

References

Aktuell

O'CONNOR 2015

J. E. O'Connor, J. J. Duda & G. E. Grant, *1000 dams down and counting, Dam removals are reconnecting rivers in the United States.* [science](#) **348** (2015), 496–497.

A major finding is that rivers are resilient, with many responding quickly to dam removal. Most river channels stabilize within months or years, not decades. Migratory fish have also responded quickly to restored river connectivity. Removal of a dam on Virginia's Rappahannock River increased American eel populations in Shenandoah National Park, 150 km upstream. Similarly, following a small dam removal in Maine, sea lamprey recolonized newly accessible habitat, increasing abundance and nesting sites by a factor of 4. Within days of the blast removing the last of Glines Canyon Dam, Elwha River Chinook salmon swam upstream past its rocky abutments.

Also clouding the future is climate change, which is likely to increase the demand for fresh-water storage, both as a low-carbon energy source and for consumptive use. The total number of U.S. and international removals are, however, more than offset by a renewed global boom in dam construction, chiefly for hydropower and in regions with emerging economies, such as Southeast Asia, South America, and Africa. But the dams of this ongoing boom will also age, just like those of the U.S. dam-building heyday. Dam removal looks like an activity with a long future ahead.

ODDEN 2012

Michelle C. Odden, Carmen A. Peralta, Mary N. Haan & Kenneth E. Covinsky, *Rethinking the Association of High Blood Pressure With Mortality in Elderly Adults, The Impact of Frailty.* [Archives of Internal Medicine](#) **172** (2012), 1162–1169.

Comment by James S. Goodwin

Background: The association of hypertension and mortality is attenuated in elderly adults. Walking speed, as a measure of frailty, may identify which elderly adults are most at risk for the adverse effects of hypertension. We hypothesized that elevated blood pressure (BP) would be associated with a greater risk of mortality in faster-, but not slower-, walking older adults.

Methods: Participants included 2340 persons 65 years and older in the National Health and Nutrition Examination Survey, 1999-2000 and 2001-2002. Mortality data were linked to death certificates in the National Death Index. Walking speed was measured over a 20-ft (6 m) walk and classified as faster (.0.8 m/s [n=1307]), slower (n=790), or incomplete (n=243). Potential confounders included age, sex, race, survey year, lifestyle and physiologic variables, health conditions, and anti-hypertensive medication use.

Results: Among the participants, there were 589 deaths through December 31, 2006. The association between BP and mortality varied by walking speed. Among faster walkers, those with elevated systolic BP (≥ 140 mm Hg) had a greater adjusted risk of mortality compared with those without (hazard ratio [HR], 1.35; 95 % CI, 1.03–1.77). Among slower walkers, neither elevated systolic nor diastolic BP

(≥ 90 mm Hg) was associated with mortality. In participants who did not complete the walk test, elevated BP was strongly and independently associated with a lower risk of death: HR, 0.38; 95 % CI, 0.23-0.62 (systolic); and HR, 0.10; 95 % CI, 0.01-0.81 (diastolic).

Conclusions: Walking speed could be a simple measure to identify elderly adults who are most at risk for adverse outcomes related to high BP.

TURKLE 2015

Sherry Turkle, *Lass das, Papa: nicht googeln!* [Spektrum der Wissenschaft 2015](#), vi, 64–66.

Die amerikanische Soziologin und Psychologin Sherry Turkle erforscht die sozialen Auswirkungen der neuen Medien. Sie warnt davor, über der digitalen Welt physische Kontakte zu vernachlässigen.

Anthropologie

HARMAND 2015

Sonia Harmand et al., *3.3-million-year-old stone tools from Lomekwi 3, West Turkana, Kenya*. [nature 521 \(2015\)](#), 310–315.

[n521-0310-Supplement.pdf](#)

Sonia Harmand, Jason E. Lewis, Craig S. Feibel, Christopher J. Lepre, Sandrine Prat, Arnaud Lenoble, Xavier Boës, Rhonda L. Quinn, Michel Brenet, Adrian Arroyo, Nicholas Taylor, Sophie Clément, Guillaume Daver, Jean-Philip Brugal, Louise Leakey, Richard A. Mortlock, James D. Wright, Sammy Lokorodi, Christopher Kirwa, Dennis V. Kent & Hélène Roche

Human evolutionary scholars have long supposed that the earliest stone tools were made by the genus *Homo* and that this technological development was directly linked to climate change and the spread of savannah grasslands. New fieldwork in West Turkana, Kenya, has identified evidence of much earlier hominin technological behaviour. We report the discovery of Lomekwi 3, a 3.3-million-year-old archaeological site where in situ stone artefacts occur in spatio-temporal association with Pliocene hominin fossils in a wooded palaeoenvironment. The Lomekwi 3 knappers, with a developing understanding of stone's fracture properties, combined core reduction with battering activities. Given the implications of the Lomekwi 3 assemblage for models aiming to converge environmental change, hominin evolution and technological origins, we propose for it the name 'Lomekwian', which predates the Oldowan by 700,000 years and marks a new beginning to the known archaeological record.

SALA 2015

Nohemi Sala et al., *Lethal Interpersonal Violence in the Middle Pleistocene*. [PLoS ONE 10 \(2015\)](#), e126589.

[DOI:10.1371/journal.pone.0126589](#).

[pone10-e0126589-Supplement.DOCX](#)

Nohemi Sala, Juan Luis Arsuaga, Ana Pantoja-Pérez, Adrián Pablos, Ignacio Martínez, Rolf M. Quam, Asier Gómez-Olivencia, José María Bermúdez de Castro & Eudald Carbonell

Evidence of interpersonal violence has been documented previously in Pleistocene members of the genus *Homo*, but only very rarely has this been posited as the possible manner of death. Here we report the earliest evidence of lethal interpersonal violence in the hominin fossil record. Cranium 17 recovered from the Sima de los Huesos Middle Pleistocene site shows two clear perimortem depression fractures

on the frontal bone, interpreted as being produced by two episodes of localized blunt force trauma. The type of injuries, their location, the strong similarity of the fractures in shape and size, and the different orientations and implied trajectories of the two fractures suggest they were produced with the same object in face-to-face interpersonal conflict. Given that either of the two traumatic events was likely lethal, the presence of multiple blows implies an intention to kill. This finding shows that the lethal interpersonal violence is an ancient human behavior and has important implications for the accumulation of bodies at the site, supporting an anthropic origin.

Bibel

FAUST 1999

Avraham Faust, *Socioeconomic Stratification in an Israelite City, Hazor VI as a Test Case*. *Levant* **31** (1999), 179–190.

This article attempts to determine the degree of socioeconomic stratification in Stratum VI of Hazor, based mainly on an analysis of the dwellings uncovered at the site. The analysis of the structures consists of four elements which are examined in relation to each of the architectural units: 1) the area of each of the houses; 2) the quality of construction; 3) the use of common walls; 4) the location of each dwelling within the site. The combination of these components is examined in order to determine the degree of wealth and power enjoyed by the owners of the different dwellings, and it seems that the analysis shows the existence of two distinct population strata: the senior and the wealthy functionaries on the one hand, and the poor on the other, and possibly the existence of a (lower -) middle class.

FAUST 2003

Avraham Faust, *Judah in the sixth century B.C.E., A rural perspective*. *Palestine Exploration Quarterly* **135** (2003), 37–53.

Not much is known about the material culture of the ‘Babylonian Period’. The lack of data has been explained in two contrasting ways: (1) the region was only sparsely inhabited, and the meagre settlement left only scant remains; (2) this is a very short period, whose material culture should be viewed as a continuation of that of the late Iron Age and as a predecessor of that of the Persian Period, and therefore difficult to identify. These schools differ in their views on the demographic reality in sixth century B.C.E. Judah. The former sees a great demographic decline, while the latter stresses continuity. The present paper suggests that the answer lies in an examination of continuity of settlement patterns in the rural sector. The importance of the rural sector results from the different considerations that influence the siting of urban and rural sites. Unlike their urban counterparts, whose location is a result of various considerations that can be met only by a relatively limited number of sites in any region, small rural sites are scattered throughout the landscape. Urban sites are therefore expected to be relocated on top of former urban sites, even if there is no continuity. However, if most or many Persian Period rural sites are located on top of Iron Age rural sites, then this indicates that they existed also during the sixth century, since rural sites are not usually expected to be located on top of earlier rural sites, unless they were inhabited continuously. Resettlement following a gap would result in the foundation of new sites, but only a minority of them would be located above previous ones.

An examination of excavated Iron Age rural sites reveals continuity in the transition to the Persian Period in some regions, but total changes and extreme discontinuity in Judah.

In summary, rural settlements in Judah exhibit extremely limited continuity from the Iron Age, and indicate that during the sixth century B.C.E. this settlement form was not very dominant there, in contrast to the situation in other regions. This situation stands in contrast also with the (recently) popular view that most of the population of Iron Age Judah continued to live in such sites during the Babylonian period. Discussion of fundamental cultural changes which took place in tandem with the processes described above, and a reexamination of the demographic reality exceeds the scope of the present paper, which discusses only the situation in the rural sector, but I should stress that both examinations are in line with the above conclusion concerning major changes and drastic population decline in sixth century B.C.E. Judah.

It should be noted that balanced views regarding the situation in Judah during the sixth century B.C.E. seem to have been prevalent among scholars in the past (e.g., Aharoni 1979; Bright 1972). Many scholars seem to have stressed, in contrast to the impression one might get from the more recent literature, that the land was not literally empty (see also Noth 1960, 296). Bright (1972, 343-44), for example, wrote that ‘... the popular notion of a total deportation which left the land empty and void is erroneous and to be discarded’. He (and others), however, stressed that ‘the catastrophe was nevertheless appalling and one which signaled the disruption of Jewish life in Palestine’. It seems to me that such balanced views match the archaeological evidence (for more recent studies, see the works of Stern, Oded and Vanderhooft cited above).

As for the settlement situation, it is most probable that we should accept Mazar’s (1982, 105) interpretation of his excavations in Kh. Abu et-Twein, where some scanty remains lead him to conclude that the fort building (and only the fort, and not the village) was (re)used after the Babylonian conquest: ‘The biblical sources provide clear evidence for the continuation of peasant settlement in Judah by “vinedresser and husbandmen” as Jeremiah defined them (Jer. 52. 16)’. This is an example of the archaeological evidence we possess for the ‘those remaining in the land’ during this period (apart, perhaps, from the Land of Benjamin) — very scanty indeed.

GLEAVES 2015

G. Scott Gleaves, *Did Jesus speak Greek? The Emerging Evidence of Greek Dominance in First-Century Palestine*. (Eugene 2015).

Did Jesus speak Greek? An affirmative answer to the question will no doubt challenge traditional presuppositions. The question relates directly to the historical preservation of Jesus’s words and theology. Traditionally, the authenticity of Jesus’s teaching has been linked to the recovery of the original Aramaic that presumably underlies the Gospels. The Aramaic Hypothesis infers that the Gospels represent theological expansions, religious propaganda, or blatant distortions of Jesus’s teachings. Consequently, uncovering the original Aramaic of Jesus’s teachings will separate the historical Jesus from the mythical personality. G. Scott Gleaves, in *Did Jesus Speak Greek?*, contends that the Aramaic Hypothesis is inadequate as an exclusive criterion of historical Jesus studies and does not aptly take into consideration the multilingual culture of first-century Palestine. Evidence from archaeological, literary, and biblical data demonstrates Greek linguistic dominance in Roman Palestine during the first century CE. Such preponderance of evidence leads not only to the conclusion that Jesus and his disciples spoke Greek but also to the recognition that the Greek New Testament generally and the Gospel of Matthew in particular were original compositions and not translations of underlying Aramaic sources.

Biographie

PÄÄBO 2014

Svante Pääbo, *Neanderthal man, In search of lost genomes*. (New York 2015).

The book is primarily a memoir. Pääbo recounts his life story with a Fenno-scandian frankness that some readers might find disconcerting. Along the way, he tells us a great deal about science and scientists. There is mercifully little of the didactic treatment of the structure of DNA and genes that authors feel obliged to rehearse on such occasions. Dispensing quickly with such banal necessities, Pääbo gets on with the cutting-edge science to which he was witness, and in some cases helped to create—the astonishing development of devices that could be used to sequence DNA ever more efficiently and at lower and lower cost. He describes the technology clearly, almost like a recipe book: you feel you should have Neanderthal Man on the bench as you try its techniques for yourself. [Henry Gee]

Biologie

ANTHES 2015

Emily Anthes, *Save blood, save lives*. [nature 520 \(2015\), 24–26](#).

Transfusions are one of the most overused treatments in modern medicine, at a cost of billions of dollars. Researchers are working out how to cut back.

KOOIJMAN 2015

Sander Kooijman et al., *Prolonged daily light exposure increases body fat mass through attenuation of brown adipose tissue activity*. [PNAS 112 \(2015\), 6748–6753](#).

Sander Kooijman, Rosa van den Berg, Ashna Ramkisoensing, Mariëtte R. Boon, Eline N. Kuipers, Marieke Loef, Tom C. M. Zonneveld, Eliane A. Lucassen, Hetty C. M. Sips, Iliana A. Chatzisprou, Riekelt H. Houtkooper, Johanna H. Meijer, Claudia P. Coomans, Nienke R. Biermasz & Patrick C. N. Rensen

Disruption of circadian rhythmicity is associated with obesity and related disorders, including type 2 diabetes and cardiovascular disease. Specifically, prolonged artificial light exposure associates with obesity in humans, although the underlying mechanism is unclear. Here, we report that increasing the daily hours of light exposure increases body adiposity through attenuation of brown adipose tissue (BAT) activity, a major contributor of energy expenditure. Mice exposed to a prolonged day length of 16- and 24-h light, compared with regular 12-h light, showed increased adiposity without affecting food intake or locomotor activity. Mechanistically, we demonstrated that prolonged day length decreases sympathetic input into BAT and reduces β -adrenergic intracellular signaling. Concomitantly, prolonging day length decreased the uptake of fatty acids from triglyceride-rich lipoproteins, as well as of glucose from plasma selectively by BAT. We conclude that impaired BAT activity is an important mediator in the association between disturbed circadian rhythm and adiposity, and anticipate that activation of BAT may overcome the adverse metabolic consequences of disturbed circadian rhythmicity.

Keywords: circadian rhythms | light pollution | obesity | brown adipose tissue | triglyceride metabolism

PATTAKOS 2012

Gregory Pattakos et al., *Outcome of Patients Who Refuse Transfusion After Cardiac Surgery, A Natural Experiment With Severe Blood Conservation*. [Archives of Internal Medicine](#) **172** (2012), 1154–1161.

Comment by Victor A. Ferraris

Gregory Pattakos, Colleen G. Koch, Mariano E. Brizzio, Lillian H. Batizy, Joseph F. Sabik III, Eugene H. Blackstone, Michael S. Lauer

Background: Jehovah's Witness patients (Witnesses) who undergo cardiac surgery provide a unique natural experiment in severe blood conservation because anemia, transfusion, erythropoietin, and antifibrinolytics have attendant risks. Our objective was to compare morbidity and long-term survival of Witnesses undergoing cardiac surgery with a similarly matched group of patients who received transfusions.

Methods: A total of 322 Witnesses and 87 453 non-Witnesses underwent cardiac surgery at our center from January 1, 1983, to January 1, 2011. All Witnesses prospectively refused blood transfusions. Among nonWitnesses, 38 467 did not receive blood transfusions and 48 986 did. We used propensity methods to match patient groups and parametric multiphase hazard methods to assess long-term survival. Our main outcome measures were postoperative morbidity complications, in-hospital mortality, and long-term survival.

Results: Witnesses had fewer acute complications and shorter length of stay than matched patients who received transfusions: myocardial infarction, 0.31 % vs 2.8 % (P=.01); additional operation for bleeding, 3.7 % vs 7.1 % (P=.03); prolonged ventilation, 6 % vs 16 % (P<.001); intensive care unit length of stay (15th, 50th, and 85th percentiles), 24, 25, and 72 vs 24, 48, and 162 hours (P<.001); and hospital length of stay (15th, 50th, and 85th percentiles), 5, 7, and 11 vs 6, 8, and 16 days (P<.001). Witnesses had better 1-year survival (95 %; 95 % CI, 93 %–96 %; vs 89 %; 95 % CI, 87 %–90 %; P=.007) but similar 20-year survival (34 %; 95 % CI, 31 %–38 %; vs 32 % 95 % CI, 28 %–35 %; P=.90).

Conclusions: Witnesses do not appear to be at increased risk for surgical complications or long-term mortality when comparisons are properly made by transfusion status. Thus, current extreme blood management strategies do not appear to place patients at heightened risk for reduced long-term survival.

SKOGLUND 2015

Pontus Skoglund, Erik Ersmark, Eleftheria Palkopoulou & Love Dalén, *Ancient Wolf Genome Reveals an Early Divergence of Domestic Dog Ancestors and Admixture into High-Latitude Breeds*. [Current Biology](#) (2015), preprint, 1–5. DOI:10.1016/j.cub.2015.04.019.

The origin of domestic dogs is poorly understood, with suggested evidence of dog-like features in fossils that predate the Last Glacial Maximum conflicting with genetic estimates of a more recent divergence between dogs and worldwide wolf populations. Here, we present a draft genome sequence from a 35,000-year-old wolf from the Taimyr Peninsula in northern Siberia. We find that this individual belonged to a population that diverged from the common ancestor of present-day wolves and dogs very close in time to the appearance of the domestic dog lineage. We use the directly dated ancient wolf genome to recalibrate the molecular timescale of wolves and dogs and find that the mutation rate is substantially slower than assumed by most previous studies, suggesting that the ancestors of dogs were separated from present-day wolves before the Last Glacial Maximum. We also find evidence of introgression from the archaic Taimyr wolf lineage into present-day dog breeds from northeast Siberia and Greenland, contributing between 1.4 % and

27.3% of their ancestry. This demonstrates that the ancestry of present-day dogs is derived from multiple regional wolf populations.

STRONG 2015

Courtenay Strong, Benjamin Zuckerberg, Julio L. Betancourt & Walter D. Koenig, *Climatic dipoles drive two principal modes of North American boreal bird irruption*. *PNAS* **112** (2015), E2795–E2802.

Pine Siskins exemplify normally boreal seed-eating birds that can be sparse or absent across entire regions of North America in one year and then appear in large numbers the next. These dramatic avian “irruptions” are thought to stem from intermittent but broadly synchronous seed production (masting) in one year and meager seed crops in the next. A prevalent hypothesis is that widespread masting in the boreal forest at high latitudes is driven primarily by favorable climate during the two to three consecutive years required to initiate and mature seed crops in most conifers. Seed production is expensive for trees and is much reduced in the years following masting, driving boreal birds to search elsewhere for food and overwintering habitat. Despite this plausible logic, prior efforts to discover climate-irruption relationships have been inconclusive. Here, analysis of more than 2 million Pine Siskin observations from Project FeederWatch, a citizen science program, reveals two principal irruption modes (North-South and WestEast), both of which are correlated with climate variability. The North-South irruption mode is, in part, influenced by winter harshness, but the predominant climate drivers of both modes manifest in the warm season as continental-scale pairs of oppositely signed precipitation and temperature anomalies (i.e., dipoles). The climate dipoles juxtapose favorable and unfavorable conditions for seed production and wintering habitat, motivating a push-pull paradigm to explain irruptions of Pine Siskins and possibly other boreal bird populations in North America.

Keywords: avian irruption | boreal birds | climate variability | migration | masting

Datierung

WENINGER 1990

B. Weninger, *Theoretical Radiocarbon Discrepancies*. In: D. A. HARDY & A. C. RENFREW (Hrsg.), *Thera and the Aegean World III, Vol. 3: Chronology, Proceedings of the Third International Congress, Santorini, Greece, 3–9 September 1989*. (London 1990), 216–231.

An attempt will be made to reconcile the calibrated radiocarbon dates from Akrotiri with the traditional archaeological chronology of the Aegean Bronze Age, supporting the archaeological date of c. 1550-1500 BC for the LM IA period.

In the past decade a number of studies have led to the impression that the calibrated radiocarbon dates for the Aegean Late Bronze Age generally tend to be earlier than the archaeological dates. To explain the difference of 100-200 years between the archaeological dating of the Minoan eruption on Santorini (c. 1550-1500 BC) and the calibrated dates (c. 1700 BC) it has been proposed that the radiocarbon samples from Akrotiri were influenced by volcanic emanations, rendering them too early due to the photosynthesis of old CO₂ deriving from fissures in the ground in the volcanic surroundings. On the other hand, on the basis of a reinterpretation of the archaeological evidence it has recently been argued that the archaeological correlations with the historical chronology of Egypt may well be consistent with the ‘high’ radiocarbon dating.

My paper will take a closer look at the radiocarbon dates from the Aegean Late Bronze Age and from Egypt. Using the new high-precision ^{14}C calibration curve, it will first be shown that in Egypt the historical chronology and the radiocarbon dates agree within margins of error judged to be 1-3 decades at the time of Dynasties XVIII-XX. This is demonstrated by sequencing the radiocarbon dates according to the known age of the Egyptian samples. When fixed to the calibration curve by Archaeological Wiggle Matching (AWM) the ^{14}C dates are in perfect agreement with the historical chronology and, furthermore, show the expected fine variations in atmospheric ^{14}C content. Using the same method, it will be judged that the radiocarbon dates from Akrotiri do not necessarily disagree with the traditional archaeological date for the Minoan eruption. The dates may well calibrate to c. 1550-1520, though not later than 1500 BC. However, the calibration reading is not unique and a date 100 years earlier, supporting recent tree-ring and ice-core studies, cannot be excluded. To find a unique ^{14}C date for the Minoan eruption, an effort was made to develop an AWM sequence for all the radiocarbon dates of the Aegean Late Bronze Age, but here the interpretation of the radiocarbon dates is heavily dependent on the rather poor archaeological information available for the samples.

The validity of the traditional chronology is, however, further supported by an analysis of the reasons why the Akrotiri dates appear to calibrate to 1700 BC, even though the samples may actually derive from c. 1520 BC. Calibration is essentially the task of transferring the ^{14}C dating probability from the ^{14}C time scale to the calendric time scale. Owing to the non-linear properties of this transformation, it is quite inevitable that the calibration readings are distorted. Model studies assuming precisely measured ^{14}C dates for samples from 1550-1500 BC show that the mean value of the calibrated dates is necessarily c. 1650 BC, both for single dates and for larger date sets, irrespective of the actual age of the samples. This is because the calibration curve is essentially flat, with a few re-entry wiggles, from 1500-1700 BC. A further implication of the non-linearity of calibration is that all archaeological ^{14}C chronologies based on large numbers of dates are fixed to artificial regions of the calendric time scale and will be distorted quite generally. The problems of the calibrated ^{14}C dates at the site of Akrotiri thus have to be generalized. Because the calibration readings of all ^{14}C dates adhere to specific time intervals it appears appropriate to look at radiocarbon dates in the general terms of what I like to call ^{14}C Quantum Chronology.

Energie

LEI 2015

Fei Lei, Pingfang Hu, Na Zhu & Tianhua Wu, *Periodic heat flux composite model for borehole heat exchanger and its application*. [Applied Energy](#) **151** (2015), 132–142.

- We present a model of a periodic cylinder heat source in composite media and give its solution in frequency domain.
- A frequency decomposition hybrid algorithm is specially designed for the periodic composite model.
- The equivalent relationship between constant heat flux model and periodic heat flux model is illustrated.
- The periodic model is applied on the data analysis of oscillatory thermal response test.

Most existing borehole heat exchanger models are based on constant heat flux solutions. This paper first proposes a periodic heat flux composite model for a

borehole heat exchanger to reproduce the periodic nature of real loads. An explicit analytical solution of a periodic cylinder-source in composite media is derived using a harmonic method. The periodic thermal response factor is defined to characterize the thermal behaviour of a borehole subjected to a periodic heat flux. The periodic thermal responses factors for high- and low-frequency periodic heat flux are dominantly determined by the thermal properties of the content inside the borehole and the ground outside the borehole, respectively. A frequency decomposition hybrid algorithm is specially designed according to the frequency response characteristic of borehole. The proposed periodic heat flux model is verified through an inter-model comparison with existing constant heat flux models and the comparison indicates an equivalent relationship between the two types of models. An annual simulation is performed using the hybrid algorithm and the accuracy of the algorithm is verified. The paper also presents a new method to analyse the data of an oscillatory thermal response test by using the periodic composite model. The effective heat capacities of the ground and grout are estimated. The simulation results of the periodic composite model are in good agreement with the experimental data.

Keywords: Ground source heat pump | Borehole heat exchanger | Frequency response | Harmonic method | Frequency decomposition

LI 2015

Min Li & Alvin C. K. Lai, *Review of analytical models for heat transfer by vertical ground heat exchangers (GHEs), A perspective of time and space scales.* [Applied Energy](#) **151** (2015), 178–191.

- We provide a review and introduction to analytic models for ground heat exchangers.
- We evaluate various models in a time and space scale framework.
- We compare six analytic G-functions for ground heat exchangers of single U-tube.
- We discuss several key problems with indoor and in situ experimental work.
- We identify several unsolved problems in the analysis of ground heat exchangers.

Ground (or geothermal) heat exchangers are attracting a great deal of attention as a way of using shallow geothermal energy. This paper provides not only a critical review but also a thorough introduction to the analysis of heat transfer by borehole and foundation pile ground heat exchangers, with an emphasis on different analytical models. The literature is reviewed in a time-scale framework because of the diversity of the time and space scales involved in the thermal processes of ground heat exchangers. We summarize, discuss, and evaluate major advances in this field, including heat-source models, short-time models, models for energy piles, in situ thermal-response tests, indoor sandbox experiments, and parameter estimation as an inverse problem. Of particular note is that the unit-step temperature response (i.e., G-function) of a ground heat exchanger with one U-shaped pipe is calculated; and six analytical models are compared: an infinite cylinder-source model, two infinite line-source models, two finite line-source models, and a composite-medium line-source model. This paper closes by identifying several unsolved problems that require solutions.

Keywords: Ground heat exchanger | Energy pile | Ground-coupled heat pump | Ground heat storage | In situ thermal-response test

Isotope

FREI 2015

Karin Margarita Frei et al., *Tracing the dynamic life story of a Bronze*

Age Female. [Scientific Reports 5 \(2015\), 10431](#). DOI:10.1038/srep10431. SciRep05-10431-Supplement.pdf

Karin Margarita Frei, Ulla Mannering, Kristian Kristiansen, Morten E. Allentoft, Andrew S. Wilson, Irene Skals, Silvana Tridico, Marie Louise Nosch, Eske Willerslev, Leon Clarke & Robert Frei

Ancient human mobility at the individual level is conventionally studied by the diverse application of suitable techniques (e.g. aDNA, radiogenic strontium isotopes, as well as oxygen and lead isotopes) to either hard and/or soft tissues. However, the limited preservation of coexisting hard and soft human tissues hampers the possibilities of investigating high-resolution diachronic mobility periods in the life of a single individual. Here, we present the results of a multidisciplinary study of an exceptionally well preserved circa 3.400-year old Danish Bronze Age female find, known as the Egtved Girl. We applied biomolecular, biochemical and geochemical analyses to reconstruct her mobility and diet. We demonstrate that she originated from a place outside present day Denmark (the island of Bornholm excluded), and that she travelled back and forth over large distances during the final months of her life, while consuming a terrestrial diet with intervals of reduced protein intake. We also provide evidence that all her garments were made of non-locally produced wool. Our study advocates the huge potential of combining biomolecular and biogeochemical provenance tracer analyses to hard and soft tissues of a single ancient individual for the reconstruction of high-resolution human mobility.

Klima

BARTOLOMÉ 2015

Miguel Bartolomé et al., *Hydrological change in Southern Europe responding to increasing North Atlantic overturning during Greenland Stadial 1*. [PNAS 112 \(2015\), 6568–6572](#).

Miguel Bartolomé, Ana Moreno, Carlos Sancho, Heather M. Stoll, Isabel Cacho, Christoph Spötl, Inchel Belmonte, R. Lawrence Edwards, Hai Cheng & John C. Hellstrom

Greenland Stadial 1 (GS-1) was the last of a long series of severe cooling episodes in the Northern Hemisphere during the last glacial period. Numerous North Atlantic and European records reveal the intense environmental impact of that stadial, whose origin is attributed to an intense weakening of the Atlantic Meridional Overturning Circulation in response to freshening of the North Atlantic. Recent high-resolution studies of European lakes revealed a mid-GS-1 transition in the climatic regimes. The geographical extension of such atmospheric changes and their potential coupling with ocean dynamics still remains unclear. Here we use a subdecadally resolved stalagmite record from the Northern Iberian Peninsula to further investigate the timing and forcing of this transition. A solid interpretation of the environmental changes detected in this new, accurately dated, stalagmite record is based on a parallel cave monitoring exercise. This record reveals a gradual transition from dry to wet conditions starting at 12,500 y before 2000 A.D. in parallel to a progressive warming of the subtropical Atlantic Ocean. The observed atmospheric changes are proposed to be led by a progressive resumption of the North Atlantic convection and highlight the complex regional signature of GS-1, very distinctive from previous stadial events.

Keywords: speleothem | Iberia | Younger Dryas | stable isotopes | Greenland Stadial 1

MEYER-JACOB 2015

Carsten Meyer-Jacob, Julie Tolu, Christian Bigler, Handong Yang & Richard Bindler, *Early land use and centennial scale changes in lake-water organic carbon prior to contemporary monitoring*. [PNAS 112 \(2015\), 6579–6584](#).

Organic carbon concentrations have increased in surface waters across parts of Europe and North America during the past decades, but the main drivers causing this phenomenon are still debated. A lack of observations beyond the last few decades inhibits a better mechanistic understanding of this process and thus a reliable prediction of future changes. Here we present past lake-water organic carbon trends inferred from sediment records across central Sweden that allow us to assess the observed increase on a centennial to millennial time scale. Our data show the recent increase in lake-water carbon but also that this increase was preceded by a landscape-wide, long-term decrease beginning already A.D. 1450–1600. Geochemical and biological proxies reveal that these dynamics coincided with an intensification of human catchment disturbance that decreased over the past century. Catchment disturbance was driven by the expansion and later cessation of widespread summer forest grazing and farming across central Scandinavia. Our findings demonstrate that early land use strongly affected past organic carbon dynamics and suggest that the influence of historical landscape utilization on contemporary changes in lake-water carbon levels has thus far been underestimated. We propose that past changes in land use are also a strong contributing factor in ongoing organic carbon trends in other regions that underwent similar comprehensive changes due to early cultivation and grazing over centuries to millennia.

Keywords: lake-water quality | carbon cycling | land use | Holocene | paleoecology

SIROCKO 2007

FRANK SIROCKO, MARTIN CLAUSSEN, MARÍA FERNANDA SÁNCHEZ GOÑI & THOMAS LITT (Hrsg.), *The climate of past interglacials*. *Developments in Quaternary Science 7 (Amsterdam 2007)*.

Historically, climate fluctuations, such as the Little Ice Age, show that interglacial climate change is not entirely stable, but responds to even subtle changes in radiative forcing. Through research, it has been made clear that even an abrupt change of climate within years is not just a theoretical possibility but has in fact happened in the prehistoric past. It is therefore clear that in principle it could happen again. Human civilization has exploded under the mild and relatively stable climatic conditions that have prevailed over the last 11,000 years.

This book focuses on revisiting the past and to study climate and environment in a suite of experiments where boundary conditions are similar but not identical to today so we can learn about the climate-environment system, its sensitivity, thresholds and feedback. The palaeoclimate community holds an important key to scientific information on climate change that provides a basis for appropriate adaptation and mitigation strategies. The authors of this book have taken up this challenge and summarize their results in this special volume. It presents state-of-the-art science on new reconstructions from all spheres of the Earth System and on their synthesis, on methodological advances, and on the current ability of numerical models to simulate low and high frequency changes of climate, environment, and chemical cycling related to interglacials.

Kultur

MARTIN 2015

Wednesday Martin, *Poor Little Rich Women*. [New York Times 2015, May 16](#).

The women I met, mainly at playgrounds, play groups and the nursery schools where I took my sons, were mostly 30-somethings with advanced degrees from prestigious universities and business schools. They were married to rich, powerful men, many of whom ran hedge or private equity funds; they often had three or four children under the age of 10; they lived west of Lexington Avenue, north of 63rd Street and south of 94th Street; and they did not work outside the home.

But as my inner anthropologist quickly realized, there was the undeniable fact of their cloistering from men. “It’s easier and more fun,” the women insisted when I asked about the sex segregation that defined their lives. “We prefer it,” the men told me at a dinner party where husbands and wives sat at entirely different tables in entirely different rooms.

Kupfer

GARNER 2015

Jennifer Garner, *Bronze Age tin mines in central Asia*. In: ANDREAS HAUPTMANN & DIANA MODARRESSI-TEHRANI (Hrsg.), *Archaeometallurgy in Europe III, Proceedings of the 3rd International Conference Deutsches Bergbau-Museum Bochum June 29 – July 1, 2011*. Der Anschnitt, Beiheft 26 ([Bochum 2015](#)), 135–143.

Since the oldest known artifacts of tin bronze appeared in Mesopotamia and ancient Orient, more and more questions arose about the origin of this alloy, particularly since neither copper nor tin deposits are present in Mesopotamia. Due to this fact some researchers believe that the source of the metal, especially tin, is located in Central Asia. In Central Asia are large copper and tin deposits with traces of mining, dating to the middle and Late Bronze age (2nd millennium BC). Tin production during the Early Bronze Age is also likely, since the first tin-bronze artefacts appeared within the Sejma-Turbino circle during the End of 3rd millennium BC. The Zeravshan valley possesses large tin deposits and a part of the later Silk Road leads through the valley connecting the eastern with the western regions. Several different tin mining districts in the Zeravshan valley were excavated: in Karnab and Lapas, situated between Samarkand and Bokhara; Èangali near Kattakurgan; Mushiston, which is not far away from Pendjikent and the famous settlement of Sarazm. The Mining took place in open cast trench mines, which followed the veins into an unknown depth or, like in Mushiston, in an underground mine, which old galleries and chambers formed a huge labyrinth. Ceramic typology and radiocarbon dates date the mines in Karnab, Lapas and Changali to the middle 2nd millennium BC (Andronovo-Tazabagjab culture). Only Mushiston started at the end of the 3rd millennium BC and stopped in the late Bronze Age.

Metallzeiten

FISCHER 2015

Josef Fischer, *Wer saß einst auf Mykenes Thron?* [Spektrum der Wissenschaft 2015, vi, 44–50](#).

Trutzige Burgen, kostbare Grabbeigaben, Freskenmalerei und eine eigene Schrift – die nach dem Fundort Mykene benannte frühgriechische Kultur beeindruckt uns bis heute. Doch ihre Regierungsform stellt Archäologen vor Rätsel. Herrschte ein Großkönig über den gesamten Kulturraum, oder teilten sich die mehrere Herrscher die Macht?

SPERLICH 2015

Waltraud Sperlich, *Auf den Spuren Homers*. [Spektrum der Wissenschaft 2015](#), vi, 51–53.

Lange galten das antike Lakonien und seine Hauptstadt Sparta Mykene-Experten als wenig interessant. Doch in den letzten Jahren mehren sich Hinweise darauf, dass auch dort ein Palast stand: so wie es Homer beschrieben hat.

Mittelpaläolithikum

BENAZZI 2014

Stefano Benazzi et al., *Middle Paleolithic and Uluzzian human remains from Fumane Cave, Italy*. [Journal of Human Evolution 70](#) (2014), 61–68.

Stefano Benazzi, Shara E. Bailey, Marco Peresani, Marcello A. Mannino, Matteo Romandini, Michael P. Richards & Jean-Jacques Hublin

The site of Fumane Cave (western Lessini Mountains, Italy) contains a stratigraphic sequence spanning the Middle to early Upper Paleolithic. During excavations from 1989 to 2011, four human teeth were unearthed from the Mousterian (Fumane 1, 4, 5) and Uluzzian (Fumane 6) levels of the cave. In this contribution, we provide the first morphological description and morphometric analysis of the dental remains. All of the human remains, except for Fumane 6, are deciduous teeth. Based on metric data (crown and cervical outline analysis, and lateral enamel thickness) and non-metric dental traits (e.g., mid-trigonid crest), Fumane 1 (lower left second deciduous molar) clearly belongs to a Neandertal. For Fumane 4 (upper right central deciduous incisor), the taxonomic attribution is difficult due to heavy incisal wear. Some morphological features observed in Fumane 5 (lower right lateral deciduous incisor), coupled with the large size of the tooth, support Neandertal affinity. Fumane 6, a fragment of a permanent molar, does not show any morphological features useful for taxonomic discrimination. The human teeth from Fumane Cave increase the sample of Italian fossil remains, and emphasize the need to develop new methods to extract meaningful taxonomic information from deciduous and worn teeth.

Keywords: Deciduous teeth | *Homo neanderthalensis* | *Homo sapiens* | Late Pleistocene | Southern Europe

WENZEL 2007

Stefan Wenzel, *Neandertal Presence and Behaviour in Central and Northwestern Europe During MIS 5e*. In: FRANK SIROCKO, MARTIN CLAUSSEN, MARÍA FERNANDA SÁNCHEZ GOÑI & THOMAS LITT (Hrsg.), *The climate of past interglacials*. Developments in Quaternary Science 7 ([Amsterdam 2007](#)), 173–193.

The dense interglacial forests of Central and Northwestern Europe are considered to have been less productive environments and therefore less favourable habitats for humans than the grasslands of glacial Europe. However, there are several sites which attest to the presence of hominids from the beginning of MIS

5e to its climatic optimum (Quercetum mixtum-Corylus phase). So far, there is no evidence of hominids during the Carpinus phase, and only a few archaeological sites are known from younger biozones of the Eemian. Britain seems to have been totally unpopulated due to its island position. The Early Neanderthals inhabiting Europe hunted big game and presumably cached goods and practised symbolic behaviour. Artefacts made of material found more than 60 km away from the outcrops are indicative of mobility and social networks no different to those of Neanderthals living under more continental climatic conditions.

Physik

MERALI 2015

Zeeya Merali, *What is Really Real? A wave of experiments is probing the root of quantum weirdness.* [nature](#) **521** (2015), 278–280.

That is essentially what Fedrizzi’s team tested. The group measured polarization and other features in a beam of photons and found a level of overlap that could not be explained by the ignorance models. The results support the alternative view that, if objective reality exists, then the wavefunction is real. “It’s really impressive that the team was able to address a profound issue, with what’s actually a very simple experiment,” says Andrea Alberti, a physicist at the University of Bonn in Germany.

Distinguishing Everett’s manyworlds interpretation from standard quantum theory is tough because both make exactly the same predictions. But last year, Howard Wiseman at Griffith University in Brisbane and his colleagues proposed a testable multiverse model¹³. Their framework does not contain a wavefunction: particles obey classical rules such as Newton’s laws of motion. The weird effects seen in quantum experiments arise because there is a repulsive force between particles and their clones in parallel universes. “The repulsive force between them sets up ripples that propagate through all of these parallel worlds,” Wiseman says.

Story or Book

MOEBUS 2015

Theresa Moebus, *What if? Was wäre wenn? – Wirklich wissenschaftliche Antworten auf absurde hypothetische Fragen.* [Spektrum der Wissenschaft](#) **2015**, vi, 88.

What If?: Serious Scientific Answers to Absurd Hypothetical Questions. Randall Munroe. John Murray (24. September 2015), 978-1848549562

Randall Munroe. *What if? Was wäre wenn? – Wirklich wissenschaftliche Antworten auf absurde hypothetische Fragen.* Aus dem Englischen von Ralf Pannowitsch. Knaus, München 2014. 368 S., E 14,99

Kann man ein Steak braten, indem man es aus großer Höhe fallen lässt? Was würde passieren, wenn alle Blitze, die in einem bestimmten Moment auf der Welt niedergehen, an derselben Stelle einschlagen? Wie viele Maschinengewehre braucht man, um mit deren Rückstoß abzuheben? Und wie lange hält ein U-Boot im Weltraum durch? Auch absurde Fragen verdienen Antworten, dachte sich Randall Munroe und gibt sie im vorliegenden Buch. Der ehemalige Robotik-Experte der NASA lässt darin Wissenschaft und Fiktion aufeinanderprallen. Für die Leser ist das ein großer Spaß: Munroe kommentiert ironisch, zeichnet Comics und inszeniert sich als liebenswürdiger Nerd. Bei alledem vermittelt er erstaunlich viel Wissen – vor allem darüber, wie man an Fragen wissenschaftlich herangeht. Ein empfehlenswertes Buch.

SHVARTSMAN 2015

Alex Shvartsman, *Grains of Wheat, A lesson learned.* [nature](#) **521** (2015), 386.

He'd gladly pay for treatment. He glanced at the bill and suppressed a chuckle; it was a measly \$127. Like her father, Rohana didn't seem to grasp that pharmaceuticals were always a sellers' market, and consumers would reach as deep as they had to into their pockets when it came to their well-being.

STRICK 2015

Heinz Klaus Strick, *Launiger Streifzug durchs Abstrakte.* [Spektrum der Wissenschaft](#) **2015**, vi, 90–91.

Journalist Alex Bellos unternimmt eine Reise durch die Welt der Zahlen und weiß dabei viel zu erzählen.

Alex Through the Looking-glass. Alex Bellos. Bloomsbury Export Editions; 978-1408850985

Alex Bellos. Warum die Elf hat, was die Zehn nicht hat. Entdeckungstouren in die faszinierende Welt der Zahlen. Aus dem Englischen von Bernhard Kleinschmidt. Berlin-Verlag, Berlin 2015, 396 S., E 22,99

Dabei legt er einen plaudernden Schreibstil, den viele Leser als ansprechend empfinden dürften. Positiv hervorzuheben sind die Klarstellungen, Anmerkungen und Literaturhinweise im Anhang sowie ein 18-seitiges Glossar. Das Werk enthält auch zahlreiche Abbildungen und Graiken, die das Verständnis fördern.

“Warum die Elf hat, was die Zehn nicht hat” eignet sich als Geschenk für mathematisch Interessierte. Trotz der genannten Schwächen ist es unterhaltsam und informativ geschrieben und hat durchaus das Potenzial, auch jugendliche Leser zu erreichen.

TURCHIN 2015

Peter Turchin, *Cultivating human culture, Did food and fuel help shape our value systems?* [science](#) **348** (2015), 508.

Foragers, Farmers, and Fossil Fuels. How Human Values Evolve. Ian Morris. Princeton University Press, 2015. 393 pp.

Morris argues that “foraging values”—fierce egalitarianism, rejection of hierarchy, tolerance for high levels of violence—characterize societies that subsist by gathering and hunting. Farming societies, however, value hierarchy and are less tolerant of violence because these traits promote social stability, which is needed to cultivate fields. He argues that fossil fuel–driven societies see political and gender hierarchy as a bad thing because hierarchy stifles creativity and innovation, important attributes in these societies.

But does the causal arrow operate from technology to morality? In my view, the evidence supports an alternative hypothesis—that shifting moral values lead to the development and adoption of new technologies (or that, perhaps, there is a dynamical feedback between the two).

The institution of private property would have had to precede or coevolve with agriculture, not follow it (4). There is also evidence that the transition to fossil-fuel economies was preceded, not followed, by a shift in social norms. Morris himself acknowledges that the Age of Enlightenment preceded the Industrial Revolution, for example.