

Literatur

Aktuell

DUMONT 2012

Marie-Noëlle Dumont, Niklas von der Assen, André Sternberg & André Bardow, *Assessing the environmental potential of carbon dioxide utilization, A graphical targeting approach*. In: I. A. KARIMI & RAJAGOPALAN SRINIVASAN (Hrsg.), *Proceedings of the 11th International Symposium on Process Systems Engineering, 15–19 July 2012, Singapore*. (2012). ISBN:978-0-444-59505-8.

Carbon Capture and Utilization (CCU) has the potential to reduce both greenhouse gas emissions and fossil fuel use. However, the conversion of CO₂ is intrinsically difficult due to its low energetic state. Thus, a positive environmental effect of a CO₂-consuming reaction cannot be taken for granted. In this work, we therefore present a graphical method to identify promising reaction schemes using CO₂ as a feedstock. Reactant mixtures leading to minimal life-cycle greenhouse gas (GHG) emissions are determined. The optimal reaction schemes strongly depend on the reactants' global warming potential (GWP); in the case of CCU, the future GWP values of CO₂ and H₂ are particularly critical and subject to major uncertainty today. The graphical method therefore provides GWP targets for CO₂ capture and H₂ production technologies. The method is demonstrated for the production of methanol. Five optimal reaction schemes are identified depending on the GWP values of CO₂ and H₂. Thus, four threshold relations for the GWP of CO₂ and H₂ are derived showing directly under which conditions the utilization of CO₂ as a feedstock is environmentally preferential.

Keywords: Carbon Capture and Utilization, LCA, Methanol, CO₂ Conversion

FORWOOD 2013

Suzanna E. Forwood, Amy Ahern, Gareth J. Hollands, Paul C. Fletcher & Theresa M. Marteau, *Underestimating calorie content when healthy foods are present: An averaging effect or a reference-dependent anchoring effect?* *PLoS ONE* **8** (2013), e71475.

[DOI:10.1371/journal.pone.0071475](https://doi.org/10.1371/journal.pone.0071475).

[pone08-e71475-Supplement1.pdf](#)

Objective: Previous studies have shown that estimations of the calorie content of an unhealthy main meal food tend to be lower when the food is shown alongside a healthy item (e.g. fruit or vegetables) than when shown alone. This effect has been called the negative calorie illusion and has been attributed to averaging the unhealthy (vice) and healthy (virtue) foods leading to increased perceived healthiness and reduced calorie estimates. The current study aimed to replicate and extend these findings to test the hypothesized mediating effect of ratings of healthiness of foods on calorie estimates.

Methods: In three online studies, participants were invited to make calorie estimates of combinations of foods. Healthiness ratings of the food were also assessed.

Results: The first two studies failed to replicate the negative calorie illusion. In a final study, the use of a reference food, closely following a procedure from a

previously published study, did elicit a negative calorie illusion. No evidence was found for a mediating role of healthiness estimates.

Conclusion: The negative calorie illusion appears to be a function of the contrast between a food being judged and a reference, supporting the hypothesis that the negative calorie illusion arises from the use of a reference-dependent anchoring and adjustment heuristic and not from an ‘averaging’ effect, as initially proposed. This finding is consistent with existing data on sequential calorie estimates, and highlights a significant impact of the order in which foods are viewed on how foods are evaluated.

HANNAH 2013

Lee Hannah et al., *Planning for agricultural adaptation to climate change and its consequences for conservation, Reply to van Leeuwen et al.* [PNAS 110 \(2013\), E3053](#).

Lee Hannah, Patrick R. Roehrdanz, Makihiko Ikegami, Anderson V. Shepard, M. Rebecca Shaw, Gary Tabord Lu Zhi, Pablo A. Marquet & Robert J. Hijmans
Viticulture will not cease in major winegrowing regions in response to climate change, because vineyard managers will not let that happen. Adaptation measures will be taken to permit continued cultivation of wine grapes. These adaptation measures can place major stress on water resources and freshwater ecosystems. Our models were designed to identify regions in which these adaptation issues might be significant and not to determine the feasibility of wine grape production in the future.

HENRICH 2013

Joseph Henrich & Joan B. Silk, *Interpretative problems with chimpanzee ultimatum game.* [PNAS 110 \(2013\), E3049](#).

If the chimpanzees did not understand the contingencies of the authors’ UG game, it is difficult to interpret any performance differences between the games. One possible explanation of the differences is that the UG was more confusing than the authors’ DG. [...] A second problem comes from the authors’ claim that typical DG offers are significantly lower than UG offers. Even in Western societies, this is only true among students. Experiments with older nonstudents have repeatedly shown no differences between DG and UG offers (3– 5). This finding means that, even if we accept Proctor et al.’s (1) findings at face value, they have curiously demonstrated that chimpanzees are similar to undergraduates, and rather unlike other human populations, including Westerners over age 25.

JENSEN 2013

Keith Jensen, Josep Call & Michael Tomasello, *Chimpanzee responders still behave like rational maximizers.* [PNAS 110 \(2013\), E1837](#).

Proctor et al. (4) suggested that chimpanzees exhibit sensitivity to fairness in a more “intuitive” ultimatum game based on token exchange, contrary to refs. 2 and 3. This contradiction, however, is more apparent than real. Responders in Proctor et al. (4) accepted 100% of all offers, even more than chimpanzees and bonobos in refs. 2 and 3. If anything, responders in Proctor et al. were more indifferent to unfairness.

LANE 2013

Christine S. Lane, Ben T. Chorn & Thomas C. Johnson, *A subdecadal record of paleoclimate around the Youngest Toba Tuff in Lake Malawi, Reply to Roberts et al.* [PNAS 110 \(2013\), E3048](#).

Roberts et al. (1) use other 74 ka age-estimates for the YTT derived from ice core and speleothem records, which do not contain YTT ash but are correlated around an unconfirmed signal in similar positions on their climate curves. We strongly discourage the correlation of archives in this manner, which assumes absolute synchronicity of the global climate signal.

VAN LEEUWEN 2013

Cornelis van Leeuwen et al., *Why climate change will not dramatically decrease viticultural suitability in main wine-producing areas by 2050*. [PNAS 110 \(2013\), E3051–E3052](#).

Cornelis van Leeuwen, Hans R. Schultz, Iñaki Garcia de Cortazar-Atauri, Eric Duchêne, Nathalie Ollat, Philippe Pieri, Benjamin Bois, Jean-Pascal Goutouly, Hervé Quénol, Jean-Marc Touzard, Aureliano C. Malheiro, Luigi Bavaresco & Serge Delrot

Hannah et al. make an interesting point in predicting which regions worldwide may become suitable for viticulture by 2050 as a consequence of climate change, and in estimating related potential ecological impact. However, their conclusion that most of the present wine-growing regions will become unsuitable for viticulture is erroneous.

PARK 2013

Joonkoo Park & Elizabeth M. Brannon, *Training the Approximate Number System Improves Math Proficiency*. [Psychological Science \(2013\), preprint, 1–7. DOI:10.1177/0956797613482944](#).

PsychSci2013-preprint-Supplement0813a.pdf, PsychSci2013-preprint-Supplement0813b.mov, PsychSci2013-preprint-Supplement0813c.mov

Humans and nonhuman animals share an approximate number system (ANS) that permits estimation and rough calculation of quantities without symbols. Recent studies show a correlation between the acuity of the ANS and performance in symbolic math throughout development and into adulthood, which suggests that the ANS may serve as a cognitive foundation for the uniquely human capacity for symbolic math. Such a proposition leads to the untested prediction that training aimed at improving ANS performance will transfer to improvement in symbolic-math ability. In the two experiments reported here, we showed that ANS training on approximate addition and subtraction of arrays of dots selectively improved symbolic addition and subtraction. This finding strongly supports the hypothesis that complex math skills are fundamentally linked to rudimentary preverbal quantitative abilities and provides the first direct evidence that the ANS and symbolic math may be causally related. It also raises the possibility that interventions aimed at the ANS could benefit children and adults who struggle with math.

Keywords: number comprehension, mathematical ability

PROCTOR 2013

Darby Proctor, Rebecca A. Williamson, Frans B. M. de Waal & Sarah F. Brosnan, *Toward a unified explanation for apes and humans, Reply to Henrich and Silk*. [PNAS 110 \(2013\), E3050](#).

PROCTOR 2013

Darby Proctor, Rebecca A. Williamson, Frans B. M. de Waal & Sarah F. Brosnan, *Equitable offers are not rationally maximizing, Reply to Jensen et al.* [PNAS 110 \(2013\), E1838](#).

Additionally, Jensen et al. expressed concern about ordering effects. We ran the preference test before the ultimatum game to ensure that our subjects preferred more over fewer rewards, a standard assumption for humans and essential to interpret chimpanzees' behavior. In doing so, we actually rewarded the subjects for selfish preferences, making their switch in preference to the equal option in the ultimatum game condition all the more striking.

ROBERTS 2013

Richard G. Roberts, Michael Storey & Michael Haslam, *Toba supereruption: Age and impact on East African ecosystems*. [PNAS 110 \(2013\), E3047](#).

East Africa. Although the YTT event had limited impact on ecosystems around Lake Malawi, we think Lane et al. (1) are premature in extrapolating their environmental findings to all of East Africa, and we dispute their contention that “the most robust age for the YTT” is 75.0 ± 0.9 ka. [...] We suggest, therefore, that the YTT event is currently best constrained by the high-precision age of 73.88 ± 0.32 ka.

WESSELBAUM 2013

Sebastian Wesselbaum, Ulrich Hintermair & Walter Leitner, *Continuous-Flow Hydrogenation of Carbon Dioxide to Pure Formic Acid using an Integrated scCO₂ Process with Immobilized Catalyst and Base*. [Angewandte Chemie Int. Ed. 51 \(2013\), 8585–8588](#).

[AngChIE51-08585-Supplement.pdf](#)

[A]ll currently known systems produce salts, adducts, or derivatives of formic acid because the formation of pure formic acid from CO₂ and H₂ is strongly disfavored by entropy shifting the equilibrium far to the left. Herein we present a new concept that allows the continuous-flow hydrogenation of supercritical CO₂ (scCO₂) with integrated product separation from an immobilized catalyst and stabilizing base to produce pure HCO₂H in a single processing unit.

WESSELBAUM 2013

Sebastian Wesselbaum, Thorsten vom Stein, Jürgen Klankermayer & Walter Leitner, *Hydrogenation of Carbon Dioxide to Methanol by Using a Homogeneous Ruthenium-Phosphine Catalyst*. [Angewandte Chemie Int. Ed. 51 \(2013\), 7499–7502](#).

[AngChIE51-07499-Supplement.pdf](#)

Herein, we describe the homogeneously catalyzed hydrogenation of CO₂ to methanol using a homogeneous transition-metal catalyst system based on a single ruthenium phosphine complex. The starting point for our investigation was a recently established robust multifunctional ruthenium system, which provided an excellent catalyst for the hydrogenation of carboxylic acids and their derivatives to the corresponding alcohols.[11–13] It comprises an in situ system 1 composed of [Ru(acac)₃] and the tridentate ligand Triphos (Triphos=1,1,1-tris(diphenylphosphinomethyl)ethane) in the presence of additional organic acid (Scheme 1).[11a] Mechanistic investigations suggested that species of type 3 comprising the facially coordinated tripodal ligand facilitate hydride transfer and protonolysis as key steps for the addition of hydrogen to the carboxylate functional group.

Amerika

WILSON 2013

Andrew S. Wilson et al., *Archaeological, radiological, and biological evidence offer insight into Inca child sacrifice*. *PNAS* **110** (2013), 13322–13327.

Andrew S. Wilson, Emma L. Brown, Chiara Villa, Niels Lynnerup, Andrew Healey, Maria Constanza Ceruti, Johan Reinhard, Carlos H. Previgiano, Facundo Arias Araoz, Josefina Gonzalez Diez & Timothy Taylor

Examination of three frozen bodies, a 13-y-old girl and a girl and boy aged 4 to 5 y, separately entombed near the Andean summit of Volcán Llullaillaco, Argentina, sheds new light on human sacrifice as a central part of the Imperial Inca capacocha rite, described by chroniclers writing after the Spanish conquest. The high-resolution diachronic data presented here, obtained directly from scalp hair, implies escalating coca and alcohol ingestion in the lead-up to death. These data, combined with archaeological and radiological evidence, deepen our understanding of the circumstances and context of final placement on the mountain top. We argue that the individuals were treated differently according to their age, status, and ritual role. Finally, we relate our findings to questions of consent, coercion, and/or compliance, and the controversial issues of ideological justification and strategies of social control and political legitimation pursued by the expansionist Inca state before European contact.

bioarchaeology | computed tomography | *Erythroxyllum coca* | ice mummies | South America

Anthropologie

ALBERTS 2013

Susan C. Alberts et al., *Reproductive aging patterns in primates reveal that humans are distinct*. *PNAS* **110** (2013), 13440–13445.

Susan C. Alberts, Jeanne Altmann, Diane K. Brockman, Marina Cords, Linda M. Fedigan, Anne Pusey, Tara S. Stoinski, Karen B. Strier, William F. Morris & Anne M. Bronikowski

Women rarely give birth after ≈ 45 y of age, and they experience the cessation of reproductive cycles, menopause, at ≈ 50 y of age after a fertility decline lasting almost two decades. Such reproductive senescence in mid-lifespan is an evolutionary puzzle of enduring interest because it should be inherently disadvantageous. Furthermore, comparative data on reproductive senescence from other primates, or indeed other mammals, remains relatively rare. Here we carried out a unique detailed comparative study of reproductive senescence in seven species of nonhuman primates in natural populations, using long-term, individual-based data, and compared them to a population of humans experiencing natural fertility and mortality. In four of seven primate species we found that reproductive senescence occurred before death only in a small minority of individuals. In three primate species we found evidence of reproductive senescence that accelerated throughout adulthood; however, its initial rate was much lower than mortality, so that relatively few individuals experienced reproductive senescence before death. In contrast, the human population showed the predicted and well-known pattern in which reproductive senescence occurred before death for many women and its rate accelerated throughout adulthood. These results provide strong support for the hypothesis that reproductive senescence in midlife, although apparent in natural-fertility, natural-mortality populations of humans, is generally absent in other primates living in such populations.

CUNNANE 1993

Stephen C. Cunnane, Laurence S. Harbige & Michael A. Crawford, *The Importance of Energy and Nutrient Supply in Human Brain Evolution. Nutrition and Health* **9** (1993), 219–235.

Current evolutionary theories do not adequately address the question of how the human brain evolved to be larger and more sophisticated than that of other primates. The human brain/body weight ratio is 4-5 times higher than in primates and, relative to the rest of the body, requires up to 10 times as much energy as in other land-based mammals. Human brain evolution must therefore have required a stable food supply providing a reliable source of both high dietary energy and a cluster of ‘brain-specific’ nutrients over a long period of time. These nutrient and energy requirements are available in the marine and shore-based food chain but are difficult if not impossible to obtain in the terrestrial food chain. We suggest that marine and estuarine ecosystems provided hominids with the appropriate stimulus to develop a relatively large brain. This occurred in conjunction with the evolution of other uniquely human features, particularly relative hairlessness, bipedalism and abundant neonatal subcutaneous fat. Invertebrates, molluscs, small or slow-moving fish, and marine algae would have provided a stable, abundant supply of energy, long chain polyunsaturates and other nutrients essential for the brain and would have done so with comparatively little mammalian competition. The land-water interface would thus have allowed the hominid brain to develop sufficient neurological complexity to enable sophisticated tool and behaviour patterns to evolve in humans as a natural sequel to such a biochemical and environmental stimulus.

OLIVIERI 2013

Anna Olivieri et al., *Mitogenomes from Two Uncommon Haplogroups Mark Late Glacial/Postglacial Expansions from the Near East and Neolithic Dispersals within Europe. PLoS ONE* **8** (2013), e70492.

[DOI:10.1371/journal.pone.0070492](https://doi.org/10.1371/journal.pone.0070492).

[pone08-e70492-Supplement1.ods](#), [pone08-e70492-Supplement2.ods](#), [pone08-e70492-Supplement3.odt](#)

Anna Olivieri, Maria Pala, Francesca Gandini, Baharak Hooshyar Kashani, Ugo A. Perego, Scott R. Woodward, Viola Grugni, Vincenza Battaglia, Ornella Semino, Alessandro Achilli, Martin B. Richards & Antonio Torroni

The current human mitochondrial (mtDNA) phylogeny does not equally represent all human populations but is biased in favour of representatives originally from north and central Europe. This especially affects the phylogeny of some uncommon West Eurasian haplogroups, including I and W, whose southern European and Near Eastern components are very poorly represented, suggesting that extensive hidden phylogenetic substructure remains to be uncovered. This study expanded and re-analysed the available datasets of I and W complete mtDNA genomes, reaching a comprehensive 419 mitogenomes, and searched for precise correlations between the ages and geographical distributions of their numerous newly identified subclades with events of human dispersal which contributed to the genetic formation of modern Europeans. Our results showed that haplogroups I (within N1a1b) and W originated in the Near East during the Last Glacial Maximum or prewarming period (the period of gradual warming between the end of the LGM, ≈ 19 ky ago, and the beginning of the first main warming phase, ≈ 15 ky ago) and, like the much more common haplogroups J and T, may have been involved in Late Glacial expansions starting from the Near East. Thus our data contribute to a better definition of the Late and postglacial re peopling of Europe, providing further evidence for the scenario that major population expansions started after the Last Glacial

Maximum but before Neolithic times, but also evidencing traces of diffusion events in several I and W subclades dating to the European Neolithic and restricted to Europe.

Biologie

OPIE 2013

Christopher Opie, Quentin D. Atkinson, Robin I. M. Dunbar & Susanne Shultz, *Male infanticide leads to social monogamy in primates*. [PNAS 110 \(2013\), 13328–13332](#).

[pnas110-13328-Supplement1.pdf](#), [pnas110-13328-Supplement2.xlsx](#)

Although common in birds, social monogamy, or pair-living, is rare among mammals because internal gestation and lactation in mammals makes it advantageous for males to seek additional mating opportunities. A number of hypotheses have been proposed to explain the evolution of social monogamy among mammals: as a male mate-guarding strategy, because of the benefits of biparental care, or as a defense against infanticidal males. However, comparative analyses have been unable to resolve the root causes of monogamy. Primates are unusual among mammals because monogamy has evolved independently in all of the major clades. Here we combine trait data across 230 primate species with a Bayesian likelihood framework to test for correlated evolution between monogamy and a range of traits to evaluate the competing hypotheses. We find evidence of correlated evolution between social monogamy and both female ranging patterns and biparental care, but the most compelling explanation for the appearance of monogamy is male infanticide. It is only the presence of infanticide that reliably increases the probability of a shift to social monogamy, whereas monogamy allows the secondary adoption of paternal care and is associated with a shift to discrete ranges. The origin of social monogamy in primates is best explained by long lactation periods caused by altriciality, making primate infants particularly vulnerable to infanticidal males. We show that biparental care shortens relative lactation length, thereby reducing infanticide risk and increasing reproductive rates. These phylogenetic analyses support a key role for infanticide in the social evolution of primates, and potentially, humans.

TOMASI 2013

Dardo Tomasi, Gene-Jack Wang & Nora D. Volkow, *Energetic cost of brain functional connectivity*. [PNAS 110 \(2013\), 13642–13647](#).

The brain's functional connectivity is complex, has high energetic cost, and requires efficient use of glucose, the brain's main energy source. It has been proposed that regions with a high degree of functional connectivity are energy efficient and can minimize consumption of glucose. However, the relationship between functional connectivity and energy consumption in the brain is poorly understood. To address this neglect, here we propose a simple model for the energy demands of brain functional connectivity, which we tested with positron emission tomography and MRI in 54 healthy volunteers at rest. Higher glucose metabolism was associated with proportionally larger MRI signal amplitudes, and a higher degree of connectivity was associated with nonlinear increases in metabolism, supporting our hypothesis for the energy efficiency of the connectivity hubs. Basal metabolism (in the absence of connectivity) accounted for 30% of brain glucose utilization, which suggests that the spontaneous brain activity accounts for 70% of the energy consumed by the brain. The energy efficiency of the connectivity hubs was higher for ventral precuneus, cerebellum, and subcortical hubs than for cortical hubs. The

higher energy demands of brain communication that hinges upon higher connectivity could render brain hubs more vulnerable to deficits in energy delivery or utilization and help explain their sensitivity to neurodegenerative conditions, such as Alzheimer's disease.

fMRI connectivity | PET-FDG | allometric scaling | energy budget | graph theory

Datierung

SCHMIDT 2013

Christoph Schmidt et al., *First chronometric dates (TL and OSL) for the Aurignacian open-air site of Românești-Dumbrăvița I, Romania.*

[Journal of Archaeological Science](#) **40** (2013), 3740–3753.

JArchSci40-3740-Supplement.pdf

Christoph Schmidt, Valéry Sitlivy, Mircea Anghelinu, Victor Chabai, Holger Kels, Thorsten Uthmeier, Thomas Hauck, Ion Băltean, Alexandra Hilgers, Jürgen Richter & Ulrich Radtke

Currently, absolute dates for the emergence of the Early Upper Paleolithic and the timing of the earliest dispersal of anatomically modern humans (AMH) into Europe are sparse. This is especially true for regions adjoining the Eastern Mediterranean and Central Europe with its dense clusters of sites along the Austrian and German Danube Valley. This article makes a first step toward filling this gap and, for the first time, presents absolute ages for the open-air site of Românești-Dumbrăvița I (Banat, SW Romania) located close to the Oase Cave where some of the oldest AMH fossils were found. A set of heated artefacts recently excavated from the Aurignacian layer GH3 was dated by thermoluminescence (TL) and gives early chronometric dates for this technocomplex in Romania.

The luminescence behavior of artefact samples required the use of different multiple- and single-aliquot measurement protocols to obtain reliable age information. In addition, analyses of glow curves and the performance during regenerative-dose measurements allowed us to distinguish two types of samples. Since one group is characterized by poor dose reproducibility, only samples showing reliable luminescence behavior were considered for final age interpretations. As a result, we could determine that the last heating of artefacts from GH3 happened most likely between ≈ 39 ka (single-aliquot age estimate) and ≈ 45 ka (multiple-aliquot age estimate) ago, with a weighted average age of the GH3 finds of 40.6 ± 1.5 ka (including all data). These dates were confirmed by OSL dating of sediments of the find layer. Such an early age fits well to technological and typological features, which place the dated lithic assemblage at the very beginning of the development of the Aurignacian technocomplex usually seen as a proxy for the earliest wide spread presence of AMH in Europe.

Keywords: Luminescence dating | Heated artefacts | Upper Paleolithic | Aurignacian | Balkans | Anatomically modern humans

Energie

VON DER ASSEN 2013

Niklas von der Assen, Johannes Jung & André Bardow, *Life-Cycle Assessment of Carbon Dioxide Capture and Utilization, Avoiding the Pitfalls.* [Energy & Environmental Science](#) **6** (2013), 2721–2734.

Carbon dioxide (CO₂) capture and utilization (CCU) aims at reducing both greenhouse-gas emissions and fossil-resource depletion. Assessment of these aims

requires quantitative environmental evaluation. So far, evaluation of CCU is based on ad hoc criteria such as the amount of CO₂ utilized, simplified CO₂ balances or CO₂ storage duration. Albeit these criteria may be useful for very early stages of potential research pathways, we show that they are insufficient as basis for decisions on implementations and that they may lead to even qualitatively wrong environmental evaluation of CCU. Therefore, a holistic evaluation using life-cycle assessment (LCA) is mandatory. However, the application of LCA to CCU is subject to methodological pitfalls: (i) utilized CO₂ might intuitively be considered as negative GHG emissions; (ii) since CCU usually generates products both in the capture and in the utilization process, choices exist how to allocate emissions to the individual products and (iii) CO₂ storage duration is not reflected in traditional LCA. To avoid the existing pitfalls, we provide a systematic framework for LCA of CCU in which (i) the utilized CO₂ is correctly considered as regular feedstock with its own production emissions; (ii) recommendations for obtaining product-specific LCA results for CCU processes are given and (iii) the CO₂ storage duration is incorporated into a time-resolved global warming metric. The developed framework is illustrated by simplified LCA of CO₂ capture from the atmosphere and from coal power plants, and of CO₂ utilization for methanol and polymer production. Overall, the presented framework allows for the sound environmental evaluation of CCU.

TOLLEFSON 2013

Jeff Tollefson, *A line in the sands*. [nature 500 \(2013\), 136–137](#).

The scientific community is sharply divided over the proposed Keystone XL pipeline from Canada’s tar sands.

The proven reserves — those that could be developed with known technologies — make up roughly 11 % of the global total for oil, and Weaver’s model suggested that full development would boost the average global temperature by just 0.03 degrees Celsius.

Isotope

REITSEMA 2013

L. J. Reitsema, T. Kozłowski & D. Makowiecki, *Human–environment interactions in medieval Poland, A perspective from the analysis of faunal stable isotope ratios*. [Journal of Archaeological Science 40 \(2013\), 3636–3646](#).

Stable isotope analyses of faunal remains provide valuable information about human–environment interactions in the past, including insights into past animal husbandry and land management strategies. Here, we report stable carbon (d13C) and nitrogen (d15N) isotope values of collagen and carbonate from archaeological fauna from Kaldus, a medieval settlement in North-Central Poland, to better understand human–environment interactions during a period of increasing urbanism and marketization. Wild and domestic animals can be separated on the basis of their isotopic values. The mean d15N value for 12 domesticated animals is $7.6 \pm 1.2\text{‰}$ and for 5 wild animals is $4.3 \pm 0.5\text{‰}$ ($p = 0.002$). The mean collagen d13C value for domesticated animals is $-20.6 \pm 1.1\text{‰}$ and for wild animals is $-22.0 \pm 0.5\text{‰}$ ($p = 0.004$). The mean carbonate d13C value for domesticated animals is $-13.14 \pm 1.3\text{‰}$ and for wild animals is $-14.14 \pm 0.9\text{‰}$ ($p = 0.034$). The “canopy effect” and anthropogenic effects that alter stable isotope ratios of plants (manuring, swidden agriculture and ploughing) are discussed in relation to these differences. Fish are isotopically variable, which suggests broad-spectrum fishing strategies

and/or trade, and increases our awareness of the difficulties in interpreting human paleodiet when freshwater fish were on the menu.

Keywords: Land management | Carbon | Nitrogen | Animal husbandry | Collagen | Carbonate | Fish | Zooarchaeology

Keramik

MARTIN 2013

Mario A. S. Martin, Adi Eliyahu-Behar, Michael Anenburg, Yuval Goren & Israel Finkelstein, *Iron IIA slag-tempered pottery in the Negev Highlands, Israel*. [Journal of Archaeological Science](#) **40** (2013), 3777–3792.

The article presents results of a petrographic investigation of pottery from Iron IIA settlements in the Negev Highlands in southern Israel. It focuses on a group of almost exclusively handmade wares that are tempered with crushed slag. The polarizing and electron microscopes explicitly identify these inclusions as copper smelting slag. Based on the slag as well as certain rock inclusions, the slag-tempered wares can be sourced to the copper districts in the Wadi Arabah, and hence for the first time provide a link between the Negev Highlands and the Arabah copper production centers in the period under review. More specifically, they demonstrate direct involvement of at least part of the pastoral-nomadic Negev Highlands population in the copper extraction system.

Keywords: Iron IIA | Negev Highlands | Wadi Arabah | Faynan | Negebite pottery | Slag-tempered pottery | Copper smelting slag

Klima

ABE-OUCHI 2013

Ayako Abe-Ouchi, Fuyuki Saito, Kenji Kawamura, Maureen E. Raymo, Jun'ichi Okuno, Kunio Takahashi & Heinz Blatter, *Insolation-driven 100,000-year glacial cycles and hysteresis of ice-sheet volume*. [nature](#) **500** (2013), 190–193.

n500-0190-Supplement1.pdf, n500-0190-Supplement2.mov

The growth and reduction of Northern Hemisphere ice sheets over the past million years is dominated by an approximately 100,000-year periodicity and a sawtooth pattern^{1,2} (gradual growth and fast termination). Milankovitch theory proposes that summer insolation at high northern latitudes drives the glacial cycles³, and statistical tests have demonstrated that the glacial cycles are indeed linked to eccentricity, obliquity and precession cycles^{4,5}. Yet insolation alone cannot explain the strong 100,000-year cycle, suggesting that internal climatic feedbacks may also be at work^{4–7}. Earlier conceptual models, for example, showed that glacial terminations are associated with the build-up of Northern Hemisphere ‘excess ice’^{5,8–10}, but the physical mechanisms underpinning the 100,000-year cycle remain unclear. Here we show, using comprehensive climate and ice-sheet models, that insolation and internal feedbacks between the climate, the ice sheets and the lithosphere–asthenosphere system explain the 100,000-year periodicity. The responses of equilibrium states of ice sheets to summer insolation show hysteresis^{11–13}, with the shape and position of the hysteresis loop playing a key part in determining the periodicities of glacial cycles. The hysteresis loop of the North American ice sheet is such that after inception of the ice sheet, its mass balance remains mostly positive through several precession cycles, whose amplitudes decrease towards an

eccentricity minimum. The larger the ice sheet grows and extends towards lower latitudes, the smaller is the insolation required to make the mass balance negative. Therefore, once a large ice sheet is established, a moderate increase in insolation is sufficient to trigger a negative mass balance, leading to an almost complete retreat of the ice sheet within several thousand years. This fast retreat is governed mainly by rapid ablation due to the lowered surface elevation resulting from delayed isostatic rebound^{14–16}, which is the lithosphere–asthenosphere response. Carbon dioxide is involved, but is not determinative, in the evolution of the 100,000-year glacial cycles.

MARSHALL 2013

Shawn J. Marshall, *Solution proposed for ice-age mystery*. [nature](#) **500** (2013), 159–160.

The ice sheets retreated 10,000 years ago during a peak in solar radiation, but this peak was no larger than previous ones. A modelling study suggests why the ice sheets were unusually vulnerable to melting at that time.

Metallzeiten

FALKENSTEIN 2013

Frank Falkenstein, *Kulturwandel und Klima im 12. Jahrhundert v. Chr. Das Beispiel Kastanas in Nordgriechenland*. [Offa](#) **69/70** (2013), 505–526.

In the decades around 1200 B.C. a system collapse of the Late Bronze Age palatial societies in the Eastern Mediterranean area took place. Accompanying effects of the complex crisis were militant conflicts, the decline of the palatial societies and of longdistance trade as well as migrations. Since the 1960s some authors favour the view that climatic impacts, especially droughts, caused the decline of the Mycenaean palatial society. According to recent paleoclimatological investigations, in the later 13th and 12th centuries B.C. two different climatic phenomena can be distinguished: On the one hand a longterm gradual coolingdown of the northern hemisphere after a particularly warm climatic phase, on the other hand a drastic climatic impact whose culmination can be dated dendrochronologically to 1159–1141 B.C.

The prehistoric settlement mound of Kastanas in Macedonia (Northern Greece) has been subject to multidisciplinary investigations with results of highresolution chronology. It thus provides a case example that is particularly appropriate for a diachronic investigation of cultural changes and subsistence economy at the end of the Aegean Bronze Age (LH III B / LH III C) with regard to the climate. The layers 15–14a (LH III B / LH III C Early) of Kastanas show a decline of subsistence economy on the basis of archaeobotanical and archaeozoological results. At the culmination point of the nutrition crisis at the transition between LH III C Early and LH III C Advanced (layers 14a–13, c. 1160–1140 B.C.) a cultural break can be asserted. This may be connected with an immigration and settling down of a population with origins in the Danube region. The Late Bronze Age cultural development in Kastanas reveals clear indications of a complex crisis scenario, such as could be expected in view of the contemporary climatic change.

In den Jahrzehnten um 1200 v. Chr. fand im östlichen Mittelmeerraum ein Systemkollaps der spätbronzezeitlichen Palastgesellschaften statt. Begleiterscheinungen der vielschichtigen Krise waren kriegerische Konflikte, der Niedergang der Palastgesellschaften und des Fernhandels sowie Migrationen. Seit den 1960er Jahren favorisieren manche Autoren klimatische Faktoren, insbesondere Dürren, als

Auslöser für den Niedergang der mykenischen Palastgesellschaft. Jüngeren paläoklimatologischen Studien zufolge lassen sich zwei verschiedene Klimaphänomene für das späte 13. und 12. Jh. v. Chr. fassen. Dies ist zum einen eine langzeitige graduelle Abkühlung der nördlichen Hemisphäre nach einer besonders warmen Klimaphase, zum anderen ein einschneidendes Klimaereignis, dessen Gipfelpunkt dendrochronologisch auf die Jahre 1159–1141 v. Chr. datiert wird. Der prähistorische Siedlungshügel von Kastanas in Makedonien (Nordgriechenland) bietet aufgrund der multidisziplinären Untersuchungen mit zeitlich hoch aufgelösten Ergebnissen ein besonders geeignetes Fallbeispiel für die diachrone Untersuchung des Kulturwandels und der Subsistenzwirtschaft am Ende der ägäischen Bronzezeit (SH III B / SH III C) im Hinblick auf das Klima. In den Schichten 15–14a (SH III B / SH III C Früh) von Kastanas lässt sich anhand der archäobotanischen und archäozoologischen Ergebnisse ein Niedergang der Subsistenzwirtschaft herausstellen. Am Kulminationspunkt der Ernährungskrise am Übergang von SH III C Früh zu SH III C Entwickelt (Schichten 14a–13, ca. 1160–1140 v. Chr.) ist in der Ansiedlung ein Kulturbruch fassbar, der mit der Einwanderung und Niederlassung einer Bevölkerung donauländischer Herkunft in Verbindung gebracht werden kann. Der spätbronzezeitliche Kulturgang in Kastanas zeigt deutliche Indikatoren eines komplexen Krisenszenarios, wie es im Hinblick auf die kontemporäre Klimaentwicklung durchaus zu erwarten wäre.

KANIEWSKI 2013

David Kaniewski, Elise Van Campo, Joël Guiot, Sabine Le Burel, Thierry Otto & Cecile Baeteman, *Environmental Roots of the Late Bronze Age Crisis*. *PLoS ONE* **8** (2013), e71004. [DOI:10.1371/journal.pone.0071004](https://doi.org/10.1371/journal.pone.0071004).

The Late Bronze Age world of the Eastern Mediterranean, a rich linkage of Aegean, Egyptian, Syro-Palestinian, and Hittite civilizations, collapsed famously 3200 years ago and has remained one of the mysteries of the ancient world since the event's retrieval began in the late 19th century AD/CE. Iconic Egyptian bas-reliefs and graphic hieroglyphic and cuneiform texts portray the proximate cause of the collapse as the invasions of the "Peoples-of-the-Sea" at the Nile Delta, the Turkish coast, and down into the heartlands of Syria and Palestine where armies clashed, famine-ravaged cities abandoned, and countrysides depopulated. Here we report palaeoclimate data from Cyprus for the Late Bronze Age crisis, alongside a radiocarbon-based chronology integrating both archaeological and palaeoclimate proxies, which reveal the effects of abrupt climate change-driven famine and causal linkage with the Sea People invasions in Cyprus and Syria. The statistical analysis of proximate and ultimate features of the sequential collapse reveals the relationships of climate-driven famine, seaborne-invasion, region-wide warfare, and politico-economic collapse, in whose wake new societies and new ideologies were created.

Methoden

MONNIER 2013

Gilliane F. Monnier, Thomas C. Hauck, Joshua M. Feinberg, Bing Luo, Jean-Marie Le Tensorer & Heba al Sakhel, *A multi-analytical methodology of lithic residue analysis applied to Paleolithic tools from Hummal, Syria*. *Journal of Archaeological Science* **40** (2013), 3722–3739.

Lithic residue analysis is traditionally based upon the morphological identification of microresidues preserved on the surfaces of stone tools. In order to improve the reliability of these identifications, we apply multiple techniques beyond morphological description to characterize the residues on stone tools from Hummal, Syria. We first document the residues using visible light microscopy and scanning electron microscopy, and then characterize them using energy dispersive X-ray spectroscopy, Fourier Transform Infrared microscopy, and confocal Raman microscopy. Our analyses confirm that some of the residues are bitumen. X-ray diffraction analysis of associated sediments is used to identify the other residues.

Keywords: Lithic residue analysis | Middle Paleolithic | Syria | Microscopy | Scanning electron microscopy | Energy dispersive X-ray spectroscopy | Fourier transform infrared microscopy | Confocal Raman microscopy | X-ray diffraction

Neolithikum

BAKELS 1997

C. C. Bakels, *The beginnings of manuring in western Europe*. [Antiquity 71 \(1997\), 442–445](#).

The history of field manuring is poorly known. Domestic waste may have been used for this purpose from the Early Neolithic onwards. It is possible that the practice of collecting animal dung began with the introduction of the ard.

Theorie

LEONHARD 1999

Kai Leonhard & Thomas Kraska, *An Equation of State Describing the Critical Region, Extension to High Pressure*. [Journal of Supercritical Fluids 16 \(1999\), i, 1–10](#).

In this paper, an equation of state is presented, which is able to model the $p\rho T$ behaviour of fluids in the critical region, in the low-density limit and at high pressure. The equation is developed in the framework of a local mean field model describing density fluctuations in a fluid. This model is based on an earlier developed model, which was employed to describe the $p\rho T$ behaviour in the critical region for several substances. It is extended here to high pressure. For the representation of the critical isotherm, argon is used as reference substance. In addition to the experimental data taken from the literature, some state points at high pressure are estimated by the Monte-Carlo simulation on the basis of ab-initio pair potentials. These data were included in the development of the equation of state in order to assure physically correct behaviour at high pressure. With this equation, the $p\rho T$ behaviour of argon, sulfur hexafluoride, methane, ethylene, nitrous oxide and carbon dioxide is modeled.

Keywords: Application; Critical region; Equation of state; High pressure; Liquid vapor equilibria.