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Araceae from the Early Cretaceous of Portugal: Evidence on the emergence of monocotyledons Else Marie Friis, Kaj Raunsgaard Pedersen, and Peter R. Crane Proc. Natl. Acad. Sci. USA. 2004; 101(47): p. 16565-16570 http://www.pnas.org/cgi/content/abstract/101/47/16565?ct

E Culotta Paleontology. Spanish fossil sheds new light on the oldest great apes. Science 19 Nov 2004 306(5700): p. 1273. http://highwire.stanford.edu/cgi/medline/pmid;15550630

Rise and Fall of the Beringian Steppe Bison Beth Shapiro, Alexei J. Drummond, Andrew Rambaut, Michael C. Wilson, Paul E. Matheus, Andrei V. Sher, Oliver G. Pybus, M. Thomas P. Gilbert, Ian Barnes, Jonas Binladen, Eske Willerslev, Anders J. Hansen, Gennady F. Baryshnikov, James A. Burns, Sergei Davydov, Jonathan C. Driver, Duane G. Froese, C. Richard Harington, Grant Keddie, Pavel Kosintsev, Michael L. Kunz, Larry D. Martin, Robert O. Stephenson, John Storer, Richard Tedford, Sergei Zimov, and Alan Cooper Science. 2004; 306(5701): p. 1561-1565 http://www.sciencemag.org/cgi/content/abstract/306/5701/1561?ct

Impact-Induced Seismic Activity on Asteroid 433 Eros: A Surface Modification Process James E. Richardson, H. Jay Melosh, and Richard Greenberg Science. 2004; 306(5701): p. 1526-1529 http://www.sciencemag.org/cgi/content/abstract/306/5701/1526?ct

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Seismic Anisotropy Beneath Ruapehu Volcano: A Possible Eruption Forecasting Tool Alexander Gerst and Martha K. Savage Science. 2004; 306(5701): p. 1543-1547 http://www.sciencemag.org/cgi/content/abstract/306/5701/1543?ct

PLANETARY SCIENCE: Nothing Simple About Asteroids Erik Asphaug Science. 2004; 306(5701): p. 1489-1492 http://www.sciencemag.org/cgi/content/summary/306/5701/1489?ct

GEOPHYSICS: Trading Places Linda Rowan Science. 2004; 306(5701): p. 1439b http://www.sciencemag.org/cgi/content/summary/306/5701/1439b?ct

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Something in the Water Science. 2004; 306(5701): p. 1469a http://www.sciencemag.org/cgi/content/summary/306/5701/1469a?ct

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DATABASE: Where the Bones Are Science. 2004; 306(5701): p. 1449b http://www.sciencemag.org/cgi/content/summary/306/5701/1449b?ct

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DJ Repeta, NT Hartman, S John, AD Jones, and R Goericke Structure elucidation and characterization of polychlorinated biphenyl carboxylic acids as major constituents of chromophoric dissolved organic matter in seawater. Environ Sci Technol 15 Oct 2004 38(20): p. 5373. http://highwire.stanford.edu/cgi/medline/pmid;15543739

Tae Hyun Yoon, Stephen B Johnson, Karim Benzerara, Colin S Doyle, Tolek Tyliszczak, David K Shuh, and Gordon E Brown Jr In Situ Characterization of Aluminum-Containing Mineral-Microorganism Aqueous Suspensions Using Scanning Transmission X-ray

Microscopy. Langmuir 23 Nov 2004 20(24): p. 10361. http://highwire.stanford.edu/cgi/medline/pmid;15544358

DA Lytle, TJ Sorg, and C Frietch Accumulation of arsenic in drinking water distribution systems. Environ Sci Technol 15 Oct 2004 38(20): p. 5365. http://highwire.stanford.edu/cgi/medline/pmid;15543738

Brian C O'neill and Michael Oppenheimer Climate change impacts are sensitive to the concentration stabilization path. Proc Natl Acad Sci U S A 15 Nov 2004. http://highwire.stanford.edu/cgi/medline/pmid;15545606

JF Lin, B Militzer, VV Struzhkin, E Gregoryanz, RJ Hemley, and HK Mao High pressure-temperature Raman measurements of H2O melting to 22 GPa and 900 K. J Chem Phys 1 Nov 2004 121(17): p. 8423. http://highwire.stanford.edu/cgi/medline/pmid;15511164

B Carstens, A Stevenson, J Degenhardt, and J Sullivan Testing Nested Phylogenetic and Phylogeographic Hypotheses in the Plethodon vandykei Species Group. Syst Biol 1 Oct 2004 53(5): p. 781. http://highwire.stanford.edu/cgi/medline/pmid;15545255

JF Adkins and C Pasquero Ocean science. Deep ocean overturning--then and now. Science 12 Nov 2004 306(5699): p. 1143. http://highwire.stanford.edu/cgi/medline/pmid;15539591

Climate change impacts are sensitive to the concentration stabilization path Brian C. O'Neill and Michael Oppenheimer Proc. Natl. Acad. Sci. USA. 2004; 101(47): p. 16411-16416 http://www.pnas.org/cgi/content/abstract/101/47/16411?ct

- **IAPC**

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Petrology ISSN 0869-5911.

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- **EARTH PAGES**

Web resources
Mineralogy links
Information on mineralogy is often hard to find on the web, so the University of Wurzburg Institute of Mineralogy in Germany has created a comprehensive set of links that cover a wealth of topics. They include teaching materials at different levels, information on experimental and analytical techniques, thermobarometry, mineral descriptions and crystallography, economic mineralogy, gemmology and much more besides. Go to http://www.uni-wuerzburg.de/mineralogie/links.html
Anthropology and geoarchaeology
The little people of Flores, Indonesia
At the end of October 2004 the front pages of newspapers world-wide carried a major geoscientific story; not about some natural disaster but the discovery of astonishingly tiny people who shared an island with us “big ‘uns” not so long ago. They were not pygmies, but an entirely different hominin species from ours (Brown, P *et al* . 2004. A new small-bodied hominin from the Late Pleistocene of Flores, Indonesia. *Nature* , v. **431** , p. 1055-1061; Morwood, M.J. *et al* . 2004. Archaeology and age of a new hominin from Flores in eastern Indonesia. *Nature* , v. **431** , p. 1087-1091). That the species came to light at all is down to the skill of Indonesian archaeologist Thomas Sutikna and his team of workers, who found the most important remains. The bones had the consistency of putty, because the find was made in a cave in humid tropical rain forest and fossilisation had not begun. By being treating with a glue, oddly known as “Tarzan's Grip” the remains survived excavation to be analysed in the lab. About one third the size of a modern human's, the skull was at first suspected to be that of an infant *Homo sapiens* . Even cursory examination proved beyond doubt that it was not. It carries worn adult molars, has no chin and possesses clear brow ridges. Limb bones suggest a stature around 1 metre (by far the smallest member of the human family), with proportionately longer arms than ours. Leaving aside the sheer tinyness of this roughly 20-year old female, these features most resemble Asian *H. erectus* , whose remains from mainland Asia and the larger Indonesian islands date from before 1.5 Ma to possibly as late as 20 ka.
Dates from the whole suite of *Homo floresiensis* remains show a remarkably long occupation of Flores, certainly for most of the last glacial period until 18 ka, and perhaps extending back 840 thousand years and to as recent as the early Holocene. For the later part of their occupancy members of *H . floresiensis* must have shared the densely forested island with modern people, who arrived there between 35 to 55 ka ago. How the little people arrived is a problem. Unlike the western Indonesian islands of Sumatra and Java, which would have been connected to Asia by land bridges during periods of glacial low sea levels, Flores and the eastern Indonesian chain of small islands are surrounded by water that is deeper than 200 metres. Even the greatest extent of continental ice during the Pleistocene could not have drawn off enough sea water to create a dry passage from Java, and Flores is not adjacent to that known home of *H. erectus* , but separated from it by the islands of Sumbawa and Komodo, and more deep channels. Together with the hominin remains in the cave are bones of the notorious Komodo Dragon, rats as big as dogs and minuscule elephants, so the original colonisers could have drifted from Java on floating vegetation rafts in the same way as the precursors of these other animals. Unlike rats, monitor lizards and elephants, it is unlikely that they

swam the necessary 150 km, and there are no records of pre-modern human boats. Whatever, new arrivals on small islands find totally different conditions from those on larger ones or continents. Potential food is limited, yet predators are fewer. There is a well-known tendency for evolutionary miniaturisation of larger mammals, the tiny elephant *Stegodon* found in the same cave being a case in point. In general it is reckoned that small-island mammals tend towards a size that is equivalent to a very large rabbit. Not so for lizards, and the Komodo Dragon, still a terrifying predator on the eponymous island, would have been top of the food chain on Flores.

Another puzzling feature of *H. floresiensis* is that despite having brains the size of a grapefruit (roughly the size of those of australopithecines), they seem to have used both sophisticated tools and fire. They were not dim-witted. Their overlap with modern humans for so long is also intriguing. In Europe the Neanderthals, physically more than a match for any modern human, drifted to extinction within about 5 thousand years after first encounters. On Flores, the truly diminutive *H. floresiensis* clung on for far longer, possibly because resources were much richer than in frigid high latitudes. Local people throughout eastern Indonesia today tell legends of the little people they call *Ebo Go Go* . Perhaps they survived into far more recent times. Undoubtedly, the dense forests and innumerable caves of the island chain may have other surprises in store. For the moment, there can be none greater than finding that modern humans walked the Earth with at least two other human species not that long ago. Nor is that of scientific interest alone. As the editorial in *New Scientist* of 30 October 2004 observes, "... *Homo floresiensis* throws into doubt many of our assumptions about intelligence". They lived just as successfully as modern human colonisers of Flores for tens of thousands of years, despite the competition and possibly worse. So brain size may not be the key to cleverness on which we pride ourselves. Nor are we as unique as we generally suppose. As with Tolkien's hobbits, we should be humbled by their tenacity.

Anthropological nit picking

The chances of extracting human DNA from old bones to compare with that in modern populations are pretty slim. It has been done for two Neanderthal specimens, and showed that living humans carry no sign of their involvement in producing hybrid offspring fit enough to pass genes upwards through the generations since about 35 ka ago. Preservation of such molecular material requires extra-special conditions. But there may be another way, which has a flavour of the opening sequences in *Jurassic Park* , where dinosaurs were cloned from blood preserved with their parasites in amber. Body and hair lice are species-specific (we do get bitten by fleas from rabbits, cats and rats, but not by their lice), and the beasts prefer hosts who live cheek by jowl together. Hair lice are especially good, because as any parent knows they leap as soon as kids get in a huddle, but no more than a few centimetres. Comparing hair lice from modern humans and chimpanzees, Dale Clayton and David Reed of the University of Utah were able to show by comparing their mitochondrial DNA that the two species' origins are about as old as the >5 Ma split between the human and chimp evolutionary clades. Taking the method a step further to compare human head lice an astonishing feature emerged (Reed D.L. 2004. Genetic Analysis of Lice Supports Direct Contact between Modern and Archaic Humans. *Public Library of Science:Biology* v. **2** , e340). There are two genetically distinct groups in the species *Pediculus humanus* . One has a global distribution and infests head and body hair, the other only being found in the Americas and is found exclusively on the scalp. Their mtDNA molecular clocks suggest a divergence more than a million years ago. Although they parasitise modern humans, they diverged before even archaic humans appeared on the scene. The authors suggest that the divergence might have coincided with the separation of the two main populations of *Homo erectus* , an Africa one that evolved to modern humans and that in Asia, which probably was not on the human clade. For one human species to carry two subgroups of anciently separated lice suggests that our ancestors went "head to head" with *H. erectus* , once in Africa and then perhaps much later in Asia, *en route* to the Americas. The next step concerns considerably more intimate intra-species contact; the team is going to investigate the different genus of human pubic lice..... The collection process may well be underway as I write.

The perils of genealogy

With all kinds of public records on the web and others easily accessible from registry offices etc., tracing one's ancestry has never been easier, should you be bitten by the family-tree bug. Genealogy is addictive, out of a sense of adventure, a desire to "belong", the possibility of tracking down untold riches because a maiden great-great aunt died intestate and her millions were invested in blue-chip stock to await your appearance at the trustees' door, or because train-spotting has lost its frisson of excitement. I suspect that there are times when "googling" is slow because genealogist are on line. There is an old chestnut that if your researches successfully reach back far enough, you will find that William of Normandy or Eric Bloodaxe is a direct ancestor. In fact research into human Y-chromosome DNA shows very clearly that Genghis Khan and his near relatives dominate the genes of millions of men in parts of Central Asia (*see Darwinian evolution of humans challenged by Y-chromosome data?* in *EPN* , March 2003). That is special case, as the eponymous warlord slaughtered most of the men in conquered areas and put most of the women into concubinage, and made damned sure that only he and his male kin had *droit de seigneur* , or its Mongol equivalent. Simple arithmetic suggests that the chestnut holds true. Going back generation by generation all of us have 2, 4, 8, 16, 32, and so on, direct ancestors. The algorithm is simply 2^n , where n is the number of generations. Say a generation is 25 years, a millennium ago our ancestors would be 40 generations back. Each of us would have had a trillion such great-great-great-great--- grandparents on this simple basis, half men and half women. Well, there would have to be 500 billion women, but maybe less men, if Genghis' unwholesome habits were common. Of course it is more complicated than that, because human populations are separated geographically, and in the past encounters would have been between relatively few travellers. In fact, for some populations, such as those of pre-colonial Tasmania, contact had been cut off many millennia ago. Because of the varied evidence for ancestors from whom all humans are genetically descended, such as "African Eve" (>150 ka) and "Big Daddy" (more recently), it is tempting to develop sophisticated models for genealogy (Rohde, D.L.T *et al* . 2004. Modelling the recent common ancestry of all living humans. *Nature* , v. **431** , p. 562-566). Leaving aside very isolated populations, such as the aboriginal Tasmans, the modelling suggests all of us only need to go back to about 3000 BC to find the ultimate tip of our family tree – our universal, identical ancestor. Anyone else who lived at that time sadly might seem to have had no effect whatever on our generation. However, pedigree is not necessarily something that would justify you putting a coat of arms on your living room wall. What we are genetically is not the same as suggested by our family tree. Further up the tree, the less chance there is that someone appearing in it passed on any genes whatever to you or me. The exponential law of genealogy no longer works, and the number of our genetic ancestors increases far more slowly. A proper search for who in your past helped determine what you are requires DNA from everybody, and I don't see many family-tree fanatics queuing to have their cheek cells swabbed, and nor will I. I am quite happy that whomever passed on my patrilineal family name was probably one of William the Conqueror's spear carriers in 1066. The genealogy goes cold not many generations back, as, in my father's words, "they were all probably illiterate anyway"!

See also: Hein, J. 2004. Pedigrees for all humanity. *Nature* , v. **431** , p. 518-519.

Geobiology, palaeontology, and evolution

A volcanic role in the origin of life?

Studies of the organic chemicals in meteorites and in "space snow" that falls continually on the Earth, show that amino acids and nucleotides (the CGAT building blocks of nucleic acids), together with other moderately complex compounds, were widespread in the solar nebula as it formed. They can form in the absence of life. Life's dependence on DNA and RNA for its necessary self-replication marks a chemically complex step that assembled such building blocks by a process of polymerisation. That presupposes an awful lot of chance reactions, none more so than the formation of the peptide bond that dominates genetic material and proteins. Lots of mechanisms have been tested, but none work sufficiently well in a test tube to be plausible candidates for processes on the early Earth. Perhaps the simplest, first proposed more than 30 years ago is the operation of a simple

gas called carbonyl sulphide (COS). Experiments that expose amino acids to carbonyl sulphide in water at “room temperature” yield lots of peptides in a matter of a few minutes to hours (Leman, L. *et al* . 2004. Carbonyl sulphide – mediated prebiotic formation of peptides. *Science* , v. **306** , p. 283-286). The more metal ions, such as those of iron, lead and cadmium, that are in the solution, the more efficient the reactions. The likeliest place for such processes to go on would be near submarine hydrothermal vents, as COH quickly breaks down once emerged from a volcanic source. Its role could have been crucial in the complex molecular evolution that many biochemists believe to have been intimately associated with the structures of clays and sulphide minerals that hydrothermal activity produces in abundance.

Planetary, extraterrestrial geology, and meteoritics

Linking seismic tomography to chemical mantle heterogeneity

Analysis of historic, global seismograph records using sophisticated software allows far more than the detection of various discontinuities in the deep mantle and core that figure in most textbooks. Essentially, it maps parts of the mantle where P and S waves travel faster or slower than expected from the depth. Up to now, most results have been interpreted in simple terms of cold (fast) and hot (slow) patches, which have been linked to gross tectonic features such as signs of descending slabs far below the earthquake belts associated with subduction, and possible zones of rising mantle that might (or might not) be plumes. That leaves a lot unsaid about the mantle, for rising and falling of material is linked to density, and that can be due to temperature anomalies, and also to compositional variations involving either bulk chemistry or different assemblages of minerals in mantle rock. A difference in seismic wave speed can be an ambiguous indicator of possible motion. Making the connections between wave speed, temperature and composition is an order of magnitude or more computationally taxing than the tomography itself, but it has been shown to be possible, given supercomputer power and plenty of free time (Trampert, J. *et al* . 2004. Probabilistic tomographic maps chemical heterogeneities throughout the lower mantle. *Science* , v. **306** , p. 853-856). Trampert and colleagues from the Netherlands and the US factored in mineral physics and temperature data, and were able to calculate the probabilities of tomographic features having a thermal or compositional origin. Their results will worry some of the earlier workers on seismic tomography who used a simplistic connection with temperature and thus slow = hot = low density and rising, while fast = cool = high density and sinking. Some zones of low wave speed can as well be connected with high-density mantle as with hot, buoyant material. That plays havoc with concepts of plumes rising from the core-mantle boundary, that have been all the rage since moderately well resolving tomograms appeared. Trampert *et al* 'r results, which superficially look just the same as other tomographic renderings of the same seismic data, include statistical evaluations of the likelihoods of wave-speed shifts being either thermal or compositional in origin. They reveal that many of the slow zones are probably chemical and mineralogical heterogeneities, especially in the deepest mantle levels. One of the largest slow zones known rises obliquely from the core-mantle boundary around southern Africa towards the surface in NE Africa. It was leapt on as a reputed superplume, perhaps connected to the last outpouring of flood basalts in Ethiopia and the Yemen around 30 Ma ago, and still active beneath the Afar Depression. Chances are, from the new work, that it is denser than average and not especially hot. Mantle geochemists will probably be gleeful at the new look at deep mantle, because they have long been wrangling ideas about gross lateral variations in the source chemistry of basaltic magmas. Some enthusiastic geotectonic speculators might remain very silent, in the hope that the Dutch-US team's work is not duplicated, and fades away…

See also: van der Hilst, R.D. 2004. Changing views on Earth's deep mantle. *Science* , v. **306** , p. 817-818

Bedout end-Permian “impact” hammered

The claim that a large circular feature beneath the sea bed between Australia and New Guinea is linked to the end-Permian mass extinction (Becker, L. *et al* . 2004. Bedout: A possible end-Permian impact crater offshore of northwestern Australia. *Science Express* 14 May 2004 – www.sciencexpress.org) (See *Crater linked to end-Permian extinction* ,

June 2004 *EPN*) has met with a flurry of sceptical comment in letters to the editor of *Science* (2004, v. **306** , p. 609-613). Becker and colleagues have published several articles on the P-Tr boundary, including data on noble gases from the boundary in China, which are alleged to be consistent with an extraterrestrial influence, a meteorite from Antarctica which they consider to be a fragment of the impacting body and this year the claim for shocked minerals and impact glass in sedimentary core over the Bedout structure. There have been unsuccessful attempts to duplicate the results on the noble gas analyses, the Antarctic meteorite is regarded as being insufficiently altered to be as old as 250 Ma, and as regards the Bedout material, the authors of the letters to *Science* consider none of the evidence to stand up to proper scrutiny. One letter from specialists in the US, Russia, South Africa, Austria and the UK (Renne. P.R. and 7 others 2004. Is Bedout an impact crater? Take 2. *Science* , v. **306** , p. 610-611) also claims that the 250 Ma argon-isotope age for Bedout samples is misconceived and without objective basis. One of the authors, Jay Melosh of the University of Arizona, is reported to have said that the Becker group, "..have deeply muddied the waters about what is going on at the Permian/Triassic boundary". These and material in the other letters are tough words indeed. Becker's group is funded by NASA, and when the flurry of letters hit home earlier in October, NASA sent a team of three scientists, including Becker, to resample the Chinese P-Tr boundary section. Ten geochemistry laboratories will receive splits of the material to settle the issue of noble-gas evidence for an end-Permian impact. But it looks very much as if a major scandal may break when the multi-lab analyses are published next year. That is not to imply that there are no other skeletons lurking in cupboards along with impact-related materials. A few years ago, editors of a major journal were asked to withdraw or refute a paper that used analyses of impact-related materials that had found there way to several laboratories without the permission of their originators or their names being mentioned. The kudos associated with publishing on extraterrestrial influences on biological extinction patterns seems hard to resist…..

See also: Dalton, R 2004. Comet impact theory faces repeat analysis. *Nature* , v. **431** , p. 1027.

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