

Literatur

Aktuell

CHEATING 2012

Cheating cuts offspring fitness. [nature 485 \(2012\), 151.](#)

‘Monogamous’ female birds often produce young with another partner. This was presumed to yield offspring fitter than those produced with the paired partner, but a study of song sparrows suggests that ‘cheating’ comes with no evolutionary reproductive benefit. Jane Reid at the University of Aberdeen, UK, and her team analysed 17 years’ worth of genetic parentage data from a small population of song sparrows (*Melospiza melodia*; nestlings pictured) on Canada’s Mandarte Island. They compared the lifetime reproductive success of half siblings with the same mother and found that young sired outside of monogamy were less reproductively fit than their half-siblings, producing on average 40 % fewer offspring and 30 % fewer grand-offspring.

The researchers suggest that there may be indirect selection against, not for, cheating in song sparrows.

Am. Nat. <http://dx.doi.org/10.1086/665665> (2012)

GAINES 2012

Robert R. Gaines et al., *Mechanism for Burgess Shale-type preservation.* [PNAS 109 \(2012\), 5180–5184.](#)

Robert R. Gaines, Emma U. Hammarlund, Xianguang Hou, Changshi Qi, Sarah E. Gabbott, Yuanlong Zhao, Jin Peng and Donald E. Canfield

Exceptionally preserved fossil biotas of the Burgess Shale and a handful of other similar Cambrian deposits provide rare but critical insights into the early diversification of animals. The extraordinary preservation of labile tissues in these geographically widespread but temporally restricted soft-bodied fossil assemblages has remained enigmatic since Walcott’s initial discovery in 1909. Here, we demonstrate the mechanism of Burgess Shale-type preservation using sedimentologic and geochemical data from the Chengjiang, Burgess Shale, and five other principal Burgess Shale-type deposits. Sulfur isotope evidence from sedimentary pyrites reveals that the exquisite fossilization of organic remains as carbonaceous compressions resulted from early inhibition of microbial activity in the sediments by means of oxidant deprivation. Low sulfate concentrations in the global ocean and low-oxygen bottom water conditions at the sites of deposition resulted in reduced oxidant availability. Subsequently, rapid entombment of fossils in fine-grained sediments and early sealing of sediments by pervasive carbonate cements at bed tops restricted oxidant flux into the sediments. A permeability barrier, provided by bed-capping cements that were emplaced at the seafloor, is a feature that is shared among Burgess Shale-type deposits, and resulted from the unusually high alkalinity of Cambrian oceans. Thus, Burgess Shale-type preservation of soft-bodied fossil assemblages worldwide was promoted by unique aspects of early Paleozoic seawater chemistry that strongly impacted sediment diagenesis, providing a fundamentally unique record of the immediate aftermath of the “Cambrian explosion.”

exceptional preservation | ocean chemistry | sedimentology

HAMON 2012

N. Hamon, P. Sepulchre, Y. Donnadieu, A.-J. Henrot, L. François, J.-J. Jaeger & G. Ramstein, *Growth of subtropical forests in Miocene Europe:*

The roles of carbon dioxide and Antarctic ice volume. [Geology](#) **40** (2012), 567–570.

The middle Miocene is a crucial period for the evolution of apes, and it corresponds to their appearance in Europe. The dispersion of apes was made possible by tectonic changes and the expansion of their habitat, (sub-) tropical forest, in Europe. The context in which the middle Miocene climatic optimum occurred still lacks constraints in terms of atmospheric pCO₂ and ice-sheet volume and extent. Using a coupled atmosphere-ocean general circulation model (GCM) and dynamic vegetation model, we investigated the sensitivity of Miocene climate and vegetation to pCO₂ levels and Antarctic ice-sheet configurations. Our results indicate that higher than present pCO₂ is necessary to simulate subtropical forest in Western and Central Europe during the middle Miocene, but that a threshold at high pCO₂ makes subtropical forest partly collapse. Moreover, removing ice over Antarctica modifies oceanic circulation and induces warmer and slightly wetter conditions in Europe, which are consistent with the expansion of subtropical forest. These results suggest that a small East Antarctic Ice Sheet (25 % of present-day ice volume) together with higher than present pCO₂ values are in better agreement with available European middle Miocene data.

HAN 2012

Jin-Woo Han, Jae Sub Oh & M. Meyyappan, *Vacuum nanoelectronics: Back to the future? Gate insulated nanoscale vacuum channel transistor.* [Applied Physics Letters](#) **100** (2012), 213505. DOI:10.1063/1.4717751.

A gate-insulated vacuum channel transistor was fabricated using standard silicon semiconductor processing. Advantages of the vacuum tube and transistor are combined here by nanofabrication. A photoresist ashing technique enabled the nanogap separation of the emitter and the collector, thus allowing operation at less than 10 V. A cut-off frequency f_T of 0.46 THz has been obtained. The nanoscale vacuum tubes can provide high frequency/power output while satisfying the metrics of lightness, cost, lifetime, and stability at harsh conditions, and the operation voltage can be decreased comparable to the modern semiconductor devices.

LYONS 2012

Timothy W. Lyons, *A perfect (geochemical) storm yielded exceptional fossils in the early ocean.* [PNAS](#) **109** (2012), 5138–5139.

It is our good fortune that ocean evolution may have given us a very special physio-bio-geochemical window to view the early diversification of animal life across the globe-but perhaps it did so uniquely and narrowly in time over the approximately half billion years of animal history.

REICH 2012

Eugenie Samuel Reich, *War of words over tribal tongue.* [nature](#) **485** (2012), 155–156.

SAREWITZ 2012

Daniel Sarewitz, *Beware the creeping cracks of bias.* [nature](#) **485** (2012), 149. Evidence is mounting that research is riddled with systematic errors. Left unchecked, this could erode public trust, warns Daniel Sarewitz.

It would therefore be naive to believe that systematic error is a problem for biomedicine alone. It is likely to be prevalent in any field that seeks to predict the behaviour of complex systems – economics, ecology, environmental science, epidemiology and so on. The cracks will be there, they are just harder to spot because it is harder to test research results through direct technological applications (such as drugs) and straightforward

indicators of desired outcomes (such as reduced morbidity and mortality). Nothing will corrode public trust more than a creeping awareness that scientists are unable to live up to the standards that they have set for themselves.

Anthropologie

DAWES 2012

Christopher T. Dawes et al., *Neural basis of egalitarian behavior*. [PNAS 109 \(2012\), 6479–6483](#).

Christopher T. Dawes, Peter John Loewen, Darren Schreiber, Alan N. Simmons, Taru Flagan, Richard McElreath, Scott E. Bokemper, James H. Fowler and Martin P. Paulus
Individuals are willing to sacrifice their own resources to promote equality in groups. These costly choices promote equality and are associated with behavior that supports cooperation in humans, but little is known about the brain processes involved. We use functional MRI to study egalitarian preferences based on behavior observed in the “random income game.” In this game, subjects decide whether to pay a cost to alter group members’ randomly allocated incomes. We specifically examined whether egalitarian behavior is associated with neural activity in the ventromedial prefrontal cortex and the insular cortex, two regions that have been shown to be related to social preferences. Consistent with previous studies, we find significant activation in both regions; however, only the insular cortex activations are significantly associated with measures of revealed and expressed egalitarian preferences elicited outside the scanner. These results are consistent with the notion that brain mechanisms involved in experiencing the emotional states of others underlie egalitarian behavior in humans.
behavioral economics | egalitarianism

Biologie

CARMODY 2012

Rachel N. Carmody, Gil S. Weintraub & Richard W. Wrangham, *Reply to Wollstonecroft et al.: Cooking increases the bioavailability of starch from diverse plant sources*. [PNAS 109 \(2012\), E992](#).

We thank Wollstonecroft et al. for supporting the evidence that not all calories are equal.

DEEGAN 2012

Robert D. Deegan, *Finessing the fracture energy barrier in ballistic seed dispersal*. [PNAS 109 \(2012\), 5166–5169](#).

pnas109-05166-Supplement1.wmv, pnas109-05166-Supplement2.avi,
pnas109-05166-Supplement3.wmv

Fracture is a highly dissipative process in which much of the stored elastic energy is consumed in the creation of new surfaces. Surprisingly, many plants use fracture to launch their seeds despite its seemingly prohibitive energy cost. Here we use *Impatiens glandulifera* as model case to study the impact of fracture on a plant’s throwing capacity. *I. glandulifera* launches its seeds with speeds up to 4 m/s using cracks to trigger an explosive release of stored elastic energy. We find that the seed pod is optimally designed to minimize the cost of fracture. These characteristics may account for its success at invading Europe and North America.
biomechanics | fracture mechanics

MULKIDJANIAN 2012

Armen Y. Mulkidjanian, Andrew Yu. Bychkov, Daria V. Dibrova, Michael Y. Galperin & Eugene V. Koonin, *Origin of first cells at terrestrial, anoxic geothermal fields*. [PNAS 109 \(2012\), 5156–5157](#).

[pnas109-05156-Fulltext.pdf](#)

All cells contain much more potassium, phosphate, and transition metals than modern (or reconstructed primeval) oceans, lakes, or rivers. Cells maintain ion gradients by using sophisticated, energydependent membrane enzymes (membrane pumps) that are embedded in elaborate ion-tight membranes. The first cells could possess neither ion-tight membranes nor membrane pumps, so the concentrations of small inorganic molecules and ions within protocells and in their environment would equilibrate. Hence, the ion composition of modern cells might reflect the inorganic ion composition of the habitats of protocells. We attempted to reconstruct the “hatcheries” of the first cells by combining geochemical analysis with phylogenomic scrutiny of the inorganic ion requirements of universal components of modern cells. These ubiquitous, and by inference primordial, proteins and functional systems show affinity to and functional requirement for K^+ , Zn^{2+} , Mn^{2+} , and phosphate. Thus, protocells must have evolved in habitats with a high K^+/Na^+ ratio and relatively high concentrations of Zn, Mn, and phosphorous compounds. Geochemical reconstruction shows that the ionic composition conducive to the origin of cells could not have existed in marine settings but is compatible with emissions of vapor-dominated zones of inland geothermal systems. Under the anoxic, CO_2 -dominated primordial atmosphere, the chemistry of basins at geothermal fields would resemble the internal milieu of modern cells. The precellular stages of evolution might have transpired in shallow ponds of condensed and cooled geothermal vapor that were lined with porous silicate minerals mixed with metal sulfides and enriched in K^+ , Zn^{2+} , and phosphorous compounds.
prebiotic chemistry | abiotic photosynthesis | hydrothermal alteration | origin of life | Na^+/K^+ gradient

WOLLSTONECROFT 2012

Michèle M. Wollstonecroft, Peter R. Ellis, Gordon C. Hillman, Dorian Q. Fuller & Peter J. Butterworth, *A calorie is not necessarily a calorie: Technical choice, nutrient bioaccessibility, and interspecies differences of edible plants*. [PNAS 109 \(2012\), E991](#).

Thermal softening of plant tissue is usually the result of cell separation and in some cases (e.g., legumes) the nutrients remain encapsulated within the cells and are less likely to be digested and absorbed in the upper gastrointestinal tract unless the cooked tissue is subjected to further (nonthermal) processing to disrupt the cell walls (4). The encapsulated macronutrients, such as starch and protein, are potentially available for fermentation by lower gut microflora and/or lost in feces.

In summary, a calorie is not necessarily a calorie: given the functional differences between edible plants, interfamily and even interspecies differences must be considered when making comparisons between food processing techniques.

Energie

LELIEVELD 2012

J. Lelieveld, D. Kunkel & M. G. Lawrence, *Global risk of radioactive fallout after major nuclear reactor accidents*. [Atmospheric Chemistry and Physics 12 \(2012\), 4245–4258](#). DOI:10.5194/acp-12-4245-2012.

[AtmosChemPhys12-04245-Supplement.pdf](#)

Abstract. Major reactor accidents of nuclear power plants are rare, yet the consequences are catastrophic. But what is meant by “rare”? And what can be learned from the Chernobyl and Fukushima incidents? Here we assess the cumulative, global risk of exposure to radioactivity due to atmospheric dispersion of gases and particles following severe nuclear accidents (the most severe ones on the International Nuclear Event Scale, INES 7), using particulate ^{137}Cs and gaseous ^{131}I as proxies for the fallout. Our results indicate that previously the occurrence of INES 7 major accidents and the risks of radioactive contamination have been underestimated. Using a global model of the atmosphere we compute that on average, in the event of a major reactor accident of any nuclear power plant worldwide, more than 90 % of emitted ^{137}Cs would be transported beyond 50 km and about 50 % beyond 1000 km distance before being deposited. This corroborates that such accidents have large-scale and transboundary impacts. Although the emission strengths and atmospheric removal processes of ^{137}Cs and ^{131}I are quite different, the radioactive contamination patterns over land and the human exposure due to deposition are computed to be similar. High human exposure risks occur around reactors in densely populated regions, notably in West Europe and South Asia, where a major reactor accident can subject around 30 million people to radioactive contamination. The recent decision by Germany to phase out its nuclear reactors will reduce the national risk, though a large risk will still remain from the reactors in neighbouring countries.

ROONEY 2012

Rebecca C. Rooney, Suzanne E. Bayley & David W. Schindler, *Oil sands mining and reclamation cause massive loss of peatland and stored carbon*. [PNAS 109 \(2012\), 4933–4937](#).

We quantified the wholesale transformation of the boreal landscape by open-pit oil sands mining in Alberta, Canada to evaluate its effect on carbon storage and sequestration. Contrary to claims made in the media, peatland destroyed by open-pit mining will not be restored. Current plans dictate its replacement with upland forest and tailings storage lakes, amounting to the destruction of over 29,500 ha of peatland habitat. Landscape changes caused by currently approved mines will release between 11.4 and 47.3 million metric tons of stored carbon and will reduce carbon sequestration potential by 5,734–7,241 metric tons C/y. These losses have not previously been quantified, and should be included with the already high estimates of carbon emissions from oil sands mining and bitumen upgrading. A fair evaluation of the costs and benefits of oil sands mining requires a rigorous assessment of impacts on natural capital and ecosystem services.
wetland reclamation | tar sands

Klima

BROOK 2012

Edward Brook, *The Ice Age Carbon Puzzle*. [science 336 \(2012\), 682–683](#).
A carbon isotope record helps to explain why carbon dioxide concentrations change during ice age cycles.

HU 2012

Aixue Hu et al., *Role of the Bering Strait on the hysteresis of the ocean conveyor belt circulation and glacial climate stability*. [PNAS 109 \(2012\), 6417–6422](#).

Aixue Hu, Gerald A. Meehl, Weiqing Han, Axel Timmermann, Bette Otto-Bliesner, Zhenyu Liu, Warren M. Washington, William Large, Ayako Abe-Ouchi, Masahide Kimoto, Kurt Lambeck and Bingyi Wug

Abrupt climate transitions, known as Dansgaard-Oeschger and Heinrich events, occurred frequently during the last glacial period, specifically from 80–11 thousand years before present, but were nearly absent during interglacial periods and the early stages of glacial periods, when major ice-sheets were still forming. Here we show, with a fully coupled state-of-the-art climate model, that closing the Bering Strait and preventing its through-flow between the Pacific and Arctic Oceans during the glacial period can lead to the emergence of stronger hysteresis behavior of the ocean conveyor belt circulation to create conditions that are conducive to triggering abrupt climate transitions. Hence, it is argued that even for greenhouse warming, abrupt climate transitions similar to those in the last glacial time are unlikely to occur as the Bering Strait remains open.
abrupt climate transitions | Atlantic Meridional Overturning Circulation

ISRADE-ALCÁNTARA 2012

Isabel Israde-Alcántara et al., *Evidence from central Mexico supporting the Younger Dryas extraterrestrial impact hypothesis*. [PNAS 109 \(2012\), 4723–4724](#).

[pnas109-04723-Fulltext.pdf](#)

Isabel Israde-Alcántara, James L. Bischoff, Gabriela Domínguez-Vázquez, Hong-Chun Li, Paul S. DeCarli, Ted E. Bunch, James H. Wittke, James C. Weaver, Richard B. Firestone, Allen West, James P. Kennett, Chris Mercer, Sujing Xie, Eric K. Richman, Charles R. Kinzie and Wendy S. Wolbach

We report the discovery in Lake Cuitzeo in central Mexico of a black, carbon-rich, lacustrine layer, containing nanodiamonds, microspherules, and other unusual materials that date to the early Younger Dryas and are interpreted to result from an extraterrestrial impact. These proxies were found in a 27-m-long core as part of an interdisciplinary effort to extract a paleoclimate record back through the previous interglacial. Our attention focused early on an anomalous, 10-cm-thick, carbon-rich layer at a depth of 2.8 m that dates to 12.9 ka and coincides with a suite of anomalous coeval environmental and biotic changes independently recognized in other regional lake sequences. Collectively, these changes have produced the most distinctive boundary layer in the late Quaternary record. This layer contains a diverse, abundant assemblage of impact-related markers, including nanodiamonds, carbon spherules, and magnetic spherules with rapid melting/quenching textures, all reaching synchronous peaks immediately beneath a layer containing the largest peak of charcoal in the core. Analyses by multiple methods demonstrate the presence of three allotropes of nanodiamond: n-diamond, i-carbon, and hexagonal nanodiamond (lonsdaleite), in order of estimated relative abundance. This nanodiamond-rich layer is consistent with the Younger Dryas boundary layer found at numerous sites across North America, Greenland, and Western Europe. We have examined multiple hypotheses to account for these observations and find the evidence cannot be explained by any known terrestrial mechanism. It is, however, consistent with the Younger Dryas boundary impact hypothesis postulating a major extraterrestrial impact involving multiple airburst(s) and and/or ground impact(s) at 12.9 ka.

black mat | cosmic impact

McKAY 2012

Robert McKay et al., *Antarctic and Southern Ocean influences on Late Pliocene global cooling*. [PNAS 109 \(2012\), 6423–6428](#).

[pnas109-06423-Supplement.xls](#)

Robert McKay, Tim Naish, Lionel Carter, Christina Riesselman, Robert Dunbar, Charlotte Sjunneskog, Diane Winter, Francesca Sangiorgi, Courtney Warren, Mark Pagani, Stefan Schouten, Veronica Willmott, Richard Levy, Robert DeConto and Ross D. Powell
The influence of Antarctica and the Southern Ocean on Late Pliocene global climate reconstructions has remained ambiguous due to a lack of well-dated Antarctic-proximal,

paleoenvironmental records. Here we present ice sheet, sea-surface temperature, and sea ice reconstructions from the ANDRILL AND-1B sediment core recovered from beneath the Ross Ice Shelf. We provide evidence for a major expansion of an ice sheet in the Ross Sea that began at ≈ 3.3 Ma, followed by a coastal sea surface temperature cooling of ≈ 2.5 °C, a stepwise expansion of sea ice, and polynya-style deep mixing in the Ross Sea between 3.3 and 2.5 Ma. The intensification of Antarctic cooling resulted in strengthened westerly winds and invigorated ocean circulation. The associated northward migration of Southern Ocean fronts has been linked with reduced Atlantic Meridional Overturning Circulation by restricting surface water connectivity between the ocean basins, with implications for heat transport to the high latitudes of the North Atlantic. While our results do not exclude low-latitude mechanisms as drivers for Pliocene cooling, they indicate an additional role played by southern high-latitude cooling during development of the bipolar world.

glacial history | West Antarctic Ice Sheet | Late Neogene | paleoceanography | paleoclimate

MCMICHAEL 2012

Anthony J. McMichael, *Insights from past millennia into climatic impacts on human health and survival*. [PNAS 109 \(2012\), 4730–4737](#).

Climate change poses threats to human health, safety, and survival via weather extremes and climatic impacts on food yields, fresh water, infectious diseases, conflict, and displacement. Paradoxically, these risks to health are neither widely nor fully recognized. Historical experiences of diverse societies experiencing climatic changes, spanning multi-century to single-year duration, provide insights into population health vulnerability—even though most climatic changes were considerably less than those anticipated this century and beyond. Historical experience indicates the following. (i) Long-term climate changes have often destabilized civilizations, typically via food shortages, consequent hunger, disease, and unrest. (ii) Medium-term climatic adversity has frequently caused similar health, social, and sometimes political consequences. (iii) Infectious disease epidemics have often occurred in association with briefer episodes of temperature shifts, food shortages, impoverishment, and social disruption. (iv) Societies have often learnt to cope (despite hardship for some groups) with recurring shorter-term (decadal to multiyear) regional climatic cycles (e.g., El Niño Southern Oscillation)—except when extreme phases occur. (v) The drought-famine-starvation nexus has been the main, recurring, serious threat to health. Warming this century is not only likely to greatly exceed the Holocene’s natural multidecadal temperature fluctuations but to occur faster. Along with greater climatic variability, models project an increased geographic range and severity of droughts. Modern societies, although larger, better resourced, and more interconnected than past societies, are less flexible, more infrastructure-dependent, densely populated, and hence are vulnerable. Adverse historical climate-related health experiences underscore the case for abating human-induced climate change.

paleoclimate | analogue | under-nutrition | pandemic

MAROTZKE 2012

Jochem Marotzke, *A grip on ice-age ocean circulation*. [nature 485 \(2012\), 180–181](#).

Climate simulations based on an ocean model may hold the key to understanding why existing climate models have failed to deliver a clear picture of ocean circulation during the last ice age.

OKA 2012

A. Oka, H. Hasumi & A. Abe-Ouchi, *The thermal threshold of the Atlantic meridional overturning circulation and its control by wind stress forcing*

during glacial climate. *Geophysical Research Letters* **39** (2012), L09709. DOI:10.1029/2012GL051421.

Paleo proxy data suggest that the Atlantic meridional overturning circulation (AMOC) was shallower and weaker at the Last Glacial Maximum (LGM) than at present. In this study, we have identified the existence of a thermal threshold of the AMOC which may explain why many coupled climate models fail to simulate the weaker AMOC during the LGM. By using results obtained from a coupled climate model and conducting sensitivity simulations with an ocean general circulation model, we found that the sudden transition from the present-day AMOC to the weaker glacial AMOC occurs when we gradually change the degree of surface cooling from present-day to glacial conditions. This result is related to response of deep convection in the northern North Atlantic Ocean; moderate cooling enhances deep convection whereas sufficient cooling results in total covering of sea ice there and suppression of deep convection. The findings indicate the existence of a thermal threshold controlling the AMOC, where the present-day-type AMOC suddenly shifts to the weaker glacial AMOC once the surface cooling exceeds this threshold. We also demonstrate that wind stress forcing plays a critical role in controlling the value of the thermal threshold. Our study suggests that slight differences in the degree of surface cooling or wind stress forcing for LGM simulations could lead to the very different response of the AMOC during the LGM as reported in previous LGM simulations.

POKHREL 2012

Yadu N. Pokhrel, Naota Hanasaki, Pat J-F. Yeh, Tomohito J. Yamada, Shinjiro Kanae & Taikan Oki, *Model estimates of sea-level change due to anthropogenic impacts on terrestrial water storage*. *Nature Geoscience* (2012) preprint, 1–4. DOI:10.1038/NNGEO1476.

NatGeo2012-preprint-Supplement.pdf

Global sea level has been rising over the past half century, according to tide-gauge data^{1,2}. Thermal expansion of oceans, melting of glaciers and loss of the ice masses in Greenland and Antarctica are commonly considered as the largest contributors, but these contributions do not entirely explain the observed sea-level rise¹. Changes in terrestrial water storage are also likely to affect sea level³⁻⁶, but comprehensive and reliable estimates of this contribution, particularly through human water use, are scarce¹. Here, we estimate sea-level change in response to human impacts on terrestrial water storage by using an integrated model that simulates global terrestrial water stocks and flows (exclusive to Greenland and Antarctica) and especially accounts for human activities such as reservoir operation and irrigation. We find that, together, unsustainable groundwater use, artificial reservoir water impoundment, climate-driven changes in terrestrial water storage and the loss of water from closed basins have contributed a sea-level rise of about 0.77mmyr⁻¹ between 1961 and 2003, about 42% of the observed sea-level rise. We note that, of these components, the unsustainable use of groundwater represents the largest contribution.

SCHMITT 2012

Jochen Schmitt et al., *Carbon Isotope Constraints on the Deglacial CO₂ Rise from Ice Cores*. *science* **336** (2012), 711–714.

s336-0711-Supplement1.pdf, s336-0711-Supplement2.xls

Jochen Schmitt, Robert Schneider, Joachim Elsig, Daiana Leuenberger, Anna Lourantou, Jérôme Chappellaz, Peter Köhler, Fortunat Joos, Thomas F. Stocker, Markus Leuenberger & Hubertus Fischer

The stable carbon isotope ratio of atmospheric CO₂ (δ¹³C_{atm}) is a key parameter in deciphering past carbon cycle changes. Here we present δ¹³C_{atm} data for the past 24,000 years derived from three independent records from two Antarctic ice cores. We conclude

that a pronounced 0.3 per mil decrease in $\delta^{13}\text{C}_{\text{atm}}$ during the early deglaciation can be best explained by upwelling of old, carbon-enriched waters in the Southern Ocean. Later in the deglaciation, regrowth of the terrestrial biosphere, changes in sea surface temperature, and ocean circulation governed the $\delta^{13}\text{C}_{\text{atm}}$ evolution. During the Last Glacial Maximum, $\delta^{13}\text{C}_{\text{atm}}$ and atmospheric CO_2 concentration were essentially constant, which suggests that the carbon cycle was in dynamic equilibrium and that the net transfer of carbon to the deep ocean had occurred before then.

Kultur

SATURNO 2012

William A. Saturno, David Stuart, Anthony F. Aveni & Franco Rossi, *Ancient Maya Astronomical Tables from Xultun, Guatemala*. [science](#) **336** (2012), 714–717.

[s336-0714-Supplement.pdf](#)

Maya astronomical tables are recognized in bark-paper books from the Late Postclassic period (1300 to 1521 C.E.), but Classic period (200 to 900 C.E.) precursors have not been found. In 2011, a small painted room was excavated at the extensive ancient Maya ruins of Xultun, Guatemala, dating to the early 9th century C.E. The walls and ceiling of the room are painted with several human figures. Two walls also display a large number of delicate black, red, and incised hieroglyphs. Many of these hieroglyphs are calendrical in nature and relate astronomical computations, including at least two tables concerning the movement of the Moon, and perhaps Mars and Venus. These apparently represent early astronomical tables and may shed light on the later books.

Methoden

MENZE 2012

Bjoern H. Menze & Jason A. Ura, *Mapping patterns of long-term settlement in Northern Mesopotamia at a large scale*. [PNAS](#) **109** (2012), 5146–5147.

[pnas109-05146-Fulltext.pdf](#)

The landscapes of the Near East show both the first settlements and the longest trajectories of settlement systems. Mounding is a characteristic property of these settlement sites, resulting from millennia of continuing settlement activity at distinguished places. So far, however, this defining feature of ancient settlements has not received much attention, or even been the subject of systematic evaluation. We propose a remote sensing approach for comprehensively mapping the pattern of human settlement at large scale and establish the largest archaeological record for a landscape in Mesopotamia, mapping about 14,000 settlement sites—spanning eight millennia—at 15-m resolution in a 23,000-km² area in northeastern Syria. To map both low- and high-mounded places—the latter of which are often referred to as “tells”—we develop a strategy for detecting anthroposols in time series of multispectral satellite images and measure the volume of settlement sites in a digital elevation model. Using this volume as a proxy to continued occupation, we find a dependency of the long-term attractiveness of a site on local water availability, but also a strong relation to the relevance within a basin-wide exchange network that we can infer from our record and third millennium B.C. intersite routes visible on the ground until recent times. We believe it is possible to establish a nearly comprehensive map of human settlements in the fluvial plains of northern Mesopotamia and beyond, and site volume may be a key quantity to uncover long-term trends in human settlement activity from such a record.

Neolithikum

IRIARTE 2012

José Iriarte et al., *Fire-free land use in pre-1492 Amazonian savannas*. [PNAS 109 \(2012\), 6473–6478](#).

José Iriarte, Mitchell J. Power, Stéphen Rostain, Francis E. Mayle, Huw Jones, Jennifer Watling, Bronwen S. Whitney and Doyle B. McKey

The nature and scale of pre-Columbian land use and the consequences of the 1492 “Columbian Encounter” (CE) on Amazonia are among the more debated topics in New World archaeology and paleoecology. However, pre-Columbian human impact in Amazonian savannas remains poorly understood. Most paleoecological studies have been conducted in neotropical forest contexts. Of studies done in Amazonian savannas, none has the temporal resolution needed to detect changes induced by either climate or humans before and after A.D. 1492, and only a few closely integrate paleoecological and archaeological data. We report a high-resolution 2,150-y paleoecological record from a French Guianan coastal savanna that forces reconsideration of how pre-Columbian savanna peoples practiced raised-field agriculture and how the CE impacted these societies and environments. Our combined pollen, phytolith, and charcoal analyses reveal unexpectedly low levels of biomass burning associated with pre-A.D. 1492 savanna raised-field agriculture and a sharp increase in fires following the arrival of Europeans. We show that pre-Columbian raised-field farmers limited burning to improve agricultural production, contrasting with extensive use of fire in pre-Columbian tropical forest and Central American savanna environments, as well as in present-day savannas. The charcoal record indicates that extensive fires in the seasonally flooded savannas of French Guiana are a post-Columbian phenomenon, postdating the collapse of indigenous populations. The discovery that pre-Columbian farmers practiced fire-free savanna management calls into question the widely held assumption that pre-Columbian Amazonian farmers pervasively used fire to manage and alter ecosystems and offers fresh perspectives on an emerging alternative approach to savanna land use and conservation that can help reduce carbon emissions.
pre-Columbian agriculture | anthropogenic fire | indigenous fire practices | savanna ecology | tropical seasonal wetlands

Physik

PUSEY 2012

Matthew F. Pusey, Jonathan Barrett & Terry Rudolph, *On the reality of the quantum state*. [nature physics \(2012\) preprint, 1–4](#).

[DOI:10.1038/NPHYS2309](#).

[NatPhys2012-preprint-Supplement.pdf](#)

Quantum states are the key mathematical objects in quantum theory. It is therefore surprising that physicists have been unable to agree on what a quantum state truly represents. One possibility is that a pure quantum state corresponds directly to reality. However, there is a long history of suggestions that a quantum state (even a pure state) represents only knowledge or information about some aspect of reality. Here we show that any model in which a quantum state represents mere information about an underlying physical state of the system, and in which systems that are prepared independently have independent physical states, must make predictions that contradict those of quantum theory.

REICH 2012

Eugenie Samuel Reich, *A boost for quantum reality*. [nature 485 \(2012\), 157–158](#).

Religion

ESPAK 2010

Peeter Espak, *The God Enki in Sumerian Royal Ideology and Mythology*. Dissertation, Universität Tartu (Tartu 2010). <<http://hdl.handle.net/10062/15915>>.

Enki-mythology was present already in the 3rd millennium Ebla and in the later texts from Mari and Elam, far from the actual Mesopotamian territory. It remains unclear to what extent the West Semitic mythology saw the god El connected to Sumerian Enki. However, the relation or closeness of the two divine concepts is clearly visible. The gods share the function of being the creators of mankind. The motive of crafting mankind appears in the later layers of Sumerian mythology and is not detectable in the Early Dynastic or Ur III texts. Since both, El and Enki, are described as creating by handicraft and using clay as the material of creation, it cannot be excluded that the crafting motive of creation originally had close connections with the Semitic mythology. On the other hand, the motive of creation by the means of copulation is present in the earliest layers of Sumerian mythology.