G E O B R A S I L

http://www.geobrasil.net

- **CONCURSOS**

Universidade Tecnológica Federal do Paraná (UTFPR) realiza concurso para professor
Inscrições até 8 de novembro
As vagas são nas áreas de Engenharia/Engenharia de Materiais, Ambiental/Hidráulica, Hidrologia e Saneamento Ambiental.
Mais informações no site http://www.ld.utfpr.edu.br/concurso/concursos.php

Concurso para professor na Universidade Federal da Fronteira Sul (UFFS)
Inscrições até 9 de novembro
Estão abertas as inscrições para o concurso público da Universidade Federal da Fronteira Sul (UFFS), que vai selecionar professores para os campi de Chapecó (SC), sede da instituição, Cerro Largo (RS), Erechim (RS), Laranjeiras (PR) e Realeza (PR).
São 165 vagas para diversas áreas e as inscrições devem ser feitas até as 20h de 9 de novembro. O valor da taxa é de R$ 90 para o cargo de dedicação exclusiva e R$ 70 para o de 20 horas. Será exigida a titulação mínima de mestre.
A primeira prova, eliminatória, vai ocorrer no dia 22 de novembro, em Florianópolis. Mais informações no site http://www.uffs.edu.br ou pelo telefone (48) 3721-6646.

- **NOTÍCIAS**

AMBIENTE BRASIL

Câmara aprova projeto sobre mudança do clima
O relator apresentou várias mudanças. Entre elas, a que estabelece que o governo terá que definir metas quantificáveis e verificáveis quanto à redução na emissão de gases do efeito estufa.

Estudo indica que casos de hepatite no Brasil estão abaixo dos números da OMS
Foram ouvidos moradores das 27 capitais brasileiras. As informações anteriores apontavam para uma alta incidência da hepatite tipo B na Região Norte, onde a doença atingia até 8% da população.

Ambientalistas protestam contra revisão do Código Florestal
No governo, os ministérios do Meio Ambiente e da Agricultura ainda não se acertaram sobre as mudanças na legislação.

Acre e Rondônia passam a fazer parte do Sistema Interligado Nacional
Segundo informações do ONS, foram necessárias ações que envolveram desde a troca de informações e a disseminação de conhecimentos, estudos de planejamento da operação elétrica e energética, até o estabelecimento de novos procedimentos operativos para integrar os dois estados ao restante do país.

Indústria foi o setor que mais contribuiu para poluição do meio ambiente
Entre as atividades industriais que mais poluíram o ambiente estão a indústria de produtos minerais, com 59%, seguida da química, com 55%, e a metalurgia, com 40% das emissões.

Ministério da Saúde vai distribuir três novos medicamentos para o tratamento da hepatite B
Entre 5% e 10% de todos adultos infectados acabam por desenvolver a forma crônica da doença, transmitida pelo sangue, esperma e as secreções vaginais.

Aumenta estimativa sobre emissão de gases de efeito estufa
O setor que mais emitiu gases de efeito estufa foi a indústria, com 56%; seguido do setor de energia, com 54%.

STJ adia julgamento de pedido de indenização de produtores rurais pela construção de Itaipu
Os produtores ocupam uma área de 70 mil hectares e alegam ter sofrido prejuízos, nos últimos 25 anos, em consequência das alterações climáticas decorrentes da formação do lago da hidrelétrica.

Petrobras nega que esteja faltando asfalto para o mercado
Segundo a estatal, a capacidade de produção da Petrobras é de 3 milhões de toneladas/ano, enquanto a demanda total prevista para as obras do PAC é de 2 milhões e 400 mil toneladas/ano.

Relator do projeto que cria a Petro-sal apresenta parecer à comissão especial
O relator proíbe a criação de novos escritórios da estatal e mantém no texto que a sede e foro da empresa será em Brasília, com escritório central no Rio de Janeiro.

Brasil e Canadá discutem comércio agropecuário
O encontro, entre representantes dos governos dos dois países, ocorre anualmente. A delegação do Canadá veio ao Brasil com cerca de 15 pessoas.

Lobão reforça pedido para que percentual de repasse de royalties do pré-sal seja de 12%
Lobão fez ainda um apelo para que não se alterem os percentuais destinados à Marinha e ao Ministério da Ciência e Tecnologia.

Brasil deve assumir liderança em Copenhague, defende ativista do Greenpeace
O Greenpeace faz protesto em frente ao Itamaraty contra mudanças climáticas e para que o Brasil assuma metas contra o aquecimento global.

Ministro diz que CPMI do MST não vai atrapalhar repasse de recursos à agricultura familiar
Ele reforçou que os procedimentos previstos na Lei dos Convênios serão mantidos. "O governo vai continuar seguindo rigorosamente o que está estabelecido e vai continuar mantendo o diálogo com representantes de empresários e trabalhadores."

Ainda não é possível afirmar se surto de meningite em Porto Seguro foi contido, diz médico
A cidade disponibilizou atendimento de 24 horas nos postos de saúde para prestar assistência aos casos suspeitos de meningite.

Funai prorroga restrição de permanência em terra indígena de Rondônia
Só poderão entrar, se locomover e permanecer na área, por tempo determinado, pessoas autorizadas pela Coordenação-Geral de Índios Isolados (CGII).

Petrobras e UFRJ inauguram laboratório para desenvolver tecnologias exploratórias
O laboratório será instalado em um prédio de 150 metros quadrados (m2) e terá como principal atribuição identificar e explorar rotas tecnológicas, desenvolver conhecimentos e avaliar tecnologias voltadas para o setor de petróleo e gás.

Colecionador encontra fóssil de réptil marinho gigante no Reino Unido
O crânio tem 2,4 metros de comprimento, e especialistas dizem que ele poderia pertencer a um dos maiores pilossauros já encontrados, por possuir até 16 metros de comprimento total.

Nasa adia lançamento do protótipo de foguete Ares 1-X
Antes do cancelamento, a Nasa teve que adiar várias vezes o lançamento a partir do Centro Espacial Kennedy, que serviria como um teste de um futuro propulsor de naves.

Explosões de estrelas explicam "neblina" no centro da Via Láctea

O centro da nossa galáxia tinha um alto número de estrelas massivas, quando comparadas com demais partes.

Respiração boca a boca reduz chances de sobrevivência
O consenso será publicado nos principais periódicos internacionais de cardiologia em outubro de 2010, mas já vem sendo discutido em vários países, incluindo o Brasil.

Meta brasileira no clima é tímida, diz Marina nos EUA
O Ministério do Meio Ambiente tem proposto uma meta mais ousada, que inclui outros setores, mas esta enfrenta resistências no governo.

Pesquisadores farão melhoramento genético de frutas amazônicas
Projeto em Roraima tem financiamento federal aprovado. Camu-camu, taperebá e araçá são foco inicial da pesquisa.

Equador já tem 75 mortos e 1.402 contaminados pela nova gripe
Entre 5 e 17 de outubro, 35 pessoas foram diagnosticadas com a doença. Maioria dos casos confirmados está na província de Guayas.

Especialista recomenda vegetarianismo contra a mudança climática
Metano liberado por vacas e porcos é 23 vezes mais potente que o CO2.
Consumo mundial de carne poderá dobrar até 2050, diz ONU.

Colômbia registra 131 mortes pela nova gripe
Mais 13 mortes foram confirmadas nesta terça-feira (27). Primeiro caso no país foi confirmado no dia 3 de maio.

Minc quer meta de 40% de redução na emissão de CO2 para 2020
'Em relação aos países em desenvolvimento, a meta é ousadíssima', disse.
Ele vai para 'reunião de emergência' em Barcelona, antes de Copenhage.

Obama promete US$ 3,4 bilhões para modernizar setor elétrico nos EUA
Objetivo é criar nova era de energia renovável, segundo o democrata. Anúncio foi feito em centro de produção de energia solar na Flórida.

Emissão de CO2 pelo setor agropecuário sobe 30% em 13 anos, diz Minc
Agropecuária responde por 25% das emissões no país. Ministro apresentou medidas para reduzir emissão em 7% até 2020.

Costa da Austrália está ameaçada por aumento do nível do mar, diz relatório
Documento parlamentar afirma que governo poderá ter que obrigar retirada de moradores de áreas costeiras.

Proteção neurológica
Com testes experimentais feitos em ratos, os pesquisadores verificaram que esse tipo de ácido graxo é capaz de minimizar a morte de neurônios durante crises epilépticas, além de ajudar na regeneração do tecido cerebral.

DVD inspirado em olho de camarão
Segundo o estudo, feito por pesquisadores da Universidade de Bristol, no Reino Unido, células sensíveis à luz, presentes nos olhos do camarão, atuam como placas que alteram o plano das oscilações das ondas luminosas que passam por elas.

JORNAL DA CIÊNCIA

Edição 3879 - Notícias de C&T - Serviço da SBPC

1. Conselho Nacional de Educação (CNE) e GT-Educação da SBPC debatem educação científica no ensino básico
2. Senado aprova fim da desvinculação das receitas da União para educação em 2011
3. Seminário avalia Programa Institucional de Bolsa de Iniciação à Docência (Pibid)
4. Concurso escolherá melhor logotipo do Ano Internacional da Química
5. Câmara aprova projeto que cria fundo sobre mudanças climáticas
6. Entidades ressalvam política climática aprovada no Congresso
7. Amazônia pode ser laboratório de novo modelo de desenvolvimento, diz Ignacy Sachs
8. Agricultura quer aliviar regra para fazendeiro
9. Uma mincada é uma mincada..., artigo de Rogério Cezar de Cerqueira Leite
10. Brasil: protagonista da inovação
11. Índia, Brasil e África do Sul entram na rota do desenvolvimento
12. CNPq assina acordo com japoneses e recebe norte-americanos
13. Finep aprova 12 novos projetos no total de R$ 131 milhões
14. Fapesp apoia acervos com R$ 20 milhões para projetos
15. Natura procura projetos inovadores
16. Crédito para inovação potencializa pequenos e micronegócios na Bahia
17. Nova soja da Embrapa vem aí
18. Brasil perde a corrida da bioética, diz especialista
19. EUA tentam aparar arestas com Brasil na questão nuclear
20. Democracia universalizada é explosiva, diz cientista social
21. Queda do muro mudou violência política
22. Grupo acha objeto mais antigo do Universo
23. DNA regenera pulmão para transplante
24. Prêmio bolsista PCI será entregue nesta sexta-feira
25. X Congresso Brasileiro de Saúde Coletiva começa no domingo
26. Mesa-redonda sobre "Formação Econômica do Brasil", de Celso Furtado
27. "Ciência Hoje": Seara interativa
28. Escola Hercules terá edição latino-americana
29. Fiocruz: Oportunidade para desenvolvimento de bioinseticidas

Edição 3878 - Notícias de C&T - Serviço da SBPC

1. Lançamento de prêmio encerra comemorações de 60 anos do CBPF
2. Conferência da Academia de Ciências do Mundo em Desenvolvimento (TWAS) fortalece Brasil na política internacional de C&T
3. Prazo para indicação de novos membros da Academia Brasileira de Ciências termina neste sábado
4. Anpocs: Momento de profunda reflexão
5. Brasil e Estados Unidos ampliarão acordo de cooperação em CT&I
6. Cooperação Brasil-Alemanha em tecnologias da produção, artigo de José Monserrat Filho
7. Governo quer recursos para Marinha e MCT no relatório do pré-sal
8. "Políticas públicas precisam favorecer a nanotecnologia"
9. Anvisa e deputados criticam INPI quanto a patentes de segundo uso
10. Câmara aprova Política Nacional sobre Mudança do Clima
11. Clima: Vergonha nacional
12. EUA investem em energia limpa e tentam acordo para Copenhague
13. Representante da ONU acha improvável adoção de novo Kyoto
14. Especialistas debatem Amazônia e mudanças climáticas
15. Observatório Indígena seleciona 17 projetos
16. Edital Universal da Fapemig aprova 700 propostas
17. Ataque à dor fantasma

18. Especialistas e gestores discutem em Minas Gerais a crise da água
19. Museu da Amazônia promove debate sobre espaço e movimento de Manaus
20. II BahiaTec debate soluções tecnológicas e inovadoras para o semiárido baiano
21. XXVII Encontro Anual de Etologia acontece no próximo mês
22. Embrapa Pantanal publicará artigo em primeira edição de revista internacional
23. "Ciência Hoje On-line": Com os pés na terra e os olhos no céu
24. "Ciência Hoje": Uso sustentável de energia
25. Programa de Verão do Departamento de Matemática da UFSCar abre inscrições
26. LNLS inscreve para linhas de luz
27. Antropologia Social da Universidade Federal de São Carlos (UFSCar) inscreve para mestrado e doutorado
28. Mestrado em Ciências Agrárias da UFMG inscreve até novembro
29. Concurso para professor na Universidade Federal da Fronteira Sul (UFFS)

Edição 3877 - Notícias de C&T - Serviço da SBPC

1. Anais da 61ª Reunião Anual da SBPC estão disponíveis na internet
2. Cientistas sociais querem aumentar participação na política de C&T
3. Militares brasileiros discutem com representantes de seis países uso da nanotecnologia
4. Federação das Indústrias do Paraná cria centro de apoio à inovação
5. CNPq lança editais no valor de R$ 26,4 milhões para o agronegócio e pesca
6. Do mundo ideal da "comunidade científica" ao mundo real das "coletividades heterogêneas de pesquisadores", artigo de Carlos José Saldanha Machado
7. C&T, como política de estado, é promovida pelo servidor, artigo de Domingos Pacheco e Elzivir Azevedo Guerra
8. Petrobras e UFRJ inauguram laboratório para desenvolver tecnologias exploratórias
9. Institutos federais de C&T elegerão reitores
10. Universidades federais oferecem bacharelados com grade flexível
11. Provinha Brasil do segundo semestre chega às escolas em novembro
12. Meta brasileira no clima é tímida, diz Marina nos EUA
13. Floresta pode estar absorvendo menos carbono que o estimado
14. Acordos bilaterais sobre o clima avançam
15. Setor de celulose e papel pressiona por créditos de carbono
16. A agricultura e as mudanças climáticas, artigo de Reinhold Stephanes
17. Redução de emissões por desmatamento pode render até US$ 16 bilhões ao país, prevê associação
18. Mudanças de hábito
19. Censo dos Oceanos chega ao Atlântico Sul
20. Pesquisador comenta artigo "Publicar ou depositar a patente?"
21. Instituto de Estudos Avançados da USP cria polo em Ribeirão Preto
22. Proteção neurológica
23. DVD inspirado em olho de camarão
24. Mundos infinitos, artigo de Marcelo Gleiser
25. "Ciência Hoje": Do racismo ao racialismo
26. Lançado blog Clube do Explorador Mirim
27. Museu Goeldi e Conservação Internacional lançam livro sobre espécies ameaçadas e áreas críticas para conservação no Pará
28. Universidade Tecnológica Federal do Paraná (UTFPR) realiza concurso para professor
29. Mestrado da Escola Politécnica da Fiocruz prorroga inscrições

SCIENCE

Petrology, Sr-Nd-Hf isotopic geochemistry and zircon chronology of the Late Palaeozoic volcanic rocks in the southwestern Tianshan Mountains, Xinjiang,

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EARTH PAGES

Anthropology and geoarchaeology

African genes

July 2009

Much of the interpretation of the growing database of human genetic variability has so far focused on migration out of Africa and across the habitable continents. To some extent the largest variability, of Africans themselves, has been undersampled, but a multinational team of Africans and non-Africans has now begun to redress the balance (Tishkoff and 24 others 2009. The genetic structure and history of Africans and African Americans. *Science*, v. **324**, p. 1025-1043) partly to study genetically-linked epidemiology and partly anthropology. The study centres on African's own ideas about their identity/ethnicity as well as documented cultural and linguistic division, and covers 3194 individuals from 121 populations in the continent, African-American populations in 4 US cities and 60 other populations from outside Africa. The team expands knowledge tremendously, as expressed by the many intricate diagrams. They use the statistical method of Bayesian clustering to tease out the ancestral bases for the genetic patterns preserved by Africans, which appear to be based on 14 major ancestral groups that mostly tally with cultural and linguistic divisions. Overall, the picture is one of repeated mixing of populations through migrations within the continent, many within historic times such as the shift of West Africans south-eastwards, but also much earlier movements such as the ancestors of the San people of southern Africa. These remaining gatherer-hunter people together with central African pygmies and the Hadza and Sandawe of Tanzania share ancestry and also, except for pygmies, language that involves click-sounds – the pygmies abandoned their original language in favour of that of the groups that now surround them in the Equatorial rain forests. Of the three groups, the Hadza most maintain the genetic structure of the earliest ancestors on the continent, but all three shared a common ancestor about 35 Ka ago. Interestingly, comparison with people outside Africa confirms earlier studies that indicated a source population for the out-of-Africa migration in East Africa close to the Red Sea. The paper is necessarily condensed and so difficult to follow, but clearly opens up great vistas in understanding intricacies at which anthropologists have previously only guessed. Like the physical landscape of Africa, that of its population reflects the range of factors that have shaped human evolution and hence a great deal of its destiny.

See also: Gibbons, A. 2009. African's deep genetic roots reveal their evolutionary story. *Science*, v. **324**, p. 575.

Very old human footprints in Mexico?

July 2009

In 2006 palaeoanthropologists in the Americas, already at loggerheads about evidence for pre-Clovis (pre 13 ka) colonisation, were rocked to their boots. A team from Liverpool John Moores University, Bournemouth University and the Mexican Geophysics Institute claimed to have found human footprints more than 40 ka old in a volcanic ash deposit (Gonzalez, S. *et al.* 2006. Human footprints in Central Mexico older than 40,000 years. *Quaternary Science Reviews,* v. **25**, p. 201-222). The extensive site exposed by quarrying carries many apparent footprints, both human and non-human. Moreover, some of the prints are in convincing-looking trackways. The very old date was obtained by optically stimulated luminescence dating of quartz-grains that measures the time since the grains were last exposed to sunlight or thermal baking. Were it not for that result probably little fuss would have been made. Now this remarkable find is under serious challenge (Feinberg, J.M. *et al.* 2009. Age constrains on alleged 'footprints' in the Xa;nene Tuff near Puebla, Mexico. *Geology*, v. **37**, p. 267-270). This US-Mexican team applied Ar-Ar dating to the ash and found an age of about 1.3 Ma, confirmed by its association with reversed magnetic polarity in the deposit – at 40 ka the geomagnetic field was as it is today. On that basis, Feinberg and colleagues claim to have refuted the identification of human footprints, and claim that they are merely quarrying marks degraded by later weathering. The Xalnene Tuff in which the footprints were found was deposited in a lake that has been periodically filled and dried out. If the disputed features can be shown irrefutably to be footprints, then there are only two possibilities: either they date from a 40 ka lowstand when the tuff was rewetted and soft, or they are of *Homo erectus* who somehow found their way to the Americas after leaving Africa around 1.7 Ma ago and crossed the drying lake bed shortly after the tuff was ejected from a nearby volcano.

'Hobbit' news

July 2009

Bones of at least 6 or 7 small people have turned up in the now famous Liang Bua cave on the island of Flores, Indonesia. Their stratigraphic positions span the period from 95 to 17 ka. There have been numerous claims that they do not represent a dwarfed human species – i.e. *Homo floresiensis* – but individuals who suffered from some form of pathological condition. The strongest evidence supporting that sceptical view is that the one near-complete skull does not fall on the well-established brain –body-size distribution that covers many species: it seems too small for either a normal pigmy modern human or a similarly diminutive *H. erectus*. Now crucial new anatomical evidence seems set to swing the balance. (Jungers, W.L. *et al.* 2009. The foot of *Homo floresiensis. Nature*, v. **459**, p. 81-84; Weston, E.N. & Lister A.M. 2009. Insular dwarfism in

hippos and a model for brain size reduction in *Homo floresiensis. Nature*, v. **459**, p. 85-88). The foot bones of the most recent and most complete specimen are not like those of humans but more ape-like, although they show clear evidence of bipedalism. Interestingly, they seem to be more primitive than those of *H. erectus*, raising the possibility of an undocumented dispersal of perhaps from Africa into Eurasia as an ultimate ancestor. Curiously, the foot is disproportionately long compared with the rest of the skeleton; another bonus for 'hobbit' fans. Not having a snout, *H. floresiensis* certainly was no ape, indeed the skull is best expressed as a scaled-down version of either *H. erectus* or *H. habilis*. As to extremely small brain size in relation to the body size of *H. floresiensis*, insular dwarfism of fossil hippos in Madagascar provides a useful analogue, as Weston and Lister suggest. In adulthood they also have disproportionately small brains. As with many puzzles in human evolution, the stir caused by these new discoveries maintains *H. floresiensis* as a 'hot topic' and further excavations are inevitable – Flores has plenty of caves, as do many islands in the Indonesian chain.

See also: Lieberman, D.E. 2009. *H. floresiensis* from head to toe. *Nature,* v. **459**, p. 41-42.

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Climate change and palaeoclimatology

Lead-in to icehouse conditions

July 2009

At 33.5 Ma, around the time of the Eocene-Oligocene boundary, Earth's climate took a sudden shift towards cooler conditions, coinciding with the onset of glaciation in the Northern Hemisphere and growth of Antarctic ice cover. Studies of a variety of proxies, including the density of pores or stomata on plant leaves, suggests that the transition resulted from a halving of atmospheric CO2 content from more than 1000 ppm in the Early Eocene to ~560 ppm in the Oligocene. So, even at twice the pre-industrial level greenhouse warming was compatible with high-latitude frigidity. Ocean-floor sediments from a site close to the Arctic Circle in the Norwegian-Greenland Sea yield pollen and spore records that chart vegetation change from 50 to 30 Ma (Eldrett, J.S *et al.* 2009. Increased seasonality through the Eocene to Oligocene transition in high northern latitudes. *Nature,* v. **459**, p. 969-973. The proxy data suggest that in the period preceding the decisive global climate change conditions became increasingly seasonal, with greater differences between winter and summer temperatures. This was largely due to increasingly cold winters, a more constant summer temperature suggesting that any land ice on Greenland was of the valley type rather than an all-covering ice sheet.

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Economic and applied geology

At last, a geoscientific April Fool joke?

July 2009

Maybe it was a coincidence, but the April issue of *Geology* contain a paper whose title looked suspiciously unreal (White, K. *et al.* 2009. Hydrologic evolution of the Edwards Aquifer recharge zone (Balcones fault zone) as recorded in the DNA of eyeless *Cicurina* cave spiders, south-central Texas. *Geology*, v. **37**, p. 339-342). Seemingly, the Cretaceous Edwards Aquifer now flows through cavern systems at the base of a fault-controlled escarpment. At higher levels in the unit are air-filled caves, that are relics of previous karstic events. It is in these dark, dry caves that the arachnid troglobites dwell. Troglobitic animals (those that inhabit totally dark caves and have no eyes) originate as normal surface dwellers, which through successive generations lose functioning eyes and coloration. Conversely, they evolve improved senses of smell, taste and vibration detection. The species that emerge are among the rarest of creatures, for they often occur in only a single cave: a special case of allopatric speciation that may happen when small populations are cut off from one another. Technically, then, this study is no joke, for analysis of mtDNA from the spiders in different caves ought to show evidence of microcosmic evolution, and possible provide a molecular 'clock' to chart the times of cave colonisation. And this is what the authors from the University of Mississippi and the endangered invertebrate group of a Texan consulting company have tried to do. The spiders in the higher caves are more evolved than those at progressively lower levels. Moreover, since the karst evolution has developed in a structurally active setting, the spider data correlates with tectonic history...

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Geobiology, palaeontology, and evolution

Mantle link with biosphere

July 2009

It is pretty clear that events in the deep Earth, which give rise to surface changes, such as topographic uplift and increases or decreases in the pace of continental drift, feed into changes in the biosphere. A convincing example of that is the manner in which uplift of the flanks of the East African Rift System led to climate change that favoured bipedal apes. But is there a more direct link involving chemical influences?

It is likely that the earliest autotrophic organisms performed a variety of chemical tricks in order to create energy and chemical conditions that moved matter back and forth through their cell walls. As well as photoautotrophs of different kinds, including those that release oxygen as waste there would have been chemautotrophs, such as sulfate-sulfide reducers, methanogens and considerably more. Oxygenic photosynthesis apparently was functioning almost 3500 Ma ago, long before the Great Oxidation Event (see *Early signs of oxygen…but in the wrong place* in this issue)

yet it was slow to make any impact on the atmosphere. In the Archaean oceans free oxygen would have been consumed by oxidation of soluble iron-II, probably creating banded iron formations. But photosynthesis has to take place in shallow sunlit water, so it would have been easy for oxygen to enter the atmosphere. Since carbon dioxide in the atmosphere is unable to react with oxygen, oxygen build up in the air might be expected to have built far faster than it did. That is, unless there was a reducing gas present in sufficient amounts to consume oxidation. The most likely buffering agent holding back an oxygen-bearing atmosphere is methane produced by methanogen autotrophs, and it has been suggested that falling methane levels towards the end of the Archaean and start of the Proterozoic Aeons eventually permitted atmospheric oxygen to remain unreacted. Since very little methane is produced by inorganic processes, that hypothesis has a corollary; that there was a decline in methanogen Bacteria and Archaea. So, how might that be tested?

A cunning piece of lateral thinking presents a test, and suggests a mechanism linked to processes in the Late Archaean – Palaeoproterozoic mantle (Konhhauser, K.O. and eight others 2009. Oceanic nickel depletion and a methanogen famine before the Great Oxidation Event. *Nature*, v. **458**, p. 750-753). The first cunning bit comes from the biochemistry of modern methanogens: Methyl-coenzyme M reductase (MCR) catalyses the formation of methane from methyl-coenzyme M and coenzyme B in methanogenic Archaea. This enzyme contains the nickel-centred porphinoid F430 tightly bound in its structure. Needless to say, the olivine-rich mantle contains abundant nickel, so the greater the percentage of mantle partial melting, the more nickel enters the surface environment. Archaean stratigraphy, especially its earlier parts, contains abundant ultramafic lavas known as komatiites, associated with some of the world's big nickel mines. From the Late Archaean onwards, komatiites are rare rocks. The second master stroke by the authors is to find a means of charting the varying abundance in Archaean and Proterozoic seawater: they analysed the Ni content relative to that of Fe in banded iron formations. To as late as 2700 Ma the Ni/Fe ratio remains high in BIFs, but thereafter it falls sharply. That seems to support the hypothesis that a decline in the mass of methanogens did allow oxygen to build up in the atmosphere, and that decline reflected a fall in the supply of mantle nickel to the oceans. The next step would be to exploit the recently demonstrated ability of methanogen Archaea to fractionate nickel isotopes during their metabolism of dead organic matter. That would ideally be done using Ni-rich BIFs, as in this study.

Hadean not so hellish for life

July 2009

Although the Earth's history before 4 Ga is not the mystery that it was, following the discovery of 4.3 Ga-old metasedimentary rocks in NE Canada (see *At last, 4.0 Ga barrier broken* in November 2008 issue of EPN), the early history of the Moon suggests that it was hectic and plagued by very large asteroid and comet impacts. The mightiest events occurred around 3.9 Ga, forming the huge

mare basins on the Moon. Scaling up for the Earth's greater gravitational pull even larger catastrophes would have pounded our planet, although its turbulent tectonics has removed all tangible traces of them. From detailed studies of rocks and impact melts from the Moon – much of the lunar regolith comprises glass spherules produced by cratering over its entire history – the late heavy bombardment (LHB) was not prolonged in geological terms, lasting 20 to 200 Ma. Yet it involved the most extreme delivery of kinetic energy since the giant Moon-forming event around 2.45 Ga, which generated stupendous power – the rate of energy delivery by impactors moving at a minimum of 15 km s-1 is about a second. This has encouraged speculation that the Earth was effectively sterilised for a second time in its history. The 500-600 Ma of Hadean history may have witnessed emerging life forms of the most basic kind, only to see them wiped out, perhaps more than once. It has been assumed, therefore, that the earliest living things which left descendants, including us, had a universal ancestor that appeared only after 3.9 Ga. Now it seems a serious rethink is needed (Abramov, O. & Mojzis, S.J. 2009. Microbial habitability of the Hadean Earth during the late heavy bombardment. *Nature*, v. **459**, p. 419-422).

Feeding the impact data from the Moon and terrestrial planets into new modelling software run on a super-fast computer, Oleg Abramov and Stephen Mojzis of the University of Colorado have been able to model the degree of thermal metamorphism that the Earth's crust may have undergone during the LHB. Interestingly, they reveal that less than 10% of the surface would have been heated above 500ºC, and only 37% would have been sterilised, even if all the huge impacts predicted for Earth landed at the same time. Assuming that any basic life forms that had arisen in the Hadean were randomly distributed at the surface and in the subsurface – a variety of extremophile bacteria still live at depths down to 4 km – populations would survive to leave descendants. If they could survive temperatures up to 110ºC, which modern hyperthermophiles do, then so much the better for life as a whole. Although based on modelling, the work by Abramov and Mozjis, gives palaeobiologists another half billion years in which inorganic processes could have assembled the immensely complex molecules the living processes demand. The earliest possible signs of life, based on carbon isotopes locked in stable minerals of a Greenland metasediment, date to 3.8 Ga. Previous assumptions about life's slate being wiped clean by the LHB therefore left only a few tens of million years for that assembly by some kind of thermodynamic miracle. The new vista will please Mike Russell of the University of Strathclyde in Glasgow. Russell is an economic geochemist turned palaeo-biochemist set on testing the Oparin-Haldane hypothesis of the origin of life using apparatus and approaches that are much more sophisticated than those used by Miller and Urey who created amino acids in vitro during the early 50s. The 21 May 2009 issue of Nature includes an account of Russell's plans and the views of those with a more cautious outlook (Whitfield, J. 2009. Nascence man. *Nature*, v. **459**, p. 316-319).

See also: Rothschild, L.J. 2009. Life battered but unbowed. *Nature*, v. **459**, p. 335-336.

Irresistible brevia

July 2009

Surprisingly, the most abundant crustacean fossils are those of ostracodes, which have two carapace shells. They reach back as far as the Ordovician. Although modern ostracodes are an ecologically very diverse group, much used in assessing changing environmental conditions, they are not the most prepossessing creatures being small and externally smooth. Ostracode bodies and appendages are rarely found as fossils, but a German, Japanese, Czech, British and French team has set out to find soft parts using X-ray synchrotron tomography on a Brazilian ostracode of Cretaceous age (Matzke-Karasz, R *et al*. 2009. Sexual intercourse involving giant sperm in Cretaceous ostracode. *Science*, v. **324**, p. 1535). A third of the ostracode's body is devoted to reproduction, males having large Zenker organs or sperm pumps. This is unsurprising, when one is informed that the ostracode sperm are sometimes longer than an individual creature. Indeed, Matzke-Karasz et al. assign some significance to them; 'persistence of reproduction with giant sperm through geological time may add a criterion to test for the pressure of sexual selection'...

Gas source for flood basalts

July 2009

Although there are several coincidences between flood basalt eruptions from large igneous provinces and mass extinction, not all basalt flood events made an impact on the biosphere and not all mass extinctions link to a LIP. Where there is a connection, two mechanisms dominate discussion: dust and noxious gas such as SO2, stratospheric aerosols from which can also induce global cooling, or global warming stemming from CO2 emissions. The odd thing is that most flood eruptions in LIPs are of tholeiitic basalt magma, which is generally low in gas content. Of sizeable flood basalt provinces, the Ethiopian (30 Ma), Karoo (~180 Ma), Parana (130 Ma) and North Atlantic (55-60 Ma) had no truly significant impact on life. Those that certainly did were the Siberian Traps implicated in the end-Permian devastation, those of Emeishan in China at the time of35 % of all genera went extinct around 260 Ma, the Central Atlantic Province the main suspect for the end-Triassic extinctions and the Deccan Traps that coincided with the Chicxulub impact at the K-T boundary. Two of these massive tholeiitic magma events have been assessed in terms of how they might have emitted gases.

The Emeishan LIP emerged through crust that contains large volumes of carbonates of Proterozoic to Silurian age. Conceivably the magma might have released carbon dioxide by inducing thermal metamorphism (Ganino, C. & Arndt, N.T. 2009. Climate change caused by degassing of sediments during the emplacement of large igneous provinces. *Geology*, v. **37**, p. 323-326). Clément Ganino and Nick Arndt of the University of Grenoble, France investigated a monstrous sill almost 2 km thick in the deeply eroded Emeishan province. It proved to have a 300 m contact aureole dominated by brucite (Mg(OH)2) marble, evidence of melting of carbonates and calc-silicate

marbles, production of which by metamorphism would have yielded huge amounts of CO2. They go on to discuss other possibilities for gas generation by magmatism, involving thermal metamorphism of coals, oil shales and evaporites. The last is a distinct possibility in the case of the Siberian Traps (Li, C. *et al.* 2009. Magmatic anhydrite-sulfide assemblages in the plumbing system of the Siberian Traps. *Geology*, v. **37**, p. 259-262). A large stratiform intrusion associated with the end-Permian flood basalts contains around 7% sulfides; truly huge for mafic magma and making it a major exploration target for platinum-group metals, yet unusual for a tholeiite. It also contains abundant anhydrite, calcium sulfate that is more usually found in sedimentary evaporites. The isotopic composition of sulfur in the intrusion is enriched in ^{34}S, suggesting that at least 50 % was derived from a sedimentary rather than a mantle source. The sedimentary sequence through which the Siberian flood basalt magmas passed contains evaporites around 5 km thick. That would be a suitable source for the sulfur in the intrusion, but would also yield stupendous amounts of SO_2 if carried to the surface by erupting magma. An example of a LIP that had little if any effect on the biosphere is that which mantled both side of the North Atlantic with flood basalts in the Palaeocene. The magma that was involved moved through almost entirely crystalline ancient continental crust. The same set-up characterised the Ethiopian, Parana and Karoo provinces.

Social behaviour among giant trilobites

July 2009

There's something about a trilobite that causes outbreaks of hyperbole: as far as I know they are the only class of animals to warrant an expletive in serious literature (Fortey, R. 2001. *Trilobite!* Flamingo). The title conjures a vision of a three-lobed, segmented alien hurtling for one's nether regions, hideous malice in its compound eye. Well, most trilobites were little, albeit with anorak-rending diversity in form and habit: they ranged from burrowing bottom feeders to inhabitants of the ocean meniscus, rather like early water boatmen. If you want to use an exclamation mark for an invertebrate, then it might be better to reserve it for the fearsome Eurypterids or sea scorpions. At up to 2 m, with mighty pincers and capable of galloping across a beach, they certainly would have best been avoided in the Ordovician to Permian. Yet, from time to time big trilobites do turn up, such as *Paradoxides*, *Ogyginus* and *Hunioides* that break the metre barrier. Rather a lot of them have been found in a Portuguese lagerstätte of Middle Ordovician age (Gutiérrez-Marco, J.C. *et al.* 2009. Giant trilobites and trilobite clusters from the Ordovician of Portugal. *Geology*, v. **37**, p. 443-446). They were up to something, as the locality described by Gutiérrez-Marco *et al.* contains huge numbers that were apparently having been overwhelmed by a sudden turbidity flow once they had gathered together. Some of them are in single file… It could be some sexual frenzy; fearfulness when moulting synchronously or something at which we cannot even guess. Whatever, it seems likely that the gigantism in the deposit is something to do with these being high-latitude animals.

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Geophysics

'Surf's up' from seismic noise

July 2009

Global warming is intensifying cyclonic storm systems, the energy retained by the greenhouse effect being redistributed to winds and in turn to ocean waves, which even have a small effect on local gravitational potential. The effects become coupled to the solid Earth and appear as the background 'noise' in seismograms. So historic seismograms, both digital and in paper form, potentially supply a proxy for climate change going back as far as the 1930s when seismographic stations first began to be set up. In some instances the records are continuous, and when digitised form a unique record that integrates, but one yet to be exploited fully (Bromirski, P.D. 2009. Earth vibrations. *Science*, v. **324**, p. 1026-1027.

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Planetary, extraterrestrial geology, and meteoritics

Is there a giant impact basin beneath the Antarctic ice?

July 2009

At present there are only two reliable means of surveying variations in the Earth's gravitational field: at the surface using gravimeters and from space, by processing measurements the height of the ocean surface from radar measurements or by accurately measuring the variation in distance between two satellite travelling in tandem over the Earth's surface. The last is used by the Gravity Recovery and Climate Experiment (GRACE) designed by NASA and the German Space Agency. It is the only realistic means of usefully precise gravity surveys over Antarctica. A truly multinational team (von Frese, R.R.B. *et al.* 2009. GRACE gravity evidence for an impact basin in Wilkes Land, Antarctica. *Geochemistry,Geophysics, Geosystems,* v. **10**, Q02014, doi:10.1029/2008GC002149 – on-line journal) has discovered a prominent positive free-air gravity anomaly over a roughly 500-km diameter subglacial basin in Wilkes Land. A basin filled with low-density ice would normally give a negative gravitational 'signature', so the positive anomaly suggests either unusually dense crustal rocks beneath it, or that the mantle is unusually close to the surface; i.e. the crust is thin. The authors suggest that the central anomaly is surrounded by roughly concentric circular features, and that it is a hitherto unsuspected impact structure, three time larger than the Chicxulub structure (also mapped by gravity data off the Yucatan Peninsula of Mexico) that caused an upward bulge of the mantle. To my eye, the hypothesis only becomes convincing when concentric circles are drawn around the undoubted major anomaly, and the evidence for them is scant compared with the similarly detected structures of Mars and the Moon. What intrigues the

authors is the position of the anomaly on a Permian continental reconstruction, It is at the antipode of the Siberian Traps flood basalt province, implicated strongly in the end-Permian mass extinction: the most devastating known. This harks back to speculation that the undoubted Chicxulub structure and caused the mantle to melt beneath its antipode to form the Deccan Traps...

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Sedimentology and stratigraphy

Quaternary snatched from jaws of extinction

July 2009

At a stormy meeting in August 2004at the 32nd International Geological Congress in Florence, a rearguard action was mounted by a group of stalwart geologists to thwart an attempt to expunge the last remnant of the stratigraphic divisions inspired by Giovanni Arduino's work in the 18th century from the minds of all future geologists (see December 2004 issue of *EPN*). The Quaternary was under siege. Despite the fact that the International Commission on Stratigraphy (ICS) of the IUGS had already prepared the ground for a *coup de gras* by stating that, "This composite epoch [the "Quaternary"] is not a formal unit in the chronostratigraphic hierarchy", its defenders seem to have won (Mascarelli, A.L. 2009. Quaternary geologists win timescale vote. *Nature*, v. **459**, p. 624). The ICS voted on 21 May 2009 to formally define the base of the Quaternary at 2.6 Ma when the Earth began to cool, glaciation began in the Northern Hemisphere and stone tools first appeared in Africa (it was formerly set at 1.8 Ma, for no obvious reason) and to pass that to IUGS for ratification. Another minority group is enraged, with rumours of chewed carpets, as the Quaternary has annexed 800 ka of what previously was designated as Pliocene: 'It's kind of a land grab', commented Philip Gibbard, a Quaternary expert from Cambridge University, possibly with a hint of glee. To me, it is a milestone decision that gives a proper place to tool making, bipedal apes – ourselves – which makes a great deal more sense that the absurd notion of the Anthropocene (see *Epoch, Age, Zone or Nonsense?* in March 2008 issue of *EPN*), whose base some deluded colleagues are trying to set at the beginning of the Industrial Revolution!

Early signs of oxygen...but in the wrong place

July 2009

The so-called 'Great Oxidation Event' is marked by the first occurrence of iron-oxide bearing subaerial sediments or palaeosols, widely regarded as occurring at around 2400 Ma. That is probably around the time that photosynthesis overtook the rate of oxidation reactions that previously consumed the oxygen that it produced, so that oxygen could build-up continually in the air. But that date is far earlier than the origin of subaerial photosynthesis and oxygenic

photosynthesis must have arisen among oceanic bacteria before then, but only those inhabiting shallow water where the sunlight is. Banded iron formations that go back into the Archaean are often cited as evidence for when such photosynthesis got underway. Their dominant mineral hematite probably formed by oxidation of soluble iron-II and combination of iron-III with free biogenic oxygen, presumed by most workers to be in shallow water. Among the oldest hematite-rich formations is the Marble Bar Chert of Western Australia, dated to 3460 Ma (Hoashi, M. *et al.* 2009. Primary haematite formation in an oxygenated sea 3.46 billion years ago. *Nature Geoscience*, v. **2**, p. 301-306). The hematite crystals in the chert seem to have formed at above 60ºC in ocean-floor hydrothermal springs that were discharging abundant dissolved iron-II. The authors estimate the basin in which the cherts formed to be between 200 to 1000 m deep. Since at such depths photosynthesis would not be possible, they claim that sufficient oxygen was produced by shallow-water photosynthesis to form oxygenated intermediate and deep ocean waters, reminiscent of far later times in Earth's history. This is a minority view, and hinges on whether or not the hematite did form directly on the sea floor. One possibility is that it could have been precipitated colloidally from iron-II-rich ocean water in the photic zone where early photosynthesisers would be, to sink to the deeper sea floor. Eventually very fine iron oxide might recrystallise.

See also: Konhauser, K. 2009. Deepening the early oxygen debate. *Nature Geoscience*, v. **2**, p. 241-242.