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Lançamento do livro "Diamante: a pedra, a gema, a lenda" de Prof. Dr. Mario Chaves da UFMG e Dr. Luís Chambel. 232 páginas Formato 16x23 cm Ilustrado em cores R$54,00. Maiores informações www.ofitexto.com.br

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CONCURSOS

• CONCURSO PARA PROFESSORES DA UNESP: SALÁRIOS TÊM REAJUSTE DE 14%

Medida segue proposta apresentada em maio às Universidades estaduais de SP; maior remuneração passa para R$ 3.414,00

A Unesp informa que os salários dos 42 professores a serem contratados para a instituição foram reajustados em 14,45%. O índice foi oferecido em maio pelo Conselho de Reitores das Universidades Estaduais Paulistas (Cruesp) aos professores das Universidades estaduais de SP.

Os valores dos salários passam, respectivamente, de R$ 2.983,64 para R$ 3.414, 71 e de R$ 1.312, 82 para R$ 1.502, 49.

O reajuste correspondente ao índice de inflação medido pelo IPC-FIPE de maio de 2002 a abril de 2003. A remuneração maior corresponde ao Regime de Dedicação Integral à Docência e a Pesquisa/RDIDP - 40 horas semanais; a remuneração menor corresponde ao Regime de Turno Completo/RTC - 24 horas semanais.

A Unesp abriu no final de maio as inscrições ao Concurso Público para contratação de 42 Professores Assistentes, em regime de CLT, para as Unidades Diferenciadas instaladas nos municípios de Registro, Itapeva, Sorocaba, Ourinhos, Tupã, Dracena e Rosana.

Para as vagas nas Unidades Diferenciadas de Registro, Sorocaba/Iperó, Tupã, Dracena e Rosana, as inscrições deverão ser feitas até o dia 27 de junho, e para as vagas nas Unidades Diferenciadas de Ourinhos e Itapeva, até o dia 30 de junho.

Os editais na íntegra, incluindo bibliografias, estão disponíveis em: http://www.unesp.br/prad/prad-unid-dif.HTM

LIVROS

• LANÇAMENTO DO LIVRO "DIAMANTE: A PEDRA, A GEMA, A LENDA" DE PROF. DR. MARIO CHAVES DA UFMG E DR. LUÍS CHAMBEL.

232 páginas Formato 16x23 cm Ilustrado em cores R$54,00. Maiores informações www.ofitexto.com.br

A atração e o fascínio que o diamante exerceu sobre os homens e mulheres através dos tempos não poupou os Autores. Mario Chaves e Luís Chambel dedicam-se ao estudo técnico, acadêmico e de campo das questões da geologia e mineração dos depósitos diamantíferos há 20 anos.

DIAMANTE: a pedra, a gema, a lenda inicia a história do diamante com os hindus, no 8º século a.C. passando pelos mitos e lendas que cercam diamantes famosos, símbolo de poder e às vezes portadores de maldições sobre seus donos, como o diamante Hope.

O principal enfoque do livro é a Geologia e a Mineração do diamante. São avaliados os depósitos diamantíferos e o potencial brasileiro, o momento atual e o possível futuro da exploração de diamantes no Brasil, solidamente relacionados ao contexto internacional. Os depósitos de Minas Gerais merecem particular atenção. Fortíssimas razões geológicas sorriem para o potencial brasileiro.

As propriedades físicas e as que valorizam os diamantes no comércio de gemas e de jóias são objeto da atenção dos Autores bem como o comércio, o papel da De Beers, indústria e o "sindicato" dos diamantes.

DIAMANTE: a pedra, a gema, a lenda destina-se aos profissionais envolvidos com prospecção, pesquisa e explotação de bens minerais, particularmente diamantes, aos envolvidos com gemologia e comércio de diamantes, aos estudantes de Geologia, Minas e Gemologia, e a todos os fascinados pela magia dos diamantes e seu universo.

CURSOS E PALESTRAS

• CURSOS ABM

Julho / 2003
Fosfatização de Metais Ferrosos
1 a 3 de julho de 2003
Dirigido a graduados de nível superior, técnicos de nível médio que atuam na área e interessados no assunto.

Agosto / 2003
Metalurgia do Pó - Processos e Produtos
20 a 22 de agosto de 2003
Destinado a engenheiros, técnicos e estudantes vinculados a empresas produtoras ou consumidores de produtos produzidos por Metalurgia do Pó)pós metálicos e materiais sinterizados)

Refratários e Insumos para Lingotamento Contínuo - BELO HORIZONTE
25 a 27 de agosto de 2003
Destinado aos engenheiros e técnicos que atuam em aciarias dotadas de lingotamento contínuo.

Adaptação do Processo de Fabricação de Ferros Fundidos na Obtenção de Melhores Propriedades Mecânicas e Microestruturais
27 a 29 de agosto de 2003
Destinado a engenheiros, técnicos e demais profissionais da área de Fundição de Ferro Fundido que desejam conhecer e desenvolver as técnicas de Fundição

Setembro / 2003
Britagem e Moagem de Carvão
8 a 9 de setembro de 2003

Refino Secundário dos Aços
15 a 19 de setembro de 2003

Análise de Falhas - BELO HORIZONTE - CDTN
22 a 26 de setembro de 2003

Trefilação
29 de setembro a 3 de outubro de 2003

Outubro / 2003
Lingotamento Contínuo de Placas
13 a 17 de outubro de 2003

Novembro / 2003

Britagem e Peneiramento
10 a 12 de novembro de 2003

Aciaria Elétrica
16 a 20 de novembro de 2003

CONGRESSOS E SIMPÓSIOS - JUNHO

Metals and Energy Recovery– de 25 a 26 de Junho, Skelleftea, Suécia. Informações: torunn.tornblom@kommun.skelleftea.se
Website: http://www.recovery2003.skelleftea.se/

7th International Conference on Biogeochemistry of Trace Elements (7th Icobte)
Special Symposium Arsenic in Soil and Groundwater Environments: biogeochemistry interactions
15-19 de junho de 2003, Upsala, Sweden

7th International Conference on the Biogeochemistry of Trace Elements (7th ICOBTE)
June 15 - 17, Uppsala, Sweden.

EUSTONE
June 15 - 20, University of Joensuu, Joensuu, Finland.

Gordon Research Conference - Permeable Sediments
June 15 - 20, Lewiston, ME, USA.

5th International Conference on the Analysis of Geological and Environmental Materials
June 16 - 18, Rovaniemi, Finland.

Euroclay
June 22 - 26, Modena, Italy.

8th International Kimberlite Conference
June 22 - 27, Victoria, British Columbia, Canada.

ICOLD, 21st Congress of the International Commission on Large Dams (Montreal)
16 June 2003 - 20 June 2003

12th Panamerican Conference on Soil Mechanics and Geotechnical Engineering
22 June 2003 - 26 June 2003

NOTÍCIAS

- **AMBIENTE BRASIL**

10/06/2003: BRASIL E ALEMANHA PODEM MANTER PROGRAMA DE PRESERVAÇÃO AMBIENTAL

A ministra do Meio Ambiente, Marina Silva, discutiu com a ministra de Cooperação Econômica e Desenvolvimento da Alemanha, Heidemarie Wieczorek-Zeul, a continuidade da parceria entre os dois países em programas de proteção ambiental. A Alemanha é o maior doador do Programa de Proteção às Florestas Tropicais do Brasil (PPG-7).

No mais recente acordo, foram destinados 35 milhões de euros para projetos ambientais na Mata Atlântica e para a demarcação de 18 milhões de hectares na Amazônia, dentro do Projeto Arpa.

A ministra alemã afirmou que seu país está disposto a continuar a colaborar com o Brasil. Marina Silva destacou a importância da cooperação entre os dois países. "O governo brasileiro reconhece e valoriza as experiências desenvolvidas com apoio do governo alemão nos últimos 10 anos. Essas experiências estão sendo avaliadas para que deixem de ser experimentos e sejam transformadas em políticas públicas", disse.

As ministras conversaram, ainda, sobre o desafio de conciliar a redução da pobreza com a proteção ambiental. Marina Silva informou que programas do PPG-7 na Amazônia têm como objetivo criar alternativas de desenvolvimento sustentável para comunidades da região. "A questão da sustentabilidade social, uma das diretrizes do governo, deve estar fortemente ligada à sustentabilidade ambiental", reforçou a ministra.

Agência Brasil

10/06/2003: VAZAMENTO DE PRODUTOS QUÍMICOS CONTAMINA RIO EM MINAS GERAIS

Um trem carregado com derivados de petróleo descarrilou na madrugada desta terça-feira (10) na região de Uberaba (MG), derramando mais 860 mil litros de produtos químicos no córrego Congonhas, um afluente do rio Uberaba, que abastece a cidade.

Segundo informações da FCA - Ferrovia Centro-Atlântica, 18 vagões tombaram e pegaram fogo. Cinco deles carregavam 245 toneladas de octanol, oito transportavam 381 toneladas de metanol, dois estavam com 94 toneladas de isobutanol e três com 147 toneladas de cloreto de potássio. Todas são substâncias químicas tóxicas e inflamáveis, solúveis em água, o que irá dificultar a identificação dos danos causados. A carga estava sendo transportada do Pólo Petroquímico de Camaçari, na Bahia, para Paulínia, em São Paulo.

Por precaução, foi interrompido, por tempo indeterminado, o fornecimento de água para cerca de 250 mil habitantes de Uberaba. O nível de contaminação da água está sendo analisado e as causas do acidente serão apuradas por técnicos da Ferrovia Centro-Atlântica.

Segundo informações do Ibama em Minas Gerais, a transportadora FCA é responsável pelo dano ambiental e deverá ser multada com base na lei de crimes ambientais. A empresa, que é controlada pela CVRD - Companhia Vale do Rio Doce, comunicou que acionou, logo após a ocorrência, a Polícia Ambiental, o Corpo de Bombeiros, a Defesa Civil e a empresa de abastecimento de água de Uberaba.

ambientebrasil

11/06/2003: PESQUISADORES DA UNICAMP ESTUDAM MÉTODO NATURAL PARA DESPOLUIR ÁGUA E SOLO

A Faculdade de Engenharia de Alimentos da Unicamp - Universidade Estadual de Campinas desenvolve em laboratório estudos com fungos e bactérias que serão utilizados para limpar a água e o solo contaminados.

Batizado de biorremediação, o processo de limpeza do meio ambiente é semelhante ao trabalho feito pela natureza. A diferença é que, com o novo método, a despoluição se processará muito mais rapidamente.

Quando ocorre algum desastre ecológico, os técnicos ambientais utilizam bombas de sucção, esponjas e pás na remoção do material. Com a nova técnica, esse método convencional será substituído pelo uso de microorganismos (fungos e bactérias) que ficam encarregados de 'devorar' o material poluente, reduzindo ou até mesmo eliminando a sua toxicidade. A expectativa dos cientistas é que essa tecnologia possa ser adotada pelo mercado dentro de poucos anos.

Eficiente, barata e limpa

Considerada ecologicamente correta, a biorremediação chega a ser entre 65% e 85% mais barata que os modelos convencionais de descontaminação e tratamento de rejeitos agroindustriais. O custo para incinerar uma tonelada de resíduos varia entre US$ 250 e US$ 300, enquanto o tratamento biológico exige gastos da ordem de US$ 40 a US$ 70.

Experimentos laboratoriais têm constatado que os microorganismos são capazes de degradar entre 50% e 100% dos poluentes. A coordenadora dos estudos, professora Lúcia Regina Durrant, disse que o principal uso da técnica será evitar que o vazamento ou mesmo o despejo de produtos tóxicos contamine o solo, os rios e o lençol freático, trazendo prejuízos à cadeia alimentar e às pessoas.

Um exemplo de conseqüência da contaminação da cadeia alimentar vem da Inglaterra e tem conexão com o Brasil. Em 2000, os ingleses descobriram que o leite e seus derivados produzidos no país continham dioxinas provenientes do farelo de polpa cítrica, produto brasileiro utilizado na ração do gado. Análises brasileiras detectaram que a origem da droga estava na cal usada no tratamento da água.

Identificar, selecionar e testar

O trabalho dos cientistas consiste em identificar, selecionar e testar as bactérias e fungos que se prestam à biorremediação. Os experimentos servem para avaliar se o microorganismo ao degradar os poluentes não gera elementos até mais tóxicos do que aqueles que deve combater.

Após essa etapa, os pesquisadores formam uma espécie de consórcio microbiano porque um microorganismo não é capaz de responder sozinho pela descontaminação. A expectativa dos cientistas é produzir, em laboratório, 'pacotes' prontos para ações de biorremediação. Alguns países desenvolvidos já dominam a tecnologia da biorremediação. O Brasil se apressa para não ficar atrás nessa corrida.

Agência Imprensa Oficial

11/06/2003: CETESB MULTA PETROBRAS POR VAZAMENTO DE ÓLEO EM SÃO SEBASTIÃO/SP

A Cetesb - Companhia de Tecnologia de Saneamento Ambiental multou a Transpetro, subsidiária da Petrobras, em 30 mil UFESPs (Unidade Fiscal do Estado de São Paulo), pelo derramamento de óleo do navio Nordic Marita, ocorrido no último dia 3, no píer sul do Tebar - Terminal Marítimo Almirante Barroso, instalado em São Sebastião.

O valor da multa, de R$ 344.700,00, foi estipulado após estimativas do dano ambiental ocorrido, já que o petróleo atingiu praias e costões rochosos na região, e pela empresa ter sido reincidente neste tipo de acidente.

No dia 14 de agosto de 2002, houve o vazamento de 2 mil litros de óleo no mar, também decorrentes de problemas na conexão de um dos braços de descarga entre a embarcação e o mesmo terminal marítimo da Petrobras.

De acordo com informações da Petrobras, foram recolhidos do mar aproximadamente 15,9 mil litros de óleo. As equipes da Cetesb estão fazendo uma avaliação do acidente, para poder checar a quantidade do produto vazado e os possíveis danos ambientais causados à população de organismos marinhos presentes nos costões e nas praias, e nas culturas de mexilhões, cuja principal fazenda de cultivo está instalada na praia da Cocanha, em Ubatuba.

Informações Cetesb

11/06/2003: MINISTÉRIO PÚBLICO DE MG APURA RESPONSABILIDADES SOBRE O DESASTRE ECOLÓGICO EM UBERABA

Nesta quinta-feira, 12 de junho, dois técnicos do Ministério Público de Minas Gerais, o biólogo Cristiano Christófaro Matosinhos e o engenheiro de segurança Marco Antônio das Graças Antunes, irão realizar perícia no local onde houve o descarilhamento e tombamento de 18 vagões de trem da FCA - Ferrovia Centro-Atlântica na zona rural de Uberaba, causando um desastre ecológico na região.

O acidente provocou o derramamento de mais de 800 toneladas de produtos químicos no Córrego Congonhas, afluente do rio Uberaba, a cerca de 8Km acima do ponto de captação de água para abastecimento da cidade de Uberaba. O fornecimento de água para cerca de 300 mil pessoas foi interrompido e só deverá ser normalizado no sábado (14). A prefeitura de Uberaba decretou estado de calamidade pública.

A partir do resultado da perícia dos técnicos do Ministério Público Estadual, a Promotoria de Justiça de Uberlândia poderá propor ação civil e criminal contra os responsáveis. Segundo o promotor de Justiça de Uberaba, Emanuel Aparecido Carapunarla, a primeira providência será restaurar a captação de água do rio. Medida que está sendo verificada pela CODAU, autarquia que cuida do abastecimento de água e tratamento de esgoto em Uberaba. O corpo de bombeiros também está no local, já que ainda há riscos de explosões.

Ascom MPMG

11/06/2003: COMISSÃO DA CÂMARA DISCUTE DÉFICIT DO SETOR NUCLEAR

A Comissão de Minas e Energia da Câmara dos Deputados promoveu audiência pública nesta terça-feira (9) sobre o sistema tarifário da Eletronuclear. Durante a reunião, o presidente da Eletrobrás, Pinguelli Rosa, disse que o déficit tarifário do setor nuclear exige a justa remuneração dessa fonte de energia, e sugeriu reajustes tarifários imediatos. Segundo ele, a Eletrobrás vem cobrindo a receita negativa da Eletronuclear, o que já consumiu mais de US$ 1,4 bilhão desde 1997.

O representante da Eletronuclear, Zieli Dutra Thomé Filho, apresentou dados sobre a situação da empresa. Segundo ele, enquanto a energia contratada é de 1.266 MW de potência média, a disponibilidade energética real é de apenas 1.630 Mw de potência média. Além disso, o déficit tarifário seria de tal ordem que a atual receita da empresa não cobriria sequer os custos financeiros e operacionais. Em 2002, o prejuízo líquido atingiu R$ 368,675 milhões. Como solução, ele sugeriu a definição de tarifas com base nos custos de produção.

DIRETRIZES

O diretor-geral da Aneel - Agência Nacional de Energia Elétrica, José Mário Abdo, apresentou as bases legais que regulam o funcionamento do setor energético, informando que a não existe uma política específica para comercialização da energia nuclear.

Conforme explicou, apesar de o Ministério de Minas e Energia ter estabelecido que a Aneel tem a competência de definir as tarifas da Eletronuclear, não foram formalizadas todas as diretrizes necessárias para isso, como a definição das regras de reajuste e revisão tarifária; a forma de cobertura dos custos com o futuro descomissionamento das usinas; e o tratamento dos resíduos.

Durante a fase dos questionamentos parlamentares, os deputados foram unânimes em defender uma solução urgente para a questão tarifária da energia nuclear. Eles deverão enviar ao Poder Executivo a sugestão de uma política voltada para a manutenção do setor, como forma de promover a diversificação da matriz energética do País. Os parlamentares também defenderam a concretização da Usina Angra III e o tratamento isonômico para todo o sistema elétrico, seja ele movido a gás, carvão, água ou energia nuclear.

A iniciativa da audiência pública, presidida pelo deputado Eduardo Sciarra (PFL-PR), foi do deputado Luiz Sérgio (PT-RJ).

Agência Câmara

• INFOMET

*** Mineracao & Nao-Ferrosos ***
Salario causa aborrecimento na Alcoa
Exportacao de rocha ornamental cresce 15% ate´ abril
Millennium investe US$ 31 milhoes para ampliacao de mina
Cresce a aplicacao de aluminio em automoveis
Alcoa vende negocio de garrafas PET e vai fortalecer aluminio
Industria brasileira do aluminio e´ referencia mundial em meio ambiente
Participacoes das exportacoes quase dobram no setor de aluminio na Votorantim, em 2 meses
Acordo comercial com EUA beneficia o cobre chileno
Arcelor e belga Umicore devem formar joint-venture na Europa
Ministro da Noruega vera´ negocio da Vale no pais
CBA atinge nivel de exportacao recorde
BHP sera´ mais afetada por alta do dolar australiano
Alcoa condiciona nova unidade no pais a oferta de energia
Alcoa investe US$ 200 milhoes por ano em meio ambiente
Alcoa investira´ US$ 2,7 bilhoes no pais ate´ 2010
CBA exportara´ 63% das vendas totais deste mes
Votorantim mostra interesse por mineradora de zinco peruana
Alcoa negocia com governo projeto de nova fabrica no Brasil ate´ 2010
Bimbo vende Novacel para Pechiney
Caemi elevara´ volume para exportacao
Votorantim estuda comprar a Volcan
Vale ja´ tem quase todo o ferro do Pais
Jazidas serao garantia para emprestimo bancario
Samarco obtem 10% de aumento da Arcelor (foto)
CVM manda Paranapanema republicar balanco

• GEOCHEM

Sulfur geochemistry of hydrothermal waters in Yellowstone National Park, Wyoming, USA. III. An anion-exchange resin technique for sampling and preservation of sulfoxyanions in natural waters

Greg K. Druschel , Martin A. A. Schoonen , D. Kirk Nordstrom , James W. Ball , Yong Xu and Corey A. Cohn

Abstract:
A sampling protocol for the retention, extraction, and analysis of sulfoxyanions in hydrothermal waters has been developed in the laboratory and tested at Yellowstone National Park and Green Lake, NY. Initial laboratory testing of the anion-exchange resin Bio-Rad AG1-X8 indicated that the resin was well suited for the sampling, preservation, and extraction of sulfate and thiosulfate. Synthetic solutions containing sulfate and thiosulfate were passed through AG1-X8 resin columns and eluted with 1 and 3 M KCl, respectively.
Recovery ranged from 89 to 100%. Comparison of results for water samples collected from five pools in Yellowstone National Park between on-site IC analysis (U.S. Geological Survey mobile lab) and IC analysis of resin-stored sample at SUNY-Stony Brook indicates 96 to 100% agreement for three pools (Cinder, Cistern, and an unnamed pool near Cistern) and 76 and 63% agreement for two pools (Sulfur Dust and Frying Pan). Attempts to extract polythionates from the AG1-X8 resin were made using HCl solutions, but were unsuccessful. Bio-Rad AG2-X8, an anion-exchange resin with weaker binding sites than the AG1-X8 resin, is better suited for polythionate extraction. Sulfate and thiosulfate extraction with this resin has been accomplished with KCl solutions of 0.1 and 0.5 M, respectively. Trithionate and tetrathionate can be extracted with 4 M KCl. Higher polythionates can be extracted with 9 M hydrochloric acid. Polythionate concentrations can then be determined directly using ion chromatographic methods, and laboratory results indicate recovery of up to 90% for synthetic polythionate solutions using AG2-X8 resin columns.

- **EARTH PAGES**

Anthropology and geoarchaeology

Elderly South African Australopithecines

The Sterkfontein Caves near Johannesburg in South Africa have provided some of the best preserved hominid remains, because they are enveloped in chemically precipitated cement. Fossils are also much more plentiful than at other sites, and the caves have yielded about 500 specimens. However, unlike sites in bedded sediments interleaved with volcanic horizons, cave deposits are difficult to date accurately. Up to now, correlation of other fossil animals in the breccias that encase Sterkfontein hominids with those at more amenable sites, together with dating based on palaeomagnetic reversals, have been hotly disputed. A new technique based on the radioactive decay of isotopes that cosmic-ray bombardment induces in quartz grains promises to resolve the paradox of wonderful fossils that cannot be dated. While quartz grains are at the surface, in alluvium or the debris on slopes, cosmic rays produce radioactive aluminium and beryllium isotopes in a fixed proportion. The longer the exposure time, the more radioactive isotopes are produced. But if such irradiated grains are buried, the isotopes decay away, because they are protected by overlying material. Detrital sediments enter cave systems very quickly, so they are near-ideal for the use of cosmogenic dating. Of the two most-used isotopes, ^{26}Al decays quicker than ^{10}Be. So, the ^{26}Al/^{10}Be ratio decreases with time and gives a measure of how long the sediment has been buried. Results from Sterkfontein

(Partridge, T.C. *et al.* 2003. Lower Pliocene hominid remains from Sterkfontein. *Science*, v. 300, p. 607-612) show that the stratigraphically lowest fossils are much older than previously thought; around 4 Ma.. Previous age estimates suggested that the oldest Sterkfontein hominids lived around the same time as *Australopithecus afarensis,* of which the famous "Lucy" skeleton was an Ethiopian member. Four million years ago *A. anamensis* would have been a contemporary, yet the hominids at Sterkfontein seem quite different anatomically. Maybe there were two species in Pliocene Africa, one East African and the other a southern one. In fact, there are hints that perhaps two species of australopithecines, along with a more robust paranthropoid may have been washed into the caves. There are two problems though: cosmogenic dating is notoriously imprecise (the age reported is 4.2±0.3 Ma), and Sterkfontein has such excellent preservation that the number of specimens outweighs those from elsewhere – comparisons are not easy!

Tracking migrations with language

One of the first surprises that arose when genetic relatedness among living people and the estimated time of their separation began to encompass global populations was how well the genetic patterns matched with the distribution of the world's languages. When populations move they not only carry their genetic heritage but their languages. Probably the greatest migrations in human evolution took place at the end of the last Ice Age, and so it might seem that plotting language distribution ought to chart the paths these wandering people took. Jared Diamond and Peter Bellwood (Diamond, J. & Bellwood, P. 2003. Farmers and their languages: the first expansions. *Science*, v. 300, p. 597-603) have reviewed just how complex such a task will be. Genes and language can tell only part of the story, because people carry skills and culture too. The two dominant cultures around 11 000 years ago were the age-old ways of the hunter-gatherer and the new agriculture and animal husbandry. There are at least five possibilities involved. Genes, language and lifestyle could mix between both groups when they came into contact. Hunters might take up farming but keep their identity. Hunters were as likely to shift as farmers when climate belts changed. Powerful incomers might impose their language but not their genes. When one group moved, another might take its place. Bearing in mind these caveats, Diamond and Bellwood review the main patterns of linguistic groups, using excellent graphics.

Economic and applied geology

Water resources and bullocks

Desalination is often touted as a solution to shortages of clean drinking water, but the most common method, using reverse osmosis, is really a luxury. It relies on electric pumps driving salty water through a membrane, so that salt concentrates on the high-pressure side of the membrane, allowing nearly fresh water through it. This method is widespread among power-rich economies along desert coastlines, but has done nothing to help the less fortunate millions in countries where electricity is unaffordable. Indian scientists, unsurprisingly, have developed a means whereby fresh water might become accessible to most coastal people in the tropics. They have worked out how to gear bullock power to reverse-osmosis pumps, so that a pair can produce up to 3000 litres each day and supply entire villages. If a bullock can do it, then why not donkeys or camels in even more arid coastal areas?

Source: Coghlan, A 2003. All hooves to India's pumps. *New Scientist*, 10 May 2003, p. 19.

Environmental geology and geohazards

Long-term prediction of volcanic activity

Unless it is possible to give people who live near dangerous volcanoes sufficient warning that they can escape disaster, eruption prediction might be looked on as a lugubrious topic. Up to now, there have been very few predictions that have been better than a few hours or days. Mexico's Popocatapetl gave two days warning in late 2001, and that was sufficient for a completely successful evacuation of those threatened. In the case of the eruption of Nyirangongo in eastern Congo, a few months later, warning signs preceded eruption by 5 days, but the people of Goma were not told and 45 people died trying to rescue possessions from the quiet, but relentless movement of a lava stream (see *EPN* February 2002, *Is volcanic eruption predictable?*). In both cases it was abnormal seismicity that presaged the events. John Murray, of the British Open University, has analysed the statistics of seismic events and eruptions of possibly the world's most monitored volcano, Etna on Sicily (Murray, J.B. 2003. Seismicity and time-lagged lava output at Mount Etna: A new method of long-term forecasting at a destructive volcano. *Geology*, v. 31, p. 443-446). Energy released during 19-year periods by earthquakes beneath the volcano since 1870 shows a inverse relationship with 9-year lava production, which suggests that seismicity and eruption are widely separated in time over long periods. However, by examining the correlation of seismic energy with eruption volume for time differences between the two from 0 to 50 years, Murray has been able to show that Etna increases its productivity roughly 25 years after major releases of seismic energy. Using this as an input to a model that might predict eruption intensity, he has been able to mimic the actual volcanism through the 20th century with fair accuracy. In his opinion, the very high eruption rate since 1950, which reached a peak in the 1990s, is only likely to decline a quarter of a century after large earthquakes (> magnitude 6) return to Sicily. So, Sicilians have a difficult choice. Should they worry about lava flows or earthquake damage? Sadly, data suitable for broadening Murray's method are available for very few volcanoes, all in quite prosperous countries.

Modelling the duration and extent of mining contaminants

Release of high concentrations of heavy metals and other pollutants to drainages is a natural consequence of geochemical anomalies associated with mineralization. However, these have come to balance with the rest of the environment over periods measured in thousands of years or even longer. The pose perpetual hazards, some of which are known, some not. Environmental disturbance by mining and associated activities scales up releases of pollutants many times over those of natural origin. Even with modern means of waste containment, escapes occur, sometimes of very large magnitude, such as the breaching of tailings dams or landslips in spoil heaps. Of course, these hit the news when they happen, but assessing how long the pollution dwells in downstream areas and how it moves is not easy. It requires some kind of model of the hydrology, erosion and sediment-transport characteristics of the affected drainage basins, that takes into account catchment topography and the size-distribution and density of escaped wastes. Such a modelling tool is now available, having been developed at the University of Wales in Aberystwyth (Coulthard, T.J. & Macklin, M.G. 2003. Modelling long-term contamination in

river systems from historical metal mining. *Geology*, v. 31, p. 451-454). It is complex, because it combines the 3-D shape of basins with water discharge and depth, vegetation cover, depth to bedrock and the properties of released materials. In a simulation of hydrological dynamics. TRACER is able to take account not just of the fate of grains that enter drainages, but how they are deposited in alluvium and then reworked by later changes in hydrology. Coulthard and Macklin apply the model to the base-metal mining district of Swaledale in North Yorkshire, England, where production began in 1700 and ended 200 years later. Swaledale was a minor producer of lead and zinc in modern terms, and the miners paid scant attention to environmental protection. Results suggest that contamination spread downstream to the flat land of the Vale of York in only 10 years after mining started, but the pollution lingers, and seems likely to stay above safe limits until well after the start of the 22nd century. When possible increases in rainfall through global warming are factored in, the simulation remains much the same for 10 to 25 % rises, and only moves towards clean-up with 50 to 100 % increases in precipitation, when clean sediments should dilute the pollutants. As well as predicting the general effects of contaminant releases, TRACER is able to highlight parts of a drainage basin that are particularly at risk due to trapping of sediments. Mining in Swaledale produced, at most, only about 600 thousand cubic metres of metal-rich waste, fine enough to be transported by water. Recent escapes from tailings dams and landslipped spoil heaps, as in Spain and OK Tedi in Papua New Guinea, were orders of magnitude larger.

Geobiology, palaeontology, and evolution

Extinction at the Precambrian-Cambrian boundary

The very beginning of the Cambrian is associated in every geologist's mind with the explosive appearance and diversification of animals with hard parts. Why this dramatic introduction to the modern biological world occurred is one of the great questions in evolution. Some connection with the effects of "Snowball Earth" events in the late Neoproterozoic was thrown into doubt by evidence that it had little effect on micro-organisms (see *Microbes showed no sign of change following a "Snowball Earth"* in May 2003 *EPN*). Exactly at the boundary there is a marked fall in the abundance of carbon-13, and this negative $d^{13}C$ excursion is so widespread that it is the best indicator of the position of the Precambrian-Cambrian boundary in stratigraphic sequences of roughly this age. One of the places that it occurs is in Oman, reported previously in *EPN* (*A possible fuse for the Cambrian Explosion*, January 2003). The paper describing the evidence from Oman that the carbon-isotope excursion relates to a mass extinction is now out (Amthor, J.E. and 6 others 2003. Extinction of *Cloudinia* and *Namacalathus* at the Precambrian-Cambrian boundary in Oman. *Geology*, v. 31, p. 431-434) The disappearance of the distinctive eukaryote fossils coincides exactly with the carbon anomaly. Luckily, so too does a volcanic ash horizon from which zircons provide a very precise U-Pb age of 542±0.3 Ma. This matches less precise dates for the anomaly from Siberia and Namibia, and seems likely to become accepted as the definitive age for the start of the Phanerozoic.

"Snowball Earth" and evolutionary diversification: Australians speak out

By comparison with the vast amounts of Australian diamictites that span a range of Neoproterozoic ages, the sites elsewhere, from which evidence in support of the "Snowball Earth" hypothesis and possible effects on evolution

have been drawn, are puny. Besides that, the Late Precambrian of Australia has the best record of biological change, including the type locality for the Ediacaran fauna that presaged the Cambrian Explosion. Although somewhat less hasty than the flurry of papers on the "Snowball" hypothesis, since 1998, the appearance of published data from the "Red Continent" is sure to push the debate decisively one way or another. Palaeontologists from the Geological Survey of Western Australia, Macquarie University and Mineral Resources Tasmania have just unveiled details of acritarchs from late-Neoproterozoic sediments that overlie the Marinoan (~600 Ma) glaciogenic rocks in South Australia (Grey, K. *et al.* 2003. Neoproterozoic biotic diversification: Snowball Earth or aftermath of the Acraman impact? *Geology*, v. 31, p. 459-462). Acritarchs are spore-like fossils, that probably represent encysting algae. Their rapid diversification makes them useful biostratigraphic indicators from the Late Precambrian to the present. Grey *et al.* Found that the same assemblage of acritarchs occur before the Marinoan glaciogenic strata and after the succeeding "cap" carbonate. They are part of a group that can be traced back to the Mesoproterozoic However, higher in the sequence that they examined there is a distinctive layer of debris that contains evidence of impact-induced shock. This can be correlated with little doubt to the 90 km Acraman structure in South Australia, which formed at 580 Ma with an energy likely to have had a major influence on life. Sure enough, in the strata above this ejecta layer a completely new type of acritarch group appears and diversifies rapidly, while the pre-impact groups simply disappear. Clearly, the Acraman impact is implicated in this sudden biological change; an extinction followed by rapid diversification. Acritarchs are thought to represent the phytoplanktonic base of the Neoproterozoic food chain. Immediately above the strata in which the post-impact acritarchs diversified lie sandstones that contain the famous Ediacara fauna of the first large, soft bodied animals. The Marinoan "Snowball" event seems disconnected from this evolutionary leap.

Geochemistry, mineralogy, petrology and volcanology

Geochemistry of the vanishingly tiny

The British press has been awash with speculation that the Prince of Wales is worried about nanotechnology and the slim possibility that the next big threat after Osama and SARS might be minute, self-replicating robots that invade our bodily orifices. It stemmed from the Prince of Wales' having asked experts for a briefing, and that may well have been just HRH's curiosity about a changing world. There is rarely an issue of the weekly science journals without news of some discovery of phenomena that occur in nanotubes and minuscule cavities; the world at scales less than a micrometre is beginning to seem strange. Rocks are full of pore spaces and inter-grain boundaries with the dimensions on which new wings of the other sciences are emerging. So it is no surprise to learn that there will soon be "nanogeochemistry" (Wang, Y. *et al.* 2003. Nanogeochemistry: geochemical reactions and mass transfers in nanopores. *Geology*, v. 31, p. 387-390). The use of natural and artificial zeolites as ionic filters has been around for a long time, so this is a branch with a new name, rather than a fundamental breakthrough. But zeolites are profitable, and only now has "blue-skies" research turned up the magnification.

Typical nanopores and pathways are grain boundaries in crystalline rocks, cleavage planes in phyllosilicates and clay minerals, and pores in fine-grained sediments, such as diatomite and kaolin, and minerals that have been precipitated as amorphous masses rather than discrete crystals, a good example being the iron oxy-hydroxides in soils. To see these structures requires advanced transmission electron microscopy, and even with them the features

are somewhat indistinct. Nanopores can make up to 40% of a material's porosity, and having such minute radii they contribute as much as 90% of the internal surface area that is exposed to chemical reactions. Artificial materials that show nanoporosity have internal surface areas as high as hundreds of square metres per gram. Clearly, such materials in nature must play a major, but largely uncharted role in geochemical change. Among the oddities discovered by Wang and colleagues at the Sandia National Laboratories and the University of New Mexico, are inclusions of native copper in weathered clay minerals and equally small particles of gold along microfractures in mylonites. Their experiments with artificial simulants of natural fine-grained materials focussed on two simple phenomena: the electrical charge on small surfaces in relation to acidty; and their ability to absorb trace elements. The paper is highly technical, but the conclusions are surprising . Nanopores develop unusually high surface-charge densities that should affect their ability to adsorb ions, and also exert controls on reactions that might seem unlikely in macro-scale simulations of geological conditions. Indeed, finely porous materials enrich trace elements by an order of magnitude compared with isolated small particles, and encourage precipitation or solution of different compounds when that would be unexpected in more open systems. As well as bearing on burial of toxic and radioactive wastes, and on mineralising processes, nano-scale processes are probably central to the whole process of weathering. Interestingly, such small scales exclude even the tiniest bacteria, so that the geochemical processes seem unlikely to impinge on life. However, spaces in rocks comprise a nested series of dimensions, and changing conditions may well flush material from one scale to another. In particular, bacteria of various kinds can control pH at the micro-scale, thereby creating the ambient conditions for nano-scale geochemistry.

Potassium in the core

It might seem impossible for planetary cores dominated by iron-nickel alloys to contain any source of heat generation. The main three elements (uranium, thorium and potassium) with long-lived radioactive isotopes and sufficient abundance to produce substantial heat energy are all highly concentrated in the Earth's crust. That is because they are incompatible with the minerals in mantle rocks, and so readily enter magmas that contribute to continental growth. However, the only natural materials that bear any resemblance to geoscientists' notions of core materials, metallic meteorites, contain abundant sulphur. Theoretically, potassium can enter sulphide minerals. So, since as long ago as the 1970s there has been debate about whether motion in the core was driven entirely by residual heat from Earth's accretion and the formation of the core, or that it contained its own heat source in the form of ^{40}K. If the first was true, then the self-exciting dynamo responsible for the Earth's magnetic field has been running down over geological time, because heat is transferred across the core-mantle boundary, eventually to reach the surface by convection. The existence of a solid inner core might result from such cooling, though its formation would release latent heat of crystallization and prolong inner motion. However, some calculations suggest that core motion and so geomagnetism ought to have vanished long ago, through loss of core heat to the surface. Substantial potassium in the core would demand considerable revision of ideas about the bulk evolution of the Earth, and other rocky planets. Experiments to prove that iron-sulphur alloys can contain abundant potassium have had a chequered history. Research at the University of Minnesota and the Carnegie Institute of Washington has discovered why there were such ambiguous results (Murthy, V.R. *et al*, 2003. Experimental evidence that potassium is a substantial radioactive heat source in planetary cores. *Nature*, v. 423, p. 163-165). The

problem was in the preparation of samples for analysis. Rama Murthy and colleagues found that the oils used in polishing samples for electron-microprobe analysis actually leach potassium from the sulphides in them, nearly all disappearing in a few days of contact. With great care, they repeated experiments on mixtures of metallic iron, iron sulphide and potassium bearing glass held at high temperature under pressures between 5 and 10 % of those experienced in the core. Their results show that potassium can indeed enter core materials with high sulphur contents. The higher the temperature the more gets in, and their most extreme run saw almost 4 % K in the quenched sulphide. Plan are afoot to discover if uranium and thorium might also be in core materials.

Incidentally, in the week that the film *The Matrix: Reloaded* was premiered in the USA, a proposal to send a probe to the core-mantle boundary also appeared (Stephenson, D.J. 2003. Mission to Earth's core – a modest proposal. *Nature*, v. 423, p. 239). David Stephenson, of the California Institute of Technology, builds on the notion of the "China Syndrome", in which meltdown of the core of a nuclear reactor would lead to superdense molten uranium melting its way through the mantle. In his proposal, ruggedised instruments in a capsule the size of a grapefruit would make the journey, along with about 10 million tons of molten iron, by propagating a large crack started by a 10 Mt nuclear explosion. Data is to be transmitted by modulated acoustic signals in the kHz range. The article helps to demonstrate the delays in publication, even in a prestigious weekly journal; it should have appeared 6 weeks earlier….

Tectonics

Plume debates

Jason Morgan's recognised in the early 1970-s that chains of volcanic islands and seamounts, such as the Hawaii-Emperor Chain, which cross sea-floor magnetic stripes, might have resulted from mantle "hot spots" that are fixed relative to motions of lithospheric plates. He went on to suggest that such magmatic anomalies might reflect narrow thermal upwellings within the deep mantle, and applied the term "plumes" to these notional convective zones. Geochemists have since flocked to active and extinct manifestations of within-plate magmatism, and developed a whole sub-culture of classification and hypotheses concerning their origin and inner workings. By the end of the 1990s over 5000 candidates for underlying plumes had been proposed, some still active and others inferred for past events, such as flood basalt provinces. Processing of seismic signals using supercomputers over the last few years has used them to map variations in P- and S-wave speeds at different depths in the mantle. Speeds below those expected are likely to reflect hot mantle relative to high-speed, colder regions. So seismic tomography potentially charts hot rising mantle and cool, descending parts; seemingly ideal for detecting mantle plumes and how deep they extend. Early results centred on proposed plumes were a mixed bag. Some seemed to have very deep origins, perhaps down to the core-mantle boundary, whereas others appeared to be above hardly anomalous mantle. Most exciting was a zone of hot, probably rising mantle with a source at the top of the core beneath the South Atlantic, yet whose upper parts sloped obliquely upwards towards the Red Sea. It seemed that the Afar plume, believed to have been responsible for continental flood volcanism in Kenya and the Ethiopian Plateau, and perhaps the East African Rift and opening of the Red Sea, still existed. Hot-spot activity is a minor aspect of global tectonics today, so it is not an ideal time to ponder on plumes. If they are real, then periods of massive flood volcanism would have been responses to superplumes, but the last in Ethiopia was 30 Ma ago.

Exciting as seismic tomography is, its resolution is currently too coarse to pick out the most revealing features of the plumes that potentially it could detect. To have sufficient gravitational potential energy to rise through the entire mantle, a very large volume is required, and that is assigned to the "plume head". Some hotspots are over large volumes of hot mantle, but they lie just beneath the lithosphere, and could have their origin at any level in the mantle. The tracks that they followed, if any, and which might continue to be a conduit for uprising material would be much narrower. Such predicted "plume tails" are too small for resolution by current tomography. A compilation and re-classification of hot spots (Courtillot, V. *et al*. 2003. Three distinct types of hotspots in the Earth's mantle. *Earth and Planetary Science Letters*, v. 205, p. 295-308) has whittled down candidates for mantle plumes to a mere 50 or so, with less than 10 likely to have risen from core depths. Two responses have arisen about this hugely popular topic: that Morgan's ideas are still basically valid, but need more work (DePaulo, D.J. & Manga, M. 2003. Deep origin of hotspots – the mantle plume model. *Sciene*, v. 300, p. 920-921); that hotspots might be linked to plate tectonics, and that mantle plumes are nothing more than a "belief system" (Fouger, G.R. & Natland, J.H. 2003. Is "hotspot" volcanism a consequence of plate tectonics? *Science*, v. 300, p. 921-922). A sensible aim that might resolve matters is to seek materials from the largest magmatic events – flood basalts – that should contain unambiguous geochemical signs that their parent mantle was at some stage exchanging matter with the core, if they had formed after rise of a superplume. But, every line of approach to deep-mantle processes relies on proxy evidence, several steps removed from actual events and properties. That makes David Stephenson's proposal for a mission to the core (above) so urgently in need of support!

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