

References

Afrika

NICOLL 2001

Kathleen Nicoll, *Radiocarbon Chronologies for Prehistoric Human Occupation and Hydroclimatic Change in Egypt and Northern Sudan*. [Geoarchaeology 16 \(2001\), 47–64](#).

This article compiles 536 published, uncalibrated radiocarbon ages from well-studied localities in the presently hyperarid Western Desert, or Arba'in Desert, in northeast Africa. The synthesis of these records frames the spatial and temporal context of prehistoric cultural activity during wet periods when the region was habitable (9000–6000 yr B.P.). The variability of records by region indicates that the Holocene was not marked by uniform hydroclimatic conditions; lacunae, or gaps in the record formerly attributed to arid intervals, are not regionally consistent. Since rapid hydroclimatic changes (i.e., “wet–dry” cycles) have played a key role in the geomorphic evolution and human history of Egypt and northern Sudan, the precise definition of arid periods will be important in the further analysis of hydroclimatic change as a driver of cultural innovation, migration, and settlement.

Aktuell

PARK 2016

Chanmo Park, Francesco Pagnini, Andrew Reece, Deborah Phillips & Ellen Langer, *Blood sugar level follows perceived time rather than actual time in people with type 2 diabetes*. [PNAS 113 \(2016\), 8168–8170](#).

The current study investigates whether perceived time has an effect on blood glucose level in people with type 2 diabetes. The hypothesis is that perceived time will have a greater influence over blood glucose level than actual time. Changes in blood glucose levels were measured in 46 participants with diabetes while they completed simple tasks during a 90-min period. Participants' perception of time was manipulated by having them refer to clocks that were either accurate or altered to run fast or slow. Blood glucose levels changed in accordance with how much time they believed had passed instead of how much time had actually passed. These results are an example of the influence psychological processes can directly exert on the body.

Keywords: perceived time | blood glucose levels | diabetes | expectations | false-clock paradigm

Significance: We investigated the hypothesis that the perception of time passing can exert a stronger influence on blood glucose level compared with the passage of actual time in people with type 2 diabetes. Our findings suggest that manipulation of participants' perception of time resulted in blood glucose levels changing in accordance with how much time participants believed had passed, instead of how much time had actually passed. These results are an important example of the influence psychological processes can directly exert on the body. Mindsets and expectations may play an increasingly important role in type 2 diabetes management.

STUBBS 2016

Alexander L. Stubbs & Christopher W. Stubbs, *Spectral discrimination in color blind animals via chromatic aberration and pupil shape*. [PNAS 113 \(2016\), 8206–8211](#).

pnas113-08206-Supplement1.mp4, pnas113-08206-Supplement2.mp4, pnas113-08206-Supplement3.mp4

We present a mechanism by which organisms with only a single photoreceptor, which have a monochromatic view of the world, can achieve color discrimination. An off-axis pupil and the principle of chromatic aberration (where different wavelengths come to focus at different distances behind a lens) can combine to provide “colorblind” animals with a way to distinguish colors. As a specific example, we constructed a computer model of the visual system of cephalopods (octopus, squid, and cuttlefish) that have a single unfiltered photoreceptor type. We compute a quantitative image quality budget for this visual system and show how chromatic blurring dominates the visual acuity in these animals in shallow water. We quantitatively show, through numerical simulations, how chromatic aberration can be exploited to obtain spectral information, especially through nonaxial pupils that are characteristic of coleoid cephalopods. We have also assessed the inherent ambiguity between range and color that is a consequence of the chromatic variation of best focus with wavelength. This proposed mechanism is consistent with the extensive suite of visual/behavioral and physiological data that has been obtained from cephalopod studies and offers a possible solution to the apparent paradox of vivid chromatic behaviors in color blind animals. Moreover, this proposed mechanism has potential applicability in organisms with limited photoreceptor complements, such as spiders and dolphins.

Keywords: spectral discrimination | chromatic aberration | color vision | pupil shape | cephalopod

Significance: We describe a means of obtaining spectral information using the principles of physical optics and an off-axis pupil shape without requiring spectrally distinct photoreceptor classes. The mechanism described here offers a possible solution to a longstanding puzzle in marine animals: cephalopods dramatically change color for both producing chromatically matched camouflage and signaling to conspecifics, despite having a single photoreceptor channel. The ability of these animals to achieve such excellent color matching to their surroundings, despite being “color blind” in the traditional sense, can be understood if they exploit chromatic aberration to deduce spectral information. The bizarre off-axis pupils of these animals can be understood as an adaptation that maximizes spectral information, even at the expense of image acuity.

Amerika

HEINTZMAN 2016

Peter D. Heintzman et al., *Bison phylogeography constrains dispersal and viability of the Ice Free Corridor in western Canada*. [PNAS 113 \(2016\), 8057–8063](#).

pnas113-08057-Supplement1.xlsx, pnas113-08057-Supplement2.rtf

Peter D. Heintzman, Duane Froese, John W. Ives, André E. R. Soares, Grant D. Zazula, Brandon Letts, Thomas D. Andrews, Jonathan C. Driver, Elizabeth Hall, P. Gregory Hare, Christopher N. Jass, Glen MacKay, John R. Southon, Mathias Stiller, Robin Woywitka, Marc A. Suchard & Beth Shapiro

The Ice Free Corridor has been invoked as a route for Pleistocene human and animal dispersals between eastern Beringia and more southerly areas of North

America. Despite the significance of the corridor, there are limited data for when and how this corridor was used. Hypothetical uses of the corridor include: the first expansion of humans from Beringia into the Americas, northward postglacial expansions of fluted point technologies into Beringia, and continued use of the corridor as a contact route between the north and south. Here, we use radiocarbon dates and ancient mitochondrial DNA from late Pleistocene bison fossils to determine the chronology for when the corridor was open and viable for biotic dispersals. The corridor was closed after $\approx 23,000$ until 13,400 calendar years ago (cal y BP), after which we find the first evidence, to our knowledge, that bison used this route to disperse from the south, and by 13,000 y from the north. Our chronology supports a habitable and traversable corridor by at least 13,000 cal y BP, just before the first appearance of Clovis technology in interior North America, and indicates that the corridor would not have been available for significantly earlier southward human dispersal. Following the opening of the corridor, multiple dispersals of human groups between Beringia and interior North America may have continued throughout the latest Pleistocene and early Holocene. Our results highlight the utility of phylogeographic analyses to test hypotheses about paleoecological history and the viability of dispersal routes over time.

Keywords: phylogeography | ice free corridor | Pleistocene | Clovis | bison

Isotope

HANSON 2016

Susan K. Hanson et al., *Measurements of extinct fission products in nuclear bomb debris, Determination of the yield of the Trinity nuclear test 70 y later*. *PNAS* **113** (2016), 8104–8108.

Susan K. Hanson, Anthony D. Pollington, Christopher R. Waidmann, William S. Kinman, Allison M. Wende, Jeffrey L. Miller, Jennifer A. Berger, Warren J. Oldham & Hugh D. Selby

This paper describes an approach to measuring extinct fission products that would allow for the characterization of a nuclear test at any time. The isotopic composition of molybdenum in five samples of glassy debris from the 1945 Trinity nuclear test has been measured. Nonnatural molybdenum isotopic compositions were observed, reflecting an input from the decay of the short-lived fission products 95Zr and 97Zr . By measuring both the perturbation of the $95\text{Mo}/96\text{Mo}$ and $97\text{Mo}/96\text{Mo}$ isotopic ratios and the total amount of molybdenum in the Trinity nuclear debris samples, it is possible to calculate the original concentrations of the 95Zr and 97Zr isotopes formed in the nuclear detonation. Together with a determination of the amount of plutonium in the debris, these measurements of extinct fission products allow for new estimates of the efficiency and yield of the historic Trinity test.

Keywords: nuclear forensics | nuclear testing | treaty monitoring | stable isotope perturbation measurements

Significance: This work describes an approach to postdetonation nuclear forensics involving isotopic measurements that allows for characterization of a nuclear detonation at any time. By performing high-precision measurements of stable isotope perturbations in nuclear bomb debris, it is possible to quantify short-lived fission products long after they have decayed below radiometric detection limits and become extinct. The extinct fission product concentrations can be used to reconstruct details of the nuclear device months to years after the detonation occurred. The approach is demonstrated by analysis of debris from the Trinity nuclear test and new estimates of the efficiency and yield of the historic test are presented.

Klima

BUBENZER 2007

Olaf Bubenzler & Heiko Riemer, *Holocene Climatic Change and Human Settlement Between the Central Sahara and the Nile Valley, Archaeological and Geomorphological Results*. *Geoarchaeology* **22** (2007), 607–620.

Supraregional investigations of the Holocene occupational history of the eastern Sahara west of the Nile combined with the study of climatic, environmental, and geomorphological archives were carried out in contrasting desert regions from the Mediterranean coast strip to Wadi Howar in Sudan. The research areas are located far away from groundwater influence and are therefore capable of indicating environmental changes. Climatic development in accordance with nearly 500 ¹⁴C dates from archaeological sites indicates a Holocene optimum lasting from approximately 9500 B.P. till the beginning of the drying trend that set in about 6300 B.P. (9000–5300 cal. B.C.). Although the faunal and floral remains are arid types, they indicate slightly wetter conditions than today. Surface water was the key factor that influenced the adaptation strategies of the mobile hunter-gatherers (and in some parts, the pastoralists) in the desert regions. Large episodic camp sites agglomerated at favorable drainage systems and water pools, and settlement patterns strongly correlate with the paleohydrological factors examined with remote sensing cartography, geomorphological work, and the analysis of digital elevation models.

COLLINS 2011

James A. Collins et al., *Interhemispheric symmetry of the tropical African rainbelt over the past 23,000 years*. *Nature Geoscience* **4** (2011), 42–45.

NatGeo04-042-Supplement.pdf

James A. Collins, Enno Schefuß, David Heslop, Stefan Mulitza, Matthias Prange, Matthias Zabel, Rik Tjallingii, Trond M. Dokken, Enqing Huang, Andreas Mackensen, Michael Schulz, Jun Tian, Michelle Zarriess & Gerold Wefer

The distribution of rainfall in tropical Africa is controlled by the African rainbelt¹, which oscillates on a seasonal basis. The rainbelt has varied on centennial to millennial timescales along with changes in Northern Hemisphere high-latitude climate^{2–5}, the Atlantic meridional overturning circulation⁶ and low-latitude insolation⁷ over the past glacial–interglacial cycle. However, the overall dynamics of the African rainbelt remain poorly constrained and are not always consistent with a latitudinal migration^{2,4–6}, as has been proposed for other regions^{8,9}. Here we use terrestrially derived organic and sedimentary markers from marine sediment cores to reconstruct the distribution of vegetation, and hence rainfall, in tropical Africa during extreme climate states over the past 23,000 years. Our data indicate that rather than migrating latitudinally, the rainbelt contracted and expanded symmetrically in both hemispheres in response to changes in climate. During the Last Glacial Maximum and Heinrich Stadial 1, the rainbelt contracted relative to the late Holocene, which we attribute to a latitudinal compression of atmospheric circulation associated with lower global mean temperatures¹⁰. Conversely, during the mid-Holocene climatic optimum, the rainbelt expanded across tropical Africa. In light of our findings, it is not clear whether the tropical rainbelt has migrated latitudinally on a global scale, as has been suggested^{8,9}.

GATTO 2015

Maria Carmela Gatto & Andrea Zerboni, *Holocene Supra-Regional Environmental Changes as Trigger for Major Socio-Cultural Processes*

in Northeastern Africa and the Sahara. African Archaeological Review **32** (2015), 301–333.

This contribution presents the environmental changes that occurred over the last ten millennia in a vast region of North Africa, encompassing the Central Sahara, the Greater Nile Valley and the Horn of Africa. These areas are of particular significance in the continent because of the early socioeconomic transformations that occurred there. An up-to-date review of palaeoclimate research is proposed with the aim to highlight new theoretical approaches, analytical methods and innovative techniques. Results of recent research on high-resolution and well-dated palaeoenvironmental archives for proxy data have been used to understand the climatic variability at different scales of resolution. We trace the regional changes in Holocene palaeohydrology, mostly regulated by monsoonal precipitation, and their effects on the landscape, and highlight the occurrence of short-term climatic events, arid or humid that may have had disruptive consequences on human communities. The contribution also discusses the cultural dynamics that occurred in those regions because the latter were exploited by hunter/ gatherer groups from the onset of the Holocene until historical times. A reconstruction of patterns of human adjustment to climatic variability is here presented, focusing on key processes such as the origin of food production, social complexity and power, and the rise and fall of complex polities and interregional networks.

Keywords: Palaeoclimates .Cultural dynamics .Holocene .Northeastern Africa | Sahara

HOLMGREN 2006

Karin Holmgren & Helena Öberg, *Climate change in Southern and Eastern Africa during the past millennium and its implications for societal development. Environment, Development and Sustainability* **8** (2006), 185–195.

Climatic records from equatorial eastern Africa and subtropical southern Africa have shown that both temperature and the amount of rainfall have varied over the past millennium. Moreover, the rainfall pattern in these regions varied inversely over long periods of time. Droughts started abruptly, were of multi-decadal to multi-centennial length and the changes in the hydrological budget were of large amplitude. Changing water resources in semi-arid regions clearly must have regional influences on both ecological and socio-economic processes. Through a detailed analysis of the historical and paleoclimatic evidence from southern and eastern Africa covering the past millennium it is shown that, depending on the vulnerability of a society, climatic variability can have an immense impact on societies, sometimes positive and sometimes disastrous. Therefore, the interconnected issue of world ecosystem and social resilience is the challenge for decision-makers if sustainable development is to be reached on global and local levels.

Keywords: anti-phase relationship | climate variability | high-resolution climate time series | social resilience | vulnerability.

ITAMBI 2010

Achakie C. Itambi, Tilo von Dobeneck & Adesina T. Adegbe, *Millennial-scale precipitation changes over Central Africa during the late Quaternary and Holocene, Evidence in sediments from the Gulf of Guinea. Journal of Quaternary Science* **25** (2010), 267–279.

We combine environmental magnetism, geochemical measurements and colour reflectance to study two late Quaternary sediment cores: GeoB 4905-4 at 2°30' N off Cameroon and GeoB 4906-3 at 0°44' N off Gabon. This area is suitable for

investigating precipitation changes over Central and West Africa because of its potential to record input of aeolian and fluvial sediments. Three magnetozones representing low and high degree of alteration of the primary rock magnetic signals were identified. The magnetic signature is dominated by fine-grained magnetite, while residual haematite prevails in the reduced intervals, showing increase in concentration and fine grain size at wet intervals. Our records also show millennial-scale changes in climate during the last glacial and interglacial cycles. At the northern location, the past 5.5 ka are marked by high-frequency oscillations of Ti and colour reflectance, which suggests aeolian input and hence aridity. The southern location remains under the influence of the Intertropical Convergence Zone and thus did not register aeolian signals. The millennial-scale climatic signals indicate that drier and/or colder conditions persisted during the late Holocene and are synchronous with the 900 a climatic cycles observed in Northern Hemisphere ice core records.

Keywords: environmental magnetism | colour reflectance | Gulf of Guinea | aridity | Holocene | diagenesis.

JOHNSON 2002

Thomas C. Johnson, Erik T. Brown, James McManus, Sylvia Barry, Philip Barker & Françoise Gasse, *A High-Resolution Paleoclimate Record Spanning the Past 25,000 Years in Southern East Africa*. [science](#) **296** (2002), 113–132.

High-resolution profiles of the mass accumulation rate of biogenic silica and other geochemical proxies in two piston cores from northern Lake Malawi provide a climate signal for this part of tropical Africa spanning the past 25,000 years. The biogenic silica mass accumulation rate was low during the relatively dry late Pleistocene, when the river flux of silica to the lake was suppressed. Millennial-scale fluctuations, due to upwelling intensity, in the late Pleistocene climate of the Lake Malawi basin appear to have been closely linked to the Northern Hemisphere climate until 11 thousand years ago. Relatively cold conditions in the Northern Hemisphere coincided with more frequent north winds over the Malawi basin, perhaps resulting from a more southward migration of the Intertropical Convergence Zone.

LINSTÄDTER 2004

Jörg Linstädter & Stefan Kröpelin, *Wadi Bakht Revisited, Holocene Climate Change and Prehistoric Occupation in the Gilf Kebir Region of the Eastern Sahara, SW Egypt*. [Geoarchaeology](#) **19** (2004), 753–778.

Geoarchaeological and chronological evidence from the remote Gilf Kebir Plateau in southwest Egypt suggests a new model for the influence of early and mid-Holocene precipitation regimes on land-use strategies of prehistoric settlers in what is now the center of the largest hyperarid area on earth. We hypothesize that the quantitatively higher, daytime, monsoon summer rainfall characteristic of the early Holocene (9300–5400 14C yr B.P./8400–4300 yr B.C.) resulted in less grass growth on the plateau compared to the winter rains that presumably fell in the cool nights during the terminal phase of the Holocene pluvial (5400–4500 yr B.P./4300–3300 yr B.C.). The unparalleled climatic transition at 5400 yr B.P. (4300 yr B.C.) caused a fundamental environmental change that resulted in different patterns of human behavior, economy, and land use in the canyon-like valleys and on the plains surrounding the plateau. The model emphasizes the crucial impact of seasonal rainfall distribution on cultural landscapes in arid regions and the lower significance of annual precipitation rates, with implications for future

numeric climate models. It also serves as an example of how past climate changes have affected human societies.

MCINTOSH 2015

Roderick J. McIntosh, Jean Maley & Robert Vernet, *African Palaeoclimate and Human Response, A Special Issue of the African Archaeological Review*. [African Archaeological Review 32 \(2015\), 167–177](#).

Acknowledging the patchiness of palaeoclimatic data, as well as a new appreciation of how complex the forcing mechanisms of Africa’s climates are, it would be premature to propose a grand synthesis of the continent’s climatic backdrop to human history and prehistory. That said, this “state-of-the-art” sampler from several regions of Africa serves several purposes. Although chronological resolution—%

palaeoclimatic and archaeological—continues to improve, the warning “Causation, Correlation or Co-incidence” still very much applies to all exercises in explanation. Even in those cases of high-resolution climatic sequences, dating of the corresponding prehistoric sequence often proves disappointing. And lastly (ending on an optimistic note), each contribution to this special issue features one or more new techniques of climate data extraction that might usefully be applied continent-wide.

Keywords: Palaeoclimate | Causation | Correlation | Chronological resolution | Proxy data

MALEY 2015

Jean Maley & Robert Vernet, *Populations and Climatic Evolution in North Tropical Africa from the End of the Neolithic to the Dawn of the Modern Era*. [African Archaeological Review 32 \(2015\), 179–232](#).

At the end of the Neolithic Era, during the third millennium BCE, there were fewer humid periods, and the sub-Saharan and Sahelian zones from the Atlantic to Lake Chad assumed their current geographical form. Since then, the climate has continued undergoing major variations. The succession of climatic episodes, humid or dry, is pointed out along with the episodes’ complex interactions. These variations are placed in parallel to cultural phases of evolution in archaeology and history. Climate-related events have always had heavy consequences on the peopling of this vast region, often subject to extreme natural conditions. The relative synchronism between the principal cultural trends from west to east across the Sahel seems to have often been subject to swings in the climate and the resulting environmental changes.

Keywords: Sahara | Sahel | Archaeology. Migration | Histoire | Palaeoclimate | Phase humide | Dry phase | Climatic impact

MANNING 2014

Katie Manning & Adrian Timpson, *The demographic response to Holocene climate change in the Sahara*. [Quaternary Science Reviews 101 \(2014\), 28–35](#).

qsr101-0028-Supplement1-7.zip, qsr101-0028-Supplement8.mp4

The timing and development of Holocene human occupation in the now hyper-arid Sahara has major implications for understanding links between climate change, demography and cultural adaptation. Here we use summed probability distributions from 3287 calibrated 14C dates from 1011 archaeological sites to demonstrate a major and rapid demographic shift between 10,500 and 5500 years BP. This event corresponds with the African Humid Period (AHP) and is sub-continental in scale, indicating climate as the prime factor driving broad-scale

population dynamics in northern Africa. Furthermore, by providing a high temporal resolution proxy for effective carrying capacity our population curve offers an independent estimate of environmental change in northern Africa, indicating a temporal delay in the terrestrial response to atmospheric climate change. These results highlight the degree to which human demography is a function of environment at the appropriate scale of observation in both time and space and sheds important new light on the social response to global environmental change.

Keywords: African humid period | Sahara | Holocene | Demography | Human sustainability

NGUETSOP 2004

Victor François Nguetsop, Simone Servant-Vildary & Michel Servant, *Late Holocene climatic changes in west Africa, a high resolution diatom record from equatorial Cameroon*. [Quaternary Science Reviews](#) **23** (2004), 591–609.

Holocene climatic changes in West Africa are usually explained by increased/decreased activity of the monsoon from the Guinean Gulf toward the continent. According to a diatom record from Lake Ossa (3.500N, 9.360E), we suggest that, in the near coastal areas of Cameroon, phases of intensification of the monsoon were marked by reduced precipitation and reduced evaporation, conditions nowadays prevailing South of the equator (4–5.S) during the austral winter. Lake Ossa is a shallow lake located in one of the rainiest areas of the African rain forest belt. During the wet season (March–November) it is fed by acid meteoric waters entailing low pH in the lacustrine waters. During the dry season (December–February) groundwater discharges allow the persistence of acid waters near the borders of the lake, but, in the inner parts, the waters tend to be alkaline, alkaliphilous diatoms are abundant in the surface sediment samples and are used as indicators of low precipitation. At that time, atmospheric dust containing reworked diatoms from Saharan Quaternary deposits is transported by the northern trade winds and reaches the Ossa area. Wind blown diatoms are considered as a signature of the northern trade winds. A diatom record from the western deep part of Lake Ossa has provided climatic data for the mid-late Holocene at a resolution of 50–60 years. A major climatic change at 2700 cal yr BP was marked by the appearance of wind blown diatoms. A millennial-scale alternation between low and high precipitation episodes is recorded during the last 5500 years. The low precipitation episodes before 2700 cal yr BP are interpreted as a consequence of a northward extension of the climatic conditions that nowadays characterize the Southern Congo during the austral winter, when the monsoon extends into West Africa and reaches the northern sub-tropical latitudes. The effects of low precipitation on the water balance and on the rain forest were obliterated by an extremely low evaporation. Between 2700 and 1300 cal yr BP, precipitation was high and the rain forest intensively disturbed in response to convective storms. A low precipitation episode between 1300 and 600 cal yr BP is explained, contrarily to the previous similar episodes, by tropical rainfalls located farther South than today during a larger part of the year. The modern climate settles at about 600 cal yr BP. The climatic oscillations on a millennial time scale were apparently coincident with temperature changes in the Northern and Southern Atlantic suggesting that the monsoon over West Africa was essentially driven by interactions between both hemispheres. This interpretation is in agreement with available data from other equatorial and sub-tropical regions of West Africa.

NICOLL 2004

Kathleen Nicoll, *Recent environmental change and prehistoric human*

activity in Egypt and Northern Sudan. Quaternary Science Reviews **23** (2004), 561–580.

This paper reviews the various Late Quaternary records that are available from western Egypt and northern Sudan, which includes more than 500 published radiocarbon dates and various sedimentary archives from local landscape components, including palaeolakes, soils, drainages (wadis), and archaeological sites. This palaeoenvironmental compilation frames the spatial and temporal context of local cultural activities when the region was most hospitable B9000–6000 BP; at this time, monsoonal weather influenced the portion of the African continental interior, creating enough convective rainfall for occasional surface water storage. In this part of the modern Sahara, rapid hydroclimatic changes play a key role in geomorphic evolution and resource availability. As ‘watering holes’ formed a riedup in the Early to Middle Holocene, Neolithic people developed various subsistence strategies, including opportunistic hunting of small animals (e.g. gazelle and hare), and food-related (e.g. wild sorghum, millet, and legumes) activities: gathering, plant cultivation and livestock-rearing. During its wettest phases during the ‘monsoonal maximum,’ the area was drought-prone, sustaining a meager steppe–shrub desert flora. Further desertification and aeolian deflation during the Middle and Late Holocene fostered technological innovation, migration and settlement, as well as the further development of agrarian communities and complex culture.

SHANAHAN 2015

Timothy M. Shanahan et al., *The time-transgressive termination of the African Humid Period. Nature Geoscience* **8** (2015), 140–144.

NatGeo08-140-Supplement.pdf

Timothy M. Shanahan, Nicholas P. McKay, Konrad A. Hughen, Jonathan T. Overpeck, Bette Otto-Bliesner, Clifford W. Heil, John King, Christopher A. Scholz & John Peck

During the African Humid Period about 14,800 to 5,500 years ago, changes in incoming solar radiation during Northern Hemisphere summers led to the large-scale expansion and subsequent collapse of the African monsoon. Hydrologic reconstructions from arid North Africa show an abrupt onset and termination of the African Humid Period. These abrupt transitions have been invoked in arguments that the African monsoon responds rapidly to gradual forcing as a result of non-linear land surface feedbacks. Here we present a reconstruction of precipitation in humid tropical West Africa for the past 20,000 years using the hydrogen isotope composition of leaf waxes preserved in sediments from Lake Bosumtwi, Ghana. We show that over much of tropical and subtropical Africa the monsoon responded synchronously and predictably to glacial reorganizations of overturning circulation in the Atlantic Ocean, but the response to the relatively weaker radiative forcing during the African Humid Period was more spatially and temporally complex. A synthesis of hydrologic reconstructions from across Africa shows that the termination of the African Humid Period was locally abrupt, but occurred progressively later at lower latitudes. We propose that this time-transgressive termination of the African Humid Period reflects declining rainfall intensity induced directly by decreasing summer insolation as well as the gradual southward migration of the tropical rainbelt that occurred during this interval.

Mesolithikum

TINNER 2007

Willy Tinner, Ebbe H. Nielsen & André F. Lotter, *Mesolithic agriculture in Switzerland? A critical review of the evidence. Quaternary*

[Science Reviews 26 \(2007\), 1416–1431.](#)

Accumulating palaeobotanical evidence points to agricultural activity in Central Europe well before the onset of the Neolithic, commonly dated at ca 5500–5200 cal BC. We reinvestigated an existing pollen profile from Soppensee with refined taxonomical resolution by further subdividing the Cerealia pollen type into *Triticum t.* and *Avena t.* because the sediments at this site currently provide the highest temporal resolution and precision for the period of interest among all sites in Switzerland. Our new results are in agreement with previous high-resolution investigations from Switzerland showing scattered but consistent presence of pollen of Cerealia, *Plantago lanceolata*, and other cultural plants or weeds during the late Mesolithic period (6700–5500 cal BC). Chronologically, this palynological evidence for sporadic agricultural activities coincides with a major break in material culture at ca 6700 calBC (i.e. the transition from early to late Mesolithic). Here, we review possible arguments against palaeobotanical evidences of Mesolithic agriculture (e.g. chronological uncertainties, misidentification, contamination, long-distance transport) and conclude that none of these can explain the consistent pollen pattern observed at several sites. The palynological evidence can, of course, not prove the existence of pre-ceramic agriculture in Central Europe. However, it is so coherent that this topic should be addressed by systematic archaeobotanical analyses in future archaeological studies. If our interpretation should turn out to be true, our conclusions would have fundamental implications for the Neolithic history of Europe. Currently, it is intensely debated whether Central European agriculture developed locally under the influence of incoming ideas from areas where Neolithic farming had already developed earlier (e.g. southeastern Europe) or whether it was introduced by immigrating farmers. On the basis of our results, we suggest that agriculture developed locally throughout the late Mesolithic and Neolithic. Mesolithic trading networks connecting Southern and Central Europe also support the hypothesis of a slow and gradual change towards sessile agriculture, probably as a result of incoming ideas and regional cultural transformation.

Neolithikum

MAEDA 2016

Osamu Maeda, Leilani Lucas, Fabio Silva, Ken-Ichi Tanno & Dorian Q. Fuller, *Narrowing the harvest, Increasing sickle investment and the rise of domesticated cereal agriculture in the Fertile Crescent.* [Quaternary Science Reviews 145 \(2016\), 226–237.](#)

For the first time we integrate quantitative data on lithic sickles and archaeobotanical evidence for domestication and the evolution of plant economies from sites dated to the terminal Pleistocene and Early Holocene (ca. 12000–5000 cal. BCE) from throughout the Fertile Crescent region of Southwest Asia. We find a strong correlation in some regions, throughout the Levant, for increasing investment in sickles that tracks the evidence for increasing reliance on cereal crops, while evidence for morphological domestication in wheats (*Triticum monococcum* and *Triticum dicoccum*) and barley (*Hordeum vulgare*) was delayed in comparison to sickle use. These data indicate that while the co-increase of sickle blades and cereal crops support the protracted development of agricultural practice, sickles did not drive the initial stages of the domestication process but rather were a cultural adaptation to increasing reliance on cereals that were still undergoing selection for morphological change. For other regions, such as the Eastern Fertile Crescent and Cyprus such correlations are weaker or non-existent suggesting diverse cultural trajectories to cereal domestication. We conclude that sickles were

an exaptation transferred to cereal harvesting and important in signalling a new cultural identity of “farmers”. Furthermore, the protracted process of technological and agricultural evolution calls into question hypotheses that the transition to agriculture was caused by any particular climatic event.

Keywords: Neolithic | Southwest Asia | Archaeobotany | Paleoethnobotany | Early Holocene | Sickle blade | Conformist bias

Ozeanien

WEISLER 2016

Marshall I. Weisler et al., *Cook Island artifact geochemistry demonstrates spatial and temporal extent of pre-European interarchipelago voyaging in East Polynesia*. *PNAS* **113** (2016), 8150–8155.

pnas113-08150-Supplement1.xlsx, pnas113-08150-Supplement2.xlsx, pnas113-08150-Supplement3.xlsx

Marshall I. Weisler, Robert Bolhar, Jinlong Ma, Emma St Pierre, Peter Shepard, Richard K. Walter, Yuexing Feng, Jian-xin Zhao & Patrick V. Kirch

The Cook Islands are considered the “gateway” for human colonization of East Polynesia, the final chapter of Oceanic settlement and the last major region occupied on Earth. Indeed, East Polynesia witnessed the culmination of the greatest maritime migration in human history. Perennial debates have critiqued whether Oceanic settlement was purposeful or accidental, the timing and pathways of colonization, and the nature and extent of postcolonization voyaging—essential for small founding groups securing a lifeline between parent and daughter communities. Centering on the well-dated Tangatatau rockshelter, Mangaia, Southern Cook Islands, we charted the temporal duration and geographic spread of exotic stone adze materials—essential woodworking tools found throughout Polynesia—imported for more than 300 y beginning in the early AD 1300s. Using a technique requiring only 200 mg of sample for the geochemical analysis of trace elements and isotopes of finegrained basalt adzes, we assigned all artifacts to an island or archipelago of origin. Adze material was identified from the chiefly complex on the Austral Islands, from the major adze quarry complex on Tutuila (Samoa), and from the Marquesas Islands more than 2,400 km distant. This interaction is the only dated example of down-the-line exchange in central East Polynesia where intermediate groups transferred commodities attesting to the interconnectedness and complexity of social relations fostered during postsettlement voyaging. For the Cook Islands, this exchange may have lasted into the 1600s, at least a century later than other East Polynesian archipelagos, suggesting that interarchipelago interaction contributed to the later development of social hierarchies.

Keywords: Polynesian archaeology | geochemical sourcing | adzes | voyaging | exchange

Significance: Oceania, the last region settled on Earth, witnessed the greatest maritime migration in human history. Scholars have debated how and when islands were colonized and the role of postsettlement voyaging in maintaining founding colonies and in subsequent diversification of island societies. We geochemically “fingerprinted” exotic stone artifacts from a well-dated archaeological site in the Cook Islands, matching artifacts to their geological sources and demonstrating that the geographical voyaging network extended beyond the Cook Islands to include the Austral, Samoa, and Marquesas archipelagos—up to 2,400 km distant. We further demonstrate that Polynesian interarchipelago voyaging lasted from about AD 1300 to the 1600s, suggesting that long-distance interaction continued to influence the development of social structures in East Polynesia well after initial colonization.