Κρινάκια στην Τέλενδο

ΕΛΛΗΝΙΚΗ
ΕΠΙΣΤΗΜΟΝΙΚΗ
ΕΤΑΙΡΕΙΑ
ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ
& ΓΕΩΤΕΧΝΙΚΗΣ
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Οθωνοί

Ζακυνθος «Ναυάγιο»

Κέρκυρα, Παλαιοκαστρίτσα

Αναμνήσεις διακοπών

Γίνετε Αρθρογράφοι του περιοδικού. Περιγράψτε έναν ενδιαφέροντα τόπο διακοπών σας με τεχνικό, γεωτεχνικό και γεωλογικό ενδιαφέρον, πλαισιώνοντας την περιγραφή σας με φωτογραφίες.

ΑΡΘΡΑ

Driving Data-Driven Decisions

The worldwide construction market is back in growth mode after climbing out of the recessionary times of just a few years ago. That growth is a welcome return to past experience, but don't expect to see a flash back to another industry norm of the past: a reliance on document-driven processes. To capture the opportunities of today, companies involved in construction, engineering, and infrastructure projects must become more data-driven and adept at working in a digitized, model-based environment.

The evidence of industry resurgence is firm. Worldwide, the construction market is expected to grow by 3.8 percent in 2015 to reach U.S. $8.5 trillion in value, up from 3.1 percent growth in 2014, according to Timetric. Meanwhile, for the U.S. market, construction starts for 2015 will rise 9 percent to a value of $612 billion, up from 5 percent growth in 2014, according to Dodge Construction Outlook.

Construction, of course, spans multiple verticals and project types, including commercial buildings, residential housing, infrastructure projects such as railways and airports, and industry-specific projects such oil rigs or electric power plants. There may be many participants involved, including global engineering, procurement & construction (EPC) companies, pure-play construction companies, and subcontractors who specialize in areas such as electrical services, mechanical services, fabrication, or architecture. Another way of describing this broad market is the term architecture, engineering, and construction (AEC). While depending on the country, region or AEC niche, there may be relatively slower growth foreseen, overall, the industry outlook is strong. Worldwide, from 2015 through 2025, the volume of construction output will grow by more than 70 percent, according to a PwC report.

This growth does not come without challenges, however. Construction projects are growing bigger, more complex, and increasingly requiring that participants be able to work within data-driven environments and interoperate with 3D digital representations of assets. This shift to data-driven methods is seen in the rapid adoption of Building Information Modeling (BIM), a collaborative approach to design and construction that leverages 3D design models and associated data as a way to better manage asset information over the entire asset lifecycle.

BIM has steadily become more mainstream among AEC companies, and in some markets, notably in the United Kingdom (U.K.) under the Government Construction Strategy, and in the European Union (EU), where procurement rules for projects may be revised, there has been movement toward making minimum levels of BIM mandatory to take part in government-funded projects. This pressure to move to a higher level of compliance is only going to intensify in the future.

In summary, the construction market has two main trends underway:

- The return to strong growth, with some regional or vertical niche exceptions.
- A greater reliance on digital approaches such as BIM and data-driven processes for asset lifecycle management.

Put these two overarching trends together, and they elevate the need for an integrated approach to enterprise systems in the AEC market. By integrated systems, this means not only further adoption of 3D design and product lifecycle management tools, but also ensuring that enterprise-class systems such as enterprise resource planning (ERP), enterprise asset management (EAM) and project management are better integrated with each other and better capable of supporting data-driven business processes.

For companies in the AEC market examining ERP and/or EAM and project management choices, these trends elevate the importance of an integrated approach. As this white paper explains, an integrated approach need not sacrifice support for unique construction business processes such as estimating based on a bill of quantity (BoQ), contract and subcontract management, and project cost control. Such industry-critical capabilities should be sought after when making an ERP choice because otherwise the user company lacks a truly integrated platform for becoming data-driven.

Thus an ERP platform for the AEC market should be project-centric, asset-centric, and support industry-specific functions. As is the case across all industries, it's also preferable that the ERP solution be flexible and scalable in the way it can be licensed and deployed, allowing users to scale into the desired solution at their own pace.

ERP's Heritage

ERP systems have been widely adopted in industries such as manufacturing because they give a company an integrated platform for taking orders, procuring parts, managing production, and controlling inventory, financials, and distribution. ERP solutions generally are effective at supporting supply chain processes in which a manufacturing company takes an order for product, and uses that product's bill of material (BOM) structure within ERP to trigger the needed materials required to manufacture the product.

This closed-loop supply chain process within ERP works well for many manufacturing companies, and has even been enhanced with product configurator capabilities for make-to-order manufacturers. The trouble is, engineering, construction and infrastructure projects aren't based on ordering products, and subsequently, don't use pre-established BOM structures. The construction market is focused on estimating and controlling scopes of work for one-off projects, often using a BoQ structure in regions that have ties to the U.K. construction industry where BoQ concepts first developed.

Take the example of a football or soccer stadium. Cities, sports franchises, or other buyers of a new stadium don't buy a stadium off the shelf, so to speak. The stadium is designed and engineered to fit a specific site, its expected capacity, and other considerations such as parking, public transit, or road access. Nearly everything about a new stadium is scoped and designed in a custom manner, from the number of seats it will have, to the number of bathrooms and sinks in those bathrooms.

When it becomes time to start building a new stadium, one doesn't order from a list of stock parts or options. Instead, the challenge revolves around establishing and bidding out many scopes of work. These scopes of work need be estimated, reviewed, approved, and revised as needed. There are often hundreds of changes to scopes of work during a construction project, ranging from significant design changes like expanding a parking lot, to a simpler change such as a substitute material a subcontractor needs to use.

As a result, instead of needing an ERP system geared to materials requirements planning, the AEC industry needs an ERP system that is project- and asset-centric, and geared to estimating scopes of work, managing subcontracts, and exerting control of project costs, timescales, quality and risk. In short, construction projects don't revolve around the typical "order to cash" process that most ERP systems support quite well. Rather, here are some of key processes involved:

- EPCs or architectural firms develop a design that will meet the owner's/ operator's needs, typically using 3D computer-aided design (3D) tools that create a digital model of the asset. The model, which serves as the foundation for BIM processes, has associated data which can be added to the model as the construction project progresses.

- Using specifications, increasingly taken from a BIM environment, bids are tendered to EPCs and other firms seeking to be the lead general contractor for the building of an asset. The project is bid out by breaking down major areas of construction according to the scopes of work involved.

- Companies involved in the bidding process develop their estimates based on various estimating approaches which have historically been based on quantities in the scopes of work, often using BoQs as the basis for the estimate. There is a trend to consider the BIM model as the basis of the estimate, which is starting to change the estimating approach. Many factors go into developing a successful bid, including knowing the subcontract work needed, the equipment and plant rental requirements, the material requirements, and the internal and subcontract labor resources that will need to be allocated and charged to the project.

- When a main contractor is bidding for a project, it typically will start subbidding out portions of the project to subcontractors. There may be some material procurement to perform, but in essence, subcontract management is as important to the construction industry as component sourcing is to a discrete manufacturer.

- As the project is being built, it needs to be coordinated using project management tools, costs need to be tracked, and milestones managed. Importantly, as the asset gets built, any "as constructed" or "as installed" changes to the asset master data need to be tracked and, increasingly, cycled back into a BIM environment.

- Once construction is complete and the asset is commissioned and handed over to the owner/operator, the construction firm or EPC needs to ensure a smooth handover of data into whatever EAM or maintenance system the owner/operator will use. In practice today, this step is an ongoing collaborative process leveraging BIM and asset data repositories. The transfer occurs in stages often referred to as data drops, rather than as one abrupt "handover" of documents or data at the final completion gate.

These common phases in the construction project lifecycle are distinctly different from the "plan, source, make, deliver" processes typical of manufacturing. This is why project- and asset-management-centric ERP is needed in the construction industry.

Industry "Must Haves"

Consider the procurement capabilities in a typical ERP system. Mainly, ERP procurement is for components, assemblies or other "parts" that have a standard lead time held in the system. When a customer orders a product, the procurement logic of the ERP system is able to look at the BOM for that product and stagger the ordering of materials so it is all on hand in plenty of time to manufacture the product, but without building up excess inventory. This process works fine for most discrete manufacturing verticals, but just doesn't fit the construction industry, where procurement is more about finding the right subcontractor for a scope of the project, or renting specialized equipment such as cranes, rather than procuring standard materials. Let's take a further look at some construction industry priorities and how they tie back to capabilities needed within an integrated ERP, EAM, and project management solution:

- **CRM and estimating**. Nearly every ERP vendor can offer a customer relationship management (CRM) module, but for engineering, construction and infrastructure projects, the CRM should be geared toward managing opportunities and subcontractor contacts, rather than managing customers and product sales. Estimating should be built around breaking down and analyzing scopes of work, including what might be needed in terms of subcontracting, equipment rental, labor such as site, project management and engineering labor and materials.

- **Sales contract management**. ERP order management might be good at taking orders for stock products, doing some product configuration, and tracking factors like sales order history, but that doesn't do much for construction projects, where the real challenge is managing the changing scope of work for a complex asset. The fundamental challenge with sales contract management is breaking down and managing every change in the project, which, for some large assets, can involve hundreds of changes and greater than 100 percent change versus the initial design. So sales contract management needs to be able to manage approval workflows, and provide revision control and manage contract changes.

- **Valuations as part of contract management**. Another unique construction requirement is the way the industry measures work done, or "valuations" as it is often called. These valuations are usually done on a cumulative monthly basis and act as the foundation for getting paid or paying subcontractors. Often, these valuations are done by making physical measurements against the BoQ using a commercial function called Quantity Surveying. These valuations are then used to produce an Application

for Payment, which is then submitted to the client or received from the subcontractor.

A certification process is then used to agree the month-end valuation numbers and invoices, or, a self-billing process is used to manage payments. The process also involves managing retentions. This whole process is complex and is rarely handled in general ERP software. It cannot be handled using a sales order processing module.

- **Subcontract management and purchasing**. The inverse of Sales Contract Management is subcontracting. All the complexities mentioned in the previous section also apply to the subcontract process. In essence, the lead construction company puts forth scopes of work for subcontractors to bid on, assesses their bids, and sets up the foundation for cost control and change management over subcontracts. Unlike procurement modules in ERP systems with a manufacturing heritage, construction industry ERP solutions must have a subcontract management capability to be effective. Another critical area is managing the purchasing of equipment on a hire and rental basis. This is also a complex requirement, which, if not built into the core software, will require heavy amounts of software customization. As with most construction functions, there is a strong need for revision control and change management within industry procurement processes as often the items being procured are complex, unique equipment which have long lead times.

- **EAM, equipment/plant hire and rental**. Most construction companies own some of the plant and equipment they need to execute the construction process. It is therefore essential that the solution can provide the ability to maintain these assets making sure they are safe, reliable and available when they are needed. An EAM system is required to be able to schedule maintenance and repairs, manage the time of service technicians, and procure spares and materials for maintenance, repair and overhaul. By having EAM integrated with ERP and project cost accounting, the allocation of MRO activity to projects and corporate financials is simplified.

It is beneficial to have one solution for both EAM and Construction Project Management as they can then share the same common back office solutions such as finance, procurement and human resources. This eliminates the need for complex, expensive integrations and also makes the solution far more user-friendly by having one common user interface. Additionally, the ability to rent, charge and track these assets when they are used on projects is a key requirement rarely found in standard ERP or EAM solutions.

- **Project cost control**. Once a bid is won and the project is underway, it's crucial that the company running the project be able to exert cost control over all activities. This goes well beyond what a normal ERP system's financial modules can do, because it spans into areas such as subcontractor costs and milestone payments, equipment rental costs, and allocation of internal and external resources to projects. The project cost control function must be able to set a budget for the overall project, facilitate periodic and real-time project reporting and analysis for review meetings, keep track of what has been spent against the budget, and revise the project forecast.

Forecasting the outcome of the project on a regular basis is a critical activity if construction companies are to keep control of the costs and margin. This process is usually done using many Microsoft® Excel® spreadsheets, so finding an ERP solution that can manage this process inside the business application is a huge benefit.

- **Facilities and service management**. Many construction companies increasingly are offering the service to maintain and sometimes operate the asset and facility once it is handed over. This means they need a facilities or service management solution, but ideally, one that is integrated with the rest of the enterprise software solution. In most organizations, they have one set of business software solutions for the construction stage of the asset's life, another set of solutions for the operations and maintenance phase, and often another set of back-office solutions such as Human Resources, Finance, Procurement and Supply Chain. This is far from ideal, as not only is it very expensive to buy, maintain and integrate these solutions, there is a need for users to master multiple user interfaces to work well across these applications. Within facilities/service management, the solution needs many of the same capabilities as are found in EAM, but in addition, it needs the ability to manage a service contract, with flexible pricing and invoicing rules.

- **Mobile workforce**. The other critical requirement in field service is to manage a mobile workforce. This calls for functionality such as mobile job management for service technicians equipped with mobile phones or tablets. With a mobile solution in place, most companies also are looking to optimize their mobile workforce while meeting the contractual service level agreement. To achieve this, an automated scheduling capability needs to be provided which is fully integrated with the job management system, supply chain and elements of human resources such and employee availability, skills, licenses etc.

- **Interoperability with 3D design and project management tools**. Companies involved in construction, engineering and infrastructure projects should have an ERP platform that has interfaces to CAD data and models to automate information exchange. Likewise, subcontractors or owners/operators may use best of breed project management software, so pre-built integration to those tools is desirable within ERP to understand the timetables and work breakdown structures of partners.

- **Offsite Manufacturing**. The industry is increasingly using offsite manufacturing facilities to build construction modules such as hotel bedrooms. So if a construction company is operating an offsite manufacturing division, or wants to be in the position where it can easily start operating such a facility, then it is critical that the software solution can support an engineer-to-order or project-based manufacturing capability. Whereas this business requirement needs many of the functions that a traditional ERP solution offers, there is also usually a need to support construction industry-specific requirements such as Sales and Subcontract Management and Hire and Rental. So a hybrid between an ERP solution and a construction industry specialist solution is needed. Again, this is something that is rarely found in generic ERP solutions or specialist construction solutions.

Achieving an Integrated Whole

The above functions are critical capabilities for companies involved in construction, engineering and infrastructure projects, but the trick is to get the processes to work in concert. That comes from an integrated approach to applications. Whereas a company could have a separate solution for CRM, a separate solution for estimating, spreadsheets for project cost control, and a standalone EAM system, there would always be an integration hurdle with that approach. Workflows might hit a dead end, or documents might get lost in the handoff between systems. That would not be the case with an integrated applications platform that spans ERP, EAM, and project management, and has integrated modules to handle specific needs like equipment rental. IFS has spent decades

adapting its modular solution suite for the construction, engineering and infrastructure market, and is able to put ERP, EAM, and project management under one roof, complete with industry-specific functions such as equipment rental and subcontract management. So yes, an integrated ERP approach is possible in construction today, without having to work around the shortcomings of ERP systems geared to manufacturing industry processes.

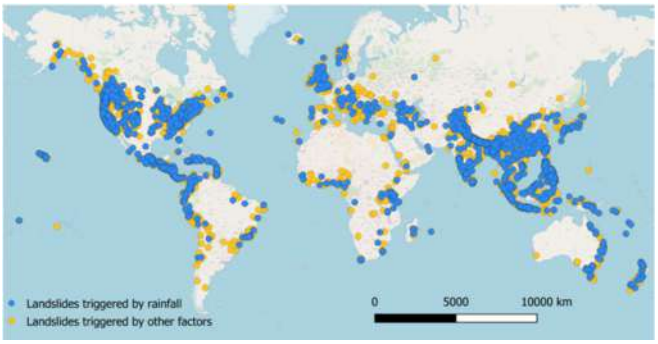
With the AEC market back in growth mode, and optimism levels for construction reaching levels not seen since the mid-2000s, now is the time for industry participants to move to an integrated foundation for enterprise, project, and asset management. The quickening pace of growth, combined with the rapid adoption of digital, model-based collaboration, is simply going to require an integrated enterprise systems approach if companies want to maximize their opportunities.

(Engineering News-Record | ENR, April 4, 2019, https://www.enr.com/articles/46608-driving-data-driven-decisions?oly_enc_id=3348A1990723J0W)

Machine Learning for Global Forecasting of Rainfall-Induced Landslides

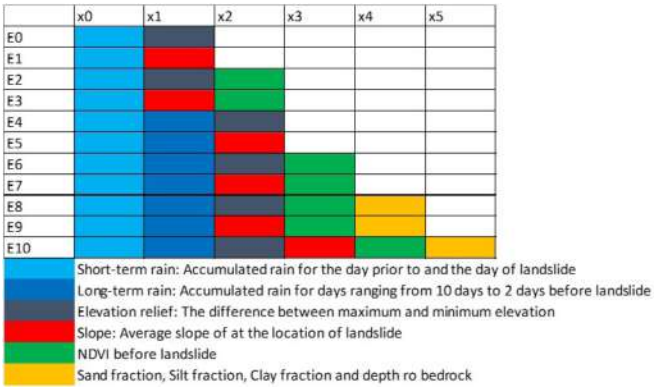
Rainfall-induced landslides are the most common type of landslide across the world. They are complex in nature and forecasting them is therefore very challenging. In this project, we used machine learning to predict rainfall-induced landslides with a combination of several controlling factors and rainfall data as the main triggering factor.

Landslides are catastrophic geo-hazards that threaten urbanisation worldwide. Population growth, in combination with the construction of critical infrastructure such as roads and pipelines, in landslide-prone areas increases the risk associated with landslides. Of the multiple factors that trigger landslides, rainfall is the most common: it has caused thousands of landslides in the past decade only, and some of the deadliest (an example being the debris flow event in August 2017 in and around Freetown in Sierra Leone, which caused 1141 fatalities). Rainfall-induced landslides are normally triggered by intense and/or prolonged precipitation and they take the form of shallow slides and debris flows. Given the complex nature of rainfall-induced landslides, a single source of data such as rainfall or terrain features, or the geotechnical properties of slopes, will not be enough to forecast them. In order to prevent or minimise the catastrophic consequences of these events, it is therefore important to combine multiple sources of data to forecast more accurately when and where they will occur. The present study therefore set up a data-driven framework for forecasting rainfall-induced landslides. A database was created for nearly 11,000 landslides, including the date and location of events across the world between 2007 and 2018, as well as the triggering and predisposing factors that caused these landslides. The database was then used to train supervised Machine Learning (ML) classification algorithms. Binary classification methods such as logistic regression were used to distinguish between landslides and non-landslide cases. To train the ML model, we built eleven sample sets (E0 to E10) with different combinations of triggering and controlling factors (model features).

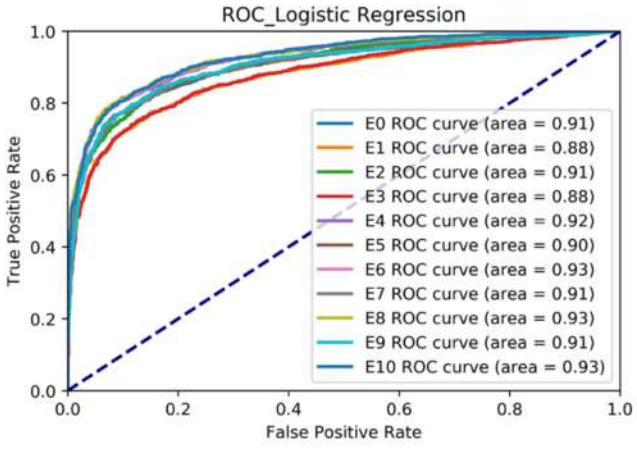


Landslide forecasting framework for this study

The sample sets were assigned to training (67%) and test (33%) sets which were then used for the training and assessment of the logistic regression model respectively. The accuracy of the logistic regression model was estimated with the Receiver Operating Characteristic (ROC) curves and the associated Area Under Cut.



Features used to train the machine learning algorithms



Accuracy of logistic regression model for classifying landslides and non-landslides

The outcome of this study is being implemented in a Landslide Early Warning System (LEWS) as part of the Delft-FEWS platform. The forecasting tool developed in this project can be used for regional landslide forecasting after regional adaptation.

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Further reading:

Tehrani et al. (2019). "A framework for predicting rainfall-induced landslides using machine learning", Proceedings of the XVII ECSMGE-2019 Geotechnical Engineering foundation of the future, September 2019, Iceland.

(Detltares, R&D Highlights 2019, p. 16, https://media.deltares.nl/R&D_highlights/edition2019/16)

Landslide Risk Assessment for the Road Network in Albania

Climate change puts many investments in the transport infrastructure in Albania at risk. Extreme weather events such as floods and landslides are expected to increase in frequency and intensity.

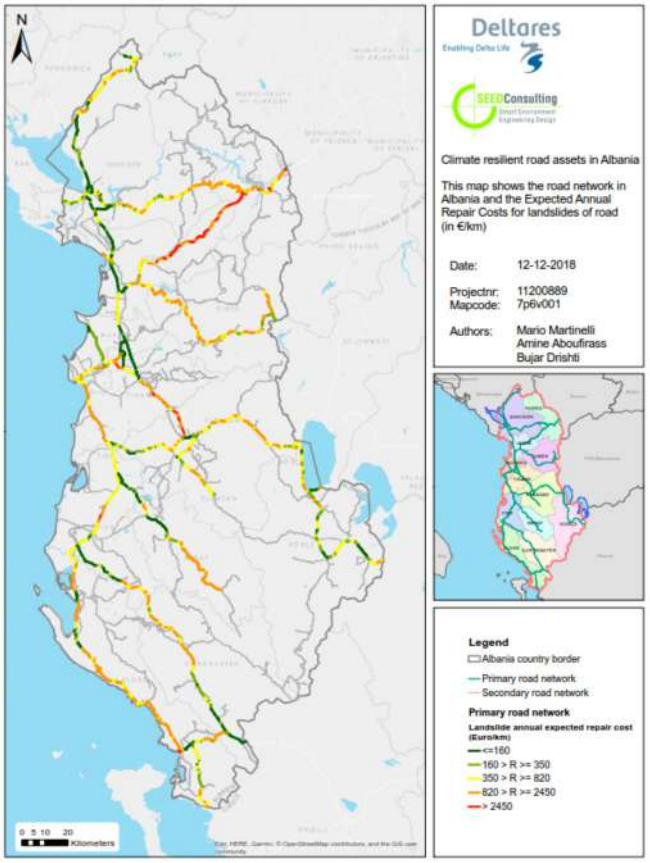
Sea level rise results in risk for coastal transport infrastructure.

The main objective of this study was to help Albanian stakeholders to prioritise future climate- and seismic-resilient investments in road assets. The objective was achieved by making an assessment of the vulnerability of the national road network in Albania to flooding, landslide and seismic events, proposing mitigation measures and developing a strategy to deal with climate uncertainties.

Roads are critically important for society. Roads that are unavailable or unreliable have a significant impact on economic growth. At the same time, transport plays a crucial role in building climate-resilient communities.

Albania ranks as the most threatened country in Europe from multiple hazards. It is ranked number 39 in the list of countries with the highest World Risk Index based on exposure to natural hazards, vulnerability, and coping and adaptation capacities. The country is prone to hydro-meteorological hazards (such as floods, drought and heavy snowfalls) and geological hazards (earthquakes and landslides, for example). Landslides are one of the most critical hazards. Deltares was therefore asked to help the World Bank and Albanian stakeholders with an assessment of, among other things, landslide hazards and the risks affecting the country's roads.

The analysis looked at nearly 1500 kilometres of roads and the associated assets that make up the Albanian primary road network. By combining the publicly available ELSUS landslide susceptibility map for the European continent with a local landslide database and local experience, the team was able to estimate how often landslides occur in selected areas with a comparable susceptibility. Moreover, we determined the repair costs associated with a landslide. These results were then combined with a traffic analysis to estimate the economic damage due to roads not being available. The outcome of this study was set out on a map that shows, for each kilometre of the road network, the Annual Expected Damage (AED) (in Euro/km) caused by landslide events.



Expected Annual Repair Costs for landslide hazard

The project also included the analysis of fluvial flooding and seismic events, followed by the production of similar maps. Furthermore, suggestions were provided for an action plan, including the cost-benefit ratios for possible solutions. The results have been summarised in three reports and they will be used by the Albanian Road Authority to prioritise current and future resilient investments in road assets.

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(Detltares, R&D Highlights 2019, p. 49, https://media.deltares.nl/R&D_highlights/edition2019/16)

ΔΙΑΚΡΙΣΕΙΣ ΕΛΛΗΝΩΝ ΓΕΩΤΕΧΝΙΚΩΝ ΜΗΧΑΝΙΚΩΝ

Three champions of Underground Space rock at international planning conference

ITACUS co-chair Antonia Cornaro, together with Activity Group 2 leader **Chrysothemis Paraskevopoulou** and UCL Bartlett School of Planning student **Asimina Paraskevopoulou**, jointly presented their contribution on "Urban Underground Space and Sustainability: an Integrated Approach on the City of the Future" to a distinguished international audience of planners, architects and built environment professionals at the "Changing Cities" International conference in Chania, Greece. The paper was co-authored by ITACUS co-chair Han Admiraal and presented the work of ITACUS and Activity Group 2 on Urban Sustainability. The presentation was well received and new contacts were made further enhancing and strengthening the ITACUS network.

ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ

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

New ITA President

During its 45th General Assembly in Naples (Italy), ITA elected Mrs Jinxiu (Jenny) Yan from China as President for the term 2019-2022.The new Executive Council for the period 2019-2022 includes: Abidemi Agwor, Nigeria, Mr. Hamdi Aydin, Turkey, Mr. Choi Hangseok, Korea, Mr. Jeyatharan Kumarasamy, Singapore, Mr. Andres Marulanda, Colombia, Mr. Jamal Rostami, Iran, Mr. Gérard Seingre, Treasurer, Switzerland, Dr. Teik Aun Ooi, Malaysia, Corresponding member WTC 2020, Mr. Soren Eskesen, Denmark, Corresponding member WTC 2021 and Fermín Sánchez, Mexico, corresponding member WTC 2022.

Indeed, the city of Cancun, Mexico has been chosen to host the 48th General Assembly and WTC 2022.

Launching of Working Group 23

During the 45th General Assembly in Naples, the ITA approved the creation of a new working group called **Shaft Design and Construction**.

16 individuals from 8 countries participated in the first Working Group 23 meeting, facilitated by Siamak Hashemi and Joe Lux, Animateur and Vice-Animateur, respectively.

For this first year, the objectives of the new WG will be to:

- Establish the correct terminology and nomenclature for shaft design and construction by providing suitable definitions for relevant items,
- Provide suitable classification for shafts based on their geometry / application / construction method for a more uniform understanding of the design and construction implications,
- Classify the shaft construction methods for soft ground and rock and provide some general design guidelines,
- Create a database of shaft construction case histories, look at the extreme conditions and challenging cases,
- Produce literature on shaft design and construction to meet the needs and demands of the members,
- Offer short courses and workshops for design and construction of shafts using the top experts in the world,
- Interact with other working groups to collaborate on issues of common interest (i.e.conventional VS mechanized systems with WG14 & 19, Health and Safety with WG-5, maintenance with WG-6, Seismic with WG-9, etc.).

Latest ITA Working Groups and Committees' publications

First part of the Open Session held on Tuesday 7 May 2019 in Naples during the WTC, was dedicated to the presentation by their authors of the ITA publications below.

They are available on ITA website. Click on the following links:

- WG2 - Guidelines for the Design of Segmental Tunnel Linings
- WG5 - Guide to ITA/BTS CAWG Report 10 for Clients and others not familiar with high pressure compressed air work
- WG14 / 15 - Handling, Treatment and Disposal of Tunnel Spoil Materials
- ITAtech – Practical approach for controlling the blasting vibration and optimizing advance in urban tunnelling
- ITAtech – Guidelines on rebuilds of machinery for mechanized tunneling excavation

- ITA COSUF - Current practice on cross-passage design to support safety in rail and metro tunnels
- ITA – FIDIC – Conditions of Contract for Underground Works (Emerald Book)

ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

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

International Workshop on Underground Oil/Gas Storage (IWUOGS), August 18-20, Shenyang, China, http://deep-mining.neu.edu.cn/IWUOGS2019

7th Asia-Pacific Conference on Unsaturated Soils, August 23~25, 2019, Nagoya, Japan, www.jiban.or.jp/e/activities/events/20190823-25-seventh-asia-pacific-conference-on-unsaturated-soils

The 17th European Conference on Soil Mechanics and Geotechnical Engineering, 1st - 6th September 2019, Reykjavik Iceland, www.ecsmge-2019.com

NORDIC GROUTING SYMPOSIUM 2019, September 2-3, 2019, Helsinki, Finland, https://www.ril.fi/en/events/nordic-grouting-symposium-2019.html

4ο Πανελλήνιο Συνέδριο Αντισεισμικής Μηχανικής & Τεχνικής Σεισμολογίας, Αθήνα, 5 – 7 Σεπτεμβρίου 2019, https://conv.eltam.org

SECED 2019 Conference Earthquake risk and engineering towards a resilient world, 9-10 September 2019, Greenwich, London, U.K., www.seced.org.uk/2019

15th International Benchmark Workshop on Numerical Analysis of Dams, 9th - 11th September 2019, Milano, Italy, www.eko.polimi.it/index.php/icold-bw2019

3rd International Conference "Challenges in Geotechnical Engineering" CGE-2019, 10-09-2019 - 13-09-2019, Zielona Gora, Poland, www.cgeconf.com

XVIII Technical Dam Control - International Conference Hydraulic Structures Monitoring and Safety, 10-13 September 2019, Warsaw, Poland, www.tkz.ibs.pw.edu.pl

International Symposium on SPH and other particle-based continuum methods and their applications in geomechanics, 11-13 September 2019, Vienna, Austria, https://sph-vienna.com

14th ISRM International Congress, 13-18 September 2019, Iguassu Falls, Brazil, www.isrm2019.com

ISGHS 2019 International Symposium on Geotechnical aspects of Heritage Structures, September 16-18, 2019, IIT Madras, Chennai, India, www.igschennai.in/ISGHS2019

12th Asian Regional Conference of IAEG, 23 ~ 27 September 2019, Jeju Island, Republic of Korea (South Korea), www.iaegarc12.org

1st MYGEC 1st Mediterranean Young Geotechnical Engineers Conference, Double Events – MYGEC & EYGEC, 23-24th September, 2019, Bodrum, Muğla, Turkey, http://mygec2019.org

27th EYGEC 27th European Young Geotechnical Engineers Conference, Double Events – MYGEC & EYGEC, 26-27th September, 2019, Bodrum, Muğla, Turkey, http://eygec2019.org

3rd ICTITG International Conference on Information Technology in Geo-Engineering, Sep. 29-02 Oct., 2019, Guimarães, Portugal, www.3rd-icitg2019.civil.uminho.pt

11th ICOLD European Club Symposium, 2 - 4 October 2019, Chania Crete – Greece, www.eurcold2019.com

4ο Πανελλήνιο Συνέδριο Αντισεισμικής Μηχανικής και Τεχνικής Σεισμολογίας *20 Χρόνια Μετά...*, Αθήνα, 4-6 Οκτωβρίου, 2019, www.eltam.org

XVII African Regional Conference on Soil Mechanics and Geotechnical Engineering 07-10 October 2019, Cape Town, South Africa, www.arc2019.org

2019 AYGE 7th African Young Geotechnical Engineers Conference, 6 October 2019, Cape Town, South Africa, www.arc2019.org/ayge-landing

HYDRO 2019 Concept to closure: practical steps, 14-16 October 2019, Porto, Portugal, www.hydropower-dams.com/hydro-2019

XVI Asian Regional Conference on Soil Mechanics and Geotechnical Engineering, 14 - 18 October 2019, Taipei, China, www.16arc.org

Developing Resilient Cities of the Future through the Integration of Tunneling and Underground Space Use
15-17 October 2019, Nigeria
events@tunnellingnigeria.org

11ème Édition des Journées Africaines de la Géotechnique
21-24 Octobre 2019, Niamey, Niger
http://ctgaafrique.org/niamey-niger-ville-hote-de-11eme-edition-journees-africaines-de-geotechnique

Conformément aux résolutions prises lors de l'Assemblée Générale du 24 octobre 2018 à Abidjan en Côte d'Ivoire, le Niger abritera cette année la 11ème édition des Journées Africaines de la Géotechnique (JAG 2019), co-organisée par la Comité

Transnational de Géotechniciens d'Afrique (CTGA) et l'Association des Laboratoires du Bâtiment et des Travaux Publics (ALBTP) sous le thème : ***"Géotechnique et efficience économique des stratégies de développement en Afrique inter-tropicale".***

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4th Regional Symposium on Landslides in the Adriatic-Balkan Region – ReSyLAB 2019 - 9th Scientific and Expert Conference GEO-EXPO 2019 23rd to 25th of October 2019, Sarajevo, Bosnia and Herzegovina, www.geotehnika.ba/ReSyLAB_&_GEO-EXPO_2019.html

8ο Πανελλήνιο Συνέδριο Γεωτεχνικής Μηχανικής, 6 – 8 Νοεμβρίου 2019, Αθήνα, Ελλάς, www.8hcge2019.gr

2019 GEOMEAST International Congress & Exhibition, 10 -14 November 2019, Cairo, Egypt, www.geomeast2019.org

The 8th International Symposium on Roller Compacted Concrete (RCC) Dams, Nov. 11th – 12th, 2019, Kunming, China, chincold-en@vip.126.com, http://www.chincold.org.cn

8th International Geotechnical Symposium, 13-15 November 2019, Istanbul, Turkey, www.geoteknik2019.org/en/

XVI Panamerican Conference on Soil Mechanics and Geotechnical Engineering, 18-22 November 2019, Cancun, Quintana Roo, Mexico, http://panamerican2019mexico.com/panamerican

International Symposium on Rock Mechanics and Engineering for Sustainable Energy, 24-24 November 2019, Hanoi, Vietnam, http://vietrocknet.org

GEOTEC HANOI 2019 The 4th International Conference on Geotechnics for Sustainable Infrastructure Development, November 28 – 29, 2019, Hanoi, Vietnam, https://geotechn.vn

YSRM2019 - The 5th ISRM Young Scholars' Symposium on Rock Mechanics and REIF2019 - International Symposium on Rock Engineering for Innovative Future - Future Initiative for Rock Mechanics and Rock Engineering - Collaboration between Young and Skilled Researchers/Engineers – 1-4 December 2019, Okinawa, Japan, www.ecpro.co.jp/ysrm2019/index.html

ICGU 4th 2019 4th International Conference on Ground Improvement and Ground Control (ICGI2019): Infrastructure Development and Natural Hazards Mitigation, 1-3 December 2019, Luxor, Egypt, https://icgi2019-ets.org/page/p/Welcome-ICGI

ETS Conference and Exhibition 2019, 4-5 December 2019, Luxor – Egypt, https://icgi2019-ets.org/page/p/Welcome-ETS

ISOG 2019 First Indian Symposium on Offshore Geotechnics, December 5-6, 2019, IIT Bhubaneswar, Odisha, India, https://sites.google.com/iitbbs.ac.in/isog2019/home

15th International Conference on Geotechnical Engineering, and 9th Asian Young Geotechnical Engineers Conference, 05 ÷ 07-12-2019, Lahore, Pakistan, http://www.pges-pak.org

GeoSS International Conference on Case Histories & Soil Properties, 5-6 December 2019, Singapore, www.iccs2019.org

1st ITA-CET Meeting for European Tunnelling Professors and PhD Students

ita-cet.secretariat@developpement-durable.gouv.fr

The ITA-Committee on Education and Training (ITA-CET) university network currently comprises 28 higher education establishments from 20 different countries around the world. This network was set up in 2009 in order to act as an exchange platform for universities offering Master's degrees in tunnelling and underground space. Its main aims are to enable professors to:

- share ideas on teaching methods and the content of Master's
- develop collaborations on specific research activities
- organise exchanges between lecturers and students
- envisage ITA endorsement of high quality Master's programmes

Over the years, whilst the number of network members has steadily increased, the global scale of this network means that meetings and regular exchanges have proved somewhat difficult to implement. Efforts have been made to facilitate cooperation, such as the setting up of an ITA-CET university

network group on Linkedin, but have not met with the success that was anticipated.

From a practical point of view, it would appear easier to organise meetings on a regional scale, within the scope of a specific event that would enable universities to promote their courses and the work conducted by their students. For this reason, ITA-CET has decided to organise its first annual meeting of European tunnelling professors and PhD students. This event will be hosted by the Politecnico di Torino in Italy on 5th and 6th December 2019.

On the 5th December, tunnelling professors from European universities are invited to meet, present their courses and reflect on possible avenues of collaboration with their counterparts. Non-European professors are also welcome to attend if they wish to do so and are able to bear travel and accommodation costs. Social events will be organised in the evening for both the professors and students.

On 6th December, a limited number of students (10 to 12) will be invited to present their PhD thesis to all those present. Universities from Austria, Greece, Switzerland, Italy and the UK have already expressed their interest in this ITA-CET event and it is expected that several more will attend.

It is hoped that this meeting will spark the organisation of similar events for universities in other regions around the globe and thereby strengthen the ITA-CET university network.

For more information, please contact the Committee secretariat: ita-cet.secretariat@developpement-durable.gouv.fr

ISSPDS-Edinburgh 2020 2nd International Symposium on Seismic Performance and Design of Slopes, January 18–22, 2020, Edinburgh, UK, www.isspds.eng.ed.ac.uk

GeoAmericas2020 4th Pan American Conference on Geosynthetics, 26-29 April 2020, Rio de Janeiro, Brazil, www.geoamericas2020.com

WTC 2020 ITA-AITES World Tunnel Conference, 15-21 May 2020, Kuala Lumpur, Malaysia, www.wtc2020.my

14th Baltic Sea Geotechnical Conference 2020 Future Challenges for Geotechnical Engineering, 25 ÷ 27 May 2020, Helsinki, Finland, www.ril.fi/en/events/bsgc-2020.html

Nordic Geotechnical Meeting Urban Geotechnics, 25-27 May 2020, Helsinki, Finland, www.ril.fi/en/events/ngm-2020.html

EUROCK 2020 Hard Rock Excavation and Support, 13-19 June 2020, Trondheim, Norway, www.eurock2020.com

DFI Deep Mixing 2020, 15 to 17 June 2020, TBD, Gdansk, Poland, www.dfi.org/DM2020

XIII International Symposium on Landslides - Landslides and Sustainable Development, June 15th – 19th 2020, Cartagena, Colombia, www.scg.org.co/xiii-isl

GEE2020 International Conference on Geotechnical Engineering Education 2020, June 24-25, 2020, Athens, Greece, www.erasmus.gr/microsites/1168

E-UNSAT 2020 4th European Conference on Unsaturated Soils - Unsaturated Horizons, 24-06-2020 ÷ 26-06-2020, Lisbon, Portugal, https://eunsat2020.tecnico.ulisboa.pt

Geotechnical Aspects of Underground Construction in Soft Ground
29 June to 01 July 2020, Cambridge, United Kingdom

Organiser: University of Cambridge
Contact person: Dr Mohammed Elshafie
Address: Laing O'Rourke Centre, Department of Engineering, Cambridge University
Phone: +44(0) 1223 332780
Email: me254@cam.ac.uk

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics – IACMAG
29-06-2020 ÷ 03-07-2020, Torino, Italy

The 16th International Conference of the International Association for Computer Methods and Advances in Geomechanics (15IACMAG) will be held in Turin, Italy, 29 June - 4 July 2020. The aim of the conference is to give an up-to-date picture of the broad research field of computational geomechanics. Contributions from experts around the world will cover a wide range of research topics in geomechanics.

Pre-conference courses will also be held in Milan and Grenoble.

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ISFOH 2020 4th International Symposium on Frontiers in Offshore Geotechnics, 16 – 19 August 2020, Austin, United States, www.isfog2020.org

2020 CHICAGO International Conference on Transportation Geotechnics, August 30 - September 2, 2020, Chicago, Illinois, USA, http://conferences.illinois.edu/ICTG2020

EUROGEO WARSAW 2020 7th European Geosynthetics Congress, 6-9 September 2020, Warsaw, Poland, www.eurogeo7.org

37th General Assembly
of the European Seismological Commission
6 to 11 September 2020, Corfu, Greece
www.esc-web.org

6th International Conference on Geotechnical and Geophysical Site Characterization "Toward synergy at site characterisation", 7 ÷ 11 September, Budapest, Hungary, www.isc6-budapest.com

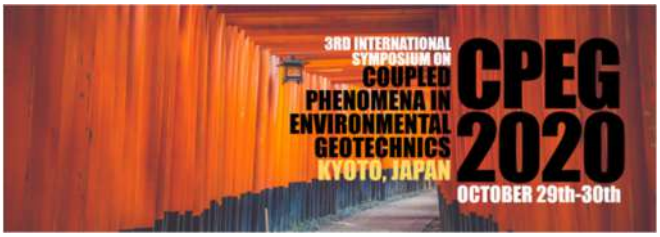
ICEGT-2020 2nd International Conference on Energy Geotechnics, September 20-23, 2020, La Jolla, California, USA, https://icegt-2020.eng.ucsd.edu/home

21-25th September 2020, Lisbon, Portugal

The Organising Committee of the **Fourth International DAM WORLD Conference** has the pleasure of inviting you to take part of the fourth edition of the **DAM WORLD** conference.

By now, we would like to ask you to SAVE THE DATE in your calendar: **LISBON, Portugal, 21-25th September 2020**.

Eliane Portela
COMITÉ ORGANIZADOR
4ª CONFERÊNCIA INTERNACIONAL DAM WORLD
LNEC • LISBOA • PORTUGAL • 21 a 25 de setembro de 2020
damworld@lnec.pt dw2020.lnec.pt



3rd International Symposium on Coupled Phenomena in Environmental Geotechnics
October 29th – 30th, 2020, Kyoto, Japan
https://cpeg2020.org

CPEG2020 is organized under the auspices of the Technical Committee TC215 (Environmental Geotechnics) of ISSMGE, and follows the very successful first two CPEG symposiums held in Torino (Italy) in 2013, and in Leeds (UK) in 2017.

CPEG2020 will be hosted in conjunction with the Japanese Geotechnical Society (JGS) and Kyoto University, and it will be followed by the 'Fifth World Landslide Forum' from November 2nd, making this a great opportunity to join both ISSMGE events in the Ancient Capital of Japan.

As we polish the details of the symposium, we will update the CPEG2020 website with further information, including keynote speakers, detailed symposium themes, and key dates. Please, keep the address of this site (www.cpeg2020.org) among your bookmarks for updated information.

5TH World Landslide Forum Implementation and Monitoring the USDR-ICL Sendai Partnerships 2015-2015, 2-6 November 2020, Kyoto, Japan, http://wlf5.iplhq.org

GeoAsia 2021

7th Asian Regional Conference on Geosynthetics
March 1-4, 2021, Taipei, Taiwan

EUROCK 2021
the ISRM European Rock Mechanics Symposium
1-6 June 2021, Torino, Italy

LATAM 2021
IX Latin American Rock Mechanics Symposium
20-22 September 2021, Asuncion, Paraguay

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3rd European Conference on Earthquake Engineering & Seismology, 19 – 24 June 2022, Bucharest, Romania, https://3ecees.ro

UNSAT2022
8th International Conference on Unsaturated Soils
June or September 2022, Milos island, Greece

ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

Κατάρρευση κτιρίων λόγω κατολίσθησης

Την Τρίτη, 2 Ιουλίου 2019 εκδηλώθηκε στην πόλη Aizawl, πρωτεύουσα του ινδικού κρατιδίου Mizoram, ανατολικά του Bangladesh, κατολίσθηση εξ αιτίας των έντονων βροχοπτώσεων.

Αποτέλεσμα της κατολίσθησης ήταν ο θάνατος 3 ανθρώπων και ο τραυματισμός αρκετών άλλων και η μερική κατάρρευση πέντε τετραωρόφων κτιρίων, εκ των οποίων τα τρία λόγω «απώλεια» του ισογείου. Τα κτίρια κατασκευάστηκαν το 2009 μετά από διαμόρφωση αναβαθών στην παλγιά βουνού. Περισσότερα στο blog: https://Abukiefa.wordpress.com

(η σχετική πληροφορία από τον συνάδελφο Γιάννη Μεταξά, https://abukiefa.wordpress.com/2019/07/)

Catastrophic dam failure in India: Officials blame crabs

Located in Ratnagiri district of the Indian Maharashtra state, Tiware dam was suddenly ruptured flooding seven downstream villages.

The incident occurred on Tuesday, July 4, 2019 and was followed by a heavy storm that struck the region. The devastating floods claimed the lives of at least 18 people and destroyed local infrastructure.

An amazing fact is that Tanaji Sawant, the state's Legislator and Water Conservation Minister declared that the dam was ruptured due to a large aggregation of crabs that weakened the structure's wall. "The wall was weakened by a large number crabs and after it was pointed out to the government officials, some remedial measures were taken up. The SIT (Special Investigation Team) appointed by Chief Minister Devendra Fadnavis will come up with its findings soon and we will come to know what exactly went wrong," he stated when asked if the dam had structural flaws.

Tiware dam collapse

According to Minister Sawant, the dam was operational for 15 years (constructed in 2004) and was storing water consistently without experiencing any damage.

Nevertheless, political opponents of the minister did not accept this bizarre excuse and accused him of concealing delinquency issues by local authorities. "You want to save a big, corrupt shark and blaming poor crabs? This cannot be tolerated. There must be an inquiry and he must be punished," Nawab Malik, national spokesperson of the Nationalist Congress Party (NCP), said.

The state of Maharashtra holds about 35% of Indian's 5,202 dams and experiences intense torrential rains that lead to stability issues. However, the state takes safer dam measures in comparison with the rest states of India. According to Maharashtra officials, all dams are consistently inspected annually before the monsoon period.

(Geoengineer, July 4, 2019, https://www.geoengineer.org/news/catastrophic-dam-failure-in-india-officials-blame-crabs)

Massive Rock slide triggered in Monsoon. An excellent example of rock joints failure.

https://twitter.com/jojaaamir/status/1155718957363367937?s=07

(από τον Ομότιμο καθηγητή ΕΜΠ Μιχάλη Σακελλαρίου)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΣΕΙΣΜΟΙ

An Even Larger Quake Just Rocked Southern California. Experts Say the Fault System Is Growing.

Late Friday (July 5), a magnitude-7.1 quake struck near the town of Ridgecrest, California, just a day after the same region experienced a magnitude-6.4 quake. Experts say the fault system is growing and even more quakes are likely in the coming days.

Another, even more powerful earthquake rocked Southern California on Friday (July 5). The temblor, which struck not far from the town of Ridgecrest in the Mojave Desert, registered as a magnitude 7.1, which is larger than the one that rocked the same general region on Thursday (July 4), according to the U.S. Geological Survey. That quake, a magnitude 6.4, was the largest to strike Southern California in 20 years, and was felt as far as Los Angeles.

Today's monster quake caused injuries, fires and rockslides, and left more than 3,000 people without power. Shaking was felt as far away San Jose, about 260 miles (418 kilometers) from Ridgecrest, the Los Angeles Times reported.

Since the magnitude-6.4 quake on Thursday, more than 1,000 aftershocks have struck the area, CBS News reported. So Friday's powerful ground-shaking was not a complete surprise.

In fact, seismologists warned earlier Friday that additional quakes were likely in the next week, and said there was a 9% chance of a quake larger than Thursday's temblor striking the area, Live Science reported. Seismologists now think that the fault system responsible for the quakes is growing, and residents of Ridgecrest and the nearby desert town of Trona can't breathe easy just yet. Aftershocks to this quake, which is now considered a "foreshock," are very likely, experts said.

"There's a 5% chance that this could be followed by an even larger quake," USGS seismologist Robert Graves said at a news conference on Friday, as reported by the LA Times.

(Tia Ghose, Associate Editor / LIVESCIENCE, July 6, 2019, https://www.livescience.com/65883-bigger-quake-strikes-southern-california.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190706-ls)

The science behind California's two big earthquakes

Firefighters battle an electrical fire in a mobile home park in Ridgecrest, California, on July 6, 2019 following the magnitude 7.1 earthquake that struck the day before. No fatalities or serious injuries have been reported from this temblor, the largest in Southern California in more than two decades.

The pair of powerful temblors that shook the United States' West Coast promise fresh clues about the region's complex geology.

On the morning of July 4, a magnitude 6.4 rocked Southern California, fracturing roads and sending people fleeing to safety. But that wasn't all the Earth had in store: Less than a day and a half later, a powerful magnitude 7.1 temblor shook the region.

While earthquakes are not unexpected, the two most recent temblors are the largest that have struck this area in decades. And they promise to yield fresh clues about its complex geology.

The duo of quakes struck in what's known as the Eastern California shear zone—an area east of the infamous San Andreas fault, where the Pacific Plate grinds against the North American Plate, creeping northwest at roughly two inches each year. The area extends from the southern Mojave Desert, up the eastern side of the Sierra Nevada, and into western Nevada. It's crisscrossed by fractures in the Earth caused by the movement along the nearby tectonic plate boundary.

"The Eastern California shear zone is a really interesting area," says Wendy Bohon, an earthquake geologist at the Incorporated Research Institutions for Seismology (IRIS). "How is it working? How is it accommodating plate motion? What are going to be the big structures that come out of this millions of years down the road?"

What happened?

The recent events are what's known as strike-slip earthquakes, which occur when two blocks of Earth shift side-by-side, grinding past each other. They seemed to have occurred along the same set of faults, located in an area known as the Little Lake fault zone.

While no deaths or major injuries have yet been reported, the intensity of the ground movement was quite strong—enough to send goods flying off store shelves and buildings swaying. The shaking was also widespread, with reports of light ground movements as far as Chico, California, and Phoenix, Arizona.

Of particular interest in these quakes is that at least the first temblor seemed to have simultaneously broken two sections of faults that cut across each other at nearly a right angle.

While such complex quakes are not unheard of, recent research suggests that they may be more common than once believed, explains Zachary Ross, a geophysicist at the California Institute of Technology.

"Historically, the thought has been that earthquakes occurred on individual faults," he says. "And then over time, as the data has gotten better and better, we've started to realize that there's potential for multiple faults to rupture for single events."

This shift in thinking was propelled by the magnitude 7.3 earthquake that shook Landers, California, in 1992. This temblor fractured along at least five fault segments. Subsequent earthquakes have revealed similar complex breakage, including the magnitude 7.2 earthquake in 2010 in Baja California, Ross notes. This latest quake is further evidence that this complexity is common, even for smaller magnitude events.

Why did two big earthquakes strike?

In most circumstances, big earthquakes strike in a familiar sequence: There's a large earthquake followed by a series of smaller events. That's because the movement that occurs during a large earthquake causes increased strain in the surrounding region. Earthquakes are the Earth's way of relieving this strain.

But in some circumstances, such as the recent pair of earthquakes in California, a relatively large temblor might just be the forerunner for even bigger event. While the difference between 7.1 and 6.4 may seem minor, magnitude is a logarithmic scale. An increase of a unit of magnitude is about 32 times more energy, which means that the second earthquake released roughly 11 times the energy of the first temblor.

Scientists think of this series of earthquakes as the foreshock, the mainshock or strongest event, and then the aftershocks, explains Susan Hough, a seismologist with the U.S. Geological Survey.

"But it's way too simplistic," she notes.

Every earthquake causes a shift in the landscape, redistributing the strain in the crust, which means all earthquakes could trigger other earthquakes. "Whether or not an earthquake itself is an aftershock," she says, "you can think of it as a potential [earthquake] parent."

The likelihood that a big earthquake will trigger a larger event is roughly one in 20, according to Hough. That's definitely a low risk. "But that one in 20 isn't zero," she says.

Scientists, however, are still untangling the connection between the recent events. The magnitude 7.1 temblor seemed to break along the the northwest-southeast limb of the pair of faults that ruptured earlier, Hough notes, extending farther than the first quake in both directions.

"Major scientific questions: Did part of the fault break and then break again? How did breaks compare in detail?" she writes on Twitter. Finding the answers to these questions could have important implications for understanding the hazards of these events.

"This appears to be the clearest case I've seen that that did indeed happen," she says of the same fault rupturing more than once in a short time period. "But much work is needed to sort out the details."

What's going to happen next?

So far, many more than a thousand aftershocks have rippled through the region. While the frequency and intensity of subsequent temblors will wane, Southern California likely has more shaking in store. "A magnitude 7 is going to produce activity for years," Ross says.

The USGS estimates that over the course of the next week, between 240 and 410 earthquakes of magnitude 3 or higher will likely ripple through the region. These are events just large enough to feel if you are positioned close to their epicenter. As for larger earthquakes, the probability becomes increasingly small, but not out of the question.

The USGS estimates that there's a 24 percent chance that as many as two earthquakes magnitude 6 or larger could strike in the next week. But as scientists continue to analyze these events, they may adjust those numbers.

Such a strong series of aftershocks is not unexpected. "Earthquakes out in the Mojave Desert traditionally have these bigger, robust aftershocks sequence," Bohon says.

She cautions, however, that all of these probabilities are forecasts and not predictions. No one, despite what some claim, can predict future earthquakes. She likens the difference to weather forecasts, which are an estimate of the probability that something might happen.

"You would never predict the weather," she says. "You can't predict with 100 percent certainty that it [will be] raining unless it's raining. And earthquakes are very similar."

Bohon emphasizes that it's normal to be scared during an earthquake, which can rock the ground like a boat in rough water. But as aftershocks ricochet through Southern California, she suggests people who live in earthquake-prone regions check how prepared they are for the next event.

"This was a good scenario earthquake," says Bohon. "It was in a fairly unpopulated area, but a lot of people felt it." Bohon hopes that means those who experienced it are getting ready for the next one.

"It's okay to be scared," she says, "but we also have to be prepared."

(Maya Wei-Haas / National Geographic, July 6, 2019, https://www.nationalgeographic.com/science/2019/07/science-behind-californias-two-big-earthquakes)

Massive crack from 7.1 California quake viewed from Satellites

California earthquake created a massive crack in the Earth visible in satellite images..The large crack extends some distance from an area that apparently held water before. The erosion patterns on the desert sand indicate that some of that water was sucked out

https://youtu.be/6ULKGwxWVWk?t=17

TheEarthMaster, 8 July 2019

Could Massive SoCal Earthquakes Trigger the 'Big One' on the San Andreas Fault?

Twin quakes — the biggest to hit Southern California in decades — rattled a parched stretch of the Mojave Desert on Thursday (July 4) and Friday (July 5), sending seismic waves rippling through Earth that could be felt from Los Angeles to San Jose.

Thankfully, no deaths were reported, partly because the two quakes hit a sparsely populated region of the Golden State.

The ruptured faults were not part of the San Andreas Fault system, which snakes 800 miles (1,287 kilometers) from north to south along the coastline, where the North American and Pacific plates meet.

The San Andreas fault system is more than 800 miles (1,300 kilometers) long, and as deep as 10 miles (16 km) in some spots.

But is there a chance that these quakes could somehow transfer stress to the San Andreas Fault, potentially triggering the much feared "Big One" in one of the state's most populous cities?

It is theoretically possible, though there's no known link between the two fault systems, geophysicists say. And because there's still so much to learn about the complicated fault system that ruptured, it's difficult to say whether the San Andreas Fault took on additional stress from the recent quakes, they say.

Hidden faults

The magnitude-7.1 quake on July 5 ruptured a known portion of the Little Lake Fault zone, while the magnitude-6.4 quake that hit the prior day ruptured a previously unmapped region of the fault zone, Glenn Biasi, a geophysicist with the USGS in Pasadena, California, told Live Science in an email. If you look at a map of faults, you'd see that the Little Lake Fault zone and the San Andreas Fault zone are not very close together.

"We do not know of a definite relationship of these earthquakes to the San Andreas," Biasi said.

That said, geologists are still learning a lot about the Little Lake Fault zone.

Many of the individual faults in this zone are active, "and because they are buried, we probably do not know them all. This area does not fit the textbook picture of sides of a plate sliding past one another," Biasi said.

Because these faults are so complicated and we know relatively little about them, it's hard to say how they will interact with the San Andreas. It is possible that the recent quakes added stress to the San Andreas Fault, though "we don't have a good way to assess the likelihood," said Michele Cooke, a geoscientist at the University of Massachusetts - Amherst.

"The San Andreas hasn't slipped in a long while. If the fault is loaded to the point where it is just about ready to slip, then it is possible that the recent earthquake could add just enough shear stress to the San Andreas to cause it to slip. Alternatively, the slip of these recent earthquakes could unclamp the San Andreas fault, making it easier to slip," Cooke told Live Science in an email.

Migrating stress?

Another intriguing possibility is that there's a bigger shakeup underground that these recent earthquakes are unmasking.

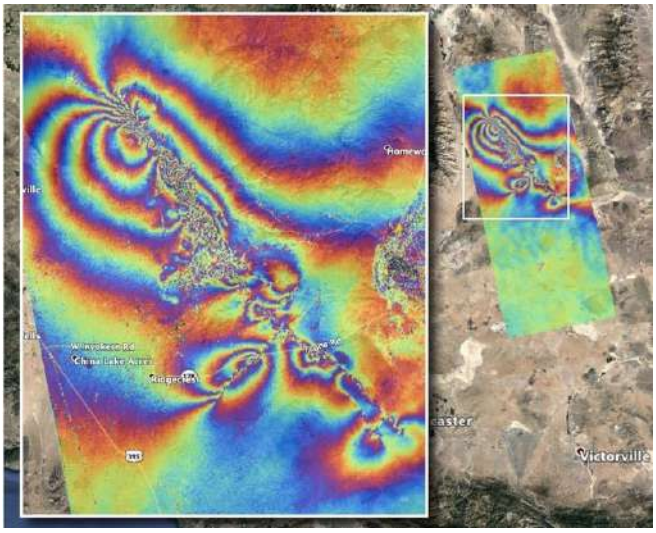
Some of the movement on the San Andreas Fault is migrating east, crossing the Mojave Desert and heading up the eastearn side of the Sierra Nevada mountain range, Biasi said.

Three big ruptures, including one in 1992, 1999 and the recent Ridgecrest quakes all seem to be aligned, and are part of what's known as the Eastern California Shear Zone (ECSZ), Cooke said. By contrast, the southern portion of the San Andreas Fault hasn't had a major rupture in 150 years, she said.

"Some suggest that we are seeing a migration of the active plate boundary away from the San Andreas Fault," Cooke said. "I'm not yet convinced of this, but I do think that this recent (geologically speaking) cluster of earthquakes in the ECSZ is very interesting."

(Tia Ghose and Jeanna Bryner / LIVESCIENCE, July 8, 2019, https://www.livescience.com/65886-could-socal-earthquakes-hit-san-andreas-fault.html?utm_source=notification)

2 SoCal Earthquakes Warped the Ground for Miles. And It's Visible from Space.



NASA experts used satellite data to map the ground displacement caused by the two major earthquakes that struck Southern California on July 4 and 5, 2019.

Two recent Southern California earthquakes warped the ground across dozens of square miles — and the changes are visible even from space.

A Japanese satellite picked up damage from the July 4 and 5 earthquakes that had magnitudes of 6.4 and 7.1, respectively. Quakes of these magnitudes are strong enough to cause moderate to severe damage to buildings.

The July 5 earthquake was the strongest to hit the Ridgecrest region (150 miles, or 241 kilometers, northeast of Los Angeles) in 40 years, according to the U.S. Geological Survey. The surface displacement caused by this temblor and its predecessor is clear in new images from Japan's Advanced Land Observing Satellite (ALOS-2) satellite.

That satellite gathers data using a technique called synthetic aperture radar, which produces detailed measurements of the height of Earth's surface. Scientists at NASA's Jet Propulsion Laboratory (JPL), which is also located in Southern California, created a map based on the data.

Each color band represents 4.8 inches (12 centimeters) of ground displacement within the radar instrument's line of sight, JPL said in a statement. The most "noisy" areas, which appear the most muddled in the image, are likely where the ground was broken up by the earthquake. In the southeast corner of the image, linear features appear to slice through colored whirls and likely mark where the surface was sliced open by the quakes.

The USGS and the California Geological Survey, as well as other scientists, will use the map to assess damage and map the new faults. The region has also experienced 1,000 aftershocks that opened up a few cracks.

Scientists are working closely with NASA's Earth Science Disasters Program (as well as many other partners that include the Federal Emergency Management Agency) to figure out how best to respond to the earthquake, JPL added.

The pair of earthquakes caused devastating damage to homes but no reported deaths or major injuries, according to news agencies.

(Elizabeth Howell, Live Science Contributor / LIVESCIENCE, July 10, 2019, https://www.livescience.com/65902-socal-earthquakes-ground-warp-space.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190710-ls)

Steve Latham, a local resident, uses his leg to measure the amount of offset in the desert floor caused by a magnitude-7.1 earthquake, along California State Route 178 between Ridgecrest and Trona, California, on June 6, 2019. Local residents and out-of-town visitors flocked to the spot to see the earthquake's geological effects on the earth's surface.

Istanbul: Seafloor study proves earthquake risk for the first time

GeoSEA sensors document tectonic strain build-up below the Marmara Sea

Summary

Istanbul is located in close proximity to the North Anatolian fault, a boundary between two major tectonic plates where devastating earthquakes occur frequently. Using an autonomous measuring system on the seafloor, researchers have now for the first time measured deformation underwater and detected a considerable build-up of tectonic strain below the Marmara Sea near Istanbul.

Collapsed houses, destroyed port facilities and thousands of victims -- on 22 May 1766 an earthquake of approximately 7.5 magnitude units and a subsequent water surge triggered a catastrophe in Istanbul. The origin of the quake was located along the North Anatolian fault in the Sea of Marmara. It was the last major earthquake to hit the metropolis on the Bosporus.

Researchers of the GEOMAR Helmholtz Centre for Ocean Research Kiel (Germany), together with colleagues from France and Turkey, have now been able to demonstrate for the first time with direct measurements on the seafloor that considerable tectonic strain has built up again on the North Anatolian fault below the Sea of Marmara. "It would be sufficient to trigger another earthquake with magnitudes between 7.1 to 7.4," says geophysicist Dr. Dietrich Lange of GEOMAR. He is the lead author of the study published today in the international journal *Nature Communications*.

The North Anatolian fault zone marks the boundary between the Eurasian and Anatolian plates. "Strong earthquakes occur when the fault zone becomes locked. Then tectonic strain accumulates, and the seismic energy is released in an earthquake," explains Dr. Lange. The last time this happened was in 1999 at a section of the North Anatolian fault near Izmit, about 90 kilometers east of Istanbul.

Tectonic strain build-up along fault zones on land has been regularly monitored for years using GPS or land surveying methods. This is not possible in seabed fault zones due to the low penetration depth of the GPS satellite signals under water. However, the section of the North Anatolian fault that poses the considerable threat to the Istanbul metropolitan region is located underwater in the Marmara Sea.

Up to now, it has only been possible to extrapolate, for example using land observations, whether the plate boundaries there are moving or locked. However, the methods could not distinguish between a creeping movement and the complete locking of the tectonic plates. The new GeoSEA system developed at GEOMAR measuring acoustic distances on the seabed now enables scientists for the first time to directly measure crustal deformation with mm-precision. Over a period of two and a half years, a total of ten measuring instruments were installed at a water depth of 800 metres on both sides of the fault. During this time, they carried out more than 650,000 distance measurements.

"In order to get measurements accurate within a few millimetres over several hundred of metres, very precise knowledge of the speed of sound underwater is required. Therefore, pressure and temperature fluctuations of the water must also be measured very precisely over the entire period," explains Prof. Dr. Heidrun Kopp, GeoSEA project manager and co-author of the current study.

"Our measurements show that the fault zone in the Marmara Sea is locked and therefore tectonic strain is building up. This is the first direct proof of the strain build-up on the seabed south of Istanbul," emphasizes Dr. Lange.

"If the accumulated strain is released during an earthquake, the fault zone would move by more than four metres. This corresponds to an earthquake with a magnitude between 7.1 and 7.4," adds Professor Kopp. Such an event would very

probably have similar far-reaching consequences for nearby Istanbul as the 1999 earthquake for Izmit with over 17,000 casualties.

(Helmholtz Centre for Ocean Research Kiel (GEOMAR), July 8, 2019, https://www.sciencedaily.com/releases/2019/07/190708131157.htm)

Interseismic strain build-up on the submarine North Anatolian Fault offshore Istanbul

Dietrich Lange, Heidrun Kopp, Jean-Yves Royer, Pierre Henry, Ziyadin Çakir, Florian Petersen, Pierre Sakic, Valerie Ballu, Jörg Bialas, Mehmet Sinan Özeren, Semih Ergintav & Louis Géli

Nature Communications **volume 10**, Article number: 3006 (2019)

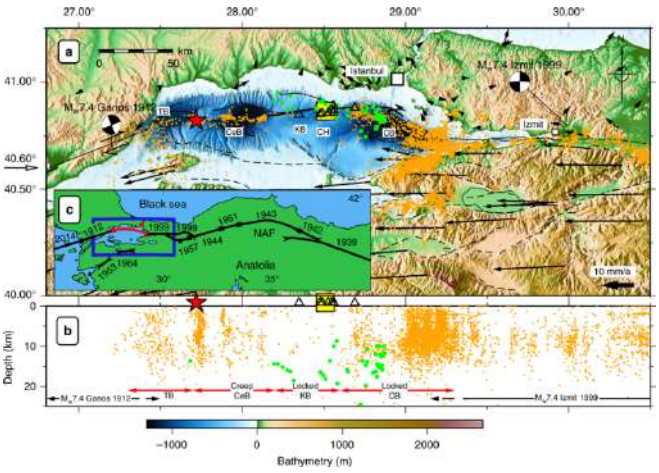
Abstract

Using offshore geodetic observations, we show that a segment of the North Anatolian Fault in the central Sea of Marmara is locked and therefore accumulating strain. The strain accumulation along this fault segment was previously extrapolated from onshore observations or inferred from the absence of seismicity, but both methods could not distinguish between fully locked or fully creeping fault behavior. A network of acoustic transponders measured crustal deformation with mm-precision on the seafloor for 2.5 years and did not detect any significant fault displacement. Absence of deformation together with sparse seismicity monitored by ocean bottom seismometers indicates complete fault locking to at least 3 km depth and presumably into the crystalline basement. The slip-deficit of at least 4 m since the last known rupture in 1766 is equivalent to an earthquake of magnitude 7.1 to 7.4 in the Sea of Marmara offshore metropolitan Istanbul.

Introduction

It is well known that Istanbul city and populations along the coasts of the Sea of Marmara were previously severely affected by earthquakes related to the submerged North Anatolian Fault (NAF) in the Sea of Marmara. Some of the earthquakes were associated with seismically driven sea-waves and six destructive run-ups are known from historical reports for the last 20 centuries. For example, the 1766 earthquake, suggested to have nucleated beneath the western Sea of Marmara, resulted in very strong shaking in Istanbul (Mercalli Intensity VII, very strong shaking) and seismically driven sea-waves submerged the quays in Istanbul.

The Sea of Marmara, crossed by the NAF, is one of the regions on the globe where the fragmentary knowledge on the degree of fault locking poses a significant impediment for assessing the seismic hazard in one of Europe's most populated regions, the Istanbul metropolitan area. Since 1939, destructive seismic events on the onshore portion of the NAF have propagated westwards towards Istanbul (Fig. 1c). The most recent events were the Mw 7.2 Düzce and Mw 7.4 Izmit earthquakes in 1999 (Fig. 1a) that caused 854 and ~18,000 casualties, respectively. Towards the Dardanelles in the west, the Mw 7.4 Ganos earthquake ruptured the NAF in 1912. In the Sea of Marmara, the NAF forms a well-known seismic gap along a 150 km-long segment, inferred to have last ruptured in 1766, whereas all the onshore segments of the NAF from the province Erzincan in Eastern Anatolia to the Sea of Marmara ruptured in the last 100 years. The degree of aseismic deformation and hence the locking state of the marine fault segments of the NAF cannot be well resolved using onshore GPS stations alone. Owing to the lack of offshore observations, the uncertainty on fault slip rates on the order of 10 mm a^{-1} in the central part of the Sea of Marmara prevails.



Overview and tectonic setting of the Sea of Marmara. **a** Tectonic setting of the NAF (solid line) in the Marmara region with local seismicity (orange dots) between 1999–2009[4] and 2010–2012. The geodetic acoustic network is located in the yellow box (top center) and the local ocean bottom seismometer (OBS) stations (29/10/2014–25/04/2015 and 26/04/2015-13/04/2016) are indicated with triangles. Microseismicity based on the OBS (this study) in the area of the geodetic network is shown with green circles. The red star indicates the location of a recent Turkish-Japanese direct path-ranging network in the western Sea of Marmara. Fault traces of the NAF and GPS displacements relative to stable Eurasia are shown with black arrows and lines. Bathymetry from and topography from. Tekirdağ basin (TB), Central Basin (CeB), Kumburgaz Basin (KB), Central High (CH) and Çınarcık Basin (CB). **b** Profile view of seismicity north of 40.6°N, same symbols as in panel a. Sedimentary basins are indicated with red arrows and the extent of the Ganos 1912 and Izmit 1999 earthquakes are indicated with black arrows. Creeping and locked segments of the NAF are labelled. See text for discussion about locked fault beneath the KB and the CB. **c** Large-scale tectonic setting of northwestern Turkey with rupture zones of major earthquakes along the North Anatolian Fault (NAF)

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Journal Reference:

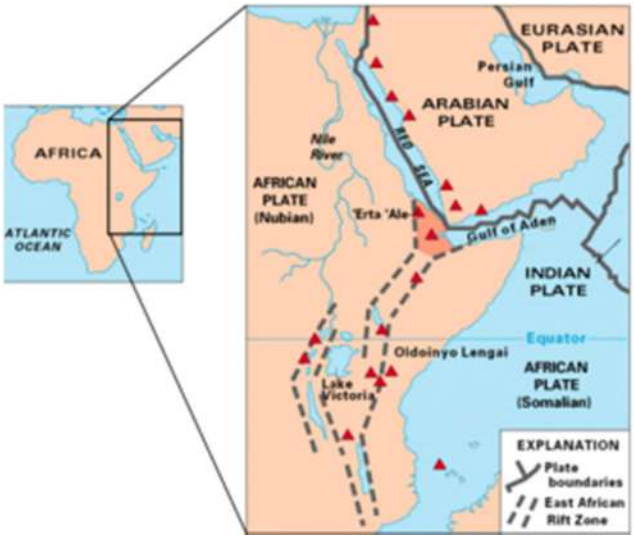
Dietrich Lange, Heidrun Kopp, Jean-Yves Royer, Pierre Henry, Ziyadin Çakir, Florian Petersen, Pierre Sakic, Valerie Ballu, Jörg Bialas, Mehmet Sinan Özeren, Semih Ergintav, Louis Géli. **Interseismic strain build-up on the submarine North Anatolian Fault offshore Istanbul**. *Nature Communications*, 2019; 10 (1) DOI: 10.1038/s41467-019-11016-z

(https://www.nature.com/articles/s41467-019-11016-z)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΓΕΩΛΟΓΙΑ

Travel Monday:
A Photo Trip to Ethiopia's Danakil Depression

In the Afar region of northern Ethiopia, lies a vast, tortured, desert plain called the Danakil Depression. Danakil lies about 410 ft (125 m) below sea level, and is one of the hottest and most inhospitable places on Earth— temperatures average 94 degrees Fahrenheit (34.5 Celsius) but have been recorded above 122 Fahrenheit (50 Celsius). Numerous sulfur springs, volcanoes, geysers, acidic pools, vast salt pans, and colorful mineral-laden lakes dot the area, which formed above the divergence of three tectonic plates. Volcanic activity heats spring water, bringing sulfur and iron to the surface, leaving behind yellow, green, and orange deposits. For centuries, locals have been trekking in with camel caravans to mine the salt by hand, and in recent years, a few have been guiding tourists into the alien-looking landscape.



Location map of the Afar Triangle (the shaded area in the center of the map) and the East African Riftzones; red triangles show historically active volcanoes.

Topographic map showing the Afar Triangle, which correlates to the shaded area in the location map shown above

Colorful features of one of several hot springs in the Danakil Depression, in Ethiopia's Afar region, photographed on February 26, 2016.

A long exposure image shot beside the crater of Erta Ale, an active volcano in Danakil.

A colorful feature of one of Danakil's hot springs.

Reddish waters of Lake Karum, or "Assale," fill a seasonally dry shallow area after flooding, due to a recent storm in the surrounding highlands, in the Danakil Desert.

A salt miner works in the heat as he digs out salt blocks by hand in the Danakil Depression on January 22, 2017.

Salt Mountains of Dallol volcano in Ethiopia.

The landscape of one of several hot springs in the Danakil Depression, photographed on February 26, 2016.

Deposits on a cone, forming around a small geyser, in one of Danakil's hot springs.

Water sputters from the tip of a cone on a small geyser in one of Danakil's hot springs.

The area around Lake Dallol and its sulfur springs.

A sulfur lake in the Danakil Depression on January 23, 2017.

Erta Ale, a continuously active basaltic shield volcano in the Afar region of northeastern Ethiopia.

A tourist stands in front of the living lava lake in the crater of Erta Ale in Ethiopia on February 27, 2016.

Ropy lava in a flow near Erta Ale crater.

Lava formations in a secondary crater of Erta Ale, on January 21, 2014.

Ethiopia's Danakil salt pan can be seen in this aerial view near the Dallol volcano on November 29, 2004.

Mineral deposits near Dallol Volcano.

Broad fungus-like mineral deposits in the Danakil Depression.

A close-up of sulfur deposits in the Danakil Depression, photographed on January 23, 2017.

An Ethiopian man walks past a sulfur spring in the Danakil Depression on January 23, 2017.

A salt flat is pictured in the Danakil Depression on January 23, 2017.

A camel caravan enters the salt mining area of the Danakil Depression on March 28, 2017. Every morning, hundreds of men converge on a dry lakebed in a remote corner of Ethiopia, where they cleave the ground open with hand axes to extract salt, just as their fathers and grandfathers once did.

A salt-covered branch lies on a salt pan in the Danakil Depression on January 22, 2017.

A camel caravan, carrying salt that was mined by hand, is led across a salt plain in the Danakil Depression on January 22, 2017, near Dallol, Ethiopia.

A camel caravan carries slabs of salt away from the Danakil Depression on April 22, 2013. The mineral is extracted and shaped into slabs, then loaded onto the animals before being transported back across the desert so that it can be sold around the country.

(Alan Taylor, Senior Editor / The Atlantic, Apr 16, 2018, https://www.theatlantic.com/photo/2018/04/travel-monday-a-photo-trip-to-ethiopias-danakil-depression/558128/)

The World's Weirdest Geological Formations

Credit: Alexander van Driessche

Weird Geology

The remnants of a 2-billion-year-old nuclear reactor and a cave of house-sized crystals might seem too strange to be natural, but the world is apparently full of such bizarre natural phenomena. Here are 10 of the weirdest geological structures on the planet.

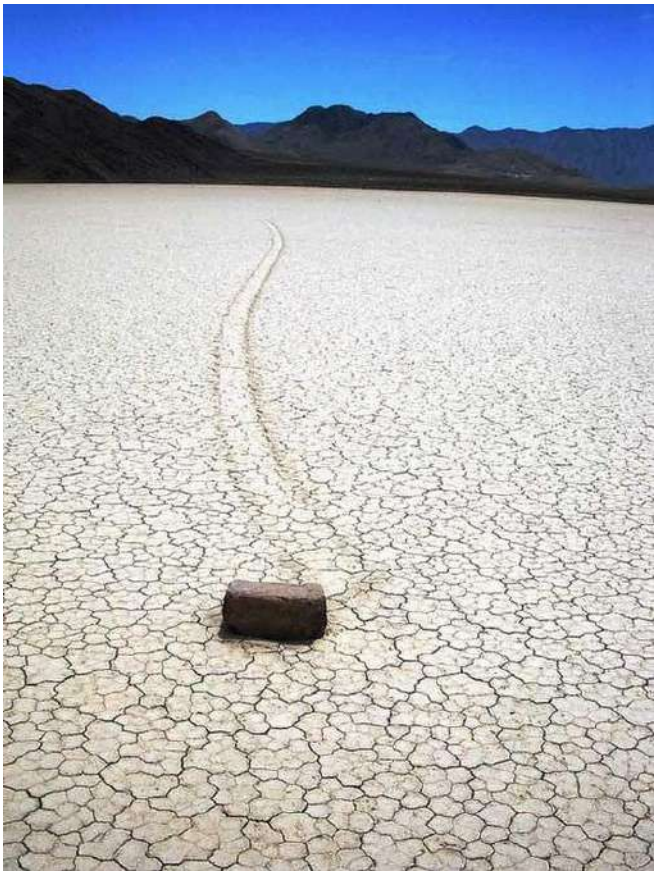
Cave of the Crystals, Mexico

The otherworldly crystals in the Cave of the Crystals in Mexico can reach sizes larger than houses, by far the largest such crystals known on the planet. They apparently grow at incredibly slow rates, gypsum formations that take as long as a million years to reach more than two stories tall. Researchers speculate that microscopic pockets of liquid within these giant crystals might hold microbes.

Eye of the Sahara, Mauritania

The Eye of the Sahara in Mauritania, also known as the Richat Structure, resembles a bull's-eye 30 miles (50 kilometers) wide. The mysterious formation is large enough for early space missions to have used it as a landmark. Scientists think it is the result of uplifted earth worn down over time by wind and water, with different rates of erosion on the varying rock types forming concentric ridges.

Sailing Stones of the Racetrack Playa in Death Valley, California



The sailing stones of the Racetrack Playa in Death Valley seem to strangely move on their own, leaving long trails behind them in the cracked clay. NASA research suggests that during the winter months, ice forms around the rocks, perhaps allowing them to slip across the frozen surface of the playa.

Giant's Causeway, Northern Ireland

The Giant's Causeway in Northern Ireland consists of more than 40,000 interlocking volcanic rock pillars, most of which are hexagonal, although some have fewer or more sides. Legend has it that the giant Finn McCool fashioned the Giant's Causeway to walk across the sea to Scotland and face his great rival Benandonner. Researchers say it was created by lava traveling out of cracks in the earth 60 million years ago, which cooled over time into a honeycomb pattern, with some pillars standing as tall as 36 feet (12 meters).

Ice Towers of Mount Erebus, Antarctica

Antarctica's Mount Erebus, an active volcano that rises 12,448 feet (3,794 meters) above the Earth's surface, is home to giant, hollow towers of ice. These form when fumaroles cracks in the Earth's crust that vent hot gas spew steam into the open air, which is so cold in the Antarctic that it freezes the steam in place, creating chimneys up to 30 feet (10 m) tall.

The remnants of the Oklo natural nuclear reactor, Gabon

Not all nuclear reactors on Earth are manmade some arise naturally. The Oklo mine in the West African nation of Gabon was once home to a natural nuclear reactor that apparently spontaneously turned on 2 billion years ago, running on uranium fuel. It seems to have lasted about 150,000 years with an average power output of 100 kilowatts, radiating the energy equivalent of 100 megaton bombs over its lifetime.

Pamukkale, Turkey

Pamukkale, which means "cotton castle" in Turkish, is found in the mountains of Turkey. It may resemble a glacier, but the site is actually bathed in hot water. The mineral-rich waters of the area's hot springs have over time formed dazzling white limestone terraces.

The Eisriesenwelt ice cave, Austria

The Eisriesenwelt German for "world of the ice giants" is the largest known ice cave in the world. The limestone cavern stays cold enough year-round to freeze any water inside. This leads to gigantic ice formations growing within.

The Tessellated Pavement of Eaglehawk Neck, Tasmania

One might easily wonder if the unusual grid of the Tessellated Pavement of Eaglehawk Neck, Tasmania, is completely unnatural. Apparently, this rare geological feature formed when the underlying siltstone cracked in blocks resembling tiles, possibly between 60 million and 160 million years ago. When seawater covers the platform, sand and wave action erodes the rock. The surface of the stone can erode faster between the rims of the tiles than on the rims themselves.

Fingal's Cave, Scotland

Fingal's Cave is a cathedral-like sea cave that stretches about 250 feet (75 meters) into the rock on the island of Staffa off the west coast of Scotland, with a roof about 70 feet (20 m) above the sea. It formed within lava flows that cooled to form hexagonal columns. The cavern inspired Mendelssohn's Hebrides overture and attracted celebrity tourists of the Victorian era such as Jules Verne, William Wordsworth, Alfred Lord Tennyson and Queen Victoria herself.

(Charles Q. Choi, Live Science Contributor / LIVESCIENCE, June 6, 2012, https://www.livescience.com/31471-weirdest-geological-formations.html)

Η άγνωστη Κρήτη των φαραγγιών

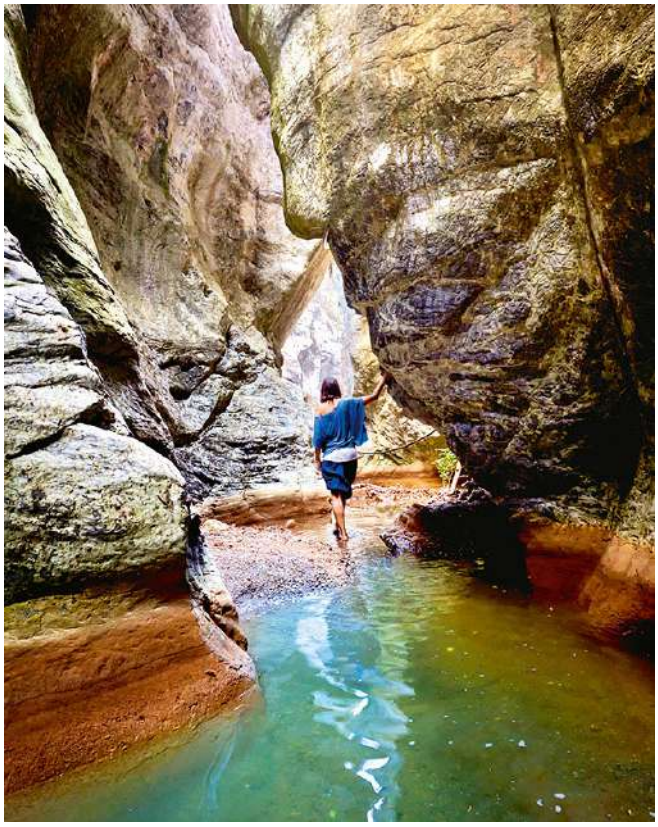
Η καταρρίχηση στις σχισμές του βουνού, ανάμεσα σε χαρουπιές και σκίνους, είναι ο καλύτερος τρόπος για να γνωρίσουμε μια όψη του νησιού που δεν ξέραμε ότι υπάρχει.

Το φαράγγι της Παναγιάς είναι στενό και συμπαγές, με τον μεγαλύτερο καταρράκτη του να φτάνει τα 15 μ.

«Αν ρωτήσεις έναν Κρητικό πού βρίσκεται ο μεγαλύτερος καταρράκτης στην Ελλάδα, θα σου πει στην Έδεσσα. Δεν ξέρει ότι βρίσκεται στα Χανιά, στο φαράγγι Πέρδικα, και έχει ύψος 240 μέτρα. Από αυτό καταλαβαίνεις ότι ο μέσος Κρητικός δεν γνωρίζει την ομορφιά που υπάρχει δίπλα στο σπίτι του». Ο Γιάννης Μπρομοιράκης σίγουρα την ξέρει. Εκπαιδευτής και πρόεδρος του Παγκρήτιου Ομίλου Διάσχισης και Εξερεύνησης Φαραγγιών (ΠΟΕΦ), με εμπειρία 15 χρόνων στο canyoning, έχει στο ενεργητικό του περί τις 1.500 διασχίσεις σε 27 χώρες του κόσμου. «Η Κρήτη έχει πάνω από 250 πεζοπορικά και τεχνικά φαράγγια. Εμείς ασχολούμαστε κυρίως με τη δεύτερη κατηγορία, δηλαδή με τα φαράγγια που χρειάζονται σχοινιά και εξοπλισμό, τα οποία υπολογίζουμε ότι είναι 90. Τα σημαντικότερα, ομορφότερα και με το μεγαλύτερο τουριστικό ενδιαφέρον βρίσκονται στον νομό Λασιθίου και στο νότιο Ηράκλειο. Στα Λασιθιώτικα Όρη, από τη νότια μεριά του Οροπεδίου Λασιθίου, το οποίο είναι και ο μεγαλύτερος τροφοδότης νερού για τα φαράγγια που μας ενδιαφέρουν».

Για τον μέσο άνθρωπο που δεν έχει ασχοληθεί ποτέ στη ζωή του με το σπορ, τι είναι το canyoning; «Το canyoning είναι το πέρασμα ενός φαραγγιού που έχει νερό. Στην Κρήτη δεν έχουμε όλη τη χρονιά –ούτε όλες τις χρονιές– νερό. Γι' αυτό συνήθως τα φαράγγια είναι κατάλληλα για canyoning για δύο τρεις μήνες, από Γενάρη μέχρι Μάρτη». Τις περιόδους που τα φαράγγια δεν έχουν νερό, οι φίλοι του αθλήματος μπορούν να κάνουν rappel (καταρρίχηση) σε ξερό πεδίο. Ένα φαράγγι μπορούν να το διασχίσουν άτομα κάθε ηλικίας που διατηρούν

μια σχετικά καλή φυσική κατάσταση. «Από 8 έως 65 ετών. Σίγουρα, βέβαια, το canyoning απευθύνεται σε ανθρώπους υγιείς και διατεθειμένους να εκτεθούν σε κάποιο ύψος».



Το φαράγγι της Άρβης έχει μήκος 1,7 χλμ. Περιλαμβάνει ένα σκοτεινό κομμάτι 200 μ., το οποίο μπορείς να διασχίσεις μόνο με φακό.

Παρότι τα τελευταία χρόνια ο τουρισμός φύσης και περιπέτειας –στον οποίο εντάσσεται το canyoning– αποκτά όλο και μεγαλύτερη απήχηση, δεν έχει ακόμα φτάσει στο σημείο να συνεισφέρει ουσιαστικά στην αλλαγή του τουριστικού προφίλ του νησιού. «Επικουρικά, ναι, αυτού του τύπου οι δραστηριότητες βοηθούν. Όμως, αν σκεφτείς ότι έρχονται κάποια εκατομμύρια τουρίστες κάθε χρόνο στην Κρήτη, οι οποίοι κλείνονται σε ένα ξενοδοχείο, τρώνε, πίνουν, λιάζονται και φεύγουν, το ποσοστό των ανθρώπων που ψάχνουν την ενδοχώρα και πραγματικά ενδιαφέρονται για τέτοιες δραστηριότητες είναι πολύ μικρό. Τους υπολογίζω σε 400 τον χρόνο. Σε σχέση με παλαιότερα, όμως, που δεν ενδιαφερόταν κανείς, είναι σημαντικό».

Ακούγοντας τον Γιάννη να μιλάει για τα κρητικά φαράγγια και να περιγράφει τις εμπειρίες του σε αυτά, καταλαβαίνεις ότι αναφέρεται σε έναν κόσμο που δεν έχει καμία σχέση με την Κρήτη των παραλιών που κατά κύριο λόγο ξέρουμε. «Τις πρώτες φορές που άνοιξα διαδρομές και μπήκα μέσα σε κάποια φαράγγια, ήμουν σε μέθη επί έναν μήνα», θυμάται. «Ήταν τόσο εξωπραγματικό αυτό που έβλεπα». Αξίζει να πάρει κανείς το θάρρος να το δοκιμάσει. Για να δει ορμητικούς καταρράκτες, να κάνει βουτιές σε παγωμένες λίμνες, να περπατήσει σε σχισμές του βουνού ανάμεσα σε ψηλά τοιχώματα και να αιωρηθεί με τα σχοινιά σε κάθετους βράχους, ενώ από πάνω του τριγυρίζουν φιλοπερίεργες σκάρες. «Γύπες, δηλαδή. Τους συναντάμε πολύ συχνά, είναι κατά κάποιον τρόπο συνοδοιπόροι μας. Δεν υπάρχει περίπτωση να πλησιάσουν, γιατί φοβούνται. Όμως παρακολουθούν».

Ο άνθρωπος που ανατριχιάζει στην ιδέα να κρεμαστεί από έναν βράχο, ενώ εκατό μέτρα πάνω από το κεφάλι του περιφέρεται ένα άγριο πουλί που εποπτεύει τις κινήσεις του, είναι αυτός που πρέπει να δοκιμάσει canyoning. Γιατί αν κάτι μπορείς να κερδίσεις από αυτό το σπορ, είναι το να αναμετρηθείς με τους φόβους σου. «Πρέπει να πιστέψεις στον εαυτό σου και να πεις "μπορώ". Να βρεθείς μόνος, "ολόγυμνος" και εκτεθειμένος και να προσπαθήσεις να προεκτείνεις τα όριά σου. Να δεις ότι τελικά είσαι κάτι πιο μεγάλο από αυτό που νόμιζες. Στις περισσότερες περιπτώσεις ένας υγιής άνθρωπος αντιμετωπίζει το canyoning σαν μια ένεση αυτοπεποίθησης, που θα του δώσει ώθηση να πάει τη Δευτέρα στη δουλειά, να ακολουθήσει το πρόγραμμα και τη ρουτίνα του, χωρίς να τον φθείρει η καθημερινότητά του».

INFO:

• Για να κάνετε canyoning επικοινωνήστε με τον ΠΟΕΦ (canyon.gr), το Cretan Adventures (cretanadventures.gr) ή το Cretan Outdoor Adventures (cretan-outdoor-adventures.com).

• Αναζητήστε στα βιβλιοπωλεία το βιβλίο του Γιάννη Μπρομοιράκη «Canyoning στα φαράγγια της Κρήτης» (Road, 2007), που περιλαμβάνει 34 φαράγγια. Μέχρι το τέλος της χρονιάς αναμένεται να είναι έτοιμη και μια νέα έκδοση με 65 φαράγγια.

ΜΕ ΒΑΘΜΟ ΔΥΣΚΟΛΙΑΣ

1. Παναγιά / Ηράκλειο
Στενό και συμπαγές φαράγγι, μήκους 1,2 χλμ., με χαρουπιές, λυγιές, κυπαρίσσια και σκίνους. Ο μεγαλύτερος καταρράκτης του είναι 15 μ.
Βαθμός δυσκολίας: 2 στα 6.
Χρόνος κατάβασης: 2 ώρες.
Εκκίνηση: Κάτω από το χωριό Καλάμι.
Τερματισμός: Στην Παναγία Κεραλιμενιώτισσα.

Το φαράγγι του Χα είναι το πιο ιδιαίτερο της Κρήτης, με 27 καταρράκτες και κάθετα τοιχώματα ύψους 400 μ.

2. Βολαχά / Ηράκλειο
Πιο ανοιχτό φαράγγι από το προηγούμενο, μήκους 2,8 χλμ., με πεύκα και μεγαλύτερους καταρράκτες.
Βαθμός δυσκολίας: 3 στα 6.
Χρόνος κατάβασης: 3½ ώρες.
Εκκίνηση: Νότια του χωριού Καπετανιανά.
Τερματισμός: Στον οικισμό Αϊ-Γιάννης.

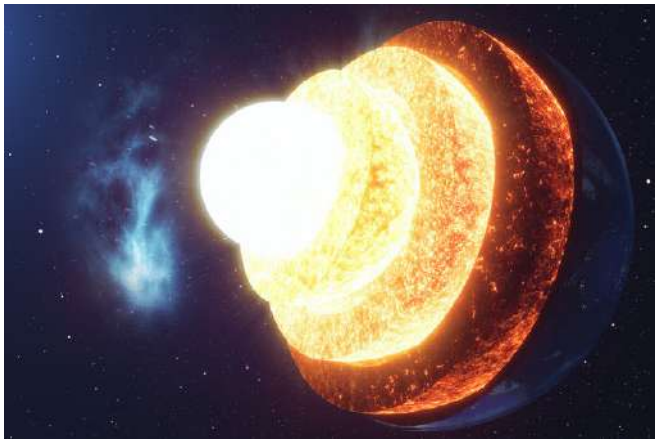
3. Πορτέλα / Ηράκλειο
Ξεχωριστό φαράγγι, μήκους 3,5 χλμ., με νεογενή ασβεστολιθικά πετρώματα, που είναι αρκετά μαλακά, γι' αυτό και το νερό παίρνει μια ελαφρώς λευκή απόχρωση.
Βαθμός δυσκολίας: 4,5 στα 6.
Χρόνος κατάβασης: 5-6 ώρες.
Σημείο εκκίνησης: Χωριό Χόνδρος.
Τερματισμός: Χωριό Καστρί.

4. Χα / Λασίθι
Πολύ ιδιαίτερο φαράγγι, μήκους 1,6 χλμ., με διαυγές νερό και 27 καταρράκτες. Τα κάθετα τοιχώματά του φτάνουν τα 400 μ. ύψος. Είναι στενό, με μέγιστο πλάτος τα 6-7 μ. και ελάχιστο τα 40 εκ. Σε περίπτωση ανάγκης δεν μπορείς να φύγεις από κανένα σημείο της διαδρομής, αλλά πρέπει να φτάσεις έως το τέλος.
Βαθμός δυσκολίας: 4,5 στα 6.
Χρόνος κατάβασης: 4 ώρες.
Εκκίνηση: Από σημείο νότια της Θρυπτής.
Τερματισμός: Χωριό Μοναστηράκι.

5. Άρβη / Ηράκλειο
Ξεχωριστό φαράγγι, μήκους 1,7 χλμ., με ένα σκοτεινό κομμάτι 200 μ. Το κενό ανάμεσα στα τοιχώματα κάποια στιγμή κλείνει και χρειάζεσαι φακό για να περάσεις. Αυτό το φαινόμενο συμβαίνει σε περίπου 100 φαράγγια σε όλο τον κόσμο και η Άρβη είναι το πιο σημαντικό ελληνικό φαράγγι τέτοιου τύπου.
Βαθμός δυσκολίας: 5-5,5 στα 6.
Χρόνος κατάβασης: 2½ με 3 ώρες.
Εκκίνηση: Νότια του χωριού Αμιράς.
Τερματισμός: Χωριό Άρβη.

(Ελευθερία Αλαβάνου / Η ΚΑΘΗΜΕΡΙΝΗ, 10.07.2019, https://www.kathimerini.gr/1033034/gallery/ta3idia/meaformh/afierwma-krhth-h-agnwsth-krhth-twn-faraggiwn)

Earth's Core Has Been Leaking for 2.5 Billion Years and Geologists Don't Know Why



Earth's scorching core is not a loner — it has been caught mingling with other, underworldly layers. That's according to a new study that found the innermost part of the planet leaks some of its contents into mantle plumes, some of which eventually reach Earth's surface.

This discovery helps settle a debate that's been raging for decades: whether the core and mantle exchange any material, the researchers said.

"Our findings suggest some core material does transfer into the base of these mantle plumes, and the core has been leaking this material for the past 2.5 billion years," the researchers wrote in The Conversation, a website where scientists write about their research for the public.

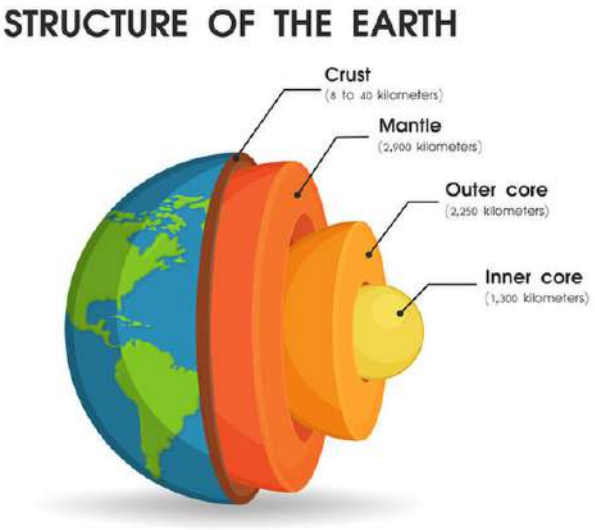
The finding was made possible by the metal tungsten (W), element 74 on the periodic table. If tungsten were to make a dating profile, it would note that it's a siderophile, or "iron lover." So, it's no surprise that a lot of tungsten hangs out in Earth's core, which is made primarily of iron and nickel.

On its profile, tungsten would also list that it has a few isotopes (an element with a different number of neutrons in its nucleus), including W-182 (with 108 neutrons) and W-184 (with 110 neutrons). While devising their study, the researchers realized that these isotopes could help them solve the core-leaking question.

Another element, hafnium (Hf), is a lithophile, meaning it loves rocks and can be found in Earth's silicate-rich mantle. With a half-life of 8.9 million years, hafnium's radioactive isotope Hf-182 decays into W-182. This means that the mantle should have more W-182 than the core does, the scientists reasoned.

"Therefore, chemical exchange between the core and the source of mantle plumes could be detectable in the 182W/184W ratio of ocean island basalts," which come from plumes in the mantle, the researchers wrote in the study.

But this difference in tungsten would be incredibly small: The tungsten-182 composition in the mantle and core were expected to differ by only about 200 parts per million (ppm). "Fewer than five laboratories in the world can do this type of analysis," the researchers wrote in The Conversation.



Earth's inner layers

Furthermore, it's not easy to study the core, because it begins at a depth of about 1,800 miles (2,900 kilometers) underground. To put that into perspective, the deepest hole humans have ever dug is the Kola Superdeep Borehole in Russia, which has a depth of about 7.6 miles (12.3 km).

So, the researchers studied the next best thing: rocks that oozed to Earth's surface from the deep mantle at the Pilbara Craton in Western Australia, and the Réunion Island and Kerguelen Archipelago hotspots in the Indian Ocean.

Leak detected

The amount of tungsten in these rocks revealed a leak from the core. Over Earth's lifetime, there was a big change in the W-182-to-W-184 ratio in Earth's mantle, the researchers found. Oddly, Earth's oldest rocks have a higher W-182-to-W-184 ratio than most modern-day rocks do, they discovered.

"The change in the 182W/184W ratio of the mantle indicates that tungsten from the core has been leaking into the mantle for a long time," the researchers wrote in The Conversation.

Earth is about 4.5 billion years old. The planet's oldest mantle rocks, however, didn't have any significant changes in tungsten isotopes. This suggests that from 4.3 billion to 2.7 billion years ago, there was little or no exchange of material from the core to the upper mantle, the researchers said.

But in the past 2.5 billion years, the tungsten isotope composition in the mantle has changed substantially. Why did this happen? If mantle plumes are rising from the core-mantle boundary, then perhaps, like a see-saw, material from Earth's surface is going down into the deep mantle, the researchers said. This surface material has oxygen in it, an element that can affect tungsten, the researchers said.

"Subduction, the term used for rocks from Earth's surface descending into the mantle, takes oxygen-rich material from the surface into the deep mantle as an integral component of plate tectonics," the researchers wrote in The Conversation. "Experiments show that [an] increase in oxygen concentration at the core-mantle boundary could cause tungsten to separate out of the core and into the mantle."

Or, maybe as the inner core solidified after Earth formed, the oxygen concentration in the outer core increased, the researchers said. "In this case, our new results could tell us something about the evolution of the core, including the origin of Earth's magnetic field," they wrote in The Conversation.

The study was published online June 20 in the journal Geochemical Perspectives Letters.

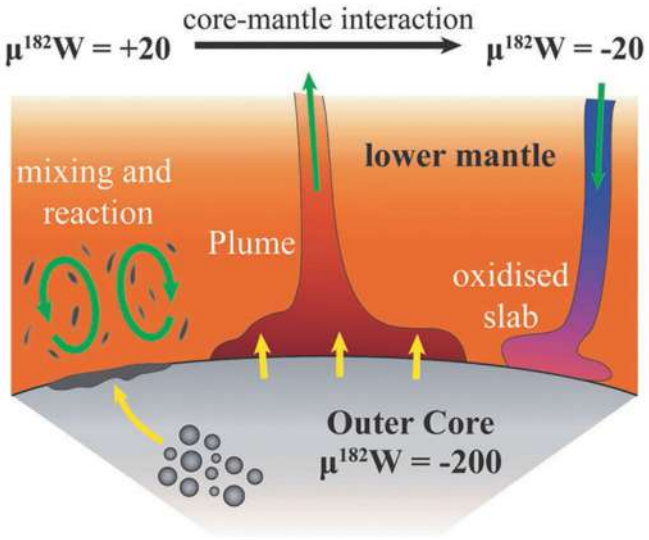
(Laura Geggel, Associate Editor / LIVESCIENCE, July 18, 2019, https://www.livescience.com/65968-earth-leaky-core.html?utm_source=ls-newsletter&utm_medium=email&utm_campaign=20190718-ls)

^{182}W evidence for core-mantle interaction in the source of mantle plumes

H. Rizo, D. Andrault, N.R. Bennett, M. Humayun, A. Brandon, I. Vlastelic, B. Moine, A. Poirier, M.A. Bouhifd, D.T. Murphy

Abstract

Tungsten isotopes are the ideal tracers of core-mantle chemical interaction. Given that W is moderately siderophile, it preferentially partitioned into the Earth's core during its segregation, leaving the mantle depleted in this element. In contrast, Hf is lithophile, and its short-lived radioactive isotope ^{182}Hf decayed entirely to ^{182}W in the mantle after metal-silicate segregation. Therefore, the ^{182}W isotopic composition of the Earth's mantle and its core are expected to differ by about 200 ppm. Here, we report new high precision W isotope data for mantle-derived rock samples from the Paleoarchean Pilbara Craton, and the Réunion Island and the Kerguelen Archipelago hotspots. Together with other available data, they reveal a temporal shift in the ^{182}W isotopic composition of the mantle that is best explained by core-mantle chemical interaction. Core-mantle exchange might be facilitated by diffusive isotope exchange at the core-mantle boundary, or the exsolution of W-rich, Si-Mg-Fe oxides from the core into the mantle. Tungsten-182 isotope compositions of mantle-derived magmas are similar from 4.3 to 2.7 Ga and decrease afterwards. This change could be related to the onset of the crystallisation of the inner core or to the initiation of post-Archean deep slab subduction that more efficiently mixed the mantle.



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Published 20 June 2019 by the European Association of Geochemistry
https://www.geochemicalperspectivesletters.org/article1917

Magma found simmering under an 'extinct' volcano. Here's what that means.

New analysis provides a stunning peek into the inner workings -and potential hazards- of volcanoes thought to have long ago gone quiet.

Lush rolling hills cradle the still waters of Romania's Saint Anne Lake, which rests in an ancient crater from the eruption of the Ciomadul volcano. The peak last blew its top some 30,000 years ago, and its lengthy quiescence has led many to presume the volcano would not likely erupt again.

But as it turns out, the rocks miles below this serene scene may be stewing with a surprising amount of heat. A study recently published in *Earth and Planetary Science Letters* suggests that the system likely harbors between five and 14 cubic miles of magma, a maximum volume more than that of 20,000 Great Pyramids of Giza.

To be clear, this does not mean an eruption is necessarily in the volcano's future. But the work calls attention to the potential hazards of often overlooked volcanoes that have quietly simmered for tens of thousands of years.

Saint Anne Lake is nestled in a crater of Romania's Ciomadul volcano, which last exploded some 30,000 years ago. Now, scientists are attempting to tease apart what might be brewing miles beneath the surface.

"We look preferentially at active volcanoes—obviously because they show evidence of real risk," says study author Mickael Laumonier of Université Clermont Auvergne, France. "But we shouldn't forget other relatively recent young volcanoes, because they could present a risk that we should assess."

By pairing geophysical and geochemical analysis with numerical simulations, the study gives researchers a stunning peek into what may be brewing beneath Ciomandul—and it promises to help scientists better understand how similar volcanic systems evolve over time.

"All of this is great work," says Janine Krippner, a volcanologist at the Smithsonian Global Volcanism Program who was not involved in the study. But she cautions that teasing apart the precise conditions miles beneath the surface is an incredibly difficult task.

"It's still not us saying that's what the case is," she says. "It's saying, We have a lot of data that show this is what it might be."

Eternal volcanic flames

At any given time, at least 20 volcanoes are erupting around the world. But there are many more that can potentially be active—the problem is figuring out which ones.

Volcanoes like Ciomadul that haven't erupted in the last 10,000 years or so are often called inactive. However, this dividing line is somewhat arbitrary, Krippner says.

When it comes to volcanoes, "'extinct' is a very iffy word," she says. Some volcanoes, like the infamous Yellowstone supervolcano, may lie dormant for hundreds of thousands of years between eruptions.

One sign that a seemingly quiet volcano has the potential for future eruptions is if volumes of molten rock linger below it, and past studies at Ciomadul had hinted that might be the case. By studying the way seismic waves ricochet through the ground, past researchers spotted some indications of a magma reservoir. Surveys of the subsurface electrical conductivity—a property that is influenced by conditions like the temperature and water content of the rocks—also hinted that the zone between three and 17 miles down may be more mush than solid.

Yet it was still unclear if the rock was truly molten, and if so, how much magma there might be.

Consulting crystal record-keepers

To answer these questions, Laumonier and his colleagues first turned to rocks from the volcano's past eruptions. As magma sits beneath a volcano, it slowly cools and forms crystals, some of which act as tiny mineralogical record-keepers, charting the conditions in which they formed.

For example, a class of minerals known as amphiboles change chemistry depending on the temperature and pressure during crystallization. Searching for these crystals in the erupted rock helps researchers learn about the conditions of this ancient magmatic system.

The team combined this geochemical data with what they knew of the system's dimensions and ran numerical simulations to determine how quickly it might have cooled through time, and to see what the volcanic plumbing could look like today. The result: The rocks in the upper crust beneath the volcano are, on average, 15 percent molten, with some regions as high as 45 percent.

The team verified this result by crafting a model based on measurements of electrical conductivity for previously erupted rocks at varying temperatures, pressures, and water content. This helped them interpret what was seen before in the electrical conductivity measurements under Ciomadul.

This second approach gave a similar result, suggesting that the zone beneath the volcano is indeed between 20 and 58 percent molten. While this is a large range for the amount of magma that could be lingering in Ciomadul's subsurface pipes, all the possible subsurface conditions yield a significant amount of melt for Ciomadul.

"We have no other options to explain the geophysical anomaly," Laumonier says.

Researchers believe that an eruption is possible if a volcano harbors more than roughly 45 percent molten rock. Below that, the "system is all locked up by crystals, and it can't erupt," says Michael Ackerson, curator of rocks and ores at the Smithsonian National Museum of Natural History in Washington, D.C.

Thus, this latest analysis suggests that an eruption may be possible at Ciomadul—but that does not mean it's inevitable.

Mushy plumbing

Importantly, this study also probes the question of what such systems deep inside Earth actually look like.

"The traditional trope of a magma chamber is this big, gigantic menacing-looking, red-hot blob of magma sitting in the crust that's about to erupt and kill us all," Ackerson says.

But research increasingly suggests that's likely not the case. Instead, magma reservoirs spend most of their lives quietly stewing in the crust. They're often at least in part crystallized, forming a mushy, stony soup with varying proportions of crystals to melt throughout the system. This ratio might drastically differ in the magmatic plumbing of one volcano to the next.

For Ciomadul, the researchers believe the molten rock collects in two zones of mush: an upper region between three and 11 miles deep and a lower, hotter reservoir starting around 18.5 miles down. Each of these zones is likely composed of overlapping pockets of molten material of slightly different temperature and composition. For now, it's unclear how the two zones precisely connect, but the new magmatic mapping still provides valuable information about this volcano's inner workings.

"This is a new data point in the story of global magmas," Ackerson says. "This is one specific volcano in one specific point in time, and that's going to help us get a much broader, nuanced picture of how magmas form and evolve."

(Maya Wei-Haas / National Geographic, July 17, 2019, https://www.nationalgeographic.com/science/2019/07/magma-found-simmering-under-extinct-volcano-what-that-means/?cmpid=org=ngp::mc=crm-email::src=ngp::cmp=editorial::add=Science_20190724::rid=0000000000001084349954)

Evidence for a persistent magma reservoir with large melt content beneath an apparently extinct volcano

M. Laumonier, O. Karakas, O. Bachmann, F. Gaillard, R. Lukács, I. Seghedi, T. Menand, S. Harangi

Abstract

Most active volcanoes display eruption frequencies of 10-1000s years but a class of volcanic systems has extremely long repose-time (>10's kyr), and are deemed as extinct. Yet, some reawaken, posing a particular threat because little is known about the way they endure and stir back to life. Reawakening primarily depends on the nature of the subvolcanic magma reservoir, especially the presence and distribution of melt. Here, we integrate petrology, thermosbarometry, thermomechanical models, geophysics and *in situ* electrical conductivity measurements to show that the magma storage beneath Ciomadul, a seemingly inactive volcano in eastern-central Europe that last erupted 30 ka, may still hold 20 to 58 km^3 of water-rich silicic melt, constituting up to 20-58% in parts of the upper crustal crystal mush body. Such a melt volume exceeds the volume of erupted lava over the entire history of the volcano. This illustrates the important longevity of a magmatic reservoir at temperature above the solidus, which implies that there is still a potential for rapid mush rejuvenation. That a seemingly dead volcano like Ciomadul is actually capable of erupting in the future calls for renewed attention to "inactive" volcanoes worldwide and perhaps for a redefinition of their activity/inactivity status.

(https://doi.org/10.1016/j.epsl.2019.06.004, https://www.sciencedirect.com/science/article/pii/S0012821X19303371#tbl0020)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΠΕΡΙΒΑΛΛΟΝ

Lava tubes considered for human habitation on moon

Lava tubes formed on Earth could potentially provide clues about human habitats on the moon, claim researchers at Purdue University in Indiana.

Thousands of photos, reconstructed into a 3D model, are helping Purdue researchers evaluate lava tubes as a potential habitat for humans on the moon or Mars. (Purdue University image/Jongseong Choi)

According to Anahita Modiriasari, a postdoctoral researcher in Purdue's Lyles School of Civil Engineering, lava tubes form when a volcanic eruption sends lava flowing in channels on the ground.

"The surface of the lava flow cools and forms a crust on top, while the hot lava keeps flowing underneath, forming a tunnel," Modiriasari said in a statement. "We know these lava tubes exist on the moon, as satellite imagery has shown openings on the lunar surface, sometimes called 'skylights.'"

In 2017, Purdue University researchers helped discover a lava tube on the moon that could protect astronauts from hazardous conditions on the surface. Now, 3D image reconstructions of lava tubes on Earth could help assess if they are stable enough to build human habitats.

The work is part of Purdue's Resilient ExtraTerrestrial Habitats (RETH) group that looks at how future human habitats on the moon or Mars can be made resilient against radiation, temperature fluctuations, seismic activity and meteorite impacts.

Lava tubes could be part of the solution and Purdue research has shown that they are much larger than those on Earth – potentially many kilometres in width, providing potential protection from space-based hazards.

Modiriasari and graduate students Jongseong Choi and Audai Theinat have visited Lava Beds National Monument in California to explore lava tubes and establish a baseline of information.

"This is an ideal test bed because it has similar basaltic rock, and it formed in a similar way to those on the moon," Modiriasari said. "These lava tubes also have skylights, which is an important factor we're investigating."

https://www.youtube.com/watch?time_continue=2&v=Osa7x3Zexoo

The team chose specific caves and identified cross-sections of rock that the members wanted to investigate. "Our main goal was to investigate the geomechanical properties of the basaltic rock," Modiriasari said. "We were particularly interested in the ceiling of the lava tube – the number and spacing of the visible fractures, the characteristics of the joints, the chemical weathering and the strength index of the rock mass."

They also took enough photographs to help reconstruct a 3D model capturing features of the lava tube, a task that a rover or drone could potentially accomplish on the moon or Mars.

"All of this collected data is vital," Modiriasari said. "We are using it to build an advanced model of the size, strength and structural stability of the lava tube. What happens during seismic activity? What would happen if a meteorite strikes? This helps us assess whether similar lava tubes on the moon or Mars would be capable of hosting a permanent human habitat."

(the engineer, 17th July 2019, https://www.theengineer.co.uk/lava-tubes-moon-purdue)

ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ

Breakthrough Issue 5

Welcome to the 5th edition of Breakthrough, the International Tunnelling and Underground Space Association's Young Members group's (ITAYM) initiative to promote opportunities for the next generation of tunnellers.

Published in: 2019 Author: ITAYM

Published in Young Members Publications

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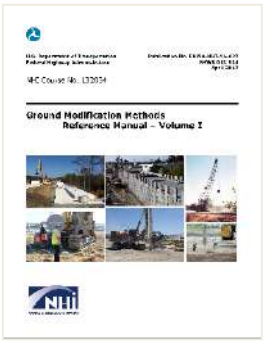

Geotechnical Engineering Circular No. 13
Ground Modification Methods Reference Manual - Volume I

Το βιβλίο ευρίσκεται στην διεύθυνση https://www.fhwa.dot.gov/engineer.../geotech/pubs/nhi16027.pdf

(από τον συνάδελφο Γιάννη Μεταξά)

ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ

https://about.ita-aites.org/publications/archives-ita/ita-news/listid-1/mailid-248-ita-news-68

Κυκλοφόρησε το τεύχος 68, Ιουλίου 2019 της ITA με τα παρακάτω περιεχόμενα:

- MESSAGE FROM JINXIU (JENNY) YAN, ITA PRESIDENT
- ITA 45th General Assembly & WTC 2019 Video and Photos
- NEW ITA PRESIDENT
- 2019 GENERAL ASSEMBLY - NAPLES
- Launching of Working Group 23
- Latest ITA Working Groups and Committees' publications
- ITA Tunnelling Awards: 71 valid entries collected
- 1st ITA-CET meeting for European tunnelling professors and PhD students
- Three champions of Underground Space rock at international planning conference
- Remembering Dick Robbins
- Breakthrough Issue 5
- ITA-CET The Committee is pleased to present its new logo!
- A productive meeting for the ITA-CET Committee in Naples
- Malaysia to plays host to prestigious World Tunnel Congress 2020
- TERRATEC joins the ITA as a Prime Sponsor
- AMITOS: First Photography Contest
- 9th Nordic Grouting Symposium
- 55th ISOCARP World Planning Congress - Beyond the Metropolis in Jakarta, Indonesia

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