon reduction, and skills shortages.

We are delighted to be bringing the industry back together in 2023. Basements and Underground Structures will be located with our Smart Geotechnics conference. Passes give you access to both events.

Contact alishah.basharat@emap.com

GROUND ENGINEERING SMART GEOTECHNI

5 October 2023, London, U.K.
https://smartgeotechnics.geplus.co.uk/smartgeotechnics2023/en/page/home

Launched in 2022, Ground Engineering is delighted to bring you the second GE Smart Geotechnics conference, an essential gathering that builds on the previous GE Instrumentation and Monitoring conference. It is aimed at anyone involved in monitoring and looking for up-to-date insight into projects, technologies, data management capabilities, use of cloud and AI.

These are exciting times for the industry as major projects are underway while some are coming to an end. To find solutions to today's challenges, new techniques are needed to improve how we monitor and analyses data. Clients are also looking to better understand the data collected and its applications.

Whether you're a project manager, designer, or client engineeer, this event is a must-attend. Join us to learn about the

latest advances in geotechnical engineering, discover new approaches to mitigating risks to third-party assets, and build your knowledge of current data analysis capabilities.

We're thrilled to be bringing the industry back together in 2023, and Smart Geotechnics will be co-located with our Basements and Underground Structures conference.

Contact alishah.basharat@emap.com

2023 15th ISRM Congress, International Congress in Rock Mechanics Challenges in Rock Mechanics and Rock Engineering, 9÷14 October 2023, Salzburg, Austria, https://www.isrm2023.info/en/

HYDRO 2023 New Ideas for Proven Resources, 16-18 October 2023, Edinburgh, Scotland, www.hydropower-dams.com/hydro-2023

ACUUS SINGAPORE 2023 18th Conference of the Associated Research Centers for the Urban Underground Space "Underground Space – the Next Frontier", 1 - 4 Nov 2023, Singapore, www.acuus2023.com

ATC 2023 18th Australasian Tunnelling Conference: Trends and Transitions in Tunnelling, 5-8 November, 2023, Auckland, Aotearoa New Zealad https://atc2023.com

6th World Landslide Forum "Landslides Science for sustainaible development", 14 to 17 November 2023, Florence, Italy, https://wlf6.org

CREST 2023 – 2nd Construction Resources for Environmentally Sustainable Technologies, November 20-22, 2023, Fukuoka, Japan, https://www.ic-crest.com

1st SLRMES Conference on Rock Mechanics for Infrastructure and Geo-Resources Development - an ISRM Specialized Conference, Colombo, Sri Lanka, December 2 -7, 2023, www.slrmes.org

GEOTEC HANOI 2023 The 5th International Conference on Geotechnics for Sustainable Infrastructure Development, December 14-15, 2023 - Hanoi, Vietnam, https://geotechn.vn

9th International Symposium on RCC Dams and CMDs December, 2023, Guangzhou, China, www.chincold-smart.com/meetings/rcc2023

World Tunnel Congress 2024 19 to 25, April, 2024, Shenzhen China, www.wtc2024.cn

8th International Conference on Earthquake Geotechnical Engineering (8ICEGE), 7-10 May, 2024 Osaka, Japan, https://confit.atlas.jp/guide/event/icege8/top?lang=en

5th Pan-American Conference on Geosynthetics
Connecting State of the Art to State of Practice
April 29 – May 1, 2024, Toronto, Canada
www.geoamericas2024.org

The quadrennial GeoAmericas engineering conference explores the appropriate use and beneficial impact of geosynthetics on civil infrastructure and sustainability throughout the Americas. The 2024 conference, which is a major regional technical conference and trade show of the International Geosynthetics Society (IGS)*, is organized by IGS North America.

GeoAmericas has previously been held in Cancún (2008), Lima (2012), Miami (2016), and Rio de Janeiro (2020 – Virtual). Toronto marks the first time a major IGS regional conference will be held in Canada. Attendees to Toronto will have a unique opportunity to build significant connections with engineering, sustainability, and infrastructure partners who will gather again in Canada just two years later for the 13th International Conference on Geosynthetics (13 ICG), which will be held in Montreal in September 2026.

Also of note, GeoAmericas 2024 will celebrate the 40th anniversary of ASTM International Committee D35 on Geosynthetics. The impact of standardization on engineering practice in the Americas will be explored throughout the conference and help tie together the event's theme: Connecting State of the Art to State of Practice.

Major Topics for 2024

Sustainability

- Reducing the carbon footprint (or decarbonizing) construction and engineering
- Life cycle assessment approaches to applications with geosynthetics
- Sustainability ethics in engineering
- Resilient infrastructure systems
- Geosynthetics and the UN Sustainable Development Goals
- The influence of sustainability on waste management design
- Water resource protection – containment, conveyance, irrigation security, floating covers, waterfront protection
- Bioinspired engineering design

Energy

- Opportunities and challenges in energy transition for geotechnical engineering
- Wind Energy – On-shore, off-shore, site design strategies and best practices, erosion control, scour protection, long-term maintenance, economics of wind farm construction and performance
- Solar Energy – Solar collection with geotechnical systems (e.g., landfill capping, floating covers)
- Energy Geotechnics – Geothermal heat exchangers, high-temperature containment ponds and waste cells, subsurface geothermal collection and storage
- Landfill Gas (LFG) – Collection, management, performance evaluation with temporary and final cover systems

Mining

- Tailings – Dams, Pits, Design, Management, Remediation
- Heap Leach – Evolving practice & scale, environmental performance, best practices, containment designs and mine ROI, high-altitude heap leach design and safety
- Mine Safety & Infrastructure – Slope stability, longwall mining, road integrity, crusher walls
- Failure & Reclamation – Causes of and response to failures, abandoned mines, reclamation strategies and examples
- Water – Site water management, evaporation control, dewatering designs and performance

Transportation Infrastructure

- Roadway, railway, and airfield applications and design
- Track foundations and embankments – Stability and performance, maintenance, rehabilitation vs. rebuild
- Bridges & Embankments
- Pavement testing and performance evaluations: highway and airfield
- Technical transfer between military and civilian engineering
- Tunneling
- Intermodal and container storage yard design
- Improving shipping and navigation – Dredging, dredge spoils management, evolving ports

Additional Topics of Interest

Design, Applications & Case Studies

- Agriculture, Aquaculture, and Land Use for Food Production
- Coastal Engineering & Resilience
- Dam Engineering
- Erosion & Sediment Control
- Geohazard / Disaster Mitigation & Response
- Geosynthetics Properties & Testing
- Landfills and changing waste management practices
- MSE Walls
- Slope Stabilization
- Soil-Geosynthetic Interaction
- Water Resources

Hot Topics in the Americas

- Durability and Long-Term Performance
- Engineering in different environments: arid zones, cold regions, high heat, humid, mountainous, tropical
- Failures & Remediation
- Geotechnical and civil software advances
- Standardization of Geosynthetics – **NOTE**: *GeoAmericas 2024 will celebrate the 40th anniversary of ASTM International Committee D35 on Geosynthetics' work. The impact of standardization on practice is welcomed throughout the conference.*

EUROCK 2024 ISRM European Rock Mechanics Symposium New challenges in rock mechanics and rock engineering July 15-19, 2024, Alicante, Spain, www.eurock2024.com

ECSMGE 24 XVIII European Conference on Soil Mechanics and Geotechnical Engineering, 26-30 August 2024, Lisbon, Portugal, www.ecsmge-2024.com

2024 ISRM International Symposium
24-28 September, New Delhi, India

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PANAMGEO CHILE 2024 17th Pan-American Conference on Soil Mechanics and Geotechnical Engineering, 12-17 November 2024, La Serena, Chile, https://panamge-ochile2024.cl

Eurock 2025
ISRM European Rock Mechanics Symposium
Expanding the underground space - future development of the subsurface - an ISRM Regional Symposium
16–20 June 2025, Trondheim, Norway

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21st International Conference on Soil Mechanics and Geotechnical Engineering
14 – 19 June 2026, Vienna, Austria

Organisers:

Austrian Geotechnical Society and Austrian Society for Geomechanics

Contact person: Prof. Helmut F. Schweiger

Email: helmut.schweiger@tugraz.at

16th International Congress on Rock Mechanics Rock Mechanics and Rock Engineering Across the Borders
17-23 October 2027, Seoul, Korea

Scope

The scope of the Congress will cover both conventional and emerging topics in broadly-defined rock mechanics and rock engineering. The themes of the Congress include but not be limited to the following areas:

- Fundamental rock mechanics
- Laboratory and field testing and physical modeling of rock mass
- Analytical and numerical methods in rock mechanics and rock engineering
- Underground excavations in civil and mining engineering
- Slope stability for rock engineering
- Rock mechanics for environmental impact
- Sustainable development for energy and mineral resources
- Petroleum geomechanics
- Rock dynamics
- Coupled processes in rock mass
- Underground storage for petroleum, gas, CO2 and radioactive waste
- Rock mechanics for renewable energy resources
- Geomechanics for sustainable development of energy and mineral resources
- New frontiers & innovations of rock mechanics
- Artificial Intelligence, IoT, Big data and Mobile (AICBM) applications in rock mechanics
- Smart Mining and Digital Oil field for rock mechanics
- Rock Engineering as an appropriate technology
- Geomechanics and Rock Engineering for Official Development Assistance (ODA) program
- Rock mechanics as an interdisciplinary science and engineering
- Future of rock mechanics and geomechanics

Our motto for the congress is "Rock Mechanics and Rock Engineering Across the Borders". This logo embodies the interdisciplinary nature of rock mechanics and challenges of ISRM across all countries and generations.

Website http://eng.ksrm.or.kr/html/

ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

Rosas in Cauca, Columbia: a truly extraordinary landslide

This is a truly extraordinary period for landslides, with so many events occurring that it is hard to decide which to cover. In India, the Joshimath landslide is continuing (rightly) to gain a lot of attention as the situation continues to deteriorate. Demolitions are underway, but are being fiercely opposed by local residents. There remains a complete lack of clarity as to the technical situation, which will be causing considerable distress. This is an abject lesson in poor communication by the authorities.

It is reported that the number of affected properties has now reached 723. Unfortunately there is some rainfall in the area, which could exacerbate the situation.

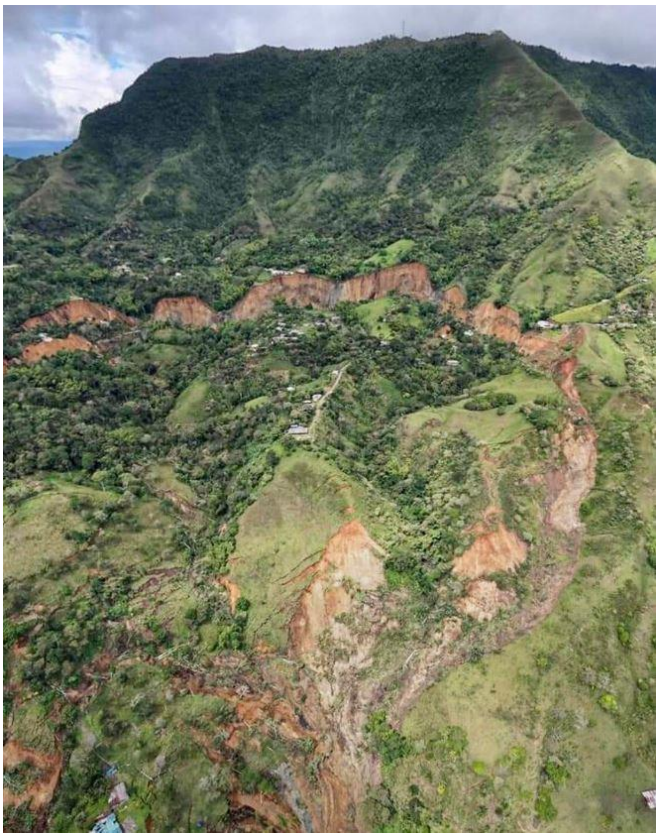
Meanwhile, California is being struck by a series of atmospheric river events, with serious impacts. There are some amazing landslide videos on Twitter.

Meanwhile, in Colombia a truly remarkable landslide has occurred in Rosas, Cauca. There are some excellent Tweets providing detail, including this one containing drone footage of the slide:-

https://twitter.com/Yobanygf/status/1612967281536933889

This landslide, which started to develop on 6 January 2023 but fully failed on 9 January 2023, has destroyed the communities of Parraga Viejo, Santa Clara, La Soledad and Chontaduro. It is reported that 64 homes have been destroyed, rendering 164 families and over 700 people homeless. The landslide has also closed over 500 metres of the Pan American Highway between Popayán and Pasto.

The best image I have found is this one, which was tweeted by Christian Mejia:-



The 9 January 2023 landslide at Rosas at Cauca in Columbia

The location of the landslide is described in a tweet by Willian Burbano:-

https://twitter.com/wilbuz/status/1612628816014237696

The coordinates of the Rosas landslide are 2.249, -76.779. The ever reliable Helbert Schneider has tweeted some background information about the landslide:

https://twitter.com/AlexLopezMaya/status/1612874902331080708

Plans are underway to purchase the land from the affected families, allowing them to relocate, whilst humanitarian assistance is being provided as an interim measure.

(Dave Petley / THE LANDSLIDE BLOG, 11 January 2023, https://blogs.agu.org/landslideblog/2023/01/11/rosas-cauca-1)

Joshimath: new InSAR analysis sheds light on active deformation

In Joshimath the landslide crisis continues, imposing a big impact on the people of the town. Apparently the investigation of the landslide is ongoing, although the exact nature of this is unclear. There is a very bold statement from unnamed "scientists" that the situation is getting better. The New Indian Express reports that:-

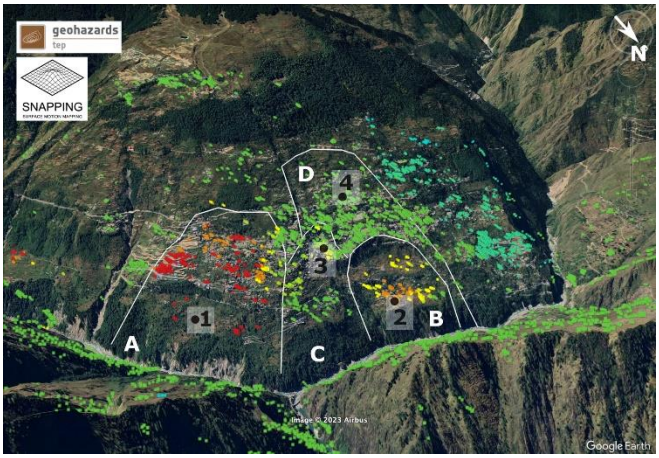
"The land of the land submergence area in Joshimath is trying to stabilise," the scientists believe. However, it will take some more time.

As soon as the summer starts, there will be a positive change in the situation. "The flow of water in JP Colony of Joshimath, which was happening at a speed of 10 litres per second, is now happening at 1.9 litres per second, which is comforting," said scientists, who didn't want to be named.

This is slightly odd. First, the summer is a long way hence, and second the summer will bring monsoon rainfall, which is unlikely to help (although it will not necessarily have an adverse effect). Finally, of course, the land is not trying to do anything except obey the laws of physics.

More importantly, we now have additional insight into the landslide from a new InSAR analysis undertaken using the Sentinel-1 instrument. This has been undertaken by renowned scientists from AUTh (Aristotle University of Thessaloniki) and CNRS-EOST (Centre National de la Recherche Scientifique / Ecole et Observatoire des Sciences de la Terre / Strasbourg) using the SNAPPING PSI Full Resolution service. The work has been released online and is freely available, with further analyses under way.

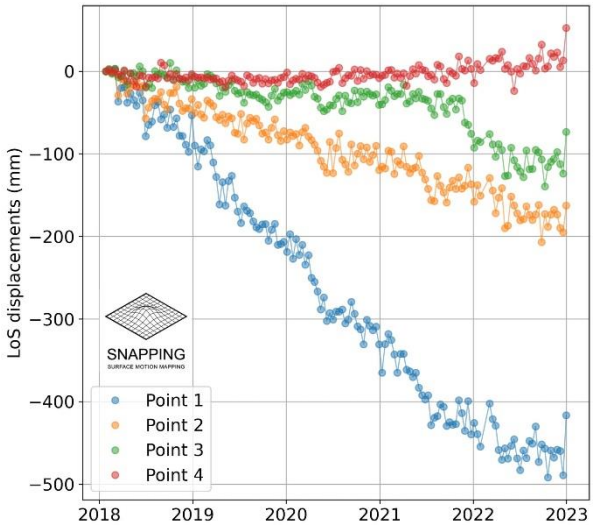
The team has produced two sets of analyses, including a times series for the movement of the slopes. The first examines movement over the period from January 2018 to 31 December 2022:-



3-Dimensional view of the Joshimath slope with the SNAPPING Full Resolution PSI results overlaid (background Google Earth). The location of the active units (A, B, C, D) are delimited by white lines. The location of selected PSI targets 1, 2, 3 and 4 are also indicated.

This diagram clearly shows the various landslide units upon which the town is built, and the movement patterns that they display in the long term. It confirms that the deformation is sliding, not subsidence, as expected.

A really important element of this work is that the team has produced a time series plot for points shown on the diagram above:-

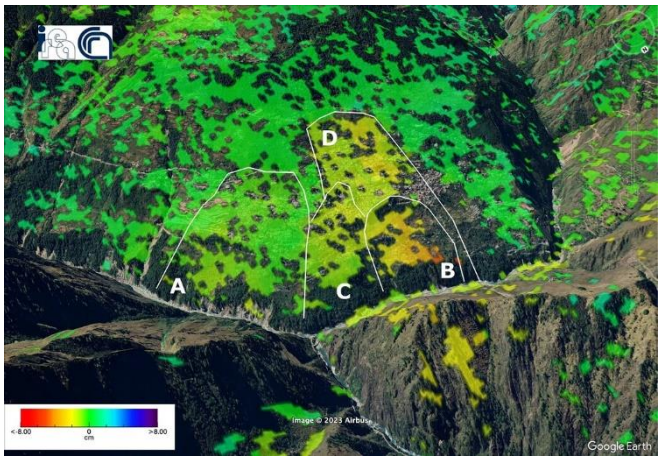


SNAPPING-derived LoS displacement time series on four points over the Joshimath slope for the period 01/2018-12/2022. The temporal evolution of surface motion among the various slope units follows a complex pattern, with different displacement rates.

There are a few things to note here. First, in the long term the different parts of the landslide complex are moving at different rates, which is not unusual. Point 1 is showing large displacements – almost half a metre with continuous creep, although the rate clearly fluctuates with time (this is similar to the results we got for the Utiku landslide in New Zealand for example). Other parts of the complex are moving more slowly, and indeed the point highest up the slope is not moving.

Point 3 shows a significant change in movement rate in late 2021.

The second analysis undertaken by the team examines movement over the last few weeks:



Unwrapped differential interferogram computed with the P-SBAS service for the Sentinel-1 ascending track 129 between the acquisitions of December 31, 2022 and January 12, 2023. Unwrapped differential interferogram provides the displacement of the ground in the LoS direction between two acquisitions. The orange and red colors indicate motion far away from the satellite corresponding to the downhill motion of the slope. Contains modified Copernicus Sentinel-1 images, 2022-2023.

The analysis shows that three portions of the landslide complex are currently moving, with the highest rates towards the lower part of the slope. The boundaries of the movement coincide with the margins of the landslide blocks identifiable from Google Earth. We would expect to see some of the greatest amounts of building damage occurring around these margins. Thus, it is really interesting to compare the above diagram with the map posted to Twitter by Thiyagarajan J (@jThiyagu) that shows the location of the wards damaged by the landslide:-

There is a strong coincidence, which suggests that these analyses are starting to pin down in more detail the nature of the landslide problem at Joshimath.

Movement of landslide complexes such as this is very complex, and we would expect to changes in the rate occurring through time. Thus, great care is going to be needed in interpreting short duration time series data. But, the bottom line is that this slope is unlikely to achieve permanent stability in its current physical state without significant engineering intervention. The current crisis will abate at some point, but the underlying chronic problem, whatever the cause, is likely to remain. That is not to say that all is lost by any means, the immediate crisis will pass, but action is likely to be needed.

Acknowledgement

Many thanks to colleagues from AUTh (Aristotle University of Thessaloniki) and CNRS-EOST (Centre National de la Recherche Scientifique / Ecole et Observatoire des Sciences de la Terre / Strasbourg) for making this analysis available online.

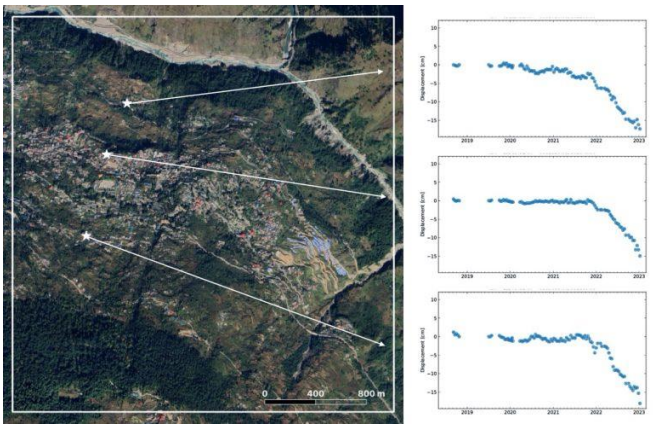
(Dave Petley / THE LANDSLIDE BLOG, 18 January 2023, https://blogs.agu.org/landslideblog/2023/01/18/joshimath-new-insar)

An update on the landslide crisis at Joshimath

In India, the landslide crisis at Joshimath continues to develop. As I have noted previously, the lack of clarity in terms of the situation from the authorities is remarkable. Crisis communication is hard, but there is ample evidence that a vacuum of information will be filled by misinformation. This is leading to considerable speculation, such as a suggestion that the cause might be the loss of ponds that used to be located around the town.

It appears that the landslide continues to move, with 863 buildings now showing signs of distress. Of these, 181 are considered to be unsafe. The situation for the displaced people has been exacerbated by snowfall in recent days, which of course has the potential to add water into the system in due course. Meanwhile, demolition of the worst affected buildings continues, most notably the large hotels that have been severely damaged by the landslide.

Simon Gascoin of CNRS has posted a very useful update on CESBIO Multitemp blog about the use of the Alaska Satellite Facility's web portal (Vertex) to generate deformation time series data for the Joshimath landslide. This generates a fascinating result:-

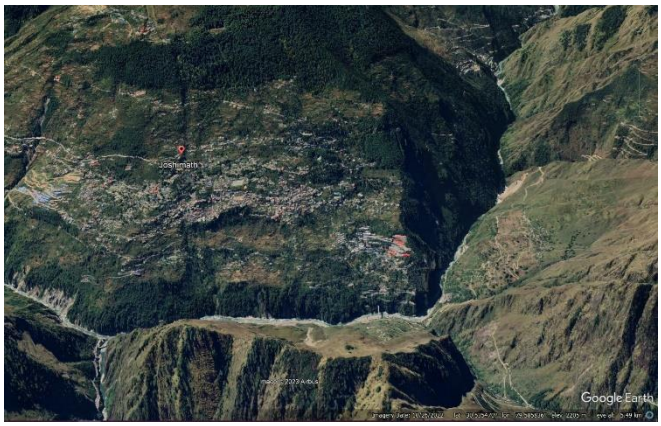


Time series of ground deformation at three locations in the Joshimath.

As Simon notes, the results support other analyses on terms of the nature and rates of movement observed. There was a sharp increase in deformation rate in October 2021, but there is a hint in the data that this might have started earlier for the point located closest to the river. This might support the suggestion that reactivation of this landslide has been triggered by erosion of the toe, but without a more detailed investigation this is conjecture.

Meanwhile, there remains a strange lack of clarity about the

nature of the processes at Joshimath. Some quarters continue to report this as subsidence, which is quite misleading as it implies vertical movement. There is no real doubt that this is a landslide, with the mass slipping down the slope. At times it is good to go back to basics – Google Earth imagery clearly demonstrates that the town is built on an ancient landslide:-



Google Earth imagery of the Joshimath landslide.

(Dave Petley / THE LANDSLIDE BLOG, 23 January 2023, https://blogs.agu.org/landslideblog/2023/01/23/joshimath-5)

United States Society on Dams (USSD) publishes Report on Analysis of Seismic Deformations of Embankment Dams

Water Overtopping Fujinuma Dam After the 2011 Tohoku Earthquake (photo by M. Yoshizawa)

In August 2022, USSD published a report on analysis of Seismic Deformation of Embankment Dams.

Per the foreword, "This report is intended to provide guidance on the evaluation of seismic deformations of embankment dams and on the use of numerical analysis procedures for such evaluations. It is intended to serve as a reference on available analysis methods for consultants, regulators, and owners involved in performing, reviewing, and procuring analyses of seismic stability and deformations of embankment dams. Because engineering practice in this field will likely continue to evolve rapidly, this guidance is expected to require periodic review and updating in the future. The document was prepared by the Committee on Earthquakes of the United States Society on Dams (USSD) and provides a consensus view of the Committee on current United States practice for analysis of embankment dam seismic deformations.

Download: https://www.ussdams.org/wp-content/uploads/2022/10/USSD-Emb-Dam-Seismic-Deformation-Guidelines-rev080822.pdf.

(Geoengineer.org, Jan, 23, 2023, https://www.geoengineer.org/news/united-states-society-on-dams-ussd-publishes-report-on-analysis-of-seismic-deformations-of-embankment-dams)

The 19 July 2019 Yahuokou landslide in Gansu Province, China

On 19 July 2019, a large (3.92 million cubic metre) landslide started to develop at Dongshan Town, Zhouqu County, Gansu Province, China. This mass movement, known as the Yahuokou landslide, is described in a good paper (He *et al.* 2019) that has recently been published in the journal *Landslides*.

The failure is large – 1,920 m long over a vertical range of 550 m. The location is 33.742, 104.516 (the position given in the paper itself is unfortunately not quite correct). Rather elegantly, there is Google Earth imagery of the site captured on 31 July 2019, just a few days after the landslide occurred:-

Google Earth imagery of the 19 July 2019 Yahuokou landslide in Gansu Province, China.

He *et al.* (2019) describe the impact of the landslide, noting that it destroyed roads and chicken farms; it blocked the river, causing the water level to rise; and it disrupted traffic. Movement continued for about a month.

As the image above shows, the landslide was a reactivation of an ancient landslide. The main mechanism of movement is a flow, triggered by heavy rainfall. The rate of movement

was comparatively low, with failure being initiated at the crown of the slope. Movement then propagated downslope through the landslide mass.

The Google Earth imagery captures rather well the displacement of the slope, and the propagation of the landslide, given that the imagery was captured whilst movement was still developing. This image is from 31 July 2019:-

Google Earth imagery of the mid section of the 19 July 2019 Yahuokou landslide in Gansu Province, China.

The road provides a rather good indicator of the amount of deformation. The first (uppermost) road section has moved about 85 m. The middle section has moved about 57 metres, whilst the lower part has moved 45 metres. At the time that the image was captured the toe of the active landslide had reached the building with the blue roof, the adjacent section of road was undamaged at this point. The most recent image (from 2021) shows that the landslide subsequently propagated through this area.

He *et al.* (2019) have highlighted a really interesting landslide, and the availability of Google Earth imagery captured during and after the movement provides a really unusual opportunity to examine the development of a flow type failure.

Reference

He, Q., Guo, F., Li, R. *et al.* 2023. Characteristics, mobility and dynamic of the Yahuokou flow-like landslide in Zhouqu, Gansu, China. *Landslides* (2023). https://doi.org/10.1007/s10346-022-02000-8

(Dave Petley / THE LANDSLIDE BLOG, 26 January 2023, https://blogs.agu.org/landslideblog/2023/01/26/yahuokou-landslide-1)

Multiple landslides from extreme rainfall in Auckland, New Zealand

In recent days Auckland and the surrounding area of New Zealand have suffered from an atmospheric river rainfall event that has been devastating, with the heaviest rainfall occurring on 27 January 2023. Met Service New Zealand tweeted about the 36 hour rainfall totals on 28 January:-

Unsurprisingly, there has been extensive flooding and large numbers of landslides. Stuff has a really good portfolio of photographs of the landslides and flood that the rainfall triggered, whilst Newstalk ZB has this image of multiple landslides in the Massey neighbourhood of Auckland:-

Multiple landslides in Massey, Auckland.

Meanwhile at Remeura in Auckland a man was killed by a landslide that knocked a house off its foundations. Yahoo News has an image of the aftermath:-

The aftermath of a fatal landslide in Remuera, Auckland. One person was killed at this site.

Meanwhile, a large landslide has destroyed State Highway 25A across Coromandel:-

The aftermath of a large landslide that has destroyed SH25A during the extreme rainfall in the Auckland area.

Repairing this level of damage is going to be time consuming and expensive.

As I write there are warnings of further severe rainfall in the northern part of New Zealand, with a red rainfall warning in place for Auckland, Coromandel and Northland:-

Further extreme rainfall could occur on Tuesday, with the mayor of Auckland warning that this could be even more dangerous than the rainfall that occurred on Friday. The challenge is not the rainfall total, which is likely to be considerably lower than on 27 January, but the presence of already saturated ground. This is a recipe for further landslides.

Already there is considerable soul searching occurring about the preparedness for these increasingly frequent rainfall events. A detailed review is going to be needed once the rainfall ends.

(THE LANDSLIDE BLOG / Dave Petley, 30 January 2023, https://blogs.agu.org/landslideblog/2023/01/30/auckland-1/)

Landslide on granite in Poraty City, Rio de Janeiro State of Brazil taken by Joao Paulo Monticelli of Brazil (IAEG CONNECTOR Nesletter, January 25, 2023, https://www.multi-briefs.com/briefs/IAEG/IAEG012523.php)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΓΕΩΛΟΓΙΑ

What is the rarest mineral on Earth?

There is only one specimen of the rarest mineral on Earth, and it's from Myanmar.

Kyawthuite, found in Myanmar, is the rarest mineral in the world.

Most human eyes have seen the mystical beauty of quartz, possibly without knowing it is the most common mineral on Earth, but which is the rarest?

Minerals are scattered everywhere on our planet, from glittering flecks in gravel or sand to actual hidden gems. According to the U.S. Geological Society (opens in new tab), minerals are naturally occurring elements or compounds that are inorganic, meaning they do not contain carbon. Each type of mineral exhibits order in its internal structure and has a unique chemical makeup. The form a mineral's crystals take, as well as its other physical properties, can vary.

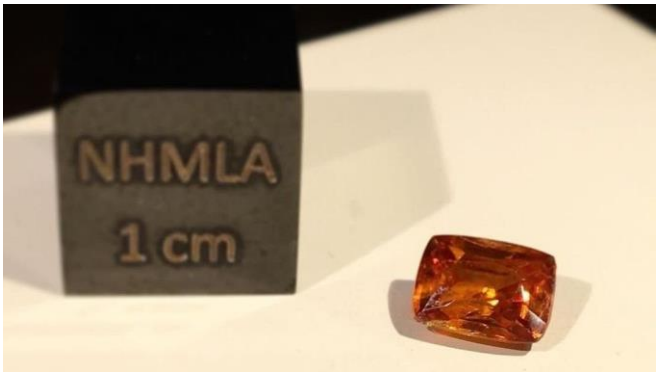
The rarest mineral on Earth is kyawthuite. Only one crystal, found in the Mogok region of Myanmar, is known to exist. Caltech's mineral database (opens in new tab) describes it as a small (1.61-karat) deep orange gemstone that the International Mineralogical Association (opens in new tab) officially recognized in 2015.

However, little is known about kyawthuite, so let's move on to the second-rarest mineral in existence. This is painite, which appears as deep red hexagonal crystals (though there are some pinkish exceptions). Though painite is now more easily found than it used to be, this mineral is still rare, and its chemical structure makes it something of a scientific enigma.

In 1952, the English gem collector and dealer Arthur Pain acquired two crimson crystals in Myanmar, according to George Rossman, a professor of mineralogy at CalTech, who has been researching painite since the 1980s and maintains an extensive database of all the samples he has analyzed microscopically.

Pain thought the crystals were rubies, which the region is famed for, but unbeknownst to him they were actually something far rarer.

Painite (which took on Arthur's surname) is sometimes unearthed along with rubies and other gemstones. That explains why Pain assumed the crystals were rubies when, according to Rossman, he donated them to the British Museum in 1954 for further study. Another painite sample from Myanmar surfaced in 1979, and until 2001, those three crystals were the only known specimens of painite in the world.



There is only one known sample of Kyawthuite on the planet

The very first painite crystal discovered, known as painite #1, was later analyzed by Rossman. His latest painite study was published in Mineralogical Magazine (opens in new tab) in 2018.

"I conducted [studies] of the [first] sample," he told Live Science. "[My results] became the standards by which further discoveries of painite were confirmed."

It was through this research that Rossman determined which elements make up painite. With infrared spectroscopy, infrared radiation is used to identify elements based on how they absorb, reflect and emit that light. With Raman spectroscopy, a laser is used to scatter visible, infrared or ultraviolet light, which makes the molecules give off unique vibrations that make them identifiable.

Rossman also found there was an error in the chemical makeup originally determined by scientists at the British Museum. While they had correctly identified aluminum, boron, calcium and oxygen, the element zirconium was missing. Another thing Rossman found out was what gave painite its reddish hue; It has trace amounts of vanadium and chromium that might make it deceptively appear like a ruby.

Here we see corundum (red) in a painite crystal specimen from Myanmar.

But what makes painite so rare? For one, it is only found in Myanmar, but the real reason lies in its formation. Painite is a borate crystal, meaning it contains boron. It also contains zirconium. Boron has a notoriously difficult time bonding with zirconium. In fact, painite is the only mineral in which the two have been found bonded in nature. While the reason is still unclear, zirconium and boron have not been found together in significant concentrations, as Rossman said. It is also

thought that these elements may not be very stable together compared with other elements they could bond with.

"To my knowledge, no one has done a serious study of what it takes to form painite," Rossman said. "I know of no attempt to synthesize it in a lab."

Why Myanmar?

What Rossman does have an idea of is why painite and so many other gems, such as kyawthuite, are found in Myanmar. When the ancient supercontinent of Gondwana began to split about 180 million years ago, India crept north and collided with what is now South Asia. Pressure and heat from the collision formed a treasure trove of rocks, many of them gemstones. He thinks the boron in painite and other borate minerals possibly came from shallow seas around the newly formed land mass.

Rossman has had many crystals suspected to be painite sent to him for identification. Some have been hidden in plain sight for decades, as they were often stashed in bags of rough gemstones or in the hands of dealers and collectors who misidentified them.

Painite suitable for luxe jewelry is hard to come by and valued as high as $60,000 a carat, Rossman said. What determines the price can be subjective, but the fewer flaws, the better.

It should be noted that there are ethical concerns about mining in Myanmar, also famous for other gemstones and specimens of tiny prehistoric creatures trapped in amber. Human Rights Watch (opens in new tab) raises awareness about human rights abuses from the military government, which profits from the mining industry, which has unsafe and disease-infested mines, forced labor and child labor. Some jewelry companies refuse to purchase gems mined there for this reason and some scientists decline to study specimens (opens in new tab) from this country.

Painite is now more common than it once was. Multiple crystals began to appear in 2005, all within that year, and most painites can now be found in Myanmar's Wet Loo and Therein Taung regions.

Though painite no longer wears the crown of rarest mineral, it's still a real gem.

(Elizabeth Rayne / LIVESCIENCE, 2 Jan. 2023, https://www.livescience.com/rarest-mineral-on-earth)

Εντοπίστηκε ο μαγματικός θάλαμος του υποθαλάσσιου ηφαιστείου Κολούμπος στη Σαντορίνη

Μια ανακοίνωση της Αμερικανικής Γεωφυσικής Ένωσης (AGU) έρχεται να αποκαλύψει τις γεωλογικές διεργασίες που συμβαίνουν στον υποθαλλάσιο χώρο της Σαντορίνης. Η ανακοίνωση κάνει λόγο για ένα συνεχώς αυξανόμενο όγκο μάγματος που συσσωρεύεται στο μαγματικό θάλαμο, σε βάθος περίπου 3 χιλιομέτρων κάτω από το υποθαλάσσιο ηφαίστειο Κολούμπος κοντά στη Σαντορίνη.

Η παρουσία αυτού του μαγματικού θαλάμου αναδεικνύει την πιθανότητα μιας μελλοντικής έκρηξης και γι' αυτό είναι σημαντικό το συγκεκριμένο ηφαίστειο – το πιο ενεργό υποθαλάσσιο ηφαίστειο όλης της Μεσογείου – να παρακολουθείται συνεχώς σε πραγματικό χρόνο. Αυτό αναφέρεται στην ανακοίνωση της AGU η οποία βασίζεται σε δημοσίευση ξένων και Ελλήνων επιστημόνων στην επιθεώρηση «Geochemistry, Geo-physics, Geosystems».

Ακριβώς αυτόν τον καιρό, βρίσκεται σε εξέλιξη στην περιοχή του Κολούμπου η διεθνής αποστολή Expedition 398 του μεγάλου αμερικανικού ερευνητικού σκάφους JOIDES Resolution, στο πλαίσιο του Διεθνούς Προγράμματος Ανακάλυψης των Ωκεανών (IODP), με τη συμμετοχή Ελλήνων επιστημόνων από το ΕΚΠΑ και το ΕΛΚΕΘΕ. Οι ερευνητές μόλις έκαναν γεώτρηση βορειοδυτικά του Κολούμπου με στόχο, μεταξύ άλλων, να ανακαλύψουν ίχνη από παλαιότερες εκρήξεις που έχουν γίνει στην περιοχή. Θα χρειαστούν πάντως κάποιοι μήνες (από τον Ιούλιο και μετά), εωσότου δημοσιοποιηθούν τα πρώτα ευρήματα της αποστολής, η οποία θα ολοκληρωθεί τον Φεβρουάριο με πρόσθετες γεωτρήσεις μέσα στην καλντέρα της Σαντορίνης.

Παράλληλα η αναπληρώτρια καθηγήτρια Παρασκευή Νομικού του Τμήματος Γεωλογίας & Γεωπεριβάλλοντος του Πανεπιστημίου Αθηνών, η οποία επιβαίνει στο JOIDES Resolution, αναφέρει ότι τοποθετήθηκαν ήδη από τις αρχές Δεκεμβρίου, με τη βοήθεια πλοίου του ΕΛΚΕΘΕ, όργανα παρακολούθησης στον Κολούμπο στο πλαίσιο του ελληνικού ερευνητικού προγράμματος SANTORY και με την οικονομική στήριξη του Δήμου Θήρας. Τόνισε ότι "είναι η πρώτη φορά που παρακολουθείται το ηφαίστειο, ενώ θα τοποθετηθούν επιπρόσθετα όργανα τους επόμενους μήνες και θα ενημερωθούν οι κάτοικοι του νησιού για τα αποτελέσματα των μετρήσεων από τη διεθνή επιστημονική ομάδα".

Η ανάλυση

Η έρευνα με επικεφαλής τον γεωφυσικό Κάτζεταν Κραπκίεβτις και τον ηφαιστειολόγο Μικέλε Παουλάτο του Κολλεγίου Imperial του Λονδίνου και με τη συμμετοχή της κας Νομικού και του καθηγητή του ΑΠΘ Κωνσταντίνου Παπαζάχου, βασίστηκε σε καινοτόμο ανάλυση των σεισμικών και άλλων δεδομένων για τον Κολούμπο που είχαν προκύψει από παλαιότερη έρευνα της αποστολής "Πρωτέας" ενός άλλου αμερικανικού ερευνητικού πλοίου στην περιοχή πριν μερικά χρόνια.

Τα αποτελέσματα οδήγησαν τους ερευνητές, στην εκτίμηση ότι "η τρέχουσα κατάσταση του θαλάμου μάγματος δείχνει πως μια έκρηξη με πιθανά σημαντικές επιπτώσεις είναι δυνατή στο μέλλον (μολονότι όχι επικείμενη), συνεπώς προτείνουμε την τοποθέτηση ενός μονίμου παρατηρητηρίου που θα αφορά τη συνεχή καταγραφή των σεισμών και της γεωδαισία του βυθού". Όπως επισημαίνουν, "τα αποτελέσματα μας δείχνουν ότι ο Κολούμπος αποτελεί σοβαρή απειλή και δικαιολογεί μια εγκατάσταση παρακολούθησης σε πραγματικό χρόνο". Κάτι που ήδη άρχισε να υλοποιείται με το πρόγραμμα SANTORY και την εγκατάσταση επιστημονικών οργάνων στο βυθό του Κολούμπου.

Το 1650 μ.Χ. ο Κολούμπος είχε εκραγεί, σκοτώνοντας περίπου

70 ανθρώπους στη Σαντορίνη λόγω δηλητηρίασης από τα αέρια της έκρηξης. Εκείνη η έκρηξη είχε πυροδοτηθεί από το συσσωρευμένο μάγμα σε ένα αντίστοιχο μαγματικό θάλαμο, πιθανώς σε αντίστοιχο βάθος 3-4 χιλιομέτρων κάτω από τον βυθό. Οι ερευνητές εκτιμούν ότι το μάγμα στον θάλαμο έχει την τάση, σε βάθος χρόνου, να φθάσει ξανά σε παρόμοιο όγκο. Σύμφωνα με τις εκτιμήσεις τους, μετά την τελευταία έκρηξη του ηφαιστείου το 1650 μ.Χ., ο μαγματικός θάλαμος μεγαλώνει με μέσο ρυθμό περίπου 4 εκατομμυρίων κυβικών μέτρων τον χρόνο. Ο συνολικός όγκος που έχει συσσωρευθεί στο "ρεζερβουάρ" μάγματος (μαγματικό θάλαμο) κάτω από τον Κολούμπο, υπολογίζεται σε 1,4 κυβικά χιλιόμετρα.

Ο ρυθμός

Σύμφωνα με τους ερευνητές αν ο συνεχιστεί ο σημερινός ρυθμός διόγκωσης του μαγματικού θαλάμου, κάποια στιγμή μέσα στα επόμενα 150 χρόνια ο Κολούμπος θα φθάσει τα 2 κυβικά χιλιόμετρα μάγματος, που εκτιμάται ότι υπήρχαν όταν έγινε η έκρηξη του 1650 μ.Χ. Όμως, μολονότι μπορεί να γίνει μια εκτίμηση για τον μελλοντικό όγκο του μάγματος, σύμφωνα με τους ερευνητές, δεν υπάρχει τρόπος να πει κανείς με βεβαιότητα πότε θα γίνει η επόμενη έκρηξη του ηφαιστείου.

Οι ερευνητές αναφέρουν ότι μολονότι δεν φαίνεται να επίκειται άμεσα κάποιος κίνδυνος, επειδή ο Κολούμπος βρίσκεται σε σχετικά μικρό βάθος θάλασσας (περίπου 500 μέτρων), αυτό είναι πιθανό να αυξήσει την εκρηκτικότητα του. Προβλέπουν ότι όταν γίνει η έκρηξη, θα προκληθεί τσουνάμι και μια στήλη τέφρας ύψους δεκάδων χιλιομέτρων πάνω από την επιφάνεια της θάλασσας, κάτι που θα μπορούσε να έχει σοβαρές επιπτώσεις για τη Σαντορίνη, η οποία απέχει μόνο επτά χιλιόμετρα από τον Κολούμπο.

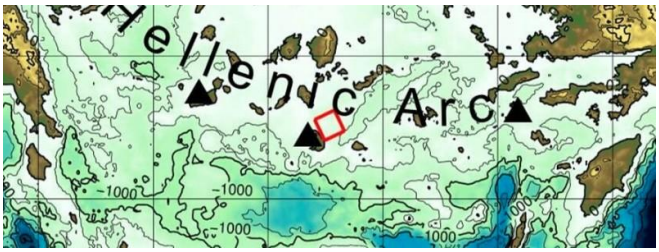
Οι ερευνητές ευελπιστούν ότι σε συνδυασμό τα νέα στοιχεία από το SANTORY και από την ευρισκόμενη σε εξέλιξη αποστολή του IODP πέριξ της Σαντορίνης θα παράσχουν πλέον καλύτερη εικόνα του ηφαιστειακού δυναμικού της περιοχής. Όπως δήλωσε στο ΑΠΕ-ΜΠΕ ο καθηγητής του ΑΠΘ Κωνσταντίνος Παπαζάχος, αν και στη Σαντορίνη λειτουργεί εδώ και δύο δεκαετίες ένα πολύ καλό σεισμολογικό και γεωδαιτικό δίκτυο παρακολούθησης από το Ινστιτούτο Μελέτης & Παρακολούθησης του Ηφαιστείου της Σαντορίνης (ΙΜΠΗΣ), κάθε πρόσθετο δεδομένο και πληροφορία που αφορά τον Κολούμπο, είναι εξαιρετικά χρήσιμα. Παράλληλα, τόνισε ότι τα στοιχεία αυτά θα αξιοποιηθούν από μία διεθνή ερευνητική ομάδα, υπό τον συντονισμό της Εθνικής Αρχής Γεωλογικών και Μεταλλευτικών Ερευνών (ΕΑΓΜΕ), για την αξιολόγηση της σχετικής σεισμο-ηφαιστειακής επικινδυνότητας του Κολούμπου, ώστε να μπορεί να σχεδιαστούν ανάλογα τα μέτρα πολιτικής προστασίας.

"Χρειαζόμαστε καλύτερα δεδομένα για το τι πραγματικά βρίσκεται κάτω από αυτά τα υποθαλάσσια ηφαίστεια. Η συνεχής παρακολούθηση τους θα μας επιτρέψει να κάνουμε καλύτερη εκτίμηση για το πότε μια έκρηξη μπορεί να συμβεί. Με τέτοια συστήματα, πιθανώς θα γνωρίζουμε για μια έκρηξη λίγες μέρες προτού συμβεί, ώστε οι άνθρωποι θα μπορέσουν να εκκενώσουν την περιοχή και να μείνουν ασφαλείς", δήλωσε ο Κραπκιεβιτς.

Πηγή: ΑΠΕ-ΜΠΕ

(Κέρδος online, 16/1/2023, http://www.kerdos.gr/επιστήμη-τεχνολογία/414306-εντοπίστηκε-ο-μαγματικός-θάλαμος-του-υποθαλάσσιου-ηφαιστείου-κολούμπος-στη-σαντορίνη-(1))

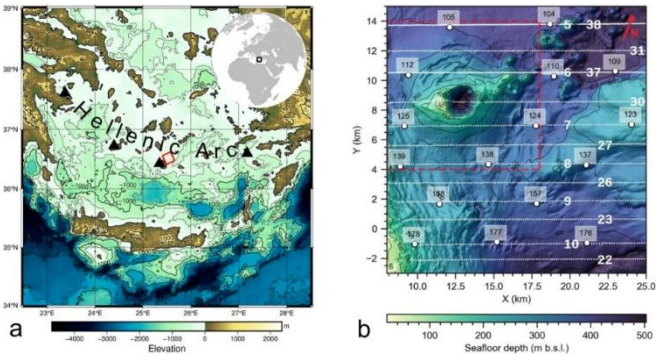
Study reveals magma chamber at submarine Kolumbo volcano near Santorini, Greece poses a serious threat



A new study published in AGU's Geochemistry, Geophysics, Geosystems has revealed the existence of a magma chamber beneath the Kolumbo volcano, located near Santorini, Greece. Using a high-resolution technology called full-waveform inversion, the study found that the magma chamber poses a serious hazard as it could produce a highly explosive, tsunamigenic eruption in the near future.

Researchers using a next-generation tomographic method with extraordinarily dense seafloor recordings of controlled marine sound sources were able to detect a body of mobile magma that has been growing at an average rate of 4×10^6 m^3 per year since the last eruption in 1650 CE. This rate is large enough to counteract the effect of cooling and crystallization.

Arc volcanoes, which mark the curved boundaries between converging tectonic plates, host the most explosive events on Earth. The associated hazard depends on how much mobile magma is currently present beneath a volcano.



Study area and data-acquisition geometry. (a) Regional topography around the Hellenic arc; black triangles denote active volcanic centers—from W to E: Methana, Milos, Santorini and Nisyros. (b) Acquisition geometry in local coordinates annotated white circles—ocean-bottom seismometers and their IDs; white dots—airgun shots; white numbers—shot-line IDs (note, some lines were shot twice).

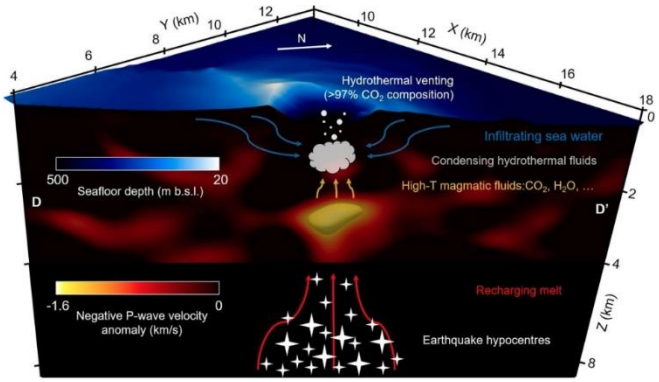
Standard tomographic methods used so far have relatively low resolution and give a blurred picture of only the largest molten-rock bodies. In particular, they struggle to distinguish between mobile magma and melt spread between tightly packed mineral grains.

The study also suggests that similar reservoirs may have gone undetected at other active volcanoes, challenging the existing eruption forecasts and reactive-flow models of magma differentiation.

The authors of the study suggest that Kolumbo poses a serious threat and deserves a real-time monitoring facility.

Despite the excellent data coverage, the small magma body was missed by standard tomography. This suggests that applying next-generation imaging methods to already well-studied volcanoes may lead to similar discoveries.

Given the potentially high societal impact of an explosive eruption at Kolumbo, the authors suggest establishing a permanent observatory involving continuous earthquake monitoring, to ensure that any future activity is closely monitored, and the necessary precautions can be taken to mitigate the risk to the local population.



Kolumbo magmatic system. Ascending rhyolitic melt replenishes the shallow chamber. The exsolved gases mix with seawater and vent at the crater floor. The depth of hydrothermal systems is inferred from seismic reflection images (Hübscher et al., 2015) and geochemical data (Rizzo et al., 2019). The approximate earthquake locations are based on Schmid et al. (2022). The velocity anomaly is extracted from the final model along the DD' profile. No vertical exaggeration is applied.

Kolumbo is a submarine volcano located near the island of Santorini in Greece. The volcano is known for its explosive eruptions, with the most recent one occurring in 1650 CE.

It is situated on the boundary between two tectonic plates, where the African plate is subducting beneath the Aegean plate. Kolumbo is an important site for studying the dynamics of arc volcanoes, which are known for their explosive eruptions and the formation of magma chambers.

The volcano is also of interest due to its potential for generating tsunamis, which can be a significant hazard for the nearby island of Santorini and the surrounding areas.

References:

Magma Chamber Detected Beneath an Arc Volcano With Full-Waveform Inversion of Active-Source Seismic Data – AGU Geochemistry, Geophysics, Geosystems – October 2022 – https://doi.org/10.1029/2022GC010475 – OPEN ACCESS

(THE WATCHERS, Wednesday, January 18, 2023, https://watchers.news/2023/01/18/study-reveals-magma-chamber-at-submarine-kolumbo-volcano-near-santorini-greece-poses-a-serious-threat)

Magma Chamber Detected Beneath an Arc Volcano With Full-Waveform Inversion of Active-Source Seismic Data

K. Chrapkiewicz, M. Paulatto, B. A. Heath, E. E. E. Hooft, P. Nomikou, C. B. Papazachos, F. Schmid, D. R. Toomey, M. R. Warner, J. V. Morgan

Abstract

Arc volcanoes are underlain by complex systems of molten-rock reservoirs ranging from melt-poor mush zones to melt-rich magma chambers. Petrological and satellite data indicate that eruptible magma chambers form in the topmost few kilometres of the crust. However, very few chambers have ever been definitively located, suggesting that most are too short-lived or too small to be imaged, which has direct implcations for hazard assessment and modeling of magma differentiation. Here we use a high-resolution technology based on inverting full seismic waveforms to image a small, high-melt-fraction magma chamber that was not detected with standard seismic tomography. The melt reservoir extends from ~2 to at least 4 km below sea level (b.s.l.) at Kolumbo—a submarine volcano near Santorini, Greece. The chamber coincides with the termination point of the recent earthquake swarms and may be a missing link between a deeper melt reservoir and the high-temperature hydrothermal system venting at the crater floor. The chamber poses a serious hazard as it could produce a highly explosive, tsunamigenic eruption in the near future. Our results suggest that similar reservoirs (relatively small but high-melt-fraction) may have gone undetected at other active volcanoes, challenging the existing eruption forecasts and reactive-flow models of magma differentiation.

Key Points

- A shallow, very strong negative V_P anomaly imaged under the explosive, submarine Kolumbo volcano, Greece, using full-waveform inversion
- The high-fidelity image and petrologic data indicate the anomaly is a small (~0.6-km wide, ~2-km deep), magma chamber with ~42% of melt
- The chamber was missed by travel-time tomography indicating similar reservoirs may have gone undetected at other volcanoes

Plain Language Summary

Arc volcanoes, which mark the curved boundaries between converging tectonic plates, host the most explosive events on Earth. The associated hazard depends on how much mobile magma is currently present shallow beneath a volcano. Standard tomographic methods used so far have relatively low resolution and give a blurred picture of only the largest molten-rock bodies. In particular, they struggle to distinguish between mobile magma and melt spread between tightly packed mineral grains. This study, a first in volcanology, combines a next-generation tomographic method with extraordinarily dense seafloor recordings of controlled marine sound sources. This state-of-the-art experiment at Kolumbo volcano, offshore of Santorini allowed us to detect a body of mobile magma which has been growing at an average rate of 4×10^6 m^3 per year since the last eruption in 1650 CE. This rate is large enough to counteract the effect of cooling and crystallization. Our results show that Kolumbo poses a serious threat and deserves a real-time monitoring facility. Despite the excellent data coverage, the small magma body was missed by standard tomography. This suggests that applying next-generation imaging methods to already-well-studied volcanoes may lead to similar discoveries. We envision that small-volume, high-melt-fraction reservoirs may be more widespread than previously thought.

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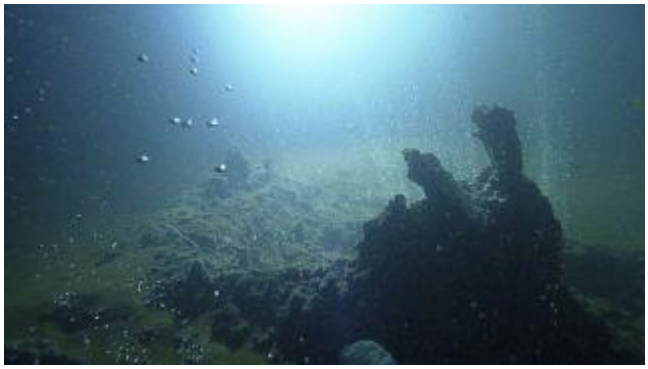
https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GC010475

Never-before-seen volcanic magma chamber discovered deep under Mediterranean, near Santorini

Using a technique to study seismic waves, researchers revealed a previously unknown magma chamber underneath a the Kolumbo submarine volcano.



This view from an international volcano monitoring system shows the Kolumbo volcanic crater on the seafloor. (Image credit: SANTORY)

A submarine volcano whose deadly eruption shattered the picturesque Greek island of Santorini nearly 400 years ago has a growing, never-before-seen magma chamber that could fuel another massive eruption within the next 150 years, a new study finds.

About 4 miles (7 kilometers) from Santorini, 1,640 feet (500 meters) under the ocean's surface, lies the Kolumbo volcano. Kolumbo is one of the most active submarine volcanoes in the world, and according to historical accounts (opens in new tab), its last eruption in A.D. 1650 killed at least 70 people. A study published Oct. 22, 2022, in the journal Geochemistry, Geophysics, Geosystems (opens in new tab) revealed that the previously undetected magma chamber growing beneath the Kolumbo volcano could lead to another eruption, thus endangering residents and tourists on Santorini.

Undersea volcanoes are monitored just like their on-land counterparts, but because undersea seismometers are challenging to install, there are fewer of them, which means scientists have less data on undersea volcanoes. In an attempt to overcome this problem, researchers decided to try a different technique to study the inner mechanics of Kolumbo.

Specifically, they used a method called full-waveform inversion, which employs artificially produced seismic waves to create a high-resolution image showing how rigid or soft the underground rock is.

"Full-waveform inversion is similar to a medical ultrasound," co-author Michele Paulatto, a volcanologist at Imperial College London, said in a statement (opens in new tab). "It uses sound waves to construct an image of the underground structure of a volcano."

Seismic waves travel at different speeds through Earth depending on the rigidity of the rock they're passing through. For example, a type of seismic wave called a P-wave travels more slowly if the rock is more like a liquid, like magma, than it does through hardened rock. By gathering data about the velocity of seismic waves traveling through the ground, researchers can get a sense of where magma is forming.

While on board a research cruise sailing near the volcano, the researchers fired an air gun, which produced seismic waves in the ground below. Those seismic waves were measured by monitors on the seafloor.

Magma forms deep within Earth's crust and then travels through dikes to the shallow magma reservoirs beneath Kolumbo volcano and the Santorini caldera. (Image credit: Nia Schamuells and Michele Paulatto, https://volcanoroots.org/santorini-and-kolumbo/)

Data from the seismic recordings showed a significant decrease in velocity underneath the volcano, indicating the presence of a magma chamber, rather than just solid rock. Further calculations revealed that the magma chamber has been growing at a rate of 141 million cubic feet (4 million cubic meters) per year ever since its eruption in 1650.

The chamber now holds roughly a third of a cubic mile (1.4 cubic km) of magma, the team found.

According to study first author Kajetan Chrapkiewicz (opens in new tab), a geophysicist at Imperial College London, the volume of magma could reach roughly half a cubic mile (2 cubic km) within the next 150 years. That was the estimated amount of magma Kolumbo ejected nearly 400 years ago.

The new study illustrates how important it is to closely monitor undersea volcanoes. Unlike earthquakes, volcanic eruptions can be predicted to some extent — but only if experts have enough data about the movement of magma beneath the volcano.

"We need better data on what's actually beneath these volcanoes," Chrapkiewicz said in the statement. "Continuous monitoring systems would allow us to have a better estimation of when an eruption might occur. With these systems, we would likely know about an eruption a few days before it happens, and people would be able to evacuate and stay safe."

For Kolumbo, an international team of scientists has been working on establishing a seafloor observatory called Santorini's Seafloor Volcanic Observatory, or SANTORY (opens in new tab). Once the observatory is up and running, scientists and hazard experts will be better equipped to monitor for possible eruptions.

(JoAnna Wendel / Live Science, January 16, 2023, https://www.livescience.com/mediterranean-volcano-growing-magma-chamber)

Piqiang Fault, China

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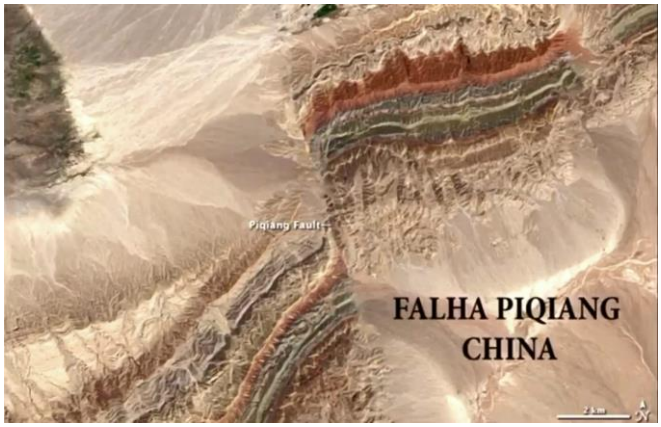
+ Follow

Impressive satellite image of a portion of the Piqiang Fault (China), a north-westerly running transcurrent fault (directional tailings fault). The reddish, greenish, and brownish layers are continental Devonian sandstones, Silurian deep marine sediments, and Cambro-Ordovician limestones, respectively. They form one of several parallel ridges (up to 1200 m high), all composed of the same rock pack and belonging to the Keping Shan belt, immediately south of the southern Tien Shan mountains.

Source: Earth Geology



ΕΝΔΙΑΦΕΡΟΝΤΑ - ΠΕΡΙΒΑΛΛΟΝ

Are volcanoes impacted by climate change? Or is it the other way around?

The eruption of Mauna Loa for the first time in 40 years on the Big Island of Hawaii follows a summer and fall that saw record-high temperatures around the world.

Is there a connection between climate change and volcanic eruptions?

While a study of Iceland proposes a possible link, scientists at Northeastern University say the effect of volcanic activity on global warming is minimal.

Daniel Douglass and Samuel Munoz of Northeastern's Marine Science Center and Coastal Sustainability Institute say the impact operates in reverse: major explosions of volcanoes in the past have decreased global temperatures by a degree or two for months.

The effect is so pronounced that some scientists want humans to duplicate the effect through geoengineering; but Douglass and Munoz say that scenario is nowhere near reality at this time.

"People do say this is something we should research and think about," says Douglass, an associate professor of geology. "A bunch of other people say that seems really dangerous."

The idea is to create a sort of umbrella over the earth that would block solar radiation from reaching the ground.

"The sunlight bounces back into space," Douglass says.

Major volcanic explosions have created this effect naturally by shooting giant plumes of ash and sulfuric acid into the atmosphere, where the latter forms aerosol particles or little droplets that reflect sunlight away from the earth's surface, Munoz says.

"That effect is actually a cooling effect," he says. "If it's a really big eruption, that cooling effect can last for a year," Munoz says.

"They create clouds where there would not otherwise have been clouds," Douglass says.

But it is a genie many scientists say should remain in the test tube bottle.

For one, sulfur dioxide "is the same stuff that causes acid rain," Douglass says.

And secondly, "there's some climate modeling that suggests that (the exercise) might decrease the amount of rains that come to India during the monsoon season," which could impact crop productivity, he says.

"There's this kind of geopolitical question that would come up about control of that—who puts their finger on the thermostat, essentially," says Munoz, an assistant professor and expert in hydrology.

Plus, the cooling effect doesn't last long, he says. "The moment you stop emitting sulfur dioxide, the climate will very quickly warm."

Volcanoes do contribute some carbon dioxide into the atmosphere, but there would have to be a lot of tectonic activity to even come close to greenhouse gas levels emitted by human activity, Munoz says.

Think back to 70 million years ago, when dinosaurs roamed the Earth and "there was a lot of volcanism," he says.

But what about climate change's impact on volcanoes?

A research paper published in 2013 raised the issue of whether glacial melt was contributing to volcanic activity in Iceland.

"The thought process is that if you melt all the glaciers of Iceland, that would decrease pressure" on rocks being brought to the surface from deep inside the earth, Douglass says.

"As they get into shallower depths, the pressure on the material goes down and (that) allows the rocks to melt and turn into magma," he says.

"I don't think the glaciers are melting that fast," Douglass says. "It may cause a minor increase in volcanic eruptions, but I can't imagine that's going to be a big driver."

As far as Mauna Loa is concerned, it's not the type of volcano that causes massive, nuclear-like explosions with towering mushroom clouds that send materials into the stratosphere, potentially creating cooling, umbrella-like effects, Douglass and Munoz say.

The Hawaiian volcano's activity has affected climate change in one way, by disrupting key equipment used to measure carbon dioxide levels in the atmosphere, according to media sites such as CNN.

But its eruption for the first time in 38 years is in essence an Earth-building, not atmosphere-impacting, event, Munoz and Douglass say.

Mauna Loa is a lava-oozing shield volcano, Munoz says. "I tell students (shield volcanoes) don't go boom. They're pretty cool to watch, though.'

This article originally appeared on News@Northeastern.

(Cynthia McCormick Hibbert / N Northeastern University / College of Science, December 2, 2022, https://cos.northeastern.edu/news/are-volcanoes-impacted-by-climate-change-or-is-it-the-other-way-around)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΛΟΙΠΑ

Researchers determine the durability of Roman concrete

An international team of researchers believe they can explain why Roman concrete has remained intact for centuries.

Pantheon's dome - *AdobeStock/Tatyana Gladskih*

The Pantheon in Rome, with the world's largest unreinforced concrete dome, dates back to A.D. 128 and is still intact, and some ancient Roman aqueducts still deliver water to Rome.

Researchers have spent decades trying to understand the secret of this ultradurable construction material, particularly in structures that endured harsh conditions.

Now, a team of investigators from MIT, Harvard University, and laboratories in Italy and Switzerland, has discovered ancient concrete-manufacturing strategies that incorporated several key self-healing functionalities. The findings are published in *Science Advances*, in a paper by MIT professor of civil and environmental engineering Admir Masic, former doctoral student Linda Seymour, and four others.

Researchers have previously assumed that ancient concrete's durability was based on pozzolanic material such as volcanic ash. These ancient samples also contain millimetre-scale bright white mineral features, which are recognized as a ubiquitous component of Roman concretes. These white chunks - lime clasts - originate from lime, another component of Roman concrete mix.

"Ever since I first began working with ancient Roman concrete, I've always been fascinated by these features," Masic said in a statement. "These are not found in modern concrete formulations, so why are they present in these ancient materials?"

Previously disregarded as evidence of careless mixing practices, or poor-quality raw materials, the new study suggests that lime clasts gave the concrete a previously unrecognized self-healing capability. "The idea that the presence of these lime clasts was simply attributed to low quality control always bothered me," said Masic. "If the Romans put so much effort into making an outstanding construction material, following all of the detailed recipes that had been optimized over the course of many centuries, why would they put so little effort into ensuring the production of a well-mixed final product? There has to be more to this story."

Using high-resolution multiscale imaging and chemical mapping techniques pioneered in Masic's research lab, the researchers gained new insights into the potential functionality of these lime clasts.

According to MIT, it had been assumed that when lime was incorporated into Roman concrete, it was first combined with water to form a highly reactive paste-like material, a process called slaking. According to the team, this process alone could not account for the presence of the lime clasts.

"Was it possible that the Romans might have actually directly used lime in its more reactive form, known as quicklime?" said Masic.

Studying samples of ancient concrete, he and his team determined that the white inclusions were made from various forms of calcium formed at extreme temperatures, as would be expected from the exothermic reaction produced by using quicklime instead of, or in addition to, slaked lime. The team concluded that hot mixing is key to the durability of Roman concrete.

"The benefits of hot mixing are twofold," Masic said. "First, when the overall concrete is heated to high temperatures, it allows chemistries that are not possible if you only used slaked lime, producing high-temperature-associated compounds that would not otherwise form. Second, this increased temperature significantly reduces curing and setting times since all the reactions are accelerated, allowing for much faster construction."

MIT said that during the hot mixing process, the lime clasts develop a brittle nanoparticulate architecture, creating an easily fractured and reactive calcium source, which could provide self-healing functionality. As soon as cracks start to form within the concrete, they can preferentially travel through the high-surface-area lime clasts. This material can then react with water, creating a calcium-saturated solution, which can recrystallize as calcium carbonate to fill the crack, or react with pozzolanic materials to further strengthen the composite material. These reactions take place spontaneously and heal the cracks before they spread. Previous support for this hypothesis was found through the examination of other Roman concrete samples that exhibited calcite-filled cracks.

To prove that this was the mechanism responsible for the durability of the Roman concrete, the team produced samples of hot-mixed concrete that incorporated both ancient and modern formulations, deliberately cracked them, and then ran water through the cracks. Within two weeks the cracks had completely healed. An identical piece of concrete made without quicklime did not heal and the water continued to flow through the sample. The team is now working to commercialize this modified cement material.

(THE ENGINEER, 09 Jan 2023, https://www.theengineer.co.uk/content/news/researchers-determine-the-durability-of-roman-concrete)

Hot mixing: Mechanistic insights into the durability of ancient Roman concrete

Linda M. Seymour, Janille Maragh, Paolo Sabatini, Michel Di Tommaso, James C. Weaver, and Admir Masic

Abstract

Ancient Roman concretes have survived millennia, but mechanistic insights into their durability remain an enigma. Here, we use a multiscale correlative elemental and chemical map-

ping approach to investigating relict lime clasts, a ubiquitous and conspicuous mineral component associated with ancient Roman mortars. Together, these analyses provide new insights into mortar preparation methodologies and provide evidence that the Romans employed hot mixing, using quicklime in conjunction with, or instead of, slaked lime, to create an environment where high surface area aggregate-scale lime clasts are retained within the mortar matrix. Inspired by these findings, we propose that these macroscopic inclusions might serve as critical sources of reactive calcium for long-term pore and crack-filling or post-pozzolanic reactivity within the cementitious constructs. The subsequent development and testing of modern lime clast–containing cementitious mixtures demonstrate their self-healing potential, thus paving the way for the development of more durable, resilient, and sustainable concrete formulations.

Science Advances, 6 Jan 2023, Vol 9, Issue 1, DOI: 10.1126/sciadv.add1602

ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ

Geotechnical Baseline Reports: Suggested Guidelines

Task Committee on Geotechnical Baseline Reports edited by Randall J. Essex

Geotechnical Baseline Reports: Suggested Guidelines, MOP 154, explains the role of the geotechnical baseline report (GBR) in allocating and managing risks associated with subsurface construction. MOP 154 contains recommendations for what should and should not be included in the GBR, provides a chapter outline and a checklist of topics to consider, provides suggested page lengths, makes suggestions that will improve clarity and understanding, and presents examples of problematic and improved practices in creating baselines.

Expanding on earlier titles, MOP 154 provides new perspectives in the following areas:

- Improvement of GBRs through more concise organization and better presentation and wording of baselines;
- For Design-Build (DB) delivery, guidance on collaboration between the owner's team and the DB team during GBR development;
- Importance of having experienced professionals engaged in the GBR writing, review, and integration with other contract documents;
- Discussion of conditions and obstructions that have led to claims on past projects;
- Broadened discussion of applications of GBRs to geotechnical construction other than tunnels and shafts;
- Discussion of legal and contractual perspectives that address trends in contractor claims and lawsuits by owners or contractors;
- Practices and lessons learned based on experience over the last 15 years; and
- Case histories that illustrate how baselines were utilized to resolve disputes.

MOP 154 is intended to serve as a reference for preparers and users of GBRs, and to inform owners of the importance of using GBRs to allocate financial risk fairly between parties.

(American Society of Civil Engineers, 2022)

ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ

An official journal of the International Society for Soil Mechanics and Geotechnical Engineering
Volume 7, Issue #2
www.geocasehistoriesjournal.org/pub/issue/view/52

ISSMGE TC218 Special Issue on Reinforced Fill Structures Published

Issue 2 of Volume 7 is a Special Issue organized by the ISSMGE Technical Committee TC218 on "Reinforced Fill Structures" and presents six well-documented case studies combining different reinforced fill structures in terms of application (simple walls, slopes, railway and highway embankments, bridge abutments, back-to-back walls, and arch bridges), environment (including urban), backfill (including marginal soils), facing type (masonry blocks, wrapped, welded wire mesh, and precast concrete panels), and reinforcement material (geogrids, polymeric straps, steel ladders and meshes). Different design method approaches and a wide range of wall heights appear in the case studies presented. Thus, most reinforced fill structure types are well-represented in this Special Issue, covering many companies and systems, both well-established and newer, providing a good representation of the market.

The Guest Editors of the issue are Dr. Ivan P. Damians, Associate Research Professor at International Centre for Numerical Methods in Engineering (CIMNE) - Universitat Politècnica de Catalunya·BarcelonaTech (UPC) and Giulia Lugli, Chair of ISSMGE TC 218.

The contents of the Special Issue and direct access to the papers are provided below.

On behalf of the Case Histories Journal,

Dimitrios Zekkos, University of California at Berkeley, Editor-in-Chief
Jean-Louis Briaud, Texas A&M, Co-Editor-in Chief

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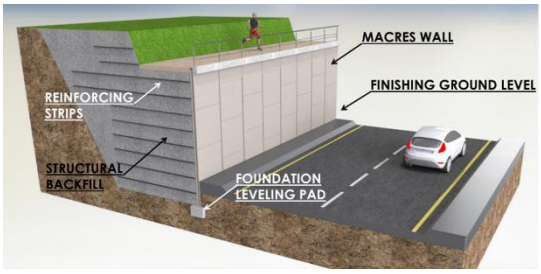
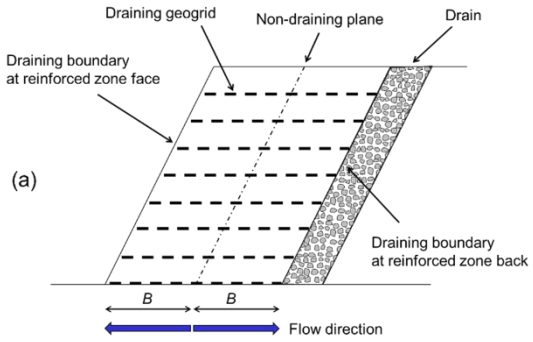
Editorial by Ivan P. Damians, Giulia Lugli

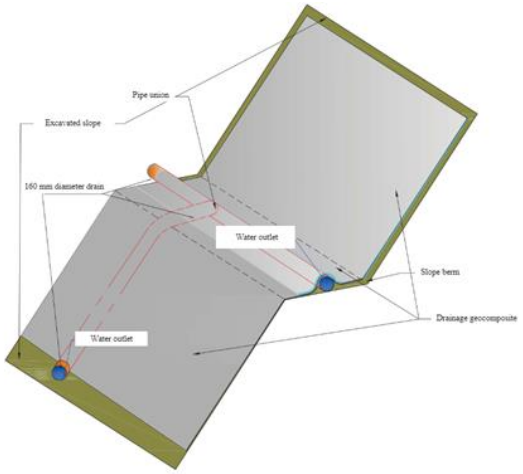


The Introduction of MSE Wall Elements into the BIM Technology: The S7 Skomielna Biala – Chabowka Project of an MSE Abutment in Poland by Fabrizia Trovato, Giulia Lugli, Giacinto Intrevado

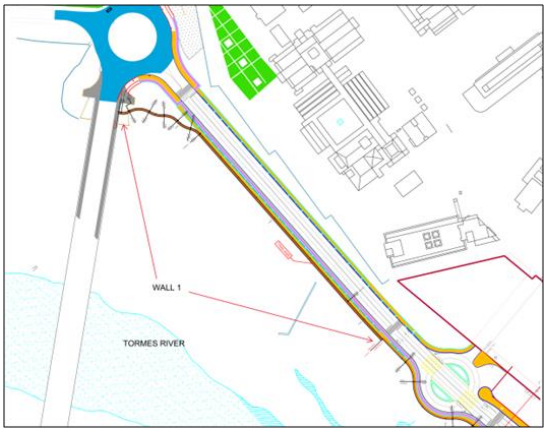
The D4R7 Reinforced Soil Retaining Walls in Bratislava, Slovakia by Elena Gil, Carlos Serrano, Carlos Pereira, Pedro Osso, Juan Lima, Ivan P. Damians



Drainage Reinforced Geocomposite for Marginal and Cohesive Slopes and Walls by Nicola Brusa, Patrick Naughton, Pietro Rimoldi



Vertical Expansion of Residential Land Using Reinforced Earth Walls – Case Study of Cerro Artola by Sergi Conesa, Félix Enrique González



Segmental Retaining Wall Reinforced with Geogrids, in New Hospital Works (Salamanca, Spain) by Marco Tomás Rodríguez Martínez, Patricia Amo Sanz

Masonry Arch Bridges with Reinforced Soil Spandrel Walls by Colin JFP Jones, Chiado Doulala-Rigby

Κυκλοφόρησε το τεύχος #77 - January 2023 των ITA News με τα ακόλουθα περιεχόμενα:

- Message from Arnold Dix, ITA President
- ITA Tunnellling Awards 2022 winners announced Read more
- ITACUS: New Year's wishes 2023 and recap of highlights 2022 Read more
- Muir Wood Lecture 2022 by Tom Melbye Read more
- Info from our Prime Sponsor: CRCHI Read more
- Latest ITA Working groups Publications Read more
- Info from our Prime Sponsor: Robbins Read more
- Info from our Prime Sponsor: Swiss Tunnelling Consultants Read more
- ITA new Slogan, Vision & Mission Read more
- WTC 2023 is fast approaching! Read more
- New publication of ITACUS with the UNEP Read more
- Cooperation between ITACUS and NIDM: "Underground urbanism in India" Report Read more
- ITACET Lunchtime Lecture Series #23 Read more
- Info from our Prime Sponsor: Bekaert Read more
- UYAK2023 (5th International Underground Excavations Symposium and Exhibition) Read more
- V International Tunneling Forum Read more

ITACET Foundation
Foundation for Education and Training on Tunnelling and Underground Space Use
Newsletter #36
January 2023

https://www.itacet.org/newsletter-36-january-2023

Κυκλοφόρησε το τεύχος 36 Ιανουαρίου 2023 του Newsletter του ITACET Foundation με τα ακόλουθα περιεχόμενα:

- Editorial
- The Lunchtime Lecture Series
- Training session reports

  LUNCHTIME LECTURE SERIES # 17, Date: 12/07/2022 Location: Build sustainable Precast Segment Lining with Fibre Reinforced Concrete. This instalment of the Lunchtime Lecture series focused on 'Build sustainable Precast Segment Lining with Fibre Reinforced Concrete'. Read more...

  SUSTAINABILITY IN UNDERGROUND DESIGN – PRACTICAL IMPLEMENTATIONS Date: 02/09/2022 to 03/09/2022 Location: Copenhagen, Denmark. The course was held over two days on 2nd-3rd September and focused on 'Sustainability in underground design and its practical implementations.'... Read more...

  LUNCHTIME LECTURE SERIES # 18 Date: 13/09/2022 Location: Tunnels and Earthquakes. This instalment of the Lunchtime Lecture series focused on 'Tunnels and Earthquakes' and was organised in collaboration with Mr Carlos A. Jaramillo and Dr. Youssef Hashash... Read more...

  CONVENTIONAL AND MECHANIZED TUNNELLING IN SOIL AND ROCK Date: 26/09/2022 to 30/09/2022 Location: Mexico, Online. On the 26th, 28th and 30th September, over half-days, a training session on 'Conventional and mechanized tunnelling in soil and rock' was co-organised with Mexican Association of tunnel and underground space engineers.... Read more...

  LUNCHTIME LECTURE SERIES # 19 Date: 11/10/2022 Location: Risks related to new energy carriers in tunnels. This instalment of the Lunchtime Lecture series focused on 'Risks related to new energy carriers in tunnels.' This episode featured three lectures: Read more...

DESIGN AND CONSTRUCTION OF ROAD TUNNELS Date: 18/10/2022 to 25/10/2022 Location: Dubai Online. This training session was held online and run over 4 half-day sessions. The objective of this course was to highlight fundamental & advanced aspects of the planning, design and construction of urban road tunnels Read more...

UNDERGROUND SPACES UNVEILED – PLANNING AND CREATING THE CITIES OF THE FUTURE Date: 27/10/2022 Location: Argentina, online training session. The ITACET Foundation and the Argentinian Association of Tunnels and Underground Space (AATES) organized the online training session during the annual "Tunnel and Underground Works Workshop"... Read more...

LUNCHTIME LECTURE SERIES #20 Date: 08/11/2022 Location: H&S during design. This instalment of the Lunchtime lecture series focused on ' H&S during design'. The episode featured one lecture: Read more...

LUNCHTIME LECTURE SERIES #21 Date: 13/12/2022 Location: Carbone neutral underground. This instalment of the Lunchtime Lecture series focused on 'Carbon-neutral underground'. The episode featured three lectures... Read more...

LUNCHTIME LECTURE SERIES #22 Date: 10/01/2023 Location: Sustainability issues - The future of under-ground. This instalment of the Lunchtime Lecture series focused on "Sustainability issues - The future of under-ground". The episode featured three lectures: Read more...

Thank you to all those lecturers who presented on behalf of ITACET

Online Lunchtime Lecture series - #17 - Build sustainable Precast Segment Lining with Fibre Reinforced Concrete: Veyra Nasri, J. Day, J. L. Bischoff

Training session – Sustainability-underground-design-practical-implementations: A. Thomas, T. Grondal, J. Haltbakk, S. Toller, H. Admiraal, A. Cornaro, P. Rajala, M. Zurita, L. Van der Tann, H. de Wit, P. van Westendorp, A. Shaw, B. Fulcher, T. Babendererde, K. Wachter, B. de Rivaz, J. Baber

Online Training session – Advances design and construction tunnels, Pune, India M. Deffayet, E. Chiriotti, P. Grasso, C. Paraskevopoulou, D. Jordan, K. Bappler, V E. Gall, E. Grov, N. Berthoz, M. Wongkaew, S. Eskesen, M. Macary, X. Monin, D. Lamont, K. Rabensteiner

Online Lunchtime Lecture series - #18 - Tunnels and Earthquakes Y. Hashash, C. A. Jaramillo

Online Training session – Conventional and mechanized tunnelling soil and rock: F. Amberg, N. Berthoz, E. Grov, G. Seingre, M. Schivre, R. Galler, M. Villeneuve, F. Renault de Vinci, D. Lamont

Online Lunchtime Lecture series - #19 - Risks related to new energy carriers in tunnels: A. Mos, J. Gehandler, P. Sturm

Online Training Session – Design and construction of road tunnels: P. Grasso, C. Larive, E. Chiriotti, D. Lamont, A. Dix

Online Training Session – Underground spaces unveiled – planning and creating the cities of the future: H. Admiraal, A. Cornaro

Online Lunchtime Lecture series - #20 - H&S during design: D. Lamont, W. Burger

Online Lunchtime Lecture series - #21 - Carbon-neutral underground: N. Bobylev, J. Kaneshiro, K. Westerlund

Online Lunchtime Lecture series - #22 - Sustainability issues - The future of underground: Arnold Dix, Tarcisio Celestino, Antonia Cornaro

- Forthcoming sessions

  LUNCHTIME LECTURE SERIES #23 Date: 14/02/2023 Location: From procurement to execution of a contract, 3 spotlights This instalment of the Lunchtime Lecture series will focus on "From procurement to execution of a contract, 3 spotlights". The episode will feature three lectures and finish with a Q&A session with all speakers: Procurement strategy: Quality and price based selection - Pravin Karki, Tender preparation: Lessons learnt and changes in the ITA Contractual Framework Checklist from 2011 to 2021 - Gonçalo Diniz Vieira, Execution of the contract: How to deal with unforeseeable physical conditions - Matthias Neuenschwander Read more...

- Other events in preparation

  The following training programmes are under preparation:

  Greece, WTC 2023 in Athens!

  This year's course will be held over two days on 12th and 13th May 2023 and will focus on 'Risk management and sus-tainable underground solutions'.

  Saudi Arabia

  The course will be held over three half-days in March 2023 and will focus on 'Planning, construction and operation of common Utility corridors'.

- Scholarschips

  ITACET Foundation gave last year the sponsorship to one student accepted into ITA-endorsed Postgraduate Master Course AETOS in Spain.

  We wish you a lot of success Camilo Jose Sanchez Avellaneda!

  "Being a scholarship recipient has been an outstanding experience because it allowed me to learn from tunnel experts. The master's program I joined has a unique curriculum. I firmly believe that the ITACET approved postgraduate master's courses are excellent for academic training, and I can see that the educational and training centers interests are always looking for better and safer practices in underground infrastructure."

  Camilo Jose Sanchez Avellaneda

Κυκλοφόρησε το IGS Newsletter της International Geosynthetics Society με τα ακόλουθα περιεχόμενα:

IGS NEWSLETTER – January 2023

Helping the world understand the appropriate value and use of geosynthetics

www.geosyntheticssociety.org/newsletters

- GeoAmericas 2024 Seeks Session, Short Course, and Training Lecture Proposals READ MORE
- IGS Netherlands Magazine Published In English READ MORE
- Lille To Host EuroGeo8 READ MORE
- IGS Sustainability Committee – Championing Geosynthetics For A Better World READ MORE
- IGS Awards: Call for Nominations 2018 – 2021 READ MORE
- Did You Know… Geosynthetics Enhance The Quality Of Soil For Construction? READ MORE
- IGS Young Member Photo Contest Winners Revealed! READ MORE
- Holiday Message From The IGS President READ MORE
- Circular Economy Explored At Italy Conference READ MORE
- IGSF Sponsors Students At Young Engineers Conference READ MORE
- Calendar of Events

ΕΚΤΕΛΕΣΤΙΚΗ ΕΠΙΤΡΟΠΗ ΕΕΕΕΓΜ (2019 – 2023)

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ΕΕΕΕΓΜ

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