

## References

### Afrika

BARHAM 1996

Lawrence S. Barham & Peter L. Smart, *An early date for the Middle Stone Age of central Zambia*. [Journal of Human Evolution](#) **30** (1996), 287–290.

The combination of small points similar to those associated with the earlier MSA in Zimbabwe (Volman, 1984) with heavier tools and lanceolates resembling the Lupemban of Central Africa (Clark, 1970; Phillipson, 1976) suggests an early Late Pleistocene date for the Twin Rivers assemblage.

In the broader African context Twin Rivers joins a small group of sites with late Middle Pleistocene dates for the MSA.

### Aktuell

KISSSLER 2020

Stephen M. Kissler, Christine Tedijanto, Edward Goldstein, Yonatan H. Grad & Marc Lipsitch, *Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period*. [science](#) **368** (2020), 860–868. DOI:10.1126/science.abb5793.

s368-0860-Supplement.pdf

It is urgent to understand the future of severe acute respiratory syndrome–coronavirus 2 (SARS-CoV-2) transmission. We used estimates of seasonality, immunity, and cross-immunity for human coronavirus OC43 (HCoV-OC43) and HCoV-HKU1 using time-series data from the United States to inform a model of SARS-CoV-2 transmission. We projected that recurrent wintertime outbreaks of SARS-CoV-2 will probably occur after the initial, most severe pandemic wave. Absent other interventions, a key metric for the success of social distancing is whether critical care capacities are exceeded. To avoid this, prolonged or intermittent social distancing may be necessary into 2022. Additional interventions, including expanded critical care capacity and an effective therapeutic, would improve the success of intermittent distancing and hasten the acquisition of herd immunity. Longitudinal serological studies are urgently needed to determine the extent and duration of immunity to SARS-CoV-2. Even in the event of apparent elimination, SARS-CoV-2 surveillance should be maintained because a resurgence in contagion could be possible as late as 2024.

### Altpaläolithikum

CONARD 2020

Nicholas J. Conard, Jordi Serangeli, Gerlinde Bigga & Veerle Rots, *A 300,000-year-old throwing stick from Schöningen, northern Germany, documents the evolution of human hunting*. [Nature Ecology & Evolution](#) **4** (2020), 690–693.

NatEcoEvo04-0690-Supplement1.pdf, NatEcoEvo04-0690-Supplement2.pdf, NatEcoEvo04-0690-Supplement3.pdf

The poor preservation of Palaeolithic sites rarely allows the recovery of wooden artefacts, which served as key tools in the arsenals of early hunters. Here, we report the discovery of a wooden throwing stick from the Middle Pleistocene open-air site of Schöningen that expands the range of Palaeolithic weaponry and establishes that late Lower Palaeolithic hominins in Northern Europe were highly effective hunters with a wide array of wooden weapons that are rarely preserved in the archaeological record.

## Amerika

ÅKESSON 2020

Christine M. Åkesson et al., *2,100 years of human adaptation to climate change in the High Andes*. [Nature Ecology & Evolution 4 \(2020\), 66–74](#).

NatEcoEvo04-0066-Supplement.pdf

Humid montane forests are challenging environments for human habitation. We used high-resolution fossil pollen, charcoal, diatom and sediment chemistry data from the iconic archaeological setting of Laguna de los Condores, Peru to reconstruct changing land uses and climates in a forested Andean valley. Forest clearance and maize cultivation were initiated during periods of drought, with periods of forest recovery occurring during wetter conditions. Between ad 800 and 1000 forest regrowth was evident, but this trend was reversed between ad 1000 and 1200 as drier conditions coincided with renewed land clearance, the establishment of a permanent village and the use of cliffs overlooking the lake as a burial site. By ad 1230 forests had regrown in the valley and maize cultivation was greatly reduced. An elevational transect investigating regional patterns showed a parallel, but earlier, history of reduced maize cultivation and forest regeneration at mid-elevation. However, a lowland site showed continuous maize agriculture until European conquest but very little subsequent change in forest cover. Divergent, climate-sensitive landscape histories do not support categorical assessments that forest regrowth and peak carbon sequestration coincided with European arrival.

Christine M. Åkesson, Frazer Matthews-Bird, Madeleine Bitting, Christie-Jane Fennell, Warren B. Church, Larry C. Peterson, Bryan G. Valencia & Mark B. Bush

## Anthropologie

GROUCUTT 2018

Huw S. Groucutt & Michael D. Petraglia et al., *Homo sapiens in Arabia by 85,000 years ago*. [Nature Ecology & Evolution 2 \(2018\), 800–809](#).

NatEcoEvo02-0800-Supplement.pdf

Understanding the timing and character of the expansion of *Homo sapiens* out of Africa is critical for inferring the colonization and admixture processes that underpin global population history. It has been argued that dispersal out of Africa had an early phase, particularly  $\approx 130$ – $90$  thousand years ago (ka), that reached only the East Mediterranean Levant, and a later phase,  $\approx 60$ – $50$  ka, that extended across the diverse environments of Eurasia to Sahul. However, recent findings from East Asia and Sahul challenge this model. Here we show that *H. sapiens* was in the

Arabian Peninsula before 85 ka. We describe the Al Wusta-1 (AW-1) intermediate phalanx from the site of Al Wusta in the Nefud desert, Saudi Arabia. AW-1 is the oldest directly dated fossil of our species outside Africa and the Levant. The palaeoenvironmental context of Al Wusta demonstrates that *H. sapiens* using Middle Palaeolithic stone tools dispersed into Arabia during a phase of increased precipitation driven by orbital forcing, in association with a primarily African fauna. A Bayesian model incorporating independent chronometric age estimates indicates a chronology for Al Wusta of  $\approx 95\text{--}86$  ka, which we correlate with a humid episode in the later part of Marine Isotope Stage 5 known from various regional records. Al Wusta shows that early dispersals were more spatially and temporally extensive than previously thought. Early *H. sapiens* dispersals out of Africa were not limited to winter rainfall-fed Levantine Mediterranean woodlands immediately adjacent to Africa, but extended deep into the semi-arid grasslands of Arabia, facilitated by periods of enhanced monsoonal rainfall.

Huw S. Groucutt, Rainer Grün, Iyad S. A. Zalmout, Nick A. Drake, Simon J. Armitage, Ian Candy, Richard Clark-Wilson, Julien Louys, Paul S. Breeze, Mathieu Duval, Laura T. Buck, Tracy L. Kivell, Emma Pomeroy, Nicholas B. Stephens, Jay T. Stock, Mathew Stewart, Gilbert J. Price, Leslie Kinsley, Wing Wai Sung, Abdullah Alsharekh, Abdulaziz Al-Omari, Muhammad Zahir, Abdullah M. Memesh, Ammar J. Abdulshakoor, Abdu M. Al-Masari, Ahmed A. Bahameem, Khaled S. M. Al Murayyi, Badr Zahrani, Eleanor M. L. Scerri & Michael D. Petraglia

## Biologie

### CUCCHI 2020

Thomas Cucchi, Katerina Papayianni, Sophie Cersoy, Laetitia Aznar-Cormano, Antoine Zazzo, Régis Debruyne, Rémi Berthon, Adrian, *Tracking the Near Eastern origins and European dispersal of the western house mouse*. [Scientific Reports 10 \(2020\), 8276](https://doi.org/10.1038/s41598-020-64939-9). DOI:10.1038/s41598-020-64939-9.

The house mouse (*Mus musculus*) represents the extreme of globalization of invasive mammals. However, the timing and basis of its origin and early phases of dispersal remain poorly documented. To track its synanthropisation and subsequent invasive spread during the development of complex human societies, we analyzed 829 *Mus* specimens from 43 archaeological contexts in Southwestern Asia and Southeastern Europe, between 40,000 and 3,000 cal. BP, combining geometric morphometrics, numerical taxonomy, ancient mitochondrial DNA and direct radiocarbon dating. We found that large late hunter-gatherer sedentary settlements in the Levant, c. 14,500 cal. BP, promoted the commensal behaviour of the house mouse, which probably led the commensal pathway to cat domestication. House mouse invasive spread was then fostered through the emergence of agriculture throughout the Near East 12,000 years ago. Stowaway transport of house mice to Cyprus can be inferred as early as

Thomas Cucchi, Katerina Papayianni, Sophie Cersoy, Laetitia Aznar-Cormano, Antoine Zazzo, Régis Debruyne, Rémi Berthon, Adrian Bălăescu, Alan Simmons, François Valla, Yannis Hamilakis, Fanis Mavridis, Marjan Mashkour, Jamshid Darvish, Roohollah Siahsharvi, Fereidoun Biglari, Cameron A. Petrie, Lloyd Weeks, Alireza Sardari, Sepideh Maziar, Christiane Denys, David Orton, Emma Jenkins, Melinda Zeder, Jeremy B. Searle, Greger Larson, François Bonhomme, Jean-Christophe Auffray & Jean-Denis Vigne

## HAZEL 2020

Wade N. Hazel, Robert Black, Richard C. Smock, Rebecca Sear & Joseph L. Tomkins, *An age-dependent ovulatory strategy explains the evolution of dizygotic twinning in humans*. [Nature Ecology & Evolution \(2020\), preprint, 1–11. DOI:10.1038/s41559-020-1173-y](#).

[NatEcoEvo2020.05-Hazel-Supplement.pdf](#)

Dizygotic twinning, the simultaneous birth of siblings when multiple ova are released, is an evolutionary paradox. Twin-bearing mothers often have elevated fitness, but despite twinning being heritable, twin births occur only at low frequencies in human populations. We resolve this paradox by showing that twinning and non-twinning are not competing strategies; instead, dizygotic twinning is the outcome of an adaptive conditional ovulatory strategy of switching from single to double ovulation with increasing age. This conditional strategy, when coupled with the well-known decline in fertility as women age, maximizes reproductive success and explains the increase and subsequent decrease in the twinning rate with maternal age that is observed across human populations. We show that the most successful ovulatory strategy would be to always double ovulate as an insurance against early fetal loss, but to never bear twins. This finding supports the hypothesis that twinning is a by-product of selection for double ovulation rather than selection for twinning.

Wade N. Hazel, Robert Black, Richard C. Smock, Rebecca Sear & Joseph L. Tomkins

## KEY 2020

Felix M. Key et al., *Emergence of human-adapted *Salmonella enterica* is linked to the Neolithization process*. [Nature Ecology & Evolution 4 \(2020\), 324–333](#).

[NatEcoEvo04-0324-Supplement.pdf](#)

It has been hypothesized that the Neolithic transition towards an agricultural and pastoralist economy facilitated the emergence of human-adapted pathogens. Here, we recovered eight *Salmonella enterica* subsp. *enterica* genomes from human skeletons of transitional foragers, pastoralists and agropastoralists in western Eurasia that were up to 6,500 yr old. Despite the high genetic diversity of *S. enterica*, all ancient bacterial genomes clustered in a single previously uncharacterized branch that contains *S. enterica* adapted to multiple mammalian species. All ancient bacterial genomes from prehistoric (agro-)pastoralists fall within a part of this branch that also includes the human-specific *S. enterica* Paratyphi C, illustrating the evolution of a human pathogen over a period of 5,000 yr. Bacterial genomic comparisons suggest that the earlier ancient strains were not host specific, differed in pathogenic potential and experienced convergent pseudogenization that accompanied their downstream host adaptation. These observations support the concept that the emergence of human-adapted *S. enterica* is linked to human cultural transformations.

Felix M. Key, Cosimo Posth, Luis R. Esquivel-Gomez, Ron Hübner, Maria A. Spyrou, Gunnar U. Neumann, Anja Furtwängler, Susanna Sabin, Marta Burri, Antje Wissgott, Aditya Kumar Lankapalli, Áshild J. Vågane, Matthias Meyer, Sarah Nagel, Rezeda Tukhbatova, Aleksandr Khokhlov, Andrey Chizhevsky, Svend Hansen, Andrey B. Belinsky, Alexey Kalmykov, Anatoly R. Kantorovich, Vladimir E. Maslov, Philipp W. Stockhammer, Stefania Vai, Monica Zavattaro, Alessandro Riga, David Caramelli, Robin Skeates, Jessica Beckett, Maria Giuseppina Gradoli, Noah Steuri, Albert Hafner, Marianne Ramstein, Inga Siebke, Sandra Lössch, Yilmaz Selim Erdal, Nabil-Fareed Alikhan, Zhemin Zhou, Mark Achtman, Kirsten

Bos, Sabine Reinhold, Wolfgang Haak, Denise Kühnert, Alexander Herbig & Johannes Krause

#### STONE 2020

Anne C. Stone, *getting sick in the Neolithic*. [Nature Ecology & Evolution 4 \(2020\), 286–287](#).

Ancient *Salmonella enterica* genomes from humans beginning to adopt farming lifestyles reveal insight into how epidemiological pathways were affected by human cultural transitions.

While infant mortality is high in extant and historical hunter-gatherers, life expectancy after age 15 is relatively high<sup>7</sup>. As agriculture is adopted fully, the move to sedentism and increased population densities likely changed disease ecology with increases in parasitism and infectious disease linked to waste and unclean water, as well as increases in the risk of zoonotic jumps of pathogens from domesticates.

#### WALKER 2020

Tom W. N. Walker & Erik Verbruggen et al., *A systemic overreaction to years versus decades of warming in a subarctic grassland ecosystem*. [Nature Ecology & Evolution 4 \(2020\), 101–108](#).

[NatEcoEvo04-0101-Supplement.pdf](#)

Temperature governs most biotic processes, yet we know little about how warming affects whole ecosystems. Here we examined the responses of 128 components of a subarctic grassland to either 5–8 or >50 years of soil warming. Warming of >50 years drove the ecosystem to a new steady state possessing a distinct biotic composition and reduced species richness, biomass and soil organic matter. However, the warmed state was preceded by an overreaction to warming, which was related to organism physiology and was evident after 5–8 years. Ignoring this overreaction yielded errors of >100% for 83 variables when predicting their responses to a realistic warming scenario of 1 °C over 50 years, although some, including soil carbon content, remained stable after 5–8 years. This study challenges long-term ecosystem predictions made from short-term observations, and provides a framework for characterization of ecosystem responses to sustained climate change.

Tom W. N. Walker, Ivan A. Janssens, James T. Weedon, Bjarni D. Sigurdsson, Andreas Richter, Josep Peñuelas, Niki I. W. Leblans, Michael Bahn, Mireia Bartrons, Cindy De Jonge, Lucia Fuchslueger, Albert Gargallo-Garriga, Gunnhildur E. Gunnarsdóttir, Sara Marañón-Jiménez, Edda S. Oddsdóttir, Ivika Ostonen, Christopher Poeplau, Judith Prommer, Dajana Radujkovic, Jordi Sardans, Páll Sigurðsson, Jennifer L. Soong, Sara Vicca, Håkan Wallander, Krassimira Ilieva-Makulec & Erik Verbruggen

## Datierung

#### FEWCLASS 2020

Helen Fewlass et al., *A <sup>14</sup>C chronology for the Middle to Upper Palaeolithic transition at Bacho Kiro Cave, Bulgaria*. [Nature Ecology & Evolution \(2020\), preprint, 1–15](#). DOI:10.1038/s41559-020-1136-3.

[NatEcoEvo2020.05-Fewlass-Supplement.pdf](#)

The stratigraphy at Bacho Kiro Cave, Bulgaria, spans the Middle to Upper Palaeolithic transition, including an Initial Upper Palaeolithic (IUP) assemblage argued to represent the earliest arrival of Upper Palaeolithic *Homo sapiens* in Europe. We applied the latest techniques in <sup>14</sup>C dating to an extensive dataset

of newly excavated animal and human bones to produce a robust, high-precision radiocarbon chronology for the site. At the base of the stratigraphy, the Middle Palaeolithic (MP) occupation dates to >51,000 yr bp. A chronological gap of over 3,000 years separates the MP occupation from the occupation of the cave by *H. sapiens*, which extends to 34,000 cal bp. The extensive IUP assemblage, now associated with directly dated *H. sapiens* fossils at this site, securely dates to 45,820–43,650 cal bp (95.4% probability), probably beginning from 46,940 cal bp (95.4% probability). The results provide chronological context for the early occupation of Europe by Upper Palaeolithic *H. sapiens*.

Helen Fewlass, Sahra Talamo, Lukas Wacker, Bernd Kromer, Thibaut Tuna, Yoann Fagault, Edouard Bard, Shannon P. McPherron, Vera Aldeias, Raquel Maria, Naomi L. Martisius, Lindsay Paskulin, Zeljko Rezek, Virginie Sinet-Mathiot, Svoboda Sirakova, Geoffrey M. Smith, Rosen Spasov, Frido Welker, Nikolay Sirakov, Tsenka Tsanova & Jean-Jacques Hublin

## Energie

LAPERRE 2020

Rémy Lapere, Laurent Menut, Sylvain Mailler & Nicolás Huneus, *Soccer games and record-breaking PM2.5 pollution events in Santiago, Chile*. *Atmospheric Chemistry and Physics* **20** (2020), 4681–4694. DOI:10.5194/acp-20-4681-2020.

In wintertime, high concentrations of atmospheric fine particulate matter (PM2.5) are commonly observed in the metropolitan area of Santiago, Chile. Hourly peaks can be very strong, up to 10 times above average levels, but have barely been studied so far. Based on atmospheric composition measurements and chemistry-transport modeling (WRF-CHIMERE), the chemical signature of sporadic skyrocketing wintertime PM2.5 peaks is analyzed. This signature and the timing of such extreme events trace their origin back to massive barbecue cooking by Santiago's inhabitants during international soccer games. The peaks end up evacuated outside Santiago after a few hours but trigger emergency plans for the next day. Decontamination plans in Santiago focus on decreasing emissions from traffic, industry, and residential heating. Thanks to the air quality network of Santiago, this study shows that cultural habits such as barbecue cooking also need to be taken into account. For short-term forecast and emergency management, cultural events such as soccer games seem a good proxy to prognose possible PM2.5 peak events. Not only can this result have an informative value for the Chilean authorities but also a similar methodology could be reproduced for other cases throughout the world in order to estimate the burden on air quality of cultural habits.

## Judentum

FREY 1997

Jörg Frey, *Different Patterns of Dualistic Thought in the Qumran Library, Reflections on their Background and History*. In: MOSHE BERNSTEIN, FLORENTINO GARCIA MARTINEZ & JOHN KAMPEN (Hrsg.), *Legal Texts and Legal Issues, Second Meeting of the International Organization for Qumran Studies, Cambridge 1995, in*

*Honour of Joseph M. Baumgarten.* Studies on the Texts of the Desert of Judah 23 ([Leiden 1997](#)), 275–336.

In our argument we have put forward the case for a distinction of at least two different patterns of dualistic thought in the Qumran library. Both are clearly different, in structure and terminology as well as in their respective origins. On the one hand there is a sapiential tradition of ethically interested, but subsequently ontologized and cosmologized dualism. Its most developed example is the instruction on the two spirits 1QS 3:13-4:26 where cosmic, ethical, and psychological levels of dualistic expression are woven together. On the other hand, there is a pattern of pure cosmic dualism, without ethical or even psychological aspects, which is characterized by the opposition of leading angelic powers and their respective hosts of spiritual and human beings as well as by a strong use of the light-darkness paradigm. The most prominent example of this pattern is the War Rule, but there is earlier attestation in a few other pre-Essene texts which equally point to an origin in priestly circles.

## Jungpaläolithikum

### BANKS 2020

William E. Banks, *Puzzling out the Middle-to-Upper Palaeolithic transition.* [Nature Ecology & Evolution \(2020\), preprint, 1–2.](#)  
[DOI:10.1038/s41559-020-1162-1.](#)

Homo sapiens remains, molecular data and a revised chronology for the Bulgarian site of Bacho Kiro document the earliest known presence of our species in Europe, representing an important jigsaw piece in the Middle-to-Upper Palaeolithic transition.

These modelled ranges of the newly obtained radiocarbon measurements agree with the molecular date ranges calculated by Hublin et al. on the human bones. Thus, these human remains from Bacho Kiro currently reflect the earliest direct evidence of our species in Europe. Aside from Bacho Kiro, the directly dated human remains from the site of Petera cu Oase (Romania) at ca. 41 cal ka bp represent the oldest known modern human presence in Europe.

### HUBLIN 2020

Jean-Jacques Hublin et al., *Initial Upper Palaeolithic Homo sapiens from Bacho Kiro Cave, Bulgaria.* [nature 581 \(2020\), 299–302.](#)  
[n581-0299-Supplement.pdf](#)

The Middle to Upper Palaeolithic transition in Europe witnessed the replacement and partial absorption of local Neanderthal populations by Homo sapiens populations of African origin<sup>1</sup>. However, this process probably varied across regions and its details remain largely unknown. In particular, the duration of chronological overlap between the two groups is much debated, as are the implications of this overlap for the nature of the biological and cultural interactions between Neanderthals and H. sapiens. Here we report the discovery and direct dating of human remains found in association with Initial Upper Palaeolithic artefacts<sup>2</sup>, from excavations at Bacho Kiro Cave (Bulgaria). Morphological analysis of a tooth and mitochondrial DNA from several hominin bone fragments, identified through proteomic screening, assign these finds to H. sapiens and link the expansion of Initial Upper Palaeolithic technologies with the spread of H. sapiens into the mid-latitudes of Eurasia before 45 thousand years ago<sup>3</sup>. The excavations yielded a wealth of bone artefacts, including pendants manufactured from cave bear teeth that are reminiscent of those later produced by the last Neanderthals of western

Europe<sup>4–6</sup>. These finds are consistent with models based on the arrival of multiple waves of *H. sapiens* into Europe coming into contact with declining Neanderthal populations<sup>7,8</sup>.

Jean-Jacques Hublin, Nikolay Sirakov, Vera Aldeias, Shara Bailey, Edouard Bard, Vincent Delvigne, Elena Endarova, Yoann Fagault, Helen Fewlass, Mateja Hajdinjak, Bernd Kromer, Ivaylo Krumov, João Marreiros, Naomi L. Martisius, Lindsey Paskulin, Virginie Sinet-Mathiot, Matthias Meyer, Svante Pääbo, Vasil Popov, Zeljko Rezek, Svoboda Sirakova, Matthew M. Skinner, Geoff M. Smith, Rosen Spasov, Sahra Talamo, Thibaut Tuna, Lukas Wacker, Frido Welker, Arndt Wilcke, Nikolay Zahariev, Shannon P. McPherron & Tsenka Tsanova

## Klima

### PENNISI 2020

Elizabeth Pennisi, *Tropical forests store carbon despite warming. science* **368** (2020), 813.

But if global temperatures reach key threshold, dying trees will release warming gases.

Other researchers see the findings as a wake-up call for action, noting the world has already warmed about 1°C above preindustrial levels. “Even though tropical forest sinks will weaken, conserving them is still better than not having them at all and turning them into carbon sources,” says Richard Betts, a climate modeler specializing in the global carbon cycle at the University of Exeter. “It is not too late,” he adds, “to avoid the most severe impacts.”

### PULLIAINEN 2020

Jouni Pulliainen et al., *Patterns and trends of Northern Hemisphere snow mass from 1980 to 2018. nature* **581** (2020), 294–298.

Warming surface temperatures have driven a substantial reduction in the extent and duration of Northern Hemisphere snow cover<sup>1–3</sup>. These changes in snow cover affect Earth’s climate system via the surface energy budget, and influence freshwater resources across a large proportion of the Northern Hemisphere<sup>4–6</sup>. In contrast to snow extent, reliable quantitative knowledge on seasonal snow mass and its trend is lacking<sup>7–9</sup>. Here we use the new GlobSnow 3.0 dataset to show that the 1980–2018 annual maximum snow mass in the Northern Hemisphere was, on average,  $3,062 \pm 35$  billion tonnes (gigatonnes). Our quantification is for March (the month that most closely corresponds to peak snow mass), covers non-alpine regions above 40° N and, crucially, includes a bias correction based on in-field snow observations. We compare our GlobSnow 3.0 estimates with three independent estimates of snow mass, each with and without the bias correction. Across the four datasets, the bias correction decreased the range from 2,433–3,380 gigatonnes (mean 2,867) to 2,846–3,062 gigatonnes (mean 2,938)—a reduction in uncertainty from 33 % to 7.4 %. On the basis of our bias-corrected GlobSnow 3.0 estimates, we find different continental trends over the 39-year satellite record. For example, snow mass decreased by 46 gigatonnes per decade across North America but had a negligible trend across Eurasia; both continents exhibit high regional variability. Our results enable a better estimation of the role of seasonal snow mass in Earth’s energy, water and carbon budgets.

Jouni Pulliainen, Kari Luojus, Chris Derksen, Lawrence Mudryk, Juha Lemmetyinen, Miia Salminen, Jaakko Ikonen, Matias Takala, Juval Cohen, Tuomo Smolander & Johannes Norberg



## SULLIVAN 2020

Martin J.P. Sullivan et al., *Long-term thermal sensitivity of Earth's tropical forests*. [science](#) **368** (2020), 869–874.

[s368-0869-Supplement.pdf](#)

The sensitivity of tropical forest carbon to climate is a key uncertainty in predicting global climate change. Although short-term drying and warming are known to affect forests, it is unknown if such effects translate into long-term responses. Here, we analyze 590 permanent plots measured across the tropics to derive the equilibrium climate controls on forest carbon. Maximum temperature is the most important predictor of aboveground biomass (-9.1 megagrams of carbon per hectare per degree Celsius), primarily by reducing woody productivity, and has a greater impact per °C in the hottest forests (>32.2°C). Our Results nevertheless reveal greater thermal resilience than observations of short-term variation imply. To realize the long-term climate adaptation potential of tropical forests requires both protecting them and stabilizing Earth's climate.

## Kultur

## WILKIN 2020

Shevan Wilkin & Jessica Hendy et al., *Dairy pastoralism sustained eastern Eurasian steppe populations for 5,000 years*. [Nature Ecology & Evolution](#) **4** (2020), 346–355.

[NatEcoEvo04-0346-Supplement.pdf](#)

Dairy pastoralism is integral to contemporary and past lifeways on the eastern Eurasian steppe, facilitating survival in agriculturally challenging environments. While previous research has indicated that ruminant dairy pastoralism was practiced in the region by circa 1300 bc, the origin, extent and diversity of this custom remain poorly understood. Here, we analyse ancient proteins from human dental calculus recovered from geographically diverse locations across Mongolia and spanning 5,000 years. We present the earliest evidence for dairy consumption on the eastern Eurasian steppe by circa 3000 bc and the later emergence of horse milking at circa 1200 bc, concurrent with the first evidence for horse riding. We argue that ruminant dairying contributed to the demographic success of Bronze Age Mongolian populations and that the origins of traditional horse dairy products in eastern Eurasia are closely tied to the regional emergence of mounted herding societies during the late second millennium bc.

Shevan Wilkin, Alicia Ventresca Miller, William T.T. Taylor, Bryan K. Miller, Richard W. Hagan, Madeleine Bleasdale, Ashley Scott, Sumiya Gankhuyg, Abigail Ramsøe, S. Ulizibayar, Christian Trachsel, Paolo Nanni, Jonas Grossmann, Ludovic Orlando, Mark Horton, Philipp W. Stockhammer, Erdene Myagmar, Nicole Boivin, Christina Warinner & Jessica Hendy

## YANG 2020

Yimin Yang, *Dairying transformed Mongolia*. [Nature Ecology & Evolution](#) **4** (2020), 288–289.

Proteomic analysis of human dental calculus finds evidence that ruminant dairying was accompanied with eastward human migration into Central Mongolia about 5,000 years ago and horse milk consumption was a part of the economic transformation in Mongolia around 1200 bc.

Wilkin and colleagues provide new clues for the timing and pathways of spread of domestic cattle and sheep from their origins in the Middle East into China. In the late fourth millennium bc, the earliest domestic cattle in China appear in the

GanQing area<sup>9</sup> and northeast China<sup>10</sup>, and the earliest domestic sheep are also found in the Gan-Qing area<sup>11</sup>. The detection of milk residue confirms the herding of cattle and sheep around 5,000 years ago in Mongolia<sup>5</sup>, yet herding was absent at that time in Xinjiang, northwestern China, the region connecting the Gan-Qing area and Central Asia; this suggests that Mongolia could have been the gateway into China for the eastward spread of cattle and sheep (Fig. 1). Recently, millet cultivation in southeastern Kazakhstan could be traced back to  $\approx 2700$  bc<sup>12</sup>, far from the domestication centres in northern China. But there is also no report of contemporary millet cultivation in Xinjiang; thus, the westward spread of millet might mirror the eastward spread of cattle and sheep, implicating the eastern Eurasian steppe as a potential crossroads for crops and livestock. The human carriers of cattle, sheep and millet, and the detailed pathways they followed will need to be clarified by multi-disciplinary research in the future.

## Mathematik

ALGER 2020

Ingela Alger, Paul L. Hooper, Donald Cox, Jonathan Stieglitz & Hillard S. Kaplan, *Paternal provisioning results from ecological change*.

[PNAS 117 \(2020\), 10746–10754.](#)

[pnas117-10746-Supplement.pdf](#)

Paternal provisioning among humans is puzzling because it is rare among primates and absent in nonhuman apes and because emergent provisioning would have been subject to paternity theft. A provisioning “dad” loses fitness at the hands of nonprovisioning, mate-seeking “cads.” Recent models require exacting interplay between male provisioning and female choice to overcome this social dilemma. We instead posit that ecological change favored widespread improvements in male provisioning incentives, and we show theoretically how social obstacles to male provisioning can be overcome. Greater availability of energetically rich, difficult-to-acquire foods enhances female–male and male–male complementarities, thus altering the fitness of dads versus cads. We identify a tipping point where gains from provisioning overcome costs from paternity uncertainty and the dad strategy becomes viable. Stable polymorphic states are possible, meaning that dads need not necessarily eliminate cads. Our simulations suggest that with sufficient complementarities, dads can emerge even in the face of high paternity uncertainty. Our theoretical focus on ecological change as a primary factor affecting the trade-off between male mating and parenting effort suggests different possibilities for using paleo-climatic, archaeological, and genomic evidence to establish the timing of and conditions associated with emergence of paternal provisioning in the hominin lineage.

**Keywords:** paternal care | fatherhood | human evolution | parental investment | cooperation

**Significance:** Paternal provisioning is ubiquitous in human subsistence societies and unique among apes. How could paternal provisioning have emerged from promiscuous or polygynous mating systems that characterize other apes? An anomalous provisioning male would encounter a social dilemma: Since this investment in prospective offspring can be expropriated by other males, this investment is unlikely to increase the provisioner’s fitness. We present an ecological theory of the evolution of human paternal investment. Ecological change favoring reliance on energetically rich, difficult-to-acquire resources increases payoffs to paternal provisioning due to female–male and/or male–male complementarities. Paternal provisioning becomes a viable reproductive strategy when complementarities are

strong, even under high paternity uncertainty. This model illuminates additional paths for understanding the evolution of fatherhood.

## Metallzeiten

BIENKOWSKI 2000

Piotr Bienkowski, *Transjordan and Assyria*. In: LAWRENCE E. STAGER JOSEPH A. GREENE & MICHAEL D. COOGAN (Hrsg.), *The Archaeology of Jordan and Beyond, Essays in Honor of James A. Sauer*. Harvard Semitic Museum Publications 1 ([Winona Lake 2000](#)), 44–58.

This marked difference between the intensity of communication of Assyria with the northern lands, and its complete lack in Transjordan, cannot be regarded as accidental. The “Great Game” of Neo-Assyrian times—complete with spies, assassinations, and fugitives—was played out in the north, and that is where Assyrian resources, communications, and administrative organization were at their most intense. In Sargonid times, when Egypt became the focus of trade and conquest, it was parts of southern Palestine that were subjected to more intense direct rule. Throughout, Transjordan remained loyal, so far as the sources indicate, and Ammon, Moab, and Edom were left as independent, tributary states with no direct imperial presence or involvement or attested exchanges of letters. Assyria did not need to interfere here: the Transjordanian states performed as required and Assyria was able to fulfill its objectives in this less strategic area at arm’s length. We are fortunate that Assyria’s lack of involvement in Trans-Jordan has been partially redressed in our day by Jim Sauer’s careful and pioneering archaeological research, and this paper is presented in his honor.

## Mittelpaläolithikum

GAUDZINSKI-WINDHEUSER 2018

Sabine Gaudzinski-Windheuser, Elisabeth S. Noack, Eduard Pop & Wil Roebroeks et al., *Evidence for close-range hunting by last interglacial Neanderthals*. [Nature Ecology & Evolution 2 \(2018\), 1087–1092](#).

[NatEcoEvo02-1087-Supplement.pdf](#)

Animal resources have been part of hominin diets since around 2.5 million years ago, with sharp-edged stone tools facilitating access to carcasses. How exactly hominins acquired animal prey and how hunting strategies varied through time and space is far from clear. The oldest possible hunting weapons known from the archaeological record are 300,000 to 400,000-year-old sharpened wooden staves. These may have been used as throwing and/or close-range thrusting spears, but actual data on how such objects were used are lacking, as unambiguous lesions caused by such weapon-like objects are unknown for most of human prehistory. Here, we report perforations observed on two fallow deer skeletons from Neumark-Nord, Germany, retrieved during excavations of 120,000-year-old lake shore deposits with abundant traces of Neanderthal presence. Detailed studies of the perforations, including micro-computed tomography imaging and ballistic experiments, demonstrate that they resulted from the close-range use of thrusting spears. Such confrontational ways of hunting require close cooperation between participants, and over time may have shaped important aspects of hominin biology and behaviour.

Sabine Gaudzinski-Windheuser, Elisabeth S. Noack, Eduard Pop, Constantin Herbst, Johannes Pfleging, Jonas Buchli, Arne Jacob, Frieder Enzmann, Lutz Kindler, Radu Iovita, Martin Street & Wil Roebroeks