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ARTIGO DA SEMANA

<http://phys.org/news/2014-12-fossil-supervolcano-italian-alps-deep.html>

Fossil supervolcano in Italian Alps may answer deep mysteries around active supervolcanoes
10 hours ago by Margaret Allen



Jim Quick studying geologic map

There's nothing subtle about the story told by the rocks in northern Italy's Sesia Valley. Evidence of ancient volcanic activity is all around, says geologist and volcanologist James Quick, Southern Methodist University, Dallas.

But the full story is much less obvious, Quick notes.

Quick led an international team that in 2009 announced they had discovered a 282-million-year-old fossil supervolcano in Sesia Valley. The find was the result of nearly two decades of geological research in the valley and its surrounding mountains.

The discovery has attracted scientific attention worldwide for its unprecedented view of a supervolcano's internal plumbing to a depth of 15.5 miles.

But that's not the end of the story—rather the beginning, says Quick, a professor in SMU's Roy M. Huffington Department of Earth Sciences in Dedman College of Humanities and Sciences.

The supervolcano holds clues—and ultimately answers—to critical scientific questions about the processes by which volcanoes erupt. "I am certain that continued study of this unique geologic exposure will reveal significant insight into the operation of active supervolcanoes," he says.

There are six active supervolcanoes in the world, including Yellowstone, Long Valley and Valles in the United States.

Volcanic plumbing, normally hidden from examination deep within the earth, is the internal geological structure through which lava migrates from the earth's mantle, up through the crust, to ultimately explode.

Volcanic plumbing and the processes within it remain matters of speculation, as volcanologists explore how lava forms and traverses through the earth.

News of a supervolcano initially sparked alarm

Supervolcanoes are one of the most potentially violent events in the world. They erupt hundreds of cubic miles of lava and ash, and have caused catastrophic changes in global climate.

Sesia Valley's supervolcano last erupted 282 million years ago, when it erupted more than 186 cubic miles of molten rock, ash and gas. The discovery by Quick and scientists from the University of Trieste made headlines worldwide in 2009. Sesia Valley residents were alarmed.

"They held a big town meeting in the largest of the communities, Borgosesia, and more than 500 people came from all over the valley,"

Quick says. "People were extremely worried the volcano would erupt again."

The scientists reassured residents they had nothing to fear. A fossil, the supervolcano no longer poses a danger.

Supervolcano is a super attraction for its scientifically unique features

Now its rocks are a popular destination for scientists, college students, villagers, tourists and school groups. Proud residents enthusiastically brand many of the valley's events and activities with their supervolcano identity.



Sesia Valley mountains

Even acclaimed Italian winemaker Cantalupo in 2013 honored the unique volcanic origins of its Sesia Valley grapes by labeling its Christmas wine with a painting of the exploding supervolcano.

The supervolcano also is a central feature of the new Sesia-Val Grande Geopark, recently designated by the U.N.'s UNESCO agency. Residents of the Piedmont region's Sesia Valley, with diverse history and cultures, joined forces after the discovery was announced to pursue the coveted UNESCO geopark status. One of only 100 geoparks in the world, Sesia-Val Grande Geopark spans tens of thousands of acres and more than 80 Alpine communities.

Chaotic riverbed blocks are key to solving volcanic rock puzzle

Rock strata of the Sesia Valley supervolcano are exposed along the banks of the Sesia River for 22 miles, sitting sideways like a tipped-over layer cake. In some places, the rocks protrude haphazardly from the sides of mountains; in other places they are obscured beneath dense forest, roads, bustling villages, fields and pastures, outdoor sports locales and tourist destinations.

Some of the supervolcano's deepest sections serve as a backdrop for Varallo, one of many communities in the Alpine valley.

Granite boulders littering the bed of the Sesia River were formed in the supervolcano's magma chamber.

Atop a hill overlooking Varallo, more than 40 chapels of the 15th century world-famous monumental religious complex Sacro Monte di Varallo were built on the furnace that powered the volcanic system.

So how did an entire valley not see an ancient fossil supervolcano until now?

Like an ant looking at an elephant, it's difficult to see something so gigantic for what it really is. In the United States, for example, it's only in about the last 30 years that geologists deciphered that Yellowstone is a supervolcano.

Scientists have known for more than a century, however, about the presence of volcanic rocks in Sesia Valley.

That's what drew Quick to the area in 1989. He sought insight into the processes in the deep crust that influence eruptions. What Quick found kept him coming back every summer for 16 years, including as head of the Volcano Hazards Program for the U.S. Geological Survey.

Quick's quest made him the first scientist in more than 50 years—building on the work of Italian geologist Mario Bertolani before World War II—to methodically tramp every mile of the steep mountainsides, sometimes with colleagues, often alone, to extensively identify and map the valley's rocks.

Years of intrepid geological work yield a supervolcano hiding in plain sight

Quick endured pounding rain, fierce lightning, poisonous snakes, mosquitos, treacherous topography, slippery waterfalls and unexpected sheer drop-offs. More than once he feared for his life.



Rock pile

"Working in the mountains there I was frequently terrified," Quick said recently, during one of his frequent treks to the valley. "I'd wonder, is this the next traverse that claims my life? I had many frightening experiences. The vegetation looks thick, but underneath the canopy it's easy to walk, except there are lots of cliffs hidden by the trees. Another problem—locating your position; because you can't look out and see the topography. We started this before GPS, doing it old school, by triangulation, reading the map, carefully locating where we were, and using altimeters."

Summer 2005 brought an unexpected breakthrough.

Quick was invited by his Italian colleague to see some puzzling rocks in the riverbed of the Sesia River in hopes he could identify them. Upon seeing the chaotic assemblage, Quick recognized the rocks were gigantic blocks torn from the rim of the volcano and mixed with volcanic ash during the eruption—an assemblage geologists call a megabreccia.

In 2009, following additional work to confirm the discovery, Quick and his team announced their discovery in the scientific journal "Geology." They estimated the mouth of the volcano when it was active would have been at least eight miles in diameter, although its true size will never be known because much of it is covered by younger sedimentary deposits of the Po Plain.

Fossil supervolcano sits against ancient boundary separating Africa, Europe

In its youth, Sesia Valley's supervolcano was inland on the supercontinent of Pangea. When Pangea began to break up into smaller continents more than 200 million years ago, the supervolcano was stranded on the coast of what we now call Africa.

About 20 million years ago, another tectonic shift sent Africa colliding into southern Europe. The coastal edges of both continents were heaved upward, creating a massive uplift – the Alps.

The Sesia Valley supervolcano, in the process, was tilted sideways and shoved upward, exposing its plumbing.

Today the supervolcano is a mecca for geologists not only for its volcanic story, but as one of the best samples of the earth's mantle exposed at the surface.

Calling it the "Rosetta Stone" of supervolcanoes, Quick says the Sesia Valley fossil supervolcano ultimately could solve the mystery,

"How does magma build up in the crust in the run up to a supereruption?"

Quick honored for scientific achievements

In 2010 the Italian Geological Society awarded Quick the Capellini Medal, presented to foreign geoscientists for a significant contribution to Italian geology.

In 2013, Quick was named a Fellow of the American Association for the Advancement of Science. Along with his Italian colleague, Silvano Sinigoi, Quick also was awarded honorary citizenship of Borgosesia, the highest award given to civilians by the largest city in the Sesia Valley.

"The discoveries in the Sesia Valley demonstrate the value of supporting basic research," says Quick, who came to SMU in 2007 after a 25-year scientific career with USGS. Quick serves also as associate vice president for research and dean of graduate studies at SMU.

NEWS METEORITICA DA SEMANA

http://www.space.com/27959-space-diamonds-meteorite-sutters-mill.html?adbid=10152496698126466&adbpl=fb&adbpr=17610706465&cmpid=514630_20141210_37044117

Space Diamonds in Gold Country: California Meteorite's Secrets Revealed

by [Elizabeth Howell](#), SPACE.com Contributor | December 10, 2014 08:00am ET



NASA Ames and SETI Institute meteor astronomer Peter Jenniskens collected fragments of the Sutter's Mill meteorite fall on April 24, 2012, two days following the fall, the second recovered find.

Credit: NASA Ames/Eric James

[View full size image](#)

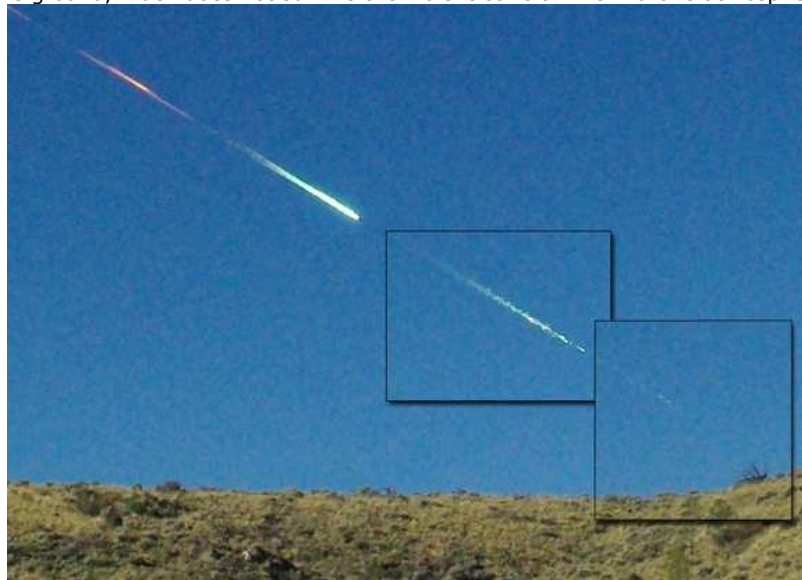
A meteorite that crashed down in California's gold country is showing off treasures of a different sort: small diamonds that could tell scientists more about the insides of asteroids.

The [Sutter's Mill meteorite](#) smashed into the ground on April 22, 2012, after a fiery entry that caught the attention of professional and amateur observers alike. A scientific team raced against rain to pick up meteorite fragments before water polluted the samples. Their efforts helped to produce a cosmic jackpot.

Embedded in part of the meteorite were 10-micron diamond grains — much smaller than what is used in diamond rings. But their diminutive size is still bigger than what is usually found in meteorites. The finding hints at what could have existed in the parent cosmic body that eventually broke apart and produced the Sutter's Mill meteoroid before the fragment slammed into Earth's atmosphere.

[[Photos: Fireball Drops Meteorites on California](#)]

"Sutter's Mill gives us a glimpse of what future NASA spacecraft may find when they bring back samples from a primitive asteroid," lead researcher Peter Jenniskens, who holds dual affiliations at the SETI Institute and at NASA's Ames Research Center, [said in a statement](#). "From what falls naturally to the ground, much does not survive the violent collision with Earth's atmosphere."



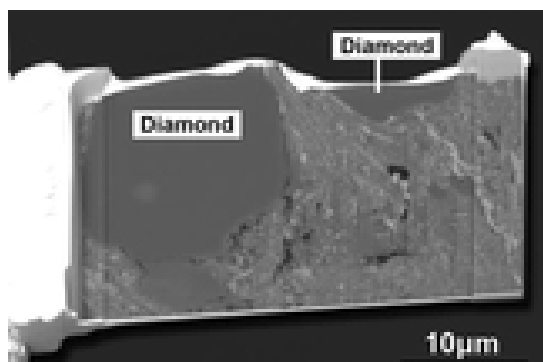
A composite image showing how the Sutter's Mill meteorite fell in California in April 2012.

Credit: L. Warren; composite by P. Jenniskens/NASA Ames/SETI

[View full size image](#)

Diamonds weren't all that researchers found. More fragments revealed isotopes of an element called chromium. The different types of chromium reveal that at least five stars sent material to the young solar system about 4.5 billion years ago, with some of the materials still sticking around in the meteorite, scientists found.

"The formation of the solar system did not fully erase and homogenize these signatures, and Sutter's Mill provides the clearest record yet," Qing-Zhu Yin, the Sutter's Mill Meteorite Consortium lead in isotope and trace element geochemistry, said in the same statement.



A secondary electron image revealing diamond crystals inside a fragment of a meteorite that fell in Sutter's Mill, California.

Credit: NASA Johnson/M. Zolensky

[View full size image](#)

The small body had a complicated history after that, with liquid water permeating some fragments (producing minerals such as calcium and magnesium carbonate). This could have been an indication of radiation in the meteorite's parent body, which heated ice beyond the melting point.

Other unusual elements — such as a calcium sulfide called oldhamite — also indicate heating in the parent body, as well as in areas that were not heated at all. Heating also came when the fragment was sailing on its own. Sometime in the past 100,000 years, the meteoroid was heated up to at least 572 degrees Fahrenheit (300 degrees Celsius). This heating could have happened during the entry into Earth's atmosphere, the researchers said.

"I don't know of any similar meteorites that contain both heated and unheated materials," said team member Mike Zolensky, a space scientist at NASA's Johnson Space Center in Houston.

The heated portions caused other changes inside the meteorite's interior, such as the removal of volatile organic compounds. Scientists also managed to track down amino acids (protein building blocks) inside the meteorite.

Thirteen papers based on the findings were recently published in the journal *Meteoritics and Planetary Science*.

AMBIENTE BRASIL

12 / 12 / 2014 [Negociações climáticas se aceleram em Lima](#)

O texto final deve deixar a via aberta para discutir, durante a COP21, em Paris, de que forma serão reduzidas as emissões de carbono para limitar a 2º C a elevação da temperatura com relação aos níveis da era pré-industrial.

12 / 12 / 2014 ['Soluções estão à mão', diz chefe do painel da ONU de mudança climática](#)

Grupo divulgou documento que norteia debates do novo acordo global. Tratado está em discussão na COP 20 e terá de ser aprovado em 2015.

12 / 12 / 2014 [Secretário de Estado dos EUA cobra ação rápida de países na COP 20](#)

John Kerry disse que não há tempo de discutir 'quem precisa fazer mais'. Secretário pede agilidade na criação de acordo contra mudança climática.

12 / 12 / 2014 [Papa afirma que tempo para achar soluções para o clima "está se esgotando"](#)

Segundo o pontífice, "as consequências das mudanças climáticas, que já são sentidas de modo dramático em muitos países, nos lembram a gravidade da negligência e da inação".

12 / 12 / 2014 [Anuário mapeia iniciativas de produção de biocombustíveis e química renovável](#)

O objetivo é oferecer a pesquisadores e à indústria um panorama abrangente das principais iniciativas em rotas tecnológicas inovadoras, como a bioquímica, termoquímica, entre outras.

12 / 12 / 2014 [Árvore genealógica dos pássaros revela estranhos casais](#)

As aves usam essencialmente os mesmos genes para cantar que nós, humanos, usamos para falar. E os flamingos são mais próximos dos pombos do que dos pelicanos. Estas são algumas revelações surpreendentes que emergiram do maior e mais sofisticado mapeamento já feito sobre a árvore genealógica das aves.

12 / 12 / 2014 [Greenpeace se desculpa por protesto nas Linhas de Nazca, no Peru](#)

Grupo estendeu letras de tecido perto de patrimônio cultural da humanidade. Segundo governo, danos foram constatados por perícia de arqueólogos.

12 / 12 / 2014 [Barriga de aluguel pode salvar espécie de rinoceronte em risco de extinção](#)

Restam apenas seis rinocerontes-brancos-do-norte no mundo inteiro. Quatro foram levados da Europa para África, mas não conseguiram procriar.

12 / 12 / 2014 [Dados da Rosetta aumentam mistério sobre origem da água da Terra](#)

Para cientistas, cometas tinham trazido água, mas hipótese foi eliminada. Água observada por sonda Rosetta em cometa não é do tipo terrestre.

12 / 12 / 2014 [Nova lei fortalece parceria entre governo e sociedade](#)

Conselheiros do Fundo Nacional do Meio Ambiente debateram o Marco Regulatório das Organizações da Sociedade Civil.

12 / 12 / 2014 [Aliança Global de Vacinas aprova US\\$ 400 milhões para luta contra ebola](#)

A ideia é vacinar o mais rápido possível a população em risco. Testes de uma das vacinas foram interrompidos temporariamente.

12 / 12 / 2014 [Brasil pode perder 30% de suas línguas indígenas nos próximos 15 anos](#)

Atualmente, os índios brasileiros falam entre 150 e 200 línguas e devem ser extintas, até 2030, de 45 a 60 idiomas.

12 / 12 / 2014 [Empresa japonesa cria projeto de 'cidade sustentável' no fundo do mar](#)

Segundo a companhia, o oceano oferece recursos ilimitados de comida, água e energia; projeto custaria mais de R\$ 66 bilhões.

12 / 12 / 2014 [Em 35 anos, 'superbactérias' poderão estar matando mais que câncer](#)

Organismos resistentes a antibióticos poderão estar matando 10 milhões de pessoas por ano a partir de 2050, diz estudo liderado por economista Jim O'Neill.

11 / 12 / 2014 [Na COP 20, ministra defende proposta do Brasil para novo acordo](#)

Izabella Teixeira, do Meio Ambiente, discursou nesta quarta para a plenária. Ela defendeu 'nova divisão' de obrigações entre países ricos e pobres.

11 / 12 / 2014 [Equipes de saúde que combatem o ebola são 'pessoa do ano' da Time](#)

Revista escolhe todo ano quem mais se destacou na mídia. Grupo que combateu vírus foi o vencedor de 2014.

11 / 12 / 2014 [Fundo Verde do Clima arrecada US\\$ 10 bi na COP 20 e bate meta da ONU](#)

Austrália e Bélgica anunciaram doações equivalentes a US\$ 230 milhões. Fundo vai ajudar países vulneráveis a lidar com os efeitos climáticos.

11 / 12 / 2014 [Peixes ainda procuram oxigênio em afluente do rio Tietê em Salto/SP](#)

Técnicos da Cetesb colheram novas amostras do córrego Ajudante. Moradores reclamam de mau cheiro próximo ao rio Tietê.

11 / 12 / 2014 ['Marcha dos Povos' concentra multidão em evento paralelo à COP 20](#)

Grupo se reuniu na região central de Lima, capital do Peru. Passeata é parte da Cúpula dos Povos e 'pressiona' conferência climática.

11 / 12 / 2014 [Comissão sobre demarcação de terras indígenas adia votação da PEC](#)

A comissão especial da Câmara que analisa a Proposta de Emenda à Constituição (PEC) 215/00 adiou para a terça-feira (16) da próxima semana a votação do parecer do relator, deputado Osmar Serraglio.

11 / 12 / 2014 [Arqueólogos encontram ossos do dinossauro com chifres mais antigo dos EUA](#)

Paleontólogos trabalhando em Montana, nos Estados Unidos, desenterraram um crânio do mais antigo dinossauro com chifres da América do Norte, do tamanho de um corvo.

11 / 12 / 2014 [Mulheres indígenas são vitais para enfrentar mudança climática](#)

Na 20ª Conferência das Partes sobre a Mudança Climática (COP20), que acontece em Lima até esta quinta-feira, a delegação indígena, formada por representantes da América, Ásia, Oceania e África, ressaltou que o conhecimento das mulheres contribuirá para a segurança alimentar do mundo.

11 / 12 / 2014 [Países da Amazônia se unem pelo clima](#)

Cooperação brasileira com nações compostas pela Floresta é reafirmada durante a COP 20, em Lima. Cadastro Ambiental Rural está entre as medidas que serão compartilhadas.

11 / 12 / 2014 [Grupo Ambiental e pescadores retiram 20 toneladas de lixo do Tietê](#)

Trabalho foi realizado durante 15 dias na represa de Barra Bonita. Todo o material será enviado a Cooperativa de Agentes Ambientais.

11 / 12 / 2014 [PF e Ibama prendem nove pessoas e lacram 22 madeiras por fraude em RO](#)

A ação faz parte da chamada Operação Mesclado, deflagrada nesta quarta-feira (10) para combater a extração ilegal de madeira do interior da Terra Indígena Mequéns, próxima à cidade de Pimenta Bueno, na região sul do estado.

11 / 12 / 2014 [Chile, Colômbia, Peru e México lançam declaração na COP 20](#)

Aliança do Pacífico cobrou metas de adaptação e financiamento nas INDCs. Anúncio foi feito por presidentes na Conferência climática da ONU, em Lima.

11 / 12 / 2014 [Peru vai processar Greenpeace por danos às Linhas de Nazca](#)

Grupo estendeu letras de tecido perto de patrimônio cultural da humanidade. Segundo governo, danos foram constatados por perícia de arqueólogos.

11 / 12 / 2014 [Ebola já matou 6.388 pessoas, de 17.942 infectados, diz balanço da OMS](#)

Incidência vem diminuindo na Libéria, mas aumentando em Serra Leoa. OMS admitiu demora na resposta à epidemia de ebola.

11 / 12 / 2014 [Oceanos estão impregnados com 269 mil toneladas de plásticos](#)

A contaminação por micro-plásticos está presente em diferentes concentrações em todos os oceanos do planeta, mas os dados são insuficientes para diferenciar com precisão o peso total dos micro e macro plásticos que flutuam nas superfícies, indica o estudo.

10 / 12 / 2014 ['Temos que agir já', diz Ban Ki-moon na abertura ministerial da COP 20](#)

Secretário-geral da ONU discursou na Cúpula sobre mudanças climáticas. Objetivo é obter prévia de acordo global para conter temperatura maior.

10 / 12 / 2014 [Curiosity descobre que montanha em Marte pode ter surgido a partir de lago](#)

Monte Sharp, que fica em cratera, pode ser formado por sedimento de lago. Rochas inclinadas dão indícios de leito de lago na cratera.

10 / 12 / 2014 [Número de mortos por malária caiu 50% desde 2000, diz OMS](#)

Agência teme que ebola prejudique a tendência de queda na África. Em 2013 foram registrados 198 milhões de casos de malária no mundo.

10 / 12 / 2014 [Liderança brasileira no combate ao efeito estufa é reconhecida](#)

A exemplo do Brasil, países apresentam níveis de referência de emissões florestais na Conferência das Nações Unidas sobre o Clima, no Peru.

10 / 12 / 2014 [Baleias mudam forma de respirar para evitar ataques de gaivotas](#)

Na Patagônia argentina, cetáceos parecem ter desenvolvido estratégia contra ataques de pássaros, mas a técnica tem desvantagens.

10 / 12 / 2014 [Governo do Rio quer sanear 80% da Baía de Guanabara para as Olimpíadas](#)

O Plano Guanabara Limpa é constituído de 12 iniciativas, entre elas obras de saneamento na Marina da Glória, reconstrução das Estações de Tratamento de Esgoto da Pavuna, no subúrbio do Rio, e de São Gonçalo, na região metropolitana, além da criação do Sistema de Coleta e Tratamento de Esgoto de Alcântara e Programa Sena Limpa, que objetiva despoluir praias da cidade.

10 / 12 / 2014 [Canadá condiciona reduzir emissões de gases estufa a iniciativa dos EUA](#)

O Canadá se comprometerá a um programa de redução de gases de efeito estufa nos setores do petróleo e gás só quando os Estados Unidos o fizerem, indicou nesta terça-feira (9) o premiê Stephen Harper.

10 / 12 / 2014 [Elefantes africanos correm risco de extinção por venda de marfim fora do controle na China](#)

Quantidades de marfim cada vez maiores são vendidas em um número crescente de lojas de luxo na China.

10 / 12 / 2014 [Sonda da Nasa que hibernava acorda para começar missão rumo a Plutão](#)

Sonda robótica New Horizons vai estudar Plutão e o Cinturão de Kuiper. Observação científica do planeta anão começa em 15 de janeiro.

10 / 12 / 2014 [Prazo para inscrição de vídeos vai até 20 de dezembro](#)

Iniciativa dos ministérios do Meio Ambiente e da Cultura, Circuito Tela Verde busca promover mais debates socioambientais no Brasil.

10 / 12 / 2014 [Ecoforte destina 37 milhões para projetos agroecológicos](#)

Projetos organizados em redes recebem financiamento para fortalecer produção orgânica.

10 / 12 / 2014 [Golfinho é atingido por flecha no Golfo do México; mortes violentas crescem](#)

Nas últimas semanas, dois golfinhos foram mortos por flechas na região. Oficiais dizem haver um aumento nas mortes violentas de golfinhos.

10 / 12 / 2014 [A experiência brasileira no monitoramento da floresta amazônica](#)

MMA apresenta em Lima os resultados obtidos em prol da redução de emissões por desmatamento e degradação florestal.

10 / 12 / 2014 [Novas definições para embalagens vazias de agrotóxicos](#)

O novo texto revisa as exigências anteriores, tornando-as compatíveis com a Política Nacional de Resíduos Sólidos, que instituiu a logística reversa no setor.

10 / 12 / 2014 [Ministério da Saúde confirma primeiro caso da febre do Nilo no país](#)

Segundo a pasta, o homem, que estava internado no Instituto de Doenças Tropicais Natan Portela, em Teresina, deve passar por reabilitação e fisioterapia.

09 / 12 / 2014 [COP 20 divulga primeira versão de rascunho do novo acordo climático](#)

Documento de 33 páginas foi elaborado por negociadores reunidos em Lima. Conferência do Clima da ONU entra na reta final nesta semana.

09 / 12 / 2014 [Países mais pobres são marginalizados do financiamento para diminuir as mudanças climáticas](#)

A metade de um fundo de quase 8 bilhões de dólares criado em 2003 para os países em desenvolvimento foi destinado a apenas dez nações, entre elas México, Marrocos e Brasil, com 500 milhões de dólares cada uma, de acordo com o relatório divulgado durante a realização em Lima, no Peru, da conferência das Nações Unidas sobre o clima, COP20.

09 / 12 / 2014 [Israel enfrenta maior desastre ecológico de sua história](#)

Pelo menos um milhão de litros de petróleo que vazou de um oleoduto no deserto atingiu uma reserva natural protegida.

09 / 12 / 2014 [Sem chuva forte, São Paulo continua a ter queda no nível dos reservatórios](#)

O Sistema Cantareira passou de 8% para 7,8%. O reservatório já opera utilizando a segunda cota da reserva técnica.

09 / 12 / 2014 [Leilão de energia alternativa terá 530 usinas eólicas e 40 de biomassa](#)

O leilão vai contratar energia elétrica com início de suprimento a partir de 1º de janeiro.

09 / 12 / 2014 [Plano de Ação Nacional protege tubarões e raias marinhas](#)

Pesca predatória ameaça equilíbrio marinho. PAN Tubarões estabelece objetivos, ações, prazo de execução, abrangência e formas de implementação e supervisão.

09 / 12 / 2014 [Desmatamento prejudica metas para conter mudança climática, mostra relatório](#)

Minas, plantações de óleo de palma, grandes fazendas e projetos de mineração estão contribuindo para um ritmo alarmante na destruição das florestas, revelou um novo relatório, atrapalhando os esforços para conter o aquecimento global.

09 / 12 / 2014 [Robô reúne mais provas da existência de antigo lago em Marte](#)

Especialistas acreditam que o planeta vermelho teve um clima mais frio que permitiu que houvesse sistemas de água e lagos durante um longo período de tempo.

09 / 12 / 2014 [Metas climáticas de EUA, China e UE seriam insuficientes contra aquecimento](#)

Os compromissos assumidos por Estados Unidos, China e União Europeia, de reduzir nas próximas décadas suas emissões de carbono, ajudariam a diminuir em 3º C a elevação das temperaturas globais até o fim do século, algo considerado "insuficiente" para evitar os efeitos catastróficos das mudanças climáticas.

09 / 12 / 2014 [Segurança alimentar deve ocupar espaço maior nas negociações climáticas](#)

A segurança alimentar deve ocupar um espaço maior em um novo acordo para combater o aquecimento global, que promova a produção orgânica no lugar das indústrias alimentícias emissoras de carbono, afirmaram nesta segunda-feira especialistas na cúpula do clima, em Lima.

09 / 12 / 2014 [Verões extremos serão mais frequentes na Europa](#)

A Europa tem dez vezes mais chances de ter verões com temperaturas extremas em comparação com o final do século passado por causa da mudança climática.

09 / 12 / 2014 Em órbita, Cbers-4 envia primeiras imagens à Terra nesta segunda

Imagens produzidas devem ser geradas às 21h, no horário de Brasília. Satélite sino-brasileiro foi lançado no domingo (7) de base na China.

09 / 12 / 2014 Divergência entre países sobre metas climáticas nacionais marca a COP 20

Chamadas de INDCs, metas de países vão ajudar a 'fechar conta do clima'. Rascunhos iniciais do novo acordo climático saíram nesta segunda, em Lima.

09 / 12 / 2014 Tufão nas Filipinas já matou pelo menos 21 pessoas, diz Cruz Vermelha

Em Manila, onde vivem 12 milhões de pessoas regularmente atingidas por grandes inundações, prosseguem as operações de evacuação.

09 / 12 / 2014 Indígenas brasileiros protestam na COP20 por demarcação de terras

Líderes indígenas protestaram nesta segunda-feira (8) na Conferência do Clima em Lima (COP-20), contra um projeto de lei que afetaria a demarcação de terras indígenas e áreas protegidas no Brasil. O projeto de lei, conhecido como PEC 215, é uma proposta de emenda à Constituição brasileira, com o objetivo de mudar o marco legal sobre as terras indígenas.

08 / 12 / 2014 Campanha 'Adote uma Espécie', do WWF-Brasil, ganha animais brasileiros

A campanha Adote uma Espécie, lançada pelo WWF-Brasil em outubro deste ano, ganha dois animais brasileiros: a arara-azul e o boto-cor-de-rosa (antes só o urso-panda, símbolo da ONG, podia ser adotado).

08 / 12 / 2014 Combate à dengue e à febre chikungunya representa um desafio duplo, diz ministro

O ministro da Saúde, Arthur Chioro, participou no sábado (6), no Rio de Janeiro, do Dia D de mobilização contra o mosquito Aedes aegypti, responsável pela transmissão da dengue e da febre chikungunya.

08 / 12 / 2014 ONGs criticam falta de progressos na Conferência sobre o Clima

"Têm existido vários falsos começos desde o início da semana", lamentou Tasneem Essop, porta-voz da ONG WWF, para quem "os negociadores ainda não entenderam que este diálogo é uma urgência planetária".

08 / 12 / 2014 Bruxelas considera vital cooperação com América Latina para acordo climático

O comissário europeu do Meio Ambiente e Energia, Miguel Arias Cañete, considera que a cooperação entre a Europa e a América Latina será fundamental para alcançar, no próximo ano, um acordo global a fim de reduzir o aquecimento do planeta.

08 / 12 / 2014 América Latina se compromete a reflorestar 20 milhões de hectares

Em um ato paralelo à cúpula da ONU, ministros da Agricultura e do Meio Ambiente de México, Peru, Guatemala, Colômbia, Equador, Chile e Costa Rica apresentaram o plano de recuperação de solos de seus respectivos países.

08 / 12 / 2014 Drones são a nova aposta para salvar recursos naturais de Peru e Panamá

Com o objetivo de conservar os recursos naturais de seus territórios ancestrais, os povos indígenas do Peru e do Panamá se preparam para utilizar drones que mostrem a contaminação e o desmatamento de suas florestas.

08 / 12 / 2014 Empresa alemã tem teste rápido para diagnosticar ebola desde 2012

Enquanto milhões eram investidos no desenvolvimento urgente de um teste rápido para detectar o vírus, um método pronto criado em Weimar aguardava validação.

08 / 12 / 2014 Ribeirinhos deixam extração ilegal de madeira e investem em turismo no AM

Com investimentos, população em reserva no Rio Negro triplicou em 10 anos. Oito unidades de conservação mantêm ações de desenvolvimento sustentável.

08 / 12 / 2014 Tufão Hagupit mata 2 nas Filipinas

A tormenta tem ventos sustentados de 140 km/h e rajadas de até 170 km/h. Fenômeno forçou meio milhão de pessoas a abandonarem suas casas.

08 / 12 / 2014 Ministros terão pouco a mudar sobre rascunho, diz presidente da COP 20

Manuel Vidal falou ao G1 sobre debate para obter acordo global climático. Negociações da ONU entram na 2ª semana e terão ministros de Estado.

08 / 12 / 2014 Fotos de verme marinho e tartaruga rara estão entre premiadas por CNPq

Resultado do Prêmio de Fotografia Ciência & Arte saiu esta semana. Concurso avaliou imagens de máquinas fotográficas e outros instrumentos.

08 / 12 / 2014 Primeiro caso de febre do Nilo no país pode ser confirmado segunda-feira

Agricultor de 52 anos seria primeira vítima infectada pela doença no país. Técnicos do Ministério da Saúde estiveram no Piauí coletando dados.

08 / 12 / 2014 Parceria entre Brasil e China, satélite Cbers-4 é lançado ao espaço

Equipamento entrou em órbita 13 minutos após o lançamento na China. Quinto projeto entre os países tem primeira câmera especial brasileira.

06 / 12 / 2014 Custo de adaptação à mudança climática pode ser 3 vezes superior ao esperado

O alerta foi feito em um estudo do Programa das Nações Unidas para o Meio Ambiente (PNUMA) apresentado nesta sexta-feira na Cúpula de Mudança Climática de Lima (COP20) pelo diretor adjunto do órgão, Ibrahim Thiaw, e por seus autores.

06 / 12 / 2014 Mesmo com chuva, Cantareira continua em queda e registra 8,2%

As chuvas sobre São Paulo não interromperam a sequência de quedas do Sistema Cantareira. Na sexta-feira (5), o nível dos reservatórios registrou 8,2%, uma redução de 0,1 ponto percentual em relação a quinta (4), segundo medição da Sabesp.

06 / 12 / 2014 Lideranças indígenas protestam contra mudança na homologação de terras

A Proposta de Emenda à Constituição (PEC) 215 transfere do Executivo para o Congresso Nacional o poder de homologar terras indígenas.

06 / 12 / 2014 Índia se recusa a sacrificar crescimento para conter mudanças climáticas

A Índia não assinará nenhum acordo em Lima para reduzir as emissões de gases de efeito estufa que ameacem seu crescimento ou seu combate à pobreza, alertou o ministro indiano do Meio Ambiente, Prakash Javadekar.

06 / 12 / 2014 Aquecimento global custará US\$ 500 bi a países emergentes

Dinheiro será necessário para enfrentar os efeitos das mudanças climáticas.

06 / 12 / 2014 Vacina brasileira contra a dengue entra em nova fase de testes

Método desenvolvido pela Fiocruz combina duas técnicas de imunização. Primeiros resultados de testes em camundongos mostraram eficácia de 100%. Em 2015, começam os testes em macacos.

06 / 12 / 2014 Grupo faz caminhada para tentar recuperação do rio Carioca

Ação deve durar cerca de duas horas no próximo domingo e vai contar com apoio de associações comunitárias de bairros cortados pelo rio.

06 / 12 / 2014 Cientistas alertam para asteroides e dizem que Terra está na 'linha de tiro'

Grupo de mais de 100 especialistas faz evento em Londres para pedir desenvolvimento de sistema de monitoramento e destruição de corpos celestes.

06 / 12 / 2014 Canadá sacrifica 80 mil aves contra gripe aviária

Donos de granjas serão indenizados pela morte de frangos e perus. Vírus H5N2 foi localizado em duas granjas canadenses na terça (2).

06 / 12 / 2014 Cápsula Orion pousa no Oceano Pacífico após missão bem sucedida

Nasa descreveu o voo de testes desta sexta-feira (5) como 'perfeito'. Lançada em Cabo Canaveral, nave pousou na costa da Baixa Califórnia.

06 / 12 / 2014 Ameaçada de extinção, onça-preta é capturada pela 1ª vez em parque do PI

Animal recebeu um colar GPS e passará a ser monitorado. Campanha visa diminuir os conflitos de predação dos animais domésticos.

06 / 12 / 2014 Testes para lançamento do satélite Cbers-4 são concluídos na China

Simulado padrão checa os sistemas do equipamento antes do lançamento. Essa é a última etapa antes do envio do Cbers ao espaço no domingo (7).

06 / 12 / 2014 Desmatamento pode estar na raiz da seca do Brasil

O corte das árvores, dizem os cientistas, está prejudicando a imensa capacidade da selva de absorver o carbono do ar - e de puxar água suficiente pelas raízes para abastecer os gigantescos "rios aéreos" que movem mais umidade do que o próprio rio Amazonas.

06 / 12 / 2014 Cientistas desenvolvem droga que pode consertar danos à medula

Testes em ratos apontaram recuperação parcial de movimentos e de controle da bexiga.

Os porta-vozes da delegação da União Europeia (UE) se mostraram otimistas durante a 20ª cúpula das Nações Unidas sobre mudança climática (COP20) em relação à possibilidade de serem firmados acordos na próxima semana, apesar de "nem todos os países estarem satisfeitos", declarou a chefe da delegação da Comissão Europeia, Elina Bardram.

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Peralkaline and alkaline magmatism of the Ossa-Morena zone (SW Iberia):

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Ruben Diez Fernandez, M. Francisco Pereira, and David A. Foster

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James M. Rine

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M. D. Lewan and M. J. Kotarba

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Taghi Shirzad and Zaher-Hossein Shomali

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John P. Loveless and Brendan J. Meade

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Azadeh Fereidoni and Gail M. Atkinson

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Corrigendum: A low-relief hill in eastern Ontario, Canada, covered by the easily erodible Queenston Formation and derived sediments -- probably the result of Quaternary tectonic uplift
J.L. Wallach

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Brian D. Rankin and Patricia A. Holroyd

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Nathan Hayward and Louise Corriveau

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ANDREW M. W. LAWFIELD, MURRAY K. GINGRAS, S. GEORGE PEMBERTON, and J. MARK ERICKSON

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This issue of GEOPHYSICS

Evert Slob

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On the electromagnetic response of a resistive cylinder buried in a conductive host

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Geophysics. 2014; 79(6): p. E341-E351
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Geophysics. 2014; 79(6): p. L41-L49
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Contributors

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Jeremy D. Pesicek, Duncan Child, Brad Artman, and Konrad Cieślik

Geophysics. 2014; 79(6): p. KS61-KS68
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Fast multimodel finite-difference controlled-source electromagnetic simulations based on a Schur complement approach

Piyooch Jaysaval, Daniil Shantsev, and Sebastien de la Kethulle de Ryhove

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Denys Grombacher, Jan O. Walbrecker, and Rosemary Knight

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This issue of GEOPHYSICS

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nuclear magnetic resonance
Denys Grombacher, Jan O. Walbrecker, and Rosemary Knight
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Small-scale physical modeling of seismic-wave propagation using
unconsolidated granular media
Ludovic Bodet, Amine Dhemaied, Roland Martin, Regis Mourgues, Faycal
Rejiba, and Vincent Tournat
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Accurate simulations of pure quasi-P-waves in complex anisotropic media
Sheng Xu and Hongbo Zhou
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GEOLOGIC NOTE

A simple model of gas production from hydrofractured horizontal wells in
shales
Tad Patzek, Frank Male, and Michael Marder
AAPG Bulletin, December 2014, v. 98, p. 2507-2529,
doi:10.1306/03241412125
<http://aapgbull.geoscienceworld.org/content/98/12/2507.abstract?etoc>

ARTICLE

Thermal-maturity limit for primary thermogenic-gas generation from humic
coals as determined by hydrous pyrolysis
M. D. Lewan and M. J. Kotarba
AAPG Bulletin, December 2014, v. 98, p. 2581-2610,
doi:10.1306/06021413204
<http://aapgbull.geoscienceworld.org/content/98/12/2581.abstract?etoc>

Constraining uncertainty in interpretation of seismically imaged
clinoforms in deltaic reservoirs, Troll field, Norwegian North Sea:
Insights from forward seismic models of outcrop analogs
Nicholas E. Holgate, Gary J. Hampson, Christopher A.-L. Jackson, and
Steen A. Petersen
AAPG Bulletin, December 2014, v. 98, p. 2629-2663,
doi:10.1306/05281413152
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The Deep Structure of the Scythian Plate Basement

V. A. Bush p. 413 [abstract](#)

Geochemical Discrimination of Basalts Formed in Major Geodynamic Settings

S. D. Velikoslavinsky and D. P. Krylov **p. 427** [abstract](#)

Late Quaternary Dislocations and Seismotectonics of the Racha Earthquake Source, the Greater Caucasus

A. N. Ovsyuchenko, A. V. Marakhanov, A. S. Lar'kov, and S. S. Novikov **p. 440** [abstract](#)

Alternative Interpretation for the Active Zones of Cuba

Mario Octavio Cotilla Rodríguez **p. 459** [abstract](#)

Finite Strain Analysis of Metavolcanics and Metapyroclastics in Gold-Bearing Shear Zone of the Dungash Area, Central Eastern Desert, Egypt

Osama M. K. Kassem and Said H. Abd El Rahim **p. 483** [abstract](#)

Tectonics and Geodynamics of Granulite-Gneiss Complexes in the East European Craton

M. V. Mints **p.496** [abstract](#)

Geochemistry International

Vol. 52, No. 12, 2014

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²³⁸U/²³⁵U Isotope Ratio Variations in Minerals from Hydrothermal Uranium Deposits

I. V. Chernyshev, V. N. Golubev, A. V. Chugaev, and A. N. Baranova **p. 1013** [abstract](#)

Geochemical Features of the Quaternary Lamproitic Lavas of Gaussberg Volcano, East Antarctica: Result of the Impact of the Kerguelen Plume

N. M. Sushchevskaya, N. A. Migdisova, A. V. Antonov, R. Sh. Krymsky, B. V. Belyatsky, D. V. Kuzmin, and Ya. V. Bychkova **p. 1030** [abstract](#)

Residence Sites and Origin of Noble Gases in Minerals as Exemplified by Ilmenite from the Alkaline Granites of the Kola Peninsula

I. N. Tolstikhin, V. I. Skiba, A. Yu. Sevost'yanov, I. L. Kamensky, and V. R. Vetrin **p. 1049** [abstract](#)

Microheterogeneity of Crystal Growth Zones as a Result of REE Fractionation

S. A. Repina, V. V. Khiller, and E. P. Makagonov **p. 1057** [abstract](#)

Interaction of Dissolved Organic Matter with Hg(II) along Salinity Gradient in Bosten Lake

Rehemanjiang Wufuer, Ying Liu, Shuyong Mu, Wenjuan Song, Xue Yang, Daoyong Zhang, and Xiangliang Pan **p. 1072** [abstract](#)

SHORT COMMUNICATIONS

Behavior of Lanthanides during the Formation of the Iul'tin Deposit, Chukchi Peninsula

Yu. A. Popova, A. Yu. Bychkov, S. S. Matveeva, and T. M. Sushchevskaya[†] **p. 1078** [abstract](#)

Is the Fischer–Tropsch Process Possible in a Geologic Medium?

M. A. Lur'e **p. 1084** [abstract](#)

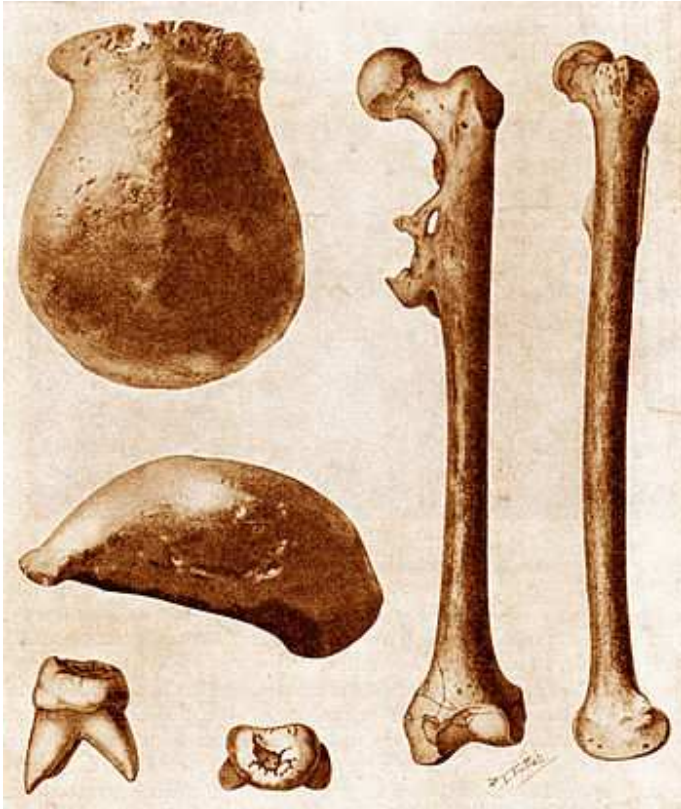
Geochemical Patterns of the Buyukkizilcik (Kahramanmaras) Fluorite Deposits

Yusuf Uras and Vahide Caliskan **p.1087** [abstract](#)

EARTH PAGES

[Art from half a million years ago](#)

Posted on [December 8, 2014](#) by [Steve Drury](#) | [Leave a comment](#)



Original fossils of *Pithecanthropus erectus* (now *Homo erectus*) found By Eugene Dubois in Java in 1891 (credit: Wikipedia)

[Eugene Dubois](#), an anatomist at the University of Amsterdam in the late 19th century, became enthralled by an idea that humans had evolved in what is now Indonesia, contrary to Charles Darwin's suggestion of an African origin. So much so that Dubois took the extraordinary step of joining the Dutch army and scrounging a posting to the Dutch East Indies to facilitate his search for a 'missing link', accompanied by his wife and newborn daughter. After a four-year quest, in 1891 he discovered the upper cranium and brow of a being that was obviously related to us, but also quite distinct as regards its beetling brow ridges. *Pithecanthropus erectus* (now *Homo erectus*) raised a storm of controversy, sadly only resolved in Dubois's favour after his death in 1940. Yet, as well as mounting the first deliberate search for human ancestors, Dubois collected everything possible in the sediments at Trinil, Java, so in a sense he was also an early palaeoecologist. The collection gathered dust in Leiden for the best part of a century, until archaeologist Josephine Joordens of the University of Leiden took on the task of reviewing its contents in 2007 (Joordens, J.C.A. and 20 others 2014. *Homo erectus* at Trinil on Java used shells for tool production and engraving. *Nature* (on-line): doi:10.1038/nature13962).



Progressively enlarged views of freshwater clam from Eugene Dubois's collection from Trinil, showing clear evidence of deliberate engraving. (credit: Joordens et al., 2014 in Nature; photos by Wim Lustenhouwer, VU University Amsterdam)

Homo erectus clearly had a taste for freshwater clams and lots of their shells figure in the Trinil collection: all are of similar large size rather than showing a wide variation according to age, suggesting a shell midden rather than a natural assemblage. A piece of serendipity revealed what may prove to be the anthropological find of the year. High-quality photos of the shells taken by a visiting mollusc specialist showed up evidence that one of them had been meticulously engraved. Its surface had a near-perfectly geometric, zig-zag pattern deeply gouged by someone with a steady hand, who probably used an associated shark's tooth as a scribing tool. Since the molluscs in life bear a dark, chitinous veneer the etching would have been more striking when freshly made. Another of these sturdy shells also show signs of having had its edge sharpened, suggesting that they were used for tools such as scrapers or graters.

The stratigraphy at Trinil suggested that the engraved shell and tools were coeval with *Homo erectus*, but that needed proof. Using sediment grains trapped in the shells and a combination of $^{40}\text{Ar}/^{39}\text{Ar}$ and thermoluminescence dating, the team have shown that they and the human fossils from Trinil date to between 430 and 540 thousand years ago: at least 350 ka older than the very similar engravings made by an anatomically modern human on ochre that was found at [Blombos Cave in South Africa](#). The next-oldest putative artwork is the controversial 'Venus' found at [Berekhat Ram](#) on the Israel-Syria border, dated between 250 and 280 ka.



Engraved ochre from [Blombos Cave](#), South Africa. (credit: Chris Henshilwood)

Probably the majority of palaeoanthropologists have dismissed humans other than *H. sapiens* as being cognitively incapable of either abstract or figurative art. The general view is that the mental capacity to create art or design began with the creation of the Blombos engraving, was restricted to anatomically modern humans and only [exploded in Europe](#) after they had migrated there by about 40 ka. A few argue that portable art, such as the Trinil and Blombos engravings, is bound by its very nature to be rare and easily overlooked. Whether having some use – counting? – merely being the making of an idle 'doodle' or expressing some unknowable ritual significance, the Trinil etching is a result of creativity and controlled skill that could only be the product of the *H. erectus* mind. Moreover, the very close comparison with the 0.35 Ma younger Blombos engraving suggests the product of a consciousness little different from that of our direct ancestors of 75 ka ago.

Related articles

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- [Homo erectus made world's oldest doodle 500,000 years ago](#)



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[Are modern humans 'domesticated'?](#)

Posted on [December 3, 2014](#) by [Steve Drury](#) | [Leave a comment](#)

While animals, especially dogs, underwent [domestication](#) the deliberate or unconscious human choice of favoured physiological and behavioural traits produced distinct differences between the ancestral species and the 'breeds' with which we are now familiar. In general domestication has resulted in dogs with reduced jaws and flatter faces, lower aggression, especially in the case of males, and reduced stressfulness in the company of humans and other tame dogs compared with their wolf ancestors. It is widely accepted that cats have 'tamed themselves' through the adoption of lifestyles associated with the benefits of close association with human communities, which have resulted in similar adaptations to those in more deliberately domesticated dogs. It is beginning to dawn on anthropologists that human social evolution may unwittingly have affected the course of our own evolution. Tighter social bonding among growing sizes of communities as brain capacity increased and the behavioural and cognitive attributes needed for that have been summarised recently by a group associated with the [Social Brain hypothesis](#) of [Robin Dunbar](#) of Oxford University, UK (Gamble, C., Gowlett, J. & Dunbar, R.I.M. 2014. *Thinking Big: How the Evolution of Social Life Shaped the Human Mind*. **ISBN-13:** 978-0500051801; Thames and Hudson: London).

It was Charles Darwin who first speculated that 'Man in many respects may be compared with those animals which have long been domesticated'. But to what extent does the hominin fossil record support such a view? Collaborators from Duke University and the University of Iowa, USA, have set out to analyse physiological changes over the last 200 ka that may be explained in this way (Cieri, R.L. *et al.* 2014. Craniofacial feminization, social tolerance and the origins of behavioural modernity. *Current Anthropology*, v. **55**, p. 419-443. Includes discussion and responses). They used the degree of projection of brow ridges, facial shape and cranial volume from 3 groups of *Homo sapiens* remains: skulls older than 80 ka (13 specimens); spanning 38 to 80 ka (41) and from recent humans (1367). They found that brow ridges shrank significantly over the last 80 thousand years, faces shortened and cranial capacity decreased, especially among males. This resulted in a convergence in appearance between males and females, which the authors attributed to general lowering of testosterone and stress hormone levels through selection for greater social tolerance: akin to similar physiognomic changes in domesticated dogs which DNA analyses have shown to be linked with modification of genes associated with aggression regulation. The finding among dogs suggests that their domestication is accomplished by slower development; i.e. young animals are naturally less fearful and have a greater tendency to taming. This delayed development from foetus to adulthood, with retention in mature individuals of juvenile characteristics, is known as neoteny, and affects all manner of adult characteristics, including coloration, snout length and the adrenal glands: as adult dogs now more resemble wolf pups, so human adults are more like young chimps than elders. At a conference where Cieri *et al.*'s results were presented, it was observed that hunter gatherer bands are intolerant, to the point of capital punishment, of wife stealers, murderers and seriously dishonest men, whereas such reactions fall off significantly among members of larger social groups involved in agriculture and urban life. Such modern behavioural patterns tally with [brow ridge](#), face length and cranial capacity, perhaps linked with selection for personalities more attuned to cooperation.



Comparison of Neanderthal and Modern human skulls from the Cleveland Museum of Natural History (credit: Wikipedia)

Although earlier human species, such as *H. neanderthalensis*, *heidelbergensis* and *erectus* had significantly different skull anatomy, each had prominent brow ridges that, on this account, may signify both greater exposure to testosterone and less social tolerance, and smaller group sizes. But, so far, analysis of the [Neanderthal genome](#) has not led to publication of any comments about testosterone or stress-hormone related genes. However, a clear strand of discussion is developing around evidence rather than mere speculation about psychological/cognitive aspects of human evolution that challenges the old-style 'what-you-see-is-what-there-was' (WYSWTW) archaeological dogma: a dialectic of social and biological relationships.

Related articles: Gibbons, A. 2014. How we tamed ourselves – and became modern. *Science*, v. **346**, p. 405-406.

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[November Picture of the Month](#)

Posted on [December 3, 2014](#) by [Steve Drury](#) | [Leave a comment](#)

If any technical terms are likely to be remembered by anyone exposed to a bit of geological education, amongst them will be two that are Hawaiian Polynesian words: pahoehoe ('pa hoy hoy') and aa ('a ah'). The first slides around the palate wonderfully while the latter give a sort of worrisome feel as if a large weight is about to land on one's toes. Aa is lava with a blocky, broken and jagged surface, whereas pahoehoe refers to lava with the appearance of a freshly set torrent of toffee. November's Picture of the Month is of basaltic lava that looks like it is chewable.



Pahoehoe lava from the Big Island of Hawaii. (Credit: Mila Zinkova)

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[Place your bets for a chance of posterity on Lunar Mission One](#)

Posted on [November 21, 2014](#) by [Steve Drury](#) | [Leave a comment](#)

When I learned about the unveiling of [Lunar Mission One](#) (LM1), a few days after the global excitement about ESA's [Rosetta mission](#) following Philae's 12 November 2014 landing on a far-distant comet and success with its core experiments, it did cross my mind that here was a bit of a let-down in PR terms. There's an old saying – 'What can follow the Lord Mayor's Show?' – and the thrill of Philae's landing rivalled any of the events at the 2012 London Olympics, plus the science it and Rosetta promise is likely to be about as leading-edge as it will get for quite some time. So what does LM1 offer that might achieve a similar scoop, and indeed your prospect of virtual immortality?

Unlike NASA or ESA missions, LM1 is to be a crowd-funded private enterprise by Lunar Missions Ltd, and for that the subscribers will want something in exchange. Through [Kickstarter](#) anyone can have a punt to help raise the initial £600 thousand goal by midnight on 17 December. Apparently that sum is to fund 3 years full-time work by a professional management team to raise further mission funds from commercial partners to take the project further: it will cost at least £0.5 billion. At this stage you can pledge any sum you wish, but what you get in return depends on your generosity. Highlights are: for £3 to 15 the reward is 'Our eternal thanks and a place in space history'; >£15 gets you a certificate and a place in an online 'wall of thanks'; >£30 escalates to your name being included in a digital 'time capsule' taken to the Moon and buried, plus membership of the Lunar Missions Club; >£60 entitles you to a voucher to invest in your own digital 'memory box' to go in the capsule – one of 'millions and millions' – and a vote on key decisions; for >£300 you can 'Meet the Team'; >£600 gets you annual meetings and a chance to ballot for the landing module's name; for higher contributions there are invitations to the launch (>£1200), sealing of the digital archive capsule and your name engraved on the lander (>£3000); and – wait for it – you get a place in the viewing gallery at Mission Control if you can stump up more than £5000.

For those contributing £60 or more, what goes in the much vaunted digital 'Memory Box' is on a sliding scale, from the equivalent of a text message to a strand of your hair and the DNA in it. One catch, if you are thinking of resurrection, is that it will be at the bottom of a 5 cm diameter hole at least 20 m deep. The buried digital archive will also contain a record of all living species on Earth and the entire history of humankind to date, but a continually updated copy will also be freely available online. Wikipedia seems not to be associated for some reason, but every item in this public archive will be peer-reviewed through an editorial board to whose deliberations schools, colleges and universities can contribute. The buried, multi-Terabyte, digital capsule is said to have a life of perhaps a billion years. Currently the longest lived data storage (~1500 years) is still ink on vellum, whereas the most advanced static and optical digital media

are estimated to have a maximum 100 year lifetime, subject to technical obsolescence. On the plus side, privacy is guaranteed, partly by the nature of the storage. So, for £10000 Joe and Josie Soap will figure on a kind of cenotaph but who- or whatever digs up the module will learn absolutely nothing about them and but conceivably could clone them from their anonymous strands of hair.

What are the science goals for an LM1 landing scheduled for 2024 that cannot be achieved by lunar-lander and sample-return missions currently under state-funded development by China, Russia, NASA, Japan and India before LM1 reaches the 'Go/No Go' stage? The landing is planned for the Moon's South Pole, on the rim of a major crater. There, LM1 will drill a hole to between 20-100 m deep, using a maximum of 1 kW of solar power – this 'will also be a major leap forward for safer and more efficient remote drilling on Earth': make of that claim what you will. Such a hole is said to enable sampling of pristine lunar rock in 15 cm lengths of 2.5 cm diameter core through the debris of the impact that caused the crater. The core samples are to be chemically analysed in the lander to test the hypothesis that Earth and Moon shared their origins. Future missions may pick up the cores and return them for more detailed analysis on Earth. But consider this: the oldest rocks known from the [Apollo programme](#) are approximately 4.4 billion year-old, feldspar-rich anorthosites that are thought to have formed the lunar highlands through fractional crystallisation of an early magma ocean that immediately followed Moon formation. Any unfractionated lunar material is only likely, if at all, at far greater depths than 20 m, and none was found or even suggested among the 0.4 tonnes of samples returned by the Apollo missions, which have been repeatedly analysed using advanced instruments. Indeed, near-surface debris from a crater rim is unlikely to be any more diverse lithologically than the various kinds of lunar surface from which the Apollo samples were collected, and may be contaminated by whatever caused the cratering and by the immense, long-lived heating at the impact site itself.



Lunar Ferroan Anorthosite #60025 (Plagioclase Feldspar). Collected by Apollo 16 from the Lunar Highlands near Descartes Crater. (credit: National Museum of Natural History in Washington, D.C.)

Compared with the prospect of advancing understanding of the origins of life and the Earth's oceans, and the early stages of Solar System evolution from data provided by Rosetta and Philae, LM1 might seem less exciting, though the buzz being hyped is that it would be a People's Mission. Yet those who place their punt on it and the commercial concerns that ultimately earn from it are two different sets of people. The ambitious global education wing will, of course, face competition from the growth of MOOCs in the science, technology, engineering and maths area that have a considerable head start, but it does have a noble ring to it. Whatever, if you make a pledge before midnight on 17 December this year and the 'pump-priming' target is not met by then, you pay nothing. If £600 thousand is raised there is no going back and only 10 years to wait. But what a challenge, you may well think... LM1 definitely has the edge over Virgin Galactica, but here on Earth there are probably a great many more vital challenges than either.

Related articles

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[A supervolcano's plumbing system](#)

Posted on [November 11, 2014](#) by [Steve Drury](#) | [Leave a comment](#)

What was the most devastating natural disaster ever to face humans? It would be tempting to suggest the Indian Ocean tsunami of 26 December 2004, but that is because most people remember it with horror. In fact the worst the Earth ever flung at us was much further back in our history and left a huge spike of sulfates in the Greenland icecap at around 73 thousand years ago. This relic of volcanic aerosols that had blasted into the stratosphere was tracked back to a 100 by 30 km caldera in Sumatra now occupied by a lake ([Lake Toba](#)) that is 500 m deep in places and almost filled by a slightly off-centre island. The eruption explosively ejected 2800 cubic kilometres of magma, of which an estimated 800 km³ fell as ash across a [wide swath of the tropics](#) westwards of Sumatra at least as far as Arabia and East Africa; the line of march taken by anatomically modern humans migrating from Africa. In India and Malaysia the Toba ash layer reaches 5-10 m thickness and probably occurs undetected as a thin layer across the entire tropics. Around 10¹⁰ tonnes of sulfuric acid belched out, some to enter and linger in the stratosphere, which is estimated to have caused an average decrease in average global temperatures of 3.0 to 3.5 °C for several years. Studies of human mtDNA hint at a genetic bottleneck around the time of Toba's eruption and a large decrease, perhaps as much as 60%, in the global population of *Homo sapiens*. But humans survived or quickly filled devastated land in India, where [stone tools are found both below and just above the Toba ash layer](#).



Landsat image (120 km across) of Lake Toba, the largest volcanic crater lake in the world. (credit: Wikipedia)

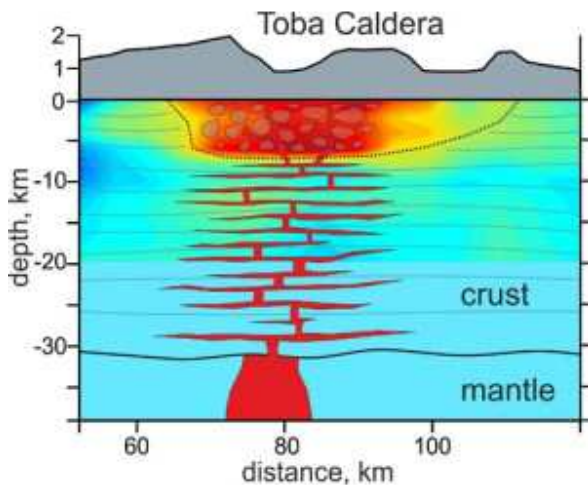
The largest volcanic eruption in the last 26 Ma, there can be little doubt that no other natural catastrophe had as large an influence on humanity as did Toba. Of course, slower processes such as climate change and ups and downs of sea level lay behind the repeated spread of humans out of Africa and probably their evolution as a whole. The drama of the [Toba event](#) has drawn attention to the massive risk posed by supervolcanoes in general, such as that centred on Yellowstone in the NW US, which show signs of activity 640 ka after its last major explosive event. Toba certainly is not dead, for its peculiar island of Samosir has been uplifted steadily since the eruption by about 450 m, probably due to influx of magma deep beneath the surface, and experiences shallow earthquakes. What lies in the guts of supervolcanoes is literally a hot topic and a new 3-D imaging method has been applied to Toba.



Traditional village on Samosir island, Lake Toba. (credit: Wikipedia)

Seismic tomography that uses background or [ambient seismic noise](#) has become a powerful technique for studying the crust and lithosphere when small-amplitude short-wavelength Rayleigh and Love surface waves are monitored to pick up subsurface reflecting bodies and measure variation in wave speed with depth. The greater the density of seismometers deployed, the finer the resolution of

deep crustal features and 40 such detectors are in place around Lake Toba. A team of Russian, French and German geophysicists have reported new results bearing on how magma may be accumulating beneath the vast caldera (Jaxibulatov, K. *et al.* 2014. A large magmatic sill complex beneath the Toba caldera. *Science*, v. **346**, p. 617-619). Down to about 7 km the tomography has picked up a structurally homogeneous low-speed zone directly beneath [Samosir Island](#) that the authors attribute to the 73 ka explosive eruption. Beneath that several magma sills appear to dominate the sub-caldera crust, possibly responsible for the post eruption uplift within the caldera: the precursor to a layered intrusive body and each an increment towards a further huge eruption.



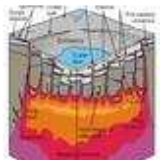
Interpretation of seismic tomography cross section of Toba. Greens to reds increasingly negative shear speed anomaly. Showing magma sills in lower crust and 74 ka damage zone above 7 km. (credit: Jaxibulatov et al. 2014)

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[October 2014 picture](#)

Posted on [October 30, 2014](#) by [Steve Drury](#) | [Leave a comment](#)



The 1200 m [Montserrat mountains](#) in Catalonia, NE Spain (credit: [Xavier Varela](#))

The Montserrat mountains are part of the Pre-Coastal Range of Catalonia in Spain and rise close to the capital Barcelona to form a spectacular backdrop.



Their peculiar pinnacled form results from their comprising tough, well-cemented thick conglomerates, pink in colour and having formed in an early Cenozoic delta. The conglomerates are in very thick, homogeneous beds riven by vertical joints. These two features control the serrated and pinnacled topography, from which is derived the ranges' Catalan name.



Cenozoic conglomerates of the Montserrat mountains, Catalonia (credit: Wikipedia)

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[Human evolution news](#)

Posted on [October 26, 2014](#) by [Steve Drury](#) | [Leave a comment](#)

Since discovery of its fossilised remains in [Liang Bua cave](#) on the Indonesian island of Flores was discovered in 2004 the diminutive *Homo floresienesis*, dubbed the 'hobbit' by the media, has remained a popular news item each time controversies surrounding it have flared. To mark the [tenth anniversary](#) of its publication of a paper describing the remains *Nature* has summarised the recollections of many of those involved in trying to understand the significance of [H. floresiensis](#) (Callaway, E. 2014. Tales of the hobbit. *Nature*, v. **514**, p. 422-426). Two main schools of thought continue in dispute, one holding that it is anatomically so different from anatomically modern humans and earlier members of the genus *Homo* that it constitutes a new species, despite its youngest member dating back only 18 ka, the other that it is *H. sapiens*, its tiny size having resulted from some kind of genetic disorder, such as microcephaly or Down's syndrome. There have been so many attempts to expunge the idea of such an odd fossil cohabiting an island with fully modern humans yet being a different and perhaps extremely archaic species that such an outlook itself seems somewhat pathological.



Replica of the Homo floresiensis skull from Liang Bua cave, Flores, Indonesia (credit: Wikipedia)

The evidence presented to force *H. floresiensis* into a deformed human mould has never been convincing, and the best way of combating that view is to document from a 'non-combatant' standpoint the many ways in which its anatomy differs from ours and how it might have arisen; a job to which [Chris Stringer](#) of the Museum of Natural History in London is amply qualified (Stringer, S. 2014. [Small remains still pose big problems](#). *Nature*, v. **514**, p. 427-429). He, like the original discoverers, feels this is a case of evolution of small stature due to a limited population being isolated for a long time on a relatively small island, which is just what happened to elephants that colonised Flores to become the pigmy *Stegodon* that *H. floresiensis* seemingly hunted. These tiny Flores dwellers (adults were about 1 m tall) used fire and made tools, similar ones dating as far back as ~1 Ma. Stringer mentions the possibility of first human colonisation about that time by Asian *H. erectus* but also the view that if it happened once there may have been several waves of immigration to Flores. The unusual 'hobbit' anatomy is not restricted to tiny size and a small skull and brain cavity (400 cm³), but includes odd hips, wrist bones, shoulder joint and collar bone. In fact the remains bear as much or more resemblance to australopithecines like 'Lucy' (3.2 Ma) than to other members of our genus, even *H. erectus* that has been proposed as its possible ancestor. Could they be far-travelled descendants of the 1.8 Ma old *H. georgicus* from Dmanisi in Georgia? More fossils clearly need to be found, and Stringer raises the possibility of the search being widened to other islands east of Java, such as Sulawesi, the Philippines and Timor. He hints that in such a tectonically active region tsunamis may have led to animals and humans saving themselves and then being current dispersed on rafts of broken vegetation, rather like some survivors of the 2004 Indian Ocean tsunami who ended up 150 miles from their homes by such a means.

Another story that is set to 'run and run' is that of 'alien' DNA in the human genome and productive relations between early out-of-Africa migrants with Neanderthals, Denisovans and perhaps yet a mysterious, earlier human species. The oldest (45 ka) [anatomically modern human](#) genome sequence so far charted is from a leg bone found by a mammoth-ivory prospector in Siberian permafrost (Fu, Q. and 27 others 2014. Genome sequence of a 45,000-year-old modern human from western Siberia. *Nature*, v. **514**, p. 445-449). Like a great many living non-Africans this individual carried about 2 % Neanderthal DNA, but unlike living people the 45 ka genome has it in significantly longer segments. That allowed the authors to re-estimate the timing of the genetic flow from Neanderthals into the individual's ancestors. Previous estimates from living DNA gave the possibility of that being between 37-86 ka, but this closer data suggests that it happened between 7 to 13 ka before the date of the fossil femur, i.e. narrowing it down to between 52 and 58 ka closer to the widely suggested time of African exodus around 60 ka (but see an Earth Pages item from [September 2014](#))

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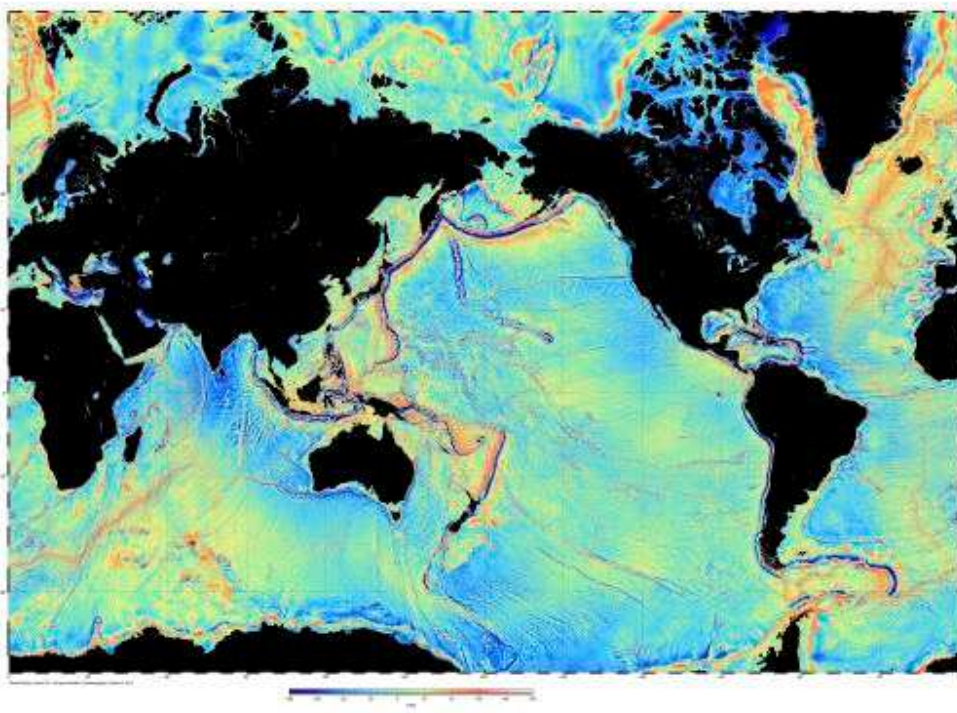
[New gravity and bathymetric maps of the oceans](#)

Posted on [October 25, 2014](#) by [Steve Drury](#) | [1 comment](#)

By far the least costly means of surveying the ocean floor on a global scale is the use of data remotely sensed from Earth orbit. That may sound absurd: how can it be possible to peer through thousands of metres of seawater? The answer comes from a practical application of lateral thinking. As well as being influenced by lunar and solar tidal attraction, sea level also depends on the Earth's gravity field; that is, on the distribution of mass beneath the sea surface – how deep the water is and on varying density of rocks that lie beneath the sea floor. Water having a low density, the deeper it is the lower the overall gravitational attraction, and vice versa. Consequently, seawater is attracted towards shallower areas, standing high over, say, a seamount and low over the abyssal plains and trenches. Measuring sea-surface elevation defines the true shape that Earth would take if the entire surface was covered by water – the geoid – and is both a key to variations in gravity over the oceans and to bathymetry.

Radar altimeters can measure the average height of the sea surface to within a couple of centimetres: the roughness and tidal fluctuations are 'ironed out' by measurements every couple of weeks as the satellite passes on a regular orbital schedule. There is absolutely no way this systematic and highly accurate approach could be achieved by ship-borne bathymetric or gravity measurements, although such surveys help check the results from radar altimetry over widely spaced transects. Even after 40 years of accurate mapping with hundreds of ship-borne echo sounders 50% of the ocean floor is more than 10 km from such a depth measurement (80% lacks depth soundings)

This approach has been used since the first radar altimeter was placed in orbit on Seasat, launched in 1978, which revolutionised bathymetry and the details of plate tectonic features on the ocean floor. Since then, improvements in measurements of sea-surface elevation and the computer processing needed to extract the information from complex radar data have shown more detail. The latest refinement stems from two satellites, NASA's [Jason-1](#) (2001) and the European Space Agency's Cryosat-2 (2010) (Sandwell, D.T. *et al.* 2014. New global marine gravity model from [CryoSat-2](#) and Jason-1 reveals buried tectonic structure. *Science*, v. **346**. p. 65-67; see also Hwang, C & Chang, E.T.Y. 2014. Seafloor secrets revealed. *Science*, v. **346**. p. 32-33). If you have Google Earth you can view the marine gravity data by clicking [here](#). The maps throw light on previously unknown tectonic features beneath the China Sea (large faults buried by sediments), the Gulf of Mexico (an extinct spreading centre) and the South Atlantic (a major propagating rift) as well as thousands of seamounts.

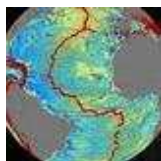


Global gravity over the oceans derived from Jason-1 and Cryosat-2 radar altimetry (credit: Scripps Institution of Oceanography)

There are many ways of processing the data, and so years of fruitful interpretation lie ahead of oceanographers and tectonicians, with more data likely from other suitably equipped satellites: [sea-surface height](#) studies are also essential in mapping changing surface currents, variations in water density and salinity, sea-ice thickness, eddies, superswells and changes due to processes linked to El Niño.

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'Earliest' figurative art now spans Eurasia

Posted on [October 10, 2014](#) by [Steve Drury](#) | [Leave a comment](#)

The first generally recognised piece of artwork is abstract in the extreme: a worked piece of hematite with a complex linear pattern etched into it. It comes from [Blombos Cave](#) in South Africa, together with similarly engraved bone, shell ornaments and advances in stone tool kits.



Artifacts from Blombos Cave, South Africa (credit: Wikipedia; copyright held by Chris Henshilwood)

Dated at 100 ka, the [Blombos culture](#) is regarded by many palaeoanthropologists as the start of the 'First Human Revolution'. Yet most believe that such a massive cultural shift only properly manifested itself around 40 ka in Europe shortly after its colonisation by [anatomically modern humans](#). It was then that lifelike pictures of animals began to appear on the walls of caves, such as those discovered in [Chauvet Cave](#) in France and radiocarbon dated to between 35.5 to 38.8 ka.



Drawing of horses in the Chauvet cave. (credit: Wikipedia)

Such a Eurocentric view is based on the lack of evidence for precedent art of this kind from elsewhere. The adage that 'absence of evidence is not evidence of absence' - attributed to Carl Sagan - recently popped up with sophisticated dating of cave art in the Indonesian island of Sulawesi. The cave-riddled limestones of southern Sulawesi have long been known for artwork on the roofs of caves and in some of their darker recesses, including sketches of local animals, humans and a great many stencils made by blowing a spray of pigment over a hand placed on a rock face. The pictures were thought to be relatively recent.



Painting of a dwarf water buffalo and stencils of human hands from a cave in SW Sulawesi (credit: Maxim Aubert, Griffith University, Australia)

A joint Australian-Indonesian group of Archaeologists used a specialist technique to date them (Aubert, M. and 9 others 2014. Pleistocene cave art from Sulawesi, Indonesia. *Nature*, v. **514**, p. 223-227. See also Roebroeks, W. 2014. Art on the move. *Nature (News & Views)*, v. **514**, p. 170-171). Like many paintings in limestone caves, with time they become coated with calcite film deposited from water flowing over the rock surface, known as flowstone or speleothem. It is possible to date the film layers using the uranium-series method to derive a maximum age for the encased pigment from speleothem beneath it and a minimum age from the layer immediately overlaying it. One of the hand stencils proved to be the oldest found anywhere, with a minimum age of 39.9 ka, while sketches of animals ranged from 35.4 to 35.7 ka. To see more images and view an interactive video about the Sulawesi finds click [here](#). The discovery by Maxime Aubert and his colleagues has set the cat among the pigeons as regards the origin of visual art. The paintings' roughly coincident age with the earliest in Europe raises three possibilities: the artistic muse struck simultaneously with people widely separated since their ancestors' emergence from Africa; somehow the skills were quickly carried a third of the way around the world from one place to the other; the original migrants from Africa took artistic ability of this kind with them to Eurasia, perhaps [as early as 125 ka ago](#).

Three points need to be considered: whether in Europe or eastern Indonesia, cave art is preserved either on the roofs or in the deep recesses of caves, where it is more likely to survive than in more exposed sites; preservation by speleothem enhances longevity and the oldest works are in limestone caves; many more archaeologists have researched caves in Europe than in the far larger areas of Asia and Africa. A view worth considering is that art may have begun outdoors, in a well-lit site on whatever 'canvas' presented itself. The artists' choice of cave walls in Europe and Indonesia may have resulted from the need for shelter from rain and/or cold, whereas much of Africa and Australia poses little need for 'interior design'. Besides, what if art began on the most easily available canvas of all – human skin! My guess is that the record will widen in space and deepen in time.

See also [here](#)

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[Signs of lunar tectonics](#)

Posted on [October 4, 2014](#) by [Steve Drury](#) | [Leave a comment](#)

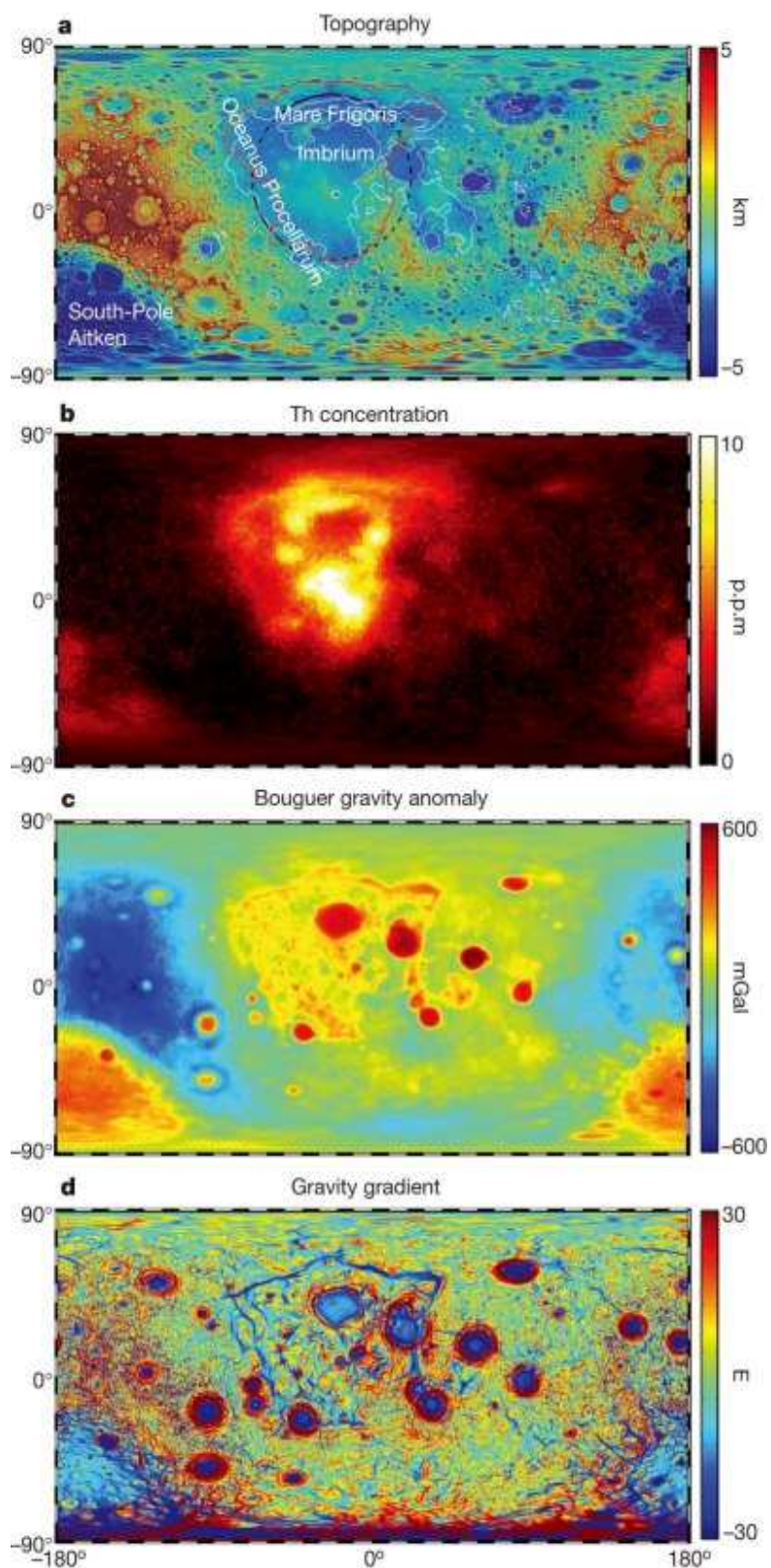
Large features on the near side of the Moon give us the illusion of the Man-in-the-Moon gazing down benevolently once a month. The lightest parts are the ancient lunar highlands made from feldspar-rich anorthosite, hence their high albedo. The dark components, originally thought to be seas or *maria*, are now known to be large areas of flood basalt formed about half a billion years after the Moon's origin. Some show signs of a circular structure and have been assigned to the magmatic aftermath of truly gigantic impacts during the 4.1-3.8 Ga [Late Heavy Bombardment](#). The largest *mare* feature, with a diameter of 3200 km, is [Oceanus Procellarum](#), which has a more irregular shape, though it envelopes some smaller *maria* with partially circular outlines.



Full Moon viewed from Earth. Oceanus Procellarum is the large, irregular dark feature at left. (credit: Wikipedia)

A key line of investigation to improve knowledge of the lunar *maria* is the structure of the Moon's gravitational field above them. Obviously, this can only be achieved by an orbiting experiment, and in early 2012 NASA launched one to provide detailed gravitational information: the [Gravity Recovery and Interior Laboratory](#) (GRAIL) whose early results were summarised by [EPN in December 2012](#). GRAIL used two satellites orbiting in a tandem configuration similar to the US-German [Gravity Recovery and Climate Experiment](#) (GRACE) launched in 2002 to measure variations over time in the Earth's gravity field. The Grail orbiters flew in a low orbit and eventually crashed into the Moon in December 2012, after producing lots of data whose processing continues.

The latest finding from GRAIL concerns the gravity structure of the Procellarum region (Andrews-Hanna, J.C. and 13 others 2014. Structure and evolution of the lunar Procellarum region as revealed by GRAIL gravity data. *Nature*, v. **514**, p. 68-71) have yielded a major surprise. Instead of a system of anomalies combining circular arcs, as might be expected from a product of major impacts, the basaltic basin has a border made up of many linear segments that define an unusually angular structure.



The topography and gravity structure of the Moon. Oceanus Procellarum is roughly at the centre. Note: the images cover both near- and far side of the Moon. (credit: Andrews-Hanna et al 2014)

The features only become apparent from the gravity data after they have been converted to the first derivative of the [Bouguer anomaly](#) (its gradient). Interpreting the features has to explain the angularity, which looks far more like an outcome of tectonics than bombardments. The features have been explained as rift structures through which basaltic magma oozed to the surface, perhaps feeding the vast outpourings of *mare* basalts, unusually rich in potassium (K), rare-earth elements (REE) and phosphorus (P) known as KREEP basalts. The Procellarum polygonal structure encompasses those parts of the lunar surface that are richest in the radioactive isotopes of

potassium, thorium and uranium (measured from orbit by a gamma-ray spectrometer) – thorium concentration is shown in the figure.

Tectonics there may be on the Moon, but the authors are not suggesting plate tectonics but rather structures formed as a huge mass of radioactively heated lunar lithosphere cooled down at a faster rate than the rest of the outer Moon. Nor are they casting doubt on the Late Heavy Bombardment, for there is no escaping the presence of both topographic and gravity-defined circular features, just that the biggest expanse of basaltic surface on the Moon may have erupted for other reasons than a huge impact.