Και όμως δεν είναι από τη Ελλάδα ή την Ιταλία αλλά από το Alhazm Mall, Doha, Qatar

Αρ. 112 – ΜΑΡΤΙΟΣ 2018

ΕΛΛΗΝΙΚΗ ΕΠΙΣΤΗΜΟΝΙΚΗ ΕΤΑΙΡΕΙΑ ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ & ΓΕΩΤΕΧΝΙΚΗΣ ΜΗΧΑΝΙΚΗΣ

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112

George Gazetas will present the 59th Rankine Lecture

George Gazetas, professor of the National Technical University of Athens and present chairman of HSSMGE, was selected by the British Geotechnical Association to give the 59th Rankine Lecture! The Rankine Lecture is given every year since 1961 with the lecturer coming from the UK in even-numbered years and from outside the UK in odd-numbered years. Previous lecturers have been some of the most important figures in the history of geotechnical engineering. The Rankine Lecture is generally accepted as the most prestigious of invited lectures in geotechnical engineering and it is a great honour and highest recognition of one's work to be selected as a Rankine Lecturer. The 59th Rankine Lecture will be given by Prof. George Gazetas on 20 March 2019 at Imperial College London.

Π Ε Ρ Ι Ε Χ Ο Μ Ε Ν Α

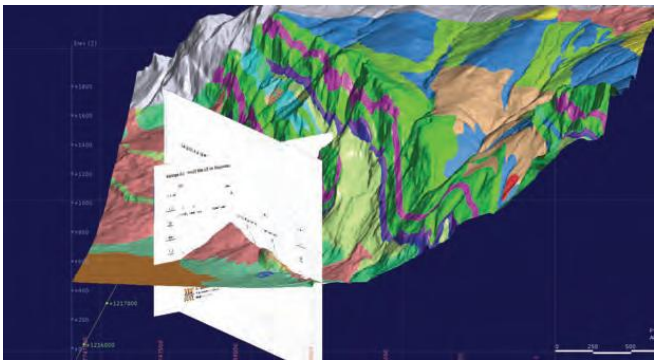
A glacial waterfall cascades over a 40-foot-high ledge in Godafoss, Iceland

Mount Cook National Park in New Zealand glows under sunrise

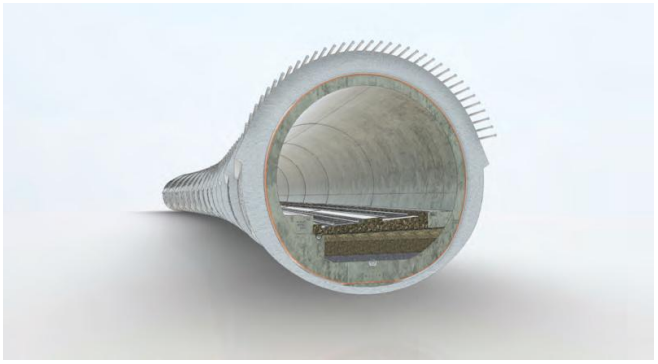
Jagged peaks of the Andes rise above the Chilean landscape

ΑΡΘΡΑ

Diving into the Digital Future?
Does digital technology have the power to disrupt the way we do things underground?
Kristina Smith investigates the rise of BIM and its impact.



3D Geology - This is Amberg's model of the geology of the Hagerbach Test Gallery



Amberg's BIM Model of the Bîzberg Tunnel

One day we were running down the street, arms waving frantically as we tried to hail a Black Cab with its light on. The next we were standing quite still, just looking at our smartphones, watching the dot of the Uber driver getting closer and closer on our screen.

Well, perhaps the change wasn't quite that fast. But you get the picture. Digital technology has the potential to alter the way we behave quite radically. And sometimes it feels like it's happened overnight.

Can digital technology bring the same kinds of disruptive change to the world of tunnelling and underground construction? The answer is almost certainly yes. What those changes might be is a little harder to say – disruption is, by definition, unexpected.

Digital technology in construction, of which BIM is a part, is already changing the way people work together. It is rearranging the order in which we do things, demanding different skills sets and creating new ways for organisations to engage with each other.

Digital construction is already starting to change the way we manage risk. Ultimately it offers the opportunity to reduce the capital and operational costs of underground space, while improving the way that space operates for the people and systems within it. But the journey to that point will probably we a rather bumpy ride for many.

Is BIM dead?

Though BIM may seem like a relatively new concept, the idea has been around for some time, says Paul Clark-Edwards, BIM practice leader for Mott MacDonald's transportation business.

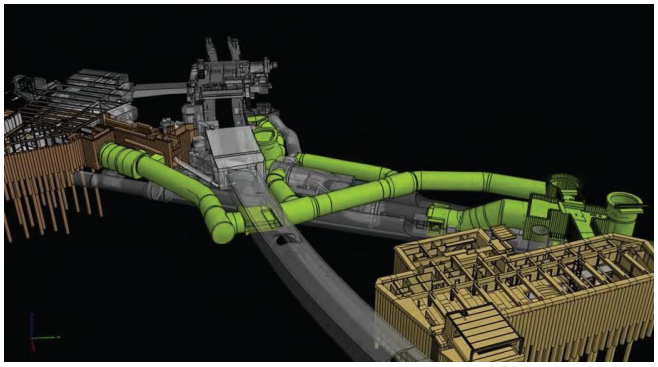
"The software vendor's business model suggested the idea of 'BIM' 15 years ago," he says. "They wanted to extend the functionality of their core graphics engines, into something smarter allowing the author to assign attributes and behaviours to the 3D geometry."

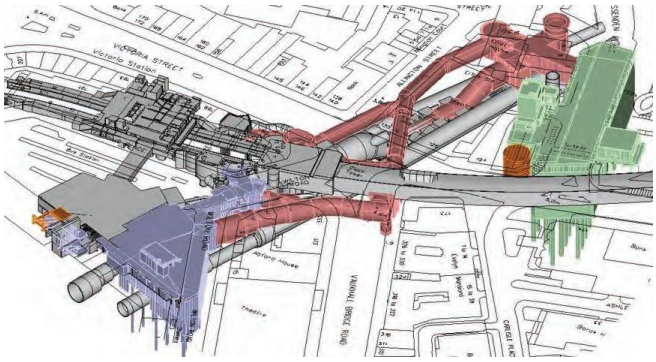
BIM gained traction in the UK back in 2011 when the Government mandated that all central Government departments had to work in 3D and in a collaborative way from April 2016 on. The players in a project didn't necessarily have to be working from the same 3D model, but the same information had to be used and exchanged between them.

There's a certain amount of confusion over what BIM is. There's a tendency to think of BIM as the 3D model, but that's not right, says Emil Rudegran, rock mechanics engineer at WSP in Sweden.

"It's important to really see what 3D is and what BIM is and to distinguish between the two," says Rudegran. "Many people think that 3D is BIM. But they have nothing to do with each other."

A BIM, or building information model, could just be a spread sheet with a list of components, or objects, and some pertinent information in a format that everyone can use. Information linked to each object could include who designed it, what stage the design is at, when the last review was done, manufacturer, operation and maintenance information.





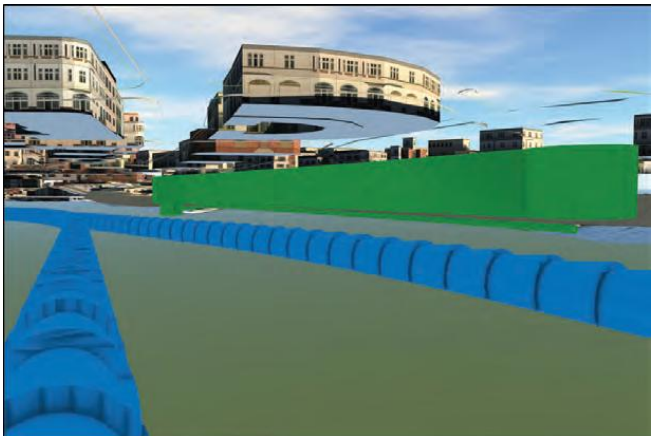
Forensic use of survey and utility information around Victoria Station meant that the positioning of grout jet columns could be carefully planned, with information from the drill rig used to create as-built drawings that then informed the tunnelling activities beneath.

"There are no limits to what information we could include," says Rudegran. "It's up to the client and the end user. We have only scratched the surface of possibilities."

In the UK, there's a push to get away from the term 'BIM' altogether. In 2015, the UK Government published a report called 'Digital Built Britain' and a year later launched a task group of the same name which aims to link a multitude of digital technologies including big data, telemetry, the internet of things and data driven manufacturing.

Since then we have seen job titles changing to reflect this change of focus. People are no longer 'head of BIM', they are 'head of digital technology' or 'digital construction'. Partha Sarkar, who is head of BIM and allied technologies at Arcadis in India predicts we will soon see some new titles emerging.

"We see there are so many influences poised to disrupt the construction industry, all these digital technologies," he says. "Maybe next year or the year after, the BIM guys will become 'digital disruptors 'or 'digital transformation leaders."



Comparison of possible alignments under the city of Geneva. (Amberg)

Reducing risk

Perhaps one of the best examples of what 3D modelling, and the integration of data from multiple sources, can do is London Underground's Victoria Station Upgrade and in particular the ground improvement work carried out there. Specialist contractor Keller, working for Taylor Woodrow-Bam Nuttall (TWBN) JV, installed over 2,200 jet grout columns, working from an area of congested London streets, to improve the gravels so that a SCL tunnel could be dug through the ground.

Clark-Edwards, who worked on the project as London Underground's information manager before he moved to Mott MacDonald, says that London Underground started modelling for Victoria Station Upgrade 15 years ago when the project was first conceived. "There was so much complexity with the existing underground assets – an operational railway, foundations, utilities – that it had to be modelled in 3D."

By piecing together information from multiple sources, Mott MacDonald's engineers built up a 3D model of the underground space beneath with the ground-level road layout layered on top of it. Specialist contractor Keller then overlaid the position of every column and used the model to plan installation, including sequencing and road closures, in 3D.

"We used the BIM model to pre-plan everything, right down to the movement of traffic," says Dr Anmol Bedi, of Bedi Consulting, a sub consultant to designer Mott MacDonald on the upgrade, and heavily involved with the BIM model.

The transformational step came when Keller was able to take parametric data recorded from the drill rigs for each of the columns they had installed and feed that back into the 3D model to create an as-built record.

"We built risk review into the model," says Bedi. "We could highlight the as-built column profiles in the 3D model so it showed all the gaps where the ground could not be treated. We knew on each advance that we were coming up to a risk area. We could stop the tunnel a safe distance from the known gaps, probe drill to find the loose ground and treat it from a safe working environment in the tunnel before we moved on."

The model proved to be a good predictor of where the untreated ground would be, and as people on site gained confidence in its usefulness, they became more engaged with it, says Bedi. Knowing what was coming up allowed TWBN and Keller to prepare labour and resources and the tunnelling crew to plan other activities while the remediation was going on.

Bedi Consulting was able to apply the same process of mapping the underground to inform a contractor's bid on the Sydney Metro where a big cavern was proposed through a faulted area adjacent to Sydney Harbour. The plan was to enlarge the cavern from TBM tunnels using SCL. Inflows of water would have been disruptive and potentially dangerous for site staff, so a pre-grouting plan had to be devised.

"To evaluate the fault and the treatment we put together information from previous surveys, studies, outcrop mapping and fault areas," explains Marco Invernici, tunnel design engineer at Bedi Consulting.

"We had survey data from around 2km in either director from projects done in 2009 and we had some points where there were outcrops on the surface. We put that with core logs undertaken in this area and south of the project areas."

Overlaying the pattern of streets from Google Earth, Bedi Consulting could then optimise the ground improvement sequence, devising an approach that didn't require road closures, reducing disruption for the city's inhabitants and commuters.

There is a wealth of information out there which can potentially be used to create these models. "With the model you have the capability to put everything together in layers," explains Invernici. "Even if we are not totally sure of where the information is coming from – for example we might want to use information from Google Earth – we can assure ourselves that it is good enough by cross checking with survey information."

This digital overlaying of information, enriches its collective value, says Invernici. "It's time-consuming but worth the effort. It expands the benefits you can get from all surveys and information collected for different reasons."

In Switzerland, Thomas Jesel, director of the tunnelling department for Amberg says that this ability to re-purpose existing data is helping clients and designers with decision making at the feasibility stages.

"We have quite a few projects where we are at a very early stage. There is all this GIF data that is owned by cities and countries, most of it public, that we can download and include it in our model. When we discuss alignments, it is a very strong first tool to show which buildings we pass under, whether there are any waste water pipes, sensitive gas pipelines or fibre optic cables under the road and what kind of parties would be affected by this alignment."

In Geneva, says Jesel, the underground geology can be downloaded in 3D, speeding up early phases. "We can find

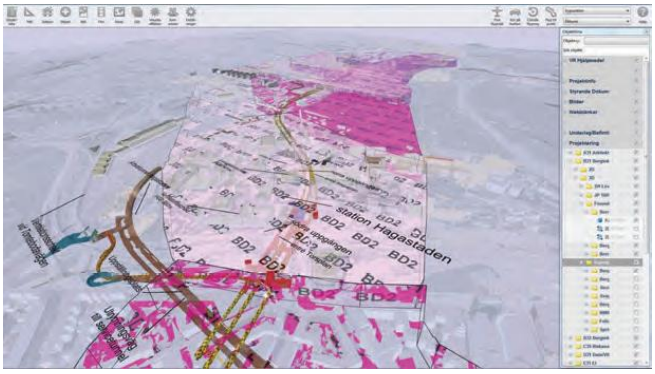
out quite fast in early stages if we are below or above water table and compare different alignments.

"Previously it took us weeks to get all this information and more weeks to get the right information into drawings. Then we had to produce longitudinal sections, cross sections, you needed a lot of imagination. 3D was only in the head of engineers. Now after two or three weeks you have the first models and you can run them."

But what is a bonus for one group of engineers might be a negative development for others. Jesel outlines how this faster access to underground geology could impact on geologists.

"Geologists sell experience," says Jesel. "They have huge archives from the last decades which are not public. If this information is integrated into a huge 3D model of a city or an area for a large infrastructure project, it will spread quite easily and most probably be used for other neighbouring projects. This will challenge the collaboration between civil engineers and geologists."

In other words, the geologists could lose the part of their income stream that comes from selling data.



WSP's Northbound Metro Line Extension to Arenastaden in Central Stockholm

Benefits emerge

Communication is perhaps the best-understood benefit of working in 3D. It's far easier for an owner or a member of the public to appreciate what a structure will look like if they can see it and even walk through it.

Augmented reality (AR) adds another dimension. WSP has an app which allows a planned structure to be seen in the existing landscape, says Rudegran, so everyone can see how the tunnel portal or shaft will impact visually.

3D and AR becomes more useful again when those who will use a facility can really interrogate how what will be where and how things might work. "Maintenance staff can see how to walk around and how it will be built and maintained. They can see things that a designer would probably never know," says Rudegran.

Clash detection is another often-quoted benefit. Details and interfaces that can be fudged or avoided in 2D drawings are exposed in 3D. Engineers sitting round a table can simply see an interface issue or a clash, rather than all trying to visualise it in 3D inside their heads.

For Rudegran, working with 3D and BIM is helping to create more effective work flows. It can cut down on design time during some phases because changes and impacts can be more quickly communicated and calculated he says.

"Say a constructor is already on the works doing rock excavation and you have a last-minute change. The workflow for getting out new data is much faster," he says. "With the coordination process being in 3D, it minimises design flows."

Feeding back real-time construction data can inform the design of later elements of the work, he says: "During construction, those on site can send back 3D scanning… so we could see, for example, that we had a wedge failure that caused the concrete amounts to go up because they had to do cast-in-place work there. Then the structural engineer already knows that, and can take it into account for the structural design of the rebar.

"Looking even further we will be able to use scanning and even photogrammetry to take a picture of the wall before and after concrete is applied. As well as being a good check, it feeds into as built drawings later on, rather than have to work from hand-sketched drawings that you can barely read."

Amberg is already working with point clouds created by laser scanning, most often to create 3D drawings of existing structures. For example, it is making as-built 3D drawings of a motorway in East Switzerland which is to be built over to create space for above-ground development.

"Real time is just around the corner," says Jesel. "The challenge in using it for checking the thickness of shotcrete, for example, is that we need high levels of accuracy to check the tolerances are right and that means we need a lot of data."

Where scanners were previously mounted on vehicles, surveyors now have the options of using drones.

What the collection, sharing and utilisation of all this digital data should mean is less risk. Ultimately this should offer more cost certainty, and the ability for clients to reduce the size of the contingency pot.

"It will allow us to reduce the cost, because a lot of the escalation factor you put into a price is for unknown elements where there is a risk involved," says Sarkar. "Some of the other benefits related to clash detection and resolution, clarity and visibility should also allow the contractor to reduce the price."

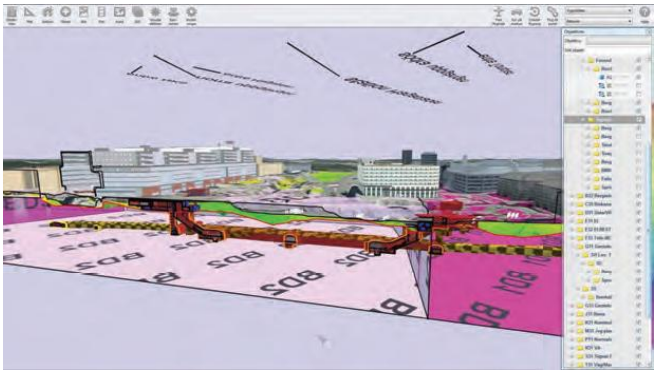
Clark-Edwards doesn't think we should be focussing solely on capital cost reduction, reminding us that cost in operation is an important consideration for the owner. "Capex represents a small percentage of the overall cost for the operational lifetime of the asset. Having a structured approach to information management during the design phase can leverage this extra value," he says.

However, the reality for many organisations is that capex and opex are very separate budgets, owned by different and unconnected parts of an organisation. "The biggest benefit of really going through the BIM process comes over the lifecycle mainly in the phase where you use your infrastructure but, in almost every project we have been involved in, construction and maintenance are separated," says Jesel. "They are two different budgets. This makes things difficult, because no one really has the big picture."

Leading the way

Looking around the world, there's a patchy picture of adoption of BIM and digital technologies. Clark-Edwards, whose role as BIM lead for Mott MacDonald takes him around the world to projects and conferences says:

"My view in terms of maturity of process and standards, is that the UK is leading. In terms of open standards, the Nordics are leading. The Nordic countries conceive of their data as open standards rather than any proprietary file format."



WSP's Northbound Metro Line Extension to Arenastaden in Central Stockholm - an alternative view

Some use open standards called IFCs (Industry Foundation Classes), for BIM data exchange. COBie (Construction Operations Building Information Exchange) is a data format, more focused on asset handover data than geometry, invented in the US and then developed in other countries including the UK.

In most countries, it is the building rather than civil construction sector that is furthest ahead with BIM. The Swedish Transport Administration, Travikverket, has been pushing hard to encourage the uptake of BIM, mandating that it should be used in all big investment projects from 2015. In the UK big infrastructure owners such as Highways England, Network Rail and Transport for London are working towards a digital approach to data. But these are big beasts, and change cannot happen overnight.

Sarkar sees the UK, parts of Scandinavia and some Middle Eastern countries as the most-advanced in their use of BIM. "It's also in demand in Singapore, Kuala Lumpur, Hong Kong and Australia," he adds. "There are bits and pieces in the US, although the focus there has been primarily on the building side."

Sarkar has worked on a number of utility projects in the Middle East, including the Doha Expressway Project, Qatar Rail and Yas South in Abu Dhabi, where the owners had a clear vision for using BIM right through from design and construction into operation and maintenance. Though he is based in India, he says that most of the projects he currently works on are in the UK.

In Switzerland, says Jesel, the move to digital data is slower with the impetus for change coming from Scandinavian projects. Amberg's first BIM project was in Sweden around 2011. "That was at a very low level, compared to engagement now-a-days," says Jesel, of Stockholm Western Bypass. "We had huge plans for what we wanted to do with BIM but the whole industry was not ready at that time and in the end, it was not much more than 3D modelling and the extensive exchange of datafiles. We had to add conventional documents."

Today Amberg uses elements of BIM, frequently, but not for an entire project. "We do not have one project where everything is 100 percent BIM," says Jesel. "On most projects we use BIM in some way, even if it is just for visualisation." It's important for Amberg to keep building the digital competencies of its talented young engineers, he adds, and to keep them interested and invested in the company.

In Sweden, WSP is working on two projects: Slussen, a new bus terminal in Stockholm and the Northbound Metro Line Extension to Arenastaden in Central Stockholm, which Amberg is working on too. All the CAD geometry for these projects must be in 3D, even the description of the rock excavation. "There are a few others going on in Sweden, but not to the same extent that I know of," says Rudegran.

Interoperability

Five years ago, people often cited interoperability – or rather the lack of it – as one of the biggest practical barriers to wider uptake of BIM. Different software packages couldn't easily talk to each other and firms further down the supply chain felt that if they invested in one particular software package for one project, they might find themselves with the 'wrong' software on the next one.

Software houses Autodesk and Bentley both offer solutions for underground construction. "I have worked with both the technologies and they both have pluses and minuses," says Sarkar, a civil engineer who worked as a senior developer consultant for Autodesk before joining Hyder Consulting which was later acquired by Arcadis. "Network Rail and Crossrail are big customers of Bentley in the UK. But for most of the upcoming rail projects, we see a lot of Autodesk technology making an inroad."

Is it "not that easy" to work between the two technologies, says Sarkar. "Both have developed their own data structure. And while, at a basic level the data is interoperable, as you add complexity – the 'I' or 'information' part of BIM - it becomes more challenging to seamlessly share data between these two platforms."

Jesel agrees: "It is difficult to exchange data between different design tools," he says. "We don't have one AutoCAD tool that can do everything including geotechnical calculations. We want to make different specialist tools talk to each other without issues."

There have been various initiatives to create standards that allow operability. International organisation buildingSMART (formerly the International Alliance for Interoperability) is creating specific IFCs. Those for tunnelling are under development. Rail sector ones already exist.

There used to be an ambition to have everyone working off the same model. And though the software houses would still have us believe it's a good plan, the concept of a one-size-fits-all BIM model doesn't work for Clark-Edwards: "As we get more comfortable with the idea of a more data-centric process the notion that you can use the same piece of authoring software from feasibility through to operation and maintenance is less credible. The power and the value will be in how we connect the data."

What the UK Government and buildingSMART want is a greater focus on the data rather than the 3D model. "We want to move to a more data-centric approach," explains Clark-Edwards. "Part of that is 3D geometry that can be coordinated between multi disciplines for critical space proving. We must include all aspects of the supply chain in a more genuinely collaborative approach to project delivery: designer, manufacturer, assembler, contractor and operator.

"The digital data is originally conceived to describe the design, to ensure it complies with the relevant code, standards and specifications. Further data is needed to support procurement, and more again to support fabrication, assembly and construction. Again more data is needed to support operations and maintenance. To make this process more manageable we connect – or federate - our disparate data sets to leverage this value rather than view this information model as a single entity."

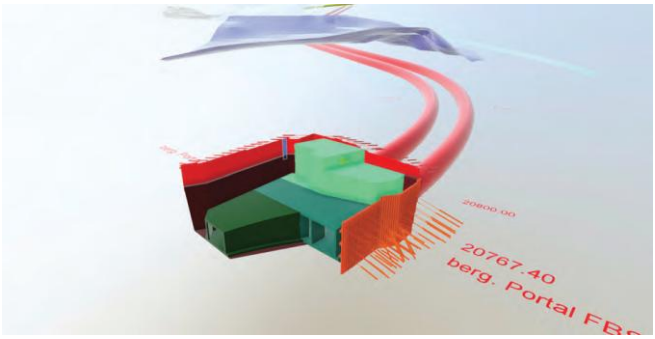
All that said, there are ways to get around interoperability problems. Both Rudegran and Invernici are quite relaxed about this issue: yes, it's a bit of a pain, but it can be done.

"We have developed a work flow that is proficient and can integrate both smart objects and the information in each object, and it involves many programmes," says Rudegran.

"In the rock engineering discipline, we start in Bentley Microstation which is our base platform. Other disciplines working here use software such as Tekla, Revit, Civil 3D which all have the common AutoCAD format DWG so everyone can export to that. So we can build the model in Microstation and export it to DWG. Inside that, in Civil 3D, you can do all the coding, add all the BIM stuff and then export to Navisworks or another collaboration platform."

For Rudegran, the biggest barrier to wider uptake of BIM and digital technologies is not practical but political: clients must demand it.

"The first step is for clients to put it in the tender," he says. "And recently they have started to do that. If they are not ready, it doesn't matter how many beautiful 3D models or examples you can do, if they don't see the time profit or the economic profit, they won't do it."



Amberg's model of the Lucerne highway bypass

Change is coming

Perhaps the biggest hurdle yet will be the switch to collaborative ways of working. "The philosophy in markets with a confrontational approach will have to change," says Jesel. "BIM is very collaborative, very open and very transparent. On a daily and weekly basis, everyone can see what you do."

While the roles of engineer, surveyor and geologist will be different in a few years' time, Jesel predicts that managers face the biggest upheaval. "In countries where management is hierarchical, where it is always the boss who makes the decision, managers will have to change dramatically because the designers looking at the models will have much more weight. Managers will have to give them freedom to work, trust them and guide them with methods other than hierarchical ones."

Earlier involvement of the wider supply chains will become the norm, as structures and systems are designed around the components, rather than the other way around. "It will change completely how clients buy data and the information that describes a design," says Clark-Edwards. "It will completely disrupt how contractors take that data and buy the bits they need to build the asset. It will disrupt the manufacturers and the component suppliers in how they deliver not only their physical components but the data related to their components."

Invernici sees a future where site engineers interact directly with models and information, rather than dealing through a surveyor. This means that they will need surveying skills and drawing skills. In Italy, says Invernici, education for engineers is already quite holistic, including all these skills, whereas in the UK roles tend to be compartmentalised.

As more functions become automated, whether that is carrying out repetitive design tasks or surveying an as-built tunnel lining and feeding back the data, engineers should have more time to analyse and manage.

"The site engineer will be able to supervise and make sure the quality and the control is adequate and they can do that in real time," says Bedi, contrasting that with the situation now where a site engineer surveys the tunnel, takes the results to a senior engineer and – if anything is wrong – has to take the bad news back down to the miners at the work face.

"Parametric design allows for 50 design iterations in the time it would take an engineer to do two," says Clark-Edwards. "However, the engineers must remain at the centre of the process and own the rule set for the algorithms that the computer uses to develop the design."

As for when we can expect these changes, everyone gave the same prediction: within three to five years. Artificial intelligence, big data, analytics, robotics drones; all these technologies are out there already and they will become commonplace overnight.

Mott MacDonald has an ambitious programme for transformation with its 'Go Digital' initiative which has a deadline at the end of this year. "We recognise these tools, processes and technology are not going away," says Clark-Edwards. "We cannot put the genie back in the bottle. We recognise that we have been in the design business for 150 years and want to build on that by using the best tools for the job and to integrate them into our common way of working."

Going digital is a daunting prospect for some, particularly those who have not grown up with computers. Clark-Edward's advice is to take control of the technology and process and make it serve your predefined purpose: "You have to consider the technology as a tool set and treat it as such. Don't be a slave to the technology, put demands on the technology and state exactly what you want it to do."

The challenge of course is that, like the Black Cab drivers, we may not know what wonderful new thing we want the technology to do until someone else has actually done it. Our 'Uber moment' could be just around the corner.

(Tunnelling Journal, February/March 2018, pp. 8-16)

Is 'Innovation' a Dirty Word in Tunneling?

It's well known in our industry that a certain billionaire entrepreneur named Elon Musk is now in the tunneling business. Through his venture The Boring Company, Musk aims to revolutionize tunnel boring. Some of Musk's plans include a 10-fold improvement in the cost per mile of tunneling, and a more than 10-fold increase in TBM advance rates, to be achieved by decreasing the tunnel diameter, and creating a high-powered, continuous tunneling and lining machine, among other things. In a statement on The Boring Company's website, "… there is virtually no investment in tunneling Research and Development [in the United States]. Thus, the construction industry is one of the only sectors in our economy that has not improved its productivity in the last 50 years." A harsh statement to be sure, but is it true? And if it is, why? As The Boring Company was not available for comment, NATJ asked representatives from different segments of the industry to weigh in on the state of innovation.

Incremental Progress

"Yes, I agree that innovation is slow. This is in part because of the form of the contract. Most projects in our industry are Design-Bid-Build, with very prescriptive specifications. What we find is that when it comes to a machine, it's already been fully specified. Contractors are risk averse as to whether or not an idea is going to work. There are certainly different procurement models, such as Design-Build, where the owner, engineer and contractor could sit down with a concept and follow through with it. But in general, nobody wants to go first," said Steve Skelhorn, Project Sponsor for contractor McNally Construction Inc. He added: "How we innovate is also different than in other industries— in tunneling one project can last many years, so there are fewer opportunities to try something new. Contractors are also allowed to keep everything hidden. Things that don't work aren't shared, and good ideas are not shared either."

Bob Goodfellow, Senior Vice President of Aldea Services, sees the state of innovation similarly. In Goodfellow's recent Insider column (NATJ Oct/Nov 2017), he discussed his views on Elon Musk's The Boring Company and industry advancement. He added to his original thoughts: "We always say contractors put their company on the line every time they put in a project bid. They can try some new things but it's going to be an incremental improvement—maybe it's been proven successful elsewhere, for example, so it's not an innovation globally. Musk, on the other hand, can do what he wants. There is a natural reluctance in the U.S. towards new technology. Owner agencies want to protect third parties and they take it very seriously, as they should. If you try something tried and trusted, then at least you tried something that has worked before and if it happens not to work on your project, then the government agency is able to deflect blame. If something is new and goes wrong, that brings significant exposure to the owner agency. That's the system that exists in North America right now—there's no real incentive in many cases to be innovative. We live in a litigious society and in urban tunneling the negative consequences can be extremely high."

For Eivind Grøv, chief scientist at SINTEF and Professor of Rock Engineering at Norway's NTNU, the view of the international market is much the same. "First of all, let me say this: I don't believe that Musk can achieve a 90% cut in tunneling costs as he says in his interview. However there must be a way to achieve a certain cut in costs related to increased advance by improving the mechanism of a rotating cutter at a rock face. We have made TBMs larger and stronger, but in many ways the interface between the cutter and the geology remains unexplored. This is where we can achieve some progress, in better pre-treatment of the face to ease the job for the steel cutters and thus obtaining better advance rate."

Musk's The Boring Company also aims to decrease the cost of tunnel construction per mile by orders of magnitude, through continuous mining, higher-powered TBMs, and other concepts.

Elon Musk's The Boring Company has stated that it aims to increase TBM advance rates by more than 10 times, beating the average speed of a snail.

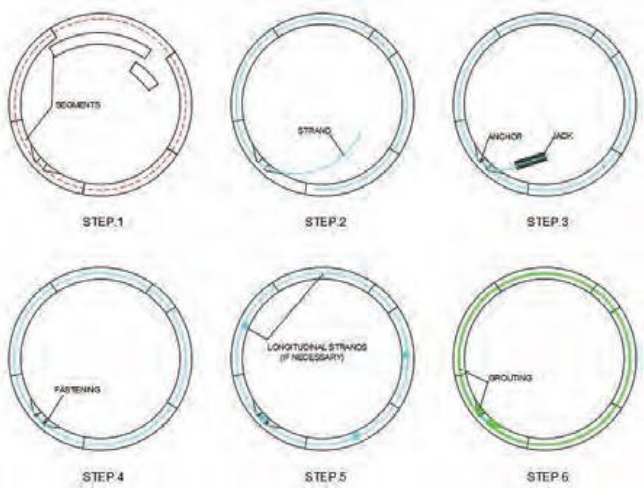
But Grøv added that the pace of innovation in tunneling, as slow as it is, is simply a reflection of the nature of tunneling: "Innovation is slow, yes, and the tunneling industry is quite conservative. There is a lot of risk taking involved in tunneling, inevitably due to the uncertainty in ground conditions. Meanwhile there is a lack of risk taking when it comes to bringing new innovations into use on real projects for on-site testing and experimenting. This may relate to the fact that there are quite a few one-time tunnel owners, and maybe not that many owners who are actually able to re-use innovations on their next projects."

Musk's people mover concept using an electric skate.

In the 1950s, the nascent tunneling industry was more willing to accept the risk posed by concept machines (pictured, a prototype machine that cut out the tunnel circumference while the center was blasted out). How can we create an atmosphere today that is more accepting of innovations?

For John Reilly, industry consultant and President of John Reilly Associates International, the slow rate of innovation has a direct effect on productivity. "The U.S. construction industry productivity has been essentially flat for decades, whereas other industries have advanced substantially. Underground construction costs have risen substantially for decades, even adjusted for inflation. Just take a look at the recent New York Times article [12/28/17, The Most Expensive Mile of Subway Track on Earth], that listed New York City subway projects such as the Second Avenue Subway and East Side Access as costing between USD$2.5 and $3.5bn per mile. Previous comparisons over 15 years ago reported London's Jubilee line at over $300million/ mile, Paris metro at $150m and Madrid metro at $35m. Why such a wide variation? Comparative examples from other countries and states would be useful. What are the key factors that result in cost differences? For example, are unions the cause, or social factors? The number of workers, or the number of workers vs. supervisors?" Or, as is implied, could the lack of innovative new technology be keeping costs high?

McNally's helical lining concept was inspired by post-tensioning systems in beams and slabs of high-rise building construction.



McNally Construction Inc.'s post-tensioned helical lining system eliminates the need for bolt connections between segments and paves the way for continuous mining of the TBM.

What is Innovation Anyway?

All the talk of slow progress begs a simpler question, however. How do we define innovation? "Almost every company claims to be innovative, but every time you bring up an innovation, someone else will say it's already been done. Is anything truly innovative then, if everything has been done before?" asked Goodfellow.

For Behzad Khorshidi, Engineering Manager at McNally Construction Inc., innovation is what is new to the industry—

meaning that it could come from another industry, and it may be better accepted that way. "I believe the tunneling industry has a moderate rate in innovation and has lots of potential to grow faster. Undeniably new tunnels are being constructed at deeper levels and higher ground and water pressures and at larger diameters. But we don't hear much about improvement in the tunneling advancement rate! As an example a decade ago while I was working in the high-rise industry I recall how we could achieve construction of two floors per week in a 107 story high-rise by utilization of proper hydraulic slip form systems in columns and core walls and post-tensioning systems in the beams and slabs in order to remove their underneath forms earlier."

Innovations are still moving forward— the FAST-Tunn project at Norway's SINTEF is a good example, identifying alloys that may substantially improve TBM cutting tool performance.

Using this idea of post-tensioning systems, Khorshidi developed a new tunnel lining system aimed at "improving tunneling and shaft construction technologies so we can construct tunnel projects faster with higher quality and more economically." Based on the post-tensioning (PT) systems employed in the construction of concrete beams and slab, Khorshidi developed the new system for precast segmental lining in tunnels and manholes.

As Khorshidi explained: "Post-tensioning of the helical segmental lining is an advanced, patented tunneling method that eliminates the necessity of expensive and time-consuming bolt connections between the segments and would provide possibility of continuous mining of the TBM without required stops for segment installation, even in soft soil tunnels. In the helical PT system the load induced by the stressed PT strand will be applied in both the circumferential and longitudinal directions, effectively pulling the tunnel structure together. The segments are universal and the PT strand is inserted into the leading circumferential edge of the segments." Such a system could improve a tunnel's structural resistance, quality, and safety at significantly lowered costs.

Barriers toward Acceptance

Despite the promise of new concepts like McNally's PT system, there are clear barriers to getting them accepted in the industry. "We have done some trials and tests of post-tensioned segments, but where can we actually try this? We are not the Engineer-of-record on our projects, so we have to convince the consultant that it will work. To do that, we would submit a value engineering proposal. But this could be difficult because the with an initial learning curve, and if it doesn't work then we carry all the responsibility for it," said Skelhorn. He added "But you have to try. If you don't try you'll never know if it works. I know in some other markets such a Germany they have projects that are specified as R&D and covered by grants. This would be a good thing to see in our industry."

"Owners are more afraid of the risk cost overruns than seeing the options for cost and time savings. But this is not in their best interest - HEP - developments are run by time, for example. That is to say that the earlier the construction is completed the earlier production of electrical power can start, and running the turbines earlier than scheduled means starting income earlier also," said Grøv.

Reilly added that risk aversion is a complex part of the problem: "There is a fear of litigation as a result of innovation that adds risk from a new tunneling method—risk here means in terms of cost and schedule as well as to contractor or owner reputation. There is also a fear that the innovation may not result in added value or profitability. Overall, lack of leadership in the industry is a problem. Who will experiment, develop and test new processes that add capability and value?"

For Goodfellow, innovation and risk—at least in terms of contractual risk allocation— don't necessarily go hand-in-hand: "Innovation should be done outside of the contract document. It's hard enough to get the contract clear and correct, without trying to anticipate any and all innovative developments and ideas. Risk allocation is complex, and the parties involved with design need to concentrate on getting the base contract right. Innovation could be added as a value engineering clause or an alternative technical concept, but then it's up to the project team to pursue whether they want it or not. If you can show all parties get savings and prove that it works, then there is incentive there to try the concept. At that point, the work and new concept can be incorporated into the contract more easily."

"...the system may cost more money with an initial learning curve, and if it doesn't work then we carry all the responsibility for it. But you have to try. If you don't try you'll never know if it works. I know in some other markets such a Germany they have projects that are specified as R&D and covered by grants. This would be a good thing to see in our industry."

Steve Skelhorn, Project Sponsor for contractor McNally Construction Inc.

Key Advances

While there are many hurdles for new technology to clear, the news is not all grim, particularly with regards to the structure of the industry itself. Reilly cited several key advances in the last few decades of the tunneling industry: "TBM advances have been continuous and beneficial in terms of added value, safety and productivity (for decades), including the use of integrated and automated systems. New contractual forms such as alliancing and the emergence of design-build have added value and schedule compression, and improved delivery processes. Finally the use

of a baseline GBR, dispute review boards, and partnering/team alignment techniques can reduce risk and conflict on current tunneling projects."

This idea of industry advancement was seconded by Goodfellow: "Through structures like alliance contracting, some innovations are easier to co-engineer and get through the process. Some owners are also taking steps to include more value engineering. For example at the Los Angeles Metro, the owner has created a Department of Innovation. They are actively pursuing and approving many innovations under their Value Engineering Proposal clauses in their design build projects."

But what of technological advancement? Concepts abound, particularly as supported through academic research programs. Grøv's FAST-Tunn project aims to identify and develop various steel qualities for cutter tooling; namely high hardness and ductility, which in itself is a contradiction. Cutters are subject to extreme loading, both in static and dynamic mode caused by the TBM itself, while the abrasive characteristics of the rock mass will cause abrasion on the steel cutter. "We have tested six different alloys so far—two of these are interesting for further work, and may involve a potential gain for the steel manufacturer and end-users. One custom alloy developed by FAST-Tunn was a medium to high chromium cast steel that, combined with a special heat treatment, has shown a potential for operation in TBM conditions." Such research could prove invaluable as long as it can be tested and corroborated in the field.

Is Innovation for the Billionaires?

With all of the obstacles in the way of significant innovation, it may seem that the truly radical design concepts must be left to the billionaire entrepreneurs who take an interest in our industry. But leaving it to the billionaires is not without risk, says Goodfellow: "Musk can't do a whole lot without guidance and there are people he's working with in our industry, for engineering, buying equipment, etc. He's shying away from industry conferences and other opportunities, which I think is a shame. If he manages to pull off his goals, that will be an interesting time. Does he keep it all to himself and just build his hyperloop, or share his advancements with the wider industry and reduce the cost of metros, CSO tunnels, and other public works? Does he help others at that point or just underbid with his new technology and put everyone else out of business?"

For Skelhorn, innovation can still be done in the industry itself, it just takes a willingness to change: "Industry can innovate itself, but it takes education among owners, suppliers, and contractors. It's a dog- eat-dog world right now, and it's moved away from the work and what we're trying to achieve. Musk's vision is on the end product—the rapid movement of people. He is changing the mindset. In our industry we have to go through approvals. It's a slow process but it is changing. Several projects in Canada and in California's Silicon Valley are looking at innovation. There are other contractor involvement models where innovation is more readily accepted."

Grøv agrees that change is possible, though not easy: "We need generous owners, creative contractors, open-minded and competent consultants, innovative suppliers, and new-thinking academia. To be able to bring the industry forward we have to have a value chain that follows this kind of path. A tunnel project is a project where these participants are linked together and interact daily. This requires that the participants are highly professional and are open-minded enough to think out of the box and find new solutions. Technical specifications and requirements must be clear and unambiguous, and the attitude must not be governed by each party's own interests above all else."

(North American Tunneling Journal, February/March 2018, pp. 18-22).

ΝΕΑ ΑΠΟ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ

ISRM

Franz Pacher 1919-2018
In memory of an outstanding engineer and man

Professor Franz Pacher, pioneer of rock mechanics and modern tunnel construction, has passed away in his hometown Salzburg on the 3rd of March 2018 at the age of 98.

Franz Pacher was born in 1919 in Mittelsuchau, now Prostřední Suchá in the Czech Republic. He grew up in Graz, Austria, where he also completed his schooling, military service and, between 1939 and 1943, his study of civil engineering at the Graz University of Technology. From 1943 to 1945 he worked as a scientist in the hydraulic engineering department. From 1945 to 1952 he was a construction manager for hydroelectric power plants in Austria.

Franz Pacher moved to Salzburg in 1952 and started work in Dr. Leopold Müller's Office for Geology and Civil Engineering. 1952 was also the first year in which a colloquium to improve the mutual understanding of geology and construction was held, albeit the number of delegates did not approach 1000 as it does today, and Dr. Müller's living room was an adequate venue. Rapid advances in the field of rock mechanics were made in the following years, in which Pacher und Müller played decisive roles. In parallel, collaboration with L. v. Rabcewicz lead to the development of modern tunnelling in the form of the "New Austrian Tunnelling Method".

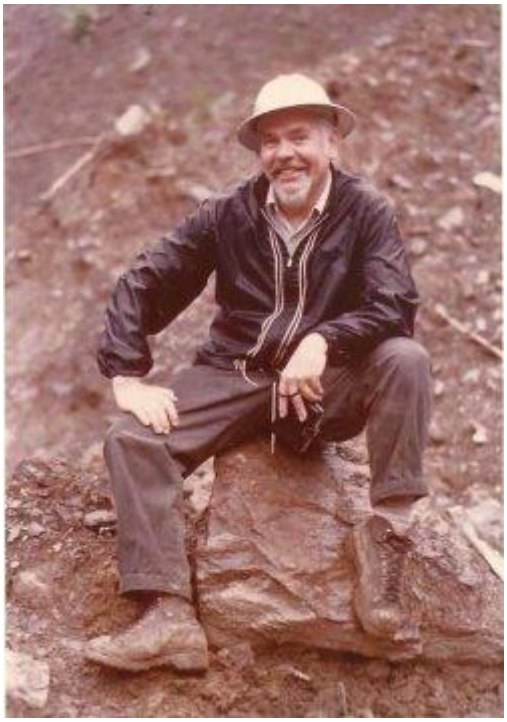
Particular achievements of Pacher are in the area of fundamental research, for example the definition of planar and volumetric proportions of discontinuities and the ground reaction curve. In a 1964 publication, Pacher demonstrated for the first time a method for prediction and graphical representation of the interaction between ground pressure and tunnel support loading (the Pacher-Fenner curve). This was based on measurements of deformations and led to the development of the convergence-confinement method. In 2009 Pacher extended this representation to a diagram showing the time-dependency of both ground pressure and deformation.

Franz Pacher was a founding member of the International Society for Rock Mechanics (ISRM) in 1962 and the Austrian Society for Geomechanics in 1968, both in Salzburg. He was also leader of an internationally active engineering company, a researcher and teacher at the Technical Universities of Munich and Vienna and an honorary member of several institutions in the fields of rock mechanics and tunnel construction. Furthermore, his 45-year career gave us 60 lectures and publications. Further information on Franz Pacher and the founding of the ISRM is available in an interview with him on the 50th anniversary of the founding of the ISRM (http://www.isrm.net/gca/?id=1110).

We will always hold this outstanding engineer and man in great respect and wish that he may be an example to us and to future generations.

Wulf Schuber

A tribute to Prof. Don Deere, 1922-2018



Regrettably Prof. Don U. Deere left us on January 14th at the age of 95. He had hardly recovered from a fall a few months earlier. His passing, however, leaves very good memories for his former students, assistants, colleagues and clients. Five years ago, when he was celebrating his 90th birthday, we were invited by his son Don W. Deere and daughter to Gainesville, Florida, to a memorable ceremony,

while Prof. Deere was still very active. His last years after he recovered almost totally from a stroke were spent golfing, dancing, etc. at his glamourous retirement resort.

He represented a very important milestone for Engineering Geology and Rock Mechanics in his activities at the University of Illinois, Champaign-Urbana Campus, in the 60s and 70s. Together with Prof. Ralph Peck, they led and pioneered Geotechnics and Rock Mechanics in the USA. His area of expertise covered Civil Engineering (Ph.D), Mining (B.S.) and Geology (M.Sc.). My own impression is that Prof. Deere was a man who was very kind and respectful of his students and colleagues whom he encouraged the most. Moreover, he was a man who knew how to utilize the potential of his assistants to make them grow together with him. This resulted in a formation of a group of very talented colleagues, such as Ron Heuer, Alfred J. Hendron, Ed Cording, Frank Patton, and later Gabriel Fernandez, among others who were not of my time. Among his former students, you can find many engineers and geologists who reached senior and influential positions, like Andy Merritt (his consulting partner), Ray Miller, Harvey Parker (President of ITA), Jim Coulson (Chief Engineer at TVA), Ray Benson and Bob Conlon (Both Geotechnical Department Heads at Acres), Brian Sinclair, Sergio Brito, Alan Smallwood, Jim Gamble, Alberto Nieto, Jim Mahar and many others including the author of these lines. After many years at the University of Illinois, he moved to the University of Florida where he could devote more time to his consulting practice.

He was a recognized expert in Engineering Geology and Rock Mechanics and has the great merit of integrating Geology in Geotechnical and Geomechanical projects. He consulted on numerous dams, mining, tunnels and other underground projects for the US government, contractors and design engineering companies all over the world. Many of these projects involved precedent structures such as the Churchill Falls hydroelectric project in Labrador, Canada and the World Trade Centre in New York city. He also acted as a member of the Board of Consultants in many other large projects around the world. In Brazil he made very important contributions as a member of Board of Consultants for the following hydroelectric projects: Itaipu, Água Vermelha, Sobradinho, Itaparica, Paulo Afonso, Itumbiara, Sao Felix, Altamira and others. His first mission in Brazil was to help me on the design of the final slopes of the Cauê Open Pit Mine, in 1972.

His experiences in the field became teaching material for his classes. He wrote and co-authored numerous papers and was, of course, the inventor of the rock mass assessment tool, the RQD. Together with Giovanni Lombardi, he invented the GIN method of grouting. He was Chairman of the US Nuclear Waste Technical Review Board. He was the President of the Commission on Standardization of Laboratory and Field Tests of the ISRM from 1968 to 1973. He received numerous distinctions throughout his career including being elected to both the National Academy of Engineering and the National Academy of Sciences. He was also a consummate joke teller.

Milton Kanji

ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

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

micro to MACRO - Mathematical Modelling in Soil Mechanics, May 29 - June 1, 2018, Reggio Calabria, Italy, www.microtomacro2018.unirc.it

GeoReinforcement Workshop, 4 - 5 June 2018, Munich, Germany, https://igs.wufoo.com/forms/q10dk31u19dx00v/

International Conference on Deep Foundations and Ground Improvement - Urbanization and Infrastructure Development: Future Challenges, June 5-8, 2018, Rome, Italy, www.dfi.org/dfieventlp.asp?13310

GeoBarrier Workshop, 6 - 7 June 2018, Munich, Germany, https://igs.wufoo.com/forms/q10dk31u19dx00v/

XVI Danube-European Conference on Geotechnical Engineering: Geotechnical Hazards and Risks: Experiences and Practices, 7 - 9 June 2018, Skopje, Former Republic of Yugoslav www.decge2018.mk

16th European Conference on Earthquake Engineering (16thECEE), 18-21 June 2018, Thessaloniki, Greece, www.16ecee.org

CPT'18 4th International Symposium on Cone Penetration Testing, 21-22 June 2018, Delft, Netherlands, www.cpt18.org

PATA DAYS 2018 - 9th International INQUA Meeting on Paleoseismology, Active Tectonics and Archeoseismology, 24-29 June 2018, Chalkidiki, Greece, www.patadays2018.org

NUMGE 2018 9th European Conference on Numerical Methods in Geotechnical Engineering, 25-27 June 2018, Porto, Portugal, www.numge2018.pt

RockDyn-3 - 3rd International Conference on Rock Dynamics and Applications, 25-29 June 2018, Trondheim, Norway, www.rocdyn.org

ICOLD 2018 26th Congress – 86th Annual Meeting, 1 - 7 July 2018, Vienna, Austria, www.icoldaustria2018.com

9th International Conference on Physical Modelling in Geotechnics (ICPMG 2018), 17-20 July 2018, London, UK, www.icpmg2018.london

ICSSTT 2018 - 20th International Conference on Soil Stabilization Techniques and Technologies, July 19 - 20, 2018, Toronto, Canada, https://waset.org/conference/2018/07/toronto/ICSSTT

GeoChine 2018 - 5th GeoChina International Conference Civil Infrastructures Confronting Severe Weathers and Climate Changes: From Failure to Sustainability, July 23-25, , HangZhou, China, http://geochina2018.geoconf.org

UNSAT2018 The 7th International Conference on Unsaturated Soils, 3 - 5 August 2018, Hong Kong, China, www.unsat2018.org

China- Europe Conference on Geotechnical Engineering, 13-16 August 2018, Vienna, Austria, https://china-euro-geo.com

CRETE 2018 6th International Conference on Industrial & Hazardous Waste Management, 4-7 September 2018, Chania, Crete, Greece, www.hwm-conferences.tuc.gr

EUCEET 2018 - 4th International Conference on Civil Engineering Education: Challenges for the Third Millennium, 5-8 September 2018, Barcelona, Spain, http://congress.cimne.com/EUCEET2018/frontal/default.asp

SAHC 2018 11th International Conference on Structural Analysis of Historical Constructions "An interdisciplinary approach", 11-13 September 2018, Cusco, Perύ http://sahc2018.com

26th European Young Geotechnical Engineers Conference, 11 - 14 September 2018, Reinischkogel, Austria, www.tugraz.at/en/institutes/ibg/events/eygec

11th International Conference on Geosynthetics (11ICG), 16 - 20 Sep 2018, Seoul, South Korea, www.11icg-seoul.org

CHALK 2018 Engineering in Chalk 2018, 17-18 September 2018, London, U.K., www.chalk2018.org

International Symposium on Energy Geotechnics SEG - 2018, 25-28 September 2018, Lausanne, Switzerland https://seg2018.epfl.ch

HYDRO 2018 - Progress through Partnerships, 15-17 October 2018, Gdansk, Poland, www.hydropower-dams.com/hydro-2018.php?c_id=88

GEC - Global Engineering Congress Turning Knowledge into Action, 22 - 26 October, London, United Kingdom, www.ice.org.uk/events/global-engineering-congress

ARMS10 - 10th Asian Rock Mechanics Symposium, ISRM Regional Symposium, 29 October - 3 November 2018, Singapore, www.arms10.org

ACUUS 2018 16th World Conference of Associated research Centers for the Urban Underground Space "Integrated Underground Solutions for Compact Metropolitan Cities", 5 – 7 November 2018, Hong Kong, China, www.acuus2018.hk

International Symposium Rock Slope Stability 2018, 13-15 November, 2018, Chambéty, France, www.c2rop.fr/symposium-rss-2018

GeoMEast 2018 International Congress and Exhibition: Sustainable Civil Infrastructures, 24 - 28 November 2018, Cairo, Egypt, www.geomeast.org

WTC2019 Tunnels and Underground Cities: Engineering and Innovation meet Archaeology, Architecture and Art and ITA - AITES General Assembly and World Tunnel Congress, 3-9 May 2019, Naples, Italy, www.wtc2019.com

14th international Conference "Underground Construction", 3 to 5 June 2019, Prague, Czech Republic, www.ucprague.com

2019 Rock Dynamics Summit in Okinawa, 7-11 May 2019, Okinawa, Japan, www.2019rds.org

Underground Construction Prague 2019, June 3–5, 2019, Prague, Czech Republic, www.ucprague.com

VII ICEGE ROMA 2019 - International Conference on Earthquake Geotechnical Engineering, 17 - 20 June 2019, Rome, Italy, www.7icege.com

ICONHIC2019 - 2nd International Conference on Natural Hazards and Infrastructure, 23-26 June 2019, Chania, Crete Island, Greece, https://iconhic.com/2019/conference

IS-GLASGOW 2019 - 7th International Symposium on Deformation Characteristics of Geomaterials, 26 - 28 June 2019, Glasgow, Scotland, UK, https://is-glasgow2019.org.uk

cmn 2019 -Congress on Numerical Methods in Engineering, July 1 - 3, 2019, Guimarães, Portugal, www.cmn2019.pt

For additional information, please contact the secretariat of the congress, Ms. Lara Leite

CMN2019, Universidade do Minho, Departamento de Engenharia Civil, 4800-058 Guimarães - Portugal
Email: cmn2019@civil.uminho.pt
Telephone: +351 253 510 748
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The 17th European Conference on Soil Mechanics and Geotechnical Engineering, 1st - 6th September 2019, Reykjavik Iceland, www.ecsmge-2019.com

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

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

The South African Institution of Civil Engineering cordially invites all our colleagues from Africa and beyond to attend the 17th African Regional Conference on Soil Mechanics and Geotechnical Engineering.

Hosted in one of the continent's most iconic cities, this conference will serve practitioners, academics and students of all geotechnical backgrounds. The conference will take place at the Cape Town International Convention Centre (CTICC) offering world class conferencing facilities in the heart of South Africa's mother city and will offer extensive opportunities for Technical Committee Meetings, Workshops, Seminars, Exhibitions and Sponsorships. Exciting Technical Visits, including tours to the famous Robben Island, await.

The 7th African Young Geotechnical Engineers' Conference (8 – 10 October 2019) will commence on 8 October 2019, the day following the African Regional Conference (ARC) opening. The conference venue will be shared with the ARC delegates to initiate dialogue between junior and senior engineers while young geotechnical engineers acquaint themselves with the industry standards, new geotechnical developments and resources available to further their careers. The YGE conference provides an approachable audience within a vibrant environment where young presenters under the age of 35 are encouraged to exercise their presentation and technical writing skills on a continental platform.

Organiser: SAICE
Contact person: Dr Denis Kalumba
Email: denis.kalumba@uct.ac.za

XVI Asian Regional Conference on Soil Mechanics and Geotechnical Engineering, 21 - 25 October 2019, Taipei, China www.16arc.org

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

YSRM2019 - the 5th ISRM Young Scholars' Symposium on Rock Mechanics and REIF2019 - International Symposium on Rock Engineering for Innovative Future
1-4 December 2019, Okinawa, Japan

Contact Person: Prof. Norikazu Shimizu, jsrm-office@rocknet-japan.org

Nordic Geotechnical Meeting
27-29 May 2020, Helsinki, Finland

Contact person: Prof. Leena Korkiala-Tanttu
Address: SGY-Finnish Geotechnical Society,
Phone: +358-(0)50 312 4775
Email: leena.korkiala-tanttu@aalto.fi

EUROCK 2020
Hard Rock Excavation and Support
June 2020, Trondheim, Norway

Contact Person: Henki Ødegaard,
henki.oedegaard@multiconsult.no

www.eurogeo7.org

We are pleased to invite you to the 7th EuroGeo conference, to be held in Warsaw, Poland in 2020. Poland is a country with more than a thousand years of recorded history and has a strong European identity. The country was first to free itself from communist domination in 1989 and is now fully democratic and a member of the European Union. Poland is a leader in infrastructure development in the region, which has resulted in many extraordinary projects. Warsaw, with its central location, is an ideal base for exploring the country. Today, the city is a dynamic cultural and business centre, with strong links not only to Western Europe but also to the East. PSG-IGS, a Polish Chapter of IGS is young but thriving organization successfully cooperating with several chapters within Central Europe. It is an honour to host such a prestigious conference in Warsaw and We sincerely believe that the sessions will prove to be a success. Come to Warsaw, bring your family and enjoy your stay in our capital and help us to make this Conference not only scientifically profitable but also an unforgettable event.

Contact: eurogeo7inpoland@gmail.com

6th International Conference on Geotechnical and Geophysical Site Characterization
07-09-2020 ÷ 11-09-2020, Budapest, Hungary
www.isc6-budapest.com

Organizer: Hungarian Geotechnical Society
Contact person: Tamas Huszak
Address: Muegyetem rkp. 3.
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Email: huszak@mail.bme.hu
Website: http://www.isc6-budapest.com
Email: info@isc6-budapest.com

ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

How Crossrail was affected by the curvature of the earth

Crossrail's tunnels under London are long, so long that when they were being planned, they were affected by something you might not expect — the curvature of the earth.

Knowing how the curvature of the earth is going to affect your new tunnels is quite important, otherwise the tunnels don't line up when they meet. Worse, in some of the really tight spaces between older tunnels, you can end up drilling right into them. That would be embarrassing.

When the current Crossrail scheme was developed in the 1990s, the planners used maps based on the Ordnance Survey National Grid reference system (BNG), but this turned out to be too crude a measure for the accuracy needed by Crossrail.

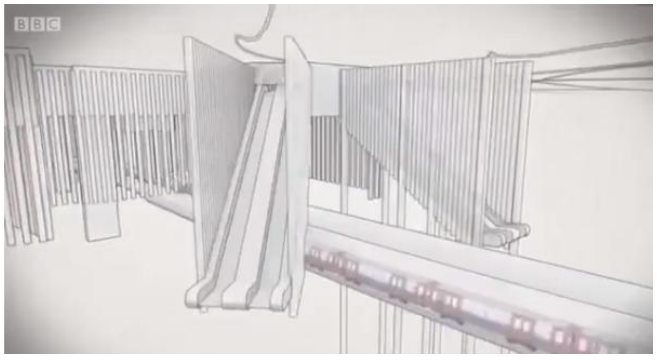
It's not that Crossrail couldn't have been dug using it, as obviously older tunnels were dug before modern maps, but there would have been risks of misalignment and a lot more time/money would have had to be spent surveying the tunnels to make sure they pointed in the right direction.

In addition, interfaces between Crossrail and existing infrastructure as owned by Network Rail and London Underground would need to fit within tighter modern engineering tolerances.

Had they used normal "street maps", then Crossrail tunnels could have been seen deviations of up to 20cm per kilometer of tunnel — due to the curvature of the earth. Maybe not a huge issue in some places, but that could have been catastrophic in central London as the Crossrail tunnels squeezed between gaps in other tube lines, sewers and modern foundations.

For example, Tottenham Court Road had a gap so tight that had they not adjusted for the curvature of the earth, the tunnel boring machine that left Paddington would have been sufficiently out of place by the time it arrived, that the cutting head might have drilled through the Northern line tunnels.

So Crossrails's maps needed to adapt for the curvature of the planet.



How is this possible?

If you've ever peeled an orange then tried to lay the peel flat on a surface, you'll appreciate how difficult it is to represent a curved surface on a sheet of paper – and maps have long had various ways of adjusting their maps to allow for that.

There are numerous mathematical solutions, each with their own way of working out where X marks the spot. Thanks to that, the various different systems of latitude and longitude in common use today can disagree on the coordinates of a location by as much as 200 metres.

If that seems excessive, then pop along to Greenwich and stand on the Prime Meridian, and pull out a GPS receiver. It'll tell you that you're 102 meters to the east of the meridian, because it uses a different mapping system to old paper maps.

The figure below shows three points that all have the same latitude and longitude, in three different coordinate systems (OSGB36, WGS84 and ED50). Each one of these coordinate systems is widely used and fit for its own unique purpose, and none of them is intrinsically wrong, yet they all disagree about where a specific location on the planets surface should be shown on a flat map.

The differences between them are just a result of the fact that any system of 'absolute coordinates' is always arbitrary.

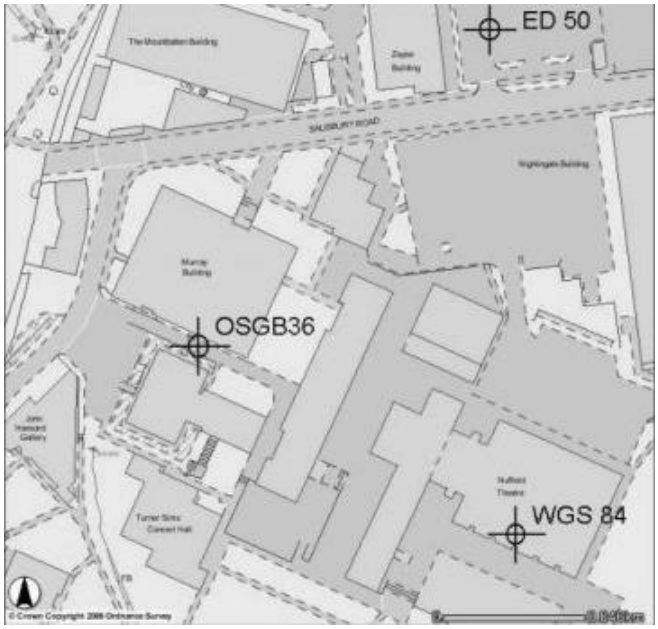


Figure 1: *three points with the same latitude and longitude in three different coordinate systems. The map extract is 200 metres square.*

When digging a tunnel under London though, such differences are no longer so arbitrary. In fact, they can be critical.

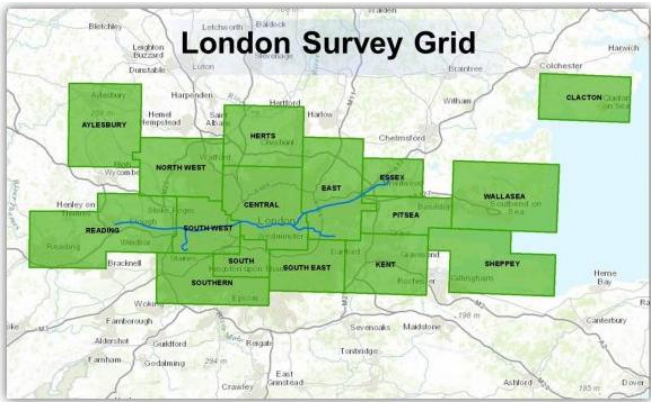
For a project as large as Crossrail, the National Grid's use of a single scale factor to represent a curved planet on a sheet to account for the distortions was too rough a measurement.

To reduce the scale distortion, Crossrail made use of a customised projection with a meridian that runs through central London. That reduced the scale distortions from an average of 20 cm per kilometer drilled to just 1 mm per kilometer.

This became London Survey Grid (LSG).

This in turn caused another problem in that they now had two different sets of measurement data and conversion

rules were developed to ensure that plans based on the British National Grid could be reliably converted into the new more accurate format.



A number of mapping zones were created for Crossrail, each with corrective parameters to help to adjust for the curvature of the ground, which could then be used to translate between the LSG and BNG.

Adoption of the curvature correction ensured that all the design and construction data was created within a real-world context and allowed for a greater ease of interoperability between computer aided design and the mapping systems.

All this was needed because the Crossrail tunnels are long enough to be affected by the curvature of the earth.

It's also one of the many legacies that Crossrail will leave behind — a more accurate map of London for use by future engineers, maybe building for example, Crossrail 2.

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A guide to coordinate systems in Great Britain

Building a Spatial Data Infrastructure for Crossrail

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GIS and Information Management on Crossrail C122 Bored Tunnels contract

Channel Tunnel Construction

(IanVisits, March 6, 2018, https://www.ianvisits.co.uk/blog/2018/03/06/how-crossrail-was-affected-by-the-curvature-of-the-earth)

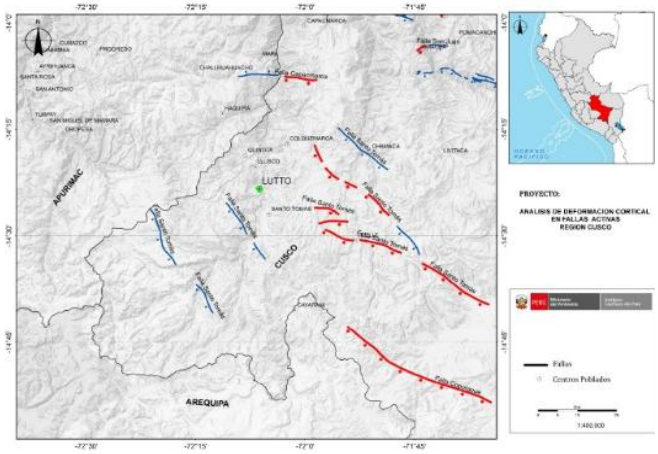
State of emergency after landslide destroys over 100 homes, Peru

The Peruvian government declared a state of emergency for the district of Llusco in the department of Cusco last week after a massive slow-moving landslide destroyed over 100 homes and other structures. There are no reports of injuries and IGP said such events are common in this mountainous region after very heavy rains.

Residents of the town of Lutto in the district of Llusco first reported the event on February 23, after very heavy rains hit the region.

The president of the Peru Geophysical Institute (IGP), Hernando Tavera, said that the landslide was caused by a saturation of water in the earth and not by an earthquake.

The town of Lutto is situated at the bottom of a slope in a mountainous area.



"Over 30 hectares [74 acres] of earth has moved, causing widespread alarm among residents," Tavera said.

More than 100 homes were destroyed, a school, a clinic, and numerous fields and roads.

FALLA GEOLÓGICA / DESASTRE NATURAL DISTRITO DE LLUSCO DE LA PROVINCIA DE CHUMBIVILCAS - CUSCO https://www.youtube.com/watch?v=Q4_xDRi0Zic

La tierra se ABRE ¡Inicios de fin del mundo? Cusco Perú 2018 https://www.youtube.com/watch?v=r7CkoDRIOy4

CUSCO: LA TIERRA SE ABRE EN CHUMBIVILCAS https://www.youtube.com/watch?v=wa1iLt4PW_0

The state of emergency will last 60 days, with the aim of bringing aid to hundreds of displaced.

(THE WATCHERS, March 09, 2018, https://watchers.news/2018/03/09/state-of-emergency-after-landslide-destroys-over-100-homes-peru)

Landslide destroys 6 homes in Hrvatska Kostajnica, Croatia

Heavy floods and landslides are affecting parts of central Croatia two weeks after record-breaking snow paralyzed the region. At this time, the worst affected is the city of Hrvatska Kostajnica (population 2 700) where heavy floods and landslides resulted in the de-

struction of several homes and at least 3 people injured.

The landslide that hit the city on Tuesday, March 13, 2018, resulted in the destruction of at least 6 houses, but experts said they expect additional activity in this area and more structures could be damaged or destroyed. Locals say this mountain is known for landslides and that government should never have allowed homes to be built there.

Several people were injured in today's landslide, but there were no casualties, the police said.

Luckily, the slide took place during daylight and was accompanied by loud rumbling noise, giving residents audible alert and several precious moments to escape. Some of them escaped just before their home collapsed.

> Snimke urusavanja. Evakuirano 10ak kuca.
> #n1infopic.twitter.com/KAYzZbAu1q
>
> Ana Mlinarić (@Ana_Mlinaric) March 13, 2018

Authorities declared a state of emergency for the city earlier in the day after Una River broke its banks, flooding homes and streets.

The situation is also critical around Hrvatska Kostajnica, in the city of Karlovac, the city on four rivers and home to more than 55 000 people, as well as in Letovanic, south of capital Zagreb. While rivers running through Hrvatska Kostajnica and Karlovac are peaking today, some regions such as Jasenovac and Frkasic are still preparing for the worst.

It is important to note that many residents of the city of Karlovac claim they are victims of irresponsible urban planning and that government should never have allowed homes to be built in flood-prone areas. Many homes, for example, were allowed to be built in dry riverbeds.

(THE WATCHERS, March 13, 2018, https://watchers.news/2018/03/13/landslide-destroys-6-homes-in-hrvatska-kostajnica-croatia/?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+adorraeli%2FtsEq+%28The+Watchers+-+watching+the+world+evolve+and+transform%29)

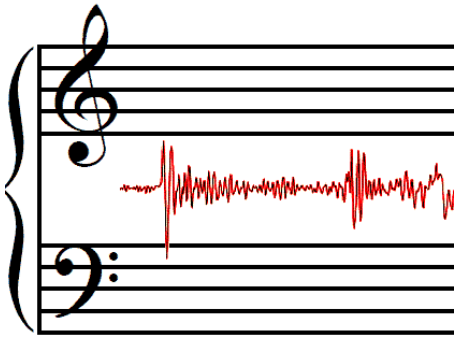
Chronology of major tailings dam failures
(from 1960) (last updated 30 Mar 2018)

Note: Due to limited availability of data, this compilation is in no way complete

http://www.wise-uranium.org/mdaf.html

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΣΕΙΣΜΟΙ

Ήχοι της γης
Τα μπάσα και τα πρίμα των σεισμών



Τι ευάρεστο θα μπορούσε να παραχθεί από τους τρομακτικούς, για την πλειοψηφία των ανθρώπων, σεισμούς; Μία μουσική μελωδία. Οι ψυχραιμότεροι -απ' ό,τι εμείς- σεισμολόγοι κατάφεραν να συνθέσουν μουσική, αναλύοντας τις συχνότητες διαφόρων σεισμογραφημάτων και επιταχυνσιογράφων, με αποτέλεσμα να αποτυπώσουν τη «φωνή» της γης ως πραγματική μουσική, ξεχωριστή σε κάθε σεισμική δόνηση, σαν μία μπάντα που παίζει συγχρονισμένα, με ηχείο το ίδιο το «σώμα» του πλανήτη μας.

Ο σεισμός του Landers της Καλιφόρνιας (το 1992) -που για την επιστήμη της σεισμολογίας αποτέλεσε σταθμό εξαιτίας των πολλών νέων μεθόδων που εφαρμόστηκαν- ήταν σημαντικός και για έναν ακόμη λόγο. Ήταν από τους πρώτους σεισμούς που μετατράπηκαν σε δίλεπτο μουσικό κομμάτι, που λέγεται ότι μοιάζει με τη μουσική ροκ (rock = πέτρωμα). Στη συνέχεια ακολούθησαν πολλές ακόμη αποτυπώσεις των μελωδικών ήχων που παράγουν οι σεισμοί, τα ρήγματα και οι ηφαιστειακοί σεισμοί από διάφορα Γεωλογικά Ινστιτούτα (π.χ. η Αμερικανική Γεωλογική Υπηρεσία USGS) και πανεπιστήμια (π.χ. Berkeley, Καλιφόρνια).

Όπως κάθε σεισμός έχει την προσωπικότητά του ώστε να μην είναι όμοιος με κανέναν άλλο, ούτε ακόμη και με σεισμό που προήλθε από την ίδια πηγή, εστία ή ρήγμα, έτσι και οι ήχοι που παράγει έχουν τις ίδιες ιδιαιτερότητες. Όπως το περιγράφουν οι σεισμολόγοι, τα σεισμικά κύματα που ταξιδεύουν στο σώμα της γης έχουν διαφορετικές συχνότητες, που καταγράφονται από τους σεισμογράφους, και διαφορετικά φάσματα, που καταγράφουν οι επιταχυνσιογράφοι (τις εδαφικές κινήσεις για να μελετηθούν οι επιπτώσεις των σεισμών στα κτίρια).

«Η Γη είναι ένας ανήσυχος πλανήτης. Παράγει χιλιάδες μικροσεισμούς κάθε μέρα, μήνα και χρόνο. Τα επιμήκη ή πρώτα κύματα, όταν φτάνουν από το εσωτερικό του φλοιού στην επιφάνεια της γης -η οποία είναι μια διαχωριστική επιφάνεια δύο μέσων με διαφορετική πυκνότητα και διαφορετικές ταχύτητες διάδοσης των κυμάτων- διαθλώνται και μεταδίδονται στην ατμόσφαιρα ως ακουστικά κύματα πλέον, σε συχνότητες δηλαδή που θα μπορούσε να τις αντιλαμβάνεται το ανθρώπινο αυτί. Αντίθετα, τα εγκάρσια ή δεύτερα κύματα δεν διαδίδονται στα ρευστά και δεν εισχωρούν στην ατμόσφαιρα. Σε πολλούς σεισμούς υπάρχουν πολλές μαρτυρίες για την υπόκωφη βοή, το τρομερό βουητό που ακούγεται κατά τη διάρκεια μιας σεισμικής δόνησης και μάλιστα κατά τη διάρκεια της άφιξης των 'ανώδυνων' πρώτων σεισμικών κυμάτων. Στην πραγματικότητα, πολλοί από αυτούς τους ήχους οφείλονται στις κινήσεις των ρηγμάτων, στην ανακατάταξη επιφανειακών σχετικά πετρωμάτων, σε καταπτώσεις βράχων και στα αντικείμενα των σπιτιών μας, όλα αποτέλεσμα της δόνησης. Την υπόκωφη βοή του σεισμού την εκλαμβάνει ο άνθρωπος ως υποχθόνιο τρομακτικό μουγκρητό. Δεν παύει να είναι, όμως, μια δυνατή κραυγή της γης, επακόλουθο μιας φυσιολογικής σεισμικής διεργασίας του πλανήτη. Όταν καταφτάνουν τα δεύτερα καταστροφικά κύματα, δεν συνοδεύονται από ηχητικά φαινόμενα» δήλωσε στο ΑΠΕ - ΜΠΕ ο καθηγητής του τμήματος Γεωλογίας του ΑΠΘ, Σπύρος Παυλίδης.

Τα μπάσα και τα πρίμα της «μπάντας» των σεισμών

Με την έναρξη ενός σεισμού, το έδαφος σείεται, ο αέρας πάλλεται και τον αισθανόμαστε δεχόμενοι ένα ευρύ φάσμα κυματικών συχνοτήτων, ωστόσο οι επιμέρους μονάδες αυτών των κυμάτων, δηλαδή οι "νότες" δεν είναι τόσο ευδιάκριτες. Έτσι προσλαμβάνουμε μόνο το δυσάρεστο αίσθημα από το τράνταγμα που προκαλούν οι σεισμικές δονήσεις (που οφείλεται στις υψηλές συχνότητες) και από την ταλάντωση (ζάλισμα, που προκαλούν οι χαμηλές).

Σύμφωνα με τον κ. Παυλίδη, οι πολλοί μικροί σεισμοί διαχέουν τα κύματά τους σε μικρές αποστάσεις και οι μεγάλου μεγέθους σε ολόκληρη τη γη, την οποία διασχίζουν και διατρέχουν πολλές φορές. Εξάλλου, οι μεγάλης ενέργειας δονήσεις διεγείρουν όλο τον πλανήτη και τον εξαναγκάζουν να πάλλεται και να δονείται σαν καμπάνα για πολλά λεπτά και ώρες μετά τη γένεσή τους.

«Οι σεισμοί σπάνια συμβαίνουν σε ένα μόνο ρήγμα. Σχεδόν πάντα δημιουργούνται από ιδιαίτερα πολύπλοκα δίκτυα ρηγμάτων, μικρών και μεγάλων. Οι πολλές αυτές διαρρήξεις εμπλουτίζουν τα σεισμικά κύματα με πολλές και διαφορετικές συχνότητες, χαμηλές και υψηλές, μπάσες και πρίμες, σαν μια μπάντα με ήχους από τύμπανα, τρομπέτες, κοντραμπάσα και κλαρίνα. Για το ίδιο μέγεθος σεισμού, ένα μικρό ρήγμα παράγει υψηλές συχνότητες και ένα μεγάλο χαμηλές. Υπάρχει κι ένας άλλος λόγος που αλλάζουν οι ακουστικές συχνότητες των σεισμών: καθώς τα σεισμικά κύματα ταξιδεύουν στον αέρα ταυτόχρονα με αυτά στο έδαφος, χάνουν ενέργεια, γι' αυτό αισθανόμαστε δυνατότερα ένα σεισμό κοντά στην πηγή του, από ό,τι μακριά από αυτήν» αναφέρει ο καθηγητής και συμπληρώνει: «Τα υψηλής συχνότητας όμως κύματα, όπως γνωρίζουμε από τη φυσική, χάνουν γρηγορότερα ενέργεια καθώς ταξιδεύουν, από ό,τι τα χαμηλής συχνότητας. Έτσι όσο πιο μακριά βρισκόμαστε από μια μπάντα, τόσο θα ξεχωρίζουμε καλύτερα τους μπάσους ήχους. Το ίδιο συμβαίνει και με ένα σεισμό: στην επικεντρική περιοχή επικρατούν οι υψηλές συχνότητες και πιο μακριά οι χαμηλές».

Το είδος των πετρωμάτων, μέσα από τα οποία διέρχονται τα σεισμικά κύματα, επηρεάζει εξίσου τις συχνότητές τους. "Ο γρανίτης είναι ένα πέτρωμα που επιτρέπει στα κύματα να διέρχονται με τις μικρότερες απώλειες ενέργειας. Αντίθετα, στα "'χαλαρά' υλικά, τα σεισμικά κύματα χάνουν περισσότερη ενέργεια και κυρίως τις υψηλές συχνότητές τους" καταλήγει ο κ. Παυλίδης.

Οι σεισμολόγοι, αναλύοντας τις συχνότητες διαφόρων σεισμογραφημάτων, κατάφεραν να αποδώσουν τους ήχους της γης ως πραγματική μουσική και όχι ως αποτέλεσμα της έμπνευσης ενός ταλαντούχου ανθρώπου. "Θα μπορούσαμε να πούμε ότι είναι τα κρυπτογραφικά μηνύματα από την ανάλυση των σεισμογραφημάτων. Από την ανάλυση αυτή προκύπτουν οι συχνότητες που μετατρέπονται σε ήχους, νότες, που έχουν ρυθμό και μελωδία. Βέβαια, στη συνέχεια, με βάση αυτό το μουσικό μοτίβο που προκύπτει, κάποιοι μουσικοί δημιούργησαν τις δικές τους συνθέσεις" εξήγησε ο καθηγητής.

Μουσική και από τους κόκκους άμμου...

Όπως αναφέρει και στο βιβλίο του "Πανγαία" (εκδόσεις Leader Books), η Γη δεν παράγει ήχους μόνο από τους σεισμούς. Είναι γνωστοί, επίσης, οι μουσικοί ήχοι από τη μαζική

κίνηση κόκκων άμμου στις ερήμους με την επίδραση του ανέμου, ενώ έχουν καταγραφεί και μελετηθεί συγκεκριμένες νότες και από μία άλλη γεωλογική διεργασία, την αιολική διάβρωση, δηλαδή της κίνησης του αέρα με κόκκους άμμου.

«Τους ήχους αυτούς μπορούμε με τα κομπιούτερ μας, να τους μετατρέψουμε σε μουσική. Φυσικά, δεν γνωρίζουμε αν όλοι αυτοί οι ήχοι αποτελούν τη γλώσσα της Γης, όπως πριν από λίγα χρόνια δεν γνωρίζαμε τίποτε για τη γλώσσα των δελφινιών και φαλαινών. Από δω και πέρα μπορούμε να σκεφτόμαστε 'ποιητική αδεία' με τη φαντασία μας για τους ψιθύρους, τις κραυγές και τη μουσική της γης» καταλήγει ο κ. Παυλίδης.

(in.gr με πληροφορίες από ΑΠΕ - ΜΠΕ, 11 Μαρ. 2018, http://www.in.gr/2018/03/11/culture/ta-mpasa-kai-ta-prima-twn-seismwn)

Reassessing the Mycenaean Earthquake Hypothesis: Results of the HERACLES Project from Tiryns and Midea, Greece

Klaus-G. Hinzen, Joseph Maran, Hector Hinojosa-Prieto, Ursula Damm-Meinhardt, Sharon K. Reamer, Jana Tzislakis, Kilian Kemna, Gregor Schweppe, Claus Fleischer, Katie Demakopoulou

Abstract

Observations at Mycenaean archaeological sites of tilted and curved walls, broken pottery, and human skeletons led to the hypothesis that these sites in the Argolid, Peloponnese, Greece, were destroyed in large earthquakes between the late palatial (thirteenth century B.C.E.) and postpalatial (1200–1050 B.C.E.) periods. In particular, the destruction of Mycenaean palaces around 1200/1190 B.C.E. has often been attributed to a devastating earthquake. To test the Mycenaean earthquake hypothesis, this project focuses on the Argive citadels of Tiryns and Midea. With active and passive seismic measurements complemented by a gravimetric survey, we explored seismic site effects at these locations and calculated synthetic seismograms for potential earthquake sources to estimate intensities of ground motions inside and outside the citadels. The field work and results were supplemented by analysis of the individual damage descriptions and observations from the archaeological literature on which the hypothesis is based. Because of poor construction techniques and the associated site effects, the buildings in the Lower Town surrounding the citadel of Tiryns were more vulnerable than the structures within the Cyclopean palace walls, but evidence of an earthquake destruction stratum in the Lower Town has not yet been found. Although some of the observations from the two investigated citadels could be explained by seismic loading, alternative nonseismic causes could equally explain most observed damage. In some cases, the structural damage was clearly not caused by earthquakes. Simulated ground motions show that severe earthquake damage at Tiryns and Midea can be expected from activation of local faults in the Argive basin; however, palaeoseismic studies for such activity in and since the Late Bronze Age (LBA) are lacking. Our results indicate that the hypothesis of a destructive earthquake in Tiryns and Midea, which may have contributed to the end of the LBA Mycenaean palatial period, is unlikely.

Bulletin of the Seismological Society of America (2018), DOI: https://doi.org/10.1785/0120170348, Published: March 27, 2018,
https://pubs.geoscienceworld.org/ssa/bssa/article-abstract/529882/reassessing-the-mycenaean-earthquake-hypothesis?redirectedFrom=fulltext

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΓΕΩΛΟΓΙΑ

Εγκαιρη προετοιμασία ζητούν ηφαιστειολόγοι για την επόμενη έκρηξη στη Γη - Τι λένε για την Ελλάδα

Η επόμενη πολύ ισχυρή ηφαιστειακή έκρηξη θα βρει τον κόσμο απροετοίμαστο. Μπορεί να εξαφανίσει ολόκληρες πόλεις και περιοχές πολλών εκατομμυρίων κατοίκων, καθώς επίσης να προκαλέσει ευρύτερη αναστάτωση στο παγκόσμιο εμπόριο, στις διεθνείς επικοινωνίες και μεταφορές, στα οικονομικά και τεχνολογικά συστήματα, στο κλίμα και στο περιβάλλον, ακόμη και στη διεθνή ειρήνη. Μάλιστα, δύο ελληνικά ηφαίστεια, της Σαντορίνης και της Κω, βρίσκονται ανάμεσα σε αυτά που μπορεί να αποτελέσουν απειλή στο μέλλον.

Τη σχετική προειδοποίηση απηύθυναν κορυφαίοι ηφαιστειολόγοι, οι οποίοι υπογράμμισαν ότι μια πολύ ισχυρή και καταστροφική έκρηξη ηφαιστείου «δεν είναι αδιανόητη». Γι' αυτό, κάλεσαν τις κυβερνήσεις και τους ειδικούς να έχουν έτοιμα διάφορα σχέδια έκτακτης ανάγκης και να μην εστιάζονται μόνο στις συχνότερες φυσικές καταστροφές, όπως οι πλημμύρες και οι σεισμοί.

Οι Στέφεν Σελφ (Πανεπιστήμιο Καλιφόρνια-Μπέρκλεϊ), Κρις Νιούχολ (Κέντρο Mirisbiris Φιλιππίνων) και 'Αλαν Ρόμποκ (Πανεπιστήμιο Rutgers-Νιού Τζέρσι), που είχαν στο παρελθόν μελετήσει τις εκρήξεις των ηφαιστείων της Αγίας Ελένης στις ΗΠΑ (1980) και του Πινατούμπο στις Φιλιππίνες (1991), με άρθρο τους στο περιοδικό γεωπιστημών "Geosphere", επισημαίνουν ότι ο κόσμος πρέπει να κάνει περισσότερα από ό,τι έως τώρα, αν δεν θέλει να χαθεί ή να απορρυθμισθεί η ζωή του από την επόμενη μεγάλη έκρηξη ηφαιστείου.

Στην κλίμακα του «Δείκτη Ηφαιστειακής Εκρηκτικότητας» (Volcanic Explosivity Index-VEI), που φθάνει έως το οκτώ, οι εκρήξεις που έχουν παγκόσμιες επιπτώσεις, είναι ισχύος επτά ή οκτώ. Τέτοιες εκρήξεις εκτιμάται ότι συμβαίνουν με μέση συχνότητα μία ή δύο φορές ανά χιλιετία.

Όπως τονίζουν οι επιστήμονες, ο σύγχρονος τεχνολογικός κόσμος δεν έχει δει τέτοια έκρηξη. Από τα μέσα του 19ου αιώνα έως σήμερα οι μεγαλύτερες ηφαιστειακές εκρήξεις οπουδήποτε στη Γη ήσαν λίγες ισχύος «έξι», με πιο γνωστές του Κρακατάου στην Ινδονησία το 1883, του Κατμάι στην Αλάσκα το 1912 και του Πινατούμπο στις Φιλιππίνες το 1991.

Η τελευταία μεγάλη έκρηξη ισχύος «επτά» ήταν εκείνη του ηφαιστείου Ταμπόρα της Ινδονησίας το 1815, που σκότωσε δεκάδες χιλιάδες ανθρώπους και επέφερε τόσο σοβαρές κλιματικές αλλαγές, που οδήγησε το 1816 να είναι ένα «έτος χωρίς καλοκαίρι» στην Ευρώπη και στην Αμερική.

«Η επόμενη έκρηξη μεγέθους VEI-7 μπορεί να συμβεί στη διάρκεια της ζωής μας ή σε εκατοντάδες χρόνια», δήλωσε ο Νιούχολ, σύμφωνα με το «Nature». Οι Νιούχολ και Σελφ είχαν δημιουργήσει τον διεθνή δείκτη VEI το 1982, συνεπώς η γνώμη τους έχει ειδικό βάρος.

Το 1257 η έκρηξη ενός άλλου ινδονησιακού ηφαιστείου είχε προκαλέσει τέτοια ηλιακή σκίαση, που η θερμοκρασία του πλανήτη μας υποχώρησε τόσο, με συνέπεια πιθανότατα να πυροδοτηθεί στη διάρκεια του Μεσαίωνα η λεγόμενη «Μικρή Εποχή των Πάγων» που διήρκεσε για αιώνες.

«Αυτά τα συμβάντα είναι τρομερά σημαντικά για τον πλανήτη, όμως η επόμενη μεγάλη έκρηξη θα συμβεί σε ένα τελείως διαφορετικό περιβάλλον» τόνισε ο Ρόμποκ. Η γεωργία, η υγεία, η οικονομία, οι μεταφορές και τα άλλα πεδία της σύγχρονης ζωής είναι πλέον πολύ πιο παγκοσμιοποιημένα και αλληλεξαρτώμενα, από ό,τι στο παρελθόν.

Πριν από οκτώ χρόνια, η έκρηξη του ισλανδικού ηφαιστείου Εϊγιαφιαλαγιοκούλ, που ήταν ισχύος μόλις «τρία» στην κλίμακα VEI, καθήλωσε τα αεροπλάνα για μέρες στα ευρωπαϊκά αεροδρόμια και οι συνολικές οικονομικές ζημιές της έφθασαν τα πέντε δισεκατομμύρια ευρώ.

Οι τρεις ηφαιστειολόγοι τονίζουν ότι πρέπει οι επιστήμονες να αρχίσουν να μελετούν πιο συστηματικά τις πιθανές επιπτώσεις (π.χ. στις επικοινωνίες και στο GPS) και να προετοιμάζουν σχέδια για την επόμενη έκρηξη ισχύος VEI-7. Βασικό αντικείμενο έρευνας επίσης πρέπει να είναι η προσπάθεια καλύτερης πρόβλεψης για το πού μπορεί να συμβεί μια τέτοια έκρηξη.

Ήδη υπάρχει ένας κατάλογος με υποψήφια ηφαίστεια ικανά για έκρηξη ισχύος «επτά» ή και «οκτώ». Αυτά περιλαμβάνουν το Ταούπο στη Νέα Ζηλανδία (εκεί όπου συνέβη η τελευταία στον κόσμο έκρηξη VEI-8 πριν 26.500 χρόνια) και το Νταμαβάντ του Ιράν, σε απόσταση μόλις 50 χιλιομέτρων από την Τεχεράνη.

Οι ερευνητές τονίζουν ότι «αν μια έκρηξη VEI-7 συμβεί κοντά σε μια μεγάλη πόλη, θα την εξαφανίσει τελείως» και «τα θύματα θα είναι αρκετά εκατομμύρια, εκτός κι έχει υπάρξει έγκαιρη εκκένωση του πληθυσμού σε μαζική κλίμακα». Αυτό είναι κάτι που, μεταξύ άλλων, αφορά τη Νάπολη της Ιταλίας, μια πόλη 4,4 εκατομμυρίων κατοίκων που γειτνιάζει με το ενεργό και επικίνδυνο ηφαίστειο των Φλεγραίων Πεδίων.

Ελλάδα

Όσον αφορά τον ελληνικό χώρο, η διάσημη έκρηξη του ηφαιστείου της Θήρας (Σαντορίνης) περί το 1610 π.Χ. εκτιμάται ότι ήταν ισχύος «επτά» στην κλίμακα VEI.

Για το μέλλον, οι ερευνητές θεωρούν ότι το ηφαίστειο της Σαντορίνης, καθώς και εκείνο της Κω, το οποίο πριν 160.000 χρόνια περίπου είχε δώσει μια παρόμοια έκρηξη, είναι τα δύο ηφαίστεια του ελλαδικού χώρου που είναι υποψήφια μέσα στις επόμενες χιλιετίες για να προκαλέσουν μια νέα μεγα-έκρηξη ισχύος «επτά» (VEI-7).

Σύμφωνα με τη νέα μελέτη, από μια μελλοντική έκρηξη του πρώτου ηφαιστείου θα κινδυνεύσει άμεσα το νησί της Σαντορίνης, ενώ μια έκρηξη του δεύτερου θα απειλήσει τα νησιά Νίσυρο, Κω και Γυαλί.

Από τις γύρω χώρες, ηφαίστεια ικανά να δώσουν στο μέλλον έκρηξη ισχύος «επτά», είναι πέντε στην Ιταλία, τέσσερα στην Τουρκία, ένα στην Αρμενία, ένα στη Γεωργία και το Νταβανάντ του Ιράν. Σε όλη την Ευρασία δεν υπάρχουν άλλα ηφαίστεια ικανά να προκαλέσουν τόσο μεγάλη έκρηξη. Αντίθετα, υπάρχει μια πληθώρα υποψήφιων μεγα-ηφαιστείων στον Ειρηνικό, στην Ωκεανία και στην Αμερική.

Η δημιουργία του καταλόγου των υποψήφιων μεγαηφαιστείων έγινε από τους ερευνητές με βάση έξι επιστημονικά κριτήρια, που περιλαμβάνουν το εκρηκτικό παρελθόν τους, τις τωρινές ενδείξεις κινητικότητας, το γενικότερο τεκτονικό περιβάλλον τους, τη σύνθεση του μάγματος, την πιθανή διαρροή αερίων κ.α.

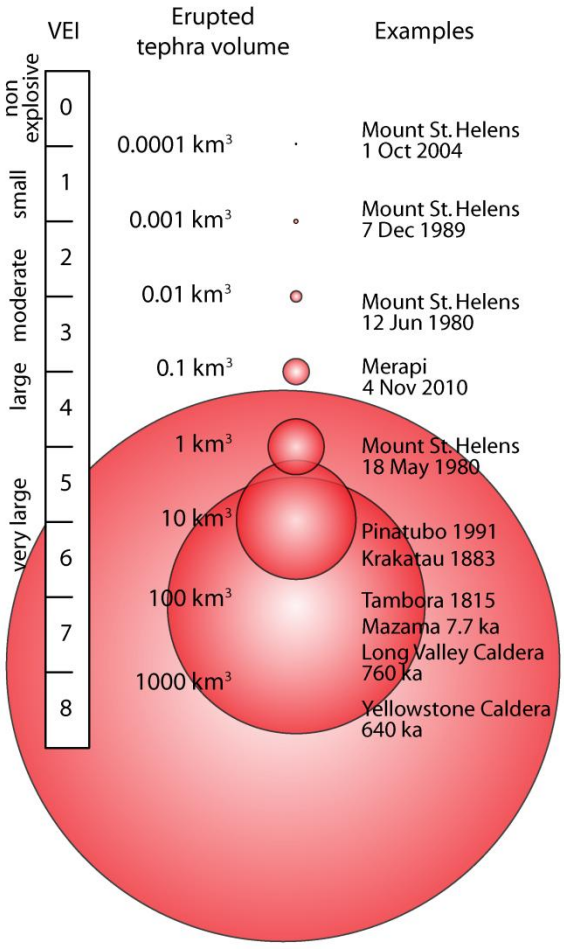
(Η ΚΑΘΗΜΕΡΙΝΗ, 07.03.2018, http://www.kathimerini.gr/952373/article/epikairothta/perivallon/egkairh-proetoimasia-zhtoyn-hfaisteiologoi-gia-thn-epomenh-ekrh3h-sth-gh---ti-lene-gia-thn-ellada)

Anticipating future Volcanic Explosivity Index (VEI) 7 eruptions and their chilling impacts

Chris Newhall, Stephen Self, Alan Robock

Abstract

Worst-case or high-end subduction-related earthquakes and tsunamis of 2004 and 2011 are painfully fresh in our memories. High-end subduction-related volcanic eruptions have not occurred in recent memory, so we review historical and geologic evidence about such eruptions that will surely recur within coming centuries. Specifically, we focus on Volcanic Explosivity Index (VEI) 7 eruptions, which occur 1–2 times per thousand years.



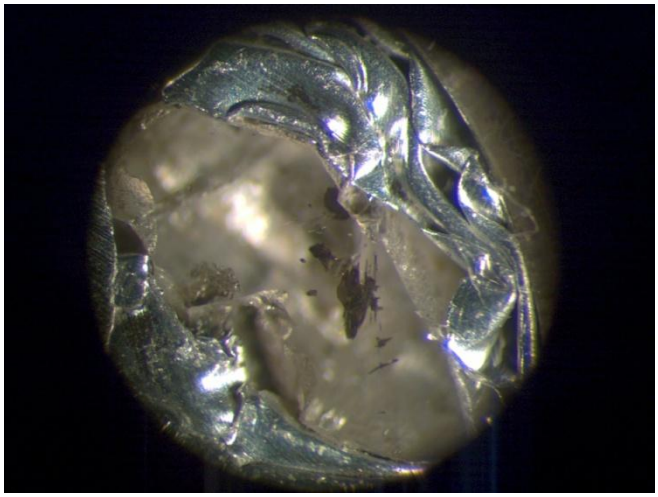
A variety of environmental changes followed the VEI 7 eruption of Rinjani (Samalas), Indonesia, in CE 1257 and several more eruptions of VEI 6 or 7 that occurred in the succeeding few centuries. The Rinjani eruption and its impacts are relatively well documented, modeled, and, for the purposes of attribution, uncomplicated by antecedent eruptions. It seems likely that the Rinjani eruption triggered the onset of the Little Ice Age, and subsequent large eruptions sustained it. Although climatic effects of eruptions like Pinatubo (Philippines) and even Tambora (Indonesia) lasted only a few years, it seems that coupling of oceans, sea ice, and atmosphere after larger eruptions can force decade- to century-long cooling, decreased precipitation, and major impacts on crops.

The next VEI 7 will affect a world very different from that of CE 1257. Today, populations within 100 km of candidate volcanoes range from fewer than 1000 people in remote areas to between 20 and 30 million people near several candidates in Indonesia and the Philippines. If a VEI 7 eruption occurs, those populations will be at dire risk, and eruptions in some locations could destabilize financial centers, national economies, and even peace between nations. Distal effects on air travel, the global positioning system, and climate will be felt by a high-technology, globally interdependent world.

We suggest and apply criteria to identify candidates for future VEI 7 eruptions, and discuss likely challenges for short-range forecasting of such events. Preparation for such low-probability but high-consequence events is difficult to imagine, yet some modest early measures can be considered. Volcanologists should refine geologic histories and ensure at least baseline monitoring of candidate volcanoes, and consider how they will judge the likelihood that an impending eruption will be of VEI 7. Forward-thinking governments and industries would be wise to consider how a proximal or distal VEI 7 eruption will affect their jurisdictions, and what responses make the most economic and sociopolitical sense.

(Geosphere (2018) 14 (2): 572-603. DOI: https://doi.org/10.1130/GES01513.1, Published: February 28, 2018, https://pubs.geoscienceworld.org/gsa/geosphere/article/529016/Anticipating-future-Volcanic-Explosivity-Index-VEI)

This Tiny Diamond Contains a Mineral That's Never Been Seen Before



This diamond discovered in Cullinan, South Africa contains the first evidence of a mineral scientists have sought after for years.

A schist in the hand may be quite continental, but diamonds are a geologist's best friend.

For proof, look no further than a recently mined diamond that contained a mineral that had never been seen in nature — until now.

The discovered mineral — called calcium silicate perovskite ($CaSiO_3$)— was found trapped inside a diamond excavated from South Africa's Cullinan mine (most famous for yielding the world's largest diamond in 1905, part of which now adorns the crown jewels of the United Kingdom). The finding, published online today (March 7) in the journal Nature, provides an important clue to the puzzle of how Earth's inner structure behaves. [Shine On: Photos of Dazzling Mineral Specimens]

While rare to human eyes, calcium silicate perovskite may be shockingly ordinary deep inside the Earth — in fact, it's thought to be the fourth most abundant mineral inside the planet, especially prevalent in slabs of oceanic crust that have plunged into the planet's mantle at tectonic boundaries.

Despite the mineral's theorized prevalence, however, previous studies have never yielded observable evidence of its existence. It's thought to occur deep inside Earth's mantle, however — some 700 kilometers (435 miles) below the planet's surface, the researchers said.

"Nobody has ever managed to keep this mineral stable at the Earth's surface," study co-author Graham Pearson, a professor in the University of Alberta's Department of Earth and Atmospheric Sciences, said in a statement. "The only possible way of preserving this mineral at the Earth's surface is when it's trapped in an unyielding container like a diamond."

In the new study, Pearson and his colleagues analyzed a tiny diamond (roughly 3 millimeters across) excavated from Cullinan less than 1 km (0.6 miles) below the Earth's surface. Despite this relatively shallow depth, the researchers determined that the crystal was an example of a "deep diamond" that most likely had been formed about 700 km below the Earth's surface, derived from a subducted slab of ocean crust and exposed to some 240,000 atmospheres of pressure.

The chunk of calcium silicate perovskite within the gemstone was visible with the naked eye after the diamond was polished, the researchers wrote, but proper analysis and imaging required an international effort. X-ray and spectroscopy tests confirmed that the diamond did contain calcium silicate perovskite — quite possibly the first intact sample ever seen.

"Diamonds are really unique ways of seeing what's in the Earth," Pearson said. "And the specific composition of the perovskite inclusion in this particular diamond very clearly indicates the recycling of oceanic crust into Earth's lower mantle. It provides fundamental proof of what happens to the fate of oceanic plates as they descend into the depths of the Earth."

(Brandon Specktor, Senior Writer / LIFE SCIENCE, March 7, 2018, https://www.livescience.com/61959-diamond-calcium-silicate-perovskite.html)

We're not cracking up or drifting – geologists

The underground fault lines along the Mai Mahiu-Narok road were caused by floods washing away deep deposits of volcanic ash, the Geological Society of Kenya has said.

Nakuru Governor Lee Kinyanjui and his Narok counterpart Samuel Tunai visit the scene where a fault line developed in Mai Mahiu Naivasha cutting off the Mai Mahiu-Narok road. KENHA has promised to relook into the design of the road following the incident.

It sought to allay fears by some people that the phenomenon could lead to parts of the African continent drifting apart.

This emerged when the experts visited the area as fault lines continued widening and getting deeper, raising fears amongst residents.

GSK chairperson Gladys Kianji said the fault lines occurred after volcanic ash in underground trenches was washed away.

The geologist said the areas with gaping faults between Mt Longonot and Mt Suswa experienced volcanic activity years back, creating underground tunnels.

"It has nothing to do with splitting of the continent. Gushing water is sweeping away the volcanic ash," she said. Kianji, a lecturer at the University of Nairobi, accused KeNHA of constructing major roads without involving the organisation of geologists, leading to such cases.

She said sand collected from Mai Mahiu was not fit for construction, as it could cause buildings to collapse.

"Volcanic ash from this area has been used to construct buildings in various parts of the country. Because of its weak nature, we have seen an increase in buildings collapsing," Kianji said.

GSK vice chairperson Marietta Mutonga said they were mapping out areas mainly in the Rift Valley that have similar problems. She said had geologists been consulted, they would have advised road engineers to avoid the area owing to the underground fault lines.

"Change in land use has also played a part in the crisis. This is a seasonal phenomenon that will end once the rains subside," she said. Mutonga said movement of underground tectonic plates happens at a rate of 1mm each one million-plus years or so..

"The claim that part of the country could be split into two is not possible, but we should invest more in research in the affected areas," she said.

Naivasha MP Jayne Kihara, who visited the area, expressed concern over the safety of families living there.

"Families have been advised to relocate to other safer places, but the main issue is they do not have other homes," she said.

(George Murage / THE STAR, Mar. 22, 2018, https://www.the-star.co.ke/news/2018/03/22/were-not-cracking-up-or-drifting-geologists_c1734050)

Kenya is not splitting, according to Geological Society of Kenya (GSK). The volcanic fault line was caused by floods washing away deep deposits of volcanic ash. Gaping faults between Mt Longonot and Mt Suswa experienced volcanic activity years back, creating underground tunnels.

Βίντεο με το τεράστιο ρήγμα που φαίνεται να χωρίζει την Κένυα στα δύο

Συγκλονιστικές είναι οι εικόνες που φέρνει στο φως της δημοσιότητας η εφημερίδα Daily Nation μέσω βίντεο στο οποίο απεικονίζεται τεράστιο ρήγμα που σημειώθηκε την περασμένη Δευτέρα και φαίνεται να χωρίζει την Κένυα στα δύο.

Ειδικότερα, το ρήγμα που εντοπίστηκε τη Δευτέρα στην Κοιλάδα Ναρόκ μετά από έντονη τεκτονική δραστηριότητα, όπως δήλωσαν σε τοπικά μέσα ενημέρωσης ειδικοί επιστήμονες και γεωλόγοι.

Όπως επισημαίνει η εφημερίδα η τεράστια σχισμή - που έχει βάθος πάνω από 15 μέτρα και πλάτος κοντά στα 20 μέτρα - στην επαρχία Ναρόκ μετέτρεψαν την μέχρι πρότινος γόνιμη πεδιάδα σε άγρια και αφιλόξενη έκταση, ενώ προκλήθηκαν και σοβαρές καταστροφές στο οδικό σύστημα της χώρας, «κόβοντας» στα δύο δρόμους και απειλώντας κατοικημένες περιοχές, οι οποίες εκκενώθηκαν αναγκαστικά.

Βίντεο με το τεράστιο ρήγμα που φαίνεται να χωρίζει την Κένυα στα δύο
https://www.youtube.com/watch?time_continue=113&v=wO7s5zIhX6k

Ωστόσο, το εν λόγω ρήγμα δεν είναι παρά ένα από τα δεκάδες, ίσως και εκατοντάδες «αδύναμα σημεία» της Κοιλάδας του Μεγάλου Ρήγματος, που καλύπτει μεγάλο μέρος της αφρικανικής ηπείρου, από το Κέρας της Αφρικής μέχρι τη Μοζαμβίκη.

Θα σχηματιστεί νέα ήπειρος;

Τέσσερις χώρες στο Κέρας της Αφρικής - η Σομαλία, η μισή Αιθιοπία, η Κένυα και η Τανζανία - αναμένεται να διαχωριστούν από την Αφρική σχηματίζοντας μια νέα ήπειρο - την επονομαζόμενη Σομαλική Πλάκα - σε περίπου 50 εκατομμύρια χρόνια, αναφέρει η τοπική εφημερίδα Daily Nation, επικαλούμενη γεωλογικές μελέτες.

Οι τεκτονικές δυνάμεις είναι ισχυρότερες στη βάση της κοιλάδας, αλλά και στην Κένυα υπάρχει έντονη γεωλογική δραστηριότητα, η οποία εστιάζεται γύρω από το ηφαίστειο Σουσουά.

«Η κοιλάδα έχει μακρύ ιστορικό τεκτονικής και ηφαιστειακής δραστηριότητας», είπε στην κενυάτικη εφημερίδα ο γεωλόγος, Ντέιβιντ Αντέντε. «Παρόλο που το ρήγμα ήταν τεκτονικά αδρανές στο πρόσφατο παρελθόν, ενδέχεται να υπήρξαν πρόσφατα κινήσεις βαθιά στον φλοιό της Γης που προκάλεσαν ζώνες αδυναμίας, οι οποίες εκτείνονται μέχρι την επιφάνεια», πρόσθεσε. «Αυτές οι ζώνες αδυναμίας σχηματίζουν ρωγμές στο έδαφος που συνήθως γεμίζουν με ηφαιστειακή τέφρα, η οποία προέρχεται από το κοντινό Όρος», επεσήμανε ο γεωλόγος.

Τις εικασίες περί διαχωρισμού της Κένυας έρχεται να διαψεύσει η Γεωλογική Κοινότητα της Κένυας (GSK), η οποία σε ανακοίνωσή της τόνισε ότι ηφαιστεικό ρήγμα προκλήθηκε από πλημμύρες, οι οποίες «ξέπλεναν» την ηφαστειακή τέφρα. Καθότι η ηφαιστειακή δραστηριότητα ανάμεσα στα Ορη Λονγκόνοτ και Σουσουά είναι ένα φαινόμενο ετών, έχει δημιουργήσει υπόγειες σήραγγες και κενά στο έδαφος.

(Η ΚΑΘΗΜΕΡΙΝΗ, 22.03.2018, http://www.kathimerini.gr/955148/gallery/epikairothta/kosmos/vinteo-me-to-terastio-rhgma-poy-fainetai-na-xwrizei-thn-kenya-sta-dyo)

Large crack in East African Rift is evidence of continent splitting in two

A large crack, stretching several kilometers, made a sudden appearance recently in south-western Kenya. The tear, which continues to grow, caused part of the Nairobi-Narok highway to collapse and was accompanied by seismic activity in the area.

The Earth is an ever-changing planet, even though in some respects change might be almost unnoticeable to us. Plate tectonics is a good example of this. But every now and again something dramatic happens and leads to renewed questions about the African continent splitting in two.

The Earth's lithosphere (formed by the crust and the upper part of the mantle) is broken up into a number of tectonic plates. These plates are not static, but move relative to each other at varying speeds, 'gliding' over a viscous asthenosphere. Exactly what mechanism or mechanisms are behind their movement is still debated, but are likely to include convection currents within the asthenosphere and the forces generated at the boundaries between plates.

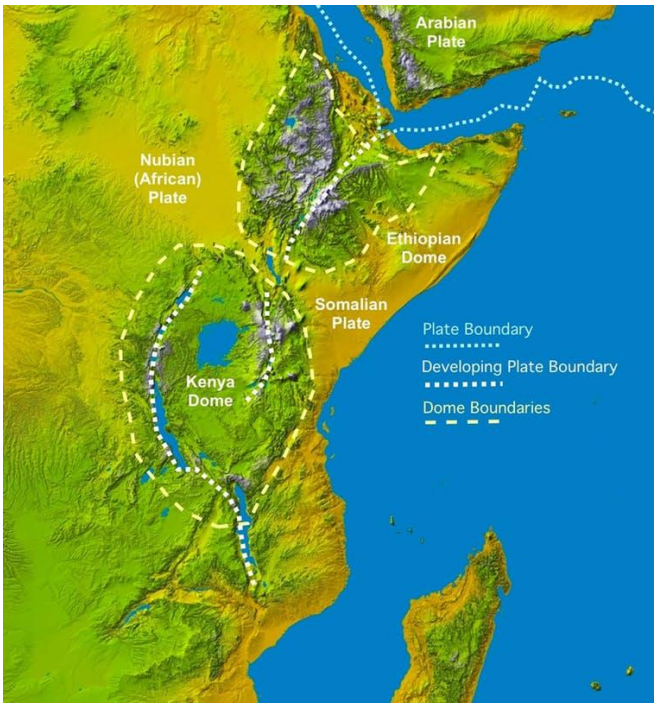
These forces do not simply move the plates around, they can also cause plates to rupture, forming a rift and potentially leading to the creation of new plate boundaries. The East African Rift system is an example of where this is currently happening.

The East African Rift Valley stretches over 3 000 km (1 864 miles) from the Gulf of Aden in the north towards Zimbabwe in the south, splitting the African plate into two unequal parts: the Somali and Nubian plates. Activity along the eastern branch of the rift valley, running along Ethiopia, Kenya and Tanzania, became evident when the large crack suddenly appeared in south-western Kenya.

This process is accompanied by surface manifestations along the rift valley in the form of volcanism and seismic activity. Rifts are the initial stage of a continental break-up and, if successful, can lead to the formation of a new ocean basin. An example of a place on Earth where this has happened is the South Atlantic ocean, which resulted from the break up of South America and Africa around 138m years ago – ever noticed how their coastlines match like pieces of the same puzzle?

Continental rifting requires the existence of extensional forces great enough to break the lithosphere. The East African Rift is described as an active type of rift, in which the source of these stresses lies in the circulation of the underlying mantle. Beneath this rift, the rise of a large mantle plume is doming the lithosphere upwards, causing it to weaken as a result of the increase in temperature, undergo stretching and breaking by faulting.

Evidence for the existence of this hotter-than-normal mantle plume has been found in geophysical data and is often referred to as the 'African Superswell'. This superplume is not only a widely-accepted source of the pull-apart forces that are resulting in the formation of the rift valley but has also been used to explain the anomalously high topography of the Southern and Eastern African Plateaus.



Topography of the Rift Valley

Breaking up isn't easy

Rifts exhibit a very distinctive topography, characterized by a series of fault-bounded depressions surrounded by higher terrain. In the East African system, a series of aligned rift valleys separated from each other by large bounding faults can be clearly seen from space.

Not all of these fractures formed at the same time, but followed a sequence starting in the Afar region in northern Ethiopia at around 30m years ago and propagating southwards towards Zimbabwe at a mean rate of between 2.5 - 5 cm a year (1 - 2 inches).

Although most of the time rifting is unnoticeable to us, the formation of new faults, fissures and cracks or renewed movement along old faults as the Nubian and Somali plates continue moving apart can result in earthquakes.

However, in East Africa most of this seismicity is spread over a wide zone across the rift valley and is of relatively small magnitude. Volcanism running alongside is a further surface manifestation of the ongoing process of continental break up and the proximity of the hot molten asthenosphere to the surface.

A timeline in action

The East African Rift is unique in that it allows us to observe different stages of rifting along its length. To the south, where the rift is young, extension rates are low and faulting occurs over a wide area. Volcanism and seismicity are limited.

Towards the Afar region, however, the entire rift valley floor is covered with volcanic rocks. This suggests that, in this area, the lithosphere has thinned almost to the point of complete break up. When this happens, a new ocean will begin forming by the solidification of magma in the space created by the broken-up plates. Eventually, over a period of tens of millions of years, seafloor spreading will progress along the entire length of the rift. The ocean will flood in and, as a result, the African continent will become smaller and there will be a large island in the Indian Ocean composed of parts of Ethiopia and Somalia, including the Horn of Africa.

Dramatic events, such as sudden motorway-splitting faults or large catastrophic earthquakes may give continental rifting a sense of urgency but, most of the time, it goes about splitting Africa without anybody even noticing.

(Lucia Perez Diaz, Postdoctoral Researcher, Fault Dynamics Research Group, Royal Holloway, The Conversation, Posted by TW on March 30, 2018, https://watchers.news/2018/03/30/large-crack-in-east-african-rift-is-evidence-of-continent-splitting-in-two/?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+adorraeli%2FtsEq+%28The+Watchers+-+watching+the+world+evolve+and+transform%29)

Το ηφαίστειο της Αίτνας «τσουλάει» αργά, αλλά σταθερά, προς τη θάλασσα!

Η Αίτνα στην ανατολική Σικελία, το πιο ενεργό ηφαίστειο της Ευρώπης, «γλιστράει» ολόκληρη, αργά αλλά σταθερά, προς τη θάλασσα της Μεσογείου με μέσο ρυθμό 14 χιλιοστών το χρόνο, δηλαδή διανύει 1,4 μέτρα στη διάρκεια 100 ετών.

Αυτό επιβεβαίωσαν Βρετανοί επιστήμονες που μελετούν εδώ και δεκαετίες το ηφαίστειο και έκαναν τη σχετική δημοσίευση στο περιοδικό ηφαιστειολογίας "Bulletin of Volcanology". Όπως είπαν, ουσιαστικά είναι η πρώτη φορά που έχει παρατηρηθεί ένα ολόκληρο ενεργό ηφαίστειο να ολισθαίνει κατ' αυτό τον τρόπο.

Οι επιστήμονες έχουν ζώσει το ηφαίστειο με ένα δίκτυο σταθμών GPS υψηλής ακρίβειας, έτσι ώστε να επιτηρούν τη συμπεριφορά του, καταγράφοντας ακόμη και μετακινήσεις μερικών χιλιοστών ή ανεπαίσθητες παραμορφώσεις του κώνου του.

Μετά από 11 χρόνια συλλογής στοιχείων, είναι πια φανερό, σύμφωνα με τους ερευνητές, ότι το ηφαίστειο μετακινείται σε κατεύθυνση ανατολική-νοτιοανατολική προς την παράκτια πόλη του Τζάρε που απέχει περίπου 15 χιλιόμετρα. Η Αίτνα φαίνεται σα να «τσουλάει» πάνω σε μια πλαγιά με πολύ μικρή κλίση ενός έως τριών μοιρών, πιθανώς επειδή «κάθεται» πάνω σε ασθενή εύκαμπτα ιζηματογενή πετρώματα.

Οι γεωλόγοι δήλωσαν ότι η κατάσταση χρειάζεται προσεκτική παρακολούθηση, επειδή μπορεί να οδηγήσει σε αυξημένους κινδύνους στο μέλλον. Παρατηρήσεις σε ανενεργά ηφαίστεια, που έχουν παρόμοια συμπεριφορά, έχουν δείξει ότι μπορεί ξαφνικά να εμφανίσουν κατάρρευση στην πλευρά τους προς την κατεύθυνση της ολίσθησης, με συνέπεια να υπάρχει κίνδυνος για καταστροφικές κατολισθήσεις.

«Θα έλεγα ότι αυτή τη στιγμή δεν υπάρχει αιτία για ανησυχία, αλλά είναι κάτι που πρέπει συνεχώς να παρακολουθούμε, ιδίως για να δούμε αν υπάρχει κάποια επιτάχυνση σε αυτή την κίνηση προς τη θάλασσα», δήλωσε ο επικεφαλής ερευνητής, ο γεωλόγος δρ Τζον Μάρεϊ της Σχολής Γεωεπιστημών του Ανοιχτού Πανεπιστημίου της Βρετανίας, ο οποίος μελετά την Αίτνα εδώ και σχεδόν μισό αιώνα, σύμφωνα με το BBC.

Ο Μάρεϊ ανέφερε ότι αν σε μερικά χρόνια ο ρυθμός ολίσθησης των 14 χιλιοστών ετησίως (που δεν είναι σταθερός, αλλά αυξομειώνεται από χρόνο σε χρόνο) διπλασιασθεί, τότε αυτό θα αποτελέσει ένα σαφές προειδοποιητικό σημάδι. Αν, από την άλλη, ο ρυθμός μετακίνησης προς τη θάλασσα μειωθεί στο μισό, τότε δεν συντρέχει κανένας λόγος ανησυχίας.

Οι γεωλόγοι επεσήμαναν ότι η συσσώρευση του τεκτονικού στρες μπορεί να πάρει αιώνες ή και χιλιετίες, έως ότου το ηφαίστειο φθάσει σε ένα κρίσιμο σημείο μερικής κατάρρευσης. Προς το παρόν πάντως, δεν υπάρχουν καθόλου ενδείξεις ότι κάτι τέτοιο πρόκειται να συμβεί σύντομα στην Αίτνα, συνεπώς ερευνητές καθησύχασαν ότι δεν πρέπει να ανησυχούν ούτε οι ντόπιοι ούτε οι τουρίστες.

(Η ΚΑΘΗΜΕΡΙΝΗ, 24.03.2018, http://www.kathimerini.gr/955608/article/epikairothta/episthmh/to-hfaisteio-ths-aitnas-tsoylaei-arga-alla-sta8era-pros-th-8alassa)

Gravitational sliding of the Mt. Etna massif along a sloping basement

Abstract

Geological field evidence and laboratory modelling indicate that volcanoes constructed on slopes slide downhill. If this happens on an active volcano, then the movement will distort deformation data and thus potentially compromise interpretation. Our recent GPS measurements demonstrate that the entire edifice of Mt. Etna is sliding to the ESE, the overall direction of slope of its complex, rough sedimentary basement. We report methods of discriminating the sliding vector from other deformation processes and of measuring its velocity, which averaged 14 mm year^{-1} during four intervals between 2001 and 2012. Though sliding of one sector of a volcano due to flank instability is widespread and well-known, this is the first time basement sliding of an entire active volcano has been directly observed. This is important because the geological record shows that such sliding volcanoes are prone to devastating sector collapse on the downslope side, and whole volcano migration should be taken into account when assessing future collapse hazard. It is also important in eruption forecasting, as the sliding vector needs to be allowed for when interpreting deformation events that take place above the sliding basement within the superstructure of the active volcano, as might occur with dyke intrusion or inflation/deflation episodes.

Introduction

Mt. Etna volcano dilates horizontally between its major flank eruptions. This outward expansion has been attributed to two processes: (1) gravitational spreading of its tall edifice and (2) inflation of a magma chamber within the volcano prior to eruption (Borgia et al. 2000; Lundgren et al. 2004; Neri et al. 2004; Obrizzo et al. 2004; Bonaccorso et al. 2006; Bonaccorso et al. 2013). However, it has long been noted that inter-eruptive horizontal displacement vectors measured from repeated GPS readings radiate not from the summit, but from an area WNW of it, leading to suggestions that the position of the inflating magma chamber is offset from the summit by up to a few kilometres, or that the magma chamber is tall and slopes in this direction (Nunnari & Puglisi 1994; Puglisi et al. 2004; Bonaccorso et al. 2011). This in turn implies that magma chamber inflation is the dominant process causing Etna's dilation, since displacement vectors caused by gravitational spreading of a conical volcano should be radial to the summit of the edifice. Another peculiarity is the lack of symmetry in vector lengths, which are consistently much longer on the ESE side of the volcano. This has been interpreted with numerical and analytical models, in which the symmetrical radial movement of the inflating magma chamber is distorted by two large rectangular sub-horizontal dislocation planes dipping in different directions, that underlie the southern and eastern flanks in 1994–1995 (Bonforte and Puglisi 2003), or by a single larger dislocation plane beneath the lower eastern flank (Lundgren et al. 2003; Bonaccorso et al. 2006, 2013), or by a drag force due to subsidence of the continental margin on that side (Bonforte et al. 2011).

In the present paper, we present evidence that explains both the off-centre expansion and its asymmetry without recourse to these complex ad hoc models, and we also demonstrate, by the use of a simple Mogi model and a laboratory analogue gravitational spreading model, that our explanation applies in the case of the two abovementioned processes. The results of our work are applicable to other volcanoes of different types and in different situations.

(Bulletin on Vulcanology, First Online: 23 March 2018, https://link.springer.com/article/10.1007/s00445-018-1209-1/fulltext.html)

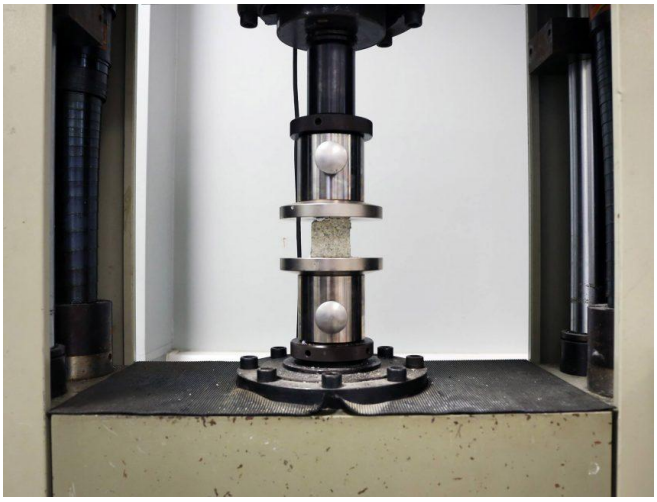
ΕΝΔΙΑΦΕΡΟΝΤΑ - ΠΕΡΙΒΑΛΛΟΝ

New material made from desert sand could offer low-carbon alternative to concrete

A team of scientists in the UK have developed a biodegradable construction material made from desert sand – a resource that has until now been useless for construction.

Called Finite, the material was developed by a group from Imperial College London. It is as strong as concrete but has half the carbon footprint.

The breakthrough comes amid increasing concern about the world's dwindling supplies of construction-grade sand, which are an essential ingredient in concrete.



Post-graduate students Carolyn Tam, Matteo Maccario, Hamza Oza and Saki Maruyami came together to create a building material that could be made from the plentiful, naturally occurring material.

While course, gritty construction-grade sand is stripped from beaches and river beds, desert sand has remained an untapped resource as its wind-swept grains are too fine and smooth to be used as filler in concrete.

"We looked at sand because we thought sand was abundant, but actually when we did more research about sand [we found] it wasn't," Tam told Dezeen.

Sand scarcity is a global issue

The world is facing a potentially disastrous sand shortage, hence the start-up's name, Finite.

Last October Dutch designers Atelier NL held a symposium at Dutch Design Week to discuss the sand crisis, which will affect glass-making and computer chip manufacturers as well as the construction industry.

"Sand is the most consumed resource on earth after fresh water," Atelier NL told Dezeen at the time.

"Yet sand is being excavated at a rate faster than it can renew itself," said the designers, who are working on a project to explore how different types of "wild" sand could be used to make glass. "It is disappearing from shorelines, rivers and sea beds, causing disastrous effects for both environmental and human systems."

Sand-mining is a multi-billion dollar industry, and illegal sand mining plagues countries such as India, where criminal gangs plunder riverbeds and beaches, damaging ecosystems.

"The wars that are going on for sand throughout the world,"said Maccario. "All these things were crazy to us when we found out."

Finite uses abundant resources

Finite could change that. The binder ingredients are a guarded secret, but the scientists are confident that it outperforms concrete on key sustainability metrics.

"The main binder in concrete is responsible for five per cent of global CO2 emissions, which is huge," said Maccario.

"Our worst-case estimate right now is less than half the CO2 footprint than concrete, in terms of what we are using," continued Maccario.

As well as being low-carbon and taking the strain off current sand sources, Finite is much more reusable than concrete, which often ends up in landfill.

"If you make a block of it in the future it's quite easy to recycle and not use any virgin material, whereas concrete needs to be essentially ground up and then used as filler for the next batch of concrete," explained Maccario.

Material suited to short-term infrastructure projects

Finite is non-toxic and can be left to decompose naturally, or remoulded to be used in another project, the inventors claim.

"We could use the material to make pavilions, then after three months when the event ends it can be deconstructed safely," said Tam.

The team believe their material is ideal for use in the Middle East as the raw material for the concrete alternative can be scooped straight out of the desert, rather than being expensively imported.

Theoretically, Finite could also be used for permanent structures such as residential projects, but for this it would need to pass rounds of testing and regulations.

New materials bring new opportunities

Early experiments with resin casting have demonstrated that the material can also be used to create objects such as vases and bowls. Left untouched, Finite takes on the colour and gradation of the filler, but natural dyes can be added in the mixing process.

Cost-wise, Maccario is confident that Finite will be a viable competitor to concrete in the construction industry once it is manufactured on a larger scale, because of the abundance of the raw materials.

"It will take more than just our project or one material, but we're really looking forward to is a future where the built environment isn't this thing where you keep it there forever or landfill it or down-cycle it, but something that uses nature and is continuously reusable," added Maccario.

"As soon as you have new materials you have new opportunities."

The sand crisis threatens to destabilise the construction industry, which uses an estimated 25 billion tons of sand and gravel every year. A further 50 billion tons per year gets trapped behind dams, meaning ecosystems stripped of sand for industry are not being naturally replenished.

(dezeen / India Block, 24 March 2018, https://www.dezeen.com/2018/03/24/desert-sand-could-offer-low-carbon-concrete-alternative)

Evidence of one of the largest floods in Earth's history in the central Mediterranean

An international team of scientists has uncovered evidence of one of the largest floods in Earth's history in the central Mediterranean seafloor.

The flood, known as the Zanclean flood, is thought to have ended the Messinian Salinity Crisis (MSC), a period during which the Mediterranean Sea became partially dried up. Due to shrinkage of its connection with the Atlantic Ocean, the Mediterranean Sea was transformed into a giant saline lake that was partially evaporated by the dry climate of the region, six million years ago.

One of the theories proposed to explain the refilling of the Mediterranean Sea at the end of the MSC some 640 000 years later is a catastrophic flood through the Strait of Gibraltar.

By examining the most comprehensive collection of seafloor data from offshore eastern Sicily and the Maltese Islands, an international team of geoscientists has now discovered an extensive buried mass of material that is thought to have been eroded and transported by the Zanclean flood.

https://www.youtube.com/watch?v=Ev1PdwbgvM8

This mass covers an area equivalent to that of the island of Crete and is up to 900 m (2 900 feet) thick in places. The passage of the Zanclean flood across the Malta Escarpment - a long submarine limestone cliff - resulted in a 1.5 km (0.9 miles) high waterfall (equivalent to five times the height of the Eiffel Tower).

This water eroded a 5 km (3.1 miles) wide and 20 km (12.4 miles) long canyon on the seafloor that is still preserved underwater offshore the city of Noto (south-east Sicily).

Authors say the discovery is important because it demonstrates that the level of the Mediterranean Sea during the MSC dropped by more than 1 000 m (0.62 miles), and that the end of the MSC coincided with a catastrophic flood that affected the entire Mediterranean Sea.

Reference:

Evidence of the Zanclean megaflood in the eastern Mediterranean Basin - Aaron Micallef et al. - Nature Scientific Reports - January 18, 2018 - DOI: 10.1038/s41598-018-19446-3 - OPEN ACCESS

Evidence of the Zanclean megaflood in the eastern Mediterranean Basin

Abstract

The Messinian salinity crisis (MSC) - the most abrupt, global-scale environmental change since the end of the Cretaceous – is widely associated with partial desiccation of the Mediterranean Sea. A major open question is the way normal marine conditions were abruptly restored at the end of the MSC. Here we use geological and geophysical data to identify an extensive, buried and chaotic sedimentary body deposited in the western Ionian Basin after the massive Messinian salts and before the Plio-Quaternary open-marine sedimentary sequence.

We show that this body is consistent with the passage of a megaflood from the western to the eastern Mediterranean Sea via a south-eastern Sicilian gateway. Our findings provide evidence for a large amplitude drawdown in the Ionian Basin during the MSC, support the scenario of a Mediterranean-wide catastrophic flood at the end of the MSC, and suggest that the identified sedimentary body is the largest known megaflood deposit on Earth.

https://www.nature.com/articles/s41598-018-19446-3

(THE WATCHERS, March 21, 2018, https://watchers.news/2018/03/21/evidence-of-one-of-the-largest-floods-in-earth-s-history-in-the-central-mediterranean/?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+adorraeli%2FtsEq+%28The+Watchers+-+watching+the+world+evolve+and+transform%29)

Πάνω από ένα μέτρο

Απότομη αύξηση της στάθμης της θάλασσας πριν 7.600 χρόνια στο Β. Αιγαίο

Μία απότομη άνοδος της στάθμης της θάλασσας, κατά τουλάχιστον ένα έως ενάμισι μέτρο, συνέβη στο Βόρειο Αιγαίο πριν από περίπου 7.600 χρόνια (δηλαδή περί το 5600 π.Χ.), ενώ κάτι ανάλογο είχε συμβεί και νωρίτερα, πριν από 8.400 χρόνια. Τα περιστατικά αυτά είχαν πιθανότατα σημαντικές κοινωνικές και οικονομικές επιπτώσεις στους ανθρώπους της περιοχής, βάζοντας «φρένο» στην ανάπτυξη των νεολιθικών γεωργικών οικισμών και του πολιτισμού, καθώς μεγάλες παράκτιες εκτάσεις θα βρέθηκαν ξαφνικά κάτω από το νερό.

Αυτό είναι το συμπέρασμα μιας νέας έρευνας Γερμανών επιστημόνων, που βασίζεται στη μελέτη των απολιθωμάτων μικροσκοπικών αρχαίων θαλάσσιων οργανισμών που έχουν διατηρηθεί στα ιζήματα του βυθού της θάλασσας του Βορείου Αιγαίου.

Οι ερευνητές του Κέντρου Βιοποικιλότητας και Κλιματικών Ερευνών Σένκενμπεργκ και του Ινστιτούτου Γεωεπιστημών του Πανεπιστημίου Γκέτε της Φρανκφούρτης, με επικεφαλής τον καθηγητή Γιενς Χέρλε, έκαναν τη σχετική δημοσίευση στο Scientific Reports.

«Κατά προσέγγιση πριν από 7.600 χρόνια, η στάθμη της θάλασσας πρέπει να ανέβηκε απότομα στις περιοχές της Μεσογείου που συνορεύουν με τη Νοτιοανατολική Ευρώπη. Το Βόρειο Αιγαίο, η Θάλασσα του Μαρμαρά και η Μαύρη Θάλασσα κατέγραψαν μια ανύψωση άνω του ενός μέτρου. Αυτό οδήγησε στο πλημμύρισμα των χαμηλών παράκτιων περιοχών, οι οποίες θα είχαν υπάρξει ιδανικές για δημιουργία οικισμών» δήλωσε ο δρ Χέρλε.

Η Νεολιθική Εποχή σηματοδότησε την μετάβαση από μια κοινωνία κυνηγών-τροφοσυλλεκτών σε μια κοινωνία γεωρ-

γών-κτηνοτρόφων. Με κοιτίδα της την Μέση Ανατολή, η γεωργική επανάσταση εξαπλώθηκε προς τη νοτιοανατολική Ευρώπη και το Αιγαίο. Οι αρχαιολογικές ανασκαφές δείχνουν όμως ότι πριν από 7.600 χρόνια υπήρξε μια ανεξήγητη και απότομη ύφεση στη δημιουργία τέτοιων οικισμών. Οι γερμανοί επιστήμονες με τη νέα μελέτη τους πιστεύουν ότι κατά πάσα πιθανότητα βρήκαν μία εξήγηση γι' αυτό.

Οι ερευνητές πήραν ένα δείγμα (πυρήνα) από το βυθό του Βορείου Αιγαίου και η μελέτη των μικροοργανισμών του βυθού, συγκεκριμένα του απολιθωμένου φυτοπλαγκτού του είδους Emiliana huxleyi, που υπάρχουν μέσα σε αυτά τα ιζήματα, επέτρεψε στους επιστήμονες να κάνουν εκτιμήσεις για τις διαχρονικές μεταβολές, όσον αφορά την περιεκτικότητα των επιφανειακών υδάτων του Αιγαίου σε αλάτι και, κατ' επέκταση, για τη στάθμη του νερού.

Η ανάλυση αποκάλυψε δύο απότομες μειώσεις της αλατότητας πριν από 8.400 και πριν από 7.600 χρόνια, οι οποίες μπορούν να εξηγηθούν, κατά τους επιστήμονες, μόνο από το γεγονός ότι μεγαλύτεροι όγκοι νερού χαμηλής περιεκτικότητας σε αλάτι θα έρρευσαν από τη Μαύρη Θάλασσα (Εύξεινο Πόντο) προς τη θάλασσα του Βορείου Αιγαίου. Αυτό θα είχε ως συνέπεια μια απότομη άνοδο της στάθμης της θάλασσας σε εκείνες τις δύο περιπτώσεις.

Οι ερευνητές εκτιμούν ότι υπήρξαν εκτεταμένες πλημμύρες κατά μήκος των ακτών του Βορείου Αιγαίου, που συνέπεσαν με δύο αντίστοιχες υφέσεις στη νεολιθική γεωργική και τεχνολογική επανάσταση. Η πιο παλαιά άνοδος των υδάτων (πριν από 8.400 χρόνια, δηλαδή περί το 6400 π.Χ.) φαίνεται να συμπίπτει με αρχαιολογικά ευρήματα, σύμφωνα με τα οποία οι παράκτιοι οικισμοί είχαν τότε περίπου αντιμετωπίσει σημαντικά εμπόδια στην ανάπτυξή τους. Το δεύτερο πλήγμα για τους κατοίκους της περιοχής ήλθε 800 χρόνια αργότερα, με τη νέα άνοδο των υδάτων και με τις νέες πλημμύρες που ακολούθησαν.

Η μελέτη ενός αντίστοιχου δείγματος (πυρήνα) από το βυθό του Νοτίου Αιγαίου, που είχε ληφθεί στο παρελθόν, δεν είχε δείξει τις ίδιες εποχές στο παρελθόν ανάλογα φαινόμενα με το Βόρειο Αιγαίο.

Συνδέοντας το παρελθόν με το μέλλον, ο Χέρλε προειδοποίησε ότι «εξαιτίας της κλιματικής αλλαγής αναμένουμε η παγκόσμια στάθμη των θαλασσών να ανέβει έως ένα μέτρο μέσα στα επόμενα 100 χρόνια. Εκατομμύρια άνθρωποι μπορεί να εκτοπισθούν από τις παράκτιες περιοχές, με σοβαρές κοινωνικές και οικονομικές επιπτώσεις».

(in.gr με πληροφορίες από ΑΠΕ - ΜΠΕ, 26 Μαρ. 2018, http://news.in.gr/science-technology/article/?aid=1500209310)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΛΟΙΠΑ

Researchers Use Carbon Fiber Waste to Strengthen Permeable Pavement

Researchers from Washington State University have shown permeable concrete can be strengthened by adding recycled carbon fiber.

The production of carbon fiber goods is on the rise; however, recycling this material still remains a challenge. It may, however, be soon possible to grind up carbon fiber waste and use it in water-draining concrete, according to a research being conducted at Washington State University.

Water-draining concrete or pervious concrete is a kind of concrete that stormwater run can drain straight through. It is a highly porous material and allows the water to pass into the soil underneath. This helps with flooding but also reduces pollution caused by stormwater.

With traditional concrete, the water will run along the road and gather pollutants, before it goes down a sewer and into the waterways.

There has been rising concern about flooding in urban areas and requirements for controlling stormwater have increased.

Several cities have so far tried using pervious concrete in parking lots and streets with low-traffic. However, because it is highly porous, it has proved not as durable as the regular concrete used on major roads. Carbon fiber helps in this aspect.

Carbon fiber becoming more popular

Carbon fiber composites have become steadily more popular in various industries. The material is super light and strong. It can be used in a variety of places ranging from airplane wings to wind turbines and cars. The market has been growing about **10 percent per year,** and industries have been trying to find out a way to recycle the waste.

The research team from Washington State University found a method to recycle this waste and put it to good use.

To grind up scrap carbon fiber provided by Boeing, the research team used an inexpensive mechanical milling technique. When ground carbon fiber was added to the existing pervious concrete mix, the resulting material ended up being very durable and strong.

"In terms of bending strength, we got really good results — as high as traditional concrete, and it still drains really quickly," said Somayeh Nassiri, who led the research team along with Karl Englund.

Left in cured form

The researchers shun using heat or chemicals to create an element from the waste carbon fiber composites. They kept the composites in their cured form maintained and thus made use of their original strength.

The mix also required using much of the composite material. This would be ideal for waste producers.

"You're already taking waste — you can't add a bunch of money to garbage and get a product," said Englund. "The key is to minimize the energy and to keep costs down."

The composite materials were scattered through the pavement mix to give stable strength. The effectiveness of the technology has been shown on laboratory samples, and scientists wish to now conduct large-scale tests.

The researchers are also working with industry to develop a supply chain. "In the lab this works to increase permeable pavement's durability and strength," said Nassiri. "The next step is to find out how to make it mainstream and widespread."

(Sibel Nicholson / INTERESTING ENGINEERING, March, 05th 2018, https://interestingengineering.com/researchers-use-carbon-fiber-waste-to-strengthen-permeable-pave-ment?_source=newsletter&_campaign=eq1AJlPdjrX1n&_uid=9wdL9JEwej&_h=9480fc0933eb231a0575c535417bef075ed6e805&utm_source=newsletter&utm_medium=mailing&utm_campaign=Newsletter-05-03-2018)

Η μεγάλη μελέτη της Google που είχε την κωδική ονομασία «Αριστοτέλης»

Η τρέχουσα σοφία του αιώνα μας λέει πως οι φοιτητές πρέπει να εφοδιαστούν με επιστημονικές γνώσεις για να αδράξουν μια θέση εργασίας, με την εξειδίκευση να είναι υψίστης σημασίας για το επαγγελματικό τους μέλλον.

Μόνο που αυτό δεν είναι παρά μια τραγική υπεραπλούστευση των δεξιοτήτων που χρειάζονται στη ζωή και η απόδειξη

μάς έρχεται από κει που θα το περιμέναμε λιγότερο: την Google!

Η Google έκανε λοιπόν μια μεγάλη μελέτη για τους υπαλλήλους της που έχει ευρύτερες συνέπειες τόσο για τους φοιτητές όσο και το εργατικό δυναμικό των επιχειρήσεων. Γιατί μας είπε ότι είναι άλλα τα βασικά εφόδια που πρέπει να φέρεις στην αγορά εργασίας από ένα καλό πτυχίο.

Οι Sergey Brin και Larry Page, ιδρυτές της Google και μεγάλα μυαλά στον τομέα τους, την τεχνολογία, υπέθεταν ότι μόνο οι πτυχιούχοι του κλάδου μπορούν να καταλάβουν την τεχνολογία. Κι έτσι η Google συνήθιζε να προσλαμβάνει αποκλειστικά πληροφορικούς και μηχανικούς με άριστους βαθμούς πτυχίων από τα μεγαλύτερα αμερικανικά πανεπιστήμια.

Το 2013 αποφάσισε ωστόσο να ελέγξει τις πτυχές της διαδικασίας των προσλήψεών της, έχοντας πια αρκετά δεδομένα από το 1998. Το «Project Oxygen» συγκλόνισε τα τμήματα ανθρώπινου δυναμικού του κόσμου όταν κατέληξε ότι μεταξύ των 8 σημαντικότερων χαρακτηριστικών που είχαν οι κορυφαίοι υπάλληλοι της Google, η εξειδίκευση στην καθαρή επιστήμη (το τετράπτυχο επιστήμη, τεχνολογία, μηχανική και μαθηματικά) κατατασσόταν στην απολύτως τελευταία θέση!

Τα πρώτα εφτά χαρακτηριστικά που εγγυόνταν την επιτυχία στις τάξεις της Google ήταν δεξιότητες που δεν μαθαίνονταν στα πανεπιστήμια, όπως ας πούμε το να είσαι καλός μάνατζερ, να επικοινωνείς και να ακούς σωστά, να καταλαβαίνεις τους άλλους γύρω σου, να υποστηρίζεις τους συναδέλφους σου, να έχεις κριτική σκέψη και να λύνεις τα προβλήματα που ανακύπτουν συνεχώς, τέτοια πράγματα.

Δεξιότητες που δεν μάθαινε δηλαδή ο προγραμματιστής ή ο μαθηματικός στο πανεπιστήμιο, αλλά μπορούσε να μάθει ένας φιλόλογος ή ένας θεατρολόγος! Η ερώτηση που προέκυψε λοιπόν ήταν αν οι καλύτεροι υπάλληλοι της Google ήταν επιτυχημένοι όχι λόγω της τεχνικής τους κατάρτισης, αλλά παρά την τεχνική τους κατάρτιση; Ανθρωπολόγοι και εθνολόγοι ανέλυσαν κατόπιν τα δεδομένα και η Google επέκτεινε τις στρατηγικές προσλήψεών της ώστε να γίνονται πια δεκτοί και άνθρωποι άλλων αντικειμένων, όπως απόφοιτοι ανθρωπιστικών και κοινωνικών επιστημών, ακόμα και καλλιτέχνες, παρά το γεγονός ότι οι Brin και Page εμφανίζονταν αποτροπιασμένοι από το γεγονός!

Μόνο που η Google δεν σταμάτησε εκεί. Το «Project Aristotle» (Πρόγραμμα Αριστοτέλης), η νέα γιγαντιαία μελέτη του κολοσσού αναφορικά με το ανθρώπινο δυναμικό του, επιβεβαιώνει τη σημασία των κοινωνικών και επικοινωνιακών δεξιοτήτων ακόμα και σε ένα τόσο «αποστειρωμένο» περιβάλλον όπως η βιομηχανία της τεχνολογίας.

Στον «Αριστοτέλη», οι ειδικοί ανέλυσαν τώρα τα δεδομένα των πλέον καινοτόμων και περίβλεπτων ομάδων της Google, των λεγόμενων Α-Ομάδων, το ίδιο το καμάρι του κολοσσού, καθώς αποτελούνται από κορυφαίους επιστήμονες με ολότελα εξειδικευμένες γνώσεις που ρίχνουν στο τραπέζι τη μία πρωτοποριακή ιδέα πίσω από την άλλη.

Κι όμως, η νέα μελέτη αποκάλυψε ότι οι σημαντικότερες, παραγωγικότερες και εμπορικότερες ιδέες της Google προέρχονται από τις Β-Ομάδες, που αποτελούνται από υπαλλήλους που δεν είναι ακριβώς διάνοιες ούτε οι εξυπνότεροι του γραφείου τους! Το «Project Aristotle» έδειξε ότι οι καλύτερες ομάδες δουλεύουν στη βάση μιας ομάδας κοινών χαρακτηριστικών που δεν συνδέονται με επιστημονικές και τεχνολογικές δεξιότητες, αλλά λειτουργούν στη βάση της ισοτιμίας των μελών, της γενναιοδωρίας, της περιέργειας αναφορικά με τις ιδέες των συναδέλφων, της ενσυναίσθησης και της συναισθηματικής νοημοσύνης!

Και το καλύτερο της ανάλυσης, ότι το Νο 1 χαρακτηριστικό των πιο πετυχημένων ομάδων εργασίας είναι η ψυχολογική ασφάλεια. Για να πετύχει μια ομάδα, μας λέει ο «Αριστοτέλης», κάθε μέλος της πρέπει να νιώθει ελεύθερο και σίγουρο ότι μπορεί να μιλήσει και να κάνει λάθος χωρίς συνέπειες ή εκφοβισμούς. Πρέπει να ξέρει δηλαδή πως κάποιος θα τον ακούσει χωρίς να τον κρίνει.

Αυτά είναι τα στοιχεία που εγγυώνται την επιτυχία και την αποτελεσματικότητα της ομάδας και όχι τα μάστερ και τα διδακτορικά. Το Τμήμα Ανθρώπινου Δυναμικού της Google προσέλαβε στατιστικολόγους, ψυχολόγους της εργασίας, κοινωνιολόγους, ανθρωπολόγους και ερευνητές άλλων κλάδων για να λύσουν τον γρίφο της διομαδικής επιτυχίας.

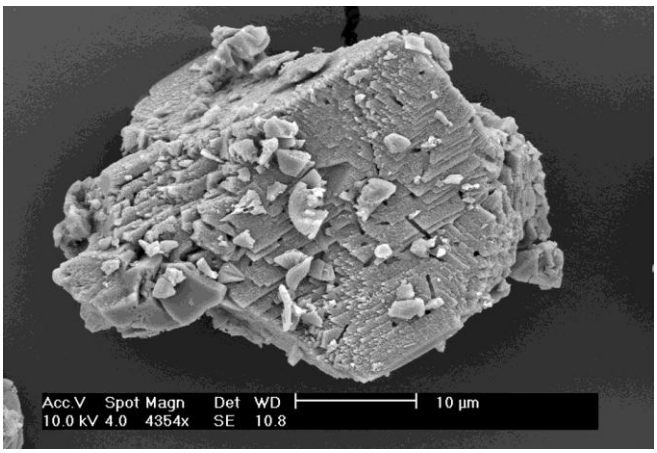
Δύο χρόνια μετά, ο «Αριστοτέλης» είχε ξεψαχνίσει 180 ομάδες της Google και είχε ελέγξει περισσότερα από 250 χαρακτηριστικά συνεργασίας. Και βρήκε πως αυτά που μετρούν πραγματικά για τις διομαδικές σχέσεις και την αποδοτικότητα της ομάδας είναι η ψυχολογική ασφάλεια (να παίρνεις ρίσκα δηλαδή χωρίς να νιώθεις ανασφάλεια ή ντροπή), η αξιοπιστία (η αλληλεξάρτηση των μελών της ομάδας), η δομή και η σαφήνεια (να είναι καθαροί και διακριτοί οι στόχοι, οι ρόλοι και το σχέδιο της ομάδας), το νόημα της δουλειάς (κάνουμε κάτι που είναι προσωπικά σημαντικό για μας;) και ο αντίκτυπος της δουλειάς μας (πιστεύουμε δηλαδή πως η δουλειά μας κάνει τη διαφορά και είναι σημαντική κοινωνικά;)…

(ΜΙΚΡΟΜΕΤΟΧΟΣ, 06.03.2018,
http://www.mikrometoxos.gr/megali-meleti-tis-google-poy-eiche-tin-kodiki-onomasia-aristotelis)

«Project Aristotle»
https://rework.withgoogle.com/print/guides/5721312655835136/

Bacterial binding could lead to self-healing buildings and historic structures

Scientists at Cardiff University are introducing the concept of biological self-healing with bacteria to buildings and historic structures.



The team have set out to produce a solution that can be applied to building stone and masonry to give it self-healing properties.

Once applied, the team believe that any sort of damage to the stone will trigger the release of bacteria and a range of precursor chemicals, allowing damage to self-repair.

Microorganisms such as bacteria can produce mineral deposits when mixed with certain precursor chemicals, including calcium carbonate, which is one of the main components in rocks and various other masonry materials.

As part of the study, the team will look at the different ways that bacteria and precursor chemicals can be introduced into building stone and masonry.

"When present in masonry, the bacteria that produce the mineral deposits become entombed as spores, alongside the chemical precursors, within the mineral that it is producing," said the study's principal investigator Dr Mike Harbottle, from Cardiff University's School of Engineering.

"When damage occurs to the masonry, the deposits within the mineral are also damaged, exposing both the bacteria and the chemicals, which react with each other again to produce even more mineral, thus healing the damage."

Self-healing materials are already being tested on a range of different materials, from glass and carbon fibre composites to concrete and electronic materials.

According to Cardiff University, there is 'substantial interest' in self-healing technology, especially from industry, as the costs associated with the maintenance and repair of materials continue to grow.

"Masonry structures are constantly deteriorating primarily due to the weathering effects. These could be physical, chemical or biological changes which can all slowly attack the masonry structure," said Dr Magdalini Theodoridou, the research fellow on the project.

"Over time, usually many years, this damage builds up until fractures arise. Whilst these may not compromise the integrity of a structure immediately, if allowed to develop then damage may become critical."

Throughout the two-year project, the team will be developing ways to engineer self-healing systems into masonry, whether this is during the material's production phase or once the masonry has been used as a building material.

"One possible application could be to produce a liquid or suspension, which you could buy from a local DIY store, containing all of the bacteria and chemicals that could be sprayed on to masonry to repair damage."

Dr Theodoridou's work is funded by the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie Individual Fellowship scheme.

(The Engineer, 7th March 2018, https://www.theengineer.co.uk/self-healing-buildings-bacteria/?cmpid=tenews_4822926&utm_medium=email&utm_source=newsletter&utm_campaign=tenews&adg=25D5594B-61A5-4477-9BBF-F97F87829407)

ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ

www.geoengineer.org

Κυκλοφόρησε το Τεύχος #154 του **Newsletter** του **Geoengineer.org** (Μαρτίου 2018) με πολλές χρήσιμες πληροφορίες για όλα τα θέματα της γεωμηχανικής. Υπενθυμίζεται ότι το Newsletter εκδίδεται από τον συνάδελφο και μέλος της ΕΕΕΕΓΜ Δημήτρη Ζέκκο (secretariat@geoengineer.org).

Ενδεικτικά αναφέρονται:

- Corinth Canal in Greece closed due to landslide (video)
- Seismic Assessments Using Best Practices for Risk Management of TVA Coal Combustion Residuals Surface
- Magnitude 6.4 earthquake hits Taiwan
- Damage Assessment by Laser Could Focus Post-Earthquake Response
- Landslide destroys homes in Tijuana, Mexico (video)
- Cars swallowed up after road collapses in Rome (video)
- Shamsher Prakash Foundation 2018 prize solicitation
- Huge crack spreading on Washington's Rattlesnake Ridge prompts evacuations (video)

http://campaign.r20.constantcontact.com/render?m=1101304736672&ca=244c2663-b647-4cff-aad3-ed61bbaf560f

ISRM International Society for Rock Mechanics and Rock Engineering NEWSLETTER

https://www.isrm.net/adm/newsletter/ver_html.php?id_newsletter=148&ver=1

Κυκλοφόρησε το Τεύχος No. 41 (Μαρτίου 2018) του Newsletter της International Society for Rock Mechanics and Rock Engineering με τα παρακάτω περιεχόμενα:

- Update on ARMS10, the 2018 ISRM International Symposium
- European Rock Mechanics Symposium - Eurock 2018, Saint-Petersburg, Russia, 22-26 May
- 21st ISRM Online Lecture by Prof. Laura Pyrak-Nolte
- Volume 20 - December 2017 of the ISR M News Journal is now online
- The Third International Conference on Rock Dynamics and Applications (RocDyn-3)
- Brazilian Symposium on Rock Mechanics – 2018 Franz Pacher 1919-2018 - In memory of an outstanding engineer and man
- In memory of Richard Z.T. Bieniawski
- A tribute to Prof. Don Deere, 1922-2018
- A tribute to Professors Richard Bieniawski and Don Deere from Brazil
- ISRM EFC Training Course – Rock Mechanics and Engineering Geology for Reduced Geo-hazards in Mining and Civil Projects, Hanoi, Vietnam, March 2018
- ISRM Rocha Medal 2020 - nominations to be received by 31 December 2018
- ISRM Sponsored meetings

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