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ΕΛΛΗΝΙΚΗ ΕΠΙΣΤΗΜΟΝΙΚΗ ΕΤΑΙΡΕΙΑ ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ & ΓΕΩΤΕΧΝΙΚΗΣ ΜΗΧΑΝΙΚΗΣ

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Αρ. 203 – ΣΕΠΤΕΜΒΡΙΟΣ 2025

Keynote Lecturers

Guido Gottardi

Alexander M. Puzrin

Gorun Arun

Christos Zerefos

Ikuo Towhata

Nicos Makris

Alberto Ledesma Villalba

Koenraad Van Balen

Manolis Korres

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ΑΡΘΡΑ

Assessing Landslide Hazards From Space

Micky Maganini, Bhuwan Awasthi, and Arif Albayrak

On May 28, 2025, the peaceful town of Blatten, Switzerland, was even more quiet than usual. Almost all of the 300 residents had been evacuated due to local geologists and glaciologists fearing the worst. That afternoon, those fears were realized, as 9 million tons of rock came crashing down on the town from the mountain above. For 800 years the village had existed, only to be buried in an instant by a landslide. Seeing this event in the news reminded me of how I and other scientists study landslides using satellite Earth observations and field methods. It reminded me of the importance of the chain of disaster risk information, from scientists recognizing and communicating a hazardous situation to those in danger taking action to mitigate their risk.

Landslides are diverse natural phenomena. They can exceed 50 mph or move less than a meter a year. Landslides have many causes, with heavy precipitation being the most common trigger for fast-moving landslides. While there are many ways that landslides can be studied on the ground, Earth-observing satellites are increasingly being used to study them globally.

While Blatten serves as an extreme example, smaller landslides are also dangerously common. According to the World Health Organization, landslides caused more than 18,000 deaths globally between 1998 and 2017. In that same period, they affected an estimated 4.8 million people, blocking roadways and isolating rural communities, or causing flooding by obstructing rivers. Earth scientists can combine ground observations and satellite data to better understand where landslides are likely to occur. This information, when carefully communicated to those in danger, can help save lives.

Field Trip

In November of 2024, we visited the sites of various landslides in the Bagmati Province in northern Nepal—a region that is especially susceptible to landslides—to better understand how satellite data can help predict landslides and keep communities safe.

Visiting landscapes like this can show us why even small landslides can cause big problems. As we left Kathmandu and headed into the Himalayas, we encountered a landslide near the village of Manakamana that had occurred right next to a fast-moving river. During the monsoon season from June to September, heavy rains frequently trigger landslides that block rivers, quickly turning a minor landslide into a major flood. Disaster scientists call these "cascading hazards," when one hazard triggers or amplifies another. Looking at satellite imagery, we see the potential cascading hazards that a landslide here could trigger. Several farms are located just downhill from the landslide. A larger landslide could have dammed the river, flooding the crops and houses.

Left: A large boulder moved by the Manakamana landslide; Top right: A panoramic view of the same landslide, which can be seen on the left side of the picture; Bottom right: A top-down view of the landslide as seen from high-resolution satellite imagery (Image © 2025 CNES/Airbus).

Even relatively small landslides can change the landscape enough to have serious downstream effects on the datasets scientists rely on. When landslides shift terrain or block river channels, the maps we use to study and predict hazards suddenly become outdated. If these maps and datasets aren't updated quickly, forecasters and emergency managers may miss key information like a shifted flood zone or a blocked evacuation route.

Left: A landslide near the village of Sano Haku, Nepal, indicated by the red arrow; Right: A top-down view of the landslide as seen from space (Imagery © 2025 Planet Labs).

Left: A kilometer-long landslide visible from across a valley, indicated by the orange arrow; Right: A top-down view of the same landslide (Image © 2025 CNES/Airbus).

Our tour also demonstrated how landslides can have cascading effects on infrastructure. At this point in our journey, we learned that a landslide had blocked the highway ahead, forcing us to take a bumpy and treacherous side road. When

landslides like this occur, they endanger motorists, cut off trade routes, and disrupt the livelihoods of local communities. If someone needs food, water, or medicine, a landslide could mean a life-threatening delay, even if it happens dozens of miles away.

Another challenge faced by communities in this region is a lack of land use planning. Houses occur on slopes that can be subject to large landslides like the one pictured above.

Monitoring this region from space can reveal whether the slope may be prone to future landslides and if the community is at risk.

How We Study Landslides

While natural-color satellite images are great for seeing where landslides have already occurred, they are not very useful for *predicting* them. However, satellite data are useful for things like estimating precipitation, soil moisture, and slope. Putting this information together can help predict where catastrophic, fast-moving landslides are likely to occur. This is precisely what is done by the Landslide Hazard Assessment for Situational Awareness Model, or LHASA, which monitors landslide hazards in near-real time. Developed by scientists at NASA's Goddard Space Flight Center, LHASA combines satellite-derived precipitation and soil moisture with information on slope, geology, and earthquake risk to map high-risk areas so communities can take precautions.

Early action systems like LHASA predict where *fast-moving* landslides occur, but their slow-moving counterparts can be equally problematic. Not only do slow-moving landslides cause damage to infrastructure like houses and bridges over time, but they can be triggered into catastrophic, fast-moving landslides after heavy precipitation or earthquakes. These slow-moving landslides creep too slowly for humans to notice, but their movement can be detected by radar satellites. The incorporation of slow-moving landslides into early warning systems like LHASA paints a more complete picture of landslide risk.

Developing a scientifically sound early warning system is just half the battle—trust must also be built with the communities using the system. Users of an early warning system may inherently distrust a system for many reasons. For example, those most affected by landslides are often not included in the design of these systems, so they may feel like their perspectives are not considered. Furthermore, scientists must limit false positives—when an early warning is issued, but no disaster occurs—as people will lose trust in a system that constantly gives false alarms.

To mitigate distrust in these early warning systems, organizations like People in Need and the Community Rural Development Society of Nepal work directly with community leaders to integrate their knowledge into their early action systems. By asking people to recount personal experiences of natural disasters or stories they have heard from their ancestors, the early warning system considers the understanding of landslides from both scientists and the user community. This process of co-development builds trust with communities.

Looking Forward

Earth-observing satellites still have limitations for studying landslides. Even the best publicly available optical imagery from U.S. satellites has a resolution down to around 15 meters, and small landslides can destroy homes and lives on a scale of 10 meters or less. What's more, dense vegetation can limit the application of radar to study landslides. Fortunately, new satellites like the NASA-ISRO Synthetic Aperture Radar, or NISAR, which launched in July of this year, are equipped to combat both of these challenges.

NASA launches Earth-observing satellites like NISAR to help protect lives and livelihoods in the United States, too. The U.S. Geological Survey estimates that landslides result in more than $1 billion in annual economic losses in the U.S. from the destruction or disruption of highway routes, contamination of water, and direct property losses. Studying landslides in places as remote and geologically unique as Nepal allows scientists to better hone these technologies for use in the U.S. As we continue to improve our understanding of landslides from space, we will build better predictive systems to protect lives and livelihoods.

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(NASA / earth observatory, September 3rd, 2025, https://earthobservatory.nasa.gov/blogs/fromthefield/2025/09/03/assessing-landslide-hazards-from-space)

Gain an appreciation for the finer things in life – soil particles, that is

Understanding soil characteristics can help determine how the ground will respond under certain loads. The finer fraction – the smaller, finer particles (e.g., fine sand, silt, and clay) – plays a large role in how soil will behave. When erosion occurs, it is usually those finer particles that are affected, and so there is no visible change; however, the shear strength of the soil has been compromised. Some examples of consequent failure include dam collapse, ground subsidence, and sinkholes. So how can engineers prevent this problem? What is the right mix of soils?

There is widespread understanding that stability is closely aligned with soil particle size distribution, but there have been different interpretations of the constriction size distribution. Researchers Kuang Cheng, Mengsi Duan, Buddhima Indraratna, and Thanh T. Nguyen explored soil internal instability for both prediction accuracy and robustness using particle-size and constriction-size based criteria. In their study, "Critical Examination of Internal Stability Criteria for Granular Soils and Development of a Coupled PSD-CSD Approach," the authors developed a database of 232 different soils and then evaluated different metrics, including the mass of eroded finer particles and the change in the hydraulic conductivity of soil, to identify the internal stability of soils. Learn more about this study and how it can predict internal stability with greater reliability in the *Journal of Geotechnical and Geoenvironmental Engineering* at https://ascelibrary.org/doi/10.1061/JGGEFK.GTENG-13479. The abstract is below.

Abstract

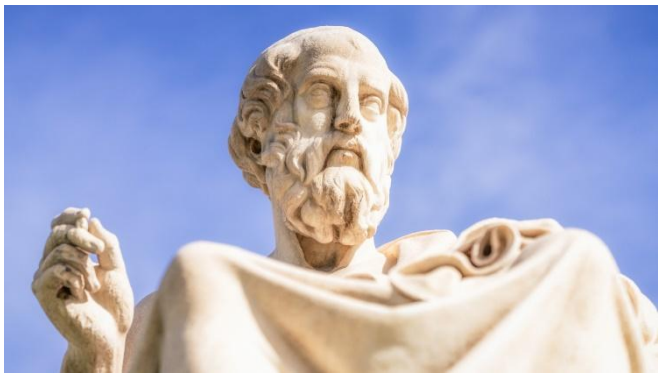
The internal instability of soils involving the loss of soil mass and consequent failures under seepage has received immense attention in the past decades, resulting in various assessment methods. Empirical criteria based on the particle size distribution (PSD) and the constriction size distribution (CSD) are some of the most preferable approaches; however, their past investigations often focus on only the prediction accuracy, while underestimating the importance of prediction reliability (robustness). The current study aims to address this issue by carrying out an extensive and novel assessment of the prediction performance of the five most typical internal stability criteria, including four PSD-based criteria and one CSD-based criterion, using a large data set of 232 continuously and gap-graded soils through various experiments during 1985–2023. A novel assessment approach based on two newly proposed parameters, i.e., the percentage of deviation and the robustness index is developed and applied consistently to the selected criteria and soils. The results show that the CSD- and the Kenney and Lau PSD-based methods by incorporating the width of the gradation gap exhibit the most accurate prediction with an accuracy that can exceed 94% for gap-graded soils. However, their accuracy can drop significantly to less than 70% in continuously graded soils when closer to the borderlines (i.e., the percentage of deviation <20%). A coupled PSD-CSD guideline that can effectively employ key advantages of both PSD- and CSD-based criteria is thus proposed. The novel guideline can significantly enhance the prediction accuracy and robustness while minimizing the excessive computational cost often required in the conventional CSD-based method.

Kuang Cheng, Mengsi Duan, Buddhima Indraratna, and Thanh T. Nguyen «Critical Examination of Internal Stability Criteria for Granular Soils and Development of a Coupled PSD-CSD Approach», Journal of Geotechnical and Geoenvironmental Engineering, Volume 151, Issue 9, https://doi.org/10.1061/JGGEFK.GTENG-13479

(Jul 14, 2025, https://www.asce.org/publications-and-news/civil-engineering-source/article/2025/09/03/gain-an-appreciation-for-the-finer-things-in-life-soil-particles-that-is)

Scientists asked ChatGPT to solve a math problem from more than 2,000 years ago — how it answered it surprised them

We've wondered for centuries whether knowledge is latent and innate or learned and grasped through experience, and a new research project is asking the same question about AI.



(Image credit: georgeclerk/Getty Images)

The Greek philosopher Plato wrote about Socrates challenging a student with the "doubling the square" problem in about 385 B.C.E. When asked to double the area of a square, the student doubled the length of each side, unaware that each side of the new square should be the length of the original's diagonal.

Scientists at Cambridge University and Jerusalem's Hebrew University selected the problem to pose to ChatGPT because of its non-obvious solution. Since Plato's writing 2,400 years ago, scholars have used the doubling the square problem to argue whether the mathematical knowledge needed to solve it is already within us, released through reason, or only accessible through experience.

Because ChatGPT, like other large language models (LLMs), is trained mostly on text rather than images, they reasoned there was a low chance that the answer to the doubling the square problem would exist in training data. This means that if it arrived at the correct solution unaided, one could argue that mathematical ability is learned and not innate.

The answer came when the team went further. As described in a study published Sept. 17 in the journal International Journal of Mathematical Education in Science and Technology, they asked the chatbot to double the area of a rectangle using similar reasoning. It responded that because the diagonal of a rectangle can't be used to double its size, there was no solution in geometry.

However, visiting University of Cambridge scholar Nadav Marco from the Hebrew University of Jerusalem, and professor of mathematics education Andreas Stylianides, knew that a geometric solution existed.

Marco said the chances of the false claim existing in ChatGPT's training data was "vanishingly small," which means it was improvising responses based on previous discussion about the doubling the square problem — a clear indication of generated rather than innate learning.

"When we face a new problem, our instinct is often to try things out based on our past experience," Marco said Sept. 18 in a statement. "In our experiment, ChatGPT seemed to do something similar. Like a learner or scholar, it appeared to come up with its own hypotheses and solutions."

Machines that think?

The study shines new light on questions about the artificial intelligence (AI) version of "reasoning" and "thinking," the scientists said.

Because it seemed to improvise responses and even make mistakes like Socrates' student, Marco and Stylianides suggested ChatGPT might be using a concept we already know from education called a zone of proximal development (ZPD), which describes the gap between what we know and what we might eventually know with the right educational guidance.

ChatGPT, they said, might be using a similar framework spontaneously, solving novel problems that aren't represented in training data simply thanks to the right prompts.

It's a stark example of the longstanding black box issue in AI, where the programming or "reasoning" a system goes through to reach a conclusion is invisible and untraceable, but the researchers said that their work ultimately highlights the opportunity to make AI work better for us.

"Unlike proofs found in reputable textbooks, students cannot assume that ChatGPT's proofs are valid," Stylianides said in the statement. "Understanding and evaluating AI-generated proofs are emerging as key skills that need to be embedded in the mathematics curriculum."

It's a core skill they want students to master in educational contexts, something they said calls for better prompt engineering – for example, telling AI "I want us to explore this problem together" rather than '"tell me the answer."

The team are cautious about the results, warning us not to over-interpret them and conclude that LLMs "work things out" like we do. But, Marco did label ChatGPT's behavior as "learner-like."

The researchers see scope for future research in several areas. Newer models can be tested on a wider set of mathematical problems, and there's also potential to combine ChatGPT with dynamic geometry systems or theorem provers, creating richer digital environments that support intuitive exploration, for instance, in the way teachers and students use AI to work together in classrooms.

(Drew Turney / LIVESCIENCE, September 27, 2025, https://www.livescience.com/technology/artificial-intelligence/scientists-ask-chatgpt-to-solve-a-math-problem-from-more-than-2-000-years-ago-how-it-answered-it-surprised-them)

An exploration into the nature of ChatGPT's mathematical knowledge

Nadav Marco & Andreas J. Stylianides

Abstract

In this article, we investigate, from the perspective of a user's digital experiences, the nature of mathematical knowledge of a Large Language Model (LLM), ChatGPT-4. As a context for our investigation, we use Plato's slave-boy experiment in 'Meno,' where Socrates demonstrated his thesis that knowledge is innate, which sparked a philosophical debate about the nature of knowledge as a recollection from memory versus knowledge as ongoingly generated from experiences. Focusing on the Doubling the Square geometry problem from the 'Meno' and conducting a 'conversation' with the Chat according to specific underpinning guidelines, we show that the Chat's responses reflected both types of knowledge. Also, our underpinning guidelines enabled us to allocate what we call the 'Chat's ZPD,' that is, problems that the Chat cannot solve by itself but can solve with some prompting from a suitably knowledgeable user. We suggest implications of our findings

for users' digital interactions with LLMs and for future research.

1. Introduction

What is the origin of human knowledge? Do we really learn new things? Or, instead, are we born with some innate and latent knowledge that our experiences in the world and our interactions with others help us recollect? These epistemological questions are addressed in Plato's famous dialogue 'Meno.' In the dialogue, Socrates argues that all our knowledge is innate and, therefore, learning should be seen as a process of recollection (this theory is also known as 'anamnesis'). Socrates demonstrates his claim with perhaps the earliest documented experiment in mathematics education – the slave-boy experiment. Socrates gives an uneducated boy the Doubling the Square geometry problem to solve (see Figure 1). Initially, the boy erroneously believes that doubling the sides of the square would suffice (Figure 1, left). However, Socrates demonstrates that this approach quadruples the area instead. The boy then erroneously proposes increasing each side by half their original length, which Socrates shows does not yield the desired area. Frustrated, the boy admits his confusion. Socrates leads him through a series of questions, ultimately helping him discover that using the diagonal of the original square as the side length of a new square pro-vides the correct solution (Figure 1, right). For Socrates, this demonstrates that the boy does not learn new facts but instead has an innate capacity to judge the truth values of mathematical claims and thus reach the final correct solution.

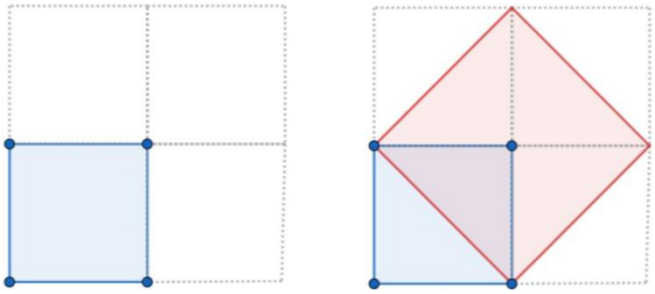


Figure 1. Doubling the Square problem: Given a square, find another square twice the area.

In this paper, we point to a timely domain in which the epistemological questions with which we started are relevant. Recent advances in machine learning and artificial intelligence (AI) have led to the introduction of generative Large Language Models (LLMs), which are now increasingly penetrating various aspects of our daily lives, including mathematics classrooms (Stokel-Walker & Van Noorden, Citation2023). LLMs, such as GPT (Generative Pre-trained Transformer), are advanced AI systems designed to generate coherent and contextually relevant text by predicting the next word or token based on previous textual input (Radford et al., Citation2019). In this study, we used ChatGPT-4, a model pre-trained on extensive textual data from diverse sources, including internet webpages, digitised books, and other publicly available documents. Through this pre-training process, the model develops probabilistic associations between textual inputs and their probable continuations, enabling contextually appropriate text generation based on learned linguistic patterns (Achiam et al., Citation2023).

Whereas some express concerns about overreliance on LLMs potentially leading to the propagation of false, biased, or misleading information (Van Dis et al., Citation2023) or students misusing LLMs (Cassinadri, Citation2024; Johnson, Citation2023), others anticipate LLM technology to profoundly influence and shape the production, life, and communication modes of the entire society (Yu, Citation2023). At the same time, some researchers have pointed to similarities between how AI and humans acquire knowledge (An et al., Citation2024). Attributing mathematical 'knowledge' to LLMs such as ChatGPT, however, invites a reconsideration of fundamental epistemological distinctions. Human knowledge typically involves phenomenal experience (Chalmers, Citation2022), whereas the knowledge attributed to AI systems is algorithmically justified and contextually mediated, emerging from interactional contexts rather than experiential awareness. Moreover, generative AI does not distinguish between meaning and knowledge in the same way that humans do; instead, it generates responses based on statistical associations without regard for their truth or epistemic validity (Watson, Citation2025). Still, Cangelosi (Citation2024) argues that LLMs can be said to 'know' if we adopt the traditional criterion of possessing true, justified beliefs, though the nature of their justification differs significantly from human cognition.

These issues echo earlier epistemological discussions about technology in mathematics education. For instance, Laborde et al. (Citation2006) highlighted the epistemological tension in geometry between visual-spatial intuition and formal logical reasoning. In digital environments such as Dynamic Geometry Software (DGS), this duality becomes more pronounced as visual manipulation and symbolic reasoning co-occur. These technologies not only support both modes of reasoning but also reshape what counts as mathematical knowledge, influencing how it is constructed through dynamic interactions between human and non-human agents (Laborde et al., Citation2006).

More recently, Villa-Ochoa and Suárez-Téllez (Citation2022) observed that while earlier research trends had explicitly examined the nature of knowledge mediated by digital tools, such as DGS and Computer Algebra Systems (CAS), this line of inquiry has seen limited continuation over the past two decades. Their review notes a lack of clarity in how recent studies address the relationship between the empirical knowledge embedded in digital environments and the theoretical mathematical knowledge they come to represent. This ambiguity, they argue, limits our understanding of how digital environments contribute to mathematical thinking and learning. They call for renewed attention to the epistemological implications of technology-mediated mathematical activity. In this article, we respond to that call.

Exploratory research in mathematics education investigating the use of LLMs such as ChatGPT, for educational mathematical purposes, is only just emerging (Taani & Alabidi, Citation2024; Wang et al., Citation2021; Wardat et al., Citation2023). Here, we reflect upon our digital experiences interacting with ChatGPT-4 while exploring the Doubling the Square geometry problem (Figure 1), a classical problem historically significant for sparking Western philosophical debates around innate ideas. Through this exploration, we aim to illuminate epistemological characteristics of ChatGPT's mathematical 'knowledge' and suggest productive approaches for conducting mathematical conversations with LLMs.

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Marco, N., & Stylianides, A. J. (2025). An exploration into the nature of ChatGPT's mathematical knowledge. *International Journal of Mathematical Education in Science and Technology*, 1–19. https://doi.org/10.1080/0020739X.2025.2543817

(https://www.tandfonline.com/doi/full/10.1080/0020739X.2025.2543817#d1e133)

Why data must drive the future of infrastructure

Alan Browne

Data-driven infrastructure is key to tackling climate risks, urban growth and system failures before they happen, says Alan Browne, co-founder of Soarvo.

Infrastructure everywhere faces mounting pressure, driven by new realities such as extreme weather, groundwater depletion, rising sea levels, rapid urbanisation, and aging systems - *AdobeStock*

Britain's infrastructure is under growing pressure from climate change and aging systems, yet too often our responses remain fragmented and reactive.

Network Rail's new partnership with engineering consultancy WSP, signals a long-overdue move towards a national, data-driven approach to risk management. One that can finally replace patchy, regional fixes with a system built for the future.

The collaboration will create a national framework to improve the UK's resilience to floods and coastal erosion. Until now, responses have varied widely by region. Train operators often follow different rules when it comes to flood responses, meaning some areas suffer unnecessarily. By harnessing aggregated data, the new system will anticipate risks across the entire network and provide a clearer, more connected view.

This is timely. Infrastructure everywhere faces mounting pressure, driven by new realities such as extreme weather, groundwater depletion, rising sea levels, rapid urbanisation, and aging systems. These threats extend beyond railways to almost every aspect of modern infrastructure, worldwide.

Globally, the risks are stark. Cities around the globe, including Jakarta, Bangkok, Ho Chi Minh City, and Shanghai are sinking, with nearly 76 million people living in subsiding areas that have subsided. The impact is impossible to imagine, but roads, buildings, and utilities in these regions face catastrophic failure unless solutions are found.

Closer to home, the UK has just experienced its hottest summer on record, marked by four consecutive heatwaves. Sections of train lines built on Victorian-era clay embankments are beginning to crumble while millions of litres of oil are leaking into the ground from ageing electricity cables designed for a century-old system. These outdated wires are designed for the energy system of the last century and can no longer keep pace with today's demands. Extreme heat has exposed, without question, that relying on outdated infrastructure is no longer sustainable.

The challenge for infrastructure managers and policymakers now goes beyond repairing wires or shoring up embankments. The priority must be prevention. We must reduce the risk of future failures that are both costly and environmentally damaging. This necessitates faster reporting and earlier detection with a fundamental shift from reactive to proactive strategies. Leading this shift is data. Only through the systematic collection, aggregation and analysis can we ensure there are no blind spots in resilience planning.

The coming decade will be defined not only by new materials, but by how we use data. LiDAR, drone, and satellite data into AI-driven 3D models–commonly known as digital twins–allow authorities to spot defects early and extend key infrastructure asset lifespans. The real value lies in aggregating this independently gathered data and making it work together.

Add real-time monitoring to the mix and infrastructure management is transformed. Continuous tracking of assets and instant access to live information provide insights unimaginable just a few years ago. Emerging tools such as cloud computing, drones, and mobile now deliver real-time visibility across vast, dispersed projects. This means that, regardless of where or when work is being carried out, there is a comprehensive, up-to-date overview of current activity and past progress. As a result, necessary tasks are completed more efficiently, and resources are directed where they are truly needed.

Network Rail partnership with the WSP highlights the importance of harnessing all available data and breaking down regional silos. Shared information and system-wide visibility mean smarter, evidence-based decisions rooted in real risk rather than assumption.

The stakes are rising fast. If we are serious about building infrastructure that can withstand the shocks of climate change and urban growth, the solution is clear: data must become the backbone of risk management.

Alan Browne, co-founder of Soarvo

(THE ENGINEER, 29 Sep 2025, https://www.theengineer.co.uk/content/opinion/why-data-must-drive-the-future-of-infrastructure)

Solving Geotechnical Data's 3 Billion Dollar Georeferencing Crisis: How DIGGS and Historic Data Conversions Are Transforming Our Industry

Ross Cutts, P.E., M.ASCE

Every day, geotechnical engineers and state transportation departments generate invaluable subsurface data through boring logs, SPT tests, and soil investigations. This data represents millions of taxpayer dollars and decades of engineering expertise. Yet across the United States, we're systematically discarding nearly half of this critical information due to a single, solvable problem: **inadequate georeferencing of borehole and site locations**.

After processing datasets from more than half of state DOTs and analyzing over 500,000 boring logs in the Geosetta database, we've uncovered a sobering reality about the state of geotechnical data management. The recent integration of Alabama DOT's 24-year project history provides a stark example of this crisis:

The Hidden Crisis: Quantifying Our Data Loss

The numbers from Alabama DOT's recent data integration tell a story that repeats across every state we've processed:

- **970** ALDOT GPJ files processed
- **69,478** total boring log records
- **35,156** successfully georeferenced locations
- **50.7%** coordinate extraction success rate

The Implications

What this means in practical terms is devastating: **34,322 boring logs from Alabama DOT alone—representing approximately $102.9 million in taxpayer-funded geotechnical investigations—lack reliable geographic coordinates**. Extrapolating this pattern across all 50 states and federal agencies, we estimate that **over $3 billion in publicly-funded geotechnical investigations** remain effectively unusable due to georeferencing failures nationwide.

Across all state DOTs in our database, we estimate that **half or more of their historic geotechnical investigation data** remains effectively unusable for regional analysis, machine learning applications, and cross-jurisdictional projects due to georeferencing failures.

This isn't just about lost money—it's about lost opportunities for:

- Regional subsurface modeling and prediction
- Multi-state transportation corridor analysis
- Climate resilience planning using historical data
- Machine learning model training for soil behavior prediction
- Emergency response planning with reliable subsurface intelligence

The Root Cause: Undocumented or Inconsistent Coordinate Reference Systems

Our analysis reveals that the georeferencing crisis stems from four primary issues:

1. **Project-Specific Stationing Systems**: The most common issue involves boring logs referenced only by project stationing (e.g., "STA 125+50, 85' LT") where the stationing baseline is specific to the particular project and the survey control data needed for conversion is not stored with the boring log data.
2. **Missing Coordinate Reference System (CRS) Codes**: Legacy boring logs contain coordinates without specifying their coordinate reference system. A coordinate pair like "567,890.5, 123,456.7" could represent State Plane, UTM, or any number of local coordinate systems.
3. **Inconsistent CRS Usage**: Within a single project, different consultants may use different coordinate systems without proper documentation.
4. **Format Variations**: Coordinates appear in decimal degrees, degrees-minutes-seconds, feet, meters, and various state plane zones without consistent identification.

Consider this real example from our Alabama DOT dataset processing:

<!-- Legacy DIGGS boring log with station/offset reference --> <samplingFeature> <Borehole gml:id="Borehole_IM_I065_390_BH1"> <gml:description>IM-I 065 (390) SOIL SURVEY, STA. 55+00, 85' LT OF SURVEY C/L</gml:description> <gml:name>BH-1</gml:name> <projectRef xlink:href="#p1"> <referencePoint> <PointLocation gml:id="Point_Location_STA_55_00"> <gml:pos>55.0 -85.0 0.0 </gml:pos> </PointLocation> </referencePoint> ... </Borehole> </samplingFeature>

This DIIGS XML snippet from a real ALDOT boring log shows the exact problem: coordinates for the borehole reference point are obtained from the the borehole description which are station/offset values (55.0, -85.0) relative to an undefined survey centerline. Without a coordinate reference system reference and the corresponding survey control, a geographic position cannot be determined and thus this boring log cannot be reliably positioned on any map or integrated with other datasets. This represents one of the 34,322 ALDOT boring logs that couldn't be georeferenced—$102.9 million in lost taxpayer-funded investigations.

Since its inception, DIGGS, which is based on Geography Markup Language (GML), has had the capability of storing necessary CRS information in a GML-defined srsName attribute. However, GML's implementation of srsName is quite general, which can complicate or hinder interoperability. Specifically:

- srsName is optional, so a DIGGS instance can pass schema validation without a CRS reference, as is the case in the above example.
- the value of srsName can be any string that conforms to the anyURI datatype. Without a standardized syntax for the srsName value, it may be impossible to determine what CRS is being referenced
- srsName can be specified at the geometry object level (eg. PointLocation above) or at the position level (gml:pos) which complicates extraction of the appropriate srsName

The above issues have prompted the DIGGS team to implement new guidance for the use of srsName along with a semantic validation tool to enforce the new rules. These new guidelines and tools will be implemented as part of the soon to be released version 3.0 update of DIGGS.

What's Changing in DIGGS 3.0?

The new guidelines include:

1. The srsName attribute **MUST** be used wherever coordinates are reported in a DIGGS instance and located at the geometry object level, or at the topmost geometry object

level (for complex geometries)

2. The value of srsName MUST directly reference the GML definition of a coordinate reference system. This should be a georeferenced CRS (eg. a geographic, projected, or compound CRS that includes both horizontal and vertical CRS's), **OR** an Engineering CRS (as might be used for station/offset) whose definition contains sufficient information to transform the local coordinates to a georeferenced CRS.

3. Implementation of a new semantic validation tool that includes modules to test and flag non-compliant DIGGS instances if the above conditions are not met.

Specific guidance and examples of srsName usage will be covered in a future blog post, but for cases where georeferenced CRS's are defined in IOGP's EPSG Geodetic Parameter Dataset (https://epsg.org), or by the Open Geospatial Consortium (OGC), we can take advantage of existing CRS resolver web services to return the appropriate GML definition as shown here:

<!-- DIGGS 3.0 with compliant CRS reference --> <samplingFeature> <Borehole gml:id="Borehole_IM_I065_390_BH1"> <gml:description>IM-I 065 (390) SOIL SURVEY, STA. 55+00, 85' LT OF SURVEY C/L</gml:description> <gml:name>BH-1</gml:name> <investigationTarget> Natural Ground</investigationTarget> <projectRef xlink:href="#p1"/> <locality> <Locality gml:id="Locality_ydg_wh3_rgc"> <station uom="ft">55</station> <offset uom="ft">-85</offset> <offsetDirection>left</offsetDirection> </Locality> </locality> <referencePoint> <PointLocation gml:id="Point_Location_STA_55_00" srsDimension="3" srsName="http://www.opengis.net/def/crs-compound?1=http://www.opengis.net/def/crs/EPSG/0/26929%262=http://www.opengis.net/def/crs/EPSG/0/6360"> <gml:pos>654321.45 1234567.89 287.5</gml:pos> </PointLocation> </referencePoint> <centerLine> <LinearExtent gml:id="Linear_Extent_0" srsDimension="3" srsName="http://www.opengis.net/def/crs-compound?1=http://www.opengis.net/def/crs/EPSG/0/26929%262=http://www.opengis.net/def/crs/EPSG/0/6360"> <gml:posList>654321.45 1234567.89 287.5 654321.45 1234567.89 265.0</gml:posList> </LinearExtent> </centerLine> ... </Borehole> </samplingFeature>

The srsName attribute identifies the CRS for the coordinates of the borehole's referencePoint and centerLine properties. The URL specified uses the OGC CRS Definition Resolver to return a GML definition for a 3D compound CRS that includes the horizontal CRS NAD83 / Alabama East (EPSG Code 26929) and the vertical CRS NAVD88 height in ftUS (EPSG Code 6360). The original station/offset information can still be included in the gml:description property and/or the locality property. With this information, processing systems can reliably interpret and convert these coordinates to any other coordinate system, integrate them with regional datasets, and display them on web maps.

Success

This new guidance will revolutionize geotechnical data interoperability. Going forward, our profession can unambiguously georeference any DIGGS file in any coordinate system, enabling:

- Seamless data sharing between jurisdictions using differnt coordinate systems
- Automatic coordinate conversion for web mapping and GIS applications
- Reliable integration of multi-state project datasets
- Machine learning training on properly georeferenced datasets

Free Coordinate Conversion API: Enabling Interoperability

To support DIGGS 3.0 compliance and enable seamless coordinate system interoperability, we've also developed a comprehensive coordinate conversion API that's freely available through the Geosetta DIGGS Tools platform.

Current API Capabilities

Our coordinate conversion service supports over 6,000 EPSG coordinate reference systems and provides:

- **Coordinate Reference System Conversion**: Convert between any EPSG coordinate reference systems for cross-jurisdictional projects
- **DIGGS 3.0 Compliance Support**: Ensure coordinates are in the correct system before creating DIGGS files
- **Batch Processing**: Convert up to 25 coordinates per request
- **US State Plane Finder**: Identify the correct EPSG codes for DOT projects by state
- **Coordinate Validation**: Verify that coordinates fall within expected geographic bounds
- **Elevation Integration**: Automatic elevation data retrieval using Open Elevation API

Real-World API Usage Examples

Converting Virginia State Plane to WGS84 for Web Mapping:

POST https://diggs.geosetta.org/api/georef/convert

```
{
  "epsg_code": 2283,
  "x": 11688443.2,
  "y": 6929154.3
}
```

Response:

```
{
  "success": true,
  "original_coordinate": {
    "epsg_code": 2283,
    "x": 11688443.2,
    "y": 6929154.3,
    "system_name": "NAD83 / Virginia North (ftUS)"
  },
  "converted_coordinate": {
    "latitude": 38.9234567,
    "longitude": -77.5678901,
    "elevation_m": 45.2,
    "elevation_ft": 148.3
  }
}
```

Batch Processing for Multi-State Highway Project:

POST https://diggs.geosetta.org/api/georef/convert/batch

```
{
  "coordinates": [
    {"epsg_code": 2283, "x": 11688443.2, "y": 6929154.3}, // Virginia
    {"epsg_code": 2248, "x": 1312456.7, "y": 558934.2}, // Maryland
    {"epsg_code": 2272, "x": 2689123.4, "y": 245678.9} // Pennsylvania
```

```
  ]
}
```

Legacy Data Recovery Process

For datasets like ALDOT's station/offset boring logs, one possible recovery process would involve:

1. **Survey Control Recovery**: Locate original highway alignment and survey control data
2. **Manual Coordinate Calculation**: Transform station/offset to state plane coordinates using survey data
3. **API Validation & Conversion**: Use our API to verify coordinates and convert between systems if needed
4. **DIGGS 3.0 File Creation**: Generate compliant files with proper srsName attributes

ALDOT Success Example: Of the 34,322 boring logs that couldn't be automatically georeferenced, many contained station/offset references like "STA. 55+00, 85' LT OF SURVEY C/L." With access to original survey control data, these could potentially be recovered, converting $102.9 million in investigation value back to usable geospatial data.

Cross-Jurisdictional Project Integration

The API's primary strength is enabling seamless data sharing between jurisdictions using different coordinate systems:

- **Virginia DOT** provides data in State Plane North (EPSG:2283)
- **Maryland DOT** uses State Plane coordinates (EPSG:2248)
- **API converts all data** to WGS84 (EPSG:4326) for web visualization
- **Result**: Unified I-95 corridor dataset for regional analysis

Multi-State Project Integration

Consider a typical interstate highway improvement project crossing Virginia, Maryland, and Pennsylvania. Previously, each state's boring logs would use different coordinate systems:

- **Virginia**: State Plane North (EPSG:2283) in US Survey Feet
- **Maryland**: State Plane (EPSG:2248) in US Survey Feet
- **Pennsylvania**: State Plane South (EPSG:2272) in US Survey Feet

With DIGGS 3.0 compliance and our coordinate conversion API, the project workflow becomes:

1. **Data Collection**: Each state provides DIGGS 3.0 files with mandatory srsName references
2. **Coordinate Standardization**: All coordinates are automatically converted to WGS84 for web mapping
3. **Unified Analysis**: Regional subsurface modeling uses consistently referenced spatial data
4. **Visualization**: Interactive maps display boring logs from all three states in a unified coordinate system

Getting Started Today

You don't need to wait for DIGGS 3.0's official release to start benefiting from improved georeferencing and coordinate standardization. Here's what you can do right now:

Begin implementing the 3.0 CRS compliance guidance NOW

- **Audit Your Data**: Review existing boring log databases for coordinate system documentation
- **Identify EPSG Codes**: Determine which georeferenced coordinate systems your organization commonly uses
- **Start adding srsName attributes to geometry elements using the OGC CRS Definition Resolver URL (for standard CRS's with EPSG codes)**
- **For local and station/offset CRS's, begin building GML CRS definitions that can be referenced by srsName**
- **Engage with the DIGGS Community: Join monthly DIGGS meetings for further guidance and to stay updated on 3.0 development progress**

Try the Coordinate Conversion Tools

Visit diggs.geosetta.org to access our free coordinate conversion tools:

- **Test Your Coordinates: Upload sample coordinate pairs and validate conversion accuracy**
- **Find EPSG Codes: Use our US State Plane finder to identify correct coordinate systems for your projects**
- **Batch Convert Data: Convert up to 25 coordinates at once to different coordinate systems**
- **Validate Geographic Bounds: Verify that your coordinates fall within expected regions**

Are you a public agency with geotechnical data?

As part of our nonprofit mission to advance geotechnical data accessibility, **Geosetta will process and convert your public datasets to DIGGS format at no cost. Contact us to contribute your data to the growing public geotechnical database.** We'll standardize coordinates, enhance georeferencing, and make your data available through our open platform.

Looking Forward: The Future of Geotechnical Data

DIGGS 3.0's mandatory georeferencing requirements represent more than a technical upgrade—they signal a fundamental shift toward data-driven geotechnical engineering. With reliable coordinate references, we're enabling:

- **Real-Time Field Validation:** Mobile applications that instantly validate coordinates against state coordinate systems
- **Predictive Subsurface Modeling:** Regional models trained on properly georeferenced datasets spanning decades
- **Climate Resilience Planning:** Historical geotechnical data integrated with climate models for infrastructure adaptation
- **Automated Quality Control:** AI systems that detect coordinate anomalies and data quality issues
- **International Collaboration:** Seamless data sharing between countries using standardized coordinate transformations

Join the DIGGS Effort

The transition to mandatory georeferencing using DIGGS 3.0's new validation tools requires industry-wide coordination and support. **Here's how you can participate:**

- **GitHub Contribution:** Help develop DIGGS validation tools at https://github.com/DIGGSml/
- **Monthly DIGGS Meetings:** Join our monthly discussions where we tackle georeferencing implementation challenges. Contact Allen Cadden or Ross Cutts for meeting invites.
- **Beta Testing:** Volunteer your organization for DIGGS 3.0 pilot testing and coordinate conversion validation.
- **Industry Advocacy:** Promote DIGGS adoption within your professional networks and state DOT relationships

A Solution for a Crisis

The georeferencing crisis that has plagued our industry for decades finally has a solution. DIGGS 3.0's mandatory srsName requirements, combined with efforts to convert historic data into DIGGS, will recover hundreds of millions of dollars in previously unusable geotechnical data.

This isn't just about better data management—it's about unlocking the full potential of our profession's collective knowledge for safer, more efficient infrastructure development.

Conclusion: A New Era for Geotechnical Data

We can no longer accept that nearly half of our taxpayer-funded geotechnical investigations remain effectively unusable due to coordinate system ambiguity.

DIGGS 3.0 represents our industry's commitment to solving this crisis through standards-based enforcement. The free coordinate conversion tools available today provide immediate relief for existing datasets while preparing the foundation for a fully interoperable geotechnical data ecosystem.

Every boring log that we successfully georeference is a victory against waste, inefficiency, and missed opportunities. Every DIGGS 3.0 compliant file created today is an investment in our profession's data-driven future.

The technology exists. The standards are being finalized. The tools are free and available now.

The question isn't whether we can solve the georeferencing crisis—it's how quickly we can implement the solution.

Join us in making 2026 the year we finally stop throwing away geotechnical data and start building the intelligent, interconnected subsurface intelligence network our infrastructure deserves.

Best regards,

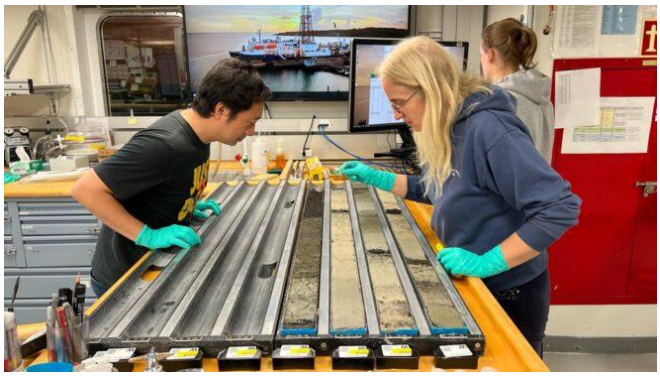
Ross Cutts, P.E., M.ASCE

Schnabel Engineer, Geosetta President, and proud member of the DIGGS team

(ASCE / GEO-INSTITUTE, 18 Sep 2025, https://www.geoinstitute.org/news/how-diggs-and-historic-data-conversions-are-transforming-our-industry)

Τέφρα από την Κω ταξίδεψε στη Σαντορίνη

Το ταξίδι της τέφρας στον πυθμένα του Αιγαίου – Επιστημονική ομάδα ανακάλυψε στρώμα πάχους έως 200 μέτρων, από την έκρηξη ηφαιστείου πριν από 161.000 χρόνια



Η επιστήμων Παρασκευή Νομικού και συνάδελφός της οριοθετούν τα δείγματα από διαφορετικές ηφαιστειακές εκρήξεις για να γίνει ορυκτολογική ανάλυση. Στον υπολογιστή καταγράφονται τα στοιχεία. Στους σωλήνες που περιέχονται στους πυρηνολήπτες που μπήκαν βαθιά στον υποθαλάσσιο πυθμένα υπάρχει το γεωλογικό υλικό (πυρήνες). Τα διαφορετικά χρώματα υποδηλώνουν διαφορετική προέλευση, ακόμα και διαφορετικές ηφαιστειακές εκρήξεις. Σχεδόν 4.000 πυρήνες ανασύρθηκαν και αναλύθηκαν από τις ερευνητικές γεωτρήσεις.

Σε μια εντυπωσιακή ανακάλυψη ενός «μυστικού», βαθιά κρυμμένου στον πυθμένα του **Αιγαίου**, προχώρησε διεθνής επιστημονική αποστολή, με ελληνική συμμετοχή. Ενα τεράστιο στρώμα **ηφαιστειακής τέφρας**, πάχους έως και 200 μέτρων, ανακαλύφθηκε στα ανοικτά της Θήρας, από τη διεθνή επιστημονική αποστολή **IODP 398 «Hellenic Arc Volcanic Field»**. Η δημοσίευση στο κορυφαίο **διεθνές περιοδικό Science Advance** τον Αύγουστο προκάλεσε αίσθηση. Το ιδιαίτερο είναι πως η τέφρα αυτή δεν προέρχεται από ηφαιστειακή δράση στην περιοχή της Σαντορίνης, αλλά από την τεράστια έκρηξη του **ηφαιστείου της Κω**, πριν από 161.000 χρόνια. Οι μάζες τέφρας μετακινήθηκαν υποθαλάσσια πάνω από 140 χιλιόμετρα από την πηγή τους!

«Είναι μια πολύ σημαντική ανακάλυψη που μας λέει πολλά για τη δυνατότητα μαζικών και πολύ ισχυρών υποθαλάσσιων ροών τέφρας, ως αποτέλεσμα ηφαιστειακών εκρήξεων. Η τέφρα στο πέρασμά της σαρώνει τα πάντα και αλλάζει το υποθαλάσσιο περιβάλλον», **λέει στην «Κ» η Παρασκευή Νομικού**, καθηγήτρια στο Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών, που συμμετείχε στη διεθνή αποστολή τον Δεκέμβριο του 2022 και τον Ιανουάριο του 2023.

«Ηταν μια έκπληξη και για εμάς. Καθώς προχωρούσαμε σε έρευνα βορειοανατολικώς της Σαντορίνης, αναζητώντας αποθέσεις από την ηφαιστειακή δραστηριότητα της περιοχής, πέσαμε πάνω σε ένα μεγάλο στρώμα τέφρας, με πάχος πάνω από 200 μέτρα, καλυμμένο από άλλα στρώματα. Προχωρώντας σε ορυκτολογικές αναλύσεις είδαμε πως δεν προέρχεται από την περιοχή της Θήρας, αλλά από πολύ πιο μακριά, από την Κω», **εξηγεί η κ. Νομικού**.

Αποστολή εννέα χωρών

Στην αποστολή συμμετείχαν 32 επιστήμονες από διάφορες ειδικότητες και εννιά χώρες (Γαλλία, Γερμανία, ΗΠΑ, Κίνα, Ιαπωνία, Αυστραλία, Βρετανία, Ινδία και Ελλάδα), στο πλαίσιο του **Διεθνούς Προγράμματος Εξερεύνησης των Ωκεανών (IODP)**. Οι γεωτρήσεις πραγματοποιήθηκαν από το ειδικότερο ωκεανογραφικό σκάφος «JOIDES Resolution». Στην αποστολή συμμετείχαν ενεργά τρεις Ελληνίδες επιστήμονες: η καθηγήτρια **Παρασκευή (Εύη) Νομικού** από το ΕΚΠΑ, η επίκουρη καθηγήτρια **Ολγα Κουκουσιούρα** από το Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης και η ερευνήτρια **Παρασκευή Πολυμενάκου** από το Ελληνικό Κέντρο Θαλασσίων Ερευνών. Στη δημοσίευση συμμετείχε επίσης ο ομότιμος καθηγητής του ΕΚΠΑ **Δημήτρης Παπανικολάου**.

Η ανακάλυψη φέρνει στο φως την άγνωστη μέχρι σήμερα υποθαλάσσια έκταση της ηφαιστειακής έκρηξης της Κω, μιας έκρηξης δέκα φορές μεγαλύτερης από εκείνη του Χούνγκα-Τόνγκα το 2022 στον Ειρηνικό. Μπαίνοντας στη θάλασσα μερος του υλικού της ηφαιστειακής έκρηξης παρέσυρε νερό και μετατράπηκε σε κρύα αιωρήματα τέφρας και ύδατος. Αυτά τα αιωρήματα στη συνέχεια μετακινήθηκαν κατά μήκος των μικρών κλίσεων του θαλάσσιου πυθμένα για πάνω από 140 χιλιόμετρα, μέχρι που συνάντησαν μια σειρά από βαθιές, υποθαλάσσιες λεκάνες που ορίζονται από ρήγματα βορειοανατολικά της **Σαντορίνης**. Εκεί συγκεντρώθηκαν και εναπέθεσαν τα φορτία τους από αιωρούμενη τέφρα σε πάχος 200 έως 300 μέτρων σε ορισμένα σημεία. Δεδομένου ότι τα σωματίδια στο στρώμα τέφρας είναι μεγαλύτερα στη βάση και μικρότερα στην κορυφή, το «μεγαστρώμα» ερμηνεύεται ως απόθεση που προέρχεται από ένα μόνο γεγονός: την ηφαιστειακή έκρηξη της Κω, ακολουθούμενη από πιθανώς αρκετές εβδομάδες έως μήνες επανακινητοποίησης και ανακατάταξης της αρχικής απόθεσης. Η διάβρωση του θαλάσσιου πυθμένα από τις ροές κατά τη διάρκεια της τοποθέτησής τους τεκμηριώνεται από μεγάλες ποσότητες θραυσμάτων βράχων και θαλάσσιων οργανισμών, όπως κοράλλια, στη βάση του στρώματος της τέφρας.

Καθώς το ηφαίστειο της Κω βρίσκεται στο ανατολικό άκρο του **Ελληνικού Ηφαιστειακού Τόξου**, οι ροές της τέφρας κινήθηκαν υποθαλάσσια προς τα δυτικά. Παρά τη μεγάλη απόσταση που διήνυσε, η υποθαλάσσια τέφρα από την Κω είναι πολύ μεγαλύτερου πάχους από τα στρώματα τέφρας που προέρχονται από τη γειτονική Σαντορίνη, δείχνοντας το μέγεθος της έκρηξης της Κω.

Περισσότερα από 200 κυβικά χιλιόμετρα τέφρας, αν προστεθεί το νέο υποθαλάσσιο στρώμα τέφρας στον όγκο των προηγουμένως γνωστών αποθέσεων τέφρας στην Κω και τα γειτονικά νησιά!

«Η ανακάλυψη στρώματος τέφρας τόσο μεγάλου πάχους σε τεταρτογενή (σχετικά σύγχρονα) ιζήματα αποτελεί παγκόσμια πρωτοτυπία και αναδεικνύει την υποεκτιμημένη δυναμική των υποθαλάσσιων ηφαιστειακών ροών. Η μελέτη αποκαλύπτει ότι μεγάλο μέρος των επιπτώσεων τέτοιων εκρήξεων παραμένει "αόρατο" στον βυθό, ενώ η προσοχή μας στρέφεται συνήθως στις επιφανειακές αποθέσεις ή τις εκπομπές στην ατμόσφαιρα», **σημειώνει η καθηγήτρια του ΕΚΠΑ**.

Οι εκρήξεις ηφαιστείων σε νησιά, όπως το Ταμπόρα (1815 μ.Χ.), το Κρακατάου (1883 μ.Χ.) και η Σαντορίνη (1600 π.Χ.), συνήθως εκτοξεύουν πυροκλαστικά ρεύματα στη θάλασσα, χωρίς όμως οι επιπτώσεις τους στον υποθαλάσσιο χώρο να έχουν καταγραφεί επαρκώς. Πρόσφατες μελέτες για την έκρηξη του ηφαιστείου Χούνγκα-Τόνγκα έδειξαν πως οι υποθαλάσσιες ηφαιστειακές ροές ταξιδεύουν υποβρύχια με υψηλές ταχύτητες, διαβρώνοντας τον βυθό, επηρεάζοντας τα υποβρύχια καλώδια και δημιουργώντας υποθαλάσσιες αποθέσεις τέφρας. Ωστόσο η μεγάλη κλίμακα στην οποία μπορούν να λειτουργήσουν αυτές οι διαδικασίες δεν είναι πλήρως κατανοητή.

«Με τις έρευνές μας επιχειρούμε να κατανοήσουμε τους μηχανισμούς και τους τρόπους που εκδηλώνονται οι υποθαλάσσιες ροές έπειτα από ηφαιστειακές εκρήξεις. Αυτό θα μας εξοπλίσει καλύτερα για περιστατικά που μπορεί να συμβούν στο μέλλον, όπως και για τον ιστορικό χαρακτήρα τέτοιων εκρήξεων, καθώς χρειάζονται χιλιάδες χρόνια για να εκδηλωθούν», εξηγεί η κ. Νομικού.

Νέα οπτική

Οπως σημειώνουν οι μελετητές στη δημοσίευση στο Science Advance, η έρευνα «αλλάζει την οπτική μας για τους δυνητικά

μεγάλους, κρυμμένους όγκους των ηφαιστειακών εκρήξεων και την ικανότητα των υποθαλάσσιων ροών να διασκορπίζουν την ηφαιστειακή τέφρα μακριά από την πηγή της έκρηξης. Ο μεγάλος όγκος και η μεγάλη έκταση της υποθαλάσσιας τέφρας της έκρηξης της Κω υποδηλώνουν ότι οι όγκοι ορισμένων άλλων εκρήξεων από ηφαιστειακά νησιά ενδέχεται να έχουν υποτιμηθεί».

«Ο ωκεανός είναι σε μεγάλο βαθμό ανεξερεύνητος, κρύβει πολλά μυστικά. Η θάλασσα είναι πηγή ζωής για τον πλανήτη Γη, από πολλές απόψεις, από το οξυγόνο που παρέχει και το διοξείδιο του άνθρακα που δεσμεύει, μέχρι την τεράστια βιοποικιλότητα. Πρέπει να τη γνωρίσουμε περισσότερο, χωρίς να επιχειρήσουμε να την "εκμεταλλευθούμε" με τον καταστροφικό τρόπο που είδαμε στη στεριά», **τονίζει στην «Κ» η Παρασκευή Νομικού**.

(Γιάννης Ελαφρός / Η ΚΑΘΗΜΕΡΙΝΗ, 06.09.2025, https://www.kathimerini.gr/society/reportaz/563798755/tefra-apo-tin-ko-taxidepse-sti-santorini)

Submarine ash megabed fed by far-traveled, shoreline-crossing pyroclastic currents from a large explosive volcanic eruption

Abigail Metcalfe, Tim Druitt, Katharina Pank, Steffen Kutterolf, Jonas Preine, Karim Kelfoun, Christian Hübscher, Paraskevi Nomikou, Thomas A. Ronge, [...] , and Dimitrios Papanikolaou +26 authors

Abstract

Large explosive volcanic eruptions from island volcanoes deliver vast quantities of ash to the marine environment. While many of the transport pathways are understood, those from shoreline-crossing or submarine pyroclastic currents, and their transformation into water-supported gravity flows, remain poorly constrained. We report the discovery by International Ocean Discovery Program (IODP) deep drilling of a 200-meter-thick ash megabed buried in rift basins of the South Aegean Volcanic Arc. The >73–cubic kilometer ash deposit originates from the Kos Plateau Tuff caldera-forming eruption, which occurred 161 thousand years ago, >120 kilometers to the east. The ash forms a chemically uniform, graded megabed lacking bioturbation, interpreted as having been emplaced by a stream of eruption-fed turbidity currents. Bioclastic debris within the ash provides evidence of widespread destruction of marine ecosystems. Large volcanic eruptions can remodel the seafloor landscape, deposit thick ash turbidites, and destroy marine biota on island arc–wide scales in short-lived, catastrophic events.

INTRODUCTION

Explosive volcanic eruptions produce ash by the violent fragmentation of gas-charged magma (*1*). The fine particle sizes (<2 mm) and low settling velocities in water (relative to the speeds of marine currents) result in wide dispersal of volcanic ash in the marine environment (*2*), significantly affecting ecosystems, biogeochemical cycles (*3*), and submarine cable networks (*4*). Some common mechanisms by which ash enters the oceans include submarine eruptions (*5*), fallout from Plinian eruption columns (*6*), attrition of pumice rafts (*7*), sedimentation from sea-surface pyroclastic currents (*8*–*12*), and fallout from atmospheric coignimbrite ash ("Phoenix") plumes (*13*). The last mechanism involves buoyant lofting of ash and hot gases from subaerial pyroclastic currents (traveling across land or sea), potentially accounting for a substantial fraction of the total erupted volume (*13*). These processes, all observable in nature and well understood (*2*), result in ash layers in marine sediments that are crucial for tephrochronology and for estimating the volumes of explosive eruptions (*14*).

The fate of the huge volumes of ash that enter the ocean in the form of dense, seafloor-hugging pyroclastic currents, which then entrain water and transform into debris flows, granular slurries, and turbidity currents, is more enigmatic (*15*–*22*). The processes and submarine products arising from the entry of pyroclastic currents into the sea have been studied using ancient examples (*15*, *16*, *19*), modern examples (*4*, *23*), and laboratory experiments (*17*, *19*), with comprehensive reviews published [(*16*, *24*, *25*) and the references therein]. One school of thought has been that dense pyroclastic currents can retain their heat for large distances under water. Supporting this idea, the submarine ignimbrite (massive, pumice-rich deposit from a pyroclastic current) from the Krakatau 1883 eruption was emplaced at temperatures of 475° to 550°C as far as 15-km offshore from the island (*26*), either because the highly concentrated basal levels of the current had entrained little seawater or because there had been insufficient time for the pyroclasts to cool. However, most studies infer that pyroclastic currents rapidly entrain seawater and transform into cold subaqueous density flows, either progressively during transport or due to explosive mixing in the littoral zone (*24*). A particularly well-documented modern example is the 2022 eruption of the partially submerged Hunga Volcano, which discharged fast-moving (exceeding 120 km hour^{-1}) pyroclastic currents by column collapse into the Pacific Ocean, scouring the seafloor, and laying down volcaniclastic sediment to over 100 km from source (*4*, *23*). However, although the volume of the Hunga-Tonga deposits is ~6 km^3, some terrestrial explosive eruptions discharge many hundreds or even thousands of cubic kilometers of ash in the form of pyroclastic currents (*27*). The entry of such pyroclastic currents into the sea can form submarine megabeds (unusually thick and laterally extensive beds that differ in composition from the host sediments) of volcaniclastic material (*24*). Submarine volcaniclastic megabeds generated directly by eruptions are distinguished from those produced by other mechanisms, such as volcanic flank collapses by an abundance of chemically homogeneous juvenile components (*20*, *24*). While ancient examples of eruption-generated submarine megabeds have been described, the source conditions are commonly unknown (*16*, *24*, *25*). Moreover, the processes of hydraulic sorting of particles of different sizes and densities in submarine volcaniclastic flows and the distal fate of the fine components remain poorly constrained. We address this knowledge gap via the deep drilling of a 200-m-thick ash megabed from the Kos Plateau Tuff (KPT) caldera-forming eruption on the South Aegean Volcanic Arc. Through a combination of sedimentological characterization, core-seismic integration, and numerical modeling, we unravel the processes that gave rise to this enormous submarine deposit.

The KPT eruption took place 161,000 ± 2000 years ago from the Kos caldera complex in the eastern part of the South Aegean Volcanic Arc (*28*, *29*) (Fig. 1). The eruption succession has been reconstructed from detailed studies of onland deposits (*30*). The eruption discharged a total of over a hundred cubic kilometers of biotite-bearing rhyolitic pumice and ash in a six-phase (A to F), waxing-to-waning sequence lasting several hours to several days (*30*). Onland unit A consists of a phreatomagmatic fall deposit, while units B to F consist of pyroclastic current deposits. The climactic phase of the eruption is represented by unit E, when the peak discharge rate is estimated from numerical modeling to have been 4 × 10^9 to 8 × 10^9 kg s^{-1} (*11*). On the basis of isopach, isopleth, and transport direction data, the eruption is inferred to have taken place from one or more vents south of Kos (Fig. 1) and to have formed a caldera 10 to 20 km in diameter (*30*). The pyroclastic currents of the eruption were generated by column collapse (*30*). To the north, they traveled across land to deposit on Kos, Kalymnos, Pserimos, and the Bodrum Peninsula. To the south and east, they traveled across either shal-

low water (*10*) or land (*31*) to deposit on Tilos, Chalki, and the Datça Peninsula (Fig. 1). The submarine deposits from the KPT pyroclastic currents have been tentatively recognized in seismic profiles around the Kos caldera (*29*, *31*, *32*) but, until now, not further away from source.

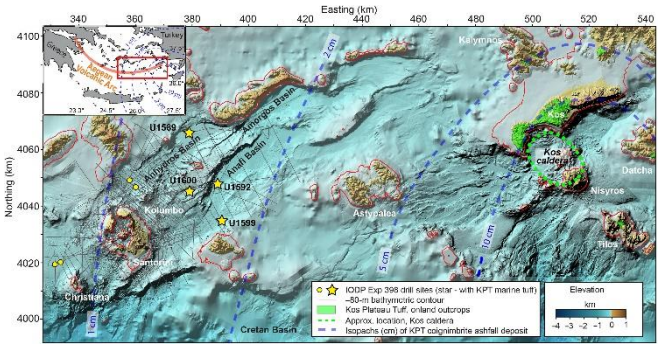


Fig. 1. Shaded bathymetric map of the eastern half of the South Aegean Volcanic Arc.

The red rectangle on the inset locates the main figure. IODP Expedition 398 drill sites outside of Santorini caldera are marked with yellow symbols and their IODP site numbers (those inside the caldera are not shown). Sites where the Kos Plateau Tuff (KPT) submarine megabed was intersected are shown as stars. Present-day water depths at these sites are 484 m (Site U1589), 693 m (Site U1592), 592 m (Site U1599), and 326 m (Site 1600). The distribution of onland outcrops of the 161 ka KPT is shown in green, along with the approximate location of the Kos caldera (*30*). Isopachs for the KPT coignimbrite ash fall are shown on the main map and inset (*14*). At the time of the eruption, sea level was about 80 m below the present-day level; the −80-m bathymetric contour is shown in red. The gray lines are published seismic profiles.

In 2022–2023, International Ocean Discovery Program (IODP) Expedition 398 (*33*) drilled the marine rifts of the central South Aegean Volcanic Arc at eight sites around Santorini Volcano to depths of up to 900 m below the seafloor (Figs. 1 and 2A). Two aims were, first, to use the basin sediments as time capsules to recover a complete record of Neogene-Quaternary volcanism and, second, to seek deposits from eruptions that entered the sea as pyroclastic currents from nearby volcanic centers. However, the presence of 200 m of KPT in the rift basins, much thicker than the 1 to 5 cm of atmospherically transported KPT coignimbrite ash previously sampled by shallow gravity coring on neighboring bathymetric highs (*14*), was not anticipated. The discovery highlights the importance of offshore deep drilling in increasing our understanding of large eruptions with a potentially global impact such as the KPT.

The marine rift basins containing the KPT megabed are situated 120 to 140 km west of Kos and 30 to 40 km northeast of the Christiana-Santorini Kolumbo Volcanic Field (Figs. 1 and 2A) (*34*, *35*). The basins lie on 20 km of rifted continental crust, with an earlier east-northeast to west-southwest Pliocene rift (the Christiana Basin) and a northeast (NE)–southwest (SW)–trending system of half-graben rifts (the Anhydros, Amorgos, and Anafi Basins) of Pleistocene age (*34*–*36*). Up to 1.4 km of volcaniclastic, tuffaceous, and nonvolcanic sediments fill these NE-SW basins above continental basement, as imaged by a dense array of over 3000 km of single and multichannel seismic profiles (*34*, *36*). Until IODP Expedition 398, the nature of the basin fills had only been characterized by offshore seismic stratigraphy [(*36*) and the references therein].

Products of the Christiana-Santorini-Kolumbo Volcanic Field dominate the volcaniclastic fill components of the rifts (*22*). Christiana Volcano has been extinct since ~1.6 Ma (*36*). The earliest onland activity at Santorini dates to 0.65 Ma (*37*). Following the large "Archaeos" eruption in the Middle Pleistocene (*22*), most of Santorini's explosive eruptions took place <0.25 Myr ago and form layers in the caldera cliffs of Santorini (table S1) (*37*) and in the marine tephrostratigraphic record (*14*, *38*). The last eruption of Kolumbo took place in 1650 CE (*39*), and the last eruption of Santorini took place in 1950 CE. In what follows, we describe the KPT megabed, a uniquely well-characterized example of distal submarine ash from a large silicic caldera-forming eruption, and we discuss its emplacement mechanism and environmental impacts.

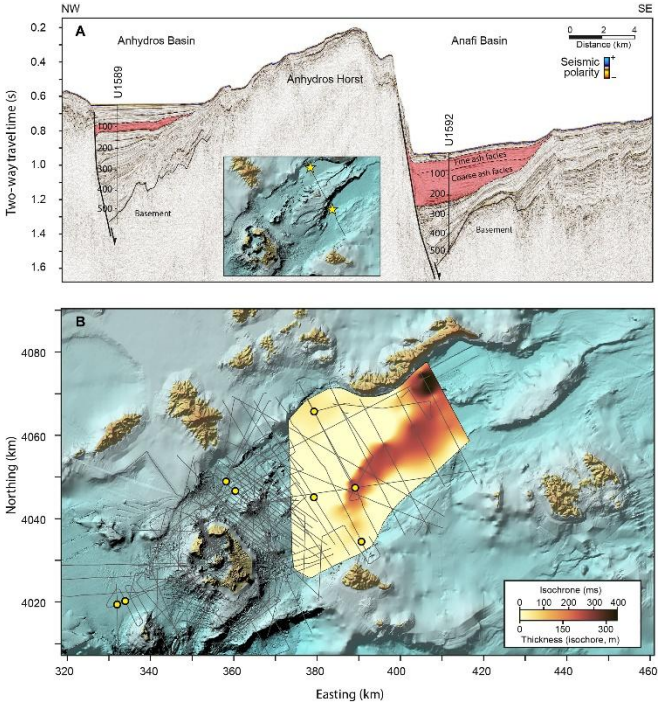


Fig. 2. Distribution and thickness of the KPT ash megabed from core-seismic integration.

(**A**) Seismic profile across the Anhydros and Anafi Basins, showing the KPT megabed. The profiles show several seismic stratigraphic packages infilling the basins and lying on Alpine basement. Two-way seismic travel time is converted to depth (in meters below sea floor) on the drill site scale constructed by core-seismic integration using shipboard seismic velocity data. The KPT megabed is shown in pink. The dotted line separates the coarse-ash (CA) facies from the overlying fine ash (FA) facies. The basal lithic-crystal facies is too thin to be resolved. (**B**) Two-way travel (TWT) time isochrones for the KPT ash megabed were derived by integration of the drill core stratigraphy with seismic profiles. The TWT values were then converted to thickness using shipboard measurements of core *P*-wave velocity. The gray lines are published seismic profiles, and the yellow circles are the IODP Expedition 398 drill sites outside of Santorini caldera.

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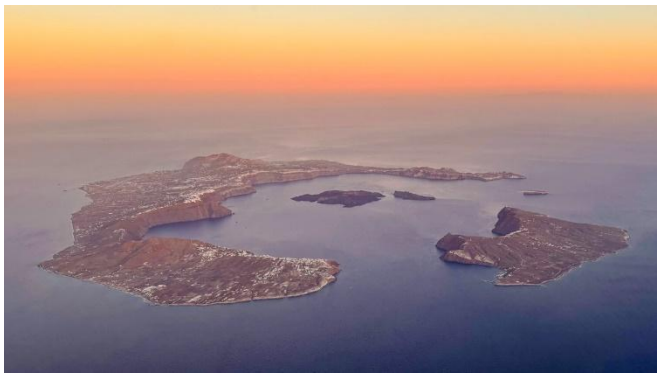
(***Science Advances,*** 13 Aug 2025, Vol 11, Issue 33, DOI: 10.1126/sciadv.ads9642, https://www.science.org/doi/10.1126/sciadv.ads9642)

Intense earthquake swarm beneath Santorini and Kolumbo volcano caused by magma intrusion

More than 28 000 earthquakes shook Santorini and neighboring islands between late January and February 2025. At the time, the cause was only speculated, but a new Nature study led by GFZ and GEOMAR shows the swarm resulted from a mid-crustal dike intrusion that linked Santorini and Kolumbo.

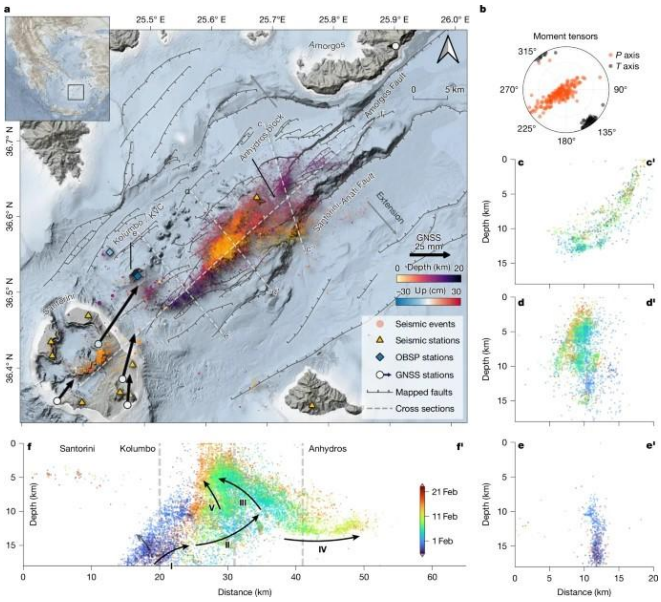


Photograph of Santorini caldera from the air. Credit: Kallerna

At 19:00 UTC on January 27, 2025, the ground beneath the Aegean Sea northeast of Santorini began to shake. The swarm intensified quickly, producing thousands of earthquakes per day. By late February, more than 28 000 events had been recorded, with the strongest exceeding M5.0.

Authorities declared a state of emergency on Santorini and nearby islands from February 6 to March 3. The intensity of shaking and the uncertainty about its cause created widespread alarm. In a region scarred by past eruptions and earthquakes, the question was urgent: were these quakes tectonic, or volcanic precursors?

The answer came later in a Nature study. A collaboration of scientists from GFZ Helmholtz Centre for Geosciences, GEOMAR Helmholtz Centre for Ocean Research Kiel, and international partners, used land-based seismic stations, ocean-bottom instruments, and satellite data to map the crisis with a level of detail not previously possible.



Distribution of seismicity. Credit: Volcanic crisis reveals coupled magma system at Santorini and Kolumbo, Marius P. Isken et al.

Magma intrusion hidden beneath the seafloor

The researchers found that the swarm resulted from the movement of about 310 million m³ (11 billion ft³) of magma intruding into the crust. The intrusion formed a 13 km (8 miles) long dike that extended from depths of 18 km (11 miles) to just 3–5 km (2–3 miles) below the seafloor.

As the molten rock pushed upwards, it fractured the crust, reactivated faults, and triggered thousands of earthquakes. This was a magmatic event expressed through seismic energy, not simply tectonic stress release.

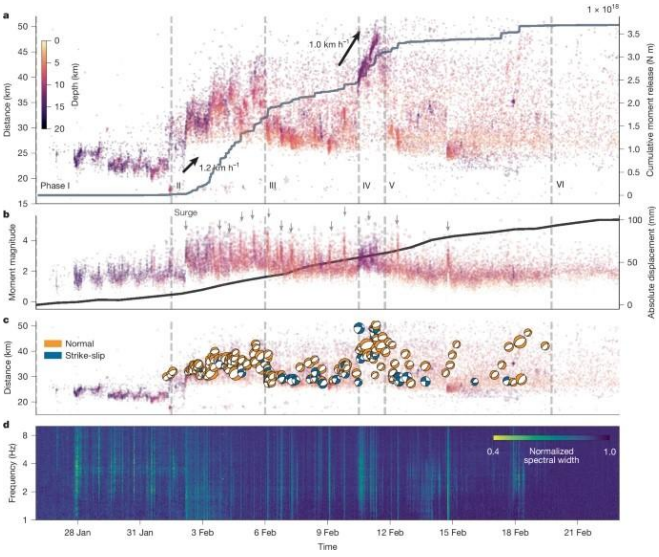
"The seismic activity was typical of magma ascending through Earth's crust," Dr. Marius Isken of GFZ explained. "The migrating magma breaks the rock and forms pathways, which causes intense earthquake activity. Our analysis enabled us to trace the path and dynamics of the magma ascent with a high degree of accuracy."

Precursors that went unnoticed

From July 2024, GNSS and InSAR satellite data detected about 45 mm (1.8 inches) of uplift inside the Santorini caldera, caused by inflation of a shallow reservoir at 3.8 km (2.4 miles) depth. Similar inflation had been observed during unrest in 2011 and 2012.

By early January 2025, seismic activity intensified beneath Santorini. At the end of the month, the earthquakes migrated northeastward, moving more than 10 km (6 miles) away from the caldera. Earthquake foci rose in pulses from 18 km (11 miles) depth to as shallow as 3 km (2 miles), suggesting that magma was on the move.

To residents and authorities, the sudden shift raised fears of either tectonic rupture or imminent volcanic eruption. Later analysis confirmed it was magma forcing its way upward.



Spatiotemporal evolution of seismicity. Credit: Volcanic crisis reveals coupled magma system at Santorini and Kolumbo, Marius P. Isken et al.

Two volcanoes acting as one

Santorini and Kolumbo volcanoes lie only 7 km (4 miles) apart. Their plumbing systems were considered mostly separate but the 2025 crisis challenged that assumption.

The data show that while Santorini inflated at first, the January 2025 intrusion originated from a mid-crustal reservoir beneath Kolumbo. As the dike propagated northeastward, Santorini began to subside while Kolumbo deflated.

"Through close international cooperation and the combination of various geophysical methods, we were able to follow the development of the seismic crisis in near real time and even learn something about the interaction between the two volcanoes," Dr. Jens Karstens of GEOMAR said. "This will help us to improve the monitoring of both volcanoes in the future."

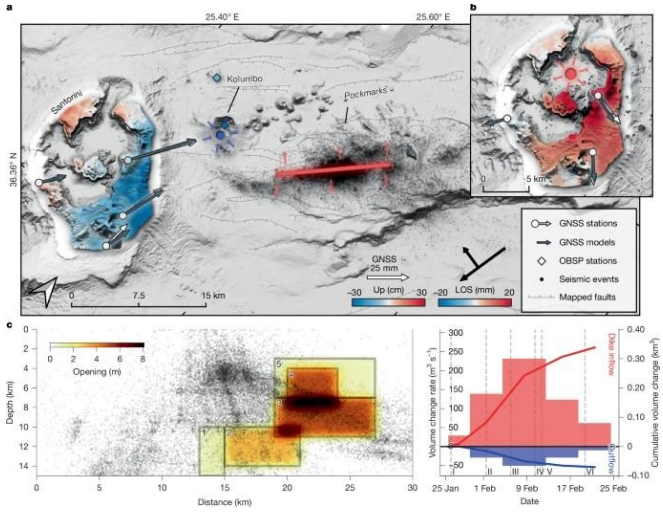
This suggests a hydraulic or stress-linked coupling between the two systems. If correct, future unrest could affect both volcanoes rather than one in isolation.

Six phases of earthquake migration

Thanks to an AI-driven earthquake detection method, scientists built a detailed catalogue of more than 30 000 events. Analysis revealed six phases of activity:

- Phase I (Jan 27–31): earthquakes initiated at 12–18 km (7–11 miles) depth with accompanying tremor.
- Phase II (Feb 1–5): activity migrated northeastward at about 1 km/h (0.6 mph), reaching 8 km (5 miles) depth, with magnitudes above 5.0.
- Phase III (Feb 6–10): seismicity shifted southwestward, clustering shallower than 5 km (3 miles).
- Phase IV (Feb 10–11): a rapid 25 km (15 miles) northeastward propagation across the Anhydros block.
- Phase V (Feb 12–19): repeated bursts of shallow earthquakes below 5 km (3 miles).
- Phase VI (after Feb 20): gradual decline in activity while ground deformation continued.

The stepwise sequence mirrors dike intrusions recorded in Iceland, Hawaii, and Japan, showing common patterns of magma movement in extensional volcanic settings.



Surface deformation and geodetic modelling. Credit: Volcanic crisis reveals coupled magma system at Santorini and Kolumbo, Marius P. Isken et al.

A region with a violent geological past

The Santorini volcanic field has a long record of destructive eruptions and earthquakes. The Bronze Age Minoan eruption around 1600 BCE was one of the largest volcanic events of the Holocene, reshaping the island and producing tsunamis across the Mediterranean.

Kolumbo erupted explosively in 1650 CE, killing dozens and generating a tsunami. More recently, Santorini erupted in 1950. In 1956, two powerful earthquakes, M7.4 and M7.2, struck between Santorini and Amorgos only 13 minutes apart, triggering another tsunami.

Their history explains the anxiety that surrounded the 2025 swarm. Even without an eruption, the parallels to past crises were clear.

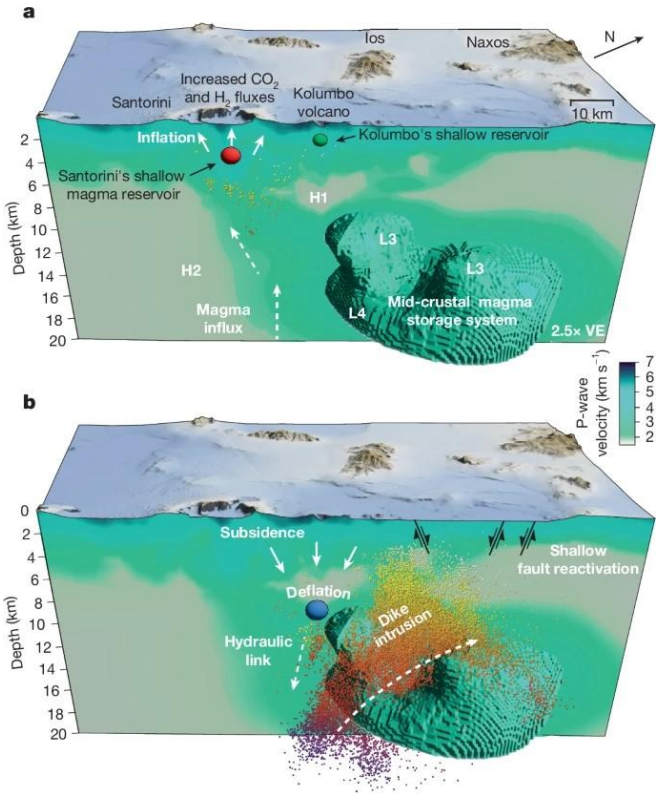
New tools changed the outcome

Two innovations made the 2025 reconstruction possible.

First, GFZ applied the Qseek pipeline, built on the PhaseNet model, to automatically detect and locate earthquakes in real time. This increased the catalogue resolution and improved the accuracy of earthquake locations.

Second, GEOMAR had deployed ocean-bottom sensors in January 2025 at Kolumbo as part of the MULTI-MAREX project. These recorded both seismic activity and pressure changes, showing that Kolumbo's crater floor subsided by 12–32 cm (4.7–12.5 inches).

Prof. Heidrun Kopp of GEOMAR said that results were shared with Greek authorities throughout the crisis to ensure a rapid response, while Prof. Paraskevi Nomikou of the University of Athens expressed the importance of long-standing German–Greek cooperation in managing the event.



Evolution of the 2025 Santorini crisis. Credit: Volcanic crisis reveals coupled magma system at Santorini and Kolumbo, Marius P. Isken et al.

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[1] Volcanic crisis reveals coupled magma system at Santorini and Kolumbo – Marius P. Isken et al. – September 24, 2025 – Nature – https://doi.org/10.1038/s41586-025-09525-7 – OPEN ACCESS

[2] Magma displacement triggered tens of thousands of earthquakes, Santorini swarm study finds – Helmholtz Association of German Research Centres – September 24, 2025

(Reet Kaur / THE WATCHERS, Thursday, September 25, 2025, https://watchers.news/epicenter/intense-earthquake-swarm-beneath-santorini-kolumbo-volcano-caused-by-magma-intrusion)

The Refined Analysis Myth

In 2003, Nigel Priestley, one of the most influential voices in earthquake engineering, stood on stage at the Mallet Milne Lecture and called out what he saw as dangerous habits in our field. His lecture was later published as "Myths and Fallacies in Earthquake Engineering, Revisited."

The Mallet Milne Lecture series was established in 1987 by the Society for Earthquake and Civil Engineering Dynamics in the UK. Held every two years in London, it honours Robert Mallet and John Milne, pioneers of seismology whose contributions still shape how we study and design for earthquakes. The series invites leading figures to challenge convention and push the profession forward. Priestley's 2003 lecture did exactly that.

One of the myths Priestley tackled still echoes loudly today:
The Refined Analysis Myth

He argued that engineers had begun to believe more sophisticated analysis automatically meant better design. Computers had become powerful, software more advanced, and the temptation was to let the model drive the design.

But as he reminded us:

Design is not an analysis exercise.
Design is a thinking exercise.

It starts with first principles, before any software is opened:

- **Define the intended behavior**. Where will the structure yield, how will it dissipate energy, and what must remain elastic?
- **Sketch the mechanism**. Outline the hierarchy of strength, which elements protect others, where plastic hinges are acceptable, and where they are not.
- **Estimate key numbers**. Rough hand calculations of base shear, yield drift, and displacement capacity/demand give you a baseline sanity check before you trust the model.
- **Prioritise performance**. Decide what matters most for this project: is it life safety, immediate occupancy, repairability, or protecting critical non-structural systems?

Analysis is there to check that story, not to write it.

Priestley warned that when analysis takes over, the engineer risks becoming a detailer rather than a designer. The danger is subtle:

- You get more decimals, but not necessarily more truth.
- And the building won't be safer simply because the model was prettier.

The lesson is timeless.

The best designs still come from engineers who can put the pencil to paper, explain the behaviour in simple terms, and then use analysis as a tool to test, refine, and verify.

That was Priestley's caution twenty years ago. And looking at our industry today, with even more powerful software at our fingertips, it feels just as urgent.

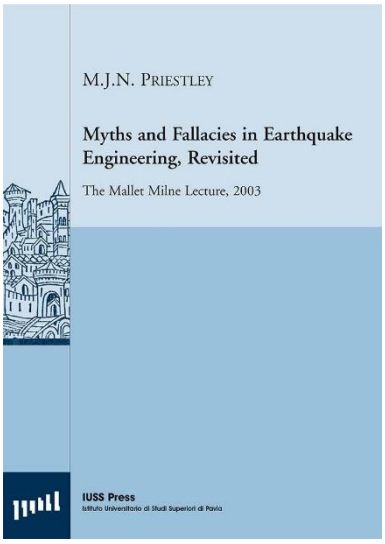
So here's the question:

☞ Are we using analysis to serve our designs, or letting analysis design for us?

Myths and Fallacies in Earthquake Engineering, Revisited

the ninth Mallet-Milne Lecture, 2003

by M J. N. Priestley



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1985 M8.0 Mexico City earthquake and the birth of earthquake early warning

Reet Kaur

When an M8.0 earthquake struck Mexico City at 13:17 UTC (07:17 LT) on September 19, 1985, shaking lasted nearly four minutes and toppled more than 400 buildings, killing over 10 000 people. The disaster revealed how resonant lakebed soils could amplify distant seismic waves into catastrophic motion, a finding that reshaped earthquake science and led to the world's first public early warning system.

Collapsed General Hospital in Mexico City. Credit: USGS

- September 19, 2025 marks the 40th anniversary of the 1985 Mexico City earthquake, one of the deadliest urban disasters of the modern era. Four decades on, its lessons remain deeply relevant not only for Mexico but for every megacity built on vulnerable ground.
- The earthquake demonstrated that local geology can be as decisive as magnitude. Despite being 350 km (217 miles) from the rupture, Mexico City suffered catastrophic losses because of resonance effects in lakebed clays.
- It also showed that building resonance matters. Many mid-rise structures built in the mid-20th century had natural vibration periods that matched the amplified ground motion, increasing their vulnerability even when they complied with existing codes.
- Seismic microzonation became a lasting contribution to earthquake science. By dividing Mexico City into zones based on soil amplification, engineers created a model for risk assessment now used worldwide, from Los Angeles to Tokyo.
- Mexico's SASMEX provided proof that alerts could be issued seconds to minutes before damaging shaking, giving critical time for protective actions. This resulted in the creation of the first public earthquake early warning system.

In the early hours of September 19, 1985, Mexico City was jolted by one of the deadliest urban earthquakes of the 20th century.

Though the rupture occurred nearly 350 km (217 miles) away off the Pacific coast of Michoacán, the capital endured catastrophic shaking. The city's ancient lakebed amplified the seismic waves, turning distant vibrations into prolonged motion that toppled buildings and exposed deep flaws in construction practices.

The event was both a national tragedy and a turning point in seismic science.

Human and structural impact

This earthquake killed more than 10 000 people in Mexico City, with some estimates suggesting higher numbers due to undocumented fatalities. At least 30 000 people were injured, and more than 250 000 were immediately displaced as thousands of residential buildings were destroyed or declared unsafe.

Hospitals, schools, and offices collapsed, severely disrupting medical and educational services. One of the most symbolic losses was the collapse of the Nuevo León apartment complex in the Tlatelolco area, where hundreds of residents died. Fires broke out due to ruptured gas pipelines, while power outages, water failures, and communication breakdowns hampered rescue operations.

In total, 412 buildings collapsed outright and more than 3,000 suffered severe structural damage. An additional 100 000 structures required repair or demolition. The scale of the disaster was unprecedented for a modern megacity, and it highlighted deep vulnerabilities in urban infrastructure.

Nuevo Leon apartment building part of the structure was only slightly damaged while another part of it collapsed

Collapsed Conalep building

Why Mexico City suffered so severely

Mexico City is situated in a closed basin once occupied by Lake Texcoco. The soils are composed of saturated clays and silts with very low shear wave velocities. When seismic waves entered the basin, they slowed down and transferred energy into strong, long-period oscillations. These oscillations were amplified by factors of 5–50 compared to nearby rock outcrops.

Apartment Complex Pino Suarez in the wake of the earthquake

Many residential and office buildings constructed between the 1950s and 1970s were 6–15 stories tall. Their natural oscillation periods coincided with the amplified wave periods in the lakebed zone, typically around 2–5 seconds. This coincidence caused resonance, where shaking intensity within the buildings increased dramatically, leading to widespread collapse.

While earthquakes closer to Mexico City typically generate short bursts of strong motion, the Michoacán rupture produced sustained low-frequency waves that reverberated within the basin.

In the worst-hit neighborhoods, shaking lasted three to four minutes. Prolonged motion exhausted the structural capacity of many buildings that might have survived shorter bursts.

Collapsed upper stories and construction equipment at work at the Ministry of Telecommunications and Transportation building

Although building codes had been updated after the 1957 earthquake, enforcement was inconsistent. Many mid-rise structures incorporated "soft stories" with open ground floors for shops or parking, a design highly vulnerable to lateral loads. Others had poor-quality concrete and inadequate steel reinforcement. These vulnerabilities became clear after 1985, forcing a reevaluation of engineering standards.

Seismic microzonation after 1985

One of the most enduring legacies of the earthquake was the scientific push for seismic microzonation, the detailed mapping of how ground conditions affect earthquake shaking across a city.

First ladies Paloma Cordero of Mexico left and Nancy Reagan of the United States right with U.S. Ambassador to Mexico John Gavin observing the damage done by the earthquake

Eight story frame structure with brick infill walls broken in two. The foundation also came off

Investigations showed that damage was not uniform. The lakebed areas in central and eastern Mexico City experienced catastrophic collapses, while hillside districts on volcanic rock reported relatively minor losses. To formalize these differences, researchers at the National Autonomous University of Mexico (UNAM) and the city's Department of Public Works developed the first official microzonation maps.

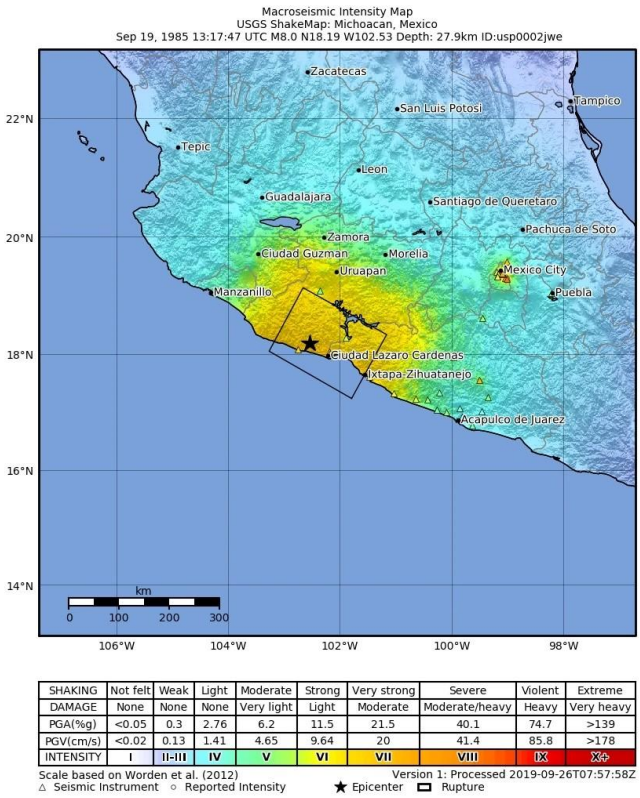
The city was divided into three principal zones:

- Zone I (Hills): areas on volcanic rock and lava flows, where amplification is minimal.
- Zone II (Transition): areas between hills and lakebed, where amplification is moderate.
- Zone III (Lakebed): the softest soils, where amplification is strongest.

In subsequent updates, Zone III was subdivided into four subzones to reflect differences in soil depth and properties. These maps became a cornerstone of seismic design. Structures in lakebed zones now require more stringent foundation designs, higher safety factors, and in some cases, construction restrictions.

The microzonation also guided the installation of an expanded strong-motion accelerograph network. Hundreds of sensors were deployed to measure shaking in real time and refine hazard models. The approach pioneered in Mexico City

later influenced seismic zoning in other cities with sedimentary basins, such as Los Angeles and Tokyo.



USGS Shakemap for the earthquake. Credit: USGS

From disaster to first early warning system

The 1985 earthquake also sparked a second innovation: earthquake early warning. Scientists realized that because Mexico City is hundreds of kilometers from the main subduction zone, there is a natural delay between the rupture offshore and the arrival of damaging waves in the basin. If seismic stations were installed along the coast, they could detect earthquakes early and issue alerts to the capital.

This idea led to the Seismic Alert System (SAS), launched in 1991. Initially, it consisted of 12 sensors along the Guerrero coast, designed to detect large subduction earthquakes. By 1993, the system was expanded to broadcast alerts to the public.

In the early 2000s, a parallel system was built for Oaxaca. Both networks were merged in 2005 to form SASMEX, which is the Mexican Seismic Alert System, managed by the nonprofit Centro de Instrumentación y Registro Sísmico (CIRES).

SASMEX works by detecting the first-arriving P-waves, which travel faster but cause less damage, and using them to predict the strength of the slower, more destructive S-waves. If the estimated magnitude and intensity exceed pre-set thresholds, alerts are issued. These are broadcast through television, radio, and more than 12 000 loudspeakers across Mexico City, and dedicated receivers in schools and public institutions.

Depending on the epicenter, the warning time for Mexico City ranges from a few seconds to more than a minute. For a megacity of over 20 million people, this lead time is enough to halt subway trains, shut down industrial operations, or allow residents to take protective action.

Legacy and lessons

The 1985 Mexico City earthquake remains one of the most significant disasters in modern urban history but its scientific and societal lessons extend beyond Mexico:

- The disaster showed that soil amplification can determine urban vulnerability more than fault distance.
- Building resonance is critical. Structures with natural periods matching ground motion are at greatest risk, even if they meet code requirements.
- Seismic microzonation is essential. Understanding local soil conditions is now standard practice in seismic risk assessment worldwide.
- Mexico pioneered the world's first operational public earthquake alert system, a model now emulated in Japan, the United States, and other regions.
- Preparedness saves lives. Annual national drills on September 19 commemorate the disaster and reinforce public awareness.

Nearly four decades on, Mexico City still faces seismic risk. Informal housing and aging buildings remain fragile, code enforcement is uneven, and public response to alerts is not always consistent. Yet the frameworks created after 1985 — microzonation, dense seismic networks, early warning, and annual civic drills — continue to stand as pillars of resilience. They are both a living memorial to those lost and a blueprint for how megacities worldwide can confront the inevitability of future earthquakes.

References:

[1] M8.0 – 1985 Michoacan, Mexico Earthquake – USGS – Accessed September 16, 2025

[2] The Mexico Earthquake of September 19, 1985—A Study of Amplification of Seismic Waves in the Valley of Mexico with Respect to a Hill Zone Site – Shri Krishna Singh et al – November 1988 – https://doi.org/10.1193/1.1585496 – OPEN ACCESS

(THE WATCHERS, Friday, September 19, 2025, https://watchers.news/epicenter/1985-m8-0-mexico-city-earthquake-birth-of-earthquake-early-warning/)

The 2018 Palu earthquake and tsunami re-shaped understanding of strike-slip hazards

Reet Kaur

A magnitude M7.5 earthquake struck Central Sulawesi at 18:02 LT (10:02 UTC) on September 28, 2018, unleashing a locally amplified tsunami, catastrophic liquefaction and slope failures that killed more than 4 300 people.

Collapsed bridge after the September 2018 earthquake and tsunami that hit Central Sulawesi. Credit: N.Hariadi

The mainshock began at 18:02 LT (10:02 UTC) on September 28, 2018, along the Palu–Koro fault system in Donggala Regency, north of Palu. The rupture reached magnitude M7.5 and extended for roughly 150 km (93 miles).

Strong shaking caused buildings across Palu and the surrounding towns to collapse. Bridges and roads were fractured, hospitals were damaged, and communication networks failed within minutes.

Yet the earthquake was only the first stage of the disaster. Within 3–8 minutes, tsunami waves entered Palu Bay and struck densely populated coastal areas. Eyewitness videos captured surges overtopping seawalls and racing inland before residents had time to react.

Runup heights varied greatly across the bay. Post-event surveys recorded typical values of 4–7 m (13–23 feet) and maxima of 10–11 m (33–36 feet) near the bay head. Inundation depths of 2–4 m (6–13 feet) destroyed homes, mosques, markets and coastal infrastructure.

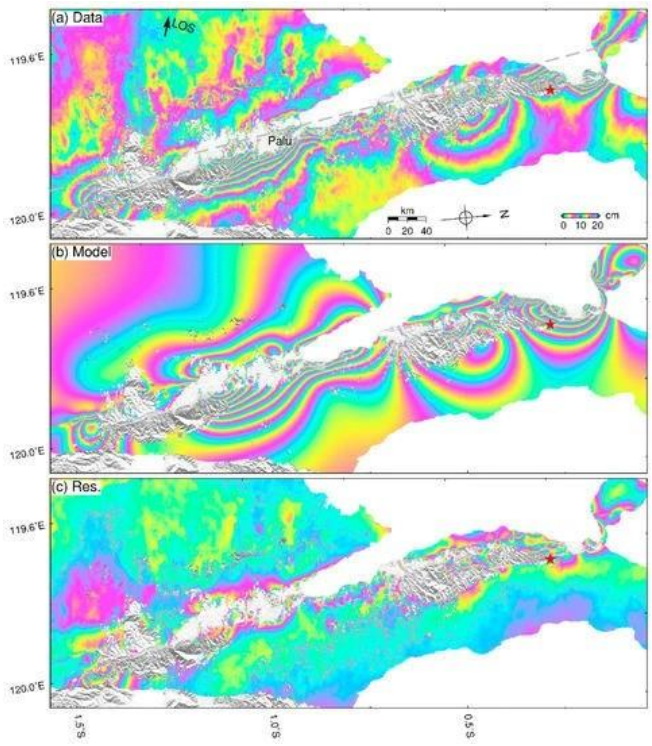
Together with catastrophic liquefaction in Petobo, Balaroa and Jono Oge, the event produced one of Indonesia's deadliest disasters in decades, with about 4 300 fatalities and many thousands displaced.

Why a strike-slip earthquake produced a destructive tsunami

Strike-slip earthquakes involve lateral fault movement, which usually does not generate strong vertical displacement of the seabed. For this reason, they are rarely associated with major tsunamis.

The Palu case defied this expectation because several unusual mechanisms acted together. Seismological inversions suggest localised dip-slip components of up to 1–3 m (3–10 feet) along fault strands entering Palu Bay. This created limited but significant vertical seabed movement.

The rupture itself propagated at supershear speeds of 4–5 km/s (2.5–3.1 miles/s). Supershear ruptures radiate concentrated energy in Mach fronts, which may have enhanced local seabed deformation and slope failure triggers.



The observed (a), modeled (b), and residual (c) coseismic LOS displacement of the 2018 Palu earthquake based on the joint inversion. Credit: The 2018 Mw 7.5 Palu Earthquake: A Supershear Rupture Event Constrained by InSAR and Broadband Regional Seismograms, Jin Fang et al.

Most importantly, multiple coastal and submarine landslides inside Palu Bay contributed short-wavelength tsunami sources. Models incorporating landslide volumes of 0.02–0.07 km³ (0.005–0.017 mi³) reproduce the short-period pulses seen in tide gauges and videos far better than earthquake-only models.

Finally, Palu Bay's geometry, 30 km (19 miles) long and just 7 km (4 miles) wide in places, funnelled and amplified the waves. Narrow bays are known to act as natural resonators, concentrating energy at the bay head.

Balaroa, a district in Palu, was obliterated by the soil liquefaction that followed immediately after the 2018 earthquake. Credit: Makassar Regional Disaster Mitigation Agency

Landslides and resonance inside Palu Bay

Eyewitnesses recorded large sections of coastal land collapsing into the water minutes after the earthquake. Submarine slope failures are harder to confirm, but bathymetric surveys and satellite imagery reveal scars consistent with landslide sources.

These landslides generated waves with very short periods, a diagnostic feature also seen in tide-gauge records at Pantoloan and Mamuju. The short, steep waves caused disproportionate destruction along the bay's narrow shores.

Numerical studies since 2019 have converged on dual-source models, a combination of tectonic slip and landslide input. These models better match the observed wave arrival times, heights and inundation patterns in Palu City.

The bay's resonance characteristics also amplified the waves. Its elongated basin shape allowed even small landslides to produce focused surges in Palu's waterfront districts, magnifying damage.

Because the landslides occurred almost simultaneously with the earthquake, no realistic warning system could have provided evacuation time. For residents, the shaking itself was the only effective signal.

Composite picture of the September 28, 2018 Palu Tsunami created from aircraft pilot video. Credit: New High-Resolution Modeling of the 2018 Palu Tsunami, Based on Supershear Earthquake Mechanisms and Mapped Coastal Landslides, Supports a Dual Source, Lauren Schambach et al.

Supershear rupture and its unusual effects

Supershear rupture occurs when an earthquake rupture front travels faster than the shear-wave velocity of the crust. This phenomenon is rare but important, as it changes how energy is distributed.

In Palu, geodetic and seismological analyses confirm rupture velocities exceeding 4 km/s (2.5 mi/s). The fault's straight geometry likely allowed rupture to accelerate to this speed, producing intense forward-directed shaking.

Supershear dynamics may have contributed to unusual damage patterns in Palu. Concentrated ground motion could explain why some areas experienced disproportionately severe destruction relative to distance from the fault.

Models also suggest supershear kinematics may enhance tsunami excitation in near-field zones, particularly when combined with localized vertical slip. Palu provides one of the clearest natural examples of this effect, making it a key reference for future hazard assessments.

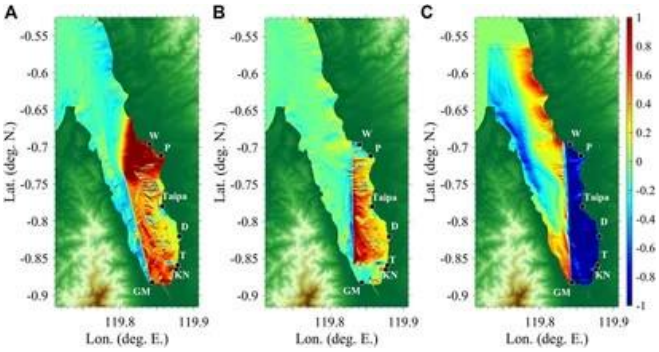
This recognition has led researchers to include rupture velocity scenarios, not just magnitude and depth, in updated tsunami hazard modelling for Indonesia.

Liquefaction and flowslides that buried entire districts

Liquefaction transformed the disaster into one of Indonesia's most complex catastrophes. In Palu's lowland suburbs, water-saturated soils lost strength during shaking, turning into fluid-like masses.

Entire neighbourhoods, including Petobo, Balaroa and Jono Oge, shifted hundreds of metres as the ground beneath them flowed laterally. Buildings, trees and roads were carried along like rafts on a river of mud.

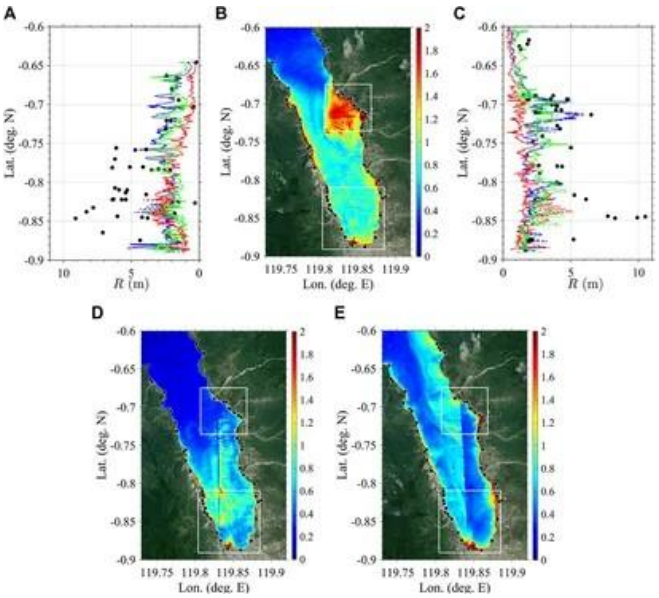
These flowslides killed thousands who had survived the tsunami. They also obliterated farmland, destroyed irrigation systems and left land unsuitable for rebuilding.



Maximum seabed subsidence computed for 2018 Palu Mw 7.5 coseismic sources. Credit: New High-Resolution Modeling of the 2018 Palu Tsunami, Based on Supershear Earthquake Mechanisms and Mapped Coastal Landslides, Supports a Dual Source, Lauren Schambach et al.

Post-event mapping revealed displacements of up to 500 m (1 640 feet) in some zones. Geotechnical analyses linked the phenomenon to loose alluvial deposits, shallow groundwater and long-period shaking from the supershear rupture.

Liquefaction at this scale in an urban environment was previously considered unlikely. Palu became a stark reminder that soil behaviour under seismic loading can rival the tsunami in destructive power.



Runups R (black dots) measured in Palu Bay by international teams. Credit: New High-Resolution Modeling of the 2018 Palu Tsunami, Based on Supershear Earthquake Mechanisms and Mapped Coastal Landslides, Supports a Dual Source, Lauren Schambach et al.

Lessons for warning and preparedness

The Palu disaster underscored critical gaps in warning and preparedness. Indonesia's national tsunami warning system, designed for far-field threats, could not react within the 3–8 minute window of local tsunami arrival.

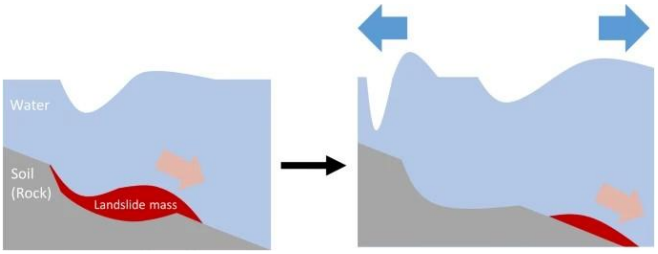
Many residents received alerts too late, or not at all, due to damaged communications and power outages. Survival often depended on immediate self-evacuation triggered by the shaking itself.

Preparedness experts now emphasize education: strong shaking in coastal zones must be taken as a natural tsunami warning. Evacuation routes, vertical shelters and community

drills are essential for bays with short lead times.

At the scientific level, Palu demonstrated the need for dense coastal monitoring networks. Local tide gauges, real-time seafloor sensors and updated bathymetric surveys are now seen as critical for Indonesia's future tsunami resilience.

For urban planning, Palu highlighted the vulnerability of developments built on young, waterlogged sediments. Land-use restrictions and stronger geotechnical planning are being considered to reduce exposure to liquefaction hazards.



Conceptual diagram of tsunami generation. Credit: Submarine landslide source models consistent with multiple tsunami records of the 2018 Palu tsunami, Sulawesi, Indonesia, Kenji Nakata et al.

Scientific significance and continuing research

Since 2018, Palu has become one of the most studied earthquake–tsunami events in recent history. It has spurred advances in rupture dynamics, landslide modelling, and compound hazard assessment.

Studies between 2020 and 2023 favour dual-source explanations combining fault slip and landslides. They also emphasize the amplifying role of narrow-bay geometry.

Newer bathymetric surveys continue to refine the locations and volumes of suspected submarine landslides, reducing uncertainty in models. InSAR and GPS data have constrained fault offsets and rupture propagation.

Researchers are now testing whether supershear ruptures in other strike-slip systems, such as the San Andreas in California or faults in Turkey and New Zealand, could pose similar compound risks. Palu has become a reference event in global hazard planning.

Despite progress, uncertainties remain about the precise sequence of slope failures and the quantitative role of supershear dynamics in tsunami excitation. Future research will rely on improved seabed mapping and higher-resolution numerical models.

https://www.youtube.com/watch?v=7j1stQCmawg&t=2s

Broader implications for coastal societies

The Palu earthquake and tsunami remind us that rare combinations of processes can devastate coastal cities. Strike-slip faults are not inherently safe from tsunami risk, especially when they intersect steep terrain and enclosed bays.

Cities worldwide with similar settings, such as San Francisco Bay, Turkey's Gulf of İzmit, or fjords in New Zealand, may need to reassess their hazard exposure. While each differs geologically, the Palu case shows that lateral faults can create vertical displacement, slope failures, and resonance effects under the right conditions.

For communities, the core lesson is that warning times may be measured in minutes or less. Preparedness must focus on rapid evacuation and resilient urban planning rather than reliance on distant alerts.

For scientists, Palu highlights the need for integrated, cross-disciplinary hazard studies that combine seismology, geotechnical engineering and coastal hydrodynamics. Only such approaches can capture the true complexity of compound disasters.

https://www.youtube.com/watch?v=ZylSvWAc2_Q

References:

[1] The 2018 Mw 7.5 Palu Earthquake: A Supershear Rupture Event Constrained by InSAR and Broadband Regional Seismograms – Jin Fang et al. – MDPI – June 3, 2019 – https://doi.org/10.3390/rs11111330 – OPEN ACCESS

[2] Submarine landslide source models consistent with multiple tsunami records of the 2018 Palu tsunami, Sulawesi, Indonesia – Kenji Nakata et al. – Earth, Planets and Space – April 3, 2020 – https://doi.org/10.1186/s40623-020-01169-3 – OPEN ACCESS

[3] New High-Resolution Modeling of the 2018 Palu Tsunami, Based on Supershear Earthquake Mechanisms and Mapped Coastal Landslides, Supports a Dual Source – Lauren Schambach et al. – Frontiers – January 11, 2021 – https://doi.org/10.3389/feart.2020.598839 – OPEN ACCESS

(Reet Kaur / THE WATCHER, Sunday, September 28, 2025, https://watchers.news/epicenter/2018-palu-earthquake-tsunami-reshaped-understanding-strike-slip-hazards/)

Empirical Relationships Between Earthquake and Tsunami Magnitudes in Japan as Tsunami Hazard Descriptors

Ioanna Triantafyllou, Fumihiko Imamura & Anawat Suppasri

Abstract

The establishment of standardized tsunami magnitude scales is a challenging issue. Five main types of scales have been proposed since the 1940s but no comparative studies have been carried out so far. Based on data of local and remote tsunamis reaching Japan from the historical times up to 2011 we established for the first-time empirical relationships between the Imamura-Iida (m), Soloviev (S), Hatori (m′), Abe (M_t) and Murty-Loomis (ML) scales, as well as among these magnitudes and the moment magnitude, M_w, of the parent earthquakes. M_t and ML do not represent real tsunami magnitude scales but alternative earthquake magnitude estimates since both calibrates for M_w. The best correlation was found for the pair M_w/M_t. However, no good correlation was found for the pairs M_w/ML and M_t/ML. This is due to difficulties in calculating accurately ML from the potential energy at the source which is the physical basis of ML. Between the various pairs composed by m, S, m′ and M_w (or M_t), the magnitude m′, ranging from − 1 to 4, showed the best correlation performance very likely since it calibrates wave height, h, for epicentral distance, Δ. On the contrary, m and S do not calibrate h for Δ. Utilizing the seismological tradition, we developed tsunami frequency-magnitude distributions (FMDs) based on the Gutenberg-Richter law established for earthquakes. Tsunami hazard descriptors in Japan have been calculated from empirical relationships and FMDs. For example, the mean repeat time of $m' \geq 3.0$ (heavily damaging wave) is about 38 yrs, while the maximum m′ expected in 10 and 100 years is ~ 2.4 and ~ 3.4, respectively. Earthquakes of M_w (or M_t) ≥ 8.2, regardless local or remote, that generate tsunamis reaching Japan repeat about every 21 years with corresponding m′ of ~ 2.4. We tested successfully the applicability of the relations developed with data of recent tsunamis generated by the 1 Jan. 2024 Noto Peninsula, Japan, earthquake ($M_w = 7.5$; we found $m' = 0.18$, $M_t = 7.48$) and the 30 Oct. 2020 Samos, east Aegean Sea, Greece, earthquake ($M_w = 7.0$; we found $m' = 0$, $M_t \sim 6.9$). Systematic magnitude calculation of past tsunamis will allow the development of regional FMDs and tsunami hazard descriptors in tsunami prone regions of the world with possible contribution in the long-term tsunami risk mitigation planning. However, the scales m, S, m′ are characterized by coarse resolution and do not allow for accurate hazard assessments.

Triantafyllou, I., Imamura, F. & Suppasri, A. Empirical Relationships Between Earthquake and Tsunami Magnitudes in Japan as Tsunami Hazard Descriptors. *Pure Appl. Geophys.* (2025). https://doi.org/10.1007/s00024-025-03828-6

Published: 23 September 2025

https://link.springer.com/article/10.1007/s00024-025-03828-6

ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ

International Society for Soil Mechanics and Geotechnical Engineering

ISSMGE News
www.issmge.org/news

Proceedings from the 2nd Southern African Geotechnical Conference (SAGC2025) available in open access

ISSMGE IT Administrator / General / 02-09-2025

The Innovation and Development Committee of ISSMGE is pleased to announce that through the initiative of Prof. SW Jacobsz, the 75 papers from the proceedings of the 2nd Southern African Geotechnical Conference (SAGC2025) are available in the ISSMGE Online Library:

https://www.issmge.org/publications/online-library

The conference was held in Durban, South Africa from May 28th to May 30th 2025.

Detailed acknowledgements for SAGC2025 can be found in the Acknowledgements section of the ISSMGE Online Library.

Abstract Submission Deadline Extension for PBD-V 2026 in Chile: now October 6 2025!

Adda Athanasopoulos-Zekkos / TC203 / 16-09-2025

The deadline for abstract submission for the upcoming PBD-V conference in Puerto Varas, Chile in November 2026, has been extended to **October 6 2025**.

This conference is the 5th of the PBD conference series established in 2009 by TC203, to focus on contributions to the engineering profession through novel design concepts and methodologies specific to problems encountered in seismic geotechnics. The PBD series is held about every 4 years in between the ICEGE, and previous conferences have been held in Tokyo (Japan, 2009), Taormina (Italy, 2012), Vancouver (Canada, 2017), and Beijing (China, 2022).

The PBD-V conference will focus on a wide range of topics, and is an excellent opportunity to contribute your work and network with geotechnical earthquake engineering professionals. There are 14 confirmed keynote speakers and 11 confirmed theme speakers from all over the world.

For more information on the conference as well as abstract submissions, please visit: https://www.pbd-v-chile.com/abstract/

Empowering the Next Generation: Highlights from the U.S. Younger Members Committee

Max Barbosa / Young Members / 19-09-2025

The Younger Members Committee (YMC) of the Geo-Institute (United States) continues to lead impactful initiatives to connect and support geotechnical professionals under 35. Operating under the Outreach and Engagement Council, the YMC fosters a vibrant, supportive network of young engineers across the U.S.

New Leadership

The YMC elected a new board at Geotechnical Frontiers 2025:

- Chair: Intisar Ahmed, P.E., P.Eng., M.ASCE
- Vice Chair: Nancy Ingabire Abayo, Ph.D., M.ASCE
- Secretary: Shivangi Jain, EIT, S.M.ASCE
- Outreach Coordinator: Hannah Hiscott, EIT, S.M.ASCE

The board is supported by advisors Helen Robinson and Melissa Beauregard.

Recent Events

In Seattle, YMC co-hosted a dynamic networking event with the G-I Seattle Chapter. The gathering included a panel of local industry leaders sharing their career journeys, offering inspiration and advice to younger professionals.

Technical Excellence

At Geotechnical Frontiers 2025 in Louisville, KY, YMC launched its first Technical Presentation Competition for younger members. Derek Donnelly (U.S. Army Corps of Engineers) won with his presentation on the Buckhorn Tailwater Campground Bank Restoration. His presentation was featured in a plenary session and is available on the G-I YouTube channel:
https://youtube.com/watch?v=cTc7W5piTuM

PE Licensure Webinar

YMC hosted a successful P.E. Licensure Webinar in July 2025 in partnership with NCEES. Presented by Stefani Goodenow and Dr. Vatsal Shah, the event attracted over 500 live attendees and provided guidance for young geotechnical professionals navigating the licensure process. The full session can be viewed here: https://youtube.com/watch?v=4ZgJaPclEps

Get Involved

YMC encourages local chapters to replicate its successful event formats and welcomes younger members globally to join its LinkedIn community:

Geo-Institute Younger Members Committee: https://www.linkedin.com/posts/geo-institute-of-asce_join-the-asce-geo-institute-young-members-activity-7338631927765090304-UAN2/

For more information or collaboration, contact: Hannah Hiscott (hhiscot@ncsu.edu)

We would love to hear from your YMPG group too! To contribute an update or video from your countrys Young Members Group, please write to: **ympg.issmge@gmail.com**

Lets keep sharing and learning together across borders!

ICSE-12 Update: Scour and Erosion

Shinji Sassa / TC213 / 21-09-2025

The 12th International Conference on Scour and Erosion (ICSE-12) website (https://icse12.cqjtu.edu.cn/index.htm) has been updated, including the following information: Keynote Speakers, Special Invite Speakers, Venue, Accommodation, as well as Technical Tours. Researchers and practitioners worldwide are cordially invited to participate in this Flagship International Conference on Scour and Erosion.

Call for Abstracts: International Conference on Advances and Innovations in Soft Soil Engineering - SOFT SOILS 2026

ISSMGE IT Administrator / TC214 / 22-09-2025

Delft University of Technology is delighted to invite you to the International Conference on Advances and Innovations in Soft Soil Engineering - SOFT SOILS 2026, which will take place from 24 to 26 August 2026 in the historic city of Delft, Netherlands.

This three-day conference brings together researchers, industry professionals and policymakers from around the world to explore the latest developments in soft soil engineering. We will discuss the most recent state-of-the-art developments in the field through keynote lectures, technical sessions and interactive discussions.

The conference will be hosted at the TU Delft Aula Conference Centre, a hub for engineering and innovation, just a 20-minute walk from the charming city centre of Delft. Known for its rich history, scenic canals and vibrant academic atmosphere, Delft provides the perfect setting for engaging discussions, knowledge exchange and networking.

Whether you are a researcher, practitioner or policymaker, SOFT SOILS 2026 offers a unique opportunity to connect with experts, present your research and experience, and gain insights into the key advancements in the field.

We look forward to welcoming you to Delft in 2026!

Themes of Interest:

We invite high-quality submissions that explore recent research, experimental developments, innovative applications, and case studies related to soft soils.

Themes include, but are not limited to:

- Design, construction, performance, and monitoring on soft soils
- Developments in laboratory and in situ testing
- Behaviour of soft soils including Bio-Chemo-Thermo-Hydro-Mechanical coupling
- Constitutive and numerical modelling of soft soils
- On-shore, near-shore, and off-shore soft soils engineering
- Climate impact and resilience, including vegetation
- Machine learning and data analysis
- Soft soils in Geo-engineering education
- Others

Abstract Submission

We invite researchers, professionals, and academics to submit contributions to the conference. Abstracts should clearly summarise the **motivations, aim & objectives**, **methodology**, and **key results** of the work, and emphasise its broader significance and impact.

The submission process will be completed in two stages, and all through the ISSMGE Conference Review Platform. First, abstracts will be submitted and reviewed by the scientific committee. Upon acceptance, authors will be invited to submit an extended abstract for inclusion in the conference proceedings published online in the ISSMGE portal.

Formatting guidelines:

- Language: English
- Length: Maximum of 250 words or 2,500 characters

We look forward to your contributions!

Important Dates

- Abstract Submission Deadline: 30 September 2025
- Notification of Acceptance: 15 October 2025
- Extended Abstract Deadline: 15 January 2026
- Early Bird Registration Deadline: 15 April 2026
- Conference Dates: 2426 August 2026

Who Should Attend?

Soft Soils 2026 is designed for a wide audience, including:

- Researchers and academic staff in geotechnical and civil engineering
- Industry professionals in infrastructure, consultancy, and construction
- Governmental and non-governmental stakeholders
- Environmental scientists and urban planners
- PhD students and early-career researchers

Why Join Us in Delft?

- Present your research to a global audience
- Network with experts in soft soil engineering
- Participate in technical sessions, workshops, and keynote lectures
- Experience the vibrant and historic city of Delft, hub of engineering innovation
- Explore cutting-edge tools, techniques, and real-world applications

ISSMGE Interactive Technical Talk Episode 26: Engineering Practice of Risk Assessment and Management (TC304)

ISSMGE IT Administrator / TC304 / 23-09-2025

The twenty-sixth episode of International Interactive Technical Talk has just been launched and is supported by TC304. Michael Hicks, Zi-Jun Cao and Suzanne Lacasse are discussing with Marc Ballouz about "Engineering Practice of Risk Assessment and Management".

https://www.issmge.org/education/interactive-technical-talks

2026 CompDSSI and 2026 SFSI-OS - Call for abstracts will open in October

Adda Athanasopoulos-Zekkos / TC203 / 24-09-2025

The 2026 International Conference on Computational Dynamic Soil-Structure Interaction (CompDSSI) and the 2026 International Advanced School in Soil-structure and Fluid-Structure Interactions in OpenSees (SFSI-OS) will take place in Trentino-Alto Adige, Italy in late June-early July 2026.

The organizing committee is expecting the call for abstracts to open in early October 2025. Please visit the conference website for updates and details.

2026 SFSI-OS

The School will build upon the previous editions (Soil-Structure Interaction in OpenSees, February 2023, September 2024) by extending its scope to an in-depth discussion of the following cutting-edge topics: dynamic soil-structure, fluid-structure, and soil-fluid-structure interactions (earthquakes, tsunamis, debris flows, fire).

The scientific sessions will be led by internationally recognised experts of the OpenSees world. During the School, numerical procedures for multiphysics interaction problems will be developed interactively, with progressively increasing complexity and accuracy.

The organisation of the 2026 SFSI-OS is guided by the following group: Davide Noè Gorini, Prof. Pedro Arduino (University of Washington, USA), Prof. José Abell (Universidad de los Andes, Chile), Prof. Nicola Tondini (University of Trento, Italy), Prof. Guido Camata (University of Chieti-Pescara, Italy).

2026 CompDSSI

The upcoming edition of CompDSSI will focus on cutting-edge numerical approaches (not limited to OpenSees) for analysing the dynamic performance (not only seismic) of soil-structure systems.

Advances in this field are playing an increasingly central role in the protection of civil engineering structures against natural hazards. We therefore believe it is essential to share knowledge systematically, in a cohesive, purposeful and multidisciplinary environment.

Another key point of CompDSSI is the involvement of designers, regarded as fundamental to orient and inspire new lines of research, and to foster their implementation into the design, protection, and retrofitting of structures.

Unlike the previous edition (September 2024), the 2026 CompDSSI will be organised as a full-fledged Conference, with broader participation and Scopus-indexed contributions.

The topics of the scientific sessions, the Keynote Speakers and the oral presentations are meticulously selected by a prestigious and broad, international Scientific Committee, with the aim of promoting high-quality contributions and the dissemination of innovative philosophies for design and assessment.

The Organising Committee is composed of: Davide Noè Gorini, Prof. Pedro Arduino, Prof. José Abell, and Dr. Domenico Gallese (Gruner Stucky, Switzerland).

https://issmge-e.eu

Dear Colleagues,

I hope this message finds you well.

We are now preparing the **Autumn 2025 edition** of the ISSMGE Europe Newsletter, which will be published in **October**. The strength of our **newsletter and website** (issmge-e.eu) lies in the active engagement and contributions from our national societies, and we warmly invite your input.

If you are interested in contributing, please share updates and news from your society, including but not limited to:

- Recent and upcoming events, conferences, or workshops
- National initiatives or collaborations
- Youth engagement activities and educational programmes
- Innovations or noteworthy geotechnical projects
- Reflections from your leadership or working groups

Submission deadline: September 30, 2025

Please send your contributions (text and any relevant images or links) to: vpeurope.issmge@epfl.ch

If possible, please keep submissions concise (around 300 words) and include photos with captions to help bring your update to life. Selected items may be featured both in the newsletter and on our website.

Should you have any questions or wish to discuss your input, please don't hesitate to get in touch.

Thank you in advance for your collaboration and continued commitment to our shared mission.

With kind regards,
Prof. Lyesse Laloui
ISSMGE Vice President, Europe

News
https://www.isrm.net

51st ISRM Online Lecture is now online 2025-09-11

The 51st ISRM Online Lecture by Professor Michel Van Sint Jan from Chile is online as of September 11. The topic of the lecture is "Rockbursts: Mechanisms, Hazards, and Engineering Implications".

Prof. Jian Zhao's "Rock Mechanics Principles" course now available in Arabic on the ISRM website 2025-09-19

Prof. Jian Zhao's course "*Rock Mechanics Principles*" was recorded between 2016 and 2020 and has been available for viewing on the ISRM website since its release.

In 2024, Mr. Tareq Albukhari, Lecturer in Rock Mechanics at the University of Tripoli in Libya, requested ISRM's authorization to translate the course into Arabic. His goal was to meet the growing needs of students, researchers, and professionals in the Arab world, while also supporting academic and practical use in universities and scientific institutions. Prof. Jian Zhao welcomed the initiative and promptly authorized the publication of the translation.

The Arabic version is now available on the ISRM website as an e-book. A printed edition will also be produced by Mr. Albukhari for strictly non-commercial purposes.

News
https://about.ita-aites.org/news

ITACET Lunchtime Lecture Series #48 09 September 2025

Join us for the next LLS on September 9!

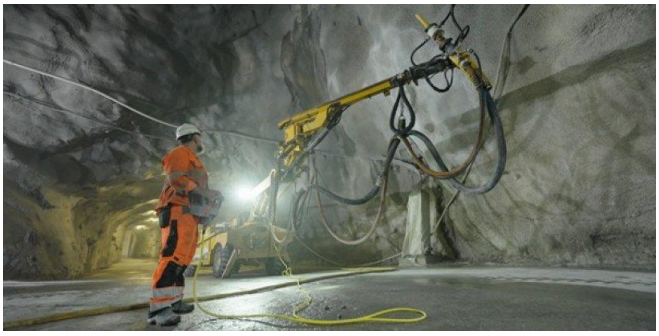
This instalment of the Lunchtime lecture series will focus on **'Unlocking the Underground: Powering Urban Growth and Climate Resilience'** in collaboration with ITACUS.

The episode will feature three lectures and will finish with a Q&A with all speakers. It will begin at 13:00 CET

- Energy Transition and the Potential of the Underground – **Antonia Cornaro, Chair, ITACUS**
- Young Professional Think Deep Programme – Recent YPTDP in Hong Kong – **Petr Salak, Programme Lead, YPTDP / ITACUS**
- Underground Space Use for Climate-Responsive Cities and Regions – **Mahak Agrawal, Urban Adaptation Lead, ITACUS**

Register here: Lunchtime lecture series#48 - ITACET

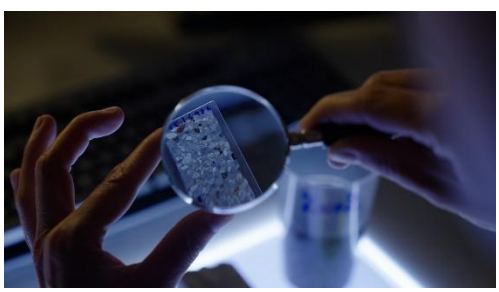
Hagerbach Test Gallery – The Underground Future Lab
22 September 2025



Since January 2025, the ITA Supporter Hagerbach Test Gallery Ltd. (VSH) is recognised by the Swiss government as a research infrastructure of national importance. Founded as a test facility for the construction industry 50 years ago, its activities have been steadily expanded over the years. Today, in addition to its traditional business, it also focuses on underground energy solutions, smart cities and space habitats & safety. The newly obtained recognition allows VSH to act as a competent research partner for academia and industry and to use dedicated funds to upgrade its infrastructure.

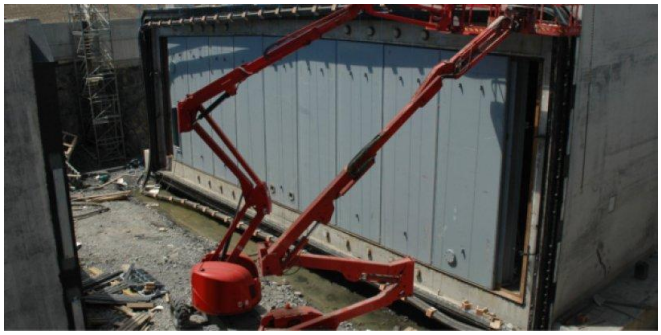
The unique tunnel and cavern infrastructure with over 5 km in length enables research to be conducted close to the application while providing laboratory conditions, both real and virtual. It is further worth mentioning the accredited building materials testing laboratory, which has been offering services and consulting in the field of materials testing as well as supporting research activities related to building materials. Performance of standardised material tests and tailor-made component tests helps the construction industry to make new developments and verify their efficiency through testing. The development of concrete formulations, materials science investigations into UHPFRC, shotcrete, CO2-reduced recipe solutions, 3D concrete printing, rock and fire resistance tests are examples of ongoing activities at VSH. A large-scale concrete mixing plant enable us to monitor and optimise the production processes on a trial basis. In this context, a monitoring method for determining the grading curve during concrete production is currently investigated.

Activities will be expanded towards the areas of sponge cities, underground thermal energy storage, underground food cultivation and underground digitalisation. The obtained recognition allows to act as a research partner in diverse R&D project and to expand and upgrade the existing infrastructure. Together with partners from academia and industry, new construction methods and materials can be developed and prototypes for sustainable technologies can be realised, bringing them a big step closer to application.



VSH as part of AMBERG Group is since decades active in ITA-AITES at various levels in organization, working groups and committee work and pushed Technology and Training efforts to strengthen quality, safety and sustainable underground works.

Trelleborg unveils first EPD for tunnel seals 23 September 2025



ITA Supporter Trelleborg Marine & Infrastructure has released its inaugural Environmental Product Declaration (EPD) for Gina gaskets, becoming one of the first manufacturers to provide third-party verified environmental data for primary tunnel sealing systems. Verified under EN 15804+A2 standards, the EPD delivers cradle-to-grave analysis of the rubber sealing components used in precast segmental tunnel construction. The results show that 51% of fossil emissions arise from material supply, while 34% stem from manufacturing processes – highlighting where interventions can have the greatest impact.

Regulatory momentum drives adoption

EPDs are shifting from optional documentation to mandatory requirements across European infrastructure projects. In the Netherlands, the Dutch Tunnel Strategy 2030 now requires EPDs for all tunnel projects exceeding €50 million, while EU Taxonomy Regulation 2020/852 accelerates standardised sustainability disclosures for construction products.

"EPDs are becoming essential for project approval, tendering and transparent lifecycle decision-making," said Mishra Koushik Kumar, Business Unit Director – Technology and Innovation at Trelleborg Marine & Infrastructure. "This shift represents an opportunity to elevate how infrastructure performance is understood and improved over time."

Beyond carbon metrics

Unlike standard carbon footprint assessments, Trelleborg's EPD encompasses multiple environmental impact categories including resource depletion, ecotoxicity, water use and end-of-life considerations. The analysis incorporates manufacturing data from the company's Qingdao facility, which avoided 1,067 tons of CO_2 emissions in 2023 through solar power initiatives. Gina gaskets have a design life of 120 years, reducing replacement cycles and embedded emissions across the tunnel lifecycle.

Industry standardisation challenges

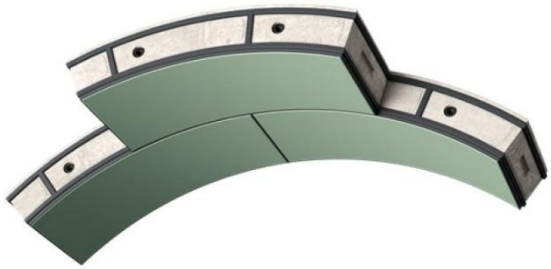
However, quality inconsistencies among EPDs remain problematic, with some relying on secondary datasets or lacking robust third-party verification. To address this, Trelleborg actively supports industry efforts toward standardisation by the European Tunnel Association's Carbon Working Group and the International Tunnelling Association's Working Group 23 on Sustainability in Tunnelling.

"The future of EPDs lies in credibility, comparability and comprehensive methodologies rooted in third-party verified primary data," added Mishra Koushik Kumar.

Trelleborg plans to expand its EPD portfolio and continue working with industry bodies to drive consistency and strengthen lifecycle data quality across the infrastructure sector – helping customers design and deliver more sustainable, resilient tunnel projects through data-driven decision-making.

ISO 14025 Life cycle stages

FAMA: Innovative Solution for Sewer Tunnel 23 September 2025



FAMA: Innovative Solution for Sewer Tunnel

ITA Supporter FAMA has been conducting research to find a solution for the control of the negative impact of aggressive agents in the tunnels of domestic water and wastewater drainage systems.

These tunnels need to be sealed to prevent infiltration and connected to contain displacements and misalignment. They also require measures to protect the concrete from contaminants and aggressive agents such as sulfuric acid and chemical and organic substances. These agents, over time, can damage the tunnel destroying its structure and compromiseing its durability. This can result in significant economic and environmental impacts.

Through FAMA's research, we conceived and designed PROTEX which represents an innovative system for the protection of the segment and hydraulic sealing of tunnels in contaminated environments. A key advantage of this system is that it requires no welding during installation and ensure a faster, safer and more efficient on-site process.

PROTEX consists of an HDPE liner embedded into the intrados of the segment which is integrated to an anchored sealing gasket, thus providing a complete protection and sealing of the segments even along the joints, without requiring secondary activities, which can often be laborious, complex and of uncertain outcome.

Cross Gasket

HDPE Layer

PROTEX also includes a sealing gasket positioned on the extrados which provides, with the gasket positioned on the intrados, a double sealing level and prevents the risk of the surrounding soil erosion in the long term. The use of a double sealing involves the adoption of a cross-gasket to confine infiltrations. This represents a further innovation as the cross-gasket is anchored to the concrete as well. At last, the extrados surface of the segment is protected against external agents by a coating treatment. PROTEX is a solution consisting of five levels of sealing that complete the tunnel lining during the installation phase, thus avoiding all the laborious secondary activities performed until now.

At the same time, construction costs and construction time are reduced and the long-term durability of the work is ensured thanks to the protection of the concrete and to watertightness from inside and outside the tunnel.

Crete's Twin Tunnels Link New Airport to Heraklion 23 September 2025

Construction of the Kasteli twin tunnels on the island of Crete, Greece, was initiated last August by **TERNA S.A.** Each tunnel measures 2.8 km in length and forms part of the new 16 km-long dual-lane motorway that will connect the currently under construction Crete International Airport with the city of Heraklion. Upon completion of construction, the motorway providing access to the airport will be handed over to the Greek state. The entire project, including the new airport that will replace the second busiest airport in Greece and double passenger capacity for Crete, is being implemented through a PPP contract under a concession agreement with shareholders including the Greek state (45.9%), TERNA (32.46%) and GMR Airports Limited (21.64%).

ITA Supporter **EDAFOS Engineering Consultants S.A.** carried out the geological, geotechnical and structural design of the tunnels that are part of the alternative road alignment that was preferred to avoid an adverse morphological terrain along a narrow gorge, to minimise environmental impact and primarily to preserve a Roman aqueduct located in the area and recognised for its substantial cultural value.

Each tunnel has two 3.5m wide lanes, two 0.5m shoulders and two 1m wide pedestrian walkways. The twin tunnels are linked by eight cross-passages spaced at approximately 350 m intervals, whereas two Lay-Bys, 50 m long each, are foreseen per tunnel tube. A conventional tunnel excavation method is being used with excavation diameter that vary between 12.0m and 13.4m depending on the support class.

The tunnels will cross a highly complex geological environment that consists of **limestone** (either from the Tripolis Unit that forms the basement of the area or the overthrusted Pindos Unit) and **flysch-type formations** (mainly associated with the flysch of Tripolis Unit). The largest part of the tunnel is expected to be mined within flysch-type formations (predominantly consisting of silty-sandstones and siltstones). The maximum overburden is approximately 140 m.

A full 3D analysis has been conducted as part of the design to verify the adequacy of the six support classes that were specified along the tunnel alignment. As construction progresses, and in accordance with the monitoring results, the

design is expected to be further optimized utilizing three-dimensional numerical models for back-analysis.

Fit for the Future 23 September 2025

New Agent in the Gulf

Horizons LLC has been officially appointed as the agent and distributor for ITA Supporter F. Willich in the Gulf Cooperation Council region (GCC region). This partnership brings F.Willich's world-class injection technologies closer to regional clients, offering tailored solutions for complex infrastructure projects. F.Willich's resins are versatile, durable, and precise—ideal for civil engineering, tunneling, and mining where waterproofing and sealing matter.

Expanding into Turkey

F. Willich is strengthening its presence in Turkey with a new partnership with **Arden Yalıtım Teknolojileri**, based in Istanbul. The collaboration gives local clients direct access to products and expertise, enhancing support for projects across the region.

Academic Partnership in Uzbekistan

The ITA Supporter also opened the Injection Technology Center at TAQU—Tashkent Architecture and Engineering University. Dean Bakhrom Tulaganov announced that F. Willich will operate on campus to train engineers and technicians in advanced resin applications, supporting complex infrastructure projects such as tunnels, dams, and foundations.

Team Spirit on the Move

This year F.Willich joined the AOK Company Run Dortmund 2025 - more than just running: a celebration of the company's values: teamwork, ambition, solidarity. In team shirts and buzzing with energy, the company team crossed the finish line together.

F. Willich's headquarters have a fresh look: a bright white facade, a new house number, sturdy scaffolding. The colour stays the same, the message is clear: The company is evolving while staying true to our identity. The updated exterior mirrors who the ITA Supporter is: innovative, future-focused, and approachable.

Looking Ahead These milestones are just the start. With strong partners, a dedicated team, and a clear vision, we're building a future grounded in expertise, trust, and forward-thinking solutions. Here's to continued success: **together**.

Guidelines of Selection of Shaft Construction Method 24 September 2025

New Online Publication: *Guidelines for Selection of Shaft Construction Method* *by Working Group 23 – Design & Construction of Shafts*

Working Group 23 (WG23) of the ITA-AITES is pleased to announce the online release of its latest document: ***Guidelines for Selection of Shaft Construction Method***.

Abstract:

Underground structures play a crucial role in both civil and mining engineering. Central to these projects are shafts—vertical or inclined passages that provide essential access to the subsurface and are fundamental to creating and maintaining these subsurface environments. They may provide access during construction of tunnels, facilitate ventilation, or be used in water and waste management.

The wide range of applications of shafts has been described in the document *"Shafts – Definitions and Classifications"* published in April 2021 by WG23 of the ITA. Each of these applications and shafts have different needs and specifications.

Since the size, shape, and depth of shafts are specified depending on project needs and based on the geological and hydrological conditions of the site, it is important to select a suitable method for the safe and economic construction of the structure and to assure the quality of the final structure for safe operation.

This document reviews the different construction methods, discusses the conditions in which they can be applied, and points out the advantages and disadvantages of each method. Charts and diagrams have been prepared that could be used as a tool to help select a suitable method based on site conditions.

Mapei Powers Major Underground Works 24 September 2025

With over 25 years of experience, ITA Prime Sponsor Mapei's Underground Technology Team (UTT) is the ideal partner for underground construction projects, supporting both traditionnal excavation and mechanised techniques. Combining advanced expertise with a focus on sustainable innovation, UTT provides products and technical service for major projects worldwide, including:

• ITALY, Alta velocità Naples–Bari: 145 km of new railway with 7 natural tunnels and several tunnels built using a mechanised system with 8 TBMs

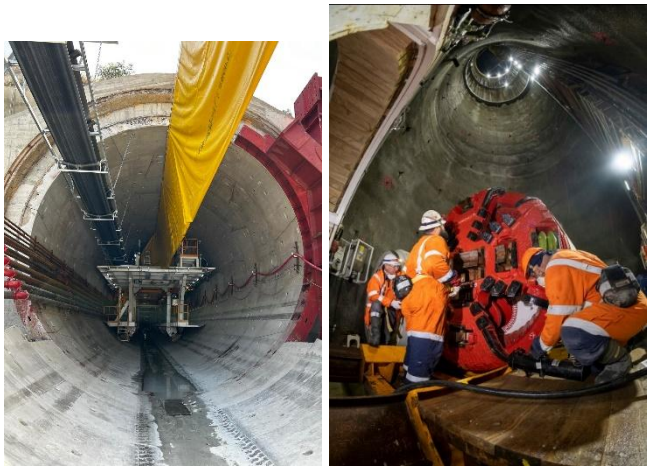
• ITALY, Alta velocità Palermo–Catania and Messina–Catania: part of the Scandinavian–Mediterranean Corridor, with an overall value of more than €11 billion. The project will involve 20 TBMs, of which 5 are currently operating

• ITALY, Terzo Valico dei Giovi: a 53 km high speed railway infrastructure project, 37 km of which will be tunnels. The project includes the construction of the 27 km "Galleria di Valico," which will be the longest railway tunnel in Italy

• ITALY/AUSTRIA, Brenner Base Tunnel: A tunnel system with a total length of 230 km, including the longest section ever excavated with a tunnel boring machine (TBM) through the Alps (14 km)

• INDIA, Ishikesh/Karnaprayag Railway Line: a 125 km Indian Railways project involving major tunnels. In April 2025, Tunnel 8 was completed, becoming the longest railway tunnel in India (14,57 km)

• NEW ZEALAND, Auckland Central Interceptor: the largest wastewater treatment project in New Zealand with a length of 16,2 km



Alta velocità Messina-Catania New Zealand_Auckland

• PERU, Lima Metro: construction of 35 km underground tunnels (27 km for the new Line 2 and 8 km for part of Line 4)

• CANADA, Broadway Subway Project, Millennium Line Extension: twin underground tunnels built using two TBMs with a 6,0 m excavation diameter

Metro Lima

• USA, Los Angeles Effluent Outfall Tunnel: construction of a new 11 km effluent outfall tunnel having a 5,50 m diameter

Following its mission to create sustainable solutions, Mapei has developed the Water Saving Program (WSP). This initiative focuses on optimising water use during mechanical excavation, for EPB TBM projects. By developing innovative soil conditioning products, WSP ensures excellent soil management reducing water consumption (WIR) compared to traditional methods. UTT Mapei products are designed for high performance, low toxicity, and excellent biodegradability and very low ecotoxicology.

More information on our website https://utt.mapei.com/en/home-page

Himalayan Tunnel Breakthrough for Herrenknecht TBMs 26 September 2025

Breakthrough in the Himalayas: Second tunnel boring machine reaches its destination near Rishikesh

A major milestone has been achieved in the Indian Himalayas: in late June, the second Herrenknecht Single Shield Tunnel Boring Machine (TBM) successfully completed its drive for the new railway line between Rishikesh and Karnaprayag. The first machine had already reached its destination in mid-April. With this achievement, both parallel tubes of the more than 20-kilometre-long tunnel system are now complete.

The Himalayas, long considered unconquerable for tunnelling, pose extreme geological challenges. This makes the breakthrough even more significant. Once completed, the new line will cut travel time from seven hours to just over two.

Project owner Rail Vikas Nigam Limited (RVNL) tasked civil contractor Larsen & Toubro Limited (L&T) with building the line's centrepiece — a 10.5-kilometre twin-tube tunnel. L&T deployed two Herrenknecht Single Shield TBMs, each 9,110 millimetres in diameter, specifically designed for Himalayan geology.

Complex geology calls for innovative solutions

The biggest challenge was the predominant rock type phyllite. But to make matters worse, the young, active rock mass is still moving. This can lead to the blocking of the shield skin. To prevent this, ITA Prime Sponsor Herrenknecht integrated torque box cylinders. These allow horizontal and vertical adjustment of the main drive and can increase the excavation diameter by up to 100mm.

In addition, the TBMs are equipped with the Herrenknecht ISP system, sending a surface wave along the tunnel wall, which turns into a spatial wave at the tunnel face. The system records the measurement and excavation data during tunnelling. If an anomaly is detected, further probe drilling is conducted. Additionally, a convergence measurement system continuously analyses the distance between shield and rock.

Impressive advance rates

The sophisticated equipment paid off. In record time, 23 rings were installed in just one day and at peak times one of the machines advanced 39 metres in a day.

With the successful project completion of this project, the experts have proven that modern tunnel boring machines can overcome the extreme conditions of the Himalayas. The project sets a significant precedent for tunnelling projects in this geologically complex region.

MACHINE DATA

› Machine type: 2x Single Shield TBM
› Diameter: 9,110 mm
› Cutterhead drive power: 4,200 kW
› Torque: 24,304 kNm

Working Group 17 visiting Rogfast 30 September 2025

WG17 continues its tradition of on-site learning with a visit to Rogfast in Norway, exchanging safety insights on deep tunnel construction with international experts.

Members of ITA-AITES Working Group 17 visited Norway's Rogfast tunnel, a 26.7 km subsea road tunnel reaching 390m below sea level.

Safety Exchange

The visit provided valuable insights into safety during deep tunnel construction, with contributions from fire brigade experts from France and Norway.

Warm Thanks

Special thanks to working group member, Anne Kathrine Kalager, and to Anne-Merete Gilje, E39 Rogfast Project Manager, for their generous hospitality and support.

We're hiring!!! **Drive Our Brand Forward – Head of Communication** 30 September 2025

Job description

Scooped by ITA-AITES #138, 1 September 2025

Nagdhunga-Sisnekhola tunnel to open from January 2026, authorities say | Nepal

HS2: West London tunnel section completed with 'huge' machines | UK

Tunnelling complete on $2.2 billion bypass | Australia

New Austrian Tunnelling Method: A Conventional Approach For Modern Infrastructure

23.4km tunnel for Azerbaijan

Tunnel boring for Hudson River tunnel project to begin next summer | USA

Innovations and challenges in Lesotho Highlands Water Project Phase II

Davao City Bypass second breakthrough imminent | Philippines

Which companies are bidding for the US$2.3bn highway and tunnel contracts in Brazil?

Montreal Prepares for WTC 2026 | Canada

BRITISH TUNNELLING SOCIETY YOUNG MEMBERS

September Workshop

Smart Tunnel Blasting: Design and Simulation Essentials

Thursday, 18th September 2025, 14:00 - 17:30 (GMT+1)
ICE HQ, 1 Great George St, London SW1P 3AA [in person]

Workshop Information:

Smart Tunnel Blasting: Design and Simulation Essentials is a fast-paced, hands-on workshop that introduces participants to the fundamentals and latest innovations in underground and tunneling blasting.

We'll start by exploring different underground blasting methods, laying the foundation for understanding how strategies must adapt to varying geological and operational scenarios. From there, we'll dive into both classical and modern blast simulation models, as well as explosive products, analyzing how design choices affect performance, overbreak, and tunnel advance.

Participants will work through real-world examples and practical cases, gaining the skills to recognize best practices and avoid common pitfalls in tunnel blasting.

Speaker

Dr. Juan Navarro

Dr. Juan Navarro holds a PhD in Mining Engineering from the Polytechnic University of Madrid (UPM) and a Master's degree in Mining and Tunneling from Montanuniversität Leoben, Austria.

He has worked at MAXAM for the past seven years, where he currently serves as Manager of Modelling and Simulation. His work focuses on the development and implementation of advanced digital tools and algorithms to optimize blasting and mining performance in both surface and underground operations.

Dr. Navarro also leads MAXAM's technological and digital research initiatives in this domain, driving innovation, efficiency, and data-driven decision-making across the mining sector.

He is the author of 10 peer-reviewed journal articles and has presented over 30 papers at international conferences.

Registration Link

INTERNATIONAL GEOSYNTHETICS SOCIETY

www.geosyntheticssociety.org

News

IGS India Releases Case History 'Flipbook' September 7, 2025

A showcase of 50 geosynthetics projects by Indian companies feature in a new digital brochure. Created by IGS India, 'Geosynthetics in India: Case Histories' presents **Read More »**

Best Geosynthetics Papers For 2024 Announced September 9, 2025

The top papers to feature in two respected industry journals last year have been revealed. The annual contest run by Geosynthetics International (GI), the IGS's **Read More »**

IGS Nordic Hosts First Educate the Educators Event September 16, 2025

A hybrid seminar introducing the concepts of geosynthetics to the higher education community in Scandinavia was held for the first time in Spring 2025. IGS **Read More »**

News
https://www.britishgeotech.org/news

Call for Entries for the Fleming Award Competition 2025 01.09.2025

The BGA is pleased to invite entries for the Fleming Competition. This is held annually to commemorate the life and work of Dr Ken Fleming and to recognise excellence in the practical application of geotechnics in a project or a part of a project. Deadline is midnight on 24th October 2025 Read More

The October 2025 issue of Ground Engineering is available on line 10.09.2025

The October 2025 issue of Ground Engineering is available on line. Online access to Ground Engineering (GE) is included in BGA subscriptions. Read More

Dr Ana Sofia Dias presents an ISSMGE Bright Spark lecture in Lisbon 10.09.2025

Dr Ana Sofia Dias presents an ISSMGE Bright Spark lecture at the 5th European Conference on Unsaturated Soils in Lisbon Read More

The BGA Earthworks 2025 Conference was a great sucess! 19.09.2025

The BGA's 4th Biennial Conference Earthworks 2025 took place at the University of Birmingham from 15th to 18th September 2025 Read More

Peter Reading 21.09.2025

The British Geotechnical Association is very sad to hear that Peter Reading has passed away. Read More

News
www.geoinstitute.org/news

How DIGGS and Historic Data Conversions Are Transforming Our Industry 18 Sep 2025

Solving Geotechnical Data's 3 Billion Dollar Georeferencing Crisis: How DIGGS and Historic Data Conversions Are Transforming Our Industry Every day, geotechnical engineers and state transportation departments generate invaluable subsurface data...

(το πλήρες κείμενου του άρθρου δίνεται στην ενότητα ΑΡΘΡΑ)

ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

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

2025 AIGTAS IWLSC 3rd International Workshop on Landslides in Sensitive Clays, September 28th to October 2nd, 2025, Quebec, Canada www.iwlsc2025.ca

GROUND ENGINEERING GEOTECH 2925 Where innovation meets opportunity, 2 October 2025, London, United Kingdom https://www.geplus.co.uk/news/ground-engineering-to-launch-geotech-2025-conference-where-innovation-meets-opportunity-16-01-2025

GEOTECH ASIA 2025 - GEOVADIS: The Future of Geotechnical Engineering, October 7th to 10th, 2025, Goa, India, https://www.geotechasia.org

*f*OMLIG3 FLORENCE 2025 Third Workshop on the Future of Machine Learning in Geotechnics "Ethics and intelligences for a geotechnical Renaissance", October 15-17, 2025, Florence, Italy https://fomlig2025.com

Urban GeoEngineering 5th AsRTC6 "Urban GeoEngineering" Symposium, 23rd & 24th of October 2025, Taipei, Taiwan, www.asrtc6urbangeoengineering2025.com/index.html

6ο Πανελλήνιο Συνέδριο Αντισεισμικής Μηχανικής και Τεχνικής Σεισμολογίας (*6ΠΣΑΜΤΣ*), 30, 31 Οκτωβρίου και 1 Νοεμβρίου 2025, https://6psamts.eltam.org

Med-GU-25 5th Annual Meeting Mediterranean Geosciences Union, 10–13 November 2025 in Athens, Greece, https://2025.medgu.org/index.php

7ο Συνέδριο Αναστηλώσεων, 13-15 Νοεμβρίου 2025, Αθήνα, www.etepam.gr/7o-synedrio-anastiloseon

ORFEUS+EFEHR+EMSC (EPOS Seismology) & Geo-INQUIRE Workshop 2025, 24-27 November 2025, Athens, Greece, https://www.geo-inquire.eu/about/terms-and-conditions, https://docs.google.com/forms/d/e/1FAIpQLSf-LXXy8X-jiEtaCaI_n2VIp7QcM-71TJAY9ZCsPlt8SVNM1Q/viewform

1st International Workshop on Bio-Rock Mechanics
26-27 November 2025, Okinawa, Japan,
https://jiban.skr.u-ryukyu.ac.jp/brm/index.html

The First International Workshop on Bio-Rock Mechanics, one of the ISRM Specialized Conferences, will be held in Okinawa, Japan, from 26 to 27 November 2025, in a hybrid format, both in-person and online.

To unravel the complex interplay between microbial activity in rocks, their mechanical properties, and geo-hazards, deepening our understanding of the novel field of bio-rock mechanics is essential. For example, microbial communities, including bacteria, algae, and lichens, colonize rock surfaces and utilize minerals as sources of nutrients or energy. Their activity can induce chemical and physical breakdown of mineral particles, a process known as microbial weathering. Although the role of microorganisms in chemical weathering is increasingly understood, their relationship with geohazards such as landslides and rockfalls, particularly those occurring without obvious triggers, remains poorly understood.

The workshop aims to explore key themes within bio-rock mechanics, highlighting the significant role this emerging discipline plays in advancing the field of rock mechanics and fostering international collaboration. Topics for discussion include:

- T1. Bioremediation and biodegradation of rock materials. Studies, including literature reviews, on methods for repairing cracks through the use of microorganisms, and research on the relationship between rock weathering and biological processes, as well as various parameters affecting the rate of weathering.

- T2. Bioerosion of rock materials. Studies, including literature reviews, on physical and/or chemical erosion of materials by organisms. For example, the physical and/or chemical breakdown of rock materials by organisms such as shells, insects, corals, and others.

- T3. Utilization of biomarkers for assessing crustal movements and their utilization of implications on tectonics. Studies, including literature reviews, on methods for evaluating crustal movement using the remains and traces of organisms, such as fossils, as indicators/bio-markers.

- T4. Evaluation of the internal structure of rocks affected by organisms. Studies, including literature reviews, on methods for evaluating and analyzing various surveys and experimental results, such as X-ray image analysis and simulations.

For more information visit the conference website. Interested participants are welcome to join. To register go to the registration area.

17th International Conference on Geotechnical Engineering 8th International Symposium on Geohazards, December 4-5, 2025, Lahore, Pakistan, https://17icge-8isg.com

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The Fifth International Conference on Rock Dynamics and Applications (RocDyn-5)
15-17 Jan 2026, Singapore
https://rocdyn.com

The series of RocDyn conferences was first launched in Lausanne, Switzerland in 2013, followed by RocDyn-2 in Suzhou, China in 2016, RocDyn-3 in Trondheim, Norway in 2018, and RocDyn-4 in Xuzhou, China in 2022.

Rocdyn-5, a specialized conference under International Society for Rock Mechanics and Rock Engineering, invites all professionals involved in rock dynamics research and engineering to gather in Singapore in 2026. This conference will cover a wide scope of topics on the dynamic behaviors of rock materials and rock masses, along with their applications in rock engineering. RocDyn-5 will empathize the theme "Towards Resilience Frontiers", addressing the challenges of induced geohazards that have recently hindered underground space creation and unconventional resource development, while striving to promote the sustainable advancement of rock engineering.

RocDyn-5 will introduce a Young Researcher Plenary Session to highlight outstanding works on rock dynamics and applications by young researchers.

- The nominated young researcher must be the sole or lead author of a submitted abstract. Self-nomination is welcome.
- Nomination package should include the submitted abstract and a nomination statement (no more than 200 words and/or representative publications), to be sent to rocdyn5@gmail.com by 31 August 2025.
- Nominees must be 38 years old or younger as of 15 January 2026.
- Selected young researchers must attend RocDyn-5 to deliver their presentations. Selected young researchers will be entitled to the student registration fee, regardless of their current status, and will receive a certificate of recognition.

The advisory committee will select up to four young researchers based on the innovation and significance of their submitted abstracts and nomination statements.

RocDyn-5 Organizing Committee
email: rocdyn5@gmail.com

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3rd Annual Conference on Foundation Decarbonization and Re-use
March 24-26 2026, Amsterdam, The Netherlands
https://foundationreuse.com

The construction industry, including the deep foundation industry, significantly contributes to the CO2 emissions. As sustainability becomes increasingly crucial, our profession must take proactive steps to reduce our carbon footprint.

Decarbonization is a vital strategy, focusing on more efficient designs that reduce the volumes of concrete and steel used, and incorporating materials with lower carbon footprints. However, we must also prioritize the reuse of existing foundations as the most sustainable option.

3rd edition of the Conference on Foundation Decarbonization and Re-use

Following the success of our initial conferences in March 2023 and May 2024, we are excited to announce the 3rd edition of the Conference on Decarbonization and Re-use of Foundations. This event will take place in Amsterdam, The Netherlands, in March 2026.

Conference topics

In this third edition, we aim to delve deeper into various aspects of foundation decarbonization and reuse. Our conference will feature four sessions focusing on:

- Session 1: The decision-making process regarding foundation decarbonization and reuse
- Session 2: The inspection and testing of existing foundations to assess their suitability for reuse
- Session 3: The design process when foundations are decarbonized or reused
- Session 4: The construction phase when foundations are decarbonized or reused

Each session is introduced by a keynote speaker, followed by the presentation of research papers from experts around the world. The sessions conclude with an extended Q&A session, encouraging active participation and discussion.

One-day site-visit

On the third day of the event, attendees will have the opportunity to visit job sites in and around Amsterdam where foundation reuse is being implemented. These site visits aim to provide practical insights and firsthand experiences of sustainable foundation practices.

Stay Connected

To keep up to date on conference highlights, visit **www.foundationreuse.com** and subscribe to the **conference newsletter**.

Follow our **LinkedIn page** to stay up to date on the latest news about the conference as well as other events and news on topics related to the foundation decarbonization and reuse.

Contact: info@foundationreuse.com

PMGEC LEBANON 2026 Pan Mediterranean Geotechnical Engineering Conference, 25 - 28 March 2026, Phoenicia Bei-rut IHG, Lebanon https://pmgec-leb.com

www.tunirock2026.com

On behalf of the organizing committee, I am delighted to invite you to participate to the International Conference on Advances in Rock Mechanics (TuniRock 2026) to be held in Hammamet, Tunisia, on April 09-12, 2026.

This Conference aims at bringing together researchers and engineers around the most recent advances in Rock mechanics and Rock engineering applications. The exciting program that the Tunisian Society for Rock Mechanics prepared includes technical and scientific sessions, keynote lectures, one-day workshops and technical field trips. We believe that you will also enjoy participating to post-Conference excursions in the region.

The participants will have a chance not only to discuss technical issues but also to socialize during the conference dinners and discuss future events. The attendance of experts in rock mechanics will result in formation of a very strong technical program on Rock mechanics advances and will also provide guidance for the next conferences.

THEMES

- Rock Mechanics and Rock Mass Behavior
- Geological and Earth Sciences
- Site Investigations, Monitoring, and Modeling
- Engineering Applications and Resource Development

International Conference on Geotechnics, Civil Engineering and Structures (CIGOS) 2026 Innovation in Planning, Design and Civil Infrastructure for Resilient and Sustainable Transformation, April 16 & 17, 2026, Ho Chi Minh City, Vietnam https://cigos2026.sciencesconf.org

LANDSLIDES 2026 Landslide Geo-Education and Risk (LaGER), 27 April - 1 May 2026, Queenstown, New Zealand http://landsliderisk.nz

15th International Conference "Modern Building Materials, Structures and Techniques", May 12-15, 2026, Vilnius, Lithuania, https://vilniustech.lt/332107

ITA-AITES WTC 2026 World Tunnel Congress, May 15 to 21, 2026, in Montreal, Quebec, Canada, https://wtc2026.ca

94th Annual Meeting & International Symposium on Large Dams - Water, Energy and Society: The Evolving Role of Dams in a Changing World, May 21 to 29, 2026, Guadalajara, Mexico, www.icoldmexico2026.com

ICPMG 2026 Physical Modelling in Geotechnics, 8–12 June 2026, ETH Zürich, Switzerland, https://tc104-issmge.com/icpmg-2026

8th International Young Geotechnical Engineers Conference - 8iYGEC, 11. - 14. June 2026, Graz, Austria, www.tugraz.at/institute/ibg/events/8iygec

21st International Conference on Soil Mechanics and Geotechnical Engineering Geotechnical Challenges in a Changing Environment, 14 – 19 June 2026, Vienna, Austria, www.icsmge2026.org/en

3rd International Geotechnical Innovation Conference - Shaping the World Beneath: Fostering Sustainability, Innovation and Resilience in Geotechnics, 15 - 16 June 2026, Jed-dah, Saudi Arabia, https://geotechnicalinnovationconference.com Email info@creativeconnectionevents.com

ICONHIC 2026 International Conference on Natural Hazards & Infrastructure, 29 June – 2 July 2026, Chania, Greece https://iconhic.com/2026

ISFMG 2026 12th International Symposium on Field Monitoring in Geomechanics, 06 -10 August 2026, Indian Institute of Technology Indore, India, https://sites.google.com/view/isfmg2026/home

Soft Soils 2026 International Conference on Advances and Innovations in Soft Soil Engineering 2026, 24-26 August 2026, Delft, Netherlands https://softsoils2026.dryfta.com

X Latin American Congress on Rock Mechanics 26 - 28 Aug, 2026, Brasilia, Brazil, https://larms2026.com

13 ICG - 13th International Conference on Geosynthetics (13 ICG), 13-17 September 2026, Montréal, Canada, www.13icg-montreal.org

Eurock 2026 Risk Management in Rock Engineering - an ISRM Regional Symposium, 15-19 September 2026, Skopje, Republic North Macedonia, https://eurock2026.com

ECEE2026 18th European Conference on Earthquake Engineering Shaping the Future of Earthquake Engineering, 14 – 18 September 2026, Berlin, Germany, https://ecee2026.eu

https://eurock2026.com

On behalf of MAG, it is our honor to invite the global ISRM community, including rock mechanics professionals' accompanying persons, to the **ISRM Regional Symposium – EUROCK 2026**, taking place from **September 15–19, 2026, in Skopje, N. Macedonia**.

We warmly welcome academics, researchers, and professionals from around the world to join us for this important event! The symposium will address the growing challenges in rock engineering, particularly in complex ground conditions, urban environments, and near critical infrastructure, while also considering environmental concerns.

The central theme will be **Risk Management in Rock Engineering**, with a focus on innovations and applied research. The program will feature global case studies, cutting-edge technologies, and interdisciplinary discussions. Our aim is to foster collaboration among engineers, researchers, designers, consultants, and academics in rock mechanics and engineering.

In addition to technical sessions, the symposium will include short courses, workshops, industrial exhibitions, and technical tours. Rockbowl competition, paper and poster contests for young researchers and students will be organized, while separate programs are planned for accompanying guests. Thus, the delegates will have opportunity to also enjoy social events, gala dinner, and guided tours showcasing Skopje's charm and North Macedonia's rich cultural heritage and natural attractions.

We look forward to welcoming the ISRM family to Skopje in September 2026!

Conference Theme

The proposed full title of the symposium is **2026 ISRM International Symposium – EUROCK2026 "Risk Management in Rock Engineering".** The theme is considered to be of high interest to the ISRM members and wider, as it covers the framework and principles in rock engineering that are necessary to achieve high quality rock engineering structures. Provisional Symposium themes are the following: (but not limited to)

- Risk assessment methods
- Rock properties, testing methods and site characterization (incl. planetary rock mechanics)
- Design methods and analysis (incl. EC 7)
- Rock dynamics, crustal stress and earth/marsquakes
- Rock mechanics related to environmental and mining engineering
- Implications of climate change on rocks and rock engineering projects
- Geotechnical aspects of soft rocks and hard soils
- Rock mechanics for cultural heritage
- Artificial Intelligence and Machine Learning in Rock Mechanics and Rock Engineering.
- Case histories
- Rock Mechanics education and training

RockBowl at EUROCK 2026

We are excited to announce that the popular RockBowl competition, sponsored by Geobrugg, will be held during EUROCK 2026 in Skopje. RockBowl is a fun and challenging quiz tournament designed for young rock engineers and scientists, testing both technical knowledge and general understanding of rock mechanics and rock engineering. More details about the competition format, registration, and prizes will be available soon.

This edition of RockBowl is exclusively sponsored by Geobrugg. https://www.geobrugg.com/en/Geobrugg-Safety-is-our-nature-114435.html

International Symposium Preservation of Monuments & Historic Sites, 16 – 18 September 2026, Athens, Greece https://tc301-athens.com

6th International Conference on Information Technology in Geo-Engineering JTC2 Conference, 13-16 October 2026, Graz, Austria, www.icitg2026.com

EWRWSE – 2026 7th International Conference on Environmental Geotechnology, Recycled Waste Materials and Sustainable Engineering, 22-25 October 2026, Surat, Gujarat, India www.egrwse2026.com

SLOPE STABILITY 2026 Slope for Safety Performance an ISRM Specialized Conference, 26 – 29 October 2026, Lima, Peru www.slopestability2026.com/en

PBD-V Chile International Conference on Performance-Based Design in Earthquake Geotechnical Engineering, November 4th to 6th, 2026, Puerto Varas, Chile www.pbd-v-chile.com

ARMS 14 Fukuoka 2026 - 14th Asian Rock Mechanics Symposium Rock Mechanics for the Next Generation –Innovations, Sustainability, and Resilience– an ISRM Regional Symposium, 22-26 November 2026, Fukuoka, Japan, www.ec-convention.com/ARMS14/

16th International Congress on Rock Mechanics Innovations in Rock Mechanics and Rock Engineering for a Sustainable Future
17-23 October 2027, Seoul, Korea

Dear colleagues, researchers, and friends in the field of rock mechanics and rock engineering,

It is our great honor and pleasure to invite you to the 16th

International Congress of the International Society for Rock Mechanics and Rock Engineering (ISRM 2027), to be held in Seoul, Korea, from October 17 to 23, 2027.

Under the theme **" Innovations in Rock Mechanics and Rock Engineering for a Sustainable Future,"** ISRM 2027 will provide a unique platform to share cutting-edge research, innovative technologies, and practical experiences that transcend disciplines, industries, and generations. In addition to traditional topics in rock mechanics, the congress will highlight emerging areas that integrate advanced technologies such as artificial intelligence, big data, and the Internet of Things (IoT).

We believe that ISRM 2027 will foster deeper academic exchange, enhance collaboration between academia and industry, and explore sustainable solutions for future challenges.

Seoul, the vibrant capital of Korea, is a city where ancient history meets modern innovation. We warmly invite you to experience not only the intellectually stimulating program, but also Korea's rich culture and hospitality.

We sincerely look forward to welcoming you to Seoul in 2027 for a memorable and inspiring congress.

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.

ISRM 2027 Secretariat: People-x, Inc.
1F, Haeoreum B/D 16, Yeoksam-ro 17 gil, Yeoksam-dong,
Gangnam-gu, Seoul 06246, Korea
Tel. +82-2-566-6031
Fax. +82-2-566-6087
Email. info@isrm2027.com

Eurock2028 - Advances in rock mechanics and rock engineering to cope with increasingly extreme conditions - an ISRM Regional Symposium

25 - 30 Jun, 2028, Aix-en-Provence, France

XIXth European Conference on Soil Mechanics and Geotechnical Engineering "Connecting Continents Through Geotechnical Innovations"

04-08 September 2028, Istanbul, Turkey

Conference Topics

01 Modelling and Experimental Assessment of Geomaterials
02 Geohazards, Earthquakes and Risk Mitigation
03 Development of Resilient and Sustainable Geosystems
04 Geotechnical Construction and Soil Improvement
05 Geotechnical Engineering of Multiscale Observations, Sensors and Monitoring
06 Energy Geotechnologies
07 Technological Innovation
08 Geo Education, Standards And Codes

Contact

R. Duzceer
(President of Turkish National Society for ISSMGE)
irduzceer@gelisim.edu.tr

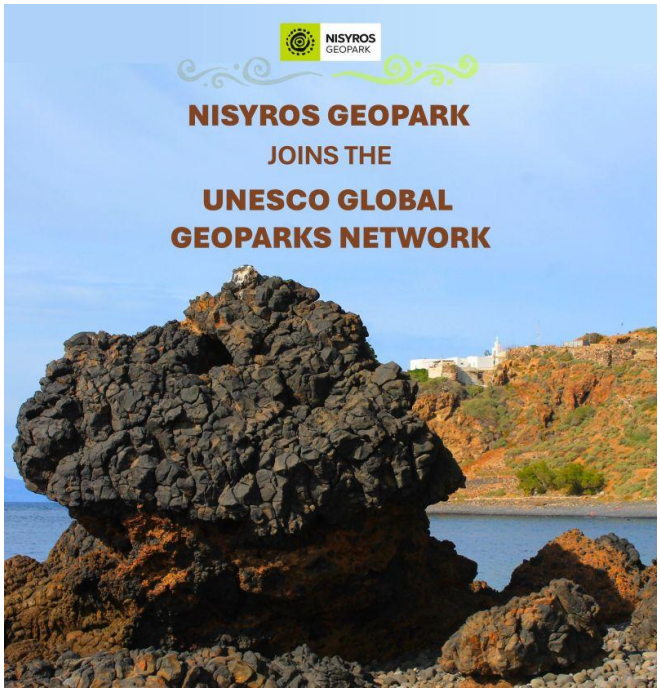
ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

Massive 50-meter sinkhole swallows road in Bangkok

A road collapse in central Bangkok has produced **a sinkhole approximately 50 meters deep** and covering some 900 square meters, disrupting traffic, damaging infrastructure, and prompting evacuations in the affected area. Initial efforts to repair the sinkhole were paused due to **partially leak of injected cement to into the tunnel beneath the road-way**. Engineers now decided to use only sand instead of a sand-cement mix. The change is intended to prevent compli-cations with future subway works in the area.

(Geoengineer.org Weekly Newsletter, September 30, 2025, https://www.linkedin.com/pulse/geoengineerorg-weekly-newsletter-geoengineer-org-iy7rf)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΓΕΩΛΟΓΙΑ



Η Νίσυρός μας γιορτάζει μια ιστορική στιγμή: το Nisyros Geopark - Γεωπάρκο Νισύρου εντάσσεται και επίσημα στο Δίκτυο των Παγκόσμιων Γεωπάρκων της UNESCO
Global Geoparks Networks

Το 10ο Παγκόσμιο Γεωπάρκο της UNESCO στην Ελλάδα είναι το ενεργό ηφαίστειο της Νισύρου όπου μαζί με τις τριγύρω βραχονησίδες (Περγούσα, Παχειά, Κονδελιούσα, Στρογγύλη) και τον θαλάσσιο χώρο αποκτούν διεθνή αναγνώριση για τον ξεχωριστό γεωλογικό τους πλούτο, την πολιτισμική τους κληρονομιά κ τη μοναδική τους βιοποικιλότητα (NATURA 2000).

Με αίσθημα ευθύνης, ομαδική δουλειά και άριστη συνεργασία με τη Διαχειριστική αρχή του Γεωπάρκου Δημοτική Κοινωφελής Επιχείρηση Νισύρου - ΔΗΚΕΝ κ τον Δήμος Νισυρίων τα καταφέραμε!!!

Το γεωπάρκο της Νισύρου είναι οι κάτοικοί του!!!!

Οι άνθρωποι που ζουν σε αυτόν τον ευλογημένο τόπο όπου ο παλμός του πλανήτη μας χτυπάει κάτω από τους κρατήρες και η ιστορία του νησιού είναι άρρηκτα συνδεδεμένη με τη γεωλογική του εξέλιξη!!

Ως Επιστημονική Υπεύθυνη του Γεωπάρκου σας ευχαριστώ ΟΛΟΥΣ από καρδιάς!!!!

Το ηφαίστειο του διδακτορικού μου και ο θαλάσσιος χώρος που μελετάμε τόσα χρόνια από το National & Kapodistrian University of Athens Τμήμα Γεωλογίας και Γεωπεριβάλλοντος αποκτούν μια θέση στα Παγκόσμια Γεωπάρκα της UNESCO!!

Και φυσικά έχουμε δεσμευτεί να συνεχίσουμε να προσφέρουμε τις γνώσεις μας, να βελτιώνουμε τις συνθήκες επισκεψιμότητας, να δημιουργούμε καινοτόμες εφαρμογές, να προστατεύουμε το περιβάλλον, να εμπνέουμε και να εκπαιδεύουμε τη νέα γενιά, να είμαστε όλοι μαζί για το Γεωπάρκο μας!!

Συνεχίζουμε…

Paraskevi (Evi) Nomikou • Professor at National & Kapodistrian University of Athens https://lnkd.in/dZiZKTJK

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΠΕΡΙΒΑΛΛΟΝ

Kinneret Lake replenished with desalinated water in world-first project

The initiative, known as the "Reverse Carrier," mirrors the National Water Carrier inaugurated in 1994, which transported Kinneret water to the center and south of the country.

Desalinated water flows into Israel's "reverse" water carrier. Photo by Itai Dodi, (photo credit: Israel Water Authority/TPS-IL)ByPESACH BENSON/TPS, SVETA LISTRATOV/TPSSEPTEMBER 21, 2025 12:04

For the first time anywhere in the world, desalinated seawater is being pumped into a freshwater lake, as Israel begins transferring Mediterranean water into the Sea of Galilee, also known as the Kinneret, in an unprecedented project described by officials as a safeguard for the country's water security.

"The Kinneret is our national reservoir. Israel does not have many natural water sources, so this lake is of tremendous importance – both emotionally and strategically. Historically it has been a vital source of drinking water, and even today it remains a strategic national water reserve," Israel Water Authority Director General Yechezkel Lifshitz told The Press Service of Israel.

The initiative, known as the "Reverse Carrier," mirrors the National Water Carrier inaugurated in 1994, which transported Kinneret water to the center and south of the country.

"The project we are now operating is essentially the reverse of the National Water Carrier: instead of sending water from the Kinneret to central Israel, we are conveying desalinated seawater from the Mediterranean into the Kinneret, along the same route but in the opposite direction," Lifshitz explained to TPS-IL.

Construction began in 2018, and the project was inaugurated in 2022 at a cost of roughly NIS 900 million ($269 million). It has now reached full-scale operation following the driest winter in a century.

According to the Water Authority, the desalinated water is being channeled into the Kinneret through the Zalmon Stream in a continuous year-round flow that also revives a once-dry streambed.

"During the winter months the flow is increased, and afterwards it drops to about 1,000 liters per second," Lifshitz said. He added that if rainfall is unusually strong, pumping may be temporarily reduced or halted.

By late October or early November, the Water Authority expects to be moving up to 5,000 cubic meters of desalinated water per hour, amounting to tens of millions of cubic meters throughout the autumn and winter months. The water travels 100 to 150 kilometers from desalination plants in Ashdod, Hadera, and other coastal sites.

A view of Lake Kinneret (credit: TOURISM MINISTRY) "Although the project was inaugurated about a year and a half ago, full-scale pumping began only now because of the severe drought. The past winter was the driest in the last hundred years, and the Kinneret dropped to what we call the 'red line' – a level we are not willing to cross," Lifshitz said.

The innovation lies in the concept.

"The desalination technology itself is not new; the innovation lies in the concept. We view nature not only as a supplier of water but also as a consumer of water. This is a unique approach: actively providing water back to nature from our desalination facilities," Lifshitz told TPS-IL.

He stressed that the desalinated water is of higher quality than the lake's natural water in terms of salinity and other parameters, with no expected negative environmental impact.

"This project was conceived with a long-term perspective. We anticipate a decline in rainfall across the Middle East, particularly in northern Israel. Therefore it is essential to maintain a high water level in the Kinneret to preserve it both as a natural asset and as a strategic national reservoir. Israel's water sector plans decades ahead; we already have a master plan extending to the year 2075," Lifshitz said.

Pumping desalinated water into freshwater lakes has rarely been attempted due to significant ecological, technical, and economic challenges. Freshwater ecosystems are delicate, and even clean desalinated water can alter salinity, pH, and nutrient balances, potentially disrupting fish, plants, and microorganisms.

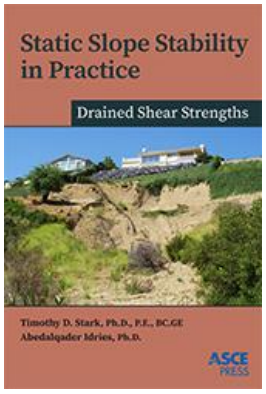
Delivering the large volumes required over long distances is technically complex, demanding extensive pipelines, pumping stations, and flow-control systems. On top of this, desalinated water is expensive to produce, making its use for lake replenishment historically seen as economically inefficient compared with supplying drinking water or agriculture.

The lake's largest natural inflow comes from the Upper Jordan River, whose main sources are the Hasbani, Dan, and Banias rivers, which originate in the Upper Galilee and Golan

Heights. These rivers are fed by rainfall and local groundwater. At the southern tip of the lake, the Jordan River continues toward the Dead Sea.

(PESACH BENSON, SVETA LISTRATOV / THE JERUSALEM POST, SEPTEMBER 21, 2025, https://www.jpost.com/environment-and-climate-change/article-868221)

ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ



Static Slope Stability in Practice: Drained Shear Strengths

Timothy D. Stark, Ph.D., P.E., BC.GE, and Abedalqader Idries, Ph.D.

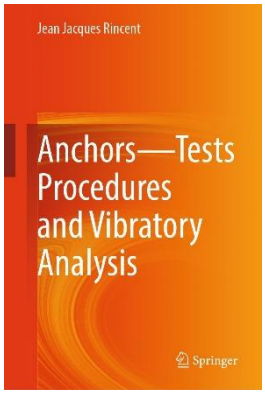
Static Slope Stability in Practice: Drained Shear Strengths provides a comprehensive walkthrough on drained stability analyses and the practical application of drained soil shear strengths for both natural and engineering slopes, highlighting the mechanisms underlying the behavior of slopes under static and rainfall-induced conditions to help engineers understand why different types of drained shear strength matter and how they impact slope stability.

Topics include

- Causes of slope stability,
- Types of slope movement,
- Two-dimensional static equilibrium stability models,
- Conducting slope stability analyses,
- Factor of Safety, uncertaintiy, and probability of failure,
- Three-dimensional static slope stability analyses,
- Drained and undrained shear strengths,
- Development of Fully Softened Strength,
- Fully Softened Strength measurement and application,
- Drained shear strength examples,
- Residual strength empirical correlations,
- Geosynthetic lined slopes,
- Slope investigations,
- Remote sensing for monitoring slopes, and
- Impact of climate change on slope stability.

Authors Timothy D. Stark and Abedalqader Idries compiled this book as a reference for students, practicing engineers, and academics using both theoretical concepts and real-world applications to improve slope stability analyses to strengthen geotechnical engineering practices worldwide.

(American Society of Civil Engineers, 2025 / 480 pp.)



Anchors—Tests Procedures and Vibratory Analysis

Jean Jacques Rincent

This book follows: Ground Anchors: Tension Force Vibratory Analysis JJ Rincent Springer Sept 2024.

This new book is a summary of experience gained from the analysis of over 24 000 test curves obtained from 3000 ground anchors analysis.

It provides practical feedback on the complexity of non-destructive testing. The test equipment, the rules to obtain interpretable acquisition results. The examples come from trials carried out in Brazil over the last 5 years and finally, the test methodology adopted for this experiment. These tests are generally carried out on ground anchors using strands as reinforcement or rebars several decades old. Information on their length and initial tension force is often non-existent after 40 years. That's why these vibration analysis tests provide the answers and information needed for stability and maintenance diagnostics.

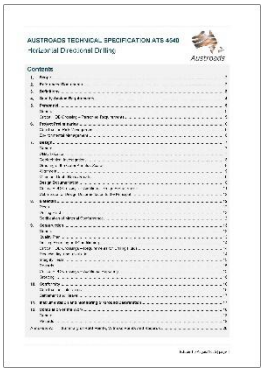
The examples chosen concern ground anchors equipped with bars, strands and also for nails, passive ground anchors and micro piles Tests on prestressed dowels are described, and a test on a reinforcing bar linked to the construction of an early 16th century castle will be carried out.

As a reminder that these tests results lead to define the total length of the tie bar, the free length, the diameter of the tie bar, i.e. the reinforcement with its cement grout, and finally the tension force at the time of testing. These data are essential for assessing the stability of retaining walls stabilised by tie rods.

It should be stated that static tests, which are difficult to carry out at height, provide no information on lengths and run the risk of breaking old tie rods. All the tests carried out are used to construct the test method that can be adopted, taking into account the feedback acquired from thousands of static tests. For retaining structures and tie rods in particular, access to the head of the tie rods must be preserved in order to: - carry out inspection tests - re-tension the tie rods, if necessary - while protecting them from corrosion. Meeting these conditions means implementing sustainable maintenance of the structures.

This test method is a diagnostic tool for ground anchors used by managers of retaining structures to design maintenance projects. The final aim is to increase the durability of the retaining structures. The tests proposed and explained using numerous examples and finally to propose a methodology for carrying out vibration analysis tests on ground anchors, as well as a framework for their interpreta-tion.

(Springer, 2025, https://link.springer.com/book/10.1007/978-981-96-3777-5)



Horizontal Directional Drilling

Edition: 1.0

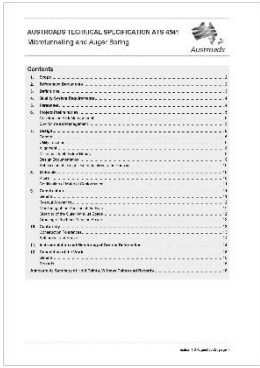
Publication no: ATS-4540-25

Austroads Technical Specification ATS 4540 sets out the requirements for the installation of pipes using Horizontal Directional Drilling (HDD). The pipes may be for the purpose of moving fluids or gases or for the protection of telecommunications/electrical cables.

PDF (free) Download

The technical specification can also be downloaded as a Word document.

(Austroads, Published: 2 September 2025)



Microtunnelling and Auger Boring

Edition: 1.0

Publication no: ATS-4541-25

Austroads Technical Specification ATS 4541 sets out the requirements for the installation of pipes by Microtunnelling or Auger Boring, which are types of trenchless technology that are launched from an excavated pit. The pipes may be for the purpose of moving fluids or gases or for the protection of telecommunications/electrical cables.

PDF (free) Download

The technical specification can also be downloaded as a Word document.

(Austroads, Published: 2 September 2025)

ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ

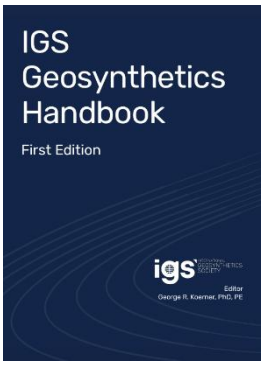
ISRM Newsletter No. 71 - Autumn 2025
https://isrm.net/newsletter/show/266

Κυκλοφόρησε το ISRM Newsletter No. 71 – Automn 2025, με τα ακόλουθα περιεχόμενα:

- Call for Papers: ARMS14 – 2026 ISRM International Symposium, Fukuoka, Japan, November 2026
- 51th ISRM Online Lecture delivered by Prof. Michel Van Sint Jan
- 50th ISRM Online Lecture delivered by Prof. Hehua Zhu
- ISRM Regional Symposium – LARMS2026 – Brazilia, Brazil, 26-28 August 2026
- ISRM Regional Symposium – EUROCK 2026 – Skopje, N. Macedonia, 15–19 September 2026
- "Evert Hoek - And the Future of Rock Engineering" by Professor Charles Fairhurst
- 1990 reconstituted lecture by Evert Hoek at the University of Leeds now on the ISRM website
- Prof. Jian Zhao's "Rock Mechanics Principles" course now available in Arabic on the ISRM website
- 17th ISRM Young Members' Seminar Series on 8 July
- Short course on Rock Engineering for Deep Geological Disposal by Dr Nick Barton
- 5th "Short-term prediction of rock failure" competition
- 1st International Workshop on Bio-Rock Mechanics – Okinawa, Japan, 26-27 November 2025
- RocDyn-5 – 15-17 January 2026, Singapore
- TuniRock 2026 – Hammamet, Tunisia, 9-12 April 2026
- LaGER 2026 – Queenstown, New Zealand, 27 April-3 May 2026
- 6th ICITG – Graz, Austria, 13-16 October 2026
- Slope Stability 2026 – Lima, Peru, 26-29 October 2026
- ISRM Rocha Medal 2027 – nominations until 31 December
- ISRM Sponsored Conferences

September 2025

IGS Handbook Launch!



The long-awaited **IGS Geosynthetics Handbook** is now available to buy. A one-stop technical reference guide suitable for all levels of experience in geosynthetics. The handbook offers a concise yet comprehensive summary of the fundamental applications of geosynthetics and is an essential reference guide for student, instructor or civil engineering professional alike.

Non member price: $200 USD
Member price: $150 USD

IGS Chapters can access a bulk buy discount of 30 copies or more at $75 USD per copy, for this option only, contact igs-sec@geosyntheticssociety.org.

Get Your Handbook Today

Reflecting on EuroGeo8

On September 15-18 2025 hundreds of people from the global geosynthetics community converged in Lille, France for EuroGeo8. Sessions addressed a broad spectrum of topics including sustainability, Circular Economy, environmental performance, durability, hydraulic and infrastructure applications with long-term resilience in mind.

The keynote presentations set the tone for an engaging program, sparking discussion and insight throughout the conference. During the multi-day event we heard from Enrico Benetto, Nicola Moraci, Daniela Felletti, Arnstein Watn and Laurent Briançon.

Alongside the technical program, memorable social events fostered connections and strengthened the global geosynthetics community. A sincere thanks to the organizers, speakers and participants for making EuroGeo8 a success!

IGS at Industry Events

During September, the IGS attended the Environmental Services & Solutions Expo and met clients and local authorities on sustainable reuse and liner solutions.

Next we'll be heading to HYDRO, Thessaloniki (22–24 Oct 2025) and Tailings & Mine Waste, Banff (2–5 Nov 2025). Come and find us to discuss geosynthetics for dams, reservoirs, water retention and tailings containment. Thank you to our Premium Corporate Members for supporting the IGS in attending these insightful events and helping us expand awareness of how geosynthetics contribute to resilient, cost-effective and sustainable infrastructure.

Research News

The Best Geosynthetics Papers for 2024 have been announced. The annual contest run by Geosynthetics International (GI), the IGS's official journal, and the Geotextiles and Geomembranes (G&G) journal aims to highlight outstanding new research or developments that advance the understanding of the geosynthetics discipline. Find the winning papers by visiting our website.

Educate the Educators

We conclude our celebration of its first decade by taking a look at EtE's global reach, hearing from some of its contributors, and learning how EtE may evolve with new technologies. Read the full article on our website.

IGS Chapter News

IGS India has created a flipbook, Geosynthetics in India: Case Histories, which presents a comprehensive cross-section of 50 geosynthetics projects by Indian companies, including reinforced soil walls and erosion control projects, to coastal protection and landfill linings. Each two-page listing summarises the project, the geosynthetics solution, and imagery. Read the full article on our website.

IGS Nordic held its first Educate the Educators in Spring 2025, the Chapter held a series of talks both online and in person, in Lund, Sweden. Topics included filter geotextiles, landfill structures, and reinforcement. Read the full article on our website.

Governance News

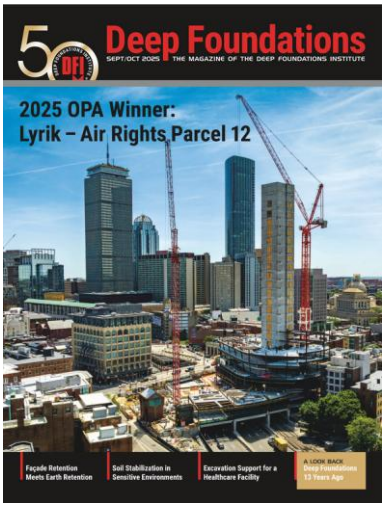
In October 2025, we will be opening nominations for the IGS Council and the positions of President and Vice President, for terms beginning in September 2026.

We will send all members an email to notify you once the nominations are formally open. We will also post updates on social media and via this newsletter. Nominations will close in December, and all members will have the opportunity to vote early in the new year. Results will be announced no later than 1 May 2026.

Upcoming Events

Explore the upcoming IGS events, industry events we will be attending and events delivered by IGS Chapters.

- **22–23 Oct 2025 Geosintec 4**, Madrid, Spain, Event page
- **22–24 Oct 2025 HYDRO**, Helexpo, Thessaloniki, Greece Event page
- **2–5 Nov 2025 Tailings & Mine Waste**, Banff, Alberta, Canada Event page
- **17–20 Nov 2025 ISO/TC 221 Meeting**, Rio de Janeiro, Brazil Event page
- **04–06 Feb 2026 ASTM D35 Meeting**, Atlanta, Georgia, USA Event page
- **30 Jun–02 Jul 2026 CEN TC 189 Meetings**, Copenhagen, Denmark Event page
- **13–17 Sep 2026 13th International Conference on Geosynthetics**, Montreal, Canada Event page



www.nxtbook.com/dfi/DEEP-FOUNDATIONS/september-october-2025

Κυκλοφόρησε το τεύχος Σεπτεμβρίου / Οκτωβρίου 2025 του περιοδικού Deep Foundations με τα ακόλουθα περιεχόμενα:

Highlights of the Sept/Oct Issue

Welcome to DFI50 from Conference Chair John Wolosick

Cover Story — 2025 OPA Winner: Lyrik – Air Rights Parcel 12

Façade Retention Meets Earth Retention: An OPA Honorable Mention

Environmental Challenges Meet Engineering Innovation

The Challenges of Excavation Support Adjacent to Healthcare Centers

A Look Back: Building a Box in a Sponge: Excavation Support for a Tunnel

ΕΚΤΕΛΕΣΤΙΚΗ ΕΠΙΤΡΟΠΗ ΕΕΕΕΓΜ (2023 – 2026)

Πρόεδρος	:	Μιχάλης ΜΠΑΡΔΑΝΗΣ, Δρ. Πολιτικός Μηχανικός, ΕΔΑΦΟΣ ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ Α.Ε. mbardanis@edafos.gr, lab@edafos.gr
Α' Αντιπρόεδρος	:	Σταυρούλα ΚΟΝΤΟΕ, Δρ. Πολιτικός Μηχανικός, Αναπληρώτρια Καθηγήτρια Τμήμα Πολιτικών Μηχανικών Πανεπιστήμιο Πατρών skontoe@upatras.gr
Β' Αντιπρόεδρος	:	Νίκος ΚΛΗΜΗΣ, Δρ. Πολιτικός Μηχανικός, Καθηγητής Τμήμα Πολιτικών Μηχανικών, Πολυτεχνική Σχολή, Δημοκρίτειο Πανεπιστήμιο Θράκης nklimis@civil.duth.gr, nsklimis@gmail.com
Γενικός Γραμματέας	:	Γιώργος ΜΠΕΛΟΚΑΣ, Δρ. Πολιτικός Μηχανικός, Επίκουρος Καθηγητής Τμήμα Πολιτικών Μηχανικών Σχολή Μηχανικών Πανεπιστημίου Δυτικής Αττικής gbelokas@uniwa.gr, gbelokas@gmail.com
Ταμίας	:	Χρήστος ΣΤΡΑΤΑΚΟΣ, Πολιτικός Μηχανικός, NAMALAB Α.Ε. stratakos@namalab.gr
Έφορος	:	Τάσος ΑΝΑΣΤΑΣΙΑΔΗΣ, Δρ. Πολιτικός Μηχανικός, Καθηγητής Τμήμα Πολιτικών Μηχανικών Αριστοτελείου Πανεπιστημίου Θεσσαλονίκης anas@civil.auth.gr
Μέλη	:	Γιώργος ΝΤΟΥΛΗΣ, Πολιτικός Μηχανικός, ΕΔΑΦΟΜΗΧΑΝΙΚΗ Α.Ε.- ΓΕΩΤΕΧΝΙΚΕΣ ΜΕΛΕΤΕΣ Α.Ε. gdoulis@edafomichaniki.gr Μαρίνα ΠΑΝΤΑΖΙΔΟΥ, Δρ. Πολιτικός Μηχανικός, Αναπληρώτρια Καθηγήτρια Σχολή Πολιτικών Μηχανικών Ε.Μ.Π. mpanta@central.ntua.gr Χρήστος ΤΣΑΤΣΑΝΙΦΟΣ, Δρ. Πολιτικός Μηχανικός, ΠΑΝΓΑΙΑ ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ Ε.Π.Ε. editor@hssmge.gr, ctsatsanifos@pangaea.gr
Αναπληρωματικά Μέλη	:	Γιάννης ΖΕΥΓΩΛΗΣ, Δρ. Μηχανικός Μεταλλείων - Μεταλλουργός, Αναπληρωτής Καθηγητής Σχολή Μεταλλειολόγων - Μεταλλουργών Μηχανικών ΕΜΠ izevgolis@metal.ntua.gr Δημήτρης ΠΙΤΙΛΑΚΗΣ, Δρ. Πολιτικός Μηχανικός, Αναπληρωτής Καθηγητής Τμήμα Πολιτικών Μηχανικών Αριστοτελείου Πανεπιστημίου Θεσσαλονίκης dpitilakis@civil.auth.gr Χάρης ΛΑΜΑΡΗΣ, Πολιτικός Μηχανικός, ΧΑΡΗΣ Π. ΛΑΜΑΡΗΣ ΚΑΙ ΣΥΝΕΡΓΑΤΕΣ ΙΚΕ h.lamaris@lamaris.gr Πρόδρομος ΨΑΡΡΟΠΟΥΛΟΣ, Δρ. Πολιτικός Μηχανικός prod@central.ntua.gr
Εκδότης	:	Χρήστος ΤΣΑΤΣΑΝΙΦΟΣ, Δρ. Πολιτικός Μηχανικός, ΠΑΝΓΑΙΑ ΣΥΜΒΟΥΛΟΙ ΜΗΧΑΝΙΚΟΙ Ε.Π.Ε. editor@hssmge.gr, ctsatsanifos@pangaea.gr

ΕΕΕΕΓΜ

Τομέας Γεωτεχνικής
ΣΧΟΛΗ ΠΟΛΙΤΙΚΩΝ ΜΗΧΑΝΙΚΩΝ
ΕΘΝΙΚΟΥ ΜΕΤΣΟΒΙΟΥ ΠΟΛΥΤΕΧΝΕΙΟΥ
Πολυτεχνειούπολη Ζωγράφου
15780 ΖΩΓΡΑΦΟΥ

Τηλ. 210.7723434
Τοτ. 210.7723428
Ηλ-Δι. secretariat@hssmge.gr ,
geotech@central.ntua.gr
Ιστοσελίδα www.hssmge.org (υπό κατασκευή)

«ΤΑ ΝΕΑ ΤΗΣ ΕΕΕΕΓΜ» Εκδότης: Χρήστος Τσατσανίφος, τηλ. 210.6929484, τοτ. 210.6928137, ηλ-δι. ctsatsanifos@pangaea.gr, editor@hssmge.gr, info@pangaea.gr

«ΤΑ ΝΕΑ ΤΗΣ ΕΕΕΕΓΜ» «αναρτώνται» και στην ιστοσελίδα www.hssmge.gr