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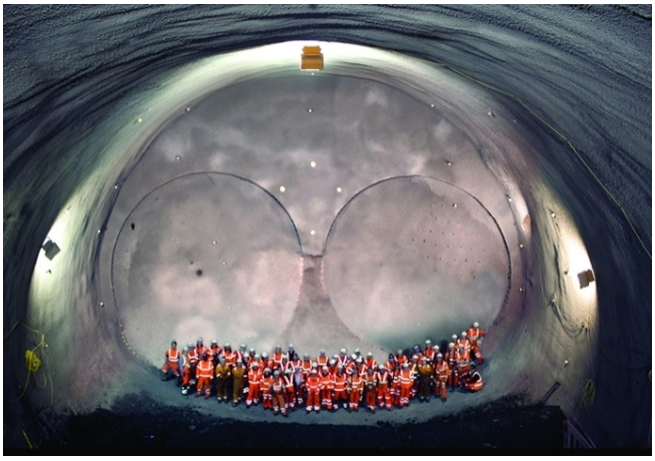
The Crossrail Project Questions and Answers

With a marathon's worth of tunnels under one of the most densely populated and complex cities in Europe, the sheer scale of London's new railway line is overwhelmingly impressive.



Completed construction of the east-bound cavern at Stepney Green

The £15bn Crossrail project needs to accommodate 200 million passengers a year across a total of 100km of track with 40 stations (including 10 new ones).

Work began back in 2008 and most of the tunnelling is now complete — but services won't start running until 2018 so there's still plenty to do.

For the latest in our series of reader Q&As, members of the engineering team behind Crossrail have answered your questions on the difficulties and innovation of the project.

Which were the trickiest parts of London to tunnel underneath and why?

Mike Black, Crossrail head of geotechnics, and Mike King, Crossrail head of underground construction:

Crossrail is among the most ambitious infrastructure projects undertaken in the UK and will dramatically change how people travel across London.

A total of 26 miles of train tunnels are being built beneath the streets of London by eight tunnelling machines. The tunnels are now more than 80 per cent complete and five of the machines have completed their drives.

The project teams specified and procured machines and equipment appropriate for the anticipated ground and groundwater conditions, and have employed construction methods suited to the ground and equipment chosen. As a result the general tunnelling has been completed as planned and as expected.

However, different areas have presented different challenges, based on the geology, groundwater conditions and the local built environment. Some worthy of particular note include:

- Launching and completing TBM drives with only shallow ground cover, in non-cohesive material and in close proximity to sensitive structures and services on several contracts.

26 miles of tunnels are being built beneath London

- For both TBM and SCL tunnels, controlling ground movements where protection of third-party assets was reliant on controlled settlement as the main method of protection This has been further complicated where multiple contracts have affected the same asset, where tunnels have been constructed in close proximity to each other and when tunnelling at shallow depth, close to third-party assets.

- Regional dewatering of the deep aquifer to assist in the construction of some of the cross-passages and deep shafts.

- On the Thames tunnel section (Plumstead to North Woolwich), the TBM drives and SCL cross-passages had to cope with high water pressures, including a tidal variation of 8m in very permeable strata.

Why was it necessary for Crossrail to pass so close to existing Tube lines? Couldn't it have 'dived' underneath them?

***Mike Black, Crossrail head of geotechnics*:** Crossrail was designed to provide direct connections to London Underground and National Rail. Constructing Crossrail with deeper tunnels and stations would have required an increased number of escalators and passageways to enable passengers to not only access Crossrail services but also interchange with the existing transport network. Not only would this have cost implications but deeper tunnels and stations would increase the time it took for passengers to access and exit Crossrail platforms. Additionally, in the event of an emergency, deeper stations would result in longer evacuation times.

The project is using eight Tunnel Boring Machines (TBMs)

A further potential issue resulting from deeper tunnels would be a wider zone of surface settlement. While the magnitude of the vertical movement within this zone would be less than for shallow tunnels, potentially more buildings and utilities would be affected.

The Crossrail stations are situated as high points relative to the running tunnels to allow for more energy-efficient brak-

ing and acceleration of the trains when entering and leaving stations.

The current methods of station construction would become very inefficient if the tunnels were deeper. The current configuration of open boxes at either end of the tunnelled stations would become impractical and stations would most likely be limited to tunnel-only access to the platform levels. The ground loads and consideration of long-term design loading for groundwater would also result in significantly more robust structures and foundations.

What was the technical process used in 'threading the eye of the needle' — tunnelling between the very tight clearances between the escalators and the Northern line at Tottenham Court Road?

Andy Alder, Crossrail project manager, western tunnels: Crossrail used an earth pressure balance (EPB) tunnel-boring machine (TBM) to mine the western-running tunnels between Royal Oak and Farringdon. The EPB TBM mined the section of tunnel directly above the operational Northern line platform tunnels at Tottenham Court Road, directly below the London Underground station structures, with less than 800mm clearance to each.

The EPB TBM controls ground movement during the tunnel mining by maintaining pressure on the clay being excavated within the cutting face. The cutterhead rotates as the TBM advances, cutting the clay with tungsten carbide cutting tools. There is a steel bulkhead that creates the cutterhead chamber, separating the cutting face from the inside of the TBM. A screw conveyor removes the excavated clay from the cutterhead chamber, and the speed of rotation of the screw conveyor controls the clay pressure at the cutterhead. In this way the ground movement is controlled and minimised. Foam is mixed with the clay to create the right consistency of spoil to use the screw conveyor to maintain pressure. Pressure in the TBM is monitored in real time to allow it to be controlled.

A TBM is lowered into position

Behind the TBM, precast concrete segments are erected to create the tunnel lining. Cement grout is injected around the segments under pressure to lock the segments in the ground, and to ensure that all voids are filled.

A laser guidance system is used on the TBM, to ensure that its position is accurately known. Variable pressure on the TBM shove rams around the circumference of the TBM is used to control the TBM position to within ±50mm.

Automatic monitoring was undertaken in the Northern line platform tunnels. This used an automatic theodolite to record the position of a number of prisms fixed to the existing tunnel lining and record any movement. This data was analysed in real time to monitor the effect of the mining on London Underground's assets. Recorded movements were less than 3mm, well within predictions, and a remarkable feat given that the 1,000t TBM passed only 800mm above.

TBM Victoria breaks through into Stepney Green cavern

Crossrail is routinely described as 'Europe's biggest archaeology project' as well as Europe's biggest construction project. To what degree have archaeological concerns hindered the progress of the project and how have you dealt with them?

***Jay Carver, Crossrail lead archaeologist*:** Archaeological finds have tremendous potential to affect a construction schedule. Unexpected finds are the key risk alongside access problems and logistics that in urban environments often prevent an early start on the archaeology works. To address this, we started at detailed design with a very thorough research phase to understand the historic land use at each of the 40 or so work sites. That allowed us to assess what the actual quality of archaeological remains was likely to be, and grade the programme risk — for example, the impact that archaeology delays could have on subsequent works.

The Chaterhouse plague pit is one of Crossrail's many archaeological finds

Combining those issues allowed us to assign each site a critical, high, medium or low rating. Critical programme sites included, for example, Liverpool Street ticket hall, where the quality of the predicted archaeology (a deep sequence of Roman remains and a 16th century burial ground) indicated that early site access was essential even though it would not be easy. In that case, a road closure and excavations to a depth of 6m was needed to fully quantify the risk.

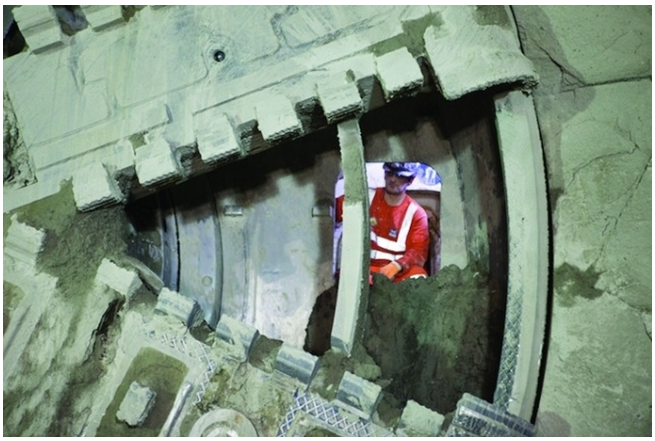
Although we have had the occasional last-minute find, such as the large haul of ice-age finds, right at the place where the western tunnels were to start at Royal Oak Portal, a daily working relationship with colleagues in construction

management has meant that solutions have been found. This includes acceleration of the work with increased resources and extended hours and carefully agreed work stages to allow both construction and archaeology to continue concurrently.

Will there be any significant differences between the engineering techniques used on Crossrail and Crossrail 2, if it happens?

***Chris Dulake, Crossrail chief engineer*:** It is envisaged that the design and construction techniques for implementing Crossrail 2 main infrastructure will be very similar to that deployed for Crossrail.

Crossrail 2 has a deeper alignment in parts through the central area and will therefore present slightly different challenges in terms of structural loading, and constructing structures at depth. Potentially different predicted ridership and passenger demands on Crossrail 2 may also determine changes in station geometry and train lengths. However, design and construction techniques are not expected to be significantly different.



An engineer checks on a TBM's progress

Following on from experience gained on Crossrail and potential technological advances in the next few years, it is possible that some of the ground movement monitoring techniques and approaches will be different for Crossrail 2, taking more advantage of fibre-optical systems, satellite GPS technology and automated systems using analytical techniques on real-time ground movement data.

What was the biggest engineering challenge that you have encountered since starting the project and what steps have you taken to overcome this?

***Bill Tucker, Crossrail central section delivery director*:** The biggest engineering challenge on Crossrail, in my opinion, is management of interfaces. The original design, which carried the programme through the Crossrail Act, was the product of three multi-discipline consultants (MDCs). Framework design consultants (FDCs) were then engaged back in 2009 to progress the design of the bored tunnels, SCL tunnels, stations, portals and shafts to the point that we could tender for construction contracts.

Now, we have our civil contractors performing temporary works design and detailed design for mechanical, electrical and architectural/fit-out of our stations, portals and shafts using standard specifications developed by our FDCs. Other FDCs also developed the conceptual design of our rail systems (track, traction power, HV power, signalling and communications) that our rail systems design-build contractors are now taking through detailed design.

In total, approximately 30 design consultant companies have been engaged in some aspect of the Crossrail design for either ourselves or our contractors. The Crossrail Technical Assurance Plan (TAP) outlines how we manage and accept designs from both our FDCs and contractors. The TAP specifies a gated acceptance process, which incorporates single-discipline and inter-discipline reviews and gains the concurrence of our infrastructure maintainers, London Underground and Rail for London.

Achieving the acceptance gates for our contractors' detailed design is important to maintaining our critical path programme. Managing the contractors' design in a manner that considers the complexity of these interfaces is a top priority of our project teams and chief engineer's group every day.

What would the Crossrail team do differently in the processes they adopted to manage the design and other activities of their project that was done before they started construction knowing what they do now as they come to the end of their programme?

***Patrick ten Have, Crossrail chief engineer's group*:** There are many opportunities to do things differently; the question is always what would have made a difference?

Perhaps one area we would adopt for future programmes like Crossrail would be to better understand the linkages, constraints and interfaces between the design of the underground structures and the actual construction methodology and timing thereof. This would involve completing the design to a greater level of detail prior to the award of the construction contracts so as to avoid change and the knock-on effect on other disciplines. Another consideration would be reducing the overall number of interfaces between contracts by grouping the asset base into larger packages of work and aligning the designers in the same fashion.

Have you been working with HS2 or any of the other rail infrastructure improvement projects going on, and how? What advice would you have for these teams?

***Chris Sexton, Crossrail technical director*:** Crossrail has regular liaison with HS2, Thames Tideway Tunnel and Thameslink, and works very closely with Network Rail and London Underground as delivery partners for Crossrail.

It is always a challenge to offer relevant advice to another project which is invariably facing similar but slightly different challenges. Apart from the number one priority of safety, I would offer three areas of focus: design accountability; management of interfaces and integration; and stakeholder engagement.

For design, ensure that accountabilities are clearly understood, BIM is fully adopted by all designers from the start and sufficient time is allowed for a mature design to be issued for construction.

On a large programme the packaging and sequence of design contracts contributes to the complexity of the challenge and due weight needs to be given to how the design will be assured and how the works are intended to be handed over. Accountability for integration and managing interfaces also need to be clear — not just on paper but actively managed and rigorously and regularly checked.

Time spent on engaging stakeholders is never wasted; respect people who are affected by the works by minimising the impacts of construction and being as good as you can be in keeping promises and communicating what is happening in good time.

How well have the Crossrail tunnelling academies helped fill your recruitment needs? What will all those tunnellers do with their skills once the project is over?

***Valerie Todd, Crossrail talent and resources director*:** From the outset we identified that there was a shortage of talent in the labour market. We wanted to do something to re-energise the skills base within tunnelling and underground construction particularly, but in rail engineering and infrastructure generally.

The Tunnelling and Underground Construction Academy (TUCA) established by Crossrail in 2011 has been a huge success. This has supported employers looking for workers by providing pre-employment training, tunnel safety training, apprenticeships and advice and guidance to those seeking work.

The first of Farringdon's tunnels was completed in November 2013

Approximately 7,000 people have received some form of training at TUCA, which has enhanced their employability by equipping them with skills and experience valued by employers.

New apprenticeships developed by Crossrail specifically for the project include tunnel operations, gantry crane operations, locomotive operations and spray concrete lining; while existing apprenticeships on offer include business administration, procurement, document administration, finance, HR, IT and accounting. Apprentices receive both training in a college environment and hands-on application in the workplace, and are employed by Crossrail itself, or one of the programme's numerous partners and contractors. Nearly 400 apprentices have worked on Crossrail to date.

Following Crossrail there will be Thames Tideway, the Northern line extension, HS2 and Crossrail 2, which will all require tunnelling expertise, as will the next generation of nuclear power stations.

It was more cost-effective to leave the 2 TBMs Phyllis and Ada buried in the ground

(Stephen Harris / theengineer, 27 October 2014, http://www.theengineer.co.uk/your-questions-answered-crossrail/1019411.article?cmpid=tenews_627713)

Choosing an Excavation Method Drilling Dilemmas

S. Paul Singh and Derek Zoldy

The choice between TBM and drill and blast is an often-faced dilemma as the two methods have been competing for more than 30 years. S. Paul Singh, Mining Engineering Department - Laurentian University, Sudbury, Ontario, and Derek Zoldy, AECOM, Markham, Ontario, discuss the conditions for the judicious selection of excavation method

Traditionally, tunnels have been excavated by drilling and blasting method (DBM), but now with the advent of road headers and TBMs, there has been a significant increase in the rate of excavation and improved safety record. Often in problematic reaches, drill and blast methods come to the rescue and are handy (Ramamurthy, 2008). When unfavourable or changed conditions are encountered without warning, it has a far greater impact on the rate of advance, construction costs and schedule delays in a TBM driven tunnel than in a drill and blast tunnelling.

It appears that TBMs and DBM are expected to provide constructability options for contractors to be competitive. In the tunneling industry, where market conditions continue to demand higher advance rates and lower costs, TBMs offer numerous benefits, including higher advance rates, continuous operation, less rock damage, uniform muck characteristics, greater safety and potential for remote automated operation.

On the other hand the DBM is very flexible and adaptable. The definite answer to which tunneling method should be chosen is always a tough question.

Proper choice of the tunneling method is crucial for the engineers and contractors, as mistakes or misjudgments can have serious consequences, both for the economic viability and the overall success of the project.

Tunnelling engineers have to make judicious choices on a case-by-case basis considering the site conditions and expected outcome. When both TBM and DBM are feasible, a careful assessment of the risks must be made, particularly, in terms of safety, economy and productivity.

Factors affecting the choice of tunnel method:

A. Tunnel design parameters
B. Rock mass characteristics
C. Performance factors
D. Contract related factors

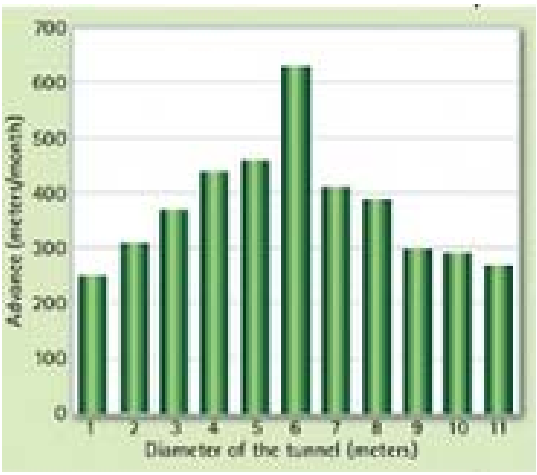
TUNNEL PARAMETERS

Diameter

Although TBMs have excavated tunnels more than 15m diameter, yet it is better to limit the size of the tunnel due to the following reasons:

- The success potential of a TBM in hard rock decreases with increasing diameter (Kovari et al., 1993; Bruland, 1998).
- There are technological limits for the maximum dimensions of some major TBM component e.g. the bearing and the head (Nord, 2006).
- The intensities of both the instability phenomena and the induced convergence also increase with increasing diameter of excavation (Tseng et al; Barla G. and Barla M., 1998).

A TBM drive requires a pre-determined (fixed) tunnel diameter but it can excavate a circular profile with a high degree of accuracy. However with the drill and blast system, the tunnel cross-section can be driven to any required size or shape and most importantly the tunnel size and shape can be changed along the length of the drive.



Diameter of the tunnel vs average advance / month

Length

Since the mobilization cost, of TBM is high, it requires a long tunnel to justify a large capital investment. Therefore TBMs will be used where tunnels are to be long and of uniform cross-section and profile.

The conventional DBM is therefore most often used on shorter tunnels.

In the case of long tunnels with favourable geology, relatively high advance rates can be achieved with a TBM. However as soon as the geology becomes complex and there are zones of disturbance, drill and blast performance can become significantly better as compared with a TBM.

A simple indicator on when a TBM solution might be suitable is to make a simple estimate as shown below. The formula simply says;

Tunnel length (m) / Tunnel diameter (m) x (UCS in Pascals)$^{1/3}$ > 1.5 (Nord, 2006)

That if the tunnel length divided by the tunnel diameter and the unconfined compressive strength of the rock at power of the third and the result is larger than 1.5 might be worthwhile to check the TBM alternative. The trigger value of 1.5 using the above formula is not as accurate as it might seem and perhaps it would be better to say that when the result is 3, the TBM option is definitely a viable solution and when the value is less than 1, the TBM option should be considered less favourable than the DBM. Please note that this expression has no scientific back up. Poor ground conditions are not foreseen here and nor is abrasive rock considered (Nord, 2006).

Based on the research at the Swiss Federal institute of Technology, TBM technology shows excellent cost efficiency in the case of tunnels longer than approximately 3 km. The exact length depends upon the rock mass characteristics, tunnel parameters, labour cost and utilization factor.

Shape

DBM is very adaptable and flexible in regards to the excavation of any tunnel cross-section (Grimscheid and Schennayder, 2002). A circular profile can be excavated with a high degree of accuracy by a TBM. However, with drill and blast system the tunnel cross-section can be created to any required shape or size and most importantly the

tunnel shape awl size can be changed along the length of the drive.

The suggestions for choice between tunnel boring machine and drill and blast system have been presented in Table 1.

Table 1. – Preference of the tunneling method based upon the tunnel parameters

PARAMETER	RANGE	METHOD	REMARKS
Length (km)	<0.5	DBM	Strongly recommended
	0.5-1.0	DBM	Recommended
	1.0-2.0	DBM	Preferred
	2.0-3.0	DBM or TBM	
	>3.0	TBM	Preferred
Diameter (m)	<3.0	DBM	Preferred
	3-10	TBM	Preferred
	>10	DBM	Preferred
Inclination in degrees	<6	TBM or DBM	
	>6<30	DBM	Recommended
Curvature	<30m radius	DBM	
	>30m radius	TBM or DBM	
Shape	Circular	TBM	Preferred
	Non-circular	DBM	Strongly recommended
Cross-section	Uniform	TBM or DBM	
	Variable	DBM	Strongly recommended

Source: Authors

ROCK MASS CHARACTERISTICS

Strength

The TBM excavation with respect to advance rate is by far much more depending on the strength characteristics of the rock than drill and blast.

Geological features

Geological conditions to be encountered such as faults and groundwater can have a major impact on machine performance, application, operation and the production rate. These parameters must be accounted for when estimating the machine utilisation, which is a key parameter in scheduling.

Analysis of field performance of different TBM projects is the foundation for estimating the effect of these geological features in the rock mass.

The opinion is that drill and blast method offers a higher flexibility and consequently better opportunities to cope up with unforeseen conditions. According to Nord and Stille (1988), variable rock conditions favour the choice of the blasting method. Water conditions affect both methods but the TBM is mote hampered than the drill and blast system if pre-grouting has to be done. The variation in tunnelling speed when excavating in favourable versus unfavourable ground conditions is also less for the drill and blast than the TBM method.

In the case of TBM, massive rock is unfavourable for fast penetration, while for DBM, it is obviously favourable due to the lack of tunnel support needs and can be drilled at reasonable speed despite the lack of jointing.

Rock type

The overall composition of the rock mass holds a first order control on TBM penetration. The more mafic (iron and magnesium rich) the rock mass the lower the penetration. Some rock types (such as fine grained or glassy dike rods, amphibolites, pegmatite, intrusive, garnetiferous zones quartz veins) have important bearing on IBM penetration and these should be identified and categorised accurately. Unique igneous and metamorphic textures can make or break a contract (Merguerian. 2005).

Abrasiveness

The abrasiveness of a rock or soil is its potential to cause wear on a tool. It is an important parameter to assess the technical and economical aspects of a tunnelling method.

Rock mass rating

Nick Barton (2000) found that the TBM technique is most competitive time-wise versus drill and blast when rock conditions ate in the Q-range 0.1 to 10 on his rock quality scale (Figure 2).

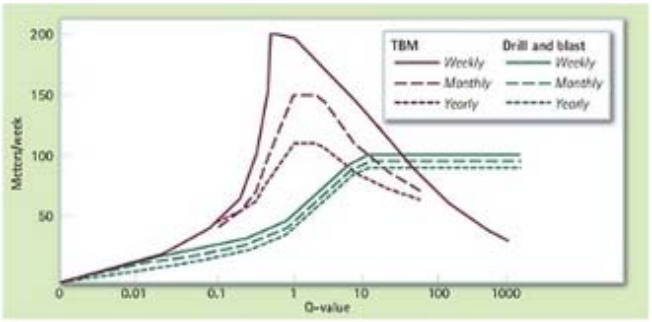


Figure *2.* Comparison of advance rates for TBM and DBM (After Barton, 2000)

It should be pointed out that this is a hypothetical statement but it does points on to the difficulties the TBM excavation faces when entering into a very poor ground. Many cases have been recorded where TBM technique has to be abandoned in favour of the drill and blast technique. But also on the very end of the quality scale the TBM excavation will be difficult due to monolithic character of the rock yielding only few joints.

In low quality rock, the penetration rate can be potentially very high but the support needs, rock jams and gripper bearing failure result in «low advance rate, with utilisation coefficient as low as five to 10 per cent or less (Barla and Pelizza,2000).

Grandori (1995) correlated the advance rate of the TBM with RMR value. It showed that RMR class III provided a peak in production for a double shield TBMs, while they

would not be recommended for neither class V (very poor) nor class I (very good rock masses).

The choice between TBM and DBM on the basis of geological and hydrogeological considerations have been suggested in Table 2.

Table 2. Preference of rhe tunnelling method bosed upon geological ond hydrologicat conditions

PARAMETER	*RANGE*	*METHOD*
Geology	Variable	DBM
Compressive strength. MPa	<300	TBM or DBM
	>300	DBM
Strength and hardness	Variable	DBM
Rock quality designation	30-80	TBM Preferred
	<30 or <80	DBM Preferred
"Q" System	<0.1	DBM Preferred
	0.1-0	TBM most competitive
	10-15	TBM preferred
	100-1,000	DBM recommended
RMR system	40-80	TBM Preferred
	<40 or >80	DBM Preferred
Ground water problems	Severe	DBM Preferred

Source: Authors

PERFORMANCE FACTORS

Rate of advance

In the case of drill and blast system, equipment is available in various sizes and is selected to fit the actual tunnel size. In a larger tunnel, more drilling machines can operate in parallel and larger units can be deployed for mucking and hewing. Therefore, there is no direct relationship between tunnel size and advance rate for drill and blast operations.

Barton analysed a large number of TBM driven tunnels and has concluded that there is a major variation in the rate of advance and penetration rate depending on the rock quality. He suggested a tunnel stability relationship based on Penetration Rates vs. Rock Quality Designation for TBMs (Barton, 2000). Since the time that this was developed, we have not seen any recent research to suggest that the TBM technology has advanced in terms of penetration rates based on Barton's work.

Barton (2000) also made a comparison between advance rates of TBMs and DBM as shown in Figure 2.

Although this relationship suggests a relationship based on project-based information. That being said, TBM and DBM equipment improvements over the past decade have increased the equipment efficiencies and as such the relationship between Rock Quality and advance rate for TBM and DBM should be updated.

Boreability

When the TBM cannot penetrate the face to a sufficient rate and or the wear of cutting tools exceeds an acceptable limit, it is an indication that rock is not borable. The penetration rate per revolution of the cutter head that can be achieved under the maximum thrust is the main index describing the capacity of a TBM to excavate a given rock. A limit of penetration per revolution below which a rock shall be considered non-borable is influenced by the abrasivity of the rock, the diameter of the tunnel and the geology of the rock formation. The high abrasivity associated with low penetration dictates frequent changes of cutters, increases the cost of excavation per unit of rock, in addition to the time lost in replacing the cutters.

The penetration rates below 2 to 2.5mm/rev of the cutter head is a signal of boreability problems. An excavation process starts to be efficient when the penetration rate crosses 3 to 4mm/rev.

When the diameter of the tunnel increases, three different effects make the situation worse [Barla and Pelizza (2000)]:

- The rotational speed of the cutter head should decrease for an equal penetration per revolution, because the bearings and seals of the disc cutters permit only a maximum speed equivalent to 150 m/min.
- The number of cutters to be changed per meter of tunnel advance increases, therefore increasing the stopping time required for such operations.
- The state of average wear of the cutters mounted on the head increases, thus decreasing the penetration per revolution.

Under extreme conditions, each one of the above three factors excites the other one bringing the progress rate down to unacceptable values. For these reasons, a rock type may be borable for a TBM of small diameter, but not for a TBM of large diameter.

- If ROP is the average rate of penetration, then
- ROP = boring length in meters/boring time in hours
- Penetration per revolution. P_r = (ROPx1000)/(RPMx60) mm/rev.
- RPM is cutter head revolutions per minute.
- Field Penetration Index. FPI = F_n/P_r kN/cutter/mm/rev.
- F_n is the cutter head load or normal force in kN.

The choice between TBM and DBM on the basis of work done by Barla and Pelizza (2000) and Hasanpour et al, (2011) is given In Table 3.

Support requirements

Most tunnels will require support to ensure its long-term stability. The type and magnitude of the support is determined by the rock mass characteristics, water conditions and state of stress.

In general, less support is needed for a TBM than a drill and blast operation. In cases where drill and blast requires little support, the TBM in similar conditions may require no support. In cases where heavy support is needed for drill and

blast operations, the support measures and stabilisation ahead of the face will not be less for TBM technology.

Table 3 Preferred tunnelling method based upon on the boreality of rocks

PARAMETER	*RANGE*	*METHOD*
Field Penetration Index (FPI) (kN/cutter/mm/revolution)	7-70	TBM
	>70 and <7	DBM
Penetration per revolution (mm)	<3	DBM
	>3	TBM

Source: Authors

In fact, they may be even larger and certainly take much mote time due to the difficulties with installations of supports right behind and ahead of the cutter head.

When heavy support is needed, TBM operations wll provide lower advance rates than the DBM system (Barla and Pelizza, 2000)

Equipment utilisation

The TBM operations experience downtime due to changes of cutters, regripping, maintenance and downtime, etc. All this down time adds up to 40 to 60 per cent of available operating time.

Skilled labour

One crew is required for a single TBM working face but a TBM crew will be larger. Crew needs higher skill level, but are easily trainable because operations are more consistent and continuous.

The suggestions for the choice between TBM and DBM on the basis of operating requirements are given in Table 4.

Table 4 Preferred tunnelling method based upon the operating requirements

PARAMETER	*RANGE*	*METHOD*
Equipment mobility	DBM	
Easy housekeeping	TBM	
Short lead time	DBM	
Almost uniform muck size	TBM	Crushed fines and chips

Source: Authors

ENVIRONMENTAL AND SAFETY CONSTRAINTS

Overbreak

Overbreak is the excavation of the rock beyond the designed profile. Overbreak increases the cost of mucking, support and concrete lining. Overbreak is generally influenced by the lithology, rock mass properties and quality of blasting.

Overbreak caused by geological instabilities is generally larger when tunneling by drill and blast than TBM. In some cases, however, it is more complicated during TBM excavation to support ahead and right behind the tunnel face and as a result of that support is installed al a very late stage resulting in larger collapses. These collapses have sometimes led to the complete burial of the TBM.

Out fall behind the gripper pads of the TBM is another form of geological overbreak linked lo the TBM operation. The overall experience is that TBM excavation will generate less geological overbreak (Nord, 2006).

Vibrations

This is a major concern when tunnelling by DBM in an urban environment. If the surroundings are highly sensitive to vibrations, there may be constraints in the amount of explosives that can be used per delay. This may limit the progress of the DBM.

However the problem is alleviated with latest advances in drill and blast technology. In case of TBMs there are significantly less disturbances to the surroundings.

Safety and environmental risks

Tunnelling is not a risk free technology. Drilling and blasting system is quite challenging when tunneling in populated areas. Not only is the work closer lo people, structures and utilities, but environmental concerns about blasting effects on flora, fauna and water resources need to be considered. In addition, government scrutiny of commercial explosives activities due to terrorist incidents and continuing threats have increased public fears regarding the applications of explosives in urban environment.

On the other hand, premature surrender to TBMs sometimes becomes a costly decision. The sensitivity of TBMs to changes in actual conditions increases the probability of involved risks.

During excavation, the situation can become critical at any minute, meter and under any circumstance. In some cases, the failure of a TBM necessitates the last minute switch to DBM. When blasting methods are introduced at the last minute without having proper planning and controls in place, the risks of blasting problems are increased. During TBM excavation, the rock support in general is installed from within the protected and shielded areas. Absence of blasting fumes and related problems inside the tunnel provides improved working environment.

Suggestions for the choice between TBM and DBM on the basis of environmental and safety requirements have been given in Table 5.

Cost

A TBM tunnel project requires more demanding infrastructure in terms of roads, power supply, muck handling, work areas for storage and robust transportation needs, there are normally higher costs and longer times required for TBM mobilization.

Transporting of the equipment to the site also needs additional time and cost. TBM tunnel projects require more electric power than DBM projects.

Tunnel quality

During TBM excavation, it may be easier to ensure accurate alignment. The periphery of a TBM tunnel is smooth and usually has less overbreak. As, such, it is possible to maintain excavation preciseness with TBMs.

Based upon cost and quality requirements, suggestions for the choice between a TBM or a DBM tunnel are given in Table 6.

Table 5 Preferred tunnelling method based upon environmental and safety constraints

REQUIREMENT		*METHOD*
Low vibrations		TBM
Minimum overbreak		TBM
Low accidental risks		TBM
Low ventilation costs		TBM
Tunnel stability		TBM (except in very poor rocks)
Short lead times		DBM
Skill of the work force	Semi-skilled	TBM
	Highly skilled	

Source: Authors

Table 6 Preferred tunnelling method based upon the costs and tunnel quality requirements

REQUIREMENT	*PREFERRED METHOD*	*REMARKS*
Low capital cost	DBM	Mobilisation for DBM is much faster than TBM tunnels
Low supporting cost	TBM	Except in very poor rocks
Accurate alignment	TBM	DBM can be accurate with survey QA/QC
Smooth tunnel	TBM	
Excavation preciseness	TBM	Generally less overbreak with TBM drive

Source: Authors

CONCLUSIONS

TBM tunnel excavation represents a large investment in the decision making process with inflexibility with regard to changes in diameter and small radius curves and challenging vertical and horizontal alignments. As such, the use of TBMs for near horizontal excavation alignments can be a potential rapid excavation and rock support method for rock tunnels.

On the other hand, DBM is very flexible and adaptable with comparatively lower advance rates. That being said, there is a need for careful planning for the optimum selection of tunnelling alternatives, because a wrong choice can lead to costly and time consuming consequences.

In this study, the suggestions for the selection of a tunnelling method base upon tunnel parameters, boreability, geological conditions, equipment operating requirements, power needs, environmental and safety constraints, costs and tunnel quality requirements have been made.

The suggestions made in this paper may help facilitate the selection of the tunnelling method for a project or produce further investigation into the selection criteria and viability for each method during the design and contract bidding stages.

Further research and review of project specific case studies in North America should be investigated to determine the validity of the penetration rates when rock quality has been a factor in the tunnel equipment selection decision making process.

References

1. **Barla, G. and Barla, M.**, 1998, *"Tunnelling in difficult conditions"*, International conference on Hydro power development in Himalayas, April 20-22, Shimla, India, 19 pages.

2. **Barla, G. and Pelliza, S.**, 2000, *TBM tunnelling in difficult ground conditions"* GeoEngineering 2000, International conference on Geotechnical and geological engineering, Melbourne, Australia, pp. 1-20.

3. **Burton, N.**, 2000, "Rock mass classification for choosing between TBM and drill and blast system or a hybrid solution", Tunnels and underground structures, Ed. Zhao, Shirlaw and Krishnan, pp. 35-50.

4. **Bruland, A.**, 1998, *"Future demands and development trends"*, Norwegian TBM tunnelling, publication no. 11, NFF, Oslo, pp. 99-103.

5. **Grandori, R., Jager, M., Antonini, F., Vigl, L.**, 1995, *"Evinos-Mornos Tunnel – Greece. Construction of a 30 km long hydraulic tunnel in less than three years under the most adverse geological conditions"*, Rapid Excavation and Tunnelling Conference, San Francisco, pp. 747-767.

6. **Grimscheid, G. and Schennayder, C.**, 2002, *"Drill and blast tunnelling practice"*, Practice periodical on structural design and construction, August 2002, pp.125-133.

7. **Hassanpour, J., Rostami, J. and Zhao, J.**, 2011, *"A new hard rock TBM performance prediction model for project planning"*, Tunnelling and underground space technology, 26 (2011), pp. 595-603.

8. **Kovari, K., Fechtig, R., Amstad, Ch.**, 1993, *"Experience with large diameter tunnel boring machines in Switzerland"*, International congress, Option for tunnelling, ITA, Amsterdam, 14 pages.

9. **Merguerian, Charles**, 2005, *"Lithologic and structural constraints on TBM tunnelling in New York City"*, Rapid Excavation and Tunnelling Conference, 2005, Proceedings Society of Mining, Metallurgy and Exploration, Seattle, USA, pp. 704-724.

10. **Nord, Gunnar**, 2006, *"TBM Vs drill and blast, the choice of tunnelling method"*, International conference and exhibition on tunnelling and trenchless technology, March 7-9, Malaysia, pp.205-218.

11. **Nord, G. and Stille, H.**, 1988, *"Bore and blast techniques in different types of rocks. Sweden's Experience"*, Tunnelling and underground space technology, Vol. 3, no. 1, pp. 45-50.

12. **Ramamurthy, T.**, 2008, *"Penetration rates of TBMs"*, World tunnelling conference 2008 – Underground facilities and better environment and safety, India, pp. 1552-1563.

13. **Tseng, Y., Wong, S., Chu, B., Wong, C.**, 1998, *"The Pinglin mechanized tunnelling in difficult ground"*, 8th congress of IAEG, September 21-25, Vancouver Canada, 6 pages.

(Tunnel and Tunnelling International, October 2014, pp. 46-51)

ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ

International Society for Soil Mechanics and Geotechnical Engineering

TC308 - Energy Geotechnics

This is a brief note to remind you of the creation of a new TC on Energy Geotechnics (TC308), and if you have interested individuals, I would ask you to enter your society's nomination directly into the ISSMGE TC database on the website, if you have not done so already.

(For a full list of the ISSMGE TCs, please see http://www.issmge.org/en/committees/technical-committees)

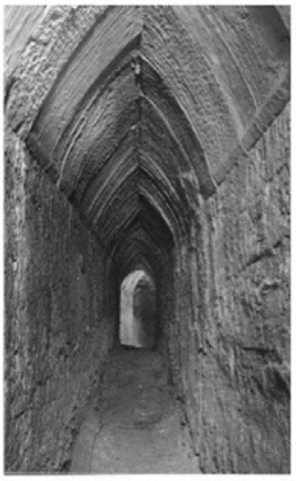
ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΣΗΡΑΓΓΩΝ και ΥΠΟΓΕΙΩΝ ΕΡΓΩΝ (Ε.Ε.Σ.Υ.Ε.)

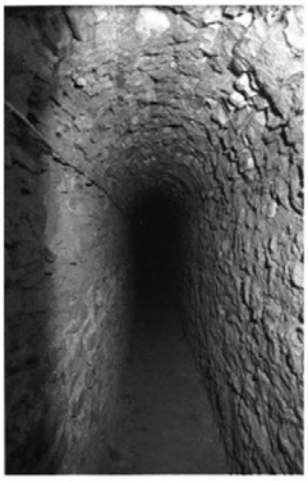
ΔΕΛΤΙΟ ΤΥΠΟΥ

Ημερ.: 30.10.2014

Η Ελληνική Επιτροπή Σηράγγων & Υπογείων Έργων (ΕΕΣΥΕ) στο πλαίσιο των επιστημονικών δραστηριοτήτων της επιχειρεί την προβολή και την ανάδειξη του Ευπαλινείου ορύγματος στη Σάμο ως διεθνές "Σηραγγολογικό Τοπόσημο". Στην προσπάθεια αυτή έχει τεθεί και ως στόχος η αναγνώριση του μοναδικού αυτού μνημείου και από την Διεθνή Επιτροπή Σηράγγων και Υπογείων Έργων (ITA-AITES). Η πρωτοβουλία αυτή ξεκίνησε κατόπιν υποβολής στο Δ.Σ. της ΕΕΣΥΕ σχετικής πρότασης του Καθ. Θ. Τάσιου.

Το Ευπαλίνειο Όρυγμα, χαρακτηρισμένο και ως Μνημείο Παγκόσμιας Κληρονομιάς από την UNESCO, αποτελεί το μεσαίο τμήμα του υδραγωγείου της αρχαίας πόλης της Σάμου. Κατασκευάσθηκε στα μέσα του 6ου αιώνα π.Χ. και συγκαταλέγεται στα σημαντικότερα Τεχνικά Έργα της αρχαιότητας. Περιγράφεται με θαυμασμό ως το «αμφίστομον όρυγμα» λόγω των δύο στομίων του από τον Ηρόδοτο, στον οποίο οφείλεται και η αναζήτηση του ορύγματος κατά τους νεότερους χρόνους και ο εντοπισμός του το 19ο αιώνα. Η σήραγγα είναι έργο του Μηχανικού Ευπαλίνου, υιού του Ναυστρόφου από τα Μέγαρα και αποτελεί το κεντρικό τμήμα του υδραγωγείου. Έχει μήκος 1036m και εσωτερικές διαστάσεις 1,80x1,80m, ενώ το ένα τοίχωμά της διατρέχεται από τάφρο πλάτους 0,60m και κυμαινόμενου βάθους από 4.0 έως 8.90m, εντός της οποία εξασφαλιζόταν η φυσική ροή του νερού εντός πήλινων σωλήνων από την πηγή των Αγιάδων. Το εκπληκτικό στην κατασκευή της σήραγγας είναι ότι η διάνοιξή της, εντός κυρίως ασβεστολίθων, έγινε ταυτόχρονα και από τα δύο στόμια, με δύο συνεργεία λιθοξόων – που δούλευαν με σφυρί και καλέμι – ενώ τα δύο μέτωπα συναντήθηκαν με ελάχιστη απόκλιση από την ευθεία. Υπολογίζεται ότι χρειάστηκαν περί τα 8 – 10 χρόνια για να ολοκληρωθεί το έργο, στο οποίο χρησιμοποιήθηκαν μαθηματικοί υπολογισμοί που εφαρμόσθηκαν στην πράξη με απλά όργανα μέτρησης (σταδίες επάνω από την κορυφογραμμή και οριζόντιες οριοθετήσεις στην περιφέρεια του λόφου).





Στο πλαίσιο λοιπόν της προσπάθειας ανάδειξης του Ευπαλινείου Ορύγματος, πραγματοποιήθηκε το διήμερο 25 – 26 Σεπτεμβρίου 2014, προ της έναρξης των εργασιών του συνεδρίου EETC 2014 - 2nd Eastern European Tunnelling Conference που διεξήχθη στην Αθήνα, επιτόπου επίσκεψη στο Ευπαλίνειο Όρυγμα στο Πυθαγόρειο της Σάμο.

Βασικός σκοπός της επίσκεψης ήταν η παρουσίαση της σήραγγας του Ευπαλίνου και των εν εξελίξει εργασιών συντήρησης και ανάδειξης, στα μέλη του Εκτελεστικού Συμβουλίου (Ε.Σ.) της Διεθνούς Επιτροπής Σηράγγων και Υπογείων Έργων (ITA-AITES). Στην επίσκεψη συμμετείχαν οι Tarcisio B. Celestino (Βραζιλία) α' Αντιπρόεδρος ITA, Daniele Peila (Ιταλία) β' Αντιπρόεδρος ITA και τα μέλη της ITA Καζίλης Νίκος (Ελλάς), Alexandre Gomes (Χιλή), Ruth Haug (Νορβηγία), Anna Sieminska – Lewandowska (Πολωνία) καθώς και ο Εκτελεστικός Διευθυντής της ITA Olivier Vion.

Τα μέλη του Ε.Σ. της ITA- συνοδεύτηκαν από τον καθ. Θ. Τάσιο, από τα μέλη του Δ.Σ. της ΕΕΣΥΕ Σ. Ραπτόπουλο (Πρόεδρο) και Γ. Φίκιρη (Ταμία), από τον εκπρόσωπο της ΕΟΑΕ (φορέα ανάθεσης των μελετών του έργου, σε συνεργασία με το ΥΠ.ΠΟ, για την προστασία και ανάδειξη του Μνημείου) κ. Γ. Αγγίσταλη, από τον Γεωτεχνικό Μελετητή του έργου κ. Γ. Ντουνιά (ΕΔΑΦΟΣ Α.Ε.) και από τους εκπροσώπους της αναδόχου εταιρείας των εργασιών συντήρησης κ.κ. Κ. Ψαλλίδα και Α. Ταμπακόπουλο (ΕΔΡΑΤΕΚ Ενεργειακή ΑΒΕΤΕ).

Η επίσκεψη της 25-9-2014 περιλάμβανε ξενάγηση στο Αρχαιολογικό Μουσείο Σάμου από τη Αναπληρώτρια Προϊσταμένη της ΚΑ΄ Εφορείας Προϊστορικών και Κλασικών Αρχαιοτήτων κα Μ. Βιγλάκη–Σοφιανού, παρουσίαση της εικονοκι-

νητικής ταινίας[1] της Εταιρείας Μελέτης Αρχαίας Ελληνικής Τεχνολογίας (ΕΜΑΕΤ) των Θ. Π. Τάσιου, Ν. Μήκα και Γ. Πολύζου, που χρηματοδοτήθηκε από τον Σύνδεσμο Τεχνικών Εταιριών Ανωτέρων Τάξεων (ΣΤΕΑΤ) και εν συνεχεία ομιλίες για το Ευπαλίνειο Όρυγμα από εκπροσώπους των Υπηρεσιών, των Μελετητών και των Κατασκευαστών.

Την Παρασκευή 26-9-2014 έγινε επίσκεψη στο Ευπαλίνειο όρυγμα όπου πραγματοποιήθηκε και διέλευση κατά μήκος όλου του υπογείου τμήματος.

Οι εντυπώσεις των εκπροσώπων της ΙΤΑ-ΑΙΤΕS ήταν, όπως άλλωστε αναμενόταν, άριστες. Το Δ.Σ. της ΕΕΣΥΕ προετοιμάζει προς υποβολή στην ΙΤΑ φάκελο πρότασης καθιέρωσης του Ευπαλινείου Ορύγματος ως διεθνές "Σηραγγολογικό τοπόσημο", ενώ όλες οι διαθέσιμες επιστημονικές πληροφορίες συγκεντρώνονται αυτή τη στιγμή σε ειδική ιστοσελίδα που αναμένεται να δημοσιοποιηθεί εντός των επόμενων ημερών.

Το Δ.Σ. της ΕΕΣΥΕ ευχαριστεί για την υποστήριξη:

- Την (πρώην) ΚΑ΄ Εφορεία Προϊστορικών και Κλασικών Αρχαιοτήτων του Υπ. ΠΟ
- Την ΕΓΝΑΤΙΑ ΟΔΟ Α.Ε.
- Τους Μελετητές που εκπροσωπήθηκαν από τον κ. Γ. Ντουνιά (ΕΔΑΦΟΣ Α.Ε.)
- Το Πνευματικό Ίδρυμα Σάμου "Νικόλαος Δημητρίου»
- Την ΕΔΡΑΤΕΚ Ενεργειακή ΑΒΕΤΕ

Για το Δ.Σ. της Ελληνικής Επιτροπής Σηράγγων & Υπογείων Έργων

Σταύρος Ραπτόπουλος (Πρόεδρος)

Γιάννης Φίκιρης (Ταμίας)

[1] Σύνδεσμος για την εικονοκινητική ταινία:
http://www.youtube.com/watch?v=AJTwxCaOODM

ΔΙΕΘΝΕΙΣ ΔΙΑΓΩΝΙΣΜΟΙ

ΣΥΝΔΕΣΜΟΣ ΕΛΛΗΝΙΚΩΝ ΕΤΑΙΡΕΙΩΝ - ΓΡΑΦΕΙΩΝ ΜΕΛΕΤΩΝ

Σας ενημερώνουμε ότι ξεκίνησε ο 6ος διαγωνισμός EFCA Young Professionals. Ο διαγωνισμός απευθύνεται σε νέους επαγγελματίες έως 35 ετών που εργάζονται σε εταιρείες/γραφεία μέλη του ΣΕΓΜ και στοχεύει στην ανάδειξη του ταλέντου των νέων ηγετών της Ευρώπης στο μελετητικό κλάδο.

Η διαδικασία συμμετοχής είναι η ακόλουθη:

- Οι νέοι επαγγελματίες συμπληρώνουν την αίτησή τους σύμφωνα με τους κανόνες του διαγωνισμού, εδώ (http://segm.gr/wp-content/uploads/2014/10/YP-Competition-Application-form-2015.doc) θα βρείτε τη σχετική φόρμα

- Στη συνέχεια αποστέλλουν την αίτηση τους στον ΣΕΓΜ στην ηλεκτρονική διεύθυνση segm@segm.gr

Η καταλυτική ημερομηνίας υποβολής των αιτήσεων είναι η 31η Μαρτίου 2015.

European Federation of Engineering Consultancy Associations

Announcement of the EFCA Young Professionals Competition 2015

Dear Directors and Secretaries-General,

We are delighted to launch herewith the sixth edition of the EFCA Young Professionals competition. This event, which is open to all professionals aged 35 and under and working for firms in the membership of your national association, aims at highlighting the talent of Europe's next generation of leaders in our sector, and at demonstrating the diversity and attractiveness of a career in our sector.

The competition also presents the opportunity for you, the Member Associations, to reach the YP population in your membership, and promote the added value of your national association and the EFCA network to both YPs and their managers.

The competition is enriched by the quality and quantity of entrants, and for 2015, we aim to make this event even more popular. We would like to see **at least one entry** from each of the national member associations, and we count on your support to reach this target.

Prize

The winner will be invited to Oslo on 28 - 30 May 2015 to participate in the EFCA GAM, conference and YP meeting at EFCA's cost, including travel and accommodation expenses.

The second and third prize winners will be awarded a support of €500, to be used for participation in the event.

The jury will also select a number of candidates to receive an honourable mention.

The award ceremony will take place during the EFCA Conference, at which certificates will be presented to the winners and honourable mentions. The winner will be invited to make a brief presentation of his or her project.

ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

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

AusRock 2014 - 3rd Australasian Ground Control in Mining Conference - an ISRM Specialized Conference, 5 – 6 November 2014, Sydney, Australia www.groundcontrol2014.ausimm.com.au

3rd ISRM International Young Scholars' Symposium on Rock mechanics - an ISRM Specialized Conference, 8 – 10 November 2014, Xi'an, China http://www.isrm.net/fotos/editor2/Nl26/sysrock2014_copy.pdf

JTC-1's First International Landslide Workshop on Physical Processes and Mechanisms of Precipitation-Induced Landslides, November 2014, Seoul, Korea, http://2014jtc-1workshop.org

7th International Congress on Environmental Geotechnics, 10-14 November 2014, Melbourne, Australia, www.7iceg2014.com

Waterproof Membranes 2014, 17 - 19 November 2014, Bonn, Germany, http://www.amiplastics.com/events/event?Code=C628#4423

GEOMATE 2014 Fourth International Conference on Geotechnique, Construction Materials + Environment, 19 - 21 Nov. 2014, Brisbane, Australia, www.geomate.org

International Symposium "Geohazards" Science, Engineering & Management, 20-21 November 2014, Kathmandu, Nepal, www.ngeotechs.org/ngs/index.php/geohazards-2014

6ο Πανελλήνιο Συνέδριο «Διαχείριση και Βελτίωση Παρακτίων Ζωνών», 24-27 Νοεμβρίου 2014, Αθήνα, Ίδρυμα Ευγενίδου, lhw@central.ntua.gr

7th International Conference on Scour and Erosion (ICSE-7), 2nd – 4th December 2014, Perth, Western Australia, http://www.2014icse.com

Underground Infrastructure & Deep Foundations UAE, 7-10 December 2014, Dubai, United Arab Emirates, enquiry@iqpc.ae, ujwal.nayak@iqpc.com, www.iqpc.com

2nd Arabian Tunnelling Conference and Exhibition Abu Dhabi, United Arab Emirates, 9-10 December 2014, www.atc2014.ae

Third Australasian Ground Control in Mining Conference 2014, Sydney, Australia, www.mining.unsw.edu.au/node/608

Proceedings of the Institution of Civil Engineers, Geotechnical Engineering, THEMED ISSUE 2015, Construction processes and installation effects, Editors: Benoît Jones, University of Warwick, UK and Stuart Haigh, University of Cambridge, UK, sarah.walker@ice.org.uk

IGS Chennai 2015 6th International Geotechnical Symposium on Disaster Mitigation in Special Geoenvironmental Conditions, January 21-23, 2015, IIT Mandras, Chennai, India, http://igschennai.in/6igschennai2015

Spritzbeton - Tagung 2015 / Shotcrete Conference and Exhibition, January 29-30, 2015, Congress Centre Alpbach, Austria, http://www.spritzbeton-tagung.com

Geosynthetics 2015, February 15 – 18, 2015, Portland, Oregon, USA, http://geosyntheticsconference.com

12th Australia New Zealand Conference on Geomechanics (ANZ 2015), 22-25 February 2015, Wellington, New Zealand, http://www.anz2015.com

GeoProc2015: International Conference on Coupled THMC Processes in Geosystems, 25-27 February 2015, Salt Lake City, USA, https://secureweb.inl.gov/geoproc2015

International Conference & Exhibition on Tunnelling & Underground Space 2015 (ICETUS 2015) Sustainable Transportation in Underground Space Development, 3 – 5 March 2015, Kuala Lumpur, Malaysia, http://icetus2015.iemtc.com

AFRICA 2015 - Water Storage and Hydropower Development for Africa, 10 to 12 March 2015, Marrakesh, Morocco http://www.hydropower-dams.com/AFRICA-2015.php?c_id=89

Third United Nations World Conference on Disaster Risk Reduction, 14 -18 March 2015, Sendai City Miyagi Prefecture Japan, http://www.wcdrr.org

16th African Regional Conference on Soil Mechanics and Geotechnical Engineering, April 27 to 30, 2015 in Hammamet, Tunisia, http://www.cramsg2015.org

ISP7-PRESSIO2015 1 to 2 May 2015, Hammamet, Tunisia, http://www.cramsg2015.org/isp7-pressio2015

13th ISRM International Congress on Rock Mechanics Innovations in Applied and Theoretical Rock Mechanics 10–13 May 2015, Montreal, Canada, www.isrm2015.com

Shale and Rock Mechanics as Applied to Slopes, Tunnels, Mines and Hydrocarbon Extraction, Special One day Symposium, May 12, 2015, Montreal, Quebec, Canada, www.isrm2015.com/Page/PageContent/ShaleSymposium

World Tunnel Congress 2015 and 41st ITA General Assembly: Promoting Tunnelling in South East European (SEE) Region, 22 - 28 May 2015, Dubrovnik, Croatia, http://wtc15.com

www.geotechnicalmonitoring.com/en/home-2

"Following the great success of the first edition of this course in 2014, sold out two months before the beginning of the course, with 100 participants from 27 countries and 24 partners, we are now pleased to announce the second edition of the "International Course on Geotechnical and Structural Monitoring" that will be held from 4th to 6th June 2015, again in the beautiful Tuscany. Based on our evaluations of the first edition, the course will include some new topics and new speakers, and more time for networking. The last day will be a workshop with lecturers given by leading experts from industry and academia, including John Burland, Michele Jamiolkowski and Elmo DiBiagio, and with interactive sessions. The workshop is intended to reinforce the vital contribution of monitoring to the success of engineering projects."

(John Dunnicliff & Paolo Mazzanti)

Geological processes and exploitation of our planet's resources continuously lead to potentially dangerous interactions with our lives. Monitoring the behaviour of the ground and of structures and infrastructure is essential for safety reasons, quality control, optimization of construction and reduction of costs and time in engineering practice. **Geotechnical and structural monitoring is crucial for a sustainable development.**

The course will focus on the words of wisdom by Dr. Ralph B. Peck "We need to carry out a vast amount of observational work, but what we do should be done for a purpose and done well."

Attendance at the course will be a great opportunity to establish a **valuable network with colleagues** from all over the world, to **meet manufacturers** and see displays of the **most recent and innovative instrumentation.**

The course will focus on the following main topics:

- Basic concepts of monitoring and planning
- Contact Monitoring methods
- Remote Monitoring methods
- Vibration Monitoring
- Offshore Monitoring
- Management, analysis and interpretation of data

A final **workshop** will be held the last day of the course with:

- Interactive sessions
- Case-histories, given by international leading experts
- Open forum

The course is intended for project managers and other decision-makers who are concerned with **management of RISK** during construction, geotechnical and structural engineers, end users, consultants, service providers, manufacturers and researchers working in following sectors:

- Large infrastructures
- Transportation
- Mining
- Oil and gas
- Land and water management
- Sensor and equipment manufacturers

For additional information contact:

secretariat@geotechnicalmonitoring.com
partnership@geotechnicalmonitoring.com
or visit our website at:
www.geotechnicalmonitoring.com

83rd ICOLD Annual Meeting & Congress Hydropower' 15, June 2015, Stavanger, Norway, www.icoldnorway2015.org

ISFOG 2015 3rd International Symposium on Frontiers in Offshore Geotechnics, Oslo, Norway, 10-12 June 2015, www.isfog2015.no

DMT 15 The 3rd International Conference on the Flat Dilatometer, Rome 15-17 June 2015, www.dmt15.com

ICGE 2015 International Conference in Geotechnical Engineering – Colombo-2015, 10 - 11 August 2015, Colombo, Colombo, Sri Lanka, http://www.slgs.lk/?p=564

China Shale Gas 2015 - an ISRM Specialized Conference, 6-8 September 2015, Wuhan, China, http://english.whrsm.cas.cn/ic/ic/201405/t20140509_120692.html

16th European Conference on Soil Mechanics and Geotechnical Engineering "Geotechnical Engineering for Infrastructure and Development", 13 - 17 September 2015, Edinburgh, UK, www.xvi-ecsmge-2015.org.uk

Workshop on Volcanic Rocks & Soils, 24 - 25 September 2015, Isle of Ischia, Italy, www.associazionegeotecnica.it

EUROCK 15 ISRM European Regional Symposium & 64th Geomechanics Colloquy, 7 – 9 October 2015, Salzburg, Austria, www.eurock2015.com

Environmental Connection Conference, February 15–18, 2015, Portland, Oregon, USA, www.ieca.org/conference/annual/ec.asp

European Conference in Geo-Environment and Construction, 26-28 November 2015, Tirana, Albania, Prof. Dr. Luljeta Bozo, lulibozo@gmail.com; luljeta_bozo@universitetipolis.edu.al

International Conference on Engineering Geology in New Millennium, 26-31 October 2015, New Delhi, India, http://isegindia.org/pdfs/1st%20circular-international-IAEG.pdf

6th International Conference on Earthquake Geotechnical Engineering, 2-4 November 2015, Christchurch, New Zealand, www.6icege.com

SEOUL 2015 - 25th World Road Congress Roads and Mobility – Creating New Value from Transport, 2–6 November, 2015, Seoul, Republic of Korea, http://www.aipcrseoul2015.org

The 15th Asian Regional Conference on Soil Mechanics and Geotechnical Engineering, 9-13 November 2015, Fukuoka, Japan, http://www.15arc.org

15th Pan-American Conference on Soil Mechanics and Geotechnical Engineering, 15 - 18 November 2015, Buenos Aires, Argentina, http://conferencesba2015.com.ar

VIII South American Congress on Rocks Mechanics, 15 - 18 November 2015, Buenos Aires, Argentina, http://conferencesba2015.com.ar

Sixth International Conference on Deformation Characteristics of Geomaterials IS Buenos Aires 2015, November 15th to 18th 2015, www.saig.org.ar/ISDCG2015

2015 6th International Conference Recent Advances in Geotechnical Engineering and Soil Dynamics, December 7-11,

2015, New Delhi (NCR), India, wason2009@gmail.com; wasonfeq@iitr.ernet.in, sharmamukat@gmail.com; mukutfeq@iitr.ernet.in, gvramanaiitdelhi@gmail.com, ajaycbri@gmail.com

Southern African Rock Engineering Symposium an ISRM Regional Symposium
5 January 2016, Cape Town, South Africa
http://10times.com/southern-african-rock

The Southern African Rock Engineering Symposium, organized by the International society for rock mechanics will take place on 5th January 2016 in Cape Town, South Africa. The conference will cover areas like Interdisciplinary Course Encompasses the Fields of Rock Mechanics, Structural Geology, Earthquake Seismology and Petroleum Engineering to Address a Wide Range of Geomechanical Problems That Arise During the Exploitation of Oil and Gas Reservoirs.

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GeoAmericas 2016
3RD PAN-AMERICAN CONFERENCE ON GEOSYNTHETICS
11-14 APRIL 2016 • MIAMI BEACH • USA

www.geoamericas2016.org

GeoAmericas 2016, the 3rd Pan-American Conference on Geosynthetics, will be held at the Lowes Hotel on South Beach in Miami, Florida. The 3rd Pan-American conference will continue the GeoAmericas tradition of excellence, providing a forum for engineers, practitioners and academe from the Americas to explore current and future potential applications for geosynthetics. It also offers an active marketplace for the promotion of geosynthetic products and technologies to users throughout the Americas.

GeoAmericas 2016 is developing a program to advance the knowledge and understanding of geosynthetics at every level, from novice to expert. All will be provided with an opportunity to gain and share knowledge. Considering the diverse range of interests and applications, the conference has chosen not to isolate a theme; rather, the event will facilitate learning and dialogue on the key issues faced by geosynthetic communities throughout the Pan-American region. We welcome transportation, mining, infrastructure, waste, water, and other relevant discussions with a focus on improving the quality and durability of our works through the application of geosynthetics.

To address the critical issues facing our industry from all perspectives, GeoAmericas 2016 will continue the tradition of making its calls in a somewhat unique format. This first call is made for proposals for technical sessions, short courses & training lectures. A call for Abstracts and Student Papers will be issued in early January 2015.

Contact us at:

GeoAmericas 2016
1934 Commerce Lane #4
Jupiter, FL 33458, USA
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Email: epeggs@minervatri.com
Website: GeoAmericas2016.org

ITA - AITES
WTC 2016
The World Tunnel Congress
Including NAT2016
SAN FRANCISCO

World Tunnel Congress 2016
Uniting the Industry
April 22-28, 2016, San Francisco, USA
http://www.wtc2016.us

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ISRM

Southern African Rock Engineering Symposium - an ISRM Regional Symposium
May 2016, Cape Town, South Africa

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84th ICOLD Annual Meeting, 16-20 May 2016, Johannesburg, South Africa, www.sancold.org.za/index.php/activities/icold-annual-meeting-2016

7th In-Situ Rock Stress Symposium 2016 - An ISRM Specialised Conference, 10-12 May 2016, Tampere, Finland, www.rs2016.org

GEOSAFE: 1st International Symposium on Reducing Risks in Site Investigation, Modelling and Construction for Rock Engineering - an ISRM Specialized Conference
25 – 27 May 2016, Xi'an, China

Contact

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NGM 2016 - The Nordic Geotechnical Meeting, 25 - 28 May 2016, Reykjavik, Iceland, www.ngm2016.com

EUROC 2016 - ISRM European Regional Symposium Rock Mechanics & Rock Engineering: From Past to the Future, 29-31 August 2016, Ürgüp-Nevşehir, Cappadocia, Turkey http://eurock2016.org

3rd ICTG
International Conference
on Transportation Geotechnics

4 - 7 September 2016, Guimaraes, Portugal
www.spgeotecnia.pt/cpgt

The Transportation Geotechnics International Conference series began under the auspices of ISSMGE-TC 3 and was initiated in 2008 at the University of Nottingham, UK, as an International event designed to address the growing requirements of infrastructure for societies. The 2nd International Conference on Transportation Geotechnics took place in 2012, at Sapporo, Japan, under the ISSMGE-TC202 that follows the TC-3 activities for the period 2009-2013. To continue the successful of these conferences and the output of ISSMGE-TC-202, the 3rd was scheduled for 2016, at Guimarães, Portugal. Following the previous one, the challenges addressed by this conference will include a better understanding of the interactions of geotechnics on roads, rails, airports, harbours and other ground transportation infrastructure with the goal of providing safe, economic, environmental, reliable and sustainable infrastructures. The 3rd ICTG will be composed of workshops and several types of sessions, as well as a technical exhibition, to better disseminations of findings and best practices. A special attention will be paid to the publication of all the peer review papers, some of them in specialised international journals. On behalf of the organizing committee I am honoured to invite you to the 3rd ICTG in the City of Guimarães, UNESCO World Heritage (September 4-7, 2016).

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EuroGeo 6 – European Regional Conference on Geosynthetics
25 – 29 Sep 2016, Istanbul, Turkey
www.eurogeo6.org

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ARMS 9
9th Asian Rock Mechanics Symposium
ISRM Regional Symposium
October 2016, Bali, Indonesia
rkw@mining.itb.ac.id

Contact Person: Dr Ridho Wattimena
Indonesian Rock Mechanics Society (IRMS)
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GeoAsia 6

6th Asian Regional Conference on Geosynthetics, 8-11 November 2016, New Delhi, India, uday@cbip.org

GeoAfrica 2017

The 3rd African Regional Conference on Geosynthetics, 9 – 13 October 2017, Morocco

11th International Conference on Geosynthetics (11ICG)

16 - 20 Sep 2018, Seoul South Korea

csyoo@skku.edu

ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

3-D printing of rocks and fossils

Summary

Geologists are using 3-D printing to study the pores within limestone reservoir rocks. A better understanding of the pore networks within the rocks could help industry get at more oil.

Iowa State University's Franek Hasiuk uses his GeoFabLab to print 3-D models for his geoscience research and teaching. Here, he shows a 3-D printed reservoir rock (left) and an idealized model of rock porosity.

Franek Hasiuk grabbed a little red ball and said it's not every day you pick up Mars.

But there it was, a Mars model about the size of a golf ball and just detailed enough to show Olympus Mons, a Martian volcano nearly 14 miles high and three times the height of Mt. Everest.

"You get a sense of how high it sticks up from the rest of the planet," said Hasiuk, an Iowa State University assistant professor of geological and atmospheric sciences and David Morehouse Faculty Fellow. "It's just spectacular."

That little globe is just one product of Hasiuk's Geological Fabrication Laboratory (or GeoFabLab), a narrow corner room in the basement of Iowa State's Science Hall. The lab specializes in 3-D scanning and printing -- as it says on the lab website, it's all about "making things geological!"

Hasiuk, who came to Iowa State two years ago from the oil and gas industry, said a research and teaching goal has been to find "projects that students could work on that would make them interesting to industry -- and employable."

When he worked in industry, Hasiuk used 2-D CT scans to study the pores within limestone reservoir rocks. It's a major industry challenge to understand fluid flow through the pore networks of rocks so oil can be extracted from the smallest pores.

When Hasiuk arrived on campus, he found researcher Joseph Gray and the CT tools at the Center for Nondestructive Evaluation. That led to 3-D scans and then 3-D prints of rock porosity.

"We're taking really small holes in rock and then printing them at magnification," Hasiuk said. "We're not getting perfect photocopying yet, but we're getting there."

With better scans, data management and 3-D prints, "We can make models of pore networks and see how fluids flow through them," he said. "Eventually, we'll get to the point of making predictions and increasing the accuracy of predictions. What geology does for the economy is reduce uncertainty when you need to get something from underground -- like oil and gas."

Hasiuk said the oil and gas industry is showing significant interest in the research project.

Communicating geology While printing the reservoir rocks, Hasiuk discovered something about the tools he was using:

"3-D printing is a great communication tool," he said. "You don't have to teach someone a shape. You can understand by touching."

And so he's also using the GeoFabLab's scanner and two 3-D printers (purchased with his faculty startup package and student computer fees) to print materials for geology classes.

As he wrote in a paper ("Making Things Geological: 3-D Printing in the Geosciences") published this summer by the Geological Society of America, "Geoscientists are some of the most prolific producers of three-dimensional (3-D) data. These data do not belong in our computers -- they belong in our hands."

"Importantly," he wrote, "3-D printing produces tangible objects that are obviously intuitive to students, non-geoscientists, and decision makers."

In his own classes, Hasiuk has printed plastic fossils, crystals, dinosaur bones and even the topography of Ames south of campus, including Jack Trice Stadium. To spread the word about 3-D printing for classrooms, he's made the data for about 100 of his 3-D models available on the Internet. And he's collaborated with the Science Education Resource Center at Carleton College in Northfield, Minn.

Hasiuk notes that it makes a lot of sense to replace fragile, $10 to $50 classroom specimens with 25-cent pieces of printed plastic. But that's not the first point he makes about the advantages of printing 3-D models for the classroom.

"These sort of things get people engaged," said Hasiuk, pointing to a T. rex skull with a moving jawbone that he printed in Iowa State cardinal and gold. "These are chompable, flexible fossils. Using this technology, the GeoFabLab can bring dead things to life."

Journal Reference

Franciszek Hasiuk. **Making things geological: 3-D printing in the geosciences**. *GSA Today*, 2014; 28 DOI: 10.1130/GSATG211GW.1

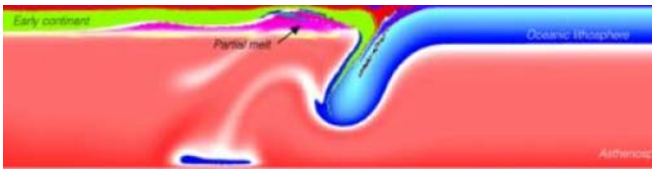
(Science Daily, September 15, 2014, Source: Iowa State University, http://www.sciencedaily.com/releases/2014/09/140915202814.htm)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΣΕΙΣΜΟΙ

New explanation for origin of plate tectonics: What set Earth's plates in motion?

Summary

Geologists have a new explanation for the origin of plate tectonics. Researchers suggest it was triggered by the spreading of early continents then it eventually became a self-sustaining process.



The image shows a snapshot from the film after 45 million years of spreading. The pink is the region where the mantle underneath the early continent has melted, facilitating its spreading, and the initiation of the plate tectonic process.

The mystery of what kick-started the motion of our earth's massive tectonic plates across its surface has been explained by researchers at the University of Sydney.

"Earth is the only planet in our solar system where the process of plate tectonics occurs," said Professor Patrice Rey, from the University of Sydney's School of Geosciences.

"The geological record suggests that until three billion years ago the Earth's crust was immobile so what sparked this unique phenomenon has fascinated geoscientists for decades. We suggest it was triggered by the spreading of early continents then eventually became a self-sustaining process."

Professor Rey is lead author of an article on the findings published in *Nature* on Wednesday, 17 September.

The other authors on the paper are Nicolas Flament, also from the School of Geosciences and Nicolas Coltice, from the University of Lyon.

There are eight major tectonic plates that move above Earth's mantle at rates up to 150 millimetres every year.

In simple terms the process involves plates being dragged into the mantle at certain points and moving away from each other at others, in what has been dubbed 'the conveyor belt'.

Plate tectonics depends on the inverse relationship between density of rocks and temperature.

At mid-oceanic ridges, rocks are hot and their density is low, making them buoyant or more able to float. As they move away from those ridges they cool down and their density increases until, where they become denser than the underlying hot mantle, they sink and are 'dragged' under.

But three to four billion years ago, Earth's interior was hotter, volcanic activity was more prominent and tectonic plates did not become cold and dense enough to spontaneously sank.

"So the driving engine for plate tectonics didn't exist," said Professor Rey said.

"Instead, thick and buoyant early continents erupted in the middle of immobile plates. Our modelling shows that these early continents could have placed major stress on the surrounding plates. Because they were buoyant they spread horizontally, forcing adjacent plates to be pushed under at their edges."

"This spreading of the early continents could have produced intermittent episodes of plate tectonics until, as the Earth's interior cooled and its crust and plate mantle became heavier, plate tectonics became a self-sustaining process which has never ceased and has shaped the face of our modern planet."

The new model also makes a number of predictions explaining features that have long puzzled the geoscience community.

Journal Reference

Patrice F. Rey, Nicolas Coltice, Nicolas Flament. **Spreading continents kick-started plate tectonics**. *Nature*, 2014; 513 (7518): 405 DOI: 10.1038/nature13728

(Science Daily, September 17, 2014, Source: University of Sydney, http://www.sciencedaily.com/releases/2014/09/140917131814.htm)

Signs in groundwater may help predict earthquakes six months in advance

Chemical spikes in water due to stress building up in the rocks could hold clues to forecasting tremors, scientists say.

In 1995, a power earthquake measuring 7.2 on the Richter scale devastated the city of Kobe, Japan, killing 6,430 people. Predicting earthquakes remains an inaccurate science. Photograph: Reuters/Corbis

Scientists searching for a way to predict earthquakes have uncovered the most promising lead yet, after uncovering tell-tale chemical spikes in groundwater up to six months before tremors struck.

Major earthquakes can kill hundreds of thousands of people, as in Haiti in 2010, but they are the only natural disaster that cannot currently be forecast. Some experts think a useful prediction of time, place and magnitude may be an impossible dream. Previously, scientists have examined radon gas leaks, heat maps and even unusual animal behaviour as possible earthquake indicators, without success (Operational Earthquake Forecasting / State of Knowledge and Guidelines for Utilization,

http://www.geos.ed.ac.uk/homes/imain/igmpapers/LAquila.pdf).

But now geologists taking weekly measurements of groundwater chemistry in northern Iceland over five years have discovered big shifts four to six months before two separate earthquakes in 2012 and 2013. The quakes were both significant in size – over magnitude five – and 47 miles from the sampling site.

"This does not mean we can predict earthquakes yet, but at the least we have shown something happens before earthquakes," said Prof Alasdair Skelton, at Stockholm University, Sweden, who led the research published in Nature Geoscience (Changes in groundwater chemistry before two consecutive earthquakes in Iceland, http://www.nature.com/ngeo/journal/v7/n10/full/ngeo2250.html). That is tantalising, as it means something is happening to the rocks before the earthquakes. We are highlighting groundwater chemistry as a promising target for future earthquake prediction studies."

The fact the chemical spikes were identified before two different earthquakes is significant, said Skelton, because it indicates they are not a mere coincidence. He said the chances of that were a hundred-thousand to one. The previous best evidence for groundwater changes was an analysis of Japanese spring water bottled before and after the huge 1995 Kobe earthquake, which killed 6,400 people. The Kobe water also revealed a chemical spike, but there was too little data to make a link to the tremor statistically convincing. The chemical changes are thought to occur as stress builds on the rocks before the earthquakes and creates small fractures which connect up different acquifers allowing them to mix.

Skelton said the next steps are to understand better exactly how the chemical spikes occur and then to see if these can be observed in other parts of the world. The rock in Iceland is of only one type, basalt, and it may be that in places where there is a mix of rock types the chemical changes will be even more marked, he said.

The new work was praised by other geologists. "The potential for predicting earthquakes has great importance, and great claims require strong evidence," writes Steven Ingebritsen, at the US Geological Survey and Michael Manga, at University of California, Berkeley, in a commentary in Nature Geoscience. "The new observations are sufficiently compelling to prompt further investigation."

Professor Ian Main, at the University of Edinburgh, Scotland, said caution was needed and the influence of other possible factors, such as shifting magma below the ground, needed to be assessed. "There is a long way to go (The IASPEI procedure for the evaluation of earthquake precursors, http://onlinelibrary.wiley.com/doi/10.1111/j.1365-246X.1997.tb06587.x/abstract) before observations such as these could be turned into operational tools for forecasting earthquake probabilities," he said. "Most geophysical and geochemical signals fluctuate all the time, so it is virtually inevitable that some areas will have signals coincident with earthquakes." The proof will be in making a successful future prediction, he said: "[Otherwise], this process is a bit like going into the bookies after a race and claiming you would have bet on the winning horse."

Main added: "Earthquake prediction, sufficiently reliable and accurate to justify an evacuation, has long been the 'holy grail' of seismology and it is likely to be difficult, if not impossible, to achieve." There are strong theoretical reasons why earthquakes may be inherently unpredictable, because large tremors can set off by relatively tiny – and therefore hard to distinguish – stresses in the rocks. But these reasons do not rule out the possibility that some reliable precursor signals may be found.

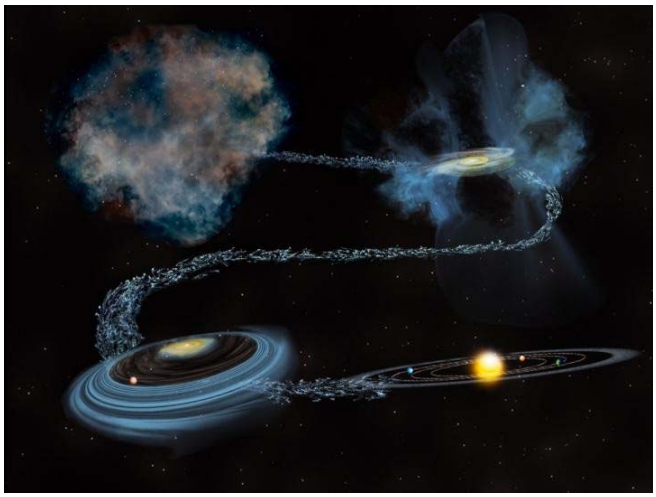
"In terms of what the public would understand by an earthquake prediction, the jury is still out," Main said.

(Damian Carrington / theguardian.com, Sunday 21 September 2014, http://www.theguardian.com/environment/2014/sep/21/scientists-predicting-earthquakes-advance)

Earth's water is older than the sun: Likely originated as ices that formed in interstellar space

Summary

Water was crucial to the rise of life on Earth and is also important to evaluating the possibility of life on other planets. Identifying the original source of Earth's water is key to understanding how life-fostering environments come into being and how likely they are to be found elsewhere. New work found that much of our solar system's water likely originated as ices that formed in interstellar space.



This is an illustration of water in our Solar System through time from before the Sun's birth through the creation of the planets.

Water was crucial to the rise of life on Earth and is also important to evaluating the possibility of life on other planets. Identifying the original source of Earth's water is key to understanding how life-fostering environments come into being and how likely they are to be found elsewhere. New work from a team including Carnegie's Conel Alexander found that much of our Solar System's water likely originated as ices that formed in interstellar space. Their work is published in *Science*.

Water is found throughout our Solar System. Not just on Earth, but on icy comets and moons, and in the shadowed basins of Mercury. Water has been found included in mineral samples from meteorites, the Moon, and Mars.

Comets and asteroids in particular, being primitive objects, provide a natural "time capsule" of the conditions during the early days of our Solar System. Their ices can tell scientists about the ice that encircled the Sun after its birth, the origin of which was an unanswered question until now.

In its youth, the Sun was surrounded by a protoplanetary disk, the so-called solar nebula, from which the planets

were born. But it was unclear to researchers whether the ice in this disk originated from the Sun's own parental interstellar molecular cloud, from which it was created, or whether this interstellar water had been destroyed and was re-formed by the chemical reactions taking place in the solar nebula.

"Why this is important? If water in the early Solar System was primarily inherited as ice from interstellar space, then it is likely that similar ices, along with the prebiotic organic matter that they contain, are abundant in most or all protoplanetary disks around forming stars," Alexander explained. "But if the early Solar System's water was largely the result of local chemical processing during the Sun's birth, then it is possible that the abundance of water varies considerably in forming planetary systems, which would obviously have implications for the potential for the emergence of life elsewhere."

In studying the history of our Solar System's ices, the team -- led by L. Ilsedore Cleeves from the University of Michigan -- focused on hydrogen and its heavier isotope deuterium. Isotopes are atoms of the same element that have the same number of protons but a different number of neutrons. The difference in masses between isotopes results in subtle differences in their behavior during chemical reactions. As a result, the ratio of hydrogen to deuterium in water molecules can tell scientists about the conditions under which the molecules formed.

For example, interstellar water-ice has a high ratio of deuterium to hydrogen because of the very low temperatures at which it forms. Until now, it was unknown how much of this deuterium enrichment was removed by chemical processing during the Sun's birth, or how much deuterium-rich water-ice the newborn Solar System was capable of producing on its own.

So the team created models that simulated a protoplanetary disk in which all the deuterium from space ice has already been eliminated by chemical processing, and the system has to start over "from scratch" at producing ice with deuterium in it during a million-year period. They did this in order to see if the system can reach the ratios of deuterium to hydrogen that are found in meteorite samples, Earth's ocean water, and "time capsule" comets. They found that it could not do so, which told them that at least some of the water in our own Solar System has an origin in interstellar space and pre-dates the birth of the Sun.

"Our findings show that a significant fraction of our Solar System's water, the most-fundamental ingredient to fostering life, is older than the Sun, which indicates that abundant, organic-rich interstellar ices should probably be found in all young planetary systems," Alexander said.

Journal Reference

L. Ilsedore Cleeves, Edwin A. Bergin, Conel M. O'D. Alexander, Fujun Du, Dawn Graninger, Karin I. Öberg, and Tim J. Harries. **The ancient heritage of water ice in the solar system**. *Science*, 26 September 2014: 1590-1593 DOI: 10.1126/science.1258055

(Science Daily, September 25, 2014, Source: Carnegie Institution, http://www.sciencedaily.com/releases/2014/09/140925141226.htm)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΠΕΡΙΒΑΛΛΟΝ

Απολιθώματα γιγάντιας αρκούδας βρέθηκαν στα Γρεβενά

Γιγαντιαία αρκούδα ζούσε πριν από τρία εκατομμύρια χρόνια στα Γρεβενά, όπου το παλαιοπεριβάλλον ήταν ευνοϊκό για την ανάπτυξη τέτοιων, τεράστιων σε μέγεθος, μορφών.

Άλλωστε, στη Μηλιά Γρεβενών έχουν βρεθεί και οι μεγαλύτεροι χαυλιόδοντες του κόσμου (5.02μ.) του μαστόδοντα Mammut borsoni, που καταχωρήθηκαν στο βιβλίο των ρεκόρ Γκίνες.

Αγριοθήριο (Agriotherium) είναι το επιστημονικό όνομα της γιγαντιαίας αρκούδας που ζούσε στην περιοχή, σύμφωνα με την αναπληρώτρια καθηγήτρια Παλαιοντολογίας του Τμήματος Γεωλογίας του Αριστοτέλειου Πανεπιστημίου Θεσσαλονίκης (Α.Π.Θ.) Ευαγγελία Τσουκαλά, η οποία μίλησε στο Διεθνές Συνέδριο για τη μελέτη της αρκούδας που διεξάγεται στη Θεσσαλονίκη. Η κα. Τσουκαλά αναφέρθηκε στην ανακάλυψη μίας πτέρνας από τον αριστερό ταρσό μιας γιγαντιαίας αρκούδας 3.000.000 ετών που βρέθηκε στην περιοχή.

«Ενδεικτικό του μεγέθους του ζώου είναι ότι η πτέρνα του που βρέθηκε είναι κατά 25% μεγαλύτερη από την αντίστοιχη μιας μεγάλης καφέ αρκούδας» επεσήμανε η καθηγήτρια, συμπληρώνοντας ότι, με την ανασκαφή, το αγριοθήριο εντοπίζεται για πρώτη φορά στην Ελλάδα. Όπως προέκυψε από τις επιστημονικές μελέτες, το συγκεκριμένο ζώο έζησε μαζί με τη μικρότερη αρχαϊκή αρκούδα (Ursus etruscus, κοινή προγονική μορφή της αρκούδας των σπηλαίων και της καφετιάς αρκούδας 1,5 εκατομμύρια χρόνια πριν) σε συνθήκες περιβάλλοντος πυκνής βλάστησης και πολλών νερών, με μεγαλύτερη θερμοκρασία από τη σημερινή.

(ΑΜΠΕ, 7 Οκτωβρίου, 2014)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΛΟΙΠΑ

7 Most Dangerous Places on Earth

From its churning, sometimes stormy atmosphere to its shifting tectonic plates, Earth can be a dangerous place. Earthquakes, floods and other natural disasters killed more than 780,000 people between 2009 and 2009, according to the UN International Strategy for Disaster Reduction Secretariat. Millions more were injured or displaced. No one knows how the next decade will shape out, but some areas have more reason to worry than others.

7 - Lake Nyos, Cameroon

A silent killer lurks beneath the surface of this West African lake. A pocket of magma deep below the lake bed leaks carbon dioxide into the lake above. Under the pressure of 650 feet (200 meters) of water, this carbon dioxide stays dissolved, much like the carbonation in a bottle of soda.

But on the night of August 21, 1986, the water in the lake abruptly turned over, and the now-depressurized carbon dioxide exploded upward like a shaken soft drink. The resulting carbon dioxide cloud rushed downhill, asphyxiating 1,700 people and thousands more animals. In the 15 miles (24 kilometers) of valleys below the lake, almost nothing survived.

Today, pipes are used to siphon carbon dioxide-rich water from the bottom of Lake Nyos. The pipes prevent carbon dioxide buildup, but that doesn't make Lake Nyos entirely safe, said George Kling, a University of Michigan geochemist who was on the team that originally investigated the 1986 disaster.

"We're keeping ahead of the game, but we're not drawing the gas down very quickly," Kling said. "That means that it still is a very dangerous lake."

6 - Naples, Italy

In 79 A.D., Mount Vesuvius blew its top, burying the ancient cities of Pompeii and Herculaneum. More than 50 subsequent eruptions and the eerie human-shaped cavities left behind in the volcano's ash haven't dissuaded people from populating the slopes of this volcano by the sea. The city of Naples lies at its base, and up to 650,000 people may live on its slopes, according to Guido Bertolaso, the head of Italy's civil protection agency. An impending eruption could force the evacuation of more than a million people.

Vesuvius isn't the only active volcano threatening this densely-populated area. The Mediterranean Sea off the coast of Italy is littered with volcanoes. The most worrisome, according to Bertolaso, is the resort island of Ischia. An eruption there would affect Naples and "could be worse than a hypothetical Vesuvius eruption," Bertolaso said.

5- Miami, Florida

No one can predict where a hurricane will hit next, but south Florida is always a reasonable bet. The U.S. Geological Survey estimates the southern tip of Florida can expect more than 60 hurricanes over a 100-year period. And in 2008, sustainability company Sustain Lane ranked Miami as the most risky city for natural disasters in the United States.

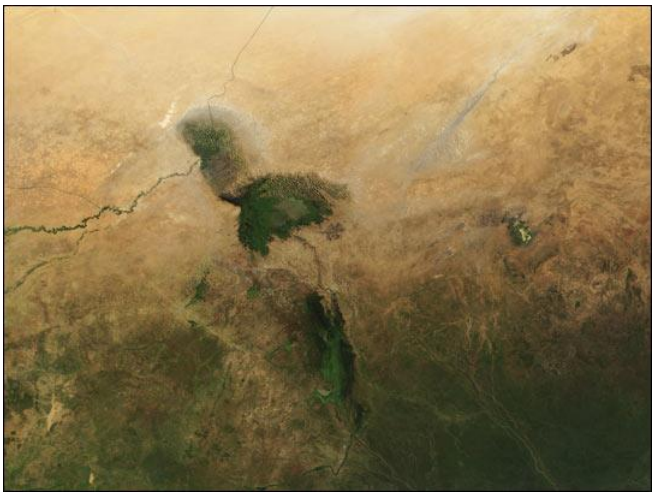
Hurricane destruction in Miami and the nearby Florida Keys is nothing new. In 1926, the Great Miami Hurricane destroyed or damaged every building in downtown Miami and killed at least 373 people, according to the Red Cross. Less than 10 years later, the Labor Day hurricane of 1935 killed 408 people in the Florida Keys. In 1960, Hurricane Donna roared through the Keys and South Florida, bringing with it 11 to 15-foot storm surges.

Perhaps the most famous hurricane to hit south Florida was 1992's Hurricane Andrew . Andrew blasted through Florida as a Category 4 storm with winds so high they broke measurement instruments. According to the National Oceanic and Atmospheric Administration, Andrew killed 23 people in the United States. The destruction totaled more than $26.5 billion.

4 - The Sahel region of Africa

Drought often doesn't get as much attention as other natural disasters, but it can be a killer. According to the United Nations Environmental Programme, more than 100,000 people died because of drought in the Sahel region of Africa from 1972 to 1984. Another 750,000 were unable to grow

their own crops and were completely dependent on food aid.



The arid Sahel region borders the Sahara Desert , stretching across northern Africa through Mauritania, Senegal, Mali, Niger, Burkina Faso, Nigeria, Chad, Sudan, Algeria, Ethiopia and Eritrea. According to the U.N., human exploitation of the area's limited water is causing desertification, raising the risk of future drought and famine.

3 - Guatemala

Central America gets hit by a triple threat of natural disasters: earthquakes, hurricanes and mudslides.

Along with the western coast of North and South America, Central America lies on the Ring of Fire, a seismically active loop that encircles the Pacific Ocean. Guatemala isn't the only country affected, but it's been hit hard: In 1976, a 7.5-magnitude earthquake killed 23,000 people, according to the USGS. Thanks to the country's mountainous terrain, landslides hampered transportation and rescue efforts.

The combination of topography and weather can be deadly as well. Heavy rains can saturate hillsides, leading to devastating mudslides. In 2005, the remnants of Hurricane Stan soaked Guatemala, El Salvador and southern Mexico, causing more than 900 mudslides. Entire villages were buried; one, Panabaj, was declared a cemetery after officials gave up hope of excavating the bodies of 300 missing villagers. The exact death toll is unknown, but some estimates suggest that up to 2,000 people lost their lives.

2 - Java and Sumatra, Indonesia

These two Indonesia islands face perhaps more natural disaster hazards than anywhere else. Droughts, floods, earthquakes, landslides, volcanoes and tsunamis all threaten Indonesia, and Java and Sumatra have the highest risk, according to the Center for Hazards and Risk Research at Columbia University.

The most famous disaster to hit Indonesia is the 2004 Indian Ocean tsunami , which killed an estimated 227,898 people after a 9.1-magnitude earthquake triggered the enormous wave. Indonesia was hardest hit among the affected Southeast Asian countries, with over 130,000 people confirmed dead.

But smaller disasters cause more regular suffering. Between 1907 and 2004 (before the tsunami), droughts killed 9,329 Indonesians, according to the Columbia University group. Volcanoes killed 17,945 people in the same time period, and earthquakes killed 21,856. One of the most famous eruptions in history, of the volcano Krakatoa, occurred in the Sunda Strait between the two islands. And as recently as this February, floods drove thousands of west Java residents from their homes, and a landslide in the village of Tenjolaya killed dozens.

1 - Istanbul, Turkey

No one knows when the North Anatolian Fault will rupture, but one thing is certain: It will rupture. The resulting earthquake could be very bad news for the 12.8 million people in Istanbul.

For the past century, earthquakes on the North Anatolian Fault in northern Turkey have been creeping westward. The last big quake happened in 1999, when a 7.6-magnitude temblor devastated the city of Izmit . The official death toll was around 17,000, but a 2004 estimate by Uni-

versity of Brasilia researcher Vasile Marza put the number at 45,000.

The next time the ground shakes, scientists expect that it will be even further west, just south Istanbul. A January 2010 study in the journal Nature Geosciences found that tensions along the fault are building and could trigger multiple small-to-moderate quakes. Or the fault could go all at once. In March, USGS geophysicist Tom Parsons told Nature that the chances of Istanbul being hit by a magnitude 7 or greater quake in the next 25 years are between 30 and 60 percent.

(Stephanie Pappas / OurAmazing Planet Contributor, July 18, 2011, http://www.livescience.com/30602-7-most-dangerous-places-earth-natural-disasters.html)

Οι 23 φωτογραφίες από δορυφόρο που μοιάζουν με έργα τέχνης

1/1/2014
Tulip Fields of Keukenhof
Lisse, Netherlands
52.271256°N 4.546365°E

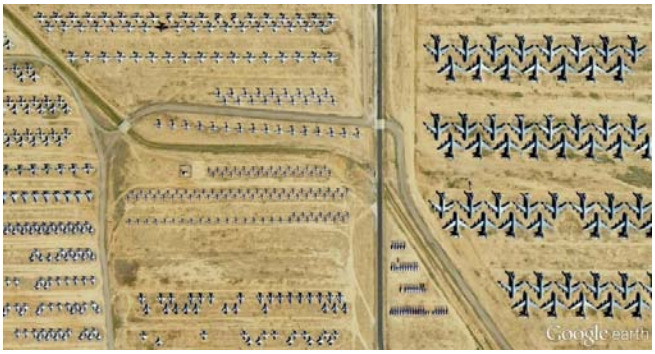
3/15/2014
Vineyards Huelva, Spain
37°42’12”N 6°36’10”W

5/12/2014
Our Lady of Almudena Cemetery
Madrid, Spain
40°25’10”N 3°38’26”W

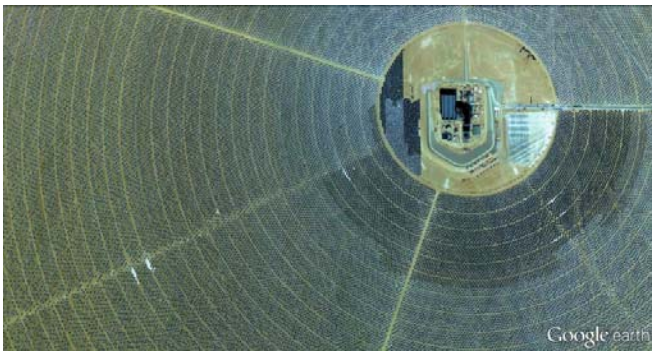
4/12/2014
Residential development
Killeen, Texas, USA
31.079844, -97.80145

6/15/2014
Pinecastle Bombing Range
Ocala National Forest, Florida, USA
29°10’25”N 81°49’18”W

9/18/2014
Davis-Monthan Air Force Base
Tucson, Arizona, USA
32°09’59”N 110°52’59”W



8/22/2014
Ivanpah Solar Power Facility
Ivanpah, California, USA
35.57°N 115.47°W



10/13/2014
Mount Taranaki
North Island, New Zealand
39°17’47”S 174°03’53”E

10/6/2014
Brighton Pier
Brighton, England, UK
50°48’59”N 0°08’14”W

9/30/2014
Erosion
Betsiboka River, Madagascar
15°48’55”S 46°16’13”E

6/17/2014
Cranberry Bogs
Carver, Massachusetts, USA
41°53’00”N 70°45’47”W

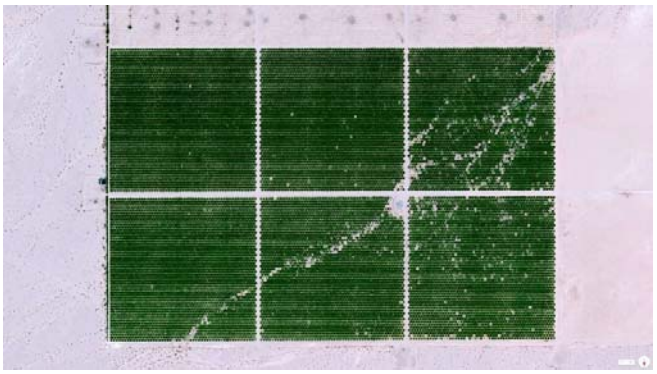
9/4/2014
Vineyards
Weinstadt, Germany
48°47’20.9”N 9°22’11.7”E

5/21/2014
Seaweed Farms
Nusa Lembongan, Indonesia
8°40.906’S 115°27.067’E

2/20/2014
Tent City
Mina, Saudi Arabia
21°24’48”N 39°53’36”E

9/22/2014
Turbine Interchange
Jacksonville, Florida, USA
30.253047949°, -81.516204357°

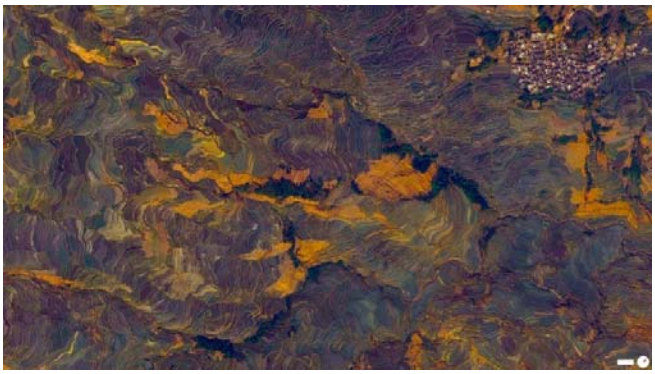
7/5/2014
Cadiz Ranch
Essex, California, USA
34.494638, -115.500469



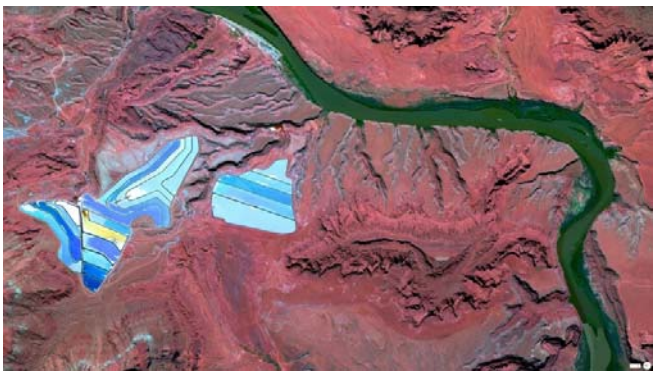
9/19/2014
Mir Mine
Mirny, Eastern Siberia, Russia
62°31’45.92”N 113°59’36.74”E

3/13/2014
Ciudad Nezahualcóyotl
Mexico City, Mexico
19°24’00”N 98°59’20”W

3/3/2014
Terraced rice paddies
Yuanyang County, Yunnan, China
23°09’32”N 102°44’41”E



3/9/2014
Settling ponds of Intrepid Potash mine
Moab, Utah
38°29’0.16”N 109°40’52.80”W



10/15/2014
Zaatari Refugee Camp
Mafraq, Jordan
32°17’44.4”N 36°19’25.5”E

4/28/2014
Port of Los Angeles
Los Angeles, California, USA
33°43’45”N 118°15’43”W

5/14/2014
Spreckles Beet Sugar Factory
Brawley, California, USA
32.905407, -115.565693

http://techit.gr/2014/10/oi-23-fotografies-apo-doruforo-pou-moiazoun-me-erga-technhs-eikones

Μαγικοί κύκλοι της Αφρικής: Νεράιδες-Επιστήμη 1-0

Αν και επιστρατεύθηκαν ακόμα και δορυφόροι, οι επιστήμονες αδυνατούν να λύσουν το αίνιγμα των μυστηριωδών κύκλων της Ναμίμπια.

Αεροφωτογραφία με τους μυστηριώδεις κύκλους των νεράιδων της Ναμίμπια. Εκατομμύρια τέτοια αινιγματικά μπαλώματα υπάρχουν σε ερημικές εκτάσεις ή σε λιβάδια με ποώδη βλάστηση. Photo: Dr. Stephan Getzin/UFZ.

ΟΙ ΜΥΣΤΗΡΙΩΔΕΙΣ κύκλοι που εμφανίζονται εδώ και καιρό στα εδάφη της Ναμίμπια, στη ΝΔ Αφρική, επανήλθαν στο προσκήνιο καθώς η εξήγηση που είχε δοθεί, ότι δηλαδή ήταν σχηματισμοί από υπόγειες αποικίες τερμιτών, κατέρρευσε, όταν διαπιστώθηκε ότι κάτι τέτοιο δεν ευσταθεί.

Πιο συγκεκριμένα, ο καθηγητής βιολογίας Νόρμπερτ Γιούργκενς, του Πανεπιστημίου του Αμβούργου, πρότεινε ότι οι μυστηριώδεις κύκλοι είναι στην πραγματικότητα το αποτέλεσμα της εξελιγμένης οικολογικής μηχανικής των τερμιτών *Psammotermes allocerus*.

Οι τερμίτες αυτοί τρώνε το γρασίδι και κατόπιν τρυπώνουν μέσα στη γη δημιουργώντας έναν κύκλο. Ο χωρίς βλάστηση κύκλος δεν μπορεί να συγκρατήσει το νερό, το οποίο διηθείται μέσα από το αμμώδες έδαφος και συσσωρεύεται σε υπόγειες δεξαμενές, επιτρέποντας στο έδαφος που είναι από πάνω να παραμένει υγρό ακόμα και κάτω από τις ξηρότερες συνθήκες.

Τα αγρωστώδη που αναπτύσσονται στις άκρες του κύκλου οφείλουν την ανάπτυξή τους στα αποθηκευμένα υπόγεια ύδατα. Οι τερμίτες τρώνε σιγά-σιγά τα αγρωστώδη με αποτέλεσμα να αυξάνεται σταδιακά το μέγεθος του κύκλου.

Με άλλα λόγια, οι τερμίτες της άμμου καλλιεργούν τις δικές τους πηγές τροφής και νερού, δημιουργώντας ένα τοπικό οικοσύστημα κατά τρόπο παρόμοιο με τον κοινό κάστορα.

Η περίπλοκη αυτή θεωρία φάνηκε να εξηγεί το γιατί μερικοί από αυτούς τους κυκλικούς θύλακες είναι μικροί, ενώ άλλοι φτάνουν σε διάμετρο τα 20 μέτρα, δεν εξηγούσε όμως την παρουσία των αινιγματικών κυκλικών σχηματισμών σε τελείως άγονο έδαφος.

Κατέρρευσε άδοξα

Η θεωρία του Γιούργκενς δεν ευδοκίμησε πολύ, καθώς αντιτάχθηκε σε αυτήν ο Γουόλτερ Τισίνκελ, βιολόγος του Πανεπιστημίου της Φλόριδας. Ο Τισίνκελ, που ερεύνησε επιτόπου τους κύκλους, αμφισβήτησε τα πορίσματα του Γιούργκενς, καθώς δεν εντόπισε πουθενά αποικίες τερμιτών.

Ο καθηγητής Γουόλτερ Τισίνκελ επιθεωρεί έναν από τους κύκλους των νεράιδων, αναζητώντας την αιτία του παράξενου αυτού φαινομένου. Photo: Walter Tschinkel.

Ο Γιούργκενς αντέδρασε λέγοντας ότι ο Τισίνκελ έψαχνε λάθος τερμίτες. Το είδος *Psammotermes allocerus*, είπε ο Γερμανός καθηγητής, δεν δημιουργεί αναχώματα ή φωλιές πάνω από το έδαφος, αλλά αντίθετα κρύβεται βαθιά μέσα σε αυτό χωρίς να αφήνει ίχνη στην άμμο.

Επειδή όμως δεν κατάφερε να την στηρίξει με αποδείξεις, η θεωρία του κατέρρευσε.

Την ίδια τύχη είχε και η θεωρία που έλεγε ότι δημιουργούνται από ανεμοστρόβιλους, καθώς το πλήθος, η διάταξη και το σχήμα τους δεν επιτρέπει κάτι τέτοιο.

Έτσι, η μόνη ονομασία που τους ταιριάζει είναι αυτή που έχουν δώσει οι ντόπιοι που τους αποκαλούν "αποτυπώματα των θεών" ή "κύκλους των νεράιδων".

Οι κύκλοι, που όπως είπαμε έχουν διάμετρο από 2 έως 20 μέτρα, βρίσκονται σε μια ζώνη της ενδοχώρας με έκταση 160 χιλιομέτρων, η οποία βρίσκεται νότια της Αγκόλας σε απόσταση περίπου 2.400 χιλιόμετρα. Το κοντινότερο χωριό απέχει πάνω από εκατό μίλια.

Οι κύκλοι αναφέρθηκαν για πρώτη φορά το 1971 και έκτοτε έχουν μελετηθεί από διάφορες αποστολές, χωρίς όμως να έχει βρεθεί έως τώρα η αιτία που τους δημιουργεί.

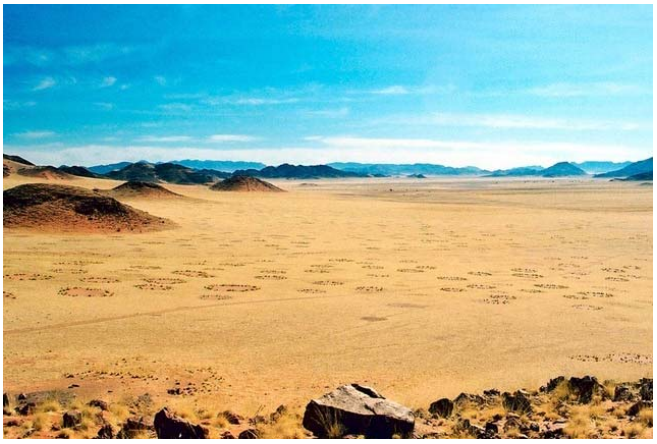
Οι φυλή των Χίμπα, που ζει κοντά στο μέρος αυτό, πιστεύει ότι τους κύκλους τους δημιουργεί η φλογερή ανάσα ενός δράκου που ζει στα έγκατα της γης. Η ανάσα του δημιουργεί πύρινες φυσαλίδες που καίνε τη βλάστηση μέσα στους σχεδόν τέλειους κύκλους.

Άλλοι, με πιο περιορισμένη φαντασία, λένε ότι τους κύκλους τους δημιουργούν τα ραδιενεργά υλικά που υπάρχουν στο χώμα ή οι τοξικές ουσίες που εκκρίνονται από την *Euphorbia Damara*, ένα δηλητηριώδες ενδημικό φυτό.

Κυκλικοί σχηματισμοί στην έρημο της Ναμίμπια. Photo: George Steinmetz.

Χιλιάδες κύκλοι νεράιδων στο NamibRand Nature Reserve. Photo: AAAS/Science.

Στρουθοκάμηλοι σε περιοχή της ερήμου Καλαχάρι στη Ναμίμπια. Photo: BBC.

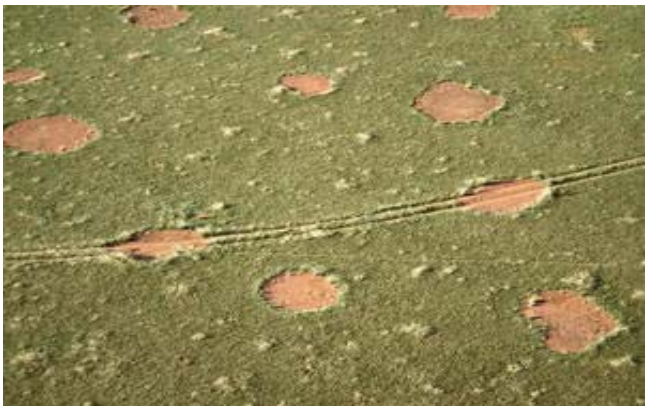


Η εμφάνιση των κύκλων των νεράιδων σε ερημικές περιοχές της Ναμίμπια προβληματίζει τους επιστήμονες εδώ και χρόνια. Photo: Flickr.

Κοντινή άποψη ενός κύκλου των νεράιδων. Photo: Hennie Rautenbach/Flickr.

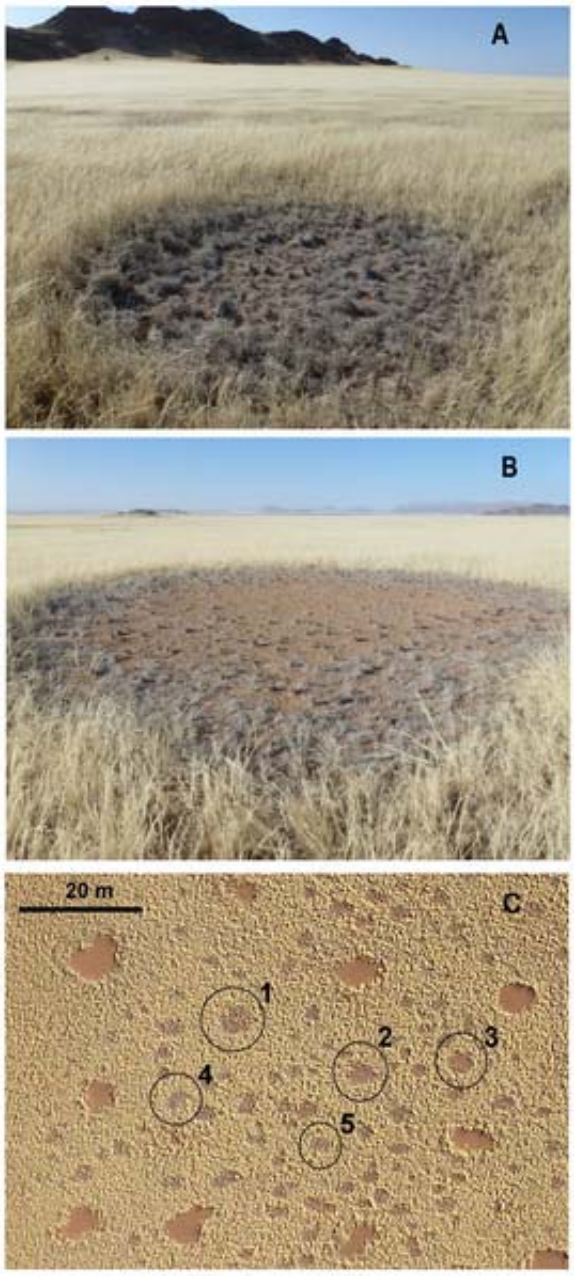
(21 Μαΐου 2014, www.youmagazine.gr/wordpress/2014/05/mysterious-fairy-circles-of-namibia-28187)

Οι μυστήριοι κύκλοι Νεραϊδών της Ναμίμπια



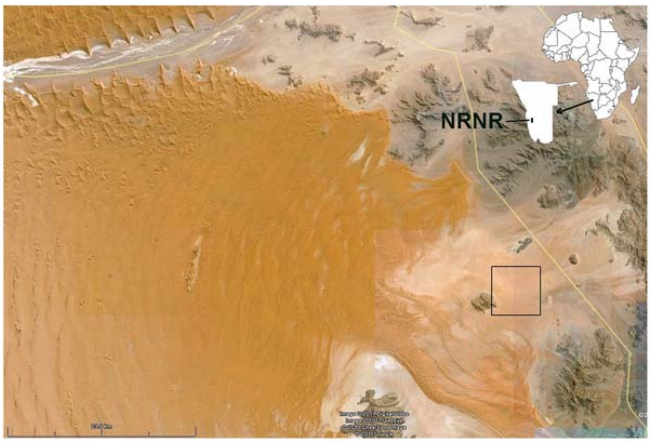
Στο ανατολικό άκρο της Ναμίμπια ερήμου της νοτιοδυτικής Αφρικής υπάρχει ένα μυστηριώδες φαινόμενο που ονομάζεται "κύκλοι νεράιδων" σχεδόν κυκλικά άγονα μπαλώματα μέσα σε μια αραιή μήτρα μικρών βραχύβιων ειδών χλόης...Στη Ναμίμπια της νοτιοδυτικής Αφρικής, τα αραιά λιβάδια που αναπτύσσονται στα βαθιά αμμώδη χώματα κάτω από τις βροχοπτώσεις μεταξύ 50 και 100 χιλ. το χρόνο από χιλιάδες σχεδόν-κυκλικά γυμνά σημεία, συνήθως περιβάλλονται από ένα ψηλότερο γρασίδι. Οι αιτίες αυτών των λεγόμενων «κύκλων νεραϊδών» είναι άγνωστη, αν και ένας αριθμός υποθέσεων έχουν προταθεί.

Ο Walter Tschinkel, ένας κρατικός καθηγητής Πανεπιστημίου της Φλώριδας της βιολογικής επιστήμης, πρόσφατα δημοσίευσε ένα έγγραφο που δημοσιεύτηκε στο έγκυρο περιοδικό PLoS One για τούς λεγόμενους « κύκλους νεραϊδών," παράξενες κυκλικές κηλίδες που συνήθως περιβάλλονται από έναν δαχτυλίδι πιο ψηλής χλόης στο τοπίο της Ναμίμπια.



Οι κύκλοι εμφανίζονται σε διάφορα μεγέθη από μικροί ως και μεγάλοι. Ο Tschinkel διαπίστωσε ότι οι μικρότεροι κύκλοι, περίπου 2 μέτρα πλάτος, προκύπτουν και εξαφανίζονται κατά τη διάρκεια ενός 24-ετή κύκλου, και οι μεγαλύτερα, περίπου 12 μέτρα πλάτος, θα εξαφανιστούν σε περίπου 75 χρόνια. Κατέληξε στα συμπεράσματά του μετά από τέσσερα έτη δορυφορικών εικόνων και να παρεκτείνει τις διάρκειες ζωής των κύκλων από τα στοιχεία.

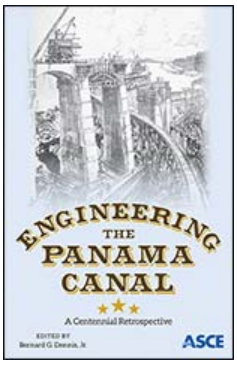
Το Google Earth δείχνει τη θέση των χρησιμοποιούμενων φωτογραφιών το 2004 και 2008 από δορυφόρο.



Η εμφάνιση και εξαφάνιση των κύκλων επιβεβαιώθηκε από δορυφορικές εικόνες που ελήφθησαν 4 χρόνια (2004, 2008). Η συχνότητα των γεννήσεων και των θανάτων ως μέρος του συνολικού πληθυσμού των κύκλων επέτρεψε στον υπολογισμό ενός κατά προσέγγιση ποσοστού κύκλου εργασιών, και από αυτό, μια εκτίμηση της διάρκειας ζωής κύκλων. Η διάρκεια ζωής εμφανίστηκε να ποικίλλει με το μέγεθος κύκλων, με τους μικρούς κύκλους που υπολογίζουν κατά μέσο όρο περίπου 24 έτη, και οι μεγαλύτεροι από 43 ως 75 έτη.

(http://anekshghta.blogspot.gr/2013/04/blog-post_8214.html)

ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ



Engineering the Panama Canal
A Centennial Retrospective

Edited by Bernard G. Dennis, Jr.

Proceedings of sessions honoring the 100th anniversary of the Panama Canal at the ASCE Global Engineering Conference 2014, held in Panama City, Panama, October 7-11, 2014. Sponsored by the History and Heritage Committee of ASCE

The history of the Panama Canal began nearly 500 years ago with the discovery by the Spanish of the isthmus between the oceans. Almost 400 years with several failed attempts would pass before the canal finally opened to boat traffic in August, 1914. This collection of nine papers presents the lives and experiences of the engineers and planners who struggled for decades to get the canal accepted, funded, built, and launched in order to ensure its successful operation during the last 100 years.

Topics include: early British and French efforts to construct a canal; building the canal and the Gatun Dam; lives of the engineers who worked on the canal; and the 1915 Panama-Pacific Exposition celebrating the completion of the canal.

This collection will be of interest to engineers, students, historians, and anyone interested in the building of this engineering landmark.

(ASCE, 2014)

ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ

International Society for Soil Mechanics and Geotechnical Engineering

http://www.issmge.org/en/resources/issmge-bulletin/676-vol-8-issue-5-october-2014

Κυκλοφόρησε το Τεύχος 5 του 8ου Τόμου του ISSMGE Bulletin (Οκτωβρίου 2014) με τα παρακάτω περιεχόμενα:

- Research Highlights : The GeoEngineering Centre at Queen's - RMC
- Report from Board-level Committee : Awards Committee (AWAC)
- Report from Member Society : New Zealand Geotechnical Society
- TC Corner : TC106 Unsaturated Soils
- Young Members' Arena : Geothermal Energy for Heating and Cooling: Full-Scale Testing and Numerical Modelling
- Major Project – Design and Construction of a Cement Stabilised-Shored Reinforced Soil Wall
- Conference Report : All-Russian Conference with International Participations
- NEWS
- Obituary - Prof. Dr. Nguyen Truong Tien
- The XV PanAmerican Conference on Soil Mechanics and Geotechnical Engineering
- Event Diary
- Corporate Associates
- News from Corporate Associates : Projects from Hayward Baker
- Foundation Donors

www.geoengineer.org

Κυκλοφόρησε το Τεύχος #116 του **Newsletter του Geoengineer.org** (Οκτωβρίου 2014) 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).

http://www.ita-aites.org/en/component/acymailing/archive/view/mailid-93?key=BKpPWOQX&subid=1894-74d7627ed3e51b67271afdd9255b5891&tmpl=component

Κυκλοφόρησε το Τεύχος 55 (Οκτωβρίου 2014) με τα παρακάτω περιεχόμενα:

- Message from SØREN DEGN ESKESEN, ITA President
- ITA at the UN climate change summit in New York
- Development of the ITA Young Members Group
- WTC 2015 preparation is in full swing
- Visit to ITA Prime Sponsors
- Photos of WTC 2014 are available
- Obituaries
- Preparation for WTC 2016
- 2014 International Tunnelling Awards
- TAC Conference in Vancouver
- Success for the Tunnel Expo Turkey
- Arabian Tunnelling Conference and Exhibition
- Expo Tunnel," Innovation in the construction of underground works", 23-24 October 2014, Bologna, Italy

www.geojournal.com.au

Κυκλοφόρησε το Σεπτεμβρίου 2014 του Geofabrics Journal (semi-annual publication providing case studies, technical articles, testing updates, and more) με τα παρακάτω περιεχόμενα:

- Marc Amtsberg, John Buckley and Chris Lane "Research and Analysis of Geosynthetics For a Tailings Storage Application".
- Preston Kendall, Charmaine Y T Cheah and Richard Austin "Installation Durability of Revetment Geotextiles".
- Daniel Gibbs and Richard Austin "Durability of Polyester Geotextiles Subjected To Outdoor and Accelerated Weathering".
- Richard Austin, Daniel Gibbs and Preston Kendall "Geomembrane Protection Using Cushioning Geotextiles".

- Daniel Gibbs and Will Gates "A Test Method To Determine Expected GCL Porosity Under Specific Site Conditions".
- Preston Kendall, John Buckley and Richard Austin "Geosynthetic Clay Liner Overlap Performance and Testing".
- What is the Geosynthetic Centre of Excellence?

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