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4. Einstein e Bill Gates
5. Projeto institui Código Nacional de Ciência, Tecnologia e Inovação
6. Brasil e União Europeia reforçam ações conjuntas na área de TIC
7. Inovação e a cobra que mordeu o rabo
8. Ministério divulga dados do Censo da Educação Superior de 2010
9. Governo lança plano para qualificar, até 2014, 1 milhão de habitantes das cidades
10. Quem ainda quer ser professor?
11. Conselho de Altos Estudos debate uso de minerais estratégicos no Brasil
12. Brasil e Suécia buscam oportunidades de parcerias tecnológicas
13. Criatividade científica tem auge aos 40
14. Reflexões sobre fraude científica
15. Presidente do CNPq anuncia investimentos para o Acre
16. Capes e Mitacs abrem inscrições para Programa Globalink 2012
17. Prêmio Inovar 2011 será entregue dia 10
18. Dia Mundial da Ciência
19. UFABC promove Semana de Engenharia Aeroespacial

Edição 4379 - Notícias de C&T - Serviço da SBPC

1. Cientistas promovem novo ato público pelos royalties do pré-sal
2. Inpa propõe tratamento diferenciado para várzea e igapó no Código Florestal
3. Vigília pelo Código Florestal
4. Governo prevê apresentar estratégia para conservação da biodiversidade na Rio+20
5. Dilma adia em duas semanas data de abertura da Rio+20
6. Mercadante quer incluir planos regionais na Estratégia Nacional de Ciência, Tecnologia e Inovação
7. Avaliação da Educação Básica começa hoje em todo País
8. Tempo na escola e ano letivo
9. Alfabetizados, mais de 40% dos alunos não sabem ler e escrever
10. O teto de vidro da educação brasileira
11. Desistência nos cursos de ciência chega a 40% nos EUA
12. Tempo para patente verde deve cair
13. Patentes, pirataria e servilismo
14. Capes promove seminários dos programas Observatório da Educação e Observatório da Educação Escolar Indígena
15. Prêmio Jovem Cientista anuncia vencedores amanhã
16. LNCC contrata bioinformata
17. Unesc realiza a 2ª Semana de Ciência e Tecnologia
18. IPF promove homenagem aos 90 anos de Paulo Freire
19. Ufes realiza Encontro "Saúde das Populações Negras e Quilombolas"

Edição 4378 - Notícias de C&T - Serviço da SBPC

1. Entidades científicas fazem novo ato público em favor da Educação e C,T&I
2. Novo Código Florestal deve seguir para Plenário dia 22
3. O Código Florestal no mundo da escassez
4. Dilma: Rio+20 será oportunidade para discutir modelo de desenvolvimento mundial
5. Governo dará incentivo para indústria de telas e semicondutores
6. Ministro participa da inauguração de radar meteorológico do Ceará
7. A falta de saneamento
8. Ocupe o digital
9. Mídias sociais facilitam interação com alunos e podem ser instrumento pedagógico
10. Um em cada cinco estudos médicos tem autor indevido
11. Extinção da megafauna foi causada por conjunto de fatores, diz estudo
12. Um longo amanhã
13. Finep divulga resultado da Subvenção Econômica
14. CNPq lança edição 2011 do Prêmio Almirante Álvaro Alberto
15. Capes publica comunicado sobre o PROEB
16. Ciência às Seis e Meia
17. Tome Ciência: Energia nuclear, um caso de vida ou morte
18. Semana Estendida de Ciência e Tecnologia em SP
19. PUC-RIO promove evento sobre Nanotecnologia

AMBIENTE BRASIL

Ministra sul-africana afirma que acordo de clima em Durban é improvável

Para Edna Molewa, as baixas expectativas são justificáveis já que prosseguem as diferenças de encontros anteriores.

Ano de 2010 teve maior pico já registrado de emissões de gases estufa

A elevação, medida de emissões de CO_2 liberadas na atmosfera resultantes da queima de carvão e gás, alcançou cerca de 6% entre 2009 e 2010, subindo de 8,6 para 9,1 bilhões de toneladas métricas.

Pesquisadores do Inpa falam sobre a Amazônia em evento na USP

Evento faz parte da Semana Nacional de Ciência e Tecnologia. Três pesquisadores do Inpa explicaram sobre a biodiversidade amazônica.

Em MS, pesquisadores testam criação de pacu em tanques-rede

Pesquisa é desenvolvida pela Embrapa Pantanal, em Corumbá. Tanques-rede foram instalados em um dos braços do rio Paraguai.

Petrobras já reutiliza 10% de toda a água que consome

A estatal já reutilizou 13 bilhões de litros de água em suas operações de extração, produção e refino de petróleo e gás natural.

Ibama autoriza construção de usina hidrelétrica no Rio Parnaíba

A hidrelétrica terá potência de 64 megawatts e deverá ser licitada no leilão A-5, que será realizado pela Agência Nacional de Energia Elétrica no dia 20 de dezembro.

Arte indígena tradicional feita com material moderno é apresentada em São Paulo

Entre as 270 peças expostas estão tangas de tecido decoradas com sementes e miçangas dos povos Tiriyó e Kaxuyana, outro exemplo de mistura do convencional com a reinvenção. A exposição ArteFAtos acontece no Pavilhão das Culturas Brasileiras, no Parque Ibirapuera, até o dia 8 de janeiro.

LHC fará colisões pesadas em busca do Big Bang

Agora os cientistas partem em busca do início do Universo. E eles farão isso colidindo íons de chumbo.

Luzes podem revelar civilizações alienígenas, dizem astrônomos

Iluminação artificial seria o modo mais seguro de encontrar ETs. Telescópios atuais não conseguiriam ver luzes fora do Sistema Solar.

Brasil será primeiro a utilizar biocombustível na produção de energia no Continente Antártico

A iniciativa faz parte de um acordo de cooperação firmado entre a Petrobras, a Vale Soluções em Energia e a Marinha.

Ecoeficiência de sacolas depende do comportamento do consumidor

Os pesquisadores analisaram o chamado "ciclo de vida" de oito opções de sacolas disponíveis no mercado brasileiro.

Chimpanzés sofrem com pesquisas médicas nos EUA

Três iniciativas em andamento de um projeto de lei no Congresso americano, uma reavaliação no sistema de financiamento federal e um pedido de mudança em decreto ambiental têm potencial para inviabilizar qualquer pesquisa médica invasiva com chimpanzés.

Cerca de 92% dos lixões no Amazonas são a céu aberto

Municípios têm que apresentar projeto de aterro sanitário até agosto de 2012. Medida é uma exigência de lei que institui política nacional de resíduos sólidos.

Navio encontrado em Ilhabela/SP é do século 19

Em abril, após uma enxurrada, uma carcaça de madeira de 15 metros surgiu na areia da praia.

Justiça retoma julgamento sobre decreto que autorizou construção de Belo Monte

Uma ação do Ministério Público Federal questiona o decreto legislativo que autorizou a construção da hidrelétrica sem a realização de consulta prévia aos povos indígenas da região.

Terremoto de 5,6 graus atinge Estado dos EUA

O terremoto foi o segundo registrado no Estado de Oklahoma em 24 horas depois que um sismo de magnitude 4,7 foi sentido no início do sábado (5).

Pesquisador americano estuda sexo das libélulas

Insetos possuem órgãos reprodutores complicados e cópula também é um ato elaborado em comparação com outras espécies.

Rumo às estrelas, só que sem motor

Agência de pesquisa avançada americana sonha com a tecnologia das próximas naves espaciais.

Brasil e Argentina fazem campanha para que Cataratas do Iguaçu entrem na lista das novas Sete Maravilhas da Natureza

Com 275 quedas d'água, na fronteira entre o Brasil e a Argentina, as cataratas já estão entre as 28 finalistas de uma eleição mundial organizada pela fundação suíça New 7 Wonders.

Fundo do Clima da ONU ainda causa polêmica entre países, diz negociador

Adoção do fundo com US$ 100 bi anuais pode ser concretizado na COP 17. Dinheiro seria para adaptação de países pobres às mudanças climáticas.

Delegados de 30 países definem metas para Rio+20

Reunião em Bogotá estuda objetivos para acesso à energia, segurança alimentar e cidades sustentáveis.

Dilma anuncia que conferência Rio+20 será adiada para 20 de junho

Evento sobre meio ambiente seria realizado no Rio de 4 a 6 de junho. Conforme Dilma, data foi alterada para países do G20 poderem participar.

Relatório dos EUA aponta recorde nas emissões de gases em 2010

Dados indicam alta de 500 milhões toneladas de carbono em um único ano. Agência Internacional de Energia já havia divulgado aumento em maio.

Tempestades atingem Gênova e matam pelo menos seis

Fortes chuvas castigam regiões costeiras do noroeste da Itália. Autoridades pediram à população que não saia de casa na região.

Prefeitura do Rio faz no domingo simulado de emergência para dias de chuva

A prefeitura pretende melhorar e ampliar as simulações para outros trechos da cidade que tradicionalmente apresentam alagamentos em dias de chuva.

ONG transporta rinocerontes com helicóptero na África do Sul

Animais foram sedados e pendurados pelos tornozelos. 19 rinocerontes negros, ameaçados de extinção, foram transferidos para um novo habitat.

Estudo mostra que casais de pássaros cantam em duetos

Cientistas acreditam que fêmeas usem a canção para testar os machos. 'Pheugopedius euophrys' habita a região dos Andes.

Rússia lança foguete com satélites para sistema de navegação

País pretende lançar mais dois satélites Glosnass-M, análogo ao GPS americano.

Termina simulação de viagem conhecida como 'Big Brother Marte'

Seis homens se isolaram por mais de um ano como se tivessem ido a Marte. Projeto é parceria entre agências espaciais de Rússia, China e Europa.

Jogos dos Povos Indígenas começam neste sábado no Tocantins

Os jogos são considerados um dos maiores encontros esportivos culturais e tradicionais de indígenas da América.

Operação combate garimpo ilegal na Terra Indígena Yanomami

Segundo a Polícia Federal, 13 garimpeiros foram detidos até o momento. Exploração de minério na reserva é um problema que já dura décadas.

Rio espera maior epidemia de dengue da história e pede ajuda à população para combater mosquito transmissor

Nesta sexta-feira (4), a prefeitura do Rio organizou, em diversos pontos da cidade, caminhadas para incentivar a população a não recuar no combate ao mosquito da dengue.

Parceria do Brasil com a Alemanha vai mover carro com gás de esgoto

Experimento-piloto funcionará em estação de tratamento de Franca (SP). Frota de 49 veículos será abastecida com combustível alternativo.

ONG ambiental WWF comemora 50 anos

Para diretor da ONG, Jim Leape, grande vitória foi colocar o conceito de desenvolvimento sustentável na agenda pública.

Psicólogo holandês assume fraudes científicas

Diederik Stapel confessou que alguns de seus artigos continham dados inventados.

Estudo: terremotos causam mais destruição que outros desastres

Mais de um milhão de tremores de intensidades diversas são registrados por ano no mundo. Além das mortes imediatas, as vítimas dos tremores incluem indivíduos seriamente feridos que não podem receber tratamento por causa da destruição da infraestrutura.

Nasa descobre rachadura em geleira e monitora formação de iceberg

Cientistas da agência afirmaram na quinta-feira (3) que a fissura se estende por 29 km na geleira da ilha Pine, na Antártida. Ela deverá dar origem a um iceberg de 880 km².

SCIENCE

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EARTH PAGES

Fracking check list

Posted on November 4, 2011 by sdrury777| 2 Comments

Aftermath of the 1906 mine explosion at Courrières, northern France; the largest mining disaster in Europe with 1099 fatalities. Image via Wikipedia

Britain is on the cusp of a shale-gasboom (see *Britain to be comprehensively fracked?* : *EPN* 14 October 2011) and it is as well to be prepared for some potential consequences. In extensively fracked parts of the US – the states of New York, Pennsylvania, Texas and Colorado – there are reports of water taps emitting roaring flames after dissolved methane in groundwater ignites. This is largely due to common-place household water supplies from unprocessed groundwater, which are rare in Britain. But there are other hazards (Mooney, C. 2011. The truth about fracking. *Scientific American*, v.**305** (Nov 2011), p. 62-67) that have enraged Americans in affected areas, which are just as likely to occur in Britain. In fact the nature of shale-gas exploitation by horizontal drilling beneath large areas poses larger threats in densely populated area, as the people of Blackpool have witnessed in the form of small earthquakes that the local shale-gas entrepreneur Cuadrilla admit as side effects of their exploratory operations .
Chris Mooney succinctly explains the processes involved in fracking shale reservoirs; basically huge volumes of water laced with a

cocktail of hazardous chemicals and sand being blasted into shales at high pressure to fracture the rock hydraulically and create pathways for natural gas to leak to the wells. One risk is that this water has to be recovered and stored in surface ponds for re-use. About 75% returns to the surface and also carries whatever has been dissolved from the shales, which can be extremely hazardous. By definition a shale containing hydrocarbons creates strongly reducing conditions, which in turn can induce several elements to enter solution as well as easily dissolved salts; for instance divalent iron (Fe^{2+}) is highly soluble, whereas more oxidised Fe^{3+} is not, so waters having passed through gas-rich shales will be iron-rich. But that is by no means the worst possibility; one of the most common iron minerals in sedimentary rocks is goethite (FeOOH), which adsorbs many otherwise soluble elements and compounds. In reducing conditions goethite can break down to release its adsorbed elements, among which is commonly arsenic. The blazing faucet hazard results from hydrocarbon gases leaking through imperfectly sealed well casings to enter shallow groundwater, where the gases can also create reducing conditions and release toxic elements and compounds into otherwise pure groundwater by dissolution of ubiquitous goethite, as in the infamous arsenic crisis of Bangladesh and adjoining West Bengal in India where natural reducing conditions do the damage.

What is not mentioned in the *Scientific American* article is the common association of hydrogen sulfide gas with petroleum, produced from abundant sulfate ions in formation water by bacteria that reduce sulfate to sulfide in the metabolism. This 'sour gas', as it is known in the oil industry, is a stealthy killer: at high concentrations it loses its rotten-eggs smell and in the early days of the petroleum industry killed more oil workers than did any other occupational hazard. Visit the spa towns of Harrogate in Yorkshire and Strathpeffer in northern Scotland and sample their waters for examples of what Carboniferous and Devonian gas-rich shales produce quite naturally: noxious stuff of questionable efficacy. The environmental effects of such natural seepage from gas-rich rocks tell a cautionary tale as regards fracking. The highly reducing cocktail of hydrocarbon and sulfide gases in rising, mineral-rich formation water kills the microbiotic symbionts that are essential to plant root systems for nutrient uptake die and so too do trees. The onshore Solway Basin of Carboniferous age in NW England illustrates both points, having many chalybeate springs as the sulfide- and iron-rich waters are euphemistically known and also a strange phenomenon in many of the deep valleys cut by glacial melt waters as land rose following the last glacial maximum. Once trees reach a certain height – and correspondingly deep root systems – they die, to litter the valley woodland with large dead-heads. Also leaves on smaller trees turn to their autumnal colours earlier than on higher ground. Both seem to be due to minor gas seepages from thick sale sequences in the depths of the sedimentary basin. Indeed, both are botanical indicators to the hydrocarbon explorationist.

To recap, a common size of a fracking operation using several horizontal wells driven from a single wellhead is 4km in diameter entering gas-rich shales at up to 2 km depth. Each well can generate fractures of a hundred metres or more in the shales and surrounding rocks, as they have to for commercial production. In Britain, most of the sites underlain by shales with gas potential are low-lying agricultural- or urban land. The producing rock in the Blackpool area is the Middle Carboniferous Bowland Shale that lies beneath the Coal Measures of what was formerly the Lancashire coalfield, now a patchwork of expanding urban centres. On 23 May 1984 an explosion occurred in Abbystead, Lancashire at an installation designed to pump winter flood water between the rivers Lune and Wyre through a tunnel beneath the Lower to Middle Carboniferous Bowland Fells. The Abbystead Disaster coincided with an inaugural demonstration of the pumping station to visitors, of whom 16 were killed and 22 injured. Methane had escaped from Carboniferous shales to build up in the flood-balancing tunnel soon after its construction. Methane build-ups were by far the worst hazard throughout the history of British coal mining, thousands dying and being maimed as a result of explosions. One of the largest death tolls in British coal-mining history was 344 miners at Hulton Colliery in Westhoughton, Lancashire in 1910 after a methane explosion; the methane may well have escaped from the underlying Bowland Shales.

Related articles

- Fracking was 'probable' cause of Lancashire tremors (independent.co.uk)

- Michael McCarthy: Can we really manage all the risks if we allow fracking in the hope of a gas bonanza? (independent.co.uk)

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Posted in Environmental geology and geohazards

Tagged Fracking, Lancashire, methane, Shale gas

Snippets on human evolution

Posted on October 28, 2011 by sdrury777| Leave a comment

Artifacts from the Blombos Cave, South Africa, including deliberately etched block of hematite Image by Chris Henshilwood via Wikipedia

The news that most humans outside of Africa carry fragments of DNA that match with those of Neanderthals and the mysterious Denisovanarchaic humans (see *Yes, it seems that they did…* and*Other rich hominin pickings* in the May 2010 issue of *EPN)* has entered into popular culture; or soon will have! Similar dalliances with the 'older folk' seem also to have occurred among those humans who remained in Africa (Hammer, M.F. *et al*. 2011. Genetic evidence for archaic admixture in Africa. *Proceedings of the National Academy of Sciences*, v. **108**, p. 15123-15128). The DNA of three groups in West Africa who maintain a hunter-gatherer lifestyles show regions that are not involved in coding for proteins that differ from the African norm. This suggests mating with an entirely separate and unknown group of hominins – probably archaic forms of humans – that produced fertile offspring, probably around 35 thousand years ago. The find spurred re-evaluation of bones with a mix of archaic and modern features that were discovered in a Nigerian cave in the 1960s (Harvati, K. *et al*. 2011. The Later Stone Age Calvaria from Iwo Eleru, Nigeria: Morphology and Chronology. *PLoS ONE*, v. **6**: e24024. doi:10.1371/journal.pone.0024024). The study confirms that the skulls are outside the fully modern human range, but display a close similarity with Neanderthal and *H. erectus*. The big surprise is that U-Th dating suggests they are quite recent, around 16 ka. The stage seems set for nor only a burst of exploration for human remains of less antiquity than early hominins but a 'paradigm shift' in our view of what constitutes a human species.

See also: Gibbons, A. 2011, African data bolster new view of modern human origins. *Science*, v. **334**, p. 167.

Another interesting link with archaic humans who had the closest of relationships with some of our ancestors is that their union may have bolstered the resistance of migrants from Africa to Eurasian pathogens (Abi-Rached, L. and 22 others 2011. The shaping of modern human immune systems by multiregional admixture with archaic humans. *Science*, v. **334**, p. 89-94). The focus was on the human leucocyte antigen (HLA) group that is a vital part of our immune system in the form of 'killer cells'. Part of modern Eurasian DNA that codes for the group (HLA-B*73 allele) appears in the Neanderthal and Denisovan genomes; indeed more than half the HLA alleles of modern Eurasians may have originated in this way, and have also been introduced into Africans subsequently.

Also at the front line of genomic research into human origins, DNA sequenced from a lock of hair given to an Edwardian anthropologist by a native Australian turns out to have an extreme antiquity compared with that of other Eurasian people descended from African migrants (Rasmussen, M. and 57 others. An aboriginal Australian genome reveals separate human dispersals into Asia.*Science*, v. **334**, p. 94-98). The unique aspects of the Australian genome signify separation of a group of individuals from the

main African population around 62-75 thousand years ago; significantly earlier than and different from ‘run of the mill’ migrants from whom modern Asians arose at between 25 to 38 ka. There is little doubt that native Australians are descended from the pioneers who first diffused from Africa either by crossing the Straits of Bab el Mandab or taking another route and they moved more speedily across southern Asia than other waves made possible by climate change and sea-level falls following the Eemian interglacial of 133-115 ka.

Despite the lingering Eurocentrist view that somehow fully modern human consciousness sprang into being at the time the famous French and Spanish cave art was painted, around 30 ka, increasing evidence points to an African origin for a sense of aesthetics and the ability to express it. The latest is the discovery of a 100 ka ‘paint box’ in a South African coastal cave (Henshilwood, C.S. *et al.*2011. A 100,000-year-old ochre-processing workshop at Blombos Cave, South Africa. *Science*, v. **334**, p. 219-223). The material consists of two large abalone shells containing traces of red and orange ochre, together with a hammer stone and grinder with adhering ochre, and fat-rich bones which ground-up would have produced a binder for the ochre. No art occurs in the cave and it might be supposed that the pigments were intended for face- or body adornment.

Related articles

- The downside of sex with Neanderthals (guardian.co.uk)
- Strong isolation between Neandertals and modern humans(dienekes.blogspot.com)

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Posted in Anthropology and Geoarchaeology

Tagged Blombos Cave, Denisova hominin, human ancestry, human immune system, Neanderthal

The ultra-deep carbon cycle

Posted on October 28, 2011 by sdrury777| Leave a comment

Image via Wikipedia

The presence of diamondsin the strange, potassium-rich, mafic to ultramafic igneous rocks known askimberlites clearly demonstrates that there is carbon in the mantle, but it could have come from either biogenic carbon having moved down subduction zones or the original meteoritic matter that accreted to form the Earth. Both are distinct possibilities for which evidence can only be found within diamonds themselves as inclusions. There is a steady flow of publications focussed on diamond inclusions subsidised to some extent by companies that mine them (see *Plate tectonics monitored by diamonds* in *EPN*, 2 August 2011). The latest centres on the original source rocks of kimberlites and the depths that they reached (Walter, M.J. and 8 others 2011. Deep mantle cycling of oceanic crust: evidence from diamonds and their mineral inclusions. *Science*, v. **334**, p. 54-57). The British, Brazilian and US team analysed inclusions in diamonds from Brazil, finding assemblages that are consistent with original minerals having formed below the 660 km upper- to lower-mantle seismic boundary and then adjusting to decreasing pressure as the kimberlite’s precursor rose to melt at shallower levels. The minerals – various forms of perovskite stable at deep-mantle pressures – from which the intricate composites of several lower-pressure phases exsolved suggest the diamonds originated around 1000 km below the

surface; far deeper than did more common diamonds. Moreover, their geochemistry suggests that the inclusions formed from deeply subducted basalts of former oceanic crust.

Previous work on the carbon isotopes in 'super-deep' diamonds seemed to rule out a biogenic origin for the carbon, suggesting that surface carbon does not survive subduction into the lower mantle. In this case, however, the diamonds are made of carbon strongly enriched in light ^{12}C relative to ^{13}C, with $\delta^{13}C$ values of around -20 ‰ (per thousand), which is far lower than that found in mantle peridotite and may have been subducted organic carbon. If that proves to be the case it extends the global carbon cycle far deeper than had been imagined, even by the most enthusiastic supporters of the Gaia hypothesis.

Related articles

- 'Superdeep' Diamonds Hint at Depth of Carbon Cycle (livescience.com)
- + Diamonds' Flaws Give Clues to Earth's Carbon Cycle(dyslexia.wordpress.com)

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Posted in Geochemistry, mineralogy, petrology and volcanology

Tagged Carbon cycle, Diamond, Mantle (geology), Subduction

Low-lying Tibet before India-Asia collision

Posted on October 19, 2011 by sdrury777| Leave a comment

The semi-arid Tibetan Plateau from spaceImage via Wikipedia

The vast Tibetan Plateau at an average elevation of 4500 m is a major influence on the climate of Asia, being central to the annual monsoons, as well as one the world's largest continental tectonic features. When it formed is crucial in palaeoclimatic modelling as well as to geomorphologists and structural geologists. Whether or not it was present before the Indian subcontinent collided with Asia at 50 Ma has been the subject of perennial debate; it could have formed during the more or less continual accretion of terranes to southern Eurasia since the Jurassic Period. A novel approach to timing uplift of Tibet is obviously needed to resolve the controversies, and that may have been achieved (Hetzel, R. *et al*. 2011. Peneplain formation in southern Tibet predates the India-Asia collision and plateau uplift. *Geology*, v.**39**, p.983-986). North of Lhasa is an area of coincident small plateaus at around 5200-5400 m into which are cut valleys a few hundred metres. It has the hallmarks of a peneplain stripped to the base level of erosion, and developed on Cretaceous granites. The German-Chinese-South African team applied a range of geochronological techniques to date the emplacement of the granites and their cooling history. U/Pb dating shows the granites to have crystallised between 120 to 110 Ma; U-Th/He dating of zircons in them indicate their cooling from 180° to 60°C between 90 and 70 Ma; apatite U-Th/He and fission-track datingshow that the granites experienced surface temperatures by around 55 Ma during a period of erosion at a rate of 200-400 m Ma^{-1}. The clear inference is that an area >10 000 km^2 became a peneplain by the end of the Palaeocene, to be unconformably overlain by Eocene continental redbeds.

By the Eocene the northern Lhasa Block had become a low-elevation plain from which a vast amount of sediment had been removed to be deposited elsewhere – Palaeocene and Eocene sediments are not common throughout the whole Tibetan Plateau. This is strong evidence that uplift of the Plateau only began after the India-Asia collision during the Eocene. Despite that and the

erosion that would have taken place, much of the peneplain remains; given resistant bedrock peneplains can be very long-lived.

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Posted in Geomorphology, Tectonics

Tagged Tibetan Plateau, Uplift

Seafloor mud cores and the seismic record

Posted on October 19, 2011 by sdrury777| Leave a comment

Japan's deep-sea Drilling Vessel "CHIKYU" Image via Wikipedia

The most important factors in attempting to assess risk from earthquakes are their frequency and the time-dependence of seismic magnitude. Historical records, although they go back more than a millennium, do not offer sufficient statistical rigor for which tens or hundreds of thousand years are needed. So the geological record is the only source of information and for most environments it is incomplete, because of erosion episodes, ambiguity of possible signs of earthquakes and difficulty in precise dating; indeed some sequences are extremely difficult to date at all with the resolution and consistency that analysis requires. One set of records that offer precise, continuous timing is that from ocean-floor sediment cores in which oxygen isotope variations related to the intricacies of climate change can be widely correlated with one another and with the records preserved in polar ice cores. For the past 50 ka they can be dated using radiocarbon methods on foraminifera shells The main difficulty lies in finding earthquake signatures in quite monotonous muds, but one kind of feature may prove crucial; evidence of sudden fracturing of otherwise gloopy ooze (Sakagusch, A. *et al*. 2011. Episodic seafloor mud brecciation due to great subduction zone earthquakes. *Geology*, v.**39**, p. 919-922).

The Japanese-US team scrutinised cores from the Integrated Ocean Drilling Program (IODP) that were drilled 5 years ago through the shallow sea floor above the subduction zone associated with the Nankai Trough to the SE of southern Japan. Young, upper sediments were targeted close to one of the long-lived faults associated with the formation of an accretionary wedge by the scraping action of subduction. Rather than examining the cores visually the team used X-ray tomography similar to that involved in CT scans, which produce precise 3-D images of internal structure. This showed up repeated examples of sediment disturbance in the form of angular pieces of clay set in a homogeneous mud matrix separated by undisturbed sections containing laminations. The repetitions are on a scale of centimetres to tens of centimetres and were dated using a combination of ^{14}C and ^{210}Pb dating (^{210}Pb forms as a stage in the decay sequence of ^{238}U and decays with a half-life of about 22 years, so is useful for recent events). The youngest mud breccia gave a ^{210}Pb age of AD 1950±20, and probably formed during the 1944 Tonankai event, a great earthquake with Magnitude 8.2. Two other near-surface breccias gave ^{14}C ages of 3512±34 and 10626±45 years before present. These too probably represent earlier great earthquakes as it can be shown that mud fracturing and brecciation by ground shaking needs accelerations of around 1G, induced by earthquakes with magnitudes greater than about 7.0. So, not all earthquakes in a particular segment of crust would show up in seafloor cores, most inducing turbidity flow of surface sediment, but knowing the frequency of the most damaging events, both by onshore seismicity and tsunamis, could be useful in risk analysis. In its favour, the method requires cores that penetrate only about 10 m, so hundreds could be systematically collected using simple piston coring rigs where a

weighted tube is dropped onto the sea floor from a small craft.

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- Earthquakes from the ocean: Danger zones (nature.com)

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Posted in Environmental geology and geohazards,Geophysics

Tagged Earthquake risk, Integrated Ocean Drilling Program, Nankai Trough,seafloor sediment

Mercury: anything new?

Posted on October 15, 2011 by sdrury777| Leave a comment

Mercury from an earlier MESSENGER fly-by. Image via Wikipedia

The Sun's nearest planet, Mercury, seems odd in some ways; for instance, it has a proportionately larger metallic core than any other planet. That feature has led some to suggest that somehow most of any original silicate mantle was lost. One possibility is that its proximity to the Sun resulted inMercury's surface being ablated. Another looks to a huge collision with another body that tore off much of the mantle; similar to the event that the chemical commonality of the Earth and Moon suggests early in Earth history. Both processes should have left a distinct geochemical signature on the surface of Mercury: some kind of residue of solar ablation or evidence of fractional crystallisation of a magma ocean, such as the feldspar-rich lunar highlands that are probably formed of crystals that floated as such a planetary silicate melt cooled and evolved. The seeming strangeness of Mercury helped underpin a well-equipped un-crewed mission, going by the acronym MESSENGER, that finally settled into Mercury orbit in March 2011 after a planned 'yo-yoing' path since launch in August 2004 that took it back and forth between Earth, Mercury and Venus in its early stages. Early analysis of results from the now permanent orbit appeared in the 30 September 2011 issue of *Science*.
MESSENGER carries several remote sensing instruments: a stereo imaging device to map landforms, and topography; a laser altimeter to back the stereo imager; a visible to short-wave infrared spectrometer to map variations in surface spectra and minerals; gamma-ray spectrometry to map distributions of naturally radioactive isotopes and emissions from other elements triggered by high-energy cosmic ray bombardment; using the Sun as a source of gamma- and X-rays to cause a variety of elements to emit lower energy X-rays – a variant of X-ray fluorescence spectrometry that is a workhorse of lab geochemistry.

The earlier Mercury fly-bys and previous missions clearly showed that its surface is heavily cratered but possesses areas resurfaced by lavas that obliterate older cratering. A little like the lunar *maria* in age and appearance, these smooth terrains show evidence of accumulations up to a kilometre thick formed by repeated lava flows (Head, J.W. and 25 others, 2011. Flood volcanism in the northern high latitudes of Mercury revealed by MESSENGER.*Science*, v. **333**, p. 1853-1855). As regards the age of these major volcanic features, all that can be said is that they post-date the largest impacts, such as the huge Caloris Basin, and are more

sparsely peppered with younger craters. Intriguingly, floors of some of the craters show clusters of small depressions and pits surrounded by light-coloured material of some kind, suggested to be solids condensed from gases that emerged from below (Blewett, D.T. and 17 others 2011. Hollows on Mercury: MESSENGER evidence for geologically recent volatile-related activity. *Science*, v. **333**, p. 1856-1859). While it is only possible to assign youth of these features relative to the craters in which they occur, they indicate an underlying source of volatiles; a factor weighing against previous accounts of Mercury's evolution by either solar ablation or giant impact.

Considerably more interesting – at least to me – are the results from the geochemically oriented instruments. Calcium, magnesium, aluminium and silicon estimates by the XRF-like instrument present not the slightest evidence for a feldspar-rich component of the early crust akin to the lunar highlands; another blow for the giant-impact and magma-ocean hypotheses. Mercury's surface seems to be similar in composition to the most ancient terrestrial lavas: Mg-rich mafic to ultramafic komatiites, compared with the more iron-rich tholeiites of the lunar *maria* (Nittler, L.R. and 14 others. The major-element composition of Mercury's surface from Messenger X-ray spectrometry.*Science*, v. **333**, p. 1847-1850). They are ten-times more enriched in sulfur than surface rocks on the Earth or Moon, though iron content seems too low to accommodate it in minerals such as pyrite (FeS_2). High sulfur content could point to an origin for Mercury from accretion of highly reduced material in the solar nebula, the Earth-Moon system being broadly more oxidised. Gamma-ray spectrometry to analyse the abundances of potassium, uranium and thorium (Peplowski, P.N. and 16 others. Radioactive elements on Mercury's surface from MESSENGER: implications for the planet's formation and evolution.*Science*, v. **333**, p. 1850-1852) doesn't serve previous ideas about the planet's history either. Potassium, which is moderately volatile, is too high relative to more refractory uranium and thorium to support any notion of solar ablation of the surface, but the U, Th and K proportions are roughly like those of the Earth's oceanic crust. One of the plots shows K-Th relationships for supposed meteorites from Mars and the extensive gamma-ray data from Mars itself, in which few of the meteorites fall in the K-Th 'cloud' for the Martian surface: now there's a thing….

It must be emphasised that the geochemical results are but a fraction of what should eventually emerge from these powerful instruments. However, these early data place Mercury in much the same envelope as the other rock worlds of the Inner Solar System (Kerr, R.A. 2011. Mercury looking less exotic, more a member of the family. *Science*, v. **333**, p. 1812).

Related articles

- 'Hollows' mark Mercury's surface (bbc.co.uk)
- Closer look at Mercury reveals mystery hollows on planet s surface(theglobeandmail.com)

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Posted in Planetary, extraterrestrial geology, and meteoritics

Tagged Caloris Basin, Mercury, MESSENGER, planetary geochemistry

Britain to be comprehensively fracked?

Posted on October 14, 2011 by sdrury777| 2 Comments

Drill rig in Pennsylvania aimed at hydraulic fracturing of the hydrocarbon-rich Marcellus Shale of Devonian age. Image via Wikipedia

In '*Fracking*' *shale and US 'peak gas'* (*EPN* of 1 July 2010) I drew attention to the relief being offered to dwindling US self-

sufficiency in natural gas by new drilling and subsurface rock-fracturing technologies that opens access to extremely 'tight' carbonaceous shale and the gas it contains. The item also hinted at the down-side of shale-gas. The 'fracking' industry has grown at an alarming rate in the USA, now supplying more than 20% of US demand for gas. This side of the Atlantic the once vast reserves of North Sea gas fields are approaching exhaustion. This is at a time when commitments to reducing carbon emissions dramatically depend to a large extent on hydrocarbon gas supplanting coal to generate electricity, releasing much lower CO_2 by burning hydrogen-rich gases such as methane (CH_4) than by using coal that contains mainly carbon. Without alternative, indigenous supplies declining gas reserves in Western Europe also seem likely to enforce dependency on piped gas from Russia or shipment of liquefied petroleum gas from those major oil fields that produce it. The scene has been set in Europe in general and Britain in particular for a massive round of exploration aimed at alternative gas sources beneath dry land. Unlike the US and Canada, the British are not accustomed to on-shore drilling rigs, seismic exploration and production platforms, and nor are most Europeans. Least welcome are the potential environmental and social hazards that have been associated with the US fracking industry, which seem a greater threat in more densely populated Europe.

The offshore oil and gas of the North Sea fields formed by a process of slow geothermal heating of solid hydrocarbons or kerogen in source rocks at a variety of stratigraphic levels, escape into surrounding rocks of the gases and liquids produced by this maturation, and their eventual migration and accumulation in geological traps. By no means all products of maturation leave shale source rocks because of their very low permeability. That residue may be much more voluminous than petroleum liquids and gases in conventional reservoir rocks; hence the attraction of fracking carbonaceous shales. British on-shore geology is bulging with them, particularly Devonian and Carboniferous lacustrine mudstones, Carboniferous and Jurassic coals, and the marine black shales of the Jurassic

(seehttp://www.bgs.ac.uk/research/energy/shaleGas.html andhttps://www.og.decc.gov.uk/upstream/licensing/shalegas.pdf), to the extent that areas of potential fracking cover around a third of England, Wales and southern Scotland.

News is breaking of a major shale-gas discovery beneath Blackpool, the seaside resort '*noted for fresh air and fun, where Mr and Mrs Ramsbottom went with Young Albert their son…*' (Albert poked a stick at Wallace the lion and was eaten), said by energy firm Cuadrilla to have gas reserves of 5.7 trillion m^3. The announcement followed 6 months of exploratory drilling, and drew attention to the burgeoning interest by entrepreneurs in the upcoming 14th Onshore Licensing Round for petroleum exploration in Britain. It isn't just from major petroleum companies, but in some cases even what amount to family businesses finding sufficient venture capital to spud wells; similar in many respects to the US fracking boom that began a mere 10 years ago.

Related articles

- Deep under Lancashire, a huge gas find that could lead to 800 'fracking' wells (independent.co.uk)
- Fracking gas test drill discussed (bbc.co.uk)
- Is fracking environmentally friendly? (environmenteng.wordpress.com)
- The answer to cheaper gas bills? (bbc.co.uk)
- Camp Frack mobilises against UK's first shale gas well (guardian.co.uk)

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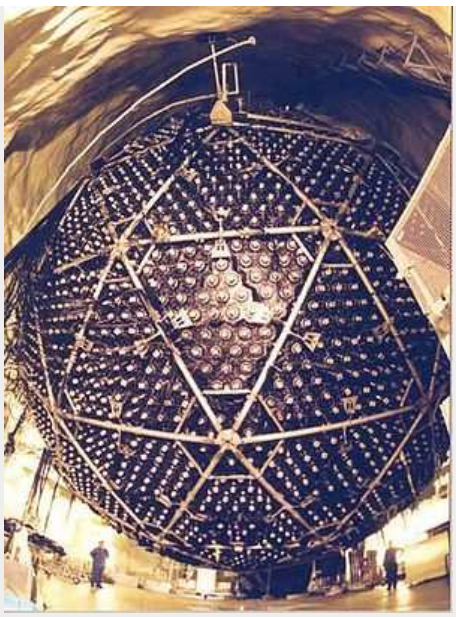
Posted in Economic and applied geology

Tagged Cuadrilla, Fracking, Hydraulic fracturing, Natural gas, Shale gas

The useful geoneutrino

Posted on October 13, 2011 by sdrury777| 1 Comment



A neutrino detector in Canada similar to KamLAND. Image via Wikipedia

While the wires were hot with news of neutrinos possibly having exceeded light speed as they were fired through the Alps by the Large Hadron Collider, steady research has been seeking answers rather than perhaps transmuting physicists' hubris into a death wish. (Note: it has to be said that British theoretical physicist Jim Al-Khalili has sufficient confidence that the speeding ticket issued to the neutrinos will be rescinded that he promises to eat his underpants if it is upheld.) The more tangible work concerns antineutrinos that the Earth emits, dubbed 'geoneutrinos' to distinguish them from extremely exotic ones from deep space which, worryingly for some, pass from one side of the Earth to the other and through us as well. When unstable isotopes, such as those of uranium, thorium and potassium that help heat the Earth, decay they emit antineutrinos as well as electrons, helium nuclei and gamma-rays. Notoriously elusive, neutrinos and antineutrinos can now be detected with sufficient precision to make useful observations, as well as produce results that have many theoretical physicists quivering in cellars from which they emerge, from time to time, covered with chalk dust from their desperate exertions to explain a material speed faster than 'little c'. To geoscientists, the results of an experiment using geoneutrinos at the Japanese Kamioka Liquid-Scintillator Antineutrino Detector (KamLAND), which involved 66 individuals from 15 Japanese, US and Dutch institutions, are much more interesting: they help resolve a long-standing puzzle about the source of geothermal heat that flows from the Earth's surface at a rate of about 44 TW (The KamLAND Collaboration 2011. Partial radiogenic heat model for Earth revealed by geoneutrino measurements. *Nature Geoscience*, v. **4**, p. 647-651).

A model of the Earth that assumes it accreted from chondritic meteorites with well-known abundances and proportions of heat-producing U, Th and K isotopes, supported by some measurements of peridotites from the mantle, suggests that less than half the geothermal flux is radiogenic, implying that a great deal is heat originally trapped in the Earth when it formed. This view depends on several assumptions: that the Earth's mantle is indeed chondritic below the 200 km or so from which samples have been brought by volcanism; that the core doesn't produce any heat by radioactive decay; and that a geophysical model of a well-mixed mantle is correct. Not surprisingly, geophysical and geochemical evidence is so flimsy that many different views have had their champions: that the core contains potassium; that there is a deep, barely tapped inner-mantle layer of high heat production formed from now-rare meteoritic material, and so on. Geoneutrinos, if distinguishable from those from elsewhere in the cosmos and indeed measurable, could help home-in on one or other hypothesis. Based on a spherical balloon containing 1000 t of hydrocarbon liquids in a deep mine shaft that floats in an 18 m metal sphere filled with buoyant oil, KamLAND relies on detecting the light emitted by very rare interactions of neutrinos with protons. That is hard enough, but the site is surrounded by Japan's 53 neutrino-emitting nuclear reactors, so a great deal of cunning operating conditions and data processing is needed to sort the 'wheat from the chaff'; at

present errors are large, but now sufficiently constrained to throw light on the great heat-flux issue. The KamLAND Collaboration reports that between 16 and 68% of heat flow is due to decay of the most productive isotopes ^{232}Th and ^{238}U – there is insufficient ^{235}U and ^{40}K in the Earth for geoneutrinos generated by their decay to be meaningfully estimated. Fuzzy as the results are, they are sufficient to support the view that Earth's 'primordial' heat of formation is still a major source of geothermal energy, thus narrowing down the geochemical aspects open for disputation.

- **See also:** Korenaga, J. 2011. Clairvoyant geoneutrinos. *Nature Geoscience*, v. **4**, p. 581-582

→ 1 Comment

Posted in Planetary, extraterrestrial geology, and meteoritics

Tagged Earth's heat flow, Geothermal energy, Kamioka Liquid Scintillator Antineutrino Detector, Neutrino

Another candidate for earliest, direct human ancestor

Posted on October 12, 2011 by sdrury777| Leave a comment

The head of Australopithecus sediba. Image via Wikipedia

In May 2010 *EPN* commented on a new find from the famous fossil-rich caves of north-eastern South Africa; a new hominin species called*Australopithecus sediba*. At least one of them fell into a deathtrap shaft, died and remained unchewed without bones being spread far and wide. Inevitably, near-complete skeletons of individual hominins are soon pored over by dozens of specialists in human evolution, as they were for the much older *Ardepithecusramidus* found in sediments of Ethiopia's Afar Depression (see *Early hominin takes over Science magazine* in the November 2009 issue of *EPN*). Now there are two near-complete, well-preserved skeletons of *Au. sediba* and the palaeoanthropological world is agog. Dating to about 1.98 Ma the specimens represent the same time as do far less impressive remains of *H habilis* from Tanzania that were found with associated rudimentary stone tools. The first hint (just a fragment of upper jaw) of any remains that might be tagged '*Homo*' dates to 2.3 Ma and is from Ethiopia, as are the first undoubted stone tools going back as far as 2.5 Ma, though lacking association with a maker.
Five consecutive papers on *Au. Sediba* occupy 22 pages in the 9 September 2011 issue of *Science* and make for startling reading. The first concerns the shape of its brain case, and therefore crudely its brain, discerned by tomographic X-ray scanning (Carlson, K.J. *et al.* 2011. The endocast of MH1, *Australopithecus sediba*. *Science*, v. **333**, p. 1402-1407). It isn't any bigger than that of other members of the genus but shows 'some foreshadowing of the human frontal lobes' and other shifts from the basic ape model that the authors imply are en route to human features. The next considers the two pelvis regions (Kibii, J.M.*et al.* 2011. A partial pelvis of *Australopithecus sediba*. *Science*, v. **333**, p. 1407-1411); again australopithecine-like in the small size of the birth canal but with a hint of the S-shape of humans. Most astonishingly well-preserved are the fragile bones of a complete hand (Kivell, T.L. *et al*. 2011. *Australopithecus sediba* hand demonstrates mosaic evolution of locomotor and manipulative abilities. *Science*, v. **333**, p. 1411-1417), which convincingly shows the long thumb and short fingers (for a primate) that characterise *Homo* and are essential for a precision grip and making things. Actually, the thumb is longer relative to fingers (60%) than in humans (54%), but Lucy's (*Au. afarensis*) was a closer match. No tools that such a hand might have created and wielded were found with the fossils. Then there is the foot (Zipfel, B. *et al*. 2011. The foot and ankle of *Australopithecus sediba*. *Science*, v. **333**, p. 1417-1420), which, again, mixes human and australopithecine features, giving 'a unique form of bipedality and some degree of arboreality'. The fifth paper (Pickering, R. *et al*. 2011.*Australopithecus sediba at 1.977 Ma and implications for the origins of the genus* Homo. *Science*, v. **333**,

p. 1417-1420) is as remarkable for the precision of U-Pb dating of speleothem (cave carbonates), which at 1.977±0.002 Ma far exceeds the workhorse Ar-Ar method used for most other hominins, as it is for the absolute age that precedes that of undisputed remains of humans.

In short, for *Australopithecus sediba* there is an embarrassment of riches unmatched until those of the 1.5 Ma old *H. erectus* ('Turkana Boy') found at Nariokotome in NW Kenya. To some extent this throws a flock of peregrines in among the palaeoanthropology pigeons, as an account of a meeting earlier in 2011, at which the bones were grandstanded, shows (Gibbons, A. 2011. Skeletons present an exquisite paleo-puzzle. *Science*, v. **333**, p. 1370). Naturally, the authors are making the most of their material especially, it seems, its finder Lee Berger of the University of Witwatersrand, South Africa, the last author in all the papers. Comparisons with more australopithecine remains were said to be needed. The soon-to-be-famous hand has been said to be essentially like others from the same genus. While the remains of the creature's pelvis could imply that its evolution was more driven by a need for efficient upright walking than to birth big-headed babies, the ankle shows a primitive trait that would have forced *Australopithecus sediba* to walk strangely as the heel bone is small and angled unlike that in human feet, which is broad and flat. But all the species's features are combined in two near-complete individuals, whereas for the rest of its contemporaries, predecessors and near successors in time speculation is based on fragments of several individuals, none more so than in the case of the earliest agreed human, near contemporaneous *H. habilis*, which barely stands up to taxonomic scrutiny (Gibbons, A. 2011. Who was *Homo habilis* – and was it really *Homo*? *Science*, v. **332**, p. 1370-1371). Some would say that it was only the associated stone tools that assigned 'Handy Man' to more elevated status than slightly large-headed australopithecine. The fact is; stone tools were around since 2.5 Ma, at least in Ethiopia, and this newly found being could have handled them and even made them with its palpable dexterity. Finding tools and skeletons together is almost as rare as hens with teeth…

Related articles

- Pieces of the Human Evolutionary Puzzle: Who Was Australopithecus sediba? (blogs.scientificamerican.com)
- Who were the Hobbit's ancestors? (blogs.nature.com)
- New evidence suggests that Au.sediba is the best candidate for the genus Homo (eurekalert.org)

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Posted in Anthropology and Geoarchaeology

Tagged Australopithecus, Australopithecus sediba,Homo habilis, human ancestry, missing link

Asteroid dust said to resolve a conundrum

Posted on October 12, 2011 by sdrury777| Leave a comment

In September 2005 a Japanese space probe, Hayabusa, twice landed lightly on the small (700 m long) asteroid Itokawa that habitually crosses the orbit of Mars. The plan was to scoop up a substantial amount of its rubbly surface and return it for lab analysis. In the event the main sampling device malfunctioned. The dismayed Hayabusa team were mollified to some extent by the second landing impact fortuitously directing dust particles up to 0.2 mm across into the sampler. After Hayabusa landed safely in Australia on 13 June 2010, the team thankfully recovered 1574 tiny grains. Most were made of single minerals: olivine, pyroxene, feldspar (including 14 alkali feldspar grains), sulfides, chromite, Ca phosphate and iron-nickel alloy. About 450 were silicate mixtures some containing K-bearing halite (NaCl) (Nakamura, T. and 21 others. Itokawa dust particles: a direct link between S-type asteroids and ordinary chondrites.*Science*, v. **333**, p. 1113-1116 – followed by 5 other papers from the Hayabusa team in the same issue). The sample analyses clearly show that Itokawa chemically and mineralogically resembles ordinary LL chondrites that make up most meteorites found on Earth.

Hardly a surprise, then… Yet it was, for Itokawa is an S-type asteroid – the most common – whose spectra do not match those of ordinary chondrite meteorites despite the logic that commonly found meteorites ought to come from the break-up of commonly seen asteroids. S-type asteroids have annoyed astronomers for decades because of their cryptic appearance, and now they are broadly relieved. Any object floating around the inner Solar System for billions of years inevitably undergoes a process for which

terrestrial weathering is a metaphor; it is affected by the stream of charged particles that constitutes the solar wind, by bumping other bodies and attracting debris from such collisions. The Itokawa dust particles turn out to have extremely thin veneers of sulfide and metallic blobs on the scale of a few nanometres that are thought to result from condensation of matter vaporised either by tiny impacts or the solar wind. This veneer gives Itokawa and probably other S-type meteorites their irritatingly uniform reddish colour. It strikes me that there is a problem here: all asteroids, no matter what their mineralogy and chemistry, would be subject to the same kind of process and end up with a similar veneer. Itakawa may well be an ordinary chondrite, but what about all the other S-type asteroids?

See also: Kerr, R.A. 2011. Hayabusa gets to the bottom of deceptive asteroid cloaking. *Science*, v. **333**, p. 1081.

Related articles

- Extraterrestrial dust reveals asteroid's past and future (newscientist.com)

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Tagged asteroids, Hayabusa, meteorites, Ordinary chondrite, S-type asteroid