

## References

### Afrika

FRANKE 2016

Gabriele Franke, *A Chronology of the Central Nigerian Nok Culture, 1500 BC to the Beginning of the Common Era*. [Journal of African Archaeology 14 \(2016\), 257–289](#).

The Central Nigerian Nok Culture and its well-known terracotta figurines have been the focus of a joint research project between the Goethe University Frankfurt and the National Commission for Museums and Monuments in Nigeria since 2005. One major research question concerns chronological aspects of the Nok Culture, for which a period from around the middle of the first millennium BC to the first centuries AD had been suggested by previous investigations. This paper presents and discusses the radiocarbon and luminescence dates obtained by the Frankfurt Nok project. Combining the absolute dates with the results of a comprehensive pottery analysis, a chronology for the Nok Culture has been developed. An early phase of the Nok Culture's development begins around the middle of the second millennium BC. Its main phase, in which terracotta figurines and iron production appear, starts in the 9th century BC and ends in the 4th century BC. A later phase with vanishing evidence extends into the last centuries BC. On sites dating from the first centuries AD onwards no more Nok terracotta or pottery are found; the end of the Nok Culture is thus set around the turn of the Common Era.

Keywords: Nok Culture | Nigeria | chronology | radiocarbon dating | pottery | Iron Age

JUNIUS 2016

Henrik Junius, *Nok Early Iron Production in Central Nigeria, New Finds and Features*. [Journal of African Archaeology 14 \(2016\), 291–311](#).

Between 2005 and 2013, new archaeometallurgical finds and features in central Nigeria resulted from several excavation campaigns conducted by the Nok research project, Goethe University, Frankfurt. This article presents the first excavation results and compares the newly generated data to the publications on the Nok iron smelting site of Taruga from 40 years ago. All newly excavated sites find close resemblance in each other in regards to dates in the middle of the first millennium BCE, furnace design, find distribution and find properties. In some cases, the finds from the Taruga valley fit in the new and homogeneous picture of Nok iron metallurgy. However, Taruga differs from the new sites in its variety of furnace design and number of furnaces.

Whereas furnace bases with a width of around one meter based on slag pits partially filled with slag seem to be the rule for all newly excavated Nok furnaces, only some furnaces at Taruga exhibit these characteristics. Furnace variability at Taruga could be explained by a longer and/or subsequent site usage through time. Modern era finds like a clay smoking pipe, the higher number of furnaces per site as well as a higher dispersion of absolute dates and the variability of furnace design could support this assumption. This paper concentrates on the archaeological context of a specific type of early iron technology in central Nigeria; ongoing archaeometric analysis of all related finds will be presented elsewhere.

Keywords: Nok | Taruga | iron smelting | iron technology | Nigeria | West Africa

## Aktuell

### BACON 2019

Christine D. Bacon, *Travel for two*. [science 364 \(2019\), 902](#).

As I boarded the plane to Spain a few months ago, I looked forward to catching some sun and scientific stimulation at a conference in the middle of the dark, wet Swedish winter. I went through my upcoming oral presentation in my head as my 4-year-old ran ahead, searching for our seats. We have traveled together as a dynamic duo ever since my baby was 3 months old, when we set off to Brazil to attend a conference and conduct fieldwork. I am a nontenured researcher looking for a permanent academic position, and travel is crucial for building my reputation and CV. But this trip would be our last for a while, because paying for my child's travel has rendered me a bankrupt botanist.

### BOUJO 2019

E. Boujo & M. Sellier, *Pancake making and surface coating, Optimal control of a gravity-driven liquid film*. [Physical Review Fluids 4 \(2019\), e64802](#). DOI:10.1103/PhysRevFluids.4.064802.

This paper investigates the flow of a solidifying liquid film on a solid surface subject to a complex kinematics, a process relevant to pancake making and surface coating. The flow is modeled using the lubrication approximation, with a gravity force whose magnitude and direction depend on the time-dependent orientation of the surface. Solidification is modeled with a temperature-dependent viscosity. Because the flow eventually ceases as the liquid film becomes very viscous, the key question this study aims to address is: what is the optimal surface kinematics for spreading the liquid layer uniformly? Two methods are proposed to tackle this problem. In the first one, the surface kinematics is assumed a priori to be harmonic and parameterized. The optimal parameters are inferred using the Monte Carlo method. This “brute-force” approach leads to a moderate improvement of the film uniformity compared to the reference case when no motion is imposed to the surface. The second method is formulated as an optimal control problem, constrained by the governing partial differential equation, and solved with an adjoint equation. Key benefits of this method are that no assumption is made on the form of the control, and that significant improvement in thickness uniformity are achieved with a comparatively smaller number of evaluations of the objective function.

### LUTZ 2019

Wolfgang Lutz, Jesus Crespo Cuaresma, Endale Kebede, Alexia Prskawetz, Warren C. Sanderson & Erich Striessnig, *Education rather than age structure brings demographic dividend*. [PNAS 116 \(2019\), 12798–12803](#).

[pnas116-12798-Supplement.pdf](#)

The relationship between population changes and economic growth has been debated since Malthus. Initially focusing on population growth, the notion of demographic dividend has shifted the attention to changes in age structures with an assumed window of opportunity that opens when falling birth rates lead to a relatively higher proportion of the working-age population. This has become the dominant paradigm in the field of population and development, and an advocacy tool for highlighting the benefits of family planning and fertility decline. While this view acknowledges that the dividend can only be realized if associated with investments in human capital, its causal trigger is still seen in exogenous fertility decline. In contrast, unified growth theory has established human capital as

a trigger of both demographic transition and economic growth. We assess the relative importance of changing age structure and increasing human capital for economic growth for a panel of 165 countries during the time period of 1980–2015. The results show a clear dominance of improving education over age structure and give evidence that the demographic dividend is driven by human capital. Declining youth dependency ratios even show negative impacts on income growth when combined with low education. Based on a multidimensional understanding of demography that considers education in addition to age, and with a view to the additional effects of education on health and general resilience, we conclude that the true demographic dividend is a human capital dividend. Global population policies should thus focus on strengthening the human resource base for sustainable development.

**Keywords:** demography | economic growth | education | age structure

**Significance:** Global environmental change and discussions about the drivers of international migration lead to renewed interest in population growth and global demographic change. The notion of the demographic dividend was introduced to highlight the benefits of fertility decline, yet, among African leaders, it is also often interpreted as describing the benefits of their youthful populations. Due to its controversial nature, the topic of population was not explicitly included in the Sustainable Development Goals. In this controversial discussion, this paper provides a systematic reassessment about what aspects of demographic change have beneficial consequences for economic growth and sustainable development.

## PARK 2019

Yoobin Park & Geoff MacDonald, *Consistency between individuals' past and current romantic partners' own reports of their personalities*. *PNAS* **116** (2019), 12793–12797.

Do people have a “type” when it comes to their romantic partners' personalities? In the present research, we used data from a 9-y longitudinal study in Germany and examined the similarity between an individual's ex- and current partners using the partners' self-reported personality profiles. Based on the social accuracy model, our analyses distinguished similarity between partners that was attributable to similarity to an average person (normative similarity) and resemblance to the target participant himself/herself (selfpartner similarity) to more precisely examine similarity from partner to partner (distinctive similarity). The results revealed a significant degree of distinctive partner similarity, suggesting that there may indeed be a unique type of person each individual ends up with. We also found that distinctive partner similarity was weaker for people high in extraversion or openness to experience, suggesting that these individuals may be less likely to be in a relationship with someone similar to their ex-partner (although the individual difference effects were not mirrored in an alternative analytic approach). These findings provide evidence for stability in distinctive partner personality and have important implications for predicting future partnering behaviors and actions in romantic relationships.

**Keywords:** partner personality | partnering patterns | romantic relationships

**Significance:** Although a romantic partner's personality creates an interpersonal environment that can be highly consequential for emotional and physical well-being, little research has examined to what degree romantic partners' personalities are similar across relationships. In this study, we provide evidence of stability in partner personality, implementing a rigorous analysis using selfreports of personalities from both past and current partners themselves. The significant degree of unique similarity between an individual's past and current partners could not be explained by important potential confounds. Our results also provided tentative

evidence that this similarity is weaker for people who are more extraverted or open to experience.

#### SCHAUER 2019

Peter Schauer, Stephen Shennan, Andrew Bevan, Gordon Cook, Kevan Edinborough, Ralph Fyfe, Tim Kerig & Mike Parker Pearson, *Supply and demand in prehistory? Economics of Neolithic mining in northwest Europe*. [Journal of Anthropological Archaeology](#) **54** (2019), 149–160.

The extent to which non-agricultural production in prehistory had cost-benefit motivations has long been a subject of discussion. This paper addresses the topic by looking at the evidence for Neolithic quarrying and mining in Britain and continental northwest Europe and asks whether changing production through time was influenced by changing demand. Radiocarbon dating of mine and quarry sites is used to define periods of use. These are then correlated with a likely first-order source of demand, the size of the regional populations around the mines, inferred from a radiocarbon-based population proxy. There are significant differences between the population and mine-date distributions. Analysis of pollen data using the REVEALS method to reconstruct changing regional land cover patterns shows that in Britain activity at the mines and quarries is strongly correlated with evidence for forest clearance by incoming Neolithic populations, suggesting that mine and quarry production were a response to the demand that this created. The evidence for such a correlation between mining and clearance in continental northwest Europe is much weaker. Here the start of large-scale mining may be a response to the arrival by long-distance exchange of high-quality prestige jade axes from a source in the Italian Alps.

**Keywords:** Neolithic | Britain | Northwest Europe | Mining | Quarrying | Radiocarbon | Population | Land cover

#### SHOVER 2019

Chelsea L. Shover, Corey S. Davis, Sanford C. Gordon & Keith Humphreys, *Association between medical cannabis laws and opioid overdose mortality has reversed over time*. [PNAS](#) **116** (2019), 12624–12626.

Medical cannabis has been touted as a solution to the US opioid overdose crisis since Bachhuber et al. [M. A. Bachhuber, B. Saloner, C. O. Cunningham, C. L. Barry, *JAMA Intern. Med.* 174, 1668–1673] found that from 1999 to 2010 states with medical cannabis laws experienced slower increases in opioid analgesic overdose mortality. That research received substantial attention in the scientific literature and popular press and served as a talking point for the cannabis industry and its advocates, despite caveats from the authors and others to exercise caution when using ecological correlations to draw causal, individual-level conclusions. In this study, we used the same methods to extend Bachhuber et al.’s analysis through 2017. Not only did findings from the original analysis not hold over the longer period, but the association between state medical cannabis laws and opioid overdose mortality reversed direction from -21% to +23% and remained positive after accounting for recreational cannabis laws. We also uncovered no evidence that either broader (recreational) or more restrictive (low-tetrahydrocannabinol) cannabis laws were associated with changes in opioid overdose mortality. We find it unlikely that medical cannabis—used by about 2.5% of the US population—has exerted large conflicting effects on opioid overdose mortality. A more plausible interpretation is that this association is spurious. Moreover, if such relationships

do exist, they cannot be rigorously discerned with aggregate data. Research into therapeutic potential of cannabis should continue, but the claim that enacting medical cannabis laws will reduce opioid overdose death should be met with skepticism.

Keywords: medical cannabis | opioid overdose | public policy

#### THAREANI 2019

Yifat Thareani, *From expelled refugee to imperial envoy, Assyria's deportation policy in light of the archaeological evidence from Tel Dan*. [Journal of Anthropological Archaeology](#) **54** (2019), 218–234.

Practiced by most ancient empires, forced movement of populations distinguished by ethnicity, class, religion or profession had far-reaching political, economic and cultural consequences on indigenous societies. Assyria's expansion westward in the late eighth – early seventh centuries BCE not only enhanced forced population transfers from and into its conquered regions; it was a regular feature of its policy. Recent studies have emphasized the role of archaeology in illustrating diverse imperial strategies practiced by the Assyrians. By following the archaeological footprints of the massive movement of people and products across the imperial space, I will emphasize the agency of deported craftsmen in the empire-building act and its implications for the economy and social composition of local communities. The Iron Age II remains at Tel Dan are the focus of this paper.

Keywords: Deportation | Imperial strategies | Assyria | Potters | Social agency

#### WEBER 2019

Jesse N. Weber & Wenfei Tong, *Jumping gene gave fish a freshwater start*. [science](#) **364** (2019), 831–832.

Fish diversification depended on multiple copies of a metabolic gene.

## Amerika

#### GOEBEL 2019

Ted Goebel & Kelly E. Graf, *Beringian Archaeology and Ancient Genomics, A New Synthesis*. [SAA Archaeological Record](#) **19** (2019), iii, 21–33.

The archaeological data south of the LIS and CIS indicate the presence of early human populations by at least 14,200 cal yr BP (Jenkins et al. 2012) and perhaps as early as 15,000 cal yr BP (Waters et al. 2018). Existing data for the IFC provide no compelling evidence for the availability or viability of this route until well after 14,000 cal yr BP and likely until nearer 13,200 cal yr BP. In contrast, the PCR provides suggestions for extensive lowland landscapes after  $\approx 15,000$  cal yr BP and increasingly diverse and abundant vertebrate records by  $\approx 14,500$  cal yr BP. If the first peoples did indeed traverse from Beringia to continental North America by  $\approx 15,000$ – $14,500$  cal yr BP, the existing evidence strongly favours the PCR.

#### JENNINGS 2019

Thomas A. Jennings & Ashley M. Smallwood, *The Clovis Record*. [SAA Archaeological Record](#) **19** (2019), iii, 45–50.

## POLITIS 2019

Gustavo G. Politis & Luciano Prates, *The Pre-Clovis Peopling of South America*. [SAA Archaeological Record 19 \(2019\), iii, 40–44.](#)

It is clear that humans were in South America when Clovis people expanded in North America and that these populations were there at least 1,500 years before Clovis. No projectile points (except the few broken points in Monte Verde II) were found in any pre-Clovis South American sites, and megamammals constitute a significant occurrence only in Arroyo Seco 2. The first evidence of continuous human occupation in South America is found between  $\approx 14,500$  and 14,000 cal BP. At  $\approx 13,000$  cal BP, in coincidence with Clovis in North America, there is a significant increase in sites, and these are scattered in the main regions of South America.

## RAFF 2019

Jennifer Raff, *Genomic Perspectives on the Peopling of the Americas*. [SAA Archaeological Record 19 \(2019\), iii, 12–15.](#)

The series of rapid population splits selected in ancient South American genomes argues strongly for a peopling process “akin to leap-frogging across large portions of the diverse intervening landscape” (Moreno-Mayar et al. 2018b:18). This is consistent not only with the unimpeded movement of peoples into previously unoccupied lands, but also with the more rapid dispersal process via boat (rather than more slowly by foot across land). Indeed, evidence from eDNA taken from lake sediment cores in the center of the ice-free corridor region (Pedersen et al. 2016) shows that the interior route was not viable until about 12,600 years ago, supporting a coastal route as the most likely path of initial dispersal of pre-Clovis peoples. This too is a hypothesis that needs further testing with archaeological data.

## WATERS 2019

Michael R. Waters, *Early Exploration and Settlement of North America During the Late Pleistocene*. [SAA Archaeological Record 19 \(2019\), iii, 34–39.](#)

Our understanding of the late Pleistocene peopling of the Americas has undergone rapid change in the last few decades. New archaeological discoveries and the reinvestigation of old sites using modern technologies have shed new light on the first Americans, and genetic studies have illuminated their population ancestry. Both are converging to tell a new and consistent story of the first Americans, with people first arriving by  $\approx 15,500$  years ago, spreading across the Americas, and leaving both an archaeological and genetic signal we are just beginning to understand. We will continue to advance our understanding of the earliest people to enter North America by undertaking more genetic studies and excavating more archaeological sites, with special attention paid to site geology, site formation, and geochronology.

## Anthropologie

## ENGELMANN 2019

J. B. Engelmann, B. Schmid, C. K. W. De Dreu, J. Chumbley & E. Fehr, *On the psychology and economics of antisocial personality*. [PNAS 116 \(2019\), 12781–12786.](#)

[pnas116-12781-Supplement.pdf](#)

How do fundamental concepts from economics, such as individuals' preferences and beliefs, relate to equally fundamental concepts from psychology, such as relatively stable personality traits? Can personality traits help us better understand economic behavior across strategic contexts? We identify an antisocial personality profile and examine the role of strategic context (the "situation"), personality traits (the "person"), and their interaction on beliefs and behaviors in trust games. Antisocial individuals exhibit a specific combination of beliefs and preferences that is difficult to reconcile with a rational choice approach that assumes that beliefs about others' behaviors are formed rationally and therefore, independently from preferences. Variations in antisocial personality are associated with effect sizes that are as large as strong variations in strategic context. Antisocial individuals have lower trust in others unless they know that they can punish them. They are also substantially less trustworthy, believe that others are like themselves, and respond to the possibility of being sanctioned more strongly, suggesting that they anticipate severe punishment if they betray their partner's trust. Antisocial individuals are not simply acting in their economic self-interest, because they harshly punish those who do not reciprocate their trust, although that reduces their economic payoff, and they do so nonimpulsively and in a very calculated manner. Antisocial individuals honor others' trust significantly less (if they cannot be punished) but also, harshly punish those who betray their trust. Overall, it seems that antisocial individuals have beliefs and behaviors based on a view of the world that assumes that most others are as antisocial as they themselves are.

**Keywords:** trust | antisocial | personality | punishment | person situation

**Significance:** Using an interdisciplinary experimental approach grounded in behavioral economics and personality psychology, we identify an antisocial personality profile and examine its role across strategic contexts. Antisocial individuals exhibit a specific combination of behaviors and beliefs: they have a high propensity to betray others' trust and believe that others are like them, but if given a punishment opportunity, they impose very harsh sanctions on those who betray their trust. More generally, antisocial individuals show beliefs and behaviors that are consistent with the assumption that most others are as antisocial as they themselves are.

## GURVEN 2019

Michael D. Gurven & Raziel J. Davison, *Periodic catastrophes over human evolutionary history are necessary to explain the forager population paradox*. *PNAS* **116** (2019), 12758–12766.

[pnas116-12758-Supplement.pdf](#)

The rapid growth of contemporary human foragers and steady decline of chimpanzees represent puzzling population paradoxes, as any species must exhibit near-stationary growth over much of their evolutionary history. We evaluate the conditions favoring zero population growth (ZPG) among 10 small-scale subsistence human populations and five wild chimpanzee groups according to four demographic scenarios: altered mean vital rates (i.e., fertility and mortality), vital rate stochasticity, vital rate covariance, and periodic catastrophes. Among most human populations, changing mean fertility or survivorship alone requires unprecedented alterations. Stochastic variance and covariance would similarly require major adjustment to achieve ZPG in most populations. Crashes could maintain ZPG in slow-growing populations but must be frequent and severe in fast-growing populations—more extreme than observed in the ethnographic record. A combination of vital rate alteration with catastrophes is the most realistic solution to the forager population paradox. ZPG in declining chimpanzees is more readily obtainable through reducing mortality and altering covariance. While some human

populations may have hovered near ZPG under harsher conditions (e.g., violence or food shortage), modern *Homo sapiens* were equipped with the potential to rapidly colonize new habitats and likely experienced population fluctuations and local extinctions over evolutionary history.

**Keywords:** life history | hunter-gatherers | chimpanzees | population growth | forager population paradox

**Significance:** Much of what is known about human life histories is based on studying modern hunter-gatherers experiencing rapid population growth. Yet, if populations are near-stationary over most of their evolutionary history, the positive growth of contemporary foragers is puzzling and potentially unrepresentative. Investigating multiple demographic scenarios in a large sample of human and chimpanzee populations, we find that periodic catastrophes combined with plausible fertility or mortality reductions can reasonably generate zero population growth. Our findings bolster arguments about the role of intergenerational cooperation and cumulative culture in supporting the colonizing potential of human populations once released from catastrophes.

## JOORDENS 2019

Josephine C. A. Joordens, Craig S. Feibel, Hubert B. Vonhof, Anne S. Schulp & Dick Kroon, *Relevance of the eastern African coastal forest for early hominin biogeography*. [Journal of Human Evolution 131 \(2019\), 176–202](#).

The influence of climate change on hominin evolution is much debated. Two issues hamper our understanding of this process: the limited hominin fossil record, and incomplete knowledge about hominin spatial occupation of Africa. Here, we analyze the presently known hominin fossil distribution pattern and explore the potential geographic distribution of hominins between  $\approx 4.5$  and  $\approx 2.5$  Ma. We focus on assessing the relevance of the Coastal Forest of Eastern Africa (CFEA) along the Indian Ocean as a core area for early hominin evolution. Based on biogeographic-phylogeographic data we propose the coastal refuge hypothesis: the CFEA provided a refugium for early hominins in periods of variable climate and strong seasonality during eccentricity maxima. From this refuge, evolved species could disperse inland (e.g. to rift basins) via vegetated humid corridors, whenever onset of stable climate periods with low seasonality during eccentricity minima allowed expansion out of the coastal enclave. We develop a conceptual model in time and space, comparing predictions with climatic and hominin fossil records. The results imply that:

- 1) between  $\approx 4.5$  and 3 Ma, ongoing (mostly anagenetic) hominin evolution occurred in the CFEA, punctuated by inland dispersal events at  $\approx 4.4$ , 4.2, 3.8, 3.5, and 3.2 Ma;
- 2) before  $\approx 3$  Ma, the Afar Basin was a (sub)core area often connected to and relatively similar to the CFEA, while other inland areas were more or less marginal for early hominin habitation;
- 3) after  $\approx 3$  Ma, Northern Hemisphere Glaciation exerted strong influence by causing latitudinal contraction of the CFEA, leading to habitat fragmentation, isolation of hominin populations and possible cladogenetic evolution.

A major challenge for the coastal refuge model is the fact that at present, no (hominin) fossils are known from the CFEA. We consider how this can be explained, and possibly overcome with targeted search efforts. Furthermore we discuss how the model can be tested, e.g. with molecular phylogeography approaches, and used to predict new hominin fossil locations. With this study, we hope to contribute a fresh perspective to the climate-evolution debate, emphasizing the



role of climatic stability, length of dry season and vegetation cover to facilitate connectivity between hominin core and marginal habitats.

Keywords: Hominin evolution | Refugium | Climate stability | Eccentricity | Dispersal corridors

## RODRÍGUEZ 2019

Jesús Rodríguez, Zorrilla-Revilla Guillermo & Mateos Ana, *Does optimal foraging theory explain the behavior of the oldest human cannibals?* [Journal of Human Evolution](#) **131** (2019), 228–239.

Cannibalism is an old and widespread human practice; however, the causes and meaning of consuming other humans are still hotly debated. Several explanations are possible for cannibalistic behavior, ranging from social and cultural motivations to purely nutritional causes. In this study, we analyze the oldest known case of cannibalism to date in the framework of the Optimal Foraging Theory (OFT). The fossil assemblage from the TD6.2 unit of the Gran Dolina site (Sierra de Atapuerca, Spain), dated to c. 0.9 Ma, includes the remains of several hominins (*Homo antecessor*) with unquestionable signs of cannibalism and a large collection of fossils of other mammals, also with evidence of human consumption. The Optimal Foraging Theory predicts that foragers confronted with a number of options aim to maximize their return rate, obtaining the maximum benefit with the minimum cost. We estimated the nutrient caloric return and the cost of acquisition of humans and other large mammals in TD6.2, and evaluated the rank of hominins among all the food resources harvested by *H. antecessor* using a Prey Choice Model (PreyCM). We also show that the abundance of the different prey types represented in the TD6.2 assemblage is proportional to the abundance of those resources in the environment, a prediction of the OFT. Although TD6.2 assemblage fits the predictions of the PreyCM, humans are overrepresented with respect to their estimated abundance in the environment. This overrepresentation of hominins was likely due to a higher encounter rate, as may be expected if the cannibalized individuals belonged to the same group as the foragers, although other explanations are possible. The results presented here show that hominins were a high-ranked prey type and, thus, their inclusion in the diet of *H. antecessor* is predicted by the OFT.

Keywords: Cannibalism | Prey choice model | Human behavioral ecology | *Homo antecessor* | Atapuerca

## Bibel

### CLINES 2019

David J. A. Clines, *What's Wrong with Genesis 1? Text and Translation.* [unknown](#) (2019), preprint, 1–13. .

How defective is the MT of Genesis 1? I have reviewed only six places, in each of which I have some confidence that the text is corrupt. There are many other places, however, that are open to question, especially when the evidence of the ancient versions is taken into account. In his edition, Hendel notes 67 words in Gen. 1.1–2.4a where there are variants between the MT and the ancient versions. That means—since there are 397 words in the passage—that one in every 5.9 words raises a textual issue.

This is a result wholly in harmony with my previous studies, mentioned at the beginning of this paper, on the attested frequency of textual issues: one word in four for 2 Samuel 22 || Psalm 18, one word in every 5.9 for Ezra 2 || Nehemiah 7. The only difference in Genesis 1 is that there is no Masoretic parallel to Genesis 1.

## Energie

HAEGEL 2019

Nancy M. Haegel et al., *Terawatt-scale photovoltaics, Transform global energy.* [science](#) **364** (2019), 836–838.

[s364-0836-Supplement.pdf](#)

Improving costs and scale reflect looming opportunities

Nancy M. Haegel, Harry Atwater Jr., Teresa Barnes, Christian Breyer, Anthony Burrell, Yet-Ming Chiang, Stefaan De Wolf, Bernhard Dimmler, David Feldman, Stefan Glunz, Jan Christoph Goldschmidt, David Hochschild, Ruben Inzunza, Izumi Kaizuka, Ben Kroposki, Sarah Kurtz, Sylvere Leu, Robert Margolis, Koji Matsubara, Axel Metz, Wyatt K. Metzger, Mahesh Morjaria, Shigeru Niki, Stefan Nowak, Ian Marius Peters, Simon Philipps, Thomas Reindl, Andre Richter, Doug Rose, Keiichiro Sakurai, Rutger Schlatmann, Masahiro Shikano, Wim Sinke, Ron Sinton, B.J. Stanbery, Marko Topic, William Tumas, Yuzuru Ueda, Jao van de Lagemaat, Pierre Verlinden, Matthias Vetter, Emily Warren, Mary Werner, Masafumi Yamaguchi, Andreas W. Bett

At high penetration, increased PV installation is synergistic with increased storage. Tesla recently installed a 100-MW battery in South Australia and in the first 6 months recovered 14% of the capital cost. California is also setting aggressive targets for storage. The price of lithium-ion batteries has decreased by more than 80% in the past 8 years.

To achieve the U.S. Department of Energy target price of U.S.\$ 150/kWh for automotive batteries capable of charging within 15 minutes, research should explore materials with higher energy density to further reduce costs.

For current manufacturing, silver consumption is 20 metric tons ( $\pm 5$  tons) per GW of production. At these levels, TW-scale production could exceed total worldwide silver production by 2030.

## Isotope

BERGER 2019

Daniel Berger et al., *Isotope systematics and chemical composition of tin ingots from Mochlos (Crete) and other Late Bronze Age sites in the eastern Mediterranean Sea: An ultimate key to tin provenance?* [PLoS ONE](#) **14** (2019), e218326. DOI:10.1371/journal.pone.0218326.

[pone14-e0218326-Supplement1.xlsx](#), [pone14-e0218326-Supplement2.xlsx](#), [pone14-e0218326-Supplement3.xlsx](#), [pone14-e0218326-Supplement4.docx](#), [pone14-e0218326-Supplement5.pdf](#)

Daniel Berger, Jeffrey S. Soles, Alessandra R. Giumlia-Mair, Gerhard Brüggemann, Ehud Galili, Nicole Lockhoff & Ernst Pernicka

The origin of the tin used for the production of bronze in the Eurasian Bronze Age is still one of the mysteries in prehistoric archaeology. In the past, numerous studies were carried out on archaeological bronze and tin objects with the aim of determining the sources of tin, but all failed to find suitable fingerprints. In this paper we investigate a set of 27 tin ingots from wellknown sites in the eastern Mediterranean Sea (Mochlos, Uluburun, Hishuley Carmel, Kfar Samir south, Haifa) that had been the subject of previous archaeological and archaeometallurgical research. By using a combined approach of tin and lead isotopes together with trace elements it is possible to narrow down the potential sources of tin for the first time. The strongly radiogenic composition of lead in the tin ingots from Israel allows the calculation of a geological model age of the parental tin ores of

291 ± 17 Ma. This theoretical formation age excludes Anatolian, central Asian and Egyptian tin deposits as tin sources since they formed either much earlier or later. On the other hand, European tin deposits of the Variscan orogeny agree well with this time span so that an origin from European deposits is suggested. With the help of the tin isotope composition and the trace elements of the objects it is further possible to exclude many tin resources from the European continent and, considering the current state of knowledge and the available data, to conclude that Cornish tin mines are the most likely suppliers for the 13th–12th centuries tin ingots from Israel. Even though a different provenance seems to be suggested for the tin from Mochlos and Uluburun by the actual data, these findings are of great importance for the archaeological interpretation of the trade routes and the circulation of tin during the Late Bronze Age. They demonstrate that the trade networks between the eastern Mediterranean and some place in the east that are assumed for the first half of the 2nd millennium BCE (as indicated by textual evidence from Kültepe/Kanesj and Mari) did not exist in the same way towards the last quarter of the millennium.

## Klima

VOOSEN 2019

Paul Voosen, *Ocean cycles sidelined in 20th century temperature record. science* **364** (2019), 814.

Haze and greenhouse gases drove start-and-stop warming.

[S]oot from industry drove early 20th century warming as it drifted into the Arctic, darkening snow and absorbing sunlight. After World War II, lightreflecting sulfate haze from power plants increased, holding off potential warming from rising greenhouse gases. Then, pollution controls arrived in the 1970s, cutting haze and allowing warming to speed ahead.

It's a compelling portrait, but it could have been substantially different if the team had used other, equally justifiable assumptions about the climate impact of aerosols, Booth says. Trenberth thinks the team's adjustments had the effect of fitting the model to an uncertain record. "There is considerable wiggle room in just what the actual record is," he says.

## Kultur

SPYROU 2019

Anna Spyrou, Lisa A. Maher, Louise A. Martin, Danielle A. Macdonald & Andrew Garrard, *Meat outside the freezer, Drying, smoking, salting and sealing meat in fat at an Epipalaeolithic megasite in eastern Jordan. Journal of Anthropological Archaeology* **54** (2019), 84–101.

Even though pivotal for understanding many aspects of human behaviour, preservation and storage of animal resources has not received great attention from archaeologists. One could argue that the main problem lies in the difficulties of demonstrating meat storage archaeologically due to the lack of direct evidence. This paper represents an attempt to refine zooarchaeological methods for the recognition of meat preservation and storage at prehistoric sites. Drawing on the faunal assemblage from Kharaneh IV, an Early/Middle Epipalaeolithic aggregation site in eastern Jordan, this study demonstrates that a combination of taphonomic and contextual analyses alongside ethnographic information may indeed lead archaeologists to insights not directly available from the archaeological record. The

empirical evidence presented here contributes to the archaeological visibility of meat preservation and storage, providing a clearer concept of the nature of these practices in preagricultural societies.

Keywords: Epipalaeolithic | Hunter-gatherers | Meat-drying rack | Gazelle | Southern Levant

## Mathematik

BOOMGARDEN 2019

Shannon A. Boomgarden, Duncan Metcalfe & Ellyse T. Simons, *An Optimal Irrigation Model, Theory, Experimental Results, and Implications for Future Research*. *American Antiquity* **84** (2019), 252–273.

A series of farming experiments was conducted between 2013 and 2017 in Range Creek Canyon, Utah, to better understand the opportunities and constraints faced by prehistoric farmers in the Southwest. The experiments were designed to collect data on the optimal amount of supplemental water that should be applied to maize fields given the costs in labor and benefits in greater yield. We investigate expected variation in water management strategies using an optimal irrigation model (OIM). The model makes clear that the payoff for farming is best understood as a continuum of relative success and that irrigation is one activity (probably of many) that may improve farming efficiency as well as increase harvest yields. The optimal harvest will always be less than the maximum harvest when there are significant operating costs associated with irrigation. Estimating the costs and benefits of irrigation in a specific area allows for an assessment of whether irrigation is expected, and if so, how much effort should be devoted to water management. A local dendroclimatological study is used to provide the prehistoric context for the Fremont who occupied Range Creek Canyon, and irrigation is expected even in periods of greater precipitation.

Keywords: experimental archaeology | Fremont | Range Creek Canyon | farming | maize | optimal foraging theory | irrigation | Utah

## Mesolithikum

WEITZEL 2019

Elic M. Weitzel, *Declining Foraging Efficiency in the Middle Tennessee River Valley Prior to Initial Domestication*. *American Antiquity* **84** (2019), 191–214.

Recently, researchers investigating the origins of domestication have debated the significance of resource intensification in the shift from foraging to food production. In eastern North America, one of several independent centers of domestication, this question remains open. To determine whether initial domestication may have been preceded by intensification in eastern North America at approximately 5000 cal BP, I evaluated the archaeofaunal assemblages from six sites in the middle Tennessee River valley. Analyses of these data suggest that overall foraging efficiency gradually declined prior to initial domestication, but patch-specific declines in foraging efficiency occurred in wetland habitats and not terrestrial ones. Climatic warming and drying during the Middle Holocene, growing human populations, and oak-hickory forest expansion were the likely drivers of these changes in foraging efficiency. These results support the hypothesis that initial domestication in eastern North America was an outcome of intensification driven by environmental change

and human population increases. Finally, while the debate concerning the relationship of intensification to domestication has been framed in terms of a conflict between niche construction theory and optimal foraging theory, these perspectives are compatible and should be integrated to understand domestication more fully.

Keywords: origins of agriculture | intensification | Boserup | zooarchaeology | Eastern Agricultural Complex | behavioral ecology | niche construction theory | optimal foraging theory

## Methoden

### MARTINÓN-TORRES 2019

Marcos Martínón-Torres, *Mobility, minds and metals, The end of archaeological science?* In: XOSE-LOIS ARMADA, MERCEDES MURILLO-BARROSO & MIKE CHARLTON (Hrsg.), *Metals, Minds and Mobility, Integrating Scientific Data With Archaeological Theory*. (Oxford 2019), 161–169.

### SCHMIDT 2016

Annika Schmidt, *Excavation 2016 and XRF Analysis at the Nok Site of Ido in Central Nigeria*. *Nyame Akuma* **86** (2016), 65–70.

Features consisting of stone-pot-arrangements occur at several Nok sites, raising questions about their purpose. Previous research has suggested that they are probably graves. I used XRF analysis at the Ido site to identify chemical traces of bodies buried in such features and detected anomalies in the composition of soil collected in the features, proving the potential of the method. However, the strong deviations observed could have been caused by soil formation processes that may have masked signatures resulting from the decomposition of a body. This problem can be solved by developing a filter for background noise (e.g. using an improved sample scheme). Excavations at Ifana, excavated in August 2016, yielded well-preserved stone-pot-arrangements and stone beads (Fig. 1-2), pointing to the existence of more graves. In this site, we collected samples using a denser grid of 10 cm x 10 cm without obvious natural features that may cause disturbances. This analysis is currently ongoing.

Although at Ido we could not conclusively identify the chemical signals of the presence of a body, the interpretation of the features as graves is still possible. Comparison with similar sites and the presence of stone beads, probably as part of necklaces, strengthen this work hypothesis. The use of different and complementary lines of research (including ethnoarchaeology, different sampling strategies and scientific methods) may allow a better and stronger interpretation of this type of sites as graves.

## Mittelpaläolithikum

### LARBAY 2019

Cynthia Larbey, Susan M. Mentzer, Bertrand Ligouis, Sarah Wurz & Martin K. Jones, *Cooked starchy food in hearths ca. 120 kya and 65 kya (MIS 5e and MIS 4) from Klasies River Cave, South Africa*. *Journal of Human Evolution* **131** (2019), 210–227.

Plant carbohydrates currently constitute 55–80 % of the modern human diet (FAO and WHO, 1997) and some of today’s key global health issues are associated with excessive carbohydrate consumption. However, starch carbohydrate is still a poorly understood element of modern human diet and our past starch diet may provide insights for future research. Despite an archaeological narrative that links our early hominin ancestors to a diet that is rich in roots and tubers, there is little deep time archaeological evidence of human plant starch consumption. Geneticists hypothesise that the duplication of starch digestion genes in early *Homo sapiens* ( $\approx 300$  kya), is an adaptive response to an increased starch diet. Here we offer the earliest evidence of identified fragments of charred starch plant tissue (parenchyma) from cave and rock shelter hearths dated to Marine Isotope Stage (MIS) 5e and MIS 4, from the Middle Stone Age (MSA) site of Klasies River main site, South Africa (34.06°S, 24.24°E).

**Keywords:** Palaeolithic | Starch diet | Tuber-parenchyma | Micro-context | Klasies

## Neolithikum

LARSEN 2019

Clark Spencer Larsen et al., *Bioarchaeology of Neolithic Çatalhöyük reveals fundamental transitions in health, mobility, and lifestyle in early farmers*. [PNAS 116 \(2019\), 12615–12623](#).

Clark Spencer Larsen, Christopher J. Knüsel, Scott D. Haddow, Marin A. Piloud, Marco Milella, Joshua W. Sadvari, Jessica Pearson, Christopher B. Ruff, Evan M. Garofalo, Emmy Bocaege, Barbara J. Betz, Irene Dori & Bonnie Glenn-cross

The transition from a human diet based exclusively on wild plants and animals to one involving dependence on domesticated plants and animals beginning 10,000 to 11,000 y ago in Southwest Asia set into motion a series of profound health, lifestyle, social, and economic changes affecting human populations throughout most of the world. However, the social, cultural, behavioral, and other factors surrounding health and lifestyle associated with the foraging-to-farming transition are vague, owing to an incomplete or poorly understood contextual archaeological record of living conditions. Bioarchaeological investigation of the extraordinary record of human remains and their context from Neolithic Çatalhöyük (7100–5950 cal BCE), a massive archaeological site in south-central Anatolia (Turkey), provides important perspectives on population dynamics, health outcomes, behavioral adaptations, interpersonal conflict, and a record of community resilience over the life of this single early farming settlement having the attributes of a protocity. Study of Çatalhöyük human biology reveals increasing costs to members of the settlement, including elevated exposure to disease and labor demands in response to community dependence on and production of domesticated plant carbohydrates, growing population size and density fueled by elevated fertility, and increasing stresses due to heightened workload and greater mobility required for caprine herding and other resource acquisition activities over the nearly 12 centuries of settlement occupation. These changes in life conditions foreshadow developments that would take place worldwide over the millennia following the abandonment of Neolithic Çatalhöyük, including health challenges, adaptive patterns, physical activity, and emerging social behaviors involving interpersonal violence.

**Keywords:** Neolithic farmers | Turkey | bioarchaeology | health | lifestyle

**Significance:** Bioarchaeological investigation of human remains from Neolithic Çatalhöyük, Turkey, contributes to a growing body of data documenting population dynamics, health, and lifestyle of early farmers in Holocene settings in the

Near East and globally. The extensive archaeological context of foodways, material culture, housing, environment, ecology, population structure and size, social interaction, and community living informs interpretation of the bioarchaeological record representing nearly 1,200 continuous years of community life. This record presents biological outcomes and comprehensive understanding of the challenges associated with dependence on domesticated plants and animals, the labor involved in acquiring food and other resources, impacts of settled community life on health and well-being, and evolving lifeways to the present day.

## Ostasien

LIU 2019

Li Liu, Jiajing Wang, Maureen J. Levin, Nasa Sinnott-Armstrong, Hao Zhao, Yanan Zhao, Jing Shao, Nan Di & Tian'en Zhang, *The origins of specialized pottery and diverse alcohol fermentation techniques in Early Neolithic China*. [PNAS 116 \(2019\), 12767–12774](#).

[pnas116-12767-Supplement1.pdf](#), [pnas116-12767-Supplement2.xlsx](#)

In China, pottery containers first appeared about 20000 cal. BP, and became diverse in form during the Early Neolithic (9000– 7000 cal. BP), signaling the emergence of functionally specialized vessels. China is also well-known for its early development of alcohol production. However, few studies have focused on the connections between the two technologies. Based on the analysis of residues (starch, phytolith, and fungus) adhering to pottery from two Early Neolithic sites in north China, here we demonstrate that three material changes occurring in the Early Neolithic signal innovation of specialized alcoholic making known in north China: (i) the spread of cereal domestication (millet and rice), (ii) the emergence of dedicated pottery types, particularly globular jars as liquid storage vessels, and (iii) the development of cerealbased alcohol production with at least two fermentation methods: the use of cereal malts and the use of moldy grain and herbs (qu and caoqu) as starters. The latter method was arguably a unique invention initiated in China, and our findings account for the earliest known examples of this technique. The major ingredients include broomcorn millet, Triticeae grasses, Job's tears, rice, beans, snake gourd root, ginger, possible yam and lily, and other plants, some probably with medicinal properties (e.g., ginger). Alcoholic beverages made with these methods were named li, jiu, and chang in ancient texts, first recorded in the Shang oracle-bone inscriptions (ca. 3200 cal. BP); our findings have revealed a much deeper history of these diverse fermentation technologies in China.

**Keywords:** ancient fermentation methods | starch granules | phytoliths | fungi | millet

**Significance:** China is well-known for its distinctive techniques in alcohol fermentation. Here we present archaeological evidence of alcohol making based on analyses of starch granules, phytoliths, and fungi in food residues adhering to 8,000- to 7,000-y-old Neolithic pottery vessels. We demonstrate the earliest association between the wide occurrences of globular jars as liquid storage vessels and the development of two methods of alcohol making: use of cereal malts and use of moldy grain and herbs as starters. The latter method was arguably a unique invention initiated in China. Neolithic people made low-alcohol beverages with broomcorn millet, Triticeae grasses, Job's tears, rice, beans, snake gourd root, ginger, yam, lily, and so forth. Such fermented beverages may have served social, spiritual, and medicinal functions.

## Story or Book

ROBINSON 2019

Andrew Robinson, *Modern math meets fairy-tale physics*. [science](#) **364** (2019), 842.

No longer seen as a simple tool, today's math is a font for new ideas in theoretical physics.

*The Universe Speaks in Numbers*. Graham Farmelo. Basic Books, 2019. 332 pp.

The proper—and hence, productive—relationship between physics and mathematics is a decades-old preoccupation of theoretical physicist Graham Farmelo, as captured in his new book, *The Universe Speaks in Numbers*. He is the author of *The Strangest Man*, a widely admired biography of Dirac, a physicist with an unusual college education—first as an undergraduate in engineering, then as an undergraduate in mathematics—who revolutionized quantum physics in the 1920s.

In 1921, [Einstein] wittily remarked: “As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.”