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References

Afrika

Carr 2023

Andrew S. Carr, Brian M. Chase, Stephen J. Birkinshaw, Peter J. Holmes, Mulalo Rabumbulu & Brian A. Stewart, *Paleolakes and socioecological implications of last glacial "greening" of the South African interior*. PNAS **120** (2023), e2221082120.

pnas120-e2221082120-Supplement.pdf

Determining the timing and drivers of Pleistocene hydrological change in the interior of South Africa is critical for testing hypotheses regarding the presence, dynamics, and resilience of human populations. Combining geological data and physically based distributed hydrological modeling, we demonstrate the presence of large paleolakes in South Africa's central interior during the last glacial period, and infer a regional-scale invigoration of hydrological networks, particularly during marine isotope stages 3 and 2, most notably 55 to 39 ka and 34 to 31 ka. The resulting hydrological reconstructions further permit investigation of regional loral and fauna responses using a modern analog approach. These suggest that the climate change required to sustain these water bodies would have replaced xeric shrubland with more productive, eutrophic grassland or higher grass-cover vegetation, capable of supporting a substantial increase in ungulate diversity and biomass. The existence of such resource-rich landscapes for protracted phases within the last glacial period likely exerted a recurrent draw on human societies, evidenced by extensive pan-side artifact assemblages. Thus, rather than representing a perennially uninhabited hinterland, the central interior's underrepresentation in late Pleistocene archeological narratives likely relects taphonomic biases stemming from a dearth of rockshelters and regional geomorphic controls. These indings suggest that South Africa's central interior experienced greater climatic, ecological, and cultural dynamism than previously appreciated and potential to host human populations whose archaeological signatures deserve systematic investigation.

Keywords: Pleistocene | southern Africa | paleolake | middle stone age

Significance: Renowned for its rich evidence pertaining to early Homo sapiens, South Africa's late Pleistocene archaeological record remains biased toward the continental margins. A profusion of coastal rockshelters, together with putative associations of glacial periods with intense aridity in the continental interior, has created historical impressions of an inland core hostile to human life during lengthy glacial phases. New geological data and largescale hydrological modeling experiments reveal that a series of large, now-dry palaeolakes existed for protracted phases of marine isotope stages 3 and 2. Modern analog reconstructions of resulting vegetational and faunal communities suggest that glacial climates were capable of transforming South Africa's central interior into a resourcerich landscape favorable to human populations.

Lejju 2006

B. Julius Lejju, Peter Robertshaw & David Taylor, *Africa's earliest bananas?* Journal of Archaeological Science **33** (2006), 102–113.

The recent discovery of banana phytoliths dating to the first millennium BC in Cameroon has ignited debate about the timing of the introduction of this import-

ant food crop to Africa. This paper presents new phytolith evidence obtained from one of three sediment cores from a swamp at Munsa, Uganda, that appears to indicate the presence of bananas (Musa) at this site during the fourth millennium BC. This discovery is evaluated in the light of existing knowledge of phytolith taphonomy, the history of Musa, ancient Indian Ocean trade and African prehistory.

Keywords: Archaeobotany | Bananas | Indian Ocean trade | Central Africa | Food production | Phytoliths

Aktuell

Kowall 2021

Bernd Kowall, Fabian Standl, Florian Oesterling, Bastian Brune, Marcus Brinkmann, Marcel Dudda, Peter Pflaumer, Karl-Heinz Jöc, *Excess mortality due to Covid-19? A comparison of total mortality in 2020 with total mortality in 2016 to 2019 in Germany, Sweden and Spain.* PLoS ONE **16** (2021), e255540. DOI:10.1371/journal.pone.0255540.

Introduction Excess mortality is a suitable indicator of health consequences of COVID-19 because death from any cause is clearly defined contrary to death from Covid-19. We compared the overall mortality in 2020 with the overall mortality in 2016 to 2019 in Germany, Sweden and Spain. Contrary to other studies, we also took the demographic development between 2016 and 2020 and increasing life expectancy into account.

Methods: Using death and population figures from the EUROSTAT database, we estimated weekly and cumulative Standardized Mortality Ratios (SMR) with 95 % confidence intervals (CI) for the year 2020. We applied two approaches to calculate weekly numbers of death expected in 2020: first, we used mean weekly mortality rates from 2016 to 2019 as expected mortality rates for 2020, and, second, to consider increasing life expectancy, we calculated expected mortality rates for 2020 by extrapolation from mortality rates from 2016 to 2019.

Results: In the first approach, the cumulative SMRs show that in Germany and Sweden there was no or little excess mortality in 2020 (SMR = 0.976 (95 % CI: 0.974–0.978), and 1.030 (1.023– 1.036), respectively), while in Spain the excess mortality was 14.8 % (1.148 (1.144–1.151)). In the second approach, the corresponding SMRs for Germany and Sweden increased to 1.009 (1.007–1.011) and 1.083 (1.076–1.090), respectively, whereas results for Spain were virtually unchanged.

Bernd Kowall, Fabian Standl, Florian Oesterling, Bastian Brune, Marcus Brinkmann, Marcel Dudda, Peter Pflaumer, Karl-Heinz Jöckel & Andreas Stang

Lewis 2023

Dyani Lewis, *Market Samples Fail to Shed Further Light on Covid Origins.* nature **617** (2023), 233–234.

New analysis of genomic data from market swabs Highlights their limitations.

He investigated whether environmental swabs rich in viral sequences were associated with genetic material from a particular animal, which could be a sign of infection. But there was no such association that made sense. In fact, the strongest associations were with species, such as fish, cows and goats, that SARSCoV-2 is not known to infect, says Bloom. The swab data merely confirm that the virus was widespread at the market, he says.

Scherb 2023

Hagen Scherb & Keiji Hayashi, *Annual All-Cause Mortality Rate in Germany and Japan (2005 to 2022) With Focus on the Covid-19 Pandemic, Hypotheses And Trend Analyses*. Medicine Clinical Science **5** (2023), ii, 1–7.

In conclusion, the official fear-mongering forecasts and the allegedly confirmed high death toll in 2020 from Covid-19 in high income countries [21,22] did not come true, neither in Japan nor in Germany. Based on early investigations in 2020 and 2021, however, great damage was not to be expected [23,24]. Therefore, it should be investigated to what extent the about 5 to 10 percent highly significantly increased mortalities in Germany and Japan in 2021 and 2022 might be due to the pandemic counter measures.

Keywords: change-point | excess mortality | regression analysis | trend | Sars-CoV-2

Amerika

Llamas 2023

Bastien Llamas & Xavier Roca-Rada, *Paleogenomic study of the Mexican past*. science **380** (2023), 578–579.

Ancient DNA analysis of ancestral Mexicans reveals a complex demographic history.

Villa-Islas 2023

Viridiana Villa-Islas & María C. Ávila-Arcos et al., *Demographic history and genetic structure in pre-Hispanic Central Mexico*. science **380** (2023), 598.

s380-0598-Supplement.pdf

Aridoamerica and Mesoamerica are two distinct cultural areas in northern and central Mexico, respectively, that hosted numerous pre-Hispanic civilizations between 2500 BCE and 1521 CE. The division between these regions shifted southward because of severe droughts ≈1100 years ago, which allegedly drove a population replacement in central Mexico by Aridoamerican peoples. In this study, we present shotgun genome-wide data from 12 individuals and 27 mitochondrial genomes from eight preHispanic archaeological sites across Mexico, including two at the shifting border of Aridoamerica and Mesoamerica. We find population continuity that spans the climate change episode and a broad preservation of the genetic structure across present-day Mexico for the past 2300 years. Lastly, we identify a contribution to pre-Hispanic populations of northern and central Mexico from two ancient unsampled "ghost" populations.

Viridiana Villa-Islas, Alan Izarraras-Gomez, Maximilian Larena, Elizabeth Mejía Perez Campos, Marcela Sandoval-Velasco, Juan Esteban Rodríguez-Rodríguez, Miriam Bravo-Lopez, Barbara Moguel, Rosa Fregel, Ernesto Garfias-Morales, Jazeps Medina Tretmanis, David Alberto Velázquez-Ramírez, Alberto Herrera-Muñóz, Karla Sandoval, Maria A. Nieves-Colón, Gabriela Zepeda García Moreno, Fernando A. Villanea, Eugenia Fernández Villanueva Medina, Ramiro Aguayo-Haro, Cristina Valdiosera, Alexander G. Ioannidis, Andrés Moreno-Estrada, Flora Jay, Emilia Huerta-Sanchez, J. Víctor Moreno-Mayar, Federico Sánchez-Quinto & María C. Ávila-Arcos

Anthropologie

Hodgson 2012

Derek Hodgson, *Accommodating Opposing Perspectives in the "Modern Human Behavior" Debate*. Current Anthropology **53** (2012), 358.

This means that, because the copying of skills as a function of the mirror system is based on associative learning, expertise can rapidly be lost should socioecological circumstances change.

As most skills are difficult to acquire, not least because of the sophistication that accrues as a result of this effect, when population rates decline or become more dispersed, skills will be lost because of a lack of input on which the mirror/theory-of-mind system can act.

Ragsdale 2023

Aaron P. Ragsdale, Timothy D. Weaver, Brenna M. Henn & Simon Gravel et al., *A weakly structured stem for human origins in Africa*. nature **617** (2023), 755–763.

n617-0755-Supplement.pdf

Despite broad agreement that Homo sapiens originated in Africa, considerable uncertainty surrounds speciic models of divergence and migration across the continent1. Progress is hampered by a shortage of fossil and genomic data, as well as variability in previous estimates of divergence times1. Here we seek to discriminate among such models by considering linkage disequilibrium and diversity-based statistics, optimized for rapid, complex demographic inference2. We infer detailed demographic models for populations across Africa, including eastern and western representatives, and newly sequenced whole genomes from 44 Nama (Khoe-San) individuals from southern Africa. We infer a reticulated African population history in which present-day population structure dates back to Marine Isotope Stage 5. The earliest population divergence among contemporary populations occurred 120,000 to 135,000 years ago and was preceded by links between two or more weakly diferentiated ancestral Homo populations connected by gene low over hundreds of thousands of years. Such weakly structured stem models explain patterns of polymorphism that had previously been attributed to contributions from archaic hominins in Africa2–7. In contrast to models with archaic introgression, we predict that fossil remains from coexisting ancestral populations should be genetically and morphologically similar, and that only an inferred 1–4 % of genetic diferentiation among contemporary human populations can be attributed to genetic drift between stem populations. We show that model misspeciication explains the variation in previous estimates of divergence times, and argue that studying a range of models is key to making robust inferences about deep history.

Aaron P. Ragsdale, Timothy D. Weaver, Elizabeth G. Atkinson, Eileen G. Hoal, Marlo Möller, Brenna M. Henn & Simon Gravel

Zeller 2023

Elke Zeller, Axel Timmermann, Kyung-Sook Yun, Pasquale Raia, Karl Stein & Jiaoyang Ruan, *Human adaptation to diverse biomes over the past 3 million years*. science **380** (2023), 604–608.

s380-0604-Supplement1.pdf, s380-0604-Supplement2.zip

To investigate the role of vegetation and ecosystem diversity on hominin adaptation and migration, we identify past human habitat preferences over time using a transient 3-million-year earth system-biome model simulation and an extensive hominin fossil and archaeological database. Our analysis shows that early African

hominins predominantly lived in open environments such as grassland and dry shrubland. Migrating into Eurasia, hominins adapted to a broader range of biomes over time. By linking the location and age of hominin sites with corresponding simulated regional biomes, we also find that our ancestors actively selected for spatially diverse environments. The quantitative Results lead to a new diversity hypothesis: Homo species, in particular Homo sapiens, were specially equipped to adapt to landscape mosaics.

Bibel

Eichler 2023

Raanan Eichler, *Why Were Moses and Aaron Punished?1*, *Draft – do not copy or distribute*. unknown (2023), preprint, 1–13. .

I have argued elsewhere23 that Aaron's flowering staff is not some one-off that disappears from biblical history after its account in Numbers 17. Rather, that account is the priestly origin story for the "asherah", apparently a stylized tree, that was a cultic focus in the Jerusalem temple according to the book of Kings (2 Kgs 21:3, 7; 23:4, 6, 7).

In my view, the priestly author thought that the asherah could be legitimate if understood correctly, namely, as a mere sign and reminder that YHWH's blessing is facilitated exclusively by the descendants of Aaron through their speech. This explains why the priestly literature and its related work Ezekiel express no hostility to the asherah and do not mention it in their lists of illegitimate cultic objects (Lev 19:4; 26:1, 30; Num 33:52; Ezek 6:3–6).

If this identification is correct, we can reach a sharper understanding of the Strifewater account. It was the priestly author's vehicle for criticizing what he saw as a misunderstanding and fetishization of the asherah, namely, the popular view that it was an instrument in its own right, and perhaps that it could be used to manipulate or even force YHWH into giving his blessing.

Biologie

Koch 2023

Christof Koch, *Do not go gently into that good night*, *The dying brain and its paradoxically heightened electrical activity*. PNAS **120** (2023), e2305985120.

The authors argue that their data are compatible with two patients awakening from their terminal coma by the alarming drop of oxygen (hypoxia) and consciously experiencing something before death. They speculate that these experiences might be similar to the feelings of peace and transcendence reported during near-death experiences by survivors. Perhaps.

Xu 2023

Gang Xu & Jimo Borjigin et al., *Surge of neurophysiological coupling and connectivity of gamma oscillations in the dying human brain*. PNAS **120** (2023), e2216268120.

pnas120-e2216268120-Supplement.pdf

The brain is assumed to be hypoactive during cardiac arrest. However, animal models of cardiac and respiratory arrest demonstrate a surge of gamma oscillations and functional connectivity. To investigate whether these preclinical indings

translate to humans, we analyzed electroencephalogram and electrocardiogram signals in four comatose dying patients before and after the withdrawal of ventilatory support. Two of the four patients exhibited a rapid and marked surge of gamma power, surge of cross-frequency coupling of gamma waves with slower oscillations, and increased interhemispheric functional and directed connectivity in gamma bands. High-frequency oscillations paralleled the activation of beta/gamma cross-frequency coupling within the somatosensory cortices. Importantly, both patients displayed surges of functional and directed connectivity at multiple frequency bands within the posterior cortical "hot zone," a region postulated to be critical for conscious processing. This gamma activity was stimulated by global hypoxia and surged further as cardiac conditions deteriorated in the dying patients. These data demonstrate that the surge of gamma power and connectivity observed in animal models of cardiac arrest can be observed in select patients during the process of dying.

Keywords: global hypoxia | gamma oscillations | cross-frequency coupling | functional connectivity | directed connectivity

Gang Xu, Temenuzhka Mihaylova, Duan Li, Fangyun Tian, Peter M. Farrehi, Jack M. Parent, George A. Mashour, Michael M. Wang & Jimo Borjigin

Significance: Is it possible for the human brain to be activated by the dying process? We addressed this issue by analyzing the electroencephalograms (EEG) of four dying patients before and after the clinical withdrawal of their ventilatory support and found that the resultant global hypoxia markedly stimulated gamma activities in two of the patients. The surge of gamma connectivity was both local, within the temporo–parieto–occipital (TPO) junctions, and global between the TPO zones and the contralateral prefrontal areas. While the mechanisms and physiological signiicance of these indings remain to be fully explored, these data demonstrate that the dying brain can still be active. They also suggest the need to reevaluate role of the brain during cardiac arrest.

Energie

Wang 2023

Gang Wang, Guoqing Li & Zhe Liu, *Wind farms dry surface soil in temporal and spatial variation*. MethodsX **10** (2023), 102000, 1–8.

MethodsX10-a102000-Supplement1.docx, MethodsX10-a102000-Supplement2.docx

Wind farms have been proved to have potential impact on the ecology. As an important ecological factor, soil moisture has a great impact on the ecosystem. Therefore, it is of great significance to explore the effect of wind farms on soil moisture. At present, the remote sensing data can be used to calculate the soil moisture of wind farm conveniently, but its spatial resolution is poor. Moreover, the measured soil moisture can't express the spatial difference. Therefore, through the effective combination of remote sensing data and measured data, this method can accurately judge the impact of wind farm on soil moisture. This method investigated wind farms located in the grasslands of China. Remote sensing images and field data were used to explore the area and extent of influence of wind farms on grassland soil moisture. We use Landsat images and field measurements to derive a linear relationship between the soil moisture and the TVDI, which was calculated based on the land surface temperature and NDVI, was developed in this work. The correlation was used to reverse spatial distribution map of soil moisture before and after the construction of wind farms. The diurnal and seasonal variation of the influence of the wind farm on the grassland soil moisture was also judged.

- This method of combining measurement and remote sensing provides a reference for analysing the influence of wind farms on soil moisture.
- This method can be used for reference to compare the meteorological factors of different wind directions before and after the construction of wind farms.

Keywords: Wind turbine | Soil moisture | Drought | Seasonal

Isotope

Linscott 2023

Bethan Linscott et al., *Reconstructing Middle and Upper Paleolithic human mobility in Portuguese Estremadura through laser ablation strontium isotope analysis.* PNAS **120** (2023), e2204501120.

pnas120-e2204501120-Supplement.pdf

Understanding mobility and landscape use is important in reconstructing subsistence behavior, range, and group size, and it may contribute to our understanding of phenomena such as the dynamics of biological and cultural interactions between distinct populations of Upper Pleistocene humans. However, studies using traditional strontium isotope analysis are generally limited to identifying locations of childhood residence or nonlocal individuals and lack the sampling resolution to detect movement over short timescales. Here, using an optimized methodology, we present highly spatially resolved 87Sr/86Sr measurements made by laser ablation multicollector inductively coupled plasma mass spectrometry along the growth axis of the enamel of two marine isotope stage 5b, Middle Paleolithic Neanderthal teeth (Gruta da Oliveira), a Tardiglacial, Late Magdalenian human tooth (Galeria da Cisterna), and associated contemporaneous fauna from the Almonda karst system, Torres Novas, Portugal. Strontium isotope mapping of the region shows extreme variation in 87Sr/86Sr, with values ranging from 0.7080 to 0.7160 over a distance of c. 50 km, allowing short-distance (and arguably short-duration) movement to be detected. We find that the early Middle Paleolithic individuals roamed across a subsistence territory of approximately 600 km2, while the Late Magdalenian individual parsimoniously fits a pattern of limited, probably seasonal movement along the right bank of the 20-km-long Almonda River valley, between mouth and spring, exploiting a smaller territory of approximately 300 km2. We argue that the differences in territory size are due to an increase in population density during the Late Upper Paleolithic.

Keywords: Palaeolithic | isotopes | strontium | mobility | Portugal

Bethan Linscott, Alistair W. G. Pike, Diego E. Angelucci, Matthew J. Cooper, James S. Milton, Henrique Matias & João Zilhão

Significance: Laser ablation MC-ICP-MS allows in situ strontium isotope data to be obtained for incrementally formed bioapatites such as enamel with extremely high spatial resolution. Here, we provide a large-scale application of the method comparing the mobility and subsistence behavior of Middle and Upper Paleolithic humans in the same landscape. These remains and the fauna analyzed alongside come from the Almonda karst system (Portuguese Estremadura). Data suggest that regional Middle Paleolithic individuals roamed across a subsistence territory of approximately 600 km2, while Upper Paleolithic individuals moved seasonally and exploited a smaller territory of approximately 300 km2.

Klima

Aldahan 2023

Ala Aldahan, *The relevance and significance of variable cyclicities in*

paleoclimate archives. PNAS **120** (2023), e2305219120.

England 2023

Mark R. England & & Lorenzo M. Polvani, *The Montreal Protocol is delaying the occurrence of the first ice-free Arctic summer*. PNAS **120** (2023), e2211432120.

pnas120-e2211432120-Supplement.pdf

The rapid melting of Arctic sea ice is the largest and clearest signal of anthropogenic climate change. Current projections indicate that the first ice-free Arctic summer will ikely occur by mid-century, owing to increasing carbon dioxide concentrations in he atmosphere. However, other powerful greenhouse gases have also contributed to Arctic sea ice loss, notably ozone-depleting substances (ODSs). In the late 1980s, ODSs became strictly regulated by the Montreal Protocol, and their atmospheric concentrations have been declining since the mid-1990s. Here, analyzing new climate model simulations, we demonstrate that the Montreal Protocol, designed to protect the ozone layer, is delaying the first appearance of an ice-free Arctic summer, by up to 15 y, depending on future emissions. We also show that this important climate mitigation tems entirely from the reduced greenhouse gas warming from the regulated ODSs, with the avoided stratospheric ozone losses playing no role. Finally, we estimate that each Gg of averted ODS emissions results in approximately 7 km2 of avoided Arctic ea ice loss.

Keywords: Arctic | Montreal Protocol | sea-ice | ozone-depleting substances

Significance: Designed to protect the ozone layer after the discovery of the ozone hole over Antarctica, the Montreal Protocol was signed in 1987 and entered into effect in 1989, when little was known as to the effect of its implementation on the global climate. Since then, it has become clear that the Montreal Protocol is an important mitigation treaty, affecting many aspects of the global climate. Here, we demonstrate that its effect reaches all the way into the Arctic. Specifically, we show that the implementation of the Montreal Protocol has postponed the occurrence of the first ice-free Arctic by as much as 15 y, depending on the details of future emissions.

Vo 2023

Thuy Trang Vo, Leiqiu Hu, Lulin Xue, Qi Li & Sisi Chen, *Urban effects on local cloud patterns*. PNAS **120** (2023), e2216765120.

pnas120-e2216765120-Supplement.pdf

Urbanization extensively modifies surface roughness and properties, impacting regional climate and hydrological cycles. Urban effects on temperature and precipitation have drawn considerable attention. These associated physical processes are also closely linked to clouds' formation and dynamics. Cloud is one of the critical components in regulating urban hydrometeorological cycles but remains less understood in urban-atmospheric systems. We analyzed satellite-derived cloud patterns spanning two decades over 447 US cities and quantified the urban-influenced cloud patterns diurnally and seasonally. The systematic assessment suggests that most cities experience enhanced daytime cloud cover in both summer and winter; nocturnal cloud enhancement prevails in summer by 5.8 %, while there is modest cloud suppression in winter nights. Statistically linking the cloud patterns with city properties, geographic locations, and climate backgrounds, we found that larger city size and stronger surface heating are primarily responsible for summer local cloud enhancement diurnally. Moisture and energy background control the urban cloud cover anomalies seasonally. Under strong mesoscale circulations induced by terrains and land–water contrasts, urban clouds exhibit considerable nighttime enhancement during warm seasons, which is relevant to strong urban

surface heating interacting with these circulations, but other local and climate impacts remain complicated and inconclusive. Our research unveils extensive urban influences on local cloud patterns, but the effects are diverse depending on time, location, and city properties. The comprehensive observational study on urban–cloud interactions calls for more in-depth research on urban cloud life cycles and their radiative and hydrologic implications under the urban warming context.

Keywords: cities | cloud climatology | remote sensing | CONUS

Significance: Clouds play a key role in radiation and precipitation processes in the climate system. Urban-modified surface properties as well as anthropogenic heat and aerosols can alter cloud processes. How and to what extent cities interact with background conditions to impact local-regional cloud patterns remain poorly understood. Using long-term and large-scale satellite cloud observations over 447 US cities, this observational-based urban–cloud interaction research reveals cloud enhancements for most cities during warm seasons, even for smaller cities. We also found ubiquitous urban effects on cloud patterns climatologically primarily determined by climate Backgrounds interacting with cities and urban surface heating. These findings advance our understanding of urban effects on regional atmospheric systems and highlight further research needs in urban hydrometeorological processes.

Wang 2023

Renée Z. Wang & Avi I. Flamholz et al., *Carbon isotope fractionation by an ancestral rubisco suggests that biological proxies for CO_2 through geologic time should be reevaluated.* PNAS **120** (2023), e2300466120.

pnas120-e2300466120-Supplement.pdf

The history of Earth's carbon cycle relects trends in atmospheric composition convolved with the evolution of photosynthesis. Fortunately, key parts of the carbon cycle have been recorded in the carbon isotope ratios of sedimentary rocks. The dominant model used to interpret this record as a proxy for ancient atmospheric CO2 is based on carbon isotope fractionations of modern photoautotrophs, and longstanding questions remain about how their evolution might have impacted the record. Therefore, we measured both biomass (ep) and enzymatic (eRubisco) carbon isotope fractionations of a cyanobacterial strain (Synechococcus elongatus PCC 7942) solely expressing a putative ancestral Form 1B rubisco dating to >1 Ga. This strain, nicknamed ANC, grows in ambient pCO2 and displays larger ep values than WT, despite having a much smaller eRubisco (17.23 ± 0.61 ‰ vs. 25.18 ± 0.31 ‰, respectively). Surprisingly, ANC ep exceeded ANC eRubisco in all conditions tested, contradicting prevailing models of cyanobacterial carbon isotope fractionation. Such models can be rectiied by introducing additional isotopic fractionation associated with powered inorganic carbon uptake mechanisms present in Cyanobacteria, but this amendment hinders the ability to accurately estimate historical pCO2 from geological data. Understanding the evolution of rubisco and the CO2 concentrating mechanism is therefore critical for interpreting the carbon isotope record, and fluctuations in the record may reflect the evolving efficiency of carbon fixing metabolisms in addition to changes in atmospheric CO2.

Keywords: evolution | carbon isotopes | rubisco | cyanobacteria | Precambrian

Renée Z. Wang, Robert J. Nichols, Albert K. Liu, Avi I. Flamholz, Juliana Artier, Doug M. Banda, David F. Savage, John M. Eiler, Patrick M. Shih & Woodward W. Fischer

Significance: Earth scientists rely on chemical fossils like the carbon isotope record to derive ancient atmospheric CO2 concentrations, but interpretation of this record is calibrated using modern organisms. We tested this assumption by

measuring the carbon isotope fractionation of a reconstructed ancestral rubisco enzyme (>1 billion years old) in vivo and in vitro. Our results contradicted prevailing models of carbon low in Cyanobacteria, but our data could be rationalized if light-driven uptake of CO2 is considered. Our study suggests that the carbon isotope record tracks both the evolution of photosynthetic physiology as well as changes in atmospheric CO2, highlighting the importance of considering both evolution and physiology for comparative biological approaches to understanding Earth's history.

Zhou 2023

Weijian Zhou et al., *Eccentricity-paced geomagnetic field and monsoon rainfall variations over the last 870 kyr.* PNAS **120** (2023), e2211495120.

pnas120-e2211495120-Supplement.pdf

Whether there are links between geomagnetic ield and Earth's orbital parameters remains unclear. Synchronous reconstructions of parallel long-term quantitative geomagnetic ield and climate change records are rare. Here, we present 10Be-derived changes of both geomagnetic ield and Asian monsoon (AM) rainfall over the last 870 kyr from the Xifeng loess–paleosol sequence on the central Chinese Loess Plateau. The 10BeGM lux (a proxy for geomagnetic ield-induced 10Be production rate) reveals 13 consecutive geomagnetic excursions in the Brunhes chron, which are synchronized with the global records, providing key time markers for Chinese loess–paleosol sequences. The 10Be-derived rainfall exhibits distinct ≈100 kyr glacial–interglacial cycles, and superimposed precessional (≈23 kyr) cycles that match with those in Chinese speleothem d18O record. We ind that changes in the geomagnetic ield and AM rainfall share a common ≈100 kyr cyclicity, implying a likely eccentricity modulation of both the geomagnetic ield and climate.

Keywords: Chinese loess | cosmogenic 10Be | geomagnetic ield | Asian monsoon rainfall | orbital eccentricity

Weijian Zhou, Xianghui Kong, Greig A. Paterson, Youbin Sun, Yubin Wu, Hong Ao, Feng Xian, Yajuan Du, Ling Tang, Jie Zhou, Zhengguo Shi, A. J. Timothy Jull, Guoqing Zhao & Zhisheng An

Significance: Whether the geomagnetic ield is forced by Earth's orbital parameters or related to climate has long been a controversial topic. Using Chinese loess 10Be, we simultaneously derive a credible geomagnetic ield record by removing the climate factors and a quantitative record of Asian monsoon (AM) rainfall for the past 870 kyr. We show that changes in 10Be-derived geomagnetic ield and AM rainfall contain a ≈100 kyr cyclicity, indicating that both geomagnetic ield and AM rainfall variability may be modulated by orbital eccentricity. We suggest that eccentricity inluences AM rainfall by modulating the amplitude of precession, while eccentricity may afect the geomagnetic ield through global ice volume changes.

Kultur

Crassard 2023

Rémy Crassard, Wael Abu-Azizeh, Olivier Barge, Jacques Élie Brochier, Frank Preusser, Hamida Seba, Abd Errahmane Kiouche, Emma, *The oldest plans to scale of humanmade mega-structures.* PLoS ONE **18** (2023), e277927. .

Data on how Stone Age communities conceived domestic and utilitarian structures are limited to a few examples of schematic and non-accurate representations

of various-sized built spaces. Here, we report the exceptional discovery of the up-to-now oldest realistic plans that have been engraved on stones. These engravings from Jordan and Saudi Arabia depict 'desert kites', humanmade archaeological mega-traps that are dated to at least 9,000 years ago for the oldest. The extreme precision of these engravings is remarkable, representing gigantic neighboring Neolithic stone structures, the whole design of which is impossible to grasp without seeing it from the air or without being their architect (or user, or builder). They reveal a widely underestimated mental mastery of space perception, hitherto never observed at this level of accuracy in such an early context. These representations shed new light on the evolution of human discernment of space, communication, and communal activities in ancient times.

Rémy Crassard, Wael Abu-Azizeh, Olivier Barge, Jacques Élie Brochier, Frank Preusser, Hamida Seba, Abd Errahmane Kiouche, Emmanuelle Régagnon, Juan Antonio Sánchez Priego, Thamer Almalki & Mohammad Tarawneh

Physik

Barrow 1986

John D. Barrow & Frank J. Tipler, *The anthropic cosmological principle*. Oxford Paperbacks (Oxford ^{3}1996).

Politik

Alesina 2023

Alberto Alesina, Sebastian Hohmann, Stelios Michalopoulos & Elias Papaioannou, *Religion and educational mobility in Africa*. nature **618** (2023), 134–143.

n618-0134-Supplement.pdf

The African people and leaders1,2 have long seen education as a driving force of development and liberation, a view shared by international institutions3,4, as schooling has large economic and non-economic returns, particularly in low-income settings5. In this study, we examine the educational progress across faiths throughout postcolonial Africa, home to some of the world's largest Christian and Muslim communities. We construct comprehensive religion-speciic measures of intergenerational mobility in education using census data from 2,286 districts in 21 countries and document the following. First, Christians have better mobility outcomes than Traditionalists and Muslims. Second, diferences in intergenerational mobility between Christians and Muslims persist among those residing in the same district, in households with comparable economic and family backgrounds. Third, although Muslims beneit as much as Christians when they move early in life to high-mobility regions, they are less likely to do so. Their low internal mobility accentuates the educational deicit, as Muslims reside on average in areas that are less urbanized and more remote with limited infrastructure. Fourth, the Christian–Muslim gap is most prominent in areas with large Muslim communities, where the latter also register the lowest emigration rates. As African governments and international organizations invest heavily in educational programmes, our indings highlight the need to understand better the private and social returns to schooling across faiths in religiously segregated communities and to carefully think about religious inequalities in the take-up of educational policies6.

Sprachlehre

Ferrara 2019
Silvia Ferrara, *The Greatest Invention, A history of the world in nine mysterious scripts.* (London 2023).

Story or Book

Wagenmakers 2023
Eric-Jan Wagenmakers, *How science breeds nonsense.* nature **617** (2023), 669–670.
Tools of rationality are increasingly being used to undermine rationality itself.
Distrust: Big Data, Data-Torturing, and the Assault on Science. Gary Smith. Oxford Univ. Press (2023)
The book joins a growing chorus saying that schools and universities ought to teach courses in quantitative literacy to counter the wider societal problem of scientific disinformation. French scholar Pierre-Simon de Laplace was already arguing for that in 1814; what Distrust often lacks is a prescription for what this might entail. One concrete recommendation is that "statistics courses in all disciplines should include substantial discussion of Bayesian methods".
Distrust lights a few candles, but mostly curses the darkness.