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http://www.nbcnews.com/science/environment/earths-biggest-extinction-due-climate-volcanoes-researchers-n298831
Earth's Biggest Extinction Due to Climate, Volcanoes: Researchers
BY LINDA CARROLL
Scientists may have found the smoking gun that ties massive volcanic eruptions in Siberia to the huge Permian extinction, known as the Great Dying. Researchers have discovered that chemicals pumped out of the volcanoes created acid rain that led to the death of some 70 percent of life on land and 90 percent of sea life, according to the study published in Geology.
The link between volcanic activity and extinctions may go further than just the Permian period: scientists have found major eruptions coincided with all five great extinctions, including that of the dinosaurs, which has in the past been attributed to an asteroid collision. All of this could be seen as a warning of what can happen if the climate gets too out of whack, since man-made pollution can produce similar effects, scientists say.
To get a closer look at what happened at the end of the Permian Period, around 250 million years ago, an international team of scientists pored over samples from rock cliffs in the Italian Dolomites, which contain a clear historical record of life before, during and after the Great Dying.
"At the time, the supercontinent Pangaea was trying to split apart," says the new study's lead author, Mark Sephton, a professor of organic geochemistry in the department of earth science and engineering at Imperial College London. "The basalts that poured out are now called the Siberian Traps and are some of the largest of their type. The Siberian eruptions were particularly nasty because they intruded into a large sedimentary basin containing coals and salts which were cooked by the heat to produce a range of gases."
When the forests died out, the soils beneath them eroded and eventually made their way to the shallow ocean waters nearby. As Pangaea split up, the sediments were uplifted and became part of a mountain chain, some of which is now exposed in the Italian cliffs. Sephton and his team hoped that the sedimentary layers would hold the key to explaining the Great Dying. When they examined the end-Permian rock samples, they found a compound called vanillin.
"We didn't go looking for it," Sephton says. "It just jumped out at us when we analyzed the rocks. Vanillin is a breakdown product of wood. It also happens to be a flavoring agent in the food industry."
The team learned from food researchers that vanillin will oxidize to vanillic acid when the pH is neutral or high. If the surrounding environment is acidic, meaning the pH is low, then the vanillin won't oxidize into vanillic acid. So, if the rocks had much more vanillin than vanillic acid, that would mean that the surrounding soils were highly acidic.
As it turns out there was plenty of vanillin in the samples. "The acidity of end Permian soils appears to have been similar to vinegar or lemon juice," Sephton says. "Acidity placed the end Permian forests under stress. Eventually, rooted vegetation would have succumbed to the increased acidity. Because the roots could no longer bind the soil, erosion would have occurred stripping the land of its surface cover. With the base of the food chain gone, the ecosystem would have collapsed."
If you think it couldn't happen now, Sephton points to the die-off of forests in the Black Triangle of the Czech Republic. "Prior to the 1990s the industrial use of brown coal led to sulfur dioxide emissions and acid rain," he says. "The local trees died providing a modern-day example of how the Permian catastrophe must have looked."
Linda Elkins-Tanton, who coauthored a study on the Siberian Traps last year, says the new research dovetails nicely with her team's findings. In that study, researchers measured the amount of sulfur spewing out of the volcanoes during the end-Permian Period and then plugged it into a global climate models. The result: a prediction of acid rain with a pH comparable to vinegar or lemon juice.
"There was another exciting discovery," says Elkins-Tanton, director of the school of earth and space exploration at Arizona State University. "These magmas had enough naturally occurring chlorine and fluorine—naturally occurring chlorofluorocarbons—to destroy the ozone layer. It would have been 70 percent worse than the modern-day ozone hole at its worst. It blew my mind that there could be naturally occurring chlorofluorocarbons, the same as the ones we banned. Turns out the earth can make them, too."
Many geoscientists are beginning to think that eruptions like the one in Siberia might be at the root of all the mass extinctions, including that of the dinosaurs, Elkins-Tanton says, noting that the Deccan flood basalts occurred at the same time as the extinction.
"There's a big battle going on right now over which mechanism [the asteroid or the volcanism] is closest to the extinction," she says. "All five big extinctions are associated with flood basalts."

We might be able to learn something about the worst-case climate change scenario by studying the end-Permian extinction, Sephton says.
"The influences we are recording are pulses of acid rain which repeatedly hit the biosphere hard," Sephton said. "Life on Earth struggled to resist the harsh conditions produced. Current climate change is driven by increasing levels of carbon dioxide in the atmosphere. That may well have been the case for the end Permian as well because the Siberian Traps emitted carbon dioxide in addition to sulfur dioxide. Once rooted vegetation was lost on land, the soil organic carbon would have been eroded and oxidized to release more carbon dioxide. Therefore, the end-Permian is a good place to look for predicting the consequences of a rapidly warming word."
Elkins-Tanton agrees. "The only thing that comes close to what happened then is what we are doing now," she says.

AMBIENTE BRASIL

06 / 02 / 2015 **Mundo está inerte para crise da água causada pelo clima, alerta o IPCC**

Seca e falta de água já são resultados da mudança climática. Painel de cientistas da ONU prevê alta de até 4,6ºC na temperatura global.

06 / 02 / 2015 **Alunos do ITA põem em órbita satélite produzido em São José/SP**

Equipamento foi lançado de Estação Espacial Internacional nesta quinta (5). Objetivo do trabalho foi capacitar profissionais para fabricação de satélites.

06 / 02 / 2015 **Governo quer acelerar adesão de produtores ao Cadastro Ambiental Rural**

Até o momento, 40% dos mais de 371,8 milhões de hectares de áreas passíveis de cadastramento foram registradas, como determina o Código Florestal.

06 / 02 / 2015 **Macacos do 'novo mundo' teriam origem africana, diz estudo**

Fósseis dizem que espécie sul-americana é mais antiga do que se pensava. Material foi encontrado na Bolívia; espécie teria vivido há 36 milhões de anos.

06 / 02 / 2015 **Réptil marinho de 70 milhões de anos identificado na Rússia**

Encontrados na região de Orenburgo, ao sul dos Urais, os fragmentos fossilizados permitiram "a descoberta de uma nova espécie, única e ainda desconhecida para a ciência".

06 / 02 / 2015 **Nova espécie de orquídea é encontrada no Camboja**

A flor é marrom e tem um centímetro de comprimento, mas, ao contrário da maioria das espécies desta flor de beleza delicada, esta tem um aspecto mais contundente.

06 / 02 / 2015 **Equador põe Galápagos em estado de urgência por encalhe de navio**

Situação não representa risco sobre o ecossistema local, dizem autoridades. Medida ajuda a agilizar recursos caso ocorra algum dano ambiental.

06 / 02 / 2015 **Empresários querem respaldo legal para investir em exploração na Lua**

Companhia dos EUA tenta autorização para iniciar operações no satélite. Não há atualmente autoridade que conceda esse tipo de liberação.

06 / 02 / 2015 **Previsões erradas de El Niño intrigam cientistas em busca de respostas**

Desde março, os prognosticadores vêm dizendo que El Niño estava a caminho. O único problema é que ele não chegou. Chame-o de período de El Niño fantasma, uma sirene de padrões climáticos que não chegaram, avistada tremulando nas cintilantes águas do Oceano Pacífico equatorial.

06 / 02 / 2015 **FMI perdoa US$ 100 milhões para países afetados pelo vírus ebola**

Medida permite que países concentrem recursos na recuperação pós surto. Órgão prepara empréstimo de $ 160 mi para Libéria, Serra Leoa e Guiné.

06 / 02 / 2015 **Lesma-do-mar incorpora genes de alga para conseguir fazer fotossíntese**

Trata-se de um exemplo raro de transferência de genes entre espécies. Entender mecanismo pode ajudar no desenvolvimento de terapia genética.

06 / 02 / 2015 **Desperdício inspira imigrante húngaro em projeto milionário de reciclagem**

Fundador da TerraCycle, empresa que revolucionou o mercado do reaproveitamento de material descartado, teve 'epifania' ao ver TVs jogadas no lixo.

06 / 02 / 2015 **Costume chinês pode incentivar caça ilegal de tigres, afirmam especialistas**

Partes do animal são usadas como símbolo de status e na medicina. Cem tigres por ano foram mortos para venda ilegal desde a virada

do século.

06 / 02 / 2015 **Monte Roraima enche de turistas e impacto ambiental preocupa**

Montanha na fronteira entre o Brasil e a Venezuela tem sido mais procurada. Visitantes chegam a 4 mil ao ano; passeios são a pé ou de helicóptero.

06 / 02 / 2015 **Nível de água fica estável no Cantareira e sobe em quatro reservatórios**
Desde o começo de fevereiro, já choveu sobre esse sistema 54,8 milímetros (mm) – bem mais do que em igual período de janeiro, quando o volume tinha atingido apenas 8,7 mm.
05 / 02 / 2015 **Secretaria estabelece embargo para exploração madeireira no Pará**

Período de proibição de retirada de árvores encerra em abril. Produtores que têm produto estocado devem fazer declaração.

05 / 02 / 2015 **Ancestral do porquinho-da-Índia pesava 1 tonelada e mordia como tigre**

Fósseis de maior roedor conhecido foi encontrado em 2007 no Uruguai. Animal viveu há 5 milhões de anos atrás, no Plioceno.

05 / 02 / 2015 **Reitores de universidades paulistas se unem para enfrentar a crise hídrica**

Unifesp, IFSP, Unicamp, Unesp, UFABC, USP e UFSCar assinaram acordo. Grupo vai criar painel para pesquisar e orientar a população sobre o tema.

05 / 02 / 2015 **Risco de falta de água e queimadas é iminente em Roraima, diz geólogo**

Segundo o especialista, estado atravessa 'forte período de estiagem'. Rios Arraia e Tacutu estão com níveis críticos na quantidade de água.

05 / 02 / 2015 **Análise genética ajuda a mapear populações de grandes carnívoros**

Estudo do DNA presente em amostras de pelos ou de fezes auxilia pesquisadores do Sisbiota a descobrir informações sobre as espécies remanescentes nos fragmentos de Mata Atlântica e de Cerrado.

05 / 02 / 2015 **Sistema Cantareira registra segunda alta consecutiva do ano**

As ligeiras altas podem ser atribuídas à chuva que atingiu o manancial, registrando 44,4 milímetros (mm) desde domingo (1º).

05 / 02 / 2015 **Pesquisa da Embrapa de São Carlos/SP cria películas plásticas comestíveis**

Embalagem aumenta conservação do alimento e serve como tempero. Novo produto depende de parcerias e não há prazo para chegar ao mercado.

05 / 02 / 2015 **Arqueólogos encontram múmia que passou por cirurgia cerebral**

No crânio da múmia, está um buraco que mede cerca de 5 centímetros de diâmetro.

05 / 02 / 2015 **Projeto que multa desperdício de água passa por comissão da Câmara**

Proposta contra crise hídrica foi elaborada pela CPI da Sabesp. Ela prevê multa de R$ 1 mil para quem lavar calçada ou carro, em SP.

05 / 02 / 2015 **Ministros reúnem esforços para conclusão do cadastramento**

A ministra do Meio Ambiente, Izabella Teixeira, articula participação do Ministério do Desenvolvimento Agrário e Ministério da Agricultura, Pecuária e Abastecimento na conclusão do Cadastro Ambiental Rural.

05 / 02 / 2015 **Cheia faz Defesa Civil do AM decretar situação de emergência em 5 cidades**

Estão na lista Guajará, Eirunepé, Envira, Ipixuna e Itamarati. Órgão mantém alerta em mais duas cidades e atenção em Boca do Acre.

05 / 02 / 2015 **Pesquisa: câncer pode atingir 2 em cada 3 pessoas no mundo**

Uma pesquisa divulgada por cientistas britânicos mostra que a doença é ainda mais fatal do que se pensava anteriormente.

05 / 02 / 2015 **São Paulo registra aumento de 163% nos casos de dengue em janeiro**

Do início de janeiro até o dia 24 a cidade de São Paulo registrou 1.304 casos de dengue notificados, dos quais 120 autóctones (originados na própria região).

05 / 02 / 2015 **Ebola: apenas 38% dos recursos prometidos foram entregues para combater epidemia**

A Organização Mundial da Saúde passou a cobrar mobilização mundial face à epidemia da doença no início de agosto de 2014, mas os primeiros US$ 500 milhões de ajuda só foram disponibilizados em meados de outubro.

04 / 02 / 2015 **Inventário identifica 37 tipos de plantas ameaçadas de extinção no Rio**

Iniciado em 2013, o inventário fez 6 mil coletas botânicas nas regiões norte e noroeste, dos Lagos e em parte da Serra fluminense.

04 / 02 / 2015 **Aumentam os registros de casos de dengue em Mazagão, no Amapá**

51 casos foram notificados em janeiro, aponta levantamento. Criadouros foram detectados no lixo doméstico dos moradores.

04 / 02 / 2015 **Demanda chinesa por partes de tigre incentiva caça ilegal**

Partes do animal são usadas como símbolo de status pelos mais ricos, que adornam duas cabeças e decoram salas de estar com tapetes feitos com suas peles.

04 / 02 / 2015 **Chuva deixa trinta mil casas sem luz na Região de Curitiba, diz Copel**

Maior parte das residências, na capital, fica no bairro Pilarzinho. Chuva forte atingiu Curitiba e Região Metropolitana nesta terça-feira (3).

04 / 02 / 2015 **Chuvas elevam nível do Sistema Cantareira pela primeira vez em 2015**

Desde domingo (1º), choveu 23,2 milímetros (mm) no Cantareira, pouco acima da média histórica, que é 21,33mm.

04 / 02 / 2015 **Nova técnica permite decifrar papiros queimados por lava**

Pela primeira vez em 2 mil anos, foi possível 'ler' papiros de sogro de imperador Júlio Cesar carbonizados pelo Vesúvio em Herculano; cientistas usam raios de fótons sobre rolos.

04 / 02 / 2015 **BID vai apoiar ações de abastecimento de água no Brasil**

O Banco Interamericano de Desenvolvimento deverá oferecer apoio técnico a questões relacionadas ao abastecimento de água, promovendo intercâmbio de experiências junto a países que passaram por situações de seca similares à que o Brasil vem enfrentando.

04 / 02 / 2015 **Laboratório lança insulina inalável para diabéticos nos Estados Unidos**

Medicamento deve ser administrado com a ajuda de um pequeno inalador. Inalação promete agir mais rápido e ser mais conveniente que injeções.

04 / 02 / 2015 **Câmara baixa do Reino Unido aprova fertilização in vitro com 'três pais'**

Regulação da técnica precisa ainda ser aprovada pela Câmara dos Lordes. Além do DNA do pai e da mãe, bebê ganhará parte do DNA de doadora.

04 / 02 / 2015 **Oficina no Amapá terá excursão de ecoturismo para treino fotográfico**

Programa vai reunir workshop e ecoturismo para prática fotográfica. 'Saída Fotográfica' será de 6 a 8 de fevereiro, em Macapá e Santana.

04 / 02 / 2015 **Temperatura pode chegar a 42ºC em fevereiro no interior de Sergipe**

De acordo com o Centro de Meteorologia, a tendência nas 75 cidades sergipanas será de chuva abaixo da média histórica agora em fevereiro.

04 / 02 / 2015 **ANA renova redução de saída mínima de água do Rio Paraíba do Sul**

A decisão foi tomada devido ao grande período de estiagem. Especialista ressalta importância da economia.

04 / 02 / 2015 **Seattle aprova lei que multará quem jogar comida no lixo**

Uma nova lei municipal que entrou em vigor no começo do ano proíbe especificamente estabelecimentos comerciais e residências de jogarem restos orgânicos no lixo.

04 / 02 / 2015 **Sesai diz que só negocia com índios após liberação de rodovia em MT**

Trecho da BR-163 está bloqueado há cinco dias como forma de protesto. Indígenas pedem melhorias na Saúde e exoneração de coordenadora.

04 / 02 / 2015 **Animais em condições de abandono são resgatados de zoológico, no PA**

Cerca de 16 jacarés e 25 quelônios foram resgatados no bairro do Tapanã. Animais foram libertados e devolvidos a natureza na segunda-feira (2).

03 / 02 / 2015 **ONU confirma que 2014 foi o ano mais quente registrado na Terra**

Temperatura média do ar na superfície superou em 0,57 grau a média. Organização acredita que o reaquecimento mundial se manterá.

03 / 02 / 2015 **Especialistas alertam para condição de hidrelétricas em duas regiões do país**

O diretor do Instituto Luiz Alberto Coimbra de Pós-Graduação e Pesquisa em Engenharia, Luiz Pinguelli Rosa, avaliou que se não chover em quantidade satisfatória, algumas hidrelétricas que geram energia para as regiões Sudeste e Centro-Oeste só terão condições de operar por mais um mês.

03 / 02 / 2015 **Polícia de Meio Ambiente intensifica fiscalização durante piracema em MG**

No fim de 2014, 376 pescadores foram fiscalizados no Alto Paranaíba. Desde o início da piracema, 11 pessoas foram detidas.

03 / 02 / 2015 **Apesar de chuvas, nível da bacia do Rio Paraíba do Sul volta a cair**

Neste domingo (1º), volume do rio Paraíba do Sul chegou a 0,33%. Chuva nesta desde sexta no Rio derrubou árvores e alagou bairros.

03 / 02 / 2015 **Tradição nos EUA, marmota 'vê' a sombra e indica inverno mais longo**

Dia da marmota é celebrado no país neste dois de fevereiro. Prognóstico sobre o frio se baseia na observação da sombra da marmota.

03 / 02 / 2015 **Estudo detecta níveis aumentados de mercúrio no atum ahi havaiano**

Os níveis de mercúrio estão aumentando no atum albacora havaiano, geralmente conhecido como ahi, a uma taxa de cerca de 4% ao ano enquanto os oceanos absorvem os poluentes do ar.

03 / 02 / 2015 **Empresa alemã cria máquina que "faz chover" em locais secos**

Tecnologia é constituída por um conjunto de tubos de metal, que faz uso da física orgânica para conseguir produzir chuva.

03 / 02 / 2015 **Índios invadem sede da Sesai em MT para cobrar melhorias na Saúde**

Cacique informou que indígenas querem exoneração da coordenadora. Índios de 2 etnias bloqueiam há 4 dias trecho da BR-163 como protesto.

03 / 02 / 2015 **Poluição afeta quase 90% das principais cidades da China**

Das 74 cidades avaliadas, apenas oito satisfizeram os padrões nacionais de qualidade do ar, principalmente quanto à densidade das pequenas partículas, as mais suscetíveis de se infiltrarem nos pulmões e de atacarem o sistema respiratório.

03 / 02 / 2015 **China abre 1º laboratório de alta biossegurança para pesquisar ebola**

Centro foi construído com ajuda da França, segundo o jornal 'China Daily'. País poderá fazer experimentos com o vírus vivo e teste em animais.

03 / 02 / 2015 **Comunidade do TO é reconhecida como remanescente de quilombo**

A comunidade Boa Esperança fica em Mateiros, região do Jalapão. Pesquisador diz que reconhecimento é caminho para alcançar cidadania.

03 / 02 / 2015 **Nasa comemora aumento de verba graças a orçamento de Obama**

Obama anunciou planos para uma missão de exploração da lua de Júpiter, Europa.

03 / 02 / 2015 **Libéria inicia testes de duas vacinas contra o ebola**

As vacinas ChAd3 e rVSV-ZEBOV são as mais promissoras contra doença. Produtos protegeram animais contra o vírus, em testes iniciais.

03 / 02 / 2015 **Nível do Cantareira fica estável no início de fevereiro**

No maior conjunto de reservatórios, o Sistema Cantareira, que enfrenta a pior situação hídrica em relação aos demais sistemas, o nível de armazenamento foi mantido em 5% depois de ter caído 0,1 ponto percentual de sábado para domingo.

02 / 02 / 2015 **Janeiro de 2015 é o 4º mês mais quente da história em SP, diz Inmet**

Média das temperaturas máximas ficou em 31,5ºC no primeiro mês do ano. Medições foram feitas no

Mirante de Santana, na Zona Norte, desde 1943.

02 / 02 / 2015 **Nasa lança satélite para medir a umidade do solo e melhorar previsão**

Equipamento foi enviado ao espaço no início desta tarde, hora de Brasília. Mapas em alta resolução devem ajudar nas previsões climáticas futuras.

02 / 02 / 2015 **Produtores rurais do sul de Minas pedem decreto de calamidade pública**

Seca prolongada afetou a produção e as perspectivas para esse ano são ruins. Com o decreto, eles poderiam renegociar dívidas e ter acesso a benefícios.

02 / 02 / 2015 **Cidade de MS é uma das campeãs em focos de ferrugem asiática em janeiro**

Chapadão do Sul registrou oito focos da doença no mês. Número representa 5,7% dos 138 registros no país em janeiro.

02 / 02 / 2015 **Polícia Ambiental apreende quase 2 toneladas de peixes em Ubatuba/SP**

Embarcação do Rio de Janeiro recebeu multa de R$ 660.700. Funcionário não tinha autorização para atividade da pesca.

02 / 02 / 2015 **Seca obriga agricultores a economizar água no interior de São Paulo**

De toda a água consumida no país, 72% vão para o solo das plantações. Sistema que utiliza mangueiras é capaz de economizar 50% da água.

02 / 02 / 2015 **Concurso comemora Dia Mundial das Zonas Úmidas**

Concurso de fotografias comemora a data de 2 de fevereiro. O vencedor ganhará uma passagem para visitar a área úmida de sua escolha, em qualquer lugar do mundo.

02 / 02 / 2015 **Limeira/SP tem alta de 100 registros de dengue em 1 dia e inicia uso de drone**

Balanço divulgado na sexta-feira aponta 481 pacientes com a doença. Prefeitura já admite risco de epidemia e vai decretar estado de emergência.

02 / 02 / 2015 **Acordo para embalagens está em fase final**

Em fevereiro, setores econômicos recebem novo texto e iniciam negociações finais para assinatura de documento que definirá responsabilidades.

02 / 02 / 2015 **Frente fria faz Rio registrar temperatura mais amena de 2015**

De acordo com as estações do Sistema Alerta Rio, da prefeitura do Rio de Janeiro, o sábado (31) foi o dia com a menor temperatura máxima desde 1º de janeiro.

02 / 02 / 2015 **Pesquisadores brasileiros criam plástico comestível que não vira lixo**

Material criado por pesquisadores da Embrapa não tem petróleo. Plástico é feito com frutas e legumes e tem sabor dos alimentos.

02 / 02 / 2015 **Comitê finaliza primeiros Planos de Saneamento no Alto São Francisco**

De acordo com o CBHSF, cerca de R$ 1,5 mi foram financiados. Seis cidades da região Centro-Oeste serão beneficiadas com projeto.

02 / 02 / 2015 **Galápagos sob nova ameaça com vazamento tóxico de navio encalhado**

O Comitê de Operações de Emergências, que avalia a situação do navio "Floreana", carregado com produtos tóxicos, pediu no sábado (31) que se declare emergência ambiental para enfrentar possíveis danos ecológicos e sejam tomadas medidas para garantir o abastecimento de combustível e alimento às ilhas, que têm 26.000 habitantes e ficam no Oceano Pacífico, a 1.000 km da costa equatoriana.

02 / 02 / 2015 **Cantareira volta a cair após sete dias com mesmo nível**

Volume das represas do sistema se manteve em 5,1% durante sete dias. Neste domingo (1º), nível caiu para 5% da capacidade, segundo a Sabesp.

26 / 01 / 2015 **Misteriosas manchas fluorescentes iluminam o mar de Hong Kong**

Fenômeno conhecido como 'mar brilhante' pode ser sinal de poluição. Proliferação excessiva de organismo unicelular provoca brilho.

26 / 01 / 2015 **Mutirão contra dengue recolhe mais de 10 toneladas de lixo em Iperó/SP**

Bairro George Oetterer registrou 205 dos 206 casos da doença na cidade. Equipes da Secretaria da Saúde percorreram bairros eliminando criadouros.

26 / 01 / 2015 **Pelicanos aparecem mutilados e mortos em costa da Flórida/EUA**

Bolsas abaixo do bico, usada para segurar peixes, estavam cortadas. As mutilações geraram alerta nos Estados Unidos.

26 / 01 / 2015 **Peixe-boi encalha duas vezes em dois dias e é resgatado no Ceará**

Filhote perdeu muito peso e será mantido em cativeiro até a fase adulta. Animal encalhou no Rio Grande do Norte há dois dias e foi solto no mar.

26 / 01 / 2015 **Modi firma acordos e convida Obama a alcançar "conquistas concretas"**

O primeiro-ministro da Índia, Narendra Modi, e o presidente dos Estados Unidos, Barack Obama, firmaram o acordo de aumentar as cooperação bilateral em defesa, energia nuclear, comércio e energias limpas.

26 / 01 / 2015 **Sumidos das praias, águas vivas e tatuís são vistos neste verão, no Rio**

Os biólogos explicam que o aparecimento dessas espécies tem a ver com a temporada de reprodução.

26 / 01 / 2015 **Despoluição da Bacia do Guandu é urgente para abastecimento do Rio**

O governo do Rio de Janeiro precisa, urgentemente, implantar ações de despoluição de rios ou pelo menos remover os poluentes de rios e riachos nas proximidades da captação do Rio Guandu, como o Rio dos Poços, por exemplo.

26 / 01 / 2015 **RN tenta superar obstáculos para explorar potencial da energia eólica**

Produção do RN responde por 30% da geração de energia eólica no país. Infraestrutura para expansão tem avanços, porém, enfrenta problemas.

26 / 01 / 2015 **Greenpeace adverte Obama sobre poluição do ar que respirará em Nova Délhi**

O presidente dos Estados Unidos, Barack Obama, respirará em Nova Délhi um ar nove vezes mais poluído que o admissível segundo a Organização Mundial da Saúde, alertou no sábado o Greenpeace.

26 / 01 / 2015 **Sobe para 15 o número de casos suspeitos de dengue em Itajaí/SC**

Até sexta (23), havia seis casos confirmados de dengue na cidade. Na semana passada, a prefeitura admitiu o surto da doença.

26 / 01 / 2015 **Rio tem sensação térmica de 45°C neste domingo**

Termômetros registraram, máxima de 37,9°C em Guaratiba, Zona Oeste. Há previsão de pancadas de chuva em pontos isolados até o final do dia.

26 / 01 / 2015 **Obama quer proteger vida selvagem no Ártico de explorações petroleiras**

Presidente americano vai propor ampliar área protegida no Alasca. Região é de vital importância para ursos polares e outros animais.

26 / 01 / 2015 **Polícia Ambiental apreende balões e animais silvestres em Jarinu/SP**

Pássaros e um bugio foram retirados de chácara na zona rural. Polícia acredita que local era usado para produzir e estocar balões.

26 / 01 / 2015 **Cantareira completa 2 semanas seguidas de queda em suas represas**

Principal sistema da Grande SP recebeu só 35,4% das chuvas de janeiro. Demais mananciais se mantiveram estáveis ou tiveram alta no nível.

27 / 01 / 2015 **Aberta consulta pública para aperfeiçoar plano de agricultura de baixo carbono**

Conhecido como Plano ABC, a iniciativa tem por objetivo organizar e planejar ações a serem realizadas para adoção das tecnologias de produção sustentáveis, que ajudem a responder aos compromissos de redução de emissão de gases de efeito estufa no setor agropecuário, assumidos pelo Brasil.

27 / 01 / 2015 **Modelo matemático simula comportamentos de inseto para controlar praga agrícola**

Ciclo de vida da vaquinha verde-amarela foi modelado por pesquisadores da Unesp de Botucatu a fim de prever e minimizar ataques a cultivos.

27 / 01 / 2015 **Parque das Aves, em Apucarana/PR, tem mais de 200 pássaros furtados**

Aves levadas estavam em recuperação para serem reinseridas na natureza. Muitas delas são de "difícil visualização na vida livre", diz secretário.

27 / 01 / 2015 **Reservatório de Santa Branca, que abastece o RJ, atinge volume morto**

É o segundo abastecedor do estado a secar em cinco dias, segundo ONS. Pezão levará a Dilma plano para amenizar consequências da estiagem.

27 / 01 / 2015 **UFSCar recebe as matrículas de 35 indígenas aprovados em vestibular**

Estudantes devem fazer procedimento pela internet até 2 de fevereiro. 8ª edição do processo seletivo teve a participação de 237 candidatos de 51 etnias de 14 estados.

27 / 01 / 2015 **Pesquisa inédita na América Latina busca baratear tratamento de água**

Pesquisador da UFSCar, em São Carlos, mira auxiliar o semiárido nordestino. Apesar da tecnologia, ele faz alerta sobre a poluição e o desperdício no Brasil.

27 / 01 / 2015 **Argentina coloca 9 baleias-francas-austrais para adoção**

Ao adotar, a pessoa pode conhecer a história de vida, acompanhar os estudos mais recentes sobre os cetáceos e contribuir com fundos à proteção dos animais.

27 / 01 / 2015 **Goiânia teve 875 casos de dengue na 1ª quinzena deste ano, diz secretaria**

Número é considerado dentro do esperado; nenhum dos pacientes morreu. Agentes trabalham para evitar proliferação de focos em canteiros de obras.

27 / 01 / 2015 **Encontrado manuscrito inédito sobre vida de São Francisco de Assis**

O francês Jacques Dalarun, especialista em estudos franciscanos, descobriu uma biografia inédita de São Francisco de Assis que apresenta novos dados sobre a vida do santo pobre.

27 / 01 / 2015 **Arqueólogos podem ter encontrado ossada de Cervantes em Madri**

Equipe encontrou caixão com as iniciais MC na igreja das Trinitárias. Pesquisadores estavam buscando ossada em nichos da cripta da igreja.

27 / 01 / 2015 **Ministério da Agricultura adota medidas contra a praga Broca do Café**

O inseto ataca os grãos de café em qualquer um de seus estágios, destruindo o interior do fruto e colocando em risco a produção.

27 / 01 / 2015 **Awá-Guajás fazem contato após ameaças de madeireiros, diz ONG**

No Maranhão, três índios de tribo isolada fizeram contato com outra aldeia. Segundo ONG, últimos 100 'Awás' isolados correm risco de dizimação.

27 / 01 / 2015 **Inmet prevê chuva para esta semana no Sudeste e Centro-Oeste**

A previsão é de muito sol e temperaturas chagando a 40ºC no Rio de Janeiro.

27 / 01 / 2015 **Nível baixo dos reservatórios leva segunda hidrelétrica a parar**

A Usina de Santa Branca, no Rio Paraíba do Sul, em São Paulo, pertencente à Light, fornecedora do Rio de Janeiro, chegou ao nível do volume morto e parou de gerar eletricidade no domingo (25).

27 / 01 / 2015 **Chuva interrompe duas semanas de quedas seguidas no Cantareira**

Principal sistema da Grande SP, no entanto, não sobe há um mês. Sistema Guarapiranga se beneficiou com chuvas na capital e teve alta.

28 / 01 / 2015 **Rio é única cidade brasileira em lista das 100 mais visitadas do mundo**

Cidade ficou em 92° lugar em 2013, segundo pesquisa. São Paulo, que havia aparecido na lista em 2012, não entrou no ranking.

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Fault rock lithologies and architecture of the central Alpine fault, New Zealand, revealed by DFDP-1 drilling
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Fault rock lithologies and architecture of the central Alpine fault, New Zealand, revealed by DFDP-1 drilling
Virginia G. Toy, Carolyn J. Boulton, Rupert Sutherland, John Townend, Richard J. Norris, Timothy A. Little, David J. Prior, Elisabetta Mariani, Daniel Faulkner, Catriona D. Menzies, Hannah Scott, and Brett M. Carpenter
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Editorial

Editorial
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EARTH PAGES

January 2015 photo of the month

Posted on February 3, 2015 by Steve Drury | 1 comment

Angular unconformity at Telheiro Beach, Portugal (credit: Gabriela Bruno)

This image posted at Earth Science Picture of the Day would be hard to beat as the definitive angular unconformity. It shows Upper Carboniferous marine metagreywackes folded during the Variscan orogeny overlain by Triassicredbeds. Structurally it is uncannily similar to Hutton's famous unconformity atSiccar Point on the coast of SE Scotland, although the tight folding there is Caledonian in age and the unconformable redbeds are Devonian in age.

1 Comment

Posted in Sedimentology and stratigraphy, Tectonics

Tagged Angular unconformity, Folded strata, Orogeny, Redbeds

Human-Neanderthal cohabitation of the Levant

Posted on February 3, 2015 by Steve Drury | Leave a comment

The earliest known remains of anatomically modern humans outside of Africa were found unearthed from the Skhul and Qafzeh caves in what is now northern Israel. Their context was that of deliberate burial at a time when climate was cooling from the last interglacial, between 90 to 120 ka. The Levant was also the repository for a number of well-preserved Neanderthal skeletons, most dating to between 35-65 ka, including ten individuals at Shanidar in today's northern Iraq, some of whom were also deliberately buried including one whose grave reputedly contained evidence for a floral tribute. The 25 ka gap between the two populations has previous been regarded as evidence for lack of contact between them. However, the Tabun Cave in modern Israel has yielded tools attributed to Neanderthal Mousterian culture that may indicate their intermittent presence from 200 to 45 ka, and fossils of two individuals dated at ~122 and ~90 ka. The remains at Skhul and Qafzeh are significantly more rugged or robust than African contemporaries and have been considered possible candidates for Neanderthal-modern human hybrids. But whatever their parentage, it seems they became extinct as the climate of the Levant dried to desert conditions around 80 ka.

Entrance to the Shanidar Cave, northern Iraq, occupied by Neanderthals between 35-65 ka (credit: Wikipedia)

A more promising overlap between modern human and Neanderthal occupation comes with the discovery by a group of Israeli, US, Canadian, German and Austrian scientists of a much younger anatomically modern human cranium from the Manot Cave, also in northern Israel (Herschkovitz, I. and 23 others 2015. Levantine cranium from Manot Cave (Israel) foreshadows the first European modern humans. *Nature* (online) doi:10.1038/nature14134). The cranium has a U-Th radiometric age of ~55 ka, well within the time span of Neanderthal occupation. Moreover, Manot Cave is one of a cluster of occupied sites in northern Israel, with separations of only a few tens of kilometres: undoubtedly, this individual and companions more than likely met Neanderthals. The big question, of course, is did the neighbours interbreed? If so the Levant would be the confirmed as the probable source of hybridisation to which the DNA of non-African living humans points. There may be a insuperable difficulty in taking this further: it is thought that the high temperatures of the region, despite its dryness, may have destroyed any chance of reconstructing ancient genomes. Yet one of the first Neanderthal bones to yield useful genetic material was from Croatia, which is not a great deal cooler in summer.

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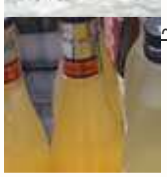
-  ~55 thousand year old modern human from Manot cave in Israel

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Posted in Anthropology and Geoarchaeology

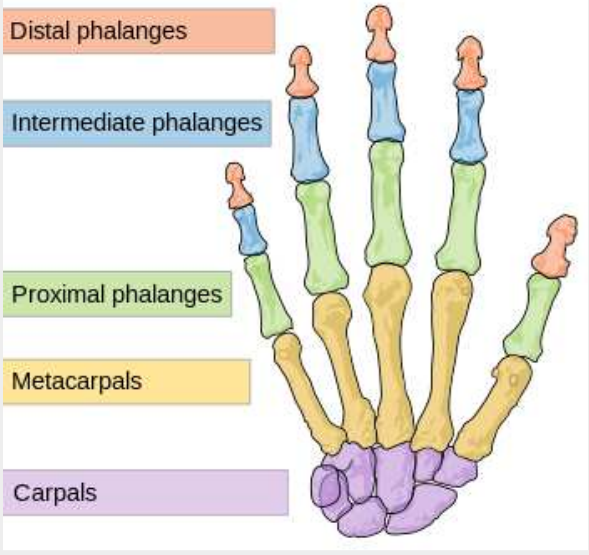
Tagged Anatomically modern humans, Cohabitation,Neanderthal

Convincing, indirect evidence for early toolmakers

Posted on February 2, 2015 by Steve Drury | Leave a comment

A surprising number of animals pick up items from their surroundings and use them, mainly to get at otherwise inaccessible foodstuffs. What sets humans apart from such tool users is that we make them and for a long time part of our repertoire has been tools used to make other tools; so-called 'machine tools'. An example is a piece of antler used to pressure-flake flint to give a stone blade a better edge, a more recent one is the increasing use of robots on assembly lines. Making a tool is impossible for a bird with only its beak and ill-adapted feet, while even a chimpanzee lacks various forms of grip needed for precisely directed force and manipulation. It was Frederick Engels who first focussed on the importance of the hand being freed to evolve the capacity for manual labour by the permanent adoption of an upright posture and gait, in his essay *The Part Played by Labour in the Transition from Ape to Man* written in 1876.

The earliest tools known turned up in 2.6 Ma old sediments at Gona in NE Ethiopia, while evidence for tool use is well accepted from cracked and sliced bones found in sediments dated at 2.5 Ma from Bouri in the same region. In neither case can the finds be tied to fossil remains of the makers and users, the earliest direct link emerging from famous Olduvai Gorge in western Tanzania, where crude Oldowan tools and worked bones occur with incomplete remains of a hominin, dubbed *Homo habilis* ('handy man') because of this association. Somewhat more controversial are bones that show cuts and scrape marks plus signs of having been cracked open that were found in a 3.4 Ma context at Dikika, also in Ethiopia, within the same sedimentary horizon as the young*Australopithecus afarensis* known as Selam ('Hello'). The Dikika material is little different from 0.9 to 1.2 Ma younger bones at Bouri and Olduvai: the controversy seems to stem more from its much greater age and association with hominins deemed by some to have been incapable of creating tools.



Bone structure of the (right) human hand. (credit: Wikipedia)

An entirely novel approach to the issue of the first tools and their makers, which with little doubt would have tickled Engels no end, is a careful anatomical and physiological examination of fossil hominin hand bones in comparison with those of chimps and living humans (Skinner, M.M. *et al*. Human-like hand use in*Australopithecus africanus*. *Science*, v. **347**, p. 395-399). The bones being scrutinized are the five metacarpals that form the links in the palms from muscles of the forearm to finger and thumb movements and thus to various kinds of grip. In humans there are a host of ways of gripping objects from the precision of opposed thumb and finger pinching, especially that using the forefinger, to the squeezing power grip that wraps thumb and all fingers around an object and makes a fist. The best a chimp can do is grabbing a branch, to which its knuckle-walking hands are well adapted. The tips of the metacarpals are mechanically loaded according to the types of grip used repeatedly in life and that works to modify the physical density of the tips' spongy bone tissue in patterns that vary according to habitual usage of the hand and its digits. This new approach is reputedly far more diagnostic than the actual shape of metacarpal bones, and requires high-resolution CT scanning.

Known early human and Neanderthal tool-makers show very similar patterns: in fact they suggest far more heavy loading through various kinds of grip than the metacarpals of humans from the modern period. In 1.8 to 3.0 Ma old *A. africanus* and *Paranthropus robustus* (a gorilla-like but bipedal australopithecine) from South Africa metacarpals suggest that both were habitually using a tree-climbing grip, much as chimpanzees do, but more closely resembled modern human and Neanderthal committed tool users. Both were certainly capable of using forceful precision grips to make and use tools up to 0.5 Ma earlier than the date of the earliest known tools. So far the technique has not been applied to the palm bones of earlier hominins such as *A. afarensis* (2.9-3.9 Ma) and *Orrorin tugenensis* (~6 Ma). Despite the suggestion of tool-makingcapability, agreeing that it did take place in non-*Homo* hominins must await finds of tools, as well as signs of their use, in close association with fossil remains of their makers. The Dikika association is simply not enough. Yet, some bipedal being must have made tools before the date of the earliest ones (~2.6 Ma) discovered at Gona. Look at it this way: it is a lucky archaeologist who discovers every piece of evidence for a fundamental social change at one site. The fact that, by definition, the vast bulk of Pliocene and Pleistocene sediments that may contain the key evidence is either buried by younger material or was a victim of erosion, means that the chance of resolving the origin of the fundamental feature of human behaviour is tiny. The chance that scientists will continue looking is astronomically higher.

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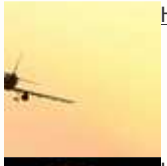
- 
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Posted in Anthropology and Geoarchaeology

Tagged Australopithecus africanus, Hand, human evolution,Tool making

Reconstructing the structure of ancient vegetation canopies

Posted on January 25, 2015 by Steve Drury | Leave a comment

One of the central measures used to describe modern ecosystems is the ratio of foliage area to that of the ground surface – the leaf area index (LAI) – which expresses the openness of vegetation canopies. A high LAI helps to retain moisture in the soil, partly by shading and cooling the surface to reduce evaporation and partly by stopping surface soil from being battered to a concrete-like consistency by heavy rain, which reduces the amount of water that can infiltrate. It is possible to estimate LAI across today's entire land area using satellite image data but a proxy for palaeoecological LAI has remained hard to find.

Hemispherical photograph used to calculate modern canopy cover. (credit: Wikipedia; photo by S.B. Weiss)

The outer coating of leaves in well-shaded (high LAI) areas tends to have protective or pavement cells that are larger and have more complicated shapes than does that of leaves in more open canopies. The framework of leaf cells is silica-based and made up of structures known as phytoliths whose morphologies vary in much the same way as the cells that they support. So theoretically it is possible to use fossil phytoliths in terrestrial sediments to estimate LAI variations through time in local canopies, but first the approach needs a means of calibration from living ecosystems. The vegetation of Central American Costa Rica varies through the entire range of possible LAI values, which leads to varying amounts of sunlight available to the leaves of cover plants. Measuring the area and the degree of shape-complexity of phytoliths in modern soils there shows that each is positively correlated with LAI.

A modern herbivorous mammal (lowland paca) from dense forest in Costa Rica. (Photo credit: Wikipedia)

Putting this approach to use in the Cenozoic terrestrial sediments of Patagonia, US and Argentinean palaeoecologists aimed to examine how the evolution of the teeth of herbivorous mammals – a major feature in their speciation – linked to changes in vegetation structure (Dunn, R.E. *et al*. 2015. Linked canopy, climate and faunal change in the Cenozoic of Patagonia. *Science*, v. **347**, p. 258-261). Using phytoliths they were able to show that in the Eocene the area was covered by dense, closed forest canopies that gradually became more

open towards the end of the Eocene to be replaced by open forest and shrubland habitats in the Oligocene and Miocene, with a brief period of regreening. It was during the period of more open vegetation that tooth structure underwent the most change. Chances are that the vegetation shifts began in response to the onset of Antarctic glaciation at the beginning of the Oligocene Epoch and related climate change at the northern margin of the Southern Ocean. Changes in the herbivore teeth may have been in response to the increasing amount of dust adhering to leaves as canopies became more open and soil increasingly dried out.

Leave a comment

Posted in Climate change and palaeoclimatology, Geobiology, palaeontology, and evolution, Sedimentology and stratigraphy

Tagged Habitat reconstruction, Palaeobotany

Bicentenary of the first national geological map

Posted on January 25, 2015 by Steve Drury | 2 comments

It's good to know that the geosciences have had revolutionising developments to match those of the rest of science. Forget the Battle of Waterloo in 1815, which of course was '*the nearest-run thing you ever saw in your life*' when the Brits were saved from defeat by the timely arrival of the Prussians: This year we can celebrate one that literally put geology on the map, kicked-off the systematic exploration for every kind of physical resource, thereby putting a great deal of money in the pockets of coal, petroleum and metal moguls and making geology a career rather than a pastime. In 1815 William Smith published *A Delineation of the Strata of England and Wales with part of Scotland*, which despite the title was a map showing the basic geology and structure of the whole of England and Wales: the first ever map showing accurately the distribution of rocks for an entire country. The original, at 2.6 by 1.8 m, dominates the main staircase at Burlington House, the home of the Geological Society of London.

William Smith's A Delineation of the Strata of England and Wales with part of Scotland (1815)

Tom Sharpe has nicely summarized the key facts surrounding Smith's masterpiece (Sharpe, T. 2015. The birth of the geological map. *Science*, v. **347**, p. 230-232). One feature that I certainly did not know was that the colour scheme for the different stratigraphic units was based on the dominant colour of the rocks themselves, such as purples for the abundant slates of the Lower Palaeozoic, brown and red for the Old- and New Red Sandstone, greys and blacks for the Coal Measures and green for the Greensand, which until quite recently remained widely used to signify Cambrian, Ordovician and Silurian; Devonian and Permian; Upper Carboniferous and Cretaceous.

Although celebrated today, Smith's map was panned by the gentlemen geologists of the Geol Soc, who attempted to do a better job, but failed ignominiously. William Smith was not a leisured chap of the Enlightenment, but worked for a living surveying coal mines, navigating canals and draining fens. Despite their antipathy, the Fellows of the Geological Society of London knew a good earner when

they saw one and plagiarized Smith's work and undercut his regular price for his map. As a result he ended up in a London debtors' prison. Even on the day of his release in 1819, bailiffs seized his house and its contents. The Geol Soc eventually did honour Smith with its Wollaston Medal in 1831, its then presidentAdam Sedgwick dubbing him 'the Father of English Geology': by that time geology had become a profession…

2 Comments

Posted in Economic and applied geology

Tagged Geological maps, William Smith

Verneshots (huge volcanic gas blasts) ten years on

Posted on January 15, 2015 by Steve Drury | Leave a comment

One of the most daring hypotheses of modern geosciences: is that of the 'Verneshot' reported by Earth Pages in 2004. Jason Phipps Morgan and colleagues explored the possible consequences of a build-up of volatiles in plume-related magmas at the base of thick continental lithosphere beneath cratons, prior to the eruption of continental flood basalts. They suggested that pressure would eventually result in an explosive release at a lithospheric weak point, followed by collapse above the plume head that would propagate upwards, at hypersonic speeds. Modelling the forces involved, the authors of the novel idea considered that they would be sufficient to fling huge rock masses into orbit. Verneshots might neatly explain the circumstances around mass extinctions, such as their coincidence with continental flood basalt events; large impact structures, most likely at the antipode of the event; global debris layers containing shocked rock, melt spherules; unusual element suites and compounds (including fullerenes); and enough toxic gas to cause biological devastation.

Ten years on, Verneshots are back, again in the prestigious journal *Earth and Planetary Science Letters*, and this time among the co-authors are Morgan *père et fils* (W. Jason a founder of plate tectonics, and Jason P. who launched the idea). This time the yet-to-be – accepted hypothesis comes with evidence of an extremely unusual and fortuitous kind (Vannucchi, P. *et al*. 2015. Direct evidence of ancient shock metamorphism at the site of the 1908 Tunguska event. *Earth and Planetary Science Letters*, v. **409**, p. 168-174). The origin of the paper lies in an attempt to verify reports of shocked quartz in samples collected close to the centre of the 2000 km^2 devastation that resulted from what is now accepted to have been a comet or asteroid air-burst explosion in June 1908 in the Tunguska region of Siberia. Apart from a disputed 300 m crater in the area, the Tunguska Event left no long-lived sign: it 'merely' knocked over millions of trees. However, its epicenter lay in a 10 km depression ringed by hills, that has been suggested to be a volcanic centre associated with the end-Permian Siberian Traps.

Trees knocked down and burned over hundreds of square km by the 1908 Tunguska Event (credit: Leonid Alekseyevich Kulik deceased)

The reported shocked quartz locality turned out to associated with an isolated occurrence of quartz-rich sand and rounded clasts of quartzite that contains sedimentary structures. The occurrence is surrounded by basalts of the Siberian Traps, yet is situated topographically above them. The quartzite is thought to be Permian terrestrial sandstone that commonly underlies much of the remaining extent of Siberian Traps.

Quartzite clasts do indeed contain shocked quartz, together with pseudotachylite glass veinlets, quartz and feldspar crystal growth on sedimentary grains and silica-rich glassy spherules. These features are not uniquely diagnostic of shock metamorphism, but are oddly absent from the surrounding Siberian Traps nearby, which suggests that whatever formed them predated the final eruptive stages of the end-Permian large igneous province. Indeed it would be unlikely that airburst of some extraterrestrial bolide in 1908 could produce the metamorphic features of the quartzites without setting ablaze the trees that it felled. A second possibility, that the Tunguska Depression is a Permo-Triassic impact crater and the quartzites being part of an associated central uplift runs into the unlikely coincidence of lying less than 5 km from the 1908 epicentre.

A third hypothesis is that the Tunguska Depression is a massive diatreme associated with a Verneshot. Another odd association lies 8 km to the south of the epicentre, a carbonatite that is one of many, along with smaller pipe-like structures all possibly linked to magmatic gas escape. The Tunguska Event, a mighty puzzle in its own right, may perhaps be eclipsed. Will silence return as it did after the original Verneshot hypothesis was published? Quite possibly, but another quirk about the Siberian Traps was reported by Earth Pages in mid-2014. In a contribution to a link between this massive end-Permian volcanic effusion and the Permian-Triassic mass extinction it was noted that in the Chinese sedimentary repository of evidence for the extinction there is an isolated spike in the abundance of nickel that is almost certainly of volcanic origin, but only the one when repeated flood basalt events perhaps ought to have led to a series of nickel anomalies. One huge volcanic gas release as the Siberian Traps were building up?

Leave a comment

Posted in Geobiology, palaeontology, and evolution,Geochemistry, mineralogy, petrology and volcanology

Tagged mass extinction, Shock metamorphism, Siberian Traps, Tunguska event,Verneshot

Bibliometrics: the numbers game

Posted on January 15, 2015 by Steve Drury | 1 comment

In mid-December, British universities, their constituent units and departments, and most academics experienced the same kind of traumatic day familiar to 18-year olds awaiting the examination results on which their advancement to higher education, or not, depended. December 18th, 2014, was REF-Day. Since its predecessor (RAE-Day), 8 years before, a vast – by university standards – effort went into preparing bids on a department-by-department basis to rank them nationally and conflate individual assessments to build a sort of institutional league table for research excellence; hence REF stands for Research Excellence Framework (the RAE was the less meritorious-sounding Research Assessment Exercise). It resembled the Guide Michelin or Automobile Association star system for restaurants and hotels or guest houses. The reason for the 8-year frenzy of activity was that the outcomes aimed to inform the selective allocation of governmental research funding. Unsurprisingly, this kind of competition stemmed from the Tory government of Margaret Thatcher, which in 1986 set the scene for 'performance-related' funding rather than that based on peer review of each individual bid for major grants, which preceded it.

To itemise each aspect of the way the REF worked could take the majority of Earth Pages readers to an early and ignoble grave. It centred on departmental selection from its full-time researchers of those who were deemed to be 'research active' and those who were not, the former having to select four recently published works or 'outputs'. They had to self-assess each according to its 'impact', defined as '*an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life,*

beyond academia'. Institutions vetted and bundled individual submissions, collated them in the subject areas designated by the REF, then sent them off to 'REF Central', where they were to be reviewed by subject-specialist panels that gave out the stars for each submitted item of work: **** = world-leading (30% were deemed to be); *** = internationally excellent (46%); ** = recognized internationally (20%); * = recognized nationally (3%); unclassified = below the standard of national recognition (1% – presumably those obviously lacking star quality were weeded out at institution level). There were more than 190 thousand 'outputs', which begs the questions; Were all of them read by at least one specialist panel member? Against what standards were they judged?

On average, each of the roughly 1000 panelists would have had to consider about 190 outputs in greater depth than a casual skim, or more if some were read by several panelists. Outputs were rated '*in terms of their "originality, significance and rigour", with reference to international research quality standards*', '*the "reach and significance" of impacts on the economy, society and/or culture*' and the part they played in their department's contribution to '*the vitality and sustainability… of the wider discipline or research base*'. On paper – and believe me, REF Central produced plenty of wordy PDFs of guidance – this level of scrutiny makes the adjective 'daunting' seem a bit of an understatement. Entering into this spirit of things in the gleeful manner of a Michelin or AA assessor does seem to me a bit hard to grasp. I wonder if the panels in reality just checked each submission for signs of an overly hubristic vision of self-worth.

To some extent, the issue of each output's citation count or other bibliometric measure must at some stage have come into REF reckoning, and here is what spurred me to defy normal cautions about boredom as a contributor to general organ failure. Physicist Reinhard Werner of Leibniz University in Hanover, Germany believes that deciding on funding and hiring, or firing, needs to steer well-clear of impact factors, citations and other kinds of bibliometrics (Werner, R. 2015 The focus on bibliometrics makes papers less useful. *Nature*, v. **517**, p. 245). Scientists cite other works for many reasons, some worthy and some less so. But it is rare that in doing so we express any opinion on the overall significance of the work that we choose to cite. Yet, conversely, a researcher can choose a field, phrase some findings and submit to such and such journal that will boost their citation frequency and impact. Just by writing about some mundane topic in a publicly accessible way, reviewing the work of lots of other people, or simply writing about this or that topic as observed or measured in an especially highly populous country where science is really booming does much the same thing. Werner makes a telling point, 'When we believe that we will be judged by silly criteria, we will adapt and behave in silly ways'. Although he does not touch on the absurdities of the REF – why on Earth would he? – Werner comments on distortion of the job market, and peer-reviewed journals. He also pleas for a return to proper scrutiny of scientific merit and, I suspect, for cutting hubris off at the roots.

Related articles

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1 Comment

Posted in End of year summaries, general musings

Tagged Citations, Excellence, Hubris, Impact factor

Judging earthquake risk

Posted on December 30, 2014 by Steve Drury | 3 comments

The early 21st century seems to have been plagued by very powerful earthquakes: 217 greater than Magnitude 7.0; 19 > Magnitude 8.0 and 2 >Magnitude 9.0. Although some lesser seismic events kill, those above M 7.0 have a far greater potential for fatal consequences. Over 700 thousand people have died from their effects: ~20 000 in the 2001 Gujarat earthquake (M 7.7); ~29 000 in 2003 Bam earthquake (M 6.6); ~250 000 in the 2004 Indian Ocean tsunami that stemmed from a M 9.1 earthquake off western Sumatra; ~95 000 in the 2005 Kashmir earthquake (M7.6); ~87 000 in the 2008 Sichuan earthquake (M 7.9); up to 316 000 in the 2010 Haiti earthquake (M 7.0); ~20 000 in the 2011 tsunami that hit NE Japan from the M 9.0 Tohoku earthquake. The 26 December 2004 Indian Ocean tsunamis spelled out the far-reaching risk to populated coastal areas that face oceans prone to seismicity or large coastal landslips, but also the need for warning systems: tsunamis travel far more slowly than seismic waves and , except for directly adjacent areas, there is good chance of escape given a timely alert. Yet, historicallyhttp://earthquake.usgs.gov/earthquakes/world/most_destructive.php, deadly risk is most often posed by earthquakes that occur beneath densely populated continental crust. Note that the most publicised earthquake that hit San Francisco in 1906 (at M 7.8) that lies on the world's best-known fault, the San Andreas, caused between 700 and 3000 fatalities, a sizable proportion of which resulted from the subsequent fire. For continental earthquakes the biggest factor in deadly risk, outside of population density, is that of building standards.

A poor neighbourhood in Port au Prince, Haiti following the 2010 earthquake measuring >7 on the Richter scale. (credit: Wikipedia)

It barely needs stating that earthquakes are due to movement on faults, and these can leave distinct signs at or near to the surface, such as scarps, offsets of linear features such as roads, and broad rises or falls in the land surface. However, if they are due to faulting that does not break the surface – so-called 'blind' faults – very little record is left for geologists to analyse. But if it is possible to see actual breaks and shifts exposed by shallow excavations through geologically young materials, as in road cuts or trenches, then it is possible to work out an actual history of movements and their dimensions. It has also become increasingly possible to date the movements precisely using radiometric or luminescence means: a key element in establishing seismic risk is the historic frequency of events on active faults. Some of the most dangerous active faults are those at mountain fronts, such as the Himalaya and the American cordilleras, which often take the form of surface-breaking thrusts that are relative easy to analyse, although little work has been done to date. A notable study is on the West Andean Thrust that breaks cover east of Chile's capital Santiago with a population of around 6 million (Vargas, G. *Et al*. 2014. Probing large intraplate earthquakes at the west flank of the Andes. *Geology*, v. **42**, p. 1083-1086). This

fault forms a prominent series of scarps in Santiago's eastern suburbs, but for most of its length along the Andean Front it is 'blind'. The last highly destructive on-shore earthquake in western South America was due to thrust movement that devastated the western Argentinean city of Mendoza in 1861. But the potential for large intraplate earthquakes is high along the entire west flank of the Andes. Vargas and colleagues from France and the US excavated a 5 m deep trench through alluvium and colluvium over a distance of 25 m across one of the scarps associated with the San Ramon Thrust. They found excellent evidence of metre-sized displacement of some prominent units within the young sediments, sufficient to detect the effects of two distinct, major earthquakes, each producing horizontal shifts of up to 5 m. Individual sediment strata were dateable using radiocarbon and optically stimulated luminescence techniques. The earlier displacement occurred at around 17-19 ka and the second at about 8 ka. Various methods of estimation of the likely earthquake magnitudes of the displacements yielded values of about M 7.2 to 7.5 for both. That is quite sufficient for devastation of now nearby Santiago and, worryingly, another movement may be likely in the foreseeable future.

3 Comments

Posted in Environmental geology and geohazards, Geophysics,Tectonics

Tagged Disaster, Earthquake risk, Haiti earthquake, Kashmir earthquake, Thrust fault,Tsunami

Basin and Range: From mountains to basin

Posted on December 13, 2014 by Steve Drury | 1 comment

The "marching caterpillars" of the Basin and Range province, showing the San Andreas Fault in green (credit: University of Maryland, USA)

The Basin and Range province of the western US is one of the world's largest products of continental extension. Being semi-arid, sedimentation has been unable to keep pace with crustal thinning thereby giving form to its name: linear mountain ridges separated by sediment-filled basins. Despite the extreme extension the Basin and Range has an average elevation of about 1400 m, although it is well below that of the Sierra Nevada range (2000+ m) that flanks it to the west. Throughout the Mesozoic, subduction towards the east beneath the North American plate produced voluminous magmas and fold-thrust belts adding to the continental crust in a manner similar to that still occurring in the South American Andes. Extension began in earnest during the Eocene (~45 Ma) and continues today.

Much of the theory regarding continental extension – listric normal faults and detachments, fault-tilt blocks, core complexes etc. – stems from studies in this huge terrain. As regards the evolution of the Basin and Range, it has been widely thought that by the Late Oligocene (~25 Ma) the thickened Cordilleran crust had been reduced to a plateau no higher than the present Sierra Nevada, which subsequent extension reduced to the present Basin and Range.

The Eocene to Miocene extensional history was punctuated by huge episodes of explosive volcanism from which hot ash flowed laterally for hundreds of kilometres, relics of which are still widespread. Such ignimbrites are often very porous and were aquifers while still exposed, until buried by sediment and subsequent nuée ardent flows. Groundwater at the time of first exposure altered the volcanic glass shards from which ignimbrites are formed, so that the oxygen and hydrogen making up what was originally rainwater is now locked in the altered ash flows. The hydrogen isotopic composition of such meteoric water is known to vary with the altitude of the clouds shedding it. Water containing the heavier hydrogen isotope deuterium (D) is preferentially precipitated at low altitudes, so that high altitude rainfall is significantly depleted in it. Because of this the alteration can give clues to the former topographic elevation of the ignimbrites when they first rushed across the land surface. Applying this method to the repeated ignimbrite events in what is now the Basin and Range has given a good idea of the actual evolution of the land surface in the western US during the Palaeogene (Cassel, E.J. *et al*. 2014. Profile of a paleo-orogen: high topography across the present-day Basin and Range from 40-23 Ma. *Geology*, v. **42**, p. 1007-1010).

The results present a major surprise. In the Eocene, elevation across the area was, as anticipated, a little more than the present Sierra Nevada (2000-2500 m). This fell back to roughly 2000 m, again as theory would suggest. But by the Late Oligocene (23-27 Ma) elevation expected to have declined further over the Basin and Range actually leapt to between 2500-3500 m, up to 2.1 km higher than it is today: the opposite of prediction. Effectively, despite evidence for Palaeogene extension the crust was buoyed-up probably by an upwelling of the asthenosphere and increased heat flow. The unexpected uplift occurred towards the end of subduction of oceanic lithosphere beneath western North America, the dynamics of which prevented the westward collapse of an earlier orogen. When subduction ended and the plate-margin tectonics became strike slip, as witnessed by the San Andreas Fault, the continental crust slid apart in the manner of books on a library shelf if a bookend is removed.

Related articles

Johnson, S.K. 2015. From rain to ranges. *Scientific American*, v. **312** (January 2015), p. 12-13.

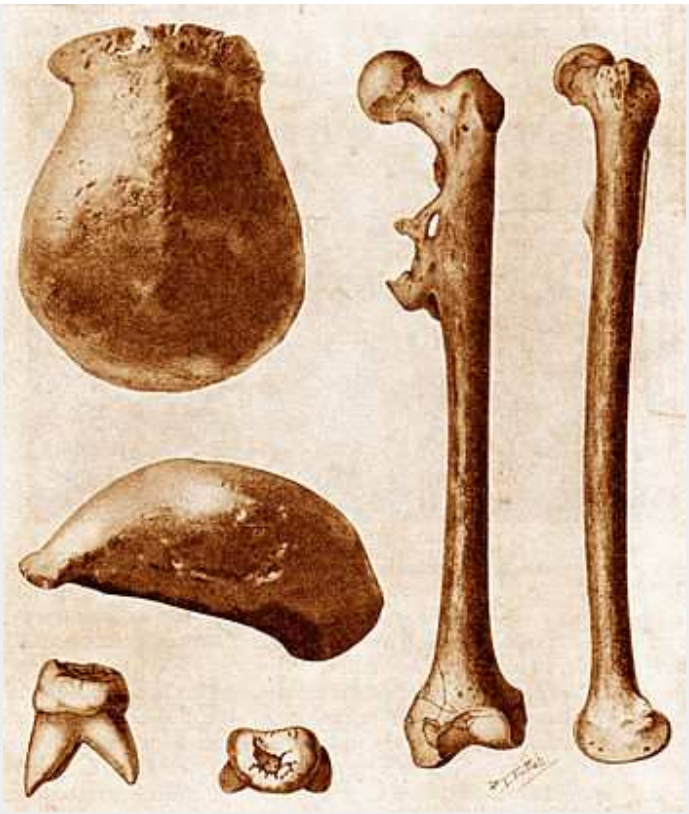
1 Comment

Posted in Tectonics

Tagged Extensional tectonics, Hydrogen isotopes, Topographic elevation

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 $^{40}Ar/^{39}Ar$ 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.