



Frontispiece 1. Wooden pencils and copper ferrules recovered during excavations at the Woodville Rosenwald School in Gloucester County, Virginia, USA. The site hosted two consecutive schoolhouses for Black children: the first stood between 1886 and 1923; the second—extant—building was in use as a school between 1923 and 1939. The site has been the subject of archaeological investigation since 2019 and the standing schoolhouse is currently being restored by a local community foundation. The wooden pencil was patented in the USA in 1858 and, by the early twentieth century, was available in many colours. The copper ferrules help to preserve the wood, explaining why only the ends of pencils, as well as the pencil leads, survive archaeologically. Scale in cm (photograph © C. Betti & Woodville Rosenwald Foundation).



Frontispiece 2. Temporary art installation at the Roman fort of Housesteads, on Hadrian's Wall, northern England. "The Future Belongs To What Was As Much As What Is Gatehouse" by Morag Myerscough, Ellen Moran and the communities of Hadrian's Wall, forms part of a series of events throughout 2022 marking the 1900th anniversary of the start of the Wall's construction in AD 122. The monumental frontier works extended for 80 Roman miles (117km) across northern England, from Wallsend in the east to Bowness-on-Solway in the west. The scaffolding structure is installed above the extant stonework of the fort's second-century AD northern gate; in the foreground are barrack blocks dating to the fourth century AD. Weather permitting, the artwork will be on site until 30 October 2022 (photograph by R. Witcher).



EDITORIAL

Climate strikes

In 1969, in their only chart-topping hit, Zager and Evans wondered whether society's over-dependence on technology and exploitation of the environment might lead to the extinction of humankind by the year 9595. Such is the speed of the so-called 'Great Acceleration' that has defined the half century since that song was written, some might now doubt whether humanity will survive another 700 years, let alone 7000. For these concerns are no longer the stuff of protest songs and science fiction. Speaking in July, UN secretary general António Guterres warned that climate change presents us with a choice, "Collective action or collective suicide".¹ A few weeks later, a group of scientists published an article arguing that the possibility of a "worldwide societal collapse or even eventual human extinction" as a result of catastrophic climate change is "a dangerously underexplored topic".² By coincidence, this summer also saw the passing of the pioneering scientist and originator of the 'Gaia Hypothesis', James Lovelock.³ Against the consensus, in the 1970s, Lovelock developed the idea of the Earth as a living and complex system capable of self-regulation to ensure suitability for all forms of life. Today, many of his ideas are core to how we understand climate and environment. Lovelock himself, however, became increasingly sceptical about the long-term prospects of human civilisation, envisaging a more vengeful Gaia, increasingly prepared to prioritise her own long-term survival over suitability for human life.⁴ Without doubt, all of the concerns have been reinforced over the year since the pivotal COP26 climate meeting in Glasgow at the end of 2021, which has illustrated the quickening pace of extreme- and record-breaking weather events and underlined the challenges we face in reducing greenhouse gases and restoring the environment to ensure a future for humanity.

This year, exceptional floods struck parts of Australia, Bangladesh, Iran, Japan, Pakistan and Uganda. Unprecedented heat across Western Europe, Central, South and East Asia, and North America led to the collapse of glaciers and fanned apocalyptic wildfires. Combined with the heat, a lack of rain also left vast regions in drought, from Chile to Somalia and across much of Europe. In the southwestern United States, already in the grip of a multi-year drought, Lake Mead and the Great Salt Lake have been reduced to record-breaking low levels.

¹ HARVEY, F. 2022. Humanity faces 'collective suicide' over climate crisis, warns UN chief. *The Guardian* 18 July 2022. Available at: <https://www.theguardian.com/environment/2022/jul/18/humanity-faces-collective-suicide-over-climate-crisis-warns-un-chief> (accessed 25 August 2022).

² KEMP, L. *et al.* 2022. Climate endgame: exploring catastrophic climate change scenarios. *Proceedings of the National Academy of Sciences of the USA* 119: p.e2108146119. <https://doi.org/10.1073/pnas.2108146119>

³ HORTON, H. 2022. James Lovelock, creator of Gaia Hypothesis, dies on 103rd birthday. *The Guardian* 27 July 2022. Available at: <https://www.theguardian.com/environment/2022/jul/27/james-lovelock-creator-of-gaia-hypothesis-dies-on-103rd-birthday> (accessed 25 August 2022).

⁴ LOVELOCK, J. 2006. *The revenge of Gaia*. London: Penguin.

Meanwhile, the flow of water in rivers, including the Danube, Rhine, Po, Thames, Tiber and Yangzi, was reduced to such low levels that crops could not be irrigated, hydroelectricity and nuclear power stations were shut down and the shipping of cargo suspended.

As these rivers, lakes and reservoirs dried up, they yielded a diverse and sometimes disturbing range of finds, from human remains and shipwrecks to prehistoric dolmens (Figure 1), a Roman fort, rock-cut Buddhist sculpture and medieval villages drowned by dam-building projects. In recent years, an increasingly frequent occurrence has been the re-emergence of ‘hunger stones’ along the rivers of Central Europe (Figure 2). The messages inscribed on these stones in the late medieval and early modern periods recorded years of drought, and warned of impending food shortages and societal distress. Such acknowledgement of tough times ahead shows that people in the past were fully able to connect their future social, economic and political well-being with earlier adverse weather and environmental conditions. Unlike today, however, those people had a very limited impact on the planet’s climate and no sense of control over it; higher forces were thought to determine the droughts, storms, floods and heatwaves that shaped human lives. In marked contrast, today, in the Anthropocene, humans have not only altered the Earth’s climate, exacerbating extreme weather events, but we also have the knowledge—and the agency—to do something about it. What is the role of archaeology in this?



Figure 1. The Dolmen of Guadalperal, visible in 2019 due to low water levels in the Valdecañas reservoir, on the Tagus river in Cáceres province, Spain (photograph by Pleonr CC BY-SA 4.0).



Figure 2. Hunger stone at Děčín, on the Elbe River in northern Czechia, visible due to low water levels in 2018 (photograph by B. Gross CC BY-SA 3.0).

Without doubt, the archaeological record is threatened by climate change, whether increasing humidity in the Atacama Desert affecting the preservation of Chinchorro mummies, wildfires threatening sites such as Machu Picchu, or desertification, more frequent sandstorms and higher salinity eroding sites across Iraq. Beyond documenting and mitigating these impacts, however, archaeology is also contributing to the understanding of climate change processes and, critically, climate change adaptation. For example, a recently published report authored by members of two European Joint Programming Initiatives ('Cultural heritage and global change' and 'Connecting climate knowledge for Europe') identifies gaps and opportunities in research at the intersection between climate change and cultural heritage.⁵ These include not simply a role in protecting cultural heritage for future generations, but a wider contribution to mitigation, adaptation and sustainable development through more interdisciplinary collaboration and more research of direct relevance for climate policy. A crucial challenge lies around communicating the potential of archaeology and cultural heritage within wider climate change research, whether through the provision of long-term environmental archives or examples of past adaptation. There are also opportunities to motivate public and political action by using threatened heritage sites to make climate change tangible and relatable. Strikingly, the report summarises multiple recent statements and policies by national and international organisations. The 2021 Rome Declaration of the G20 Ministers of Culture, for example, explicitly recognises the role of culture in addressing climate change, including 'leveraging' the potential of culture-based solutions to build resilience, 'upscaling' the role of culture in climate change policies, and encouraging all countries to integrate cultural heritage into their adaptation plans.⁶ To respond to such opportunities, and translate archaeological research on climate change into policy with real societal impact, we will need to collaborate more closely than ever with cognate disciplines, learn new technical and bureaucratic languages, and become even more skilled at communicating with wider and more diverse public and professional audiences.

Living on the edge

Through the Late Pleistocene and Early Holocene, humans adapted to significant climate and environmental change. During the Last Glacial Maximum (LGM, *c.* 30 000–19 000 years ago), for example, global temperatures were 2–3 degrees cooler than today and sea levels 120m lower, leading to significant changes in coastlines, vegetation and fauna. Island Southeast Asia has emerged as a particularly important region for studying human adaptation to climate change in tropical environments. In this issue, Janine Ochoa and colleagues draw on evidence from Palawan Island, in the western Philippines, to explore how human populations adjusted to the dramatic changes in biomes caused by fluctuating sea levels and temperatures. Combining evidence from several cave sites, the authors track the multiple and

⁵ FLUCK, H. & R. KNIGHT. 2022. *Climate change adaptation report* (Research Report Series 17–2022). Portsmouth: Historic England. Available at: <https://historicengland.org.uk/research/results/reports/8614/ClimateChangeAdaptationReport> (accessed 25 August 2022).

⁶ Rome Declaration of the G20 Ministers of Culture, Rome, July 30, 2021. Available at: <http://www.g20.utoronto.ca/2021/210730-culture.html> (accessed 25 August 2022).

diverse niches to which humans successfully adapted, starting with tropical rainforests *c.* 39 000 BP, through open savanna during the LGM and the Terminal Pleistocene, and back to tropical rainforest again during the Early Holocene. Over this time period, for humans to remain in the same region required the adaptation of subsistence strategies to exploit the changing flora and fauna that flourished under different climate and environmental conditions. In doing so, the authors show how the human populations of Island Southeast Asia combined both generalising and specialist foraging activities to ensure their survival.

Of course, climate and environmental change did not end with the Early Holocene. Two other articles in this issue focus on coastal sites that were positioned to exploit the rich resources found at the interface between land and sea, but which today are located in very different environments. During the Chinese Middle Neolithic (*c.* 5000–3800 BC), the Hemudu site of Tianluoshan was located on the coastline, allowing its inhabitants to access a diversity of resources; today, however, the site lies some 22km inland from the East China Sea. The deep stratigraphy and anaerobic preservation conditions at Tianluoshan have yielded an extraordinary assemblage of organic material. In this issue, Judith Cameron and Guoping Sun report on the evidence from the site for early craft specialisation, adopting a *chaîne opératoire* approach to track the production of textiles, from the processing of fibres, through spinning to weaving and sewing. The inhabitants of Tianluoshan appear to have been part-time craft specialists working at the household level and making use of ‘cutting-edge’ developments, for example, in loom technology.

Meanwhile, Heather McKillop and E. Cory Sills report on Maya craft production on the coast of southern Belize. Here, during the Late Classic (AD 600–800), dozens of ‘salt kitchens’ were located around a coastal creek, with the collective capacity to produce substantial amounts of salt for the burgeoning inland Maya cities. In contrast to now-land-locked Tianluoshan, today these formally coastal Maya sites are submerged below sea level; the site preservation conditions are, however, no less impressive. As well as evidence for salt production using the brine-boiling technique, the objects retrieved from the seafloor at the site of Ta’ab Nuk Na illuminate a range of activities, from food preparation to spinning and woodworking. For millennia, coastal environments such as at Tianluoshan and Ta’ab Nuk Na have attracted human settlement due to their varied resources and the opportunities for connectivity with other places. When climate and environmental conditions change, however, these locations can be some of the most exposed, requiring greater human adaptability than many other niches.

Thought for food

Whether in the past or the present, farmers are particularly alert to changing climate and environmental conditions. In this issue, Li Tang and colleagues take us to western Tibet to examine archaeobotanical evidence for high-altitude crop cultivation dating to the late first millennium BC and the early first millennium AD. With very little precipitation and low temperatures, this is one of the most challenging environments into which humans have successfully introduced arable production. Previous studies have documented how, in the lower and more hospitable Tibetan valleys, a range of crops, such as millet, were introduced and cultivated from as early as the third millennium BC. In their article, the authors present a series of new archaeobotanical assemblages from small sites located in the agriculturally

marginal, higher altitude valleys. Their results show that crop cultivation in these areas developed in particular under the Zhangzhung kingdom (500 BC–AD 625) and was restricted almost exclusively to barley. Around the world, small farmers have traditionally responded to environmental risk by diversifying their production, growing a range of crops each year so that should one particular crop fail, others are still available for harvest. The decision of the small farmers of the high valleys of western Tibet to specialise in barley is therefore, at face value, surprising. In this case, the authors theorise that, in this harsh, high-elevation environment, diversifying to cultivate other crops even less well suited to the challenging growing conditions would simply have ensured the inevitability of crop failure. Alongside pastoralism, and within the political and economic structure of the Zhangzhung kingdom, crop specialisation was therefore a rational response to risk in this particular context.

Meanwhile in the far reaches of north-west Europe, isotope analysis of archaeobotanical assemblages is revealing how farmers of the early fourth millennium BC deployed a series of strategies to ensure the continuity of their subsistence base. The Neolithic site of Balbridie, originally reported in *Antiquity* 30 years ago,⁷ is well known for its large timber hall and an assemblage of some 20 000 carbonised cereal grains. In this issue, Rosie Bishop and colleagues use carbon and nitrogen stable isotope analysis to examine a sample of that material, alongside cereal remains from other broadly contemporaneous Scottish sites. The results show levels of variability that exceed those expected if the Balbridie crops had been grown in the same field and in the same year, suggesting the exploitation of multiple landscape locations and/or the storage of more than one year's harvest. Both practices are forms of risk management, reducing the chances of crop failure within and between years. Indeed, the authors note that all the archaeobotanical assemblages from individual contexts at Balbridie, bar one, are a mix of emmer and naked barley, suggesting that the crops were grown as maslins, that is, the sowing of a mix of crops to benefit from the tendency of one of them to perform better under unpredictable growing conditions—another risk buffering strategy. At some of the other sites examined, the isotope results also point towards manuring and the storage of crops grown on diverse soils, suggesting innovations to ensure the ongoing fertility of the land and, perhaps, the development of social networks to help buffer against risk.

In the modern world, monocropping rather than maslins, a narrow focus on maize, rice, soy and wheat, and the application of vast quantities of fertilisers, herbicides and pesticides has allowed farmers to feed a population of eight billion. Yet, in 2022, the concurrence of drought and war has conspired to reveal the fragility of this system. The conflict in Ukraine has severely reduced global supplies of wheat, cooking oil and other agricultural commodities, and next year's harvest is far from assured; the spiralling price of oil and gas has also pushed up the cost of everything from fertiliser to shipping. Simultaneously, drought has affected harvests elsewhere in the Northern Hemisphere for crops as varied as cauliflowers, chickpeas, chillies, olives, rice and wheat. If it took a global pandemic to remind us of the importance of sociality, the events of 2022 have underscored the importance of food security, directing attention to new—or rather, old—crops and landraces, sustainable and nature-based

⁷ FAIRWEATHER, A.D. & I.B.M. RALSTON. 1993. The Neolithic timber hall at Balbridie, Grampian Region, Scotland: the building, the date, the plant macrofossils. *Antiquity* 67: 313–23. <https://doi.org/10.1017/S0003598X00045373>


strategies, and solutions sensitive to local needs, both human and environmental. Increasingly, farmers in search of more drought- or heat-resistant crops are exploring the potential of so-called ‘forgotten foods’, such as amaranth, taro, fonio, cowpea and millet, and wine producers and fruit growers are seeking out more resilient, older varieties of grape vine and apple tree.

In documenting the history and diversity of agricultural practices, including the experimentation with and adoption of crops, archaeology can contribute to these goals. In their Project Gallery article, Matthew Brudenell and colleagues report on the discovery of broom-corn millet from a Late Bronze Age site in eastern England. Previously, the earliest known occurrences of this crop in Britain were from the Roman period, and, even then, it appears to have played a very minor role. How, therefore, do we explain the fleeting appearance of this crop in eastern England during the Late Bronze Age? One possibility the authors consider is that this was an experimental crop, prompted by the cooler and wetter conditions of the time that may have shortened the growing season. Most significant, however, is the fact that this fast-growing, drought-tolerant crop was ultimately never adopted on any scale in either Bronze Age or Roman Britain, perhaps, the authors suggest, due to deeply entrenched agricultural and dietary practices.

Finally, Kevin Lane and colleagues take us to the alpine tundra of the high Andes and a wetland habitat known locally as *bofedales*. Through the construction of unlined earthen channels and silt-traps to improve water and soil retention, the pre-Hispanic Chocorvos population expanded the natural *bofedales* as a valuable source of grazing for camelids and to secure water supplies at lower elevations. Radiocarbon dating indicates that at least some of this low-tech but effective hydraulic infrastructure was also constructed and used during the period of Inca domination in the fifteenth century AD, before being abandoned after the Spanish conquest, presumably due to the collapse in camelid populations caused by the introduction of Old-World animals and new diseases. Even here at 4000m asl, there is also evidence for maize pollen—a reminder that, across the Andes, maize (and potato) cultivation was combined with pastoralism at very high altitudes—perhaps in similar ways to the adoption of barley in western Tibet.

All these articles speak to human experimentation and adaptability in exploiting environmental niches. Yet, more than as models to be imitated in our search for a sustainable and secure future, these and other archaeological examples point to the need, above all else, for flexibility and place-based solutions in response to changing climate. In the long view, specialising in a few crops that can only be grown under narrow environmental conditions, reliant on a single technological model and on the stability of complex political and economic frameworks, is the very antithesis of human adaptability.

Place-making, place-breaking

 If climate change demands that we transform how we produce food, it will also require us to think about where we live and about our attachment to place. Under current predictions for sea-level rise, over the next century, millions of people will need to relocate from coastal locations increasingly exposed to flooding and extreme weather events. Within decades, major cities such as Jakarta and Miami may become uninhabitable as land subsides and seas rise. As a place-making species, humans have found endless ways to mark out meaningful

locations for social, economic and political interaction, and, once rooted, people can be reluctant to move on, even when staying put may be difficult. In this issue, we feature several articles that consider the creation, destruction and remaking of places.

We start in Bohemia, where Václav Vondrovský and colleagues report new research on the monumental enclosures of Neolithic Central Europe known as rondels. These sites are often interpreted as places of gathering for individual communities. In some cases, however, rondels cluster in groups of two, three, or even four. Were the rondels in each of these groups in use at the same time and, if so, why might these early farming populations have built multiple rondels in close proximity? Using Bayesian modelling of radiocarbon dates from two adjacent rondels in Bohemia, the authors demonstrate that these enclosures were probably used contemporaneously during the early fifth millennium BC. In turn, this leads the authors to focus on the subtle differences in the forms of individual rondels at multi-rondel sites, arguing that these may indicate construction by different communities. Rondel clusters may therefore have facilitated a form of inter-community competition, creating places through which to negotiate, and diffuse, social tensions. Sometimes, however, rivalries cannot be resolved, and places may then be targeted, whether for their symbolic capital, economic resources or strategic significance; the destruction of Aleppo and Mariupol reminds us that such violent actions are not confined to the distant past. In their Project Gallery article, Achim Lichtenberger and colleagues report on the site of Tell Iztabba (also known as Beth She'an and Nysa-Scythopolis) in Israel. A focus of settlement since at least the Chalcolithic period, the site was destroyed and refounded on multiple occasions, including at the end of the Bronze Age at the hands of the Assyrians and, during late antiquity, by an earthquake. Here, the authors examine a range of bioarchaeological evidence to establish the season during which the city came under attack as part of the larger Hasmonean campaign against Samaria at the end of the second century BC. The results point to spring/early summer in 107 BC. As with so many other sites across this region, however, the site was rebuilt and repopulated within decades, attesting to the power of place and human attachment to them.

Another article in this issue explores the persistence of place in the context of fifteenth- and sixteenth-century AD Guatemala. Here, prior to the arrival of the Spanish, conflict between Maya groups had pushed the inhabitants of Zaculeu, the capital of the Mam Kingdom, up into the highlands, where the displaced population founded a series of fortified centres, including Chiantla Viejo. Victor Castillo reports on excavations at the latter site, which reveal spatial and architectural arrangements that echo those of the ancestral centre of Zaculeu, particularly in relation to public ritual practices. If the displaced Mam people reproduced elements of their former home in their new mountain settlements, however, they still sought to return to Zaculeu; but despite repeated their attempts to do so they were finally forced by the Spanish to relocate to new colonial towns. Contexts such as this underline the complexity of place as both a physical and psychological construct.

Finally, on the theme of place, Tereza Majerovičová and colleagues take us to Senegal and a project that explores a series of traditional villages which were abandoned during the mid twentieth century as a result of the creation of the Niokolo-Koba National Park. Combining archaeological and ethnographic methods, the authors have mapped and excavated some of these settlements and collected oral accounts from local populations. Here, the break from traditional lifestyles is within living memory, and it is possible not only to use these accounts

to interpret the archaeological evidence in terms of ethnic identity, social organisation, religious practices and subsistence strategies, but also to understand how the abandonment of such places leads to the loss of traditional knowledge. Around the world, the climate emergency is stimulating radical new ideas about the relationship between people, place and identity. Some of the South Pacific islands under existential threat from rising sea levels, such as Tuvalu, for example, have advanced the notion of sovereign countries retaining their statehood even if their territories are submerged. The viability of these concepts will depend on a deep understanding of how people relate to place. Projects such as that reported by Majerovičová and colleagues demonstrate how archaeologists might help to document these relationships for future generations.

Also in this issue

Among the other research on offer in this issue, we feature articles on the production of stone vessels in Bronze Age Iran (Eskandari & Vidale) and the repurposing of metal vessels intended for drinking and feasting as cremation urns in Iron Age Europe (Desplanques). Turning to archaeological science, Tony Brown and colleagues present the results of a research project to investigate crannog sites in Scotland and Ireland. Using a battery of biomolecular and palaeoecological techniques, including the analysis of biogenic silica, stable isotopes, faecal stanols, bile acids and sedaDNA, the authors are able to build a detailed picture of life on some of these long-lived and often high-status island sites. Meanwhile, Mark Pollard and Ruiliang Liu examine alloying practices in ancient China, using the results of XRF analysis to untangle a long-standing debate about the metal ‘recipes’ specified in the Eastern Zhou text, the *Rites of Zhou*. We also feature Project Gallery articles on new evidence for Palaeolithic activity in the Tian Shan (Pavlenok *et al.*), Neolithic rock art in Arabia (Charloux *et al.*) and evidence from Isla Hornos, at the tip of South America, for what may be the most southerly extent of pre-industrial human expansion (Buma *et al.*). We hope that this rich and varied collection of topics offers something of interest for everyone. As ever, if you would like to see your own research featured in *Antiquity*, find out more at www.antiquity.ac.uk/submit-paper or get in touch via editor@antiquity.ac.uk. We look forward to hearing from you!

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