Frontispiece 1. The recreated head and reconstructed skull of Shanidar Z, an adult female Neanderthal originally buried in Shanidar Cave in Iraqi Kurdistan around 75 000 years ago. The crushed skull was rebuilt from hundreds of bone fragments by a team of archaeologists and conservators led by the University of Cambridge. The recreation was then made, based on this reconstruction, by palaeoartists Adrie and Alfons Kennis for the documentary, 'Secrets of the Neanderthals', produced by BBC Studios Science Unit and released on Netflix worldwide. Photograph: BBC Studios/Jamie Simonds, reproduced with kind permission.

Frontispiece 2. A school pupil examines insect remains from the archaeological record through a microscope. The display helped to explain that environmental remains provide information about the climate in the past and about climate change over time. The image was taken at Wessex Archaeology's stand at New Scientist Live, held at the Excel Exhibition Centre in London in 2022. The School Open Day was attended by approximately 5000 young people from London who came to experience science and its practical application in the workplace. As a registered charity, Wessex Archaeology's charitable aims include the advancement of education, the arts, culture, heritage and science. Photograph by Wessex Archaeology, reproduced with kind permission, and with thanks to Nicola Kalimeris for assistance.

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EDITORIAL

I thought I would choose a less contentious topic for this issue's editorial—that of archaeological science—having explored decolonising *Antiquity* in the previous issue.[1] It hasn't quite worked out that way. For a start, I invited a team of early career researchers to reflect on a conference they recently organised about 'Envisioning decolonial futures through archaeology', which neatly follows this piece as a Guest Editorial. And a key part of what Rennan Lemos, Linda Mbeki, Bolaji Owoseni, Natasha Rai and Abigail Moffett argue is that Western science and archaeology have perpetuated features of coloniality, including an undermining of the traditional knowledge of Indigenous communities plus global inequalities in the power to set research frameworks, control research funding, extract and store research data and shape historical narratives. They therefore call for decolonial futures where archaeological science is practised—not at odds but in collaboration—with diverse Indigenous and local communities in ways that are more respectful, equitable, mutually beneficial, pluralist and multivocal. Similar views have been expressed in the contemporary debate about whether the future of science is to be 'fast' or 'slow' (or somewhere in between). And, given the multidisciplinary nature of archaeological research and the prominence of its findings in the public domain (Frontispieces 1 & 2), archaeological science has found itself caught up in the quarrel.

The Third Science Revolution and counter-revolution

Just over a decade ago, Kristian Kristiansen highlighted a new trend in archaeological research, characterised by the fast-growing availability of huge amounts of digitised data, quantitative modelling, and studies of ancient DNA (aDNA) and stable isotopes.[2] He termed this 'the Third Science Revolution in archaeology', contrasting it with two earlier scientific revolutions in Europe: the establishment of archaeology as a scientific discipline between 1850 and 1860; and the rise of science-based archaeology employing new methods such as radiocarbon dating, pollen analysis and trace element analysis between 1950 and 1960. He situated this third revolution within a wider intellectual shift away from the theoretical priorities of postmodernity towards a new paradigm of "revised modernity" (p.23), characterised broadly by a dissolving of opposition between science and humanities, theory and data, micro and macro. As for possible consequences in archaeology, Kristiansen predicted a return to a more positivistic approach informing 'grand narratives' of human mobility, migration and diet, but also foresaw archaeological researchers engaging more critically and publicly in relevant political and ethical issues. More recently, Kristiansen has reiterated

[1] Skeates, R. 2025. Editorial. *Antiquity* 99: 1–12. https://doi.org/10.15184/aqy.2024.226
[2] Kristiansen, K. 2014. Towards a new paradigm? The third science revolution and its possible consequences for archaeology. *Current Swedish Archaeology* 22: 11–34. https://doi.org/10.37718/CSA.2014.01

and defended his position in his book, *Archaeology and the Genetic Revolution in European Prehistory*[3].

While appropriately acknowledging Kristiansen's distinguished research and service in European archaeology, diverse commentators on his vision have questioned his definitions, characterisations and predictions. They have also proposed alternative future scenarios. For example, Isto Huvila stresses the difficulties of verifying, harmonising and comparing datasets of different types and scales produced by diverse researchers, equipment and institutions, and the complexity and contingency of translating those incomplete data into explanations and knowledge[4]. Tim Flohr Sørensen complains of the increasing fetishisation of data and quantitative methods in archaeology, and of the sometimes-careless use of scientific data. Instead, he calls for attention to potentially absent or uncertain data, and for archaeological methods to include disciplined and critical speculation[5]. Katharina Rebay-Salisbury acknowledges the wealth of detailed insights into the lives of past people that archaeogenetic and isotopic analyses have brought, but notes that the speed of this integration has allowed insufficient time for reflection on the nature and meaning of the scientific data. She therefore looks forward to more nuanced interpretations emerging as researchers learn the language and epistemology of collaborating disciplines, to inform, for example, understandings of sex, gender and identities in the past and present[6]. Liv Nilsson Stutz points out the negative impact of the Third Science Revolution on archaeological knowledge production, including the growing adoption by government agencies and corporate universities of metrics-based evaluations of academic research grants and publications—the latter dominated by a few powerful journals that can sensationalise and simplify thinking about the past.[7] She recommends that archaeologists collaborate with a broader set of transdisciplinary partners—across the humanities, social sciences and natural sciences—to truly integrate multiple perspectives into understanding the past, and to problematise that knowledge in the context of our contemporary world. Similarly, Susanne Hakenbeck warns that the grand narratives of archaeogenetics can uncritically reify genetic populations as ethnic groups, which risks fuelling far-right and white-supremacist notions of racial purity and fears of non-European migrants[8]. She therefore calls on geneticists and their archaeological collaborators to engage with the theoretical

[3] Kristiansen, K. 2022. *Archaeology and the genetic revolution in European prehistory*. Cambridge: Cambridge University Press. https://doi.org/10.1017/9781009228701

[4] Huvila, I. 2014. Be informed of your information. *Current Swedish Archaeology* 22: 47–51. https://doi.org/10.37718/CSA.2014.04

[5] E.g. Flohr Sørensen, T. 2017. The two cultures and a world apart: archaeology and science at a new crossroads. *Norwegian Archaeological Review* 50: 101–15. https://doi.org/10.1080/00293652.2017.1367031

[6] Rebay-Salisbury, K. 2024. Sex, gender and the third science revolution, in U. Matić, B. Gaydarska, L. Coltofean & M. Díaz-Guardamino (ed.) *Gender trouble and current archaeological debates*: 19–31. Cham: Springer. https://doi.org/10.1007/978-3-031-68157-8_2

[7] Nilsson Stutz, L. 2019. A future for archaeology: in defence of an intellectually engaged, collaborative and confident archaeology. *Norwegian Archaeological Review* 51: 48–56. https://doi.org/10.1080/00293652.2018.1544168; Nilsson Stutz, L. 2022. Rewards, prestige and power: interdisciplinary archaeology in the era of the neoliberal university. *Forum Kritische Archäologie* 11: 40–52. http://dx.doi.org/10.17169/refubium-37027.2

[8] Hakenbeck, S.E. 2019. Genetics, archaeology and the far right: an unholy Trinity. *World Archaeology* 51: 517–27. https://doi.org/10.1080/00438243.2019.1617189; see also Källén, A. 2025. *The trouble with ancient DNA: telling stories of the past with genomic science*. Chicago: University of Chicago Press.

complexities surrounding ethnicity and migration, and to be more cautious and critical in communicating their research to the public, to avoid generating headlines such as, "Story of the most murderous people of all time revealed in ancient DNA"[9]. Alfredo González-Ruibal also advocates openness to a much wider range of archaeological practitioners, research questions and theoretical alternatives on a global scale.[10]

Negotiating archaeological science

Notwithstanding these and other critical responses to Kristiansen's position, the basic notion of a Third Science Revolution has become lodged in the mindsets and jargon of many archaeologists. So, it seems valid to reassess Kristiansen's position, specifically in relation to the archaeological research published in the current issue of *Antiquity*. All the research articles included here present the results of studies that have employed various scientific materials and methods. Their range is broadly representative of the archaeological sciences, with obvious exceptions in this issue (but not in others) being analyses of human aDNA and stable isotopes—two of the key areas of recent scientific advance singled out by Kristiansen. Does this mean, then, that all the articles published here are second-rate? I hope not. I think not. But the clamour around archaeological science and disciplinarity generated by Kristiansen, and comparable discussion by archaeological thinkers before him[11], does mean that we should continue to review the practice, significance and future of scientific archaeology. My attempt below is partly to summarise the contributions made by scientific approaches to current archaeological understandings of the past but also to provide a behind-the-scenes insight into the impact of peer review, which can question and refine the outcomes of such scientific work. I appreciate that peer review is itself increasingly being challenged as subjective, superficial, unpaid labour that delays the dissemination of scientific knowledge. In my opinion, however, the reviewers that have contributed to the current issue of *Antiquity* have been generous, diligent and constructive. The same applies to my colleagues who kindly commented on an earlier draft of this text: Clio Hall, Anna Källén and Liv Nilsson Stutz. Despite the powerful momentum of archaeological science, good reviewers can still ensure, on the one hand, that good authors acknowledge the limits of their empirical evidence and are more cautious in interpretation, and, on the other hand, that they understand the complexity of their data and offer richer, more nuanced interpretations. More broadly, I hope to demonstrate that first-rate archaeological science is incremental, substantiated, incomplete, integrated, reflexive, ethical, cautious, contextual, negotiated and accessible. And if that makes for less eye-catching headlines or eye-watering citation counts, all the better, since the credibility of archaeological research is at stake.

[9] Barras, C. 2019. Story of the most murderous people of all time revealed in ancient DNA. *New Scientist*, 27 March 2019.

[10] González-Ruibal, A. 2014. Archaeological revolution(s). *Current Swedish Archaeology* 22: 41–45. https://doi.org/10.37718/CSA.2014.03

[11] E.g. Jones, A.M. 2001. *Archaeological theory and scientific practice*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511606069; Lidén, K. & G. Eriksson. 2013. Archaeology vs. archaeological science: do we have a case? *Current Swedish Archaeology* 21: 11–20. https://doi.org/10.37718/CSA.2013.01

Radiocarbon dating

Seven of the articles published in this issue of *Antiquity* present the results of radiocarbon dating and their calibration and modelling—which, according to Kristiansen's scheme, can be assigned to a second science revolution in archaeology. Their details and peer reviewers' comments are in many ways first class.

Nichola Arthur and colleagues present a programme of radiocarbon dating designed to provide a more robust chronology for the deposition of human remains in the London reaches of the River Thames. Thirty new samples of human bone curated at the Natural History Museum and prepared at the Institute of Archaeology in London were dated using an Accelerator Mass Spectrometer (AMS) at the University of Groningen's Centre for Isotope Research. The study also involved a collation of all other available radiocarbon dates on human bones recovered from the River Thames. The calibrated results for the entire dataset cover a long timespan, between approximately 4000 BC and AD 1800. Notwithstanding potential sample selection biases, the results confirm a predominance of Bronze Age and Iron Age dates, which tie in with a wider trend of ritual deposition in watery places in later prehistoric north-west Europe. They also reveal a distinction in spatial patterning, with Bronze and Iron Age bones tending to come from upstream areas, and medieval and post-medieval bones found in and around the City of London. Peer reviewers welcomed the scientific results in providing an improved level of chronological resolution, and the presentation of the research methods in a way that is easy to follow for non-specialists. They appropriately requested, however, explicit acknowledgement of the ethical review and approval provided by the museum for the sampling and analysis of the human remains.

In the work by Rune Iversen and colleagues, radiocarbon dating is used to help date the deposition of numerous engraved stone plaques, many carrying linear motifs interpreted as representing the sun and plants, at Neolithic enclosure sites on the Danish island of Bornholm. (One of these motifs features on the front cover of this issue of *Antiquity*.) At Vasagård West, the plaques were mostly found in upper ditch deposits assigned by ceramic typology to *c*. 2900–2800 BC, but were also recovered from the postholes of a novel circular structure associated with timber palisades. The results of the radiocarbon dating, by the Aarhus AMS Centre, of four charcoal samples from these postholes span *c*. 3100–2900 BC. The authors therefore argue that the 'sun stones' were deposited en masse over a short period, *c*. 2900 BC, coinciding with a climatic cooling event in the northern hemisphere that is documented in ice cores. They suggest this cooling was caused by a volcanic eruption that reduced solar irradiance, which triggered crop failure, ritual deposition of the engraved stones in the hope of restoring the sun and harvest, and ultimately cultural change. Peer reviewers enjoyed this ingenious argument, but also called for the introduction of a greater degree of interpretative caution throughout.

Liya Tang and colleagues focus on the radiocarbon dating, by Beta Analytic, of a carbonised grain of naked six-row barley recovered from a ceramic jar deposited in a grave at the second-millennium BC Gepa serul cemetery. This high-altitude site is located almost 4000m above sea level on the western Tibetan Plateau, adjacent to a tributary of the Sutlej River. The result places the artificial range expansion of naked barley onto the western Tibetan Plateau at around 1500–1400 BC. The authors interpret this contextually, with reference to an extensive bioarchaeological dataset for central Asia, as having been introduced either from the Indus Valley, by cereal farmers migrating gradually northwards up the Himalayan valleys, or more rapidly from the northern margin of the Iranian plateau, via trade flowing south-east through the Pamir mountains and the Wakhan mountain corridor. The peer reviewers regarded the research as methodologically sound, but successfully encouraged the contextual interpretation of the dated sample to be extended beyond the region of the western Tibetan Plateau.

The multi-method study presented by Hamza Benattia and colleagues involves radiocarbon dating by four laboratories, in this case of domesticated plant seeds and animal bones from archaeological excavations at the later prehistoric site of Kach Kouch in north-west Morocco. The results confirm the existence of a stable settlement where a full farming economy, based on animal husbandry and crop cultivation, was practised between the thirteenth and seventh centuries BC—challenging the consensus that north-west Africa was occupied by predominantly nomadic communities at that time. Our peer reviewers called for detailing, in online supplementary materials (OSM), of the rigorous sampling of bioarchaeological remains. They also asked the authors to acknowledge the chronological uncertainties for the site's third phase, broadly assigned to the eighth to seventh centuries BC, because of the limited information provided by the relevant radiocarbon dates due to the Hallstatt Plateau, where radiocarbon measurement probabilities are spread out across a relatively flat area on the calibration curve between *c*. 800 and 400 BC.

Steinar Solheim and colleagues make use of radiocarbon dating on 29 samples of charcoal and cremated human bone, undertaken at the University of Uppsala's Tandem Laboratory (Figure 1), and construct a chronological model using Bayesian statistics available in OxCal, to help date the deposition of fragments of a single standing stone in the Iron Age Svingerud gravefield in Hole in south-east Norway. This was inscribed with runes from the oldest of the runic alphabets—the older futhark. The modelled radiocarbon dating results, combined with stratigraphic data, indicate that the standing stone was originally erected in a flat grave *c*. 15 BC–AD 195, then fragmented and distributed also to an adjacent flat grave *c*. 50 BC–AD 275, and on top of the old ground surface, where a series of grave mounds were later constructed. This chronology leads the authors to claim that the Hole fragments comprise the oldest known archaeologically dated rune-stone. Peer reviewers justifiably asked the authors to be more cautious interpretatively, both in categorising the standing stone as a 'rune-stone' and in emphasising its significance as the earliest example of that tradition of commemorative stones.

The article by Edwin Román Ramírez and colleagues incorporates the results of radiocarbon dating undertaken to establish a chronology for the construction, use and termination of several buildings in the southern sector of the lowland Maya dynastic seat of Tikal in modern-day Guatemala, including a residential compound with an altar painted in the distinctive style of Teotihuacan in central Mexico. The AMS dating was carried out at two laboratories in the USA, Beta Analytic and International Chemical Analysis Inc., on nine samples of carbonised wood. The results, which date the altar to the fifth century AD, add to other archaeological evidence that, during the Mesoamerican Early Classic Period (AD 250–550), close economic and political ties developed between elites based in the metropolis of Teotihuacan in central Mexico and the lowland Maya in Guatemala, over 1000 km to the south-east. More

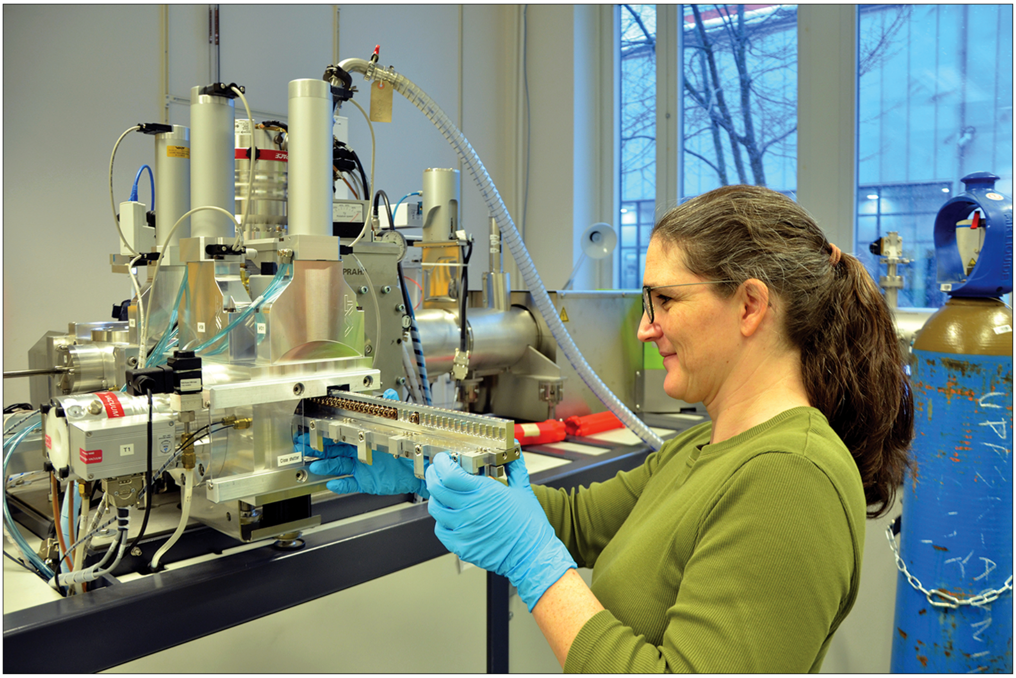

Figure 1. The compact MICADAS (mini carbon dating system) tandem accelerator, designed for highly accurate accelerator mass spectrometry of carbon isotopes (^{12}C, ^{13}C and ^{14}C) and used for radiocarbon dating, at the University of Uppsala's Tandem Laboratory. Photograph by Svenja Lohmann, reproduced with kind permission, and with thanks to Daniel Primetzhofer for assistance.

specifically, the authors argue that the altar was decorated by painters trained at Teotihuacan, who resided and worked at Tikal following the *Entrada*—the conquest of Tikal in AD 378, documented by hieroglyphs on the Tikal Marcador stone carving and arguably connected to Teotihuacan actors. Peer reviewers did not question the chronology, but did call on the authors to consult and cite additional publications regarding the much-debated *Entrada*.

The work by Alan Covey and colleagues contributes to a recent trend of actively incorporating scientific dating into studies of the origins and expansion of the Inca empire, whose historical chronology has traditionally relied on dated events recorded in Spanish chronicles and archival documents, and on the relative dating provided by stratigraphy and ceramic typology. Radiocarbon dating by the AMS laboratory at the University of Arizona of 18 charcoal samples from archaeological test excavations at Ak'awillay, a major settlement situated in the Xaquixaguana Valley near the Inca imperial capital of Cuzco, Peru, was intended to provide a chronology for the occupation history of this rural site. Instead of supporting an interpretation of persistent occupation, the results indicate that Ak'awillay was first settled and grew substantially *c.* AD 425–775, but then declined and remained sparsely occupied between the late eighth century and the start of the fourteenth century AD, until after the extensive Inca empire had been established, when the site was eventually reoccupied by a rapidly growing community in the early 1400s as part of an imperial reorganisation of settlement in the valley. The peer reviewers recommended greater acknowledgement of the limitations of the dataset of fieldsurvey sites and of radiocarbon dates on charcoal samples excavated from small test pits, and—related to this—greater interpretative caution in using these data as the basis for making general statements about patterns of Inca political and territorial expansion and reorganisation in the Cuzco imperial 'heartland'.

Bioarchaeology

Three other articles published in this issue of *Antiquity* present a variety of bioarchaeological research materials, methods and results, and richly contextualised historical and archaeological interpretations of these. Peer review again contributed to this scientific process.

John Marston and Lorenzo Castellano provide a comprehensive synthesis of archaeobotanical and zooarchaeological data from excavated Roman, Byzantine and early Islamic archaeological sites across modern Türkiye, intended to chart and explain changes in agricultural practices and climate through the first and second millennia AD. Their approach includes the use of simple numerical analysis and principal component analysis (PCA), plus comparison with published pollen records and climate syntheses. The results indicate substantial changes made by farming communities towards short-term-return agricultural strategies. These appear to have been primarily in response to factors of political economy, although climatic changes also affected agricultural potential and practices over time and space, if arguably to a lesser extent. Our peer reviewers welcomed this data synthesis, recognising the impact it could have on future research in the region. But they called for greater attention to the details and limitations of the palynological data—including the poor representation of some taxa in, and imprecise chronological resolution for, some pollen diagrams—particularly when used as proxy climate evidence. Evidently, synthetic models are only as good as the data fed into them.

Kimberley Connor reports on her archaeobotanical identification of a large collection of desiccated plant remains from Hyde Park Barracks in Sydney, Australia, which was used as the Female Immigration Depot and Destitute Asylum between 1848 and 1886 (Figure 2). The samples were recovered during salvage excavations beneath the floorboards of the rooms and hallways. The results indicate that the female inhabitants of these colonial institutions supplemented their daily rations by snacking on an unexpectedly wide range of unofficial plant foods, including fresh fruit and imported nuts. The peer reviewers helpfully asked for enhanced discussion to contribute to the archaeology of institutions. This led the author to suggest that the female inhabitants actively used the unofficial plant foods to provide relief from monotonous official rations and to resist the totalising discipline of the institution.

Elizabeth Wright and colleagues also present their zooarchaeological reanalysis of the composition, pathological conditions and diet-related stable isotopes of faunal assemblages from nine archaeological sites in the sixteenth- to seventeenth-century AD entertainment hub on Bankside in London, to identify bear baiting. The results show that, while small numbers of bear remains may be present, a key indicator of bear-baiting assemblages is a predominant representation of bones from a particular kind of dog (Figure 3), tending to be much larger than the bones of breeds used for hunting and displaying cranial and rib injuries, and also a high proportion of bones from knackered equids, likely fed to the dogs. The article's peer reviewers liked the use of OSM as a repository for background information and details of

Figure 2. Portable microscope from the University of Queensland used to identify diagnostic features on the desiccated soft tissues of plant remains from Hyde Park Barracks. Under the microscope are two pieces of dried lychee peel, while the bags to the rear contain potential banana peel and corn cobs. Photograph by Kimberley Connor, reproduced with kind permission.

Figure 3. Selection of dog leg bones from Bankside, London. Photograph by Lizzie Wright, reproduced with kind permission, and with thanks to Hannah O'Regan for assistance.

methods but requested that more details of the data be presented here, such as the frequency of injuries observed by individual or by skeletal element.

Materials science

Materials science is also represented by four articles in the current issue of *Antiquity*. These focus on porcelain, copper, ceramics and amber. Peer reviewers again positively impacted the presentation of their analyses.

Wenpeng Xu and colleagues use portable x-ray fluorescence (pXRF) to determine the provenance of Chinese *qingbai* (bluish-white) porcelain—thought to originate from the Dehua production centre and adjacent port of Quanzhou in south-east China—found on the twelfth-century AD Nanhai I shipwreck in the South China Sea (Figure 4). The study involves an impressively large dataset: compositional data from 172 samples from the shipwreck were compared against a reference dataset of 686 samples from 19 kiln sites at Dehua using multivariate statistical methods, including PCA and Random Forest. Despite the existence of numerous kiln sites producing similar porcelain products, the results narrow down the provenance of most samples to two subregions within Dehua County (Giade and Longxun-Sanban), which produced some distinct vessel forms. The peer reviewers

Figure 4. PhD student, Zhitao Chen, using a portable x-ray fluorescence (pXRF) analyser at the Maritime Silk Road Museum of Guangdong, China, to study Dehua-style porcelain from the Nanhai I shipwreck. Photograph by Wenpeng Xu, reproduced with kind permission.

appreciated that the results provide greater nuance to understanding patterns of export-oriented porcelain production and maritime trade, but they also asked for more information on the sampling strategy and on the application of the Random Forest algorithm.

Another geochemical study using pXRF (alongside macroscopic and microscopic analyses) is presented by Khaled Douglas and colleagues to help understand the composition and provenance of a pair of copper cymbals discovered at a Bronze Age site at Dahwa in northern Oman. The results indicate that the cymbals were not cast from locally mined mafic copper but from ultramafic copper originating elsewhere in Oman, possibly from sources some 170km to the south-west. The peer reviewers welcomed the results for adding to a growing archaeological picture of complex flows of people, cultural practices and materials between the Arabian Peninsula and the Indus Valley across the Gulf of Oman during the third millennium BC. They also asked the authors to explain the results of the analyses in more accessible ways for non-specialists, and to be more cautious interpretatively in using partial scientific datasets to support the chronological attribution of artefacts.

A third geochemical study, by Anna Smogorzewska, analysed ceramics and clays from in and around the Early Neolithic coastal site of Bahra 1 in modern-day northern Kuwait to help answer questions about the manufacture and provenance of the earliest pottery used in the Persian (Arabian) Gulf during the late sixth and early fifth millennia BC. A total of

47 archaeological ceramic and geological clay samples were investigated using inductively-coupled plasma mass spectrometry (ICP-MS) at the University of Warsaw. Adding to the evidence of unfired clay vessels and pottery wasters at Bahra 1, the results confirm the hypothesis that Red Coarse Ware was made at the site using local clay sources and tempering materials, and that it is compositionally distinct from the Ubaid-style ceramics found there, which are thought to have been imported from southern Mesopotamia, at the head of the Gulf. Peer reviewers regarded the scientific approach taken as appropriate but requested that full details of the scientific research materials, methods and results be included as OSM.

In a fourth materials science article, Martin Mortensen and colleagues describe their use of Fourier transform-infrared spectroscopy (FT-IR) and gas chromatography-mass spectrometry (GC-MS) at the National Museum of Denmark to identify the composition and provenance of two fragments of tubular amber beads found in a cremation grave assigned to the Iron Age (*c.* 1075–925 BC) at the ancient city of Hama—an important trade hub situated on the Orontes River in west-central Syria. The resulting FT-IR spectra and GC-MS chromatograms, when compared with a Baltic amber reference sample from a known source, identify the material of the beads as amber from the Baltic coast of northern Europe. This adds to the map of other scientifically characterised examples of Baltic amber artefacts found at archaeological sites in the Near East dating from the early second millennium BC onwards, where ancient texts confirm that amber was understood to originate in a distant land and was highly valued. Our peer reviewers were very supportive of publication but recommended consideration of alternative chronological scenarios, whereby the beads could either have been Iron Age imports or potentially heirlooms from the Late Bronze Age eventually deposited in an Iron Age grave.

Remote sensing

The current issue of *Antiquity* also includes an example of the scientific application of remote sensing technology. Robert Weiner and colleagues used Light Detection and Ranging (lidar) data made available by the US Geological Survey, combined with ground-truthing, to enhance the mapping of a monumental road constructed by communities affiliated with the Chacoan culture during the ninth to twelfth centuries AD at the Gasco site, situated in the Red Mesa Valley, 70km south of Chaco Canyon in the US Southwest. The results reveal that the Gasco road is longer than previously documented, comprises two parallel roads and two associated *herraduras* (interpreted as road-related shrines), and forms alignments between natural springs and towards the winter solstice sunrise over Mount Taylor, which was likely regarded as a sacred mountain. Pointing to ongoing archaeological debate, the peer reviewers called for the authors' arguments regarding the function of Chacoan roads to be presented with closer connection to the data from the Gasco area, with greater caution and with acknowledgement of alternative interpretations.

Slow science, slow archaeology

Such discourse around the scientific construction of knowledge in archaeology, both in published articles and through peer review, should give us pause for thought. Indeed, over the past decade, various archaeologists have begun to argue that our work would benefit from slowing down. For example, in developing the concept of 'slow archaeology', William Caraher offers a critique of archaeologists' adoption and use of digital tools and practices that permit greater speed, efficiency and standardisation, particularly in commercial archaeology, and calls for repurposing of this technology to embrace the complexity of archaeological datasets[12]. Positions such as this are informed by the proliferating 'slow movement'. This stems intellectually from critiques of modern capitalism, advocating a reduction in the pace of modern life and the adoption of sustainable practices spanning food, gardening, cities, fashion, tourism and much more besides. Science is not exempt. For example, back in 2010, a community of Berlin-based scientists issued a 'slow science manifesto'.[13] This acknowledges that scientists are in the game that contributes to the accelerated science of the early twenty-first century but maintains that "scientists must *take* their time" to think, to read, to digest, also to misunderstand and to fail, because science develops unsteadily over long timespans. Isabelle Stengers, however, characterises this manifesto as nostalgically lamenting scientists' loss of autonomy and respect.[14] Her alternative slow science agenda demands not asking to be left alone but greater interdependence between scientific and public communities, learning collectively and symbiotically through engaging with messy categories and encountering dissenting voices around issues of common and different concern.

Strengers' slow science manifesto shares much with the counter-revolution in archaeological science envisioned (as outlined above) by the likes of Tim Flohr Sørensen, Katharina Rebay-Salisbury, Liv Nilsson Stutz and Alfredo González-Ruibal. And their thinking complements the writings of other archaeologists seeking, more broadly, deacceleration in archaeology. For example, Jerimy Cunningham and Scott MacEachern criticise 'fast science' as capitalist, "managerial, competitive, data-centric, technocratic and alienated from the societies it serves and studies" (p.631), and consequently propose that ethnoarchaeology should be reconceived as a form of slow science, involving ethically driven and collaborative research undertaken in close relationship with its subjects in the field[15]. James Flexner likewise regards archaeology's entanglement with capitalism as unsustainable.[16] He therefore outlines a degrowth approach to archaeology, in which archaeological labour takes on more scaled-back, democratic, meaningful and enjoyable forms, at the same time as collaboration and capacity-building in parts of the world with fewer resources. Nicolas Zorzin even calls for professional field archaeologists to resist the neo-liberal order through collective acts of disobedience,

[12] Caraher, W. 2016. Slow archaeology: technology, efficiency and archaeological work, in E.W. Averett, J.M. Gordon & D.B. Counts (ed.) *Mobilizing the past for a digital future: the potential of digital archaeology*: 421–41. Grand Forks (ND): The Digital Press at the University of North Dakota. https://doi.org/10.17613/59jx4-2ha98

[13] The Slow Science Academy. 2010. The slow science manifesto. http://slow-science.org/ (accessed 31 January 2025).

[14] Stengers, I. 2018. *Another science is possible: a manifesto for slow science*. Cambridge: Polity Press; c.f. Berg, M. & B.K. Seeber. 2016. *The slow professor: challenging the culture of speed in the academy*. Toronto: University of Toronto Press.

[15] Cunningham, J. & S. MacEachern. 2016. Ethnoarchaeology as slow science. *World Archaeology* 48: 628–41. https://doi.org/10.1080/00438243.2016.1260046

[16] Flexner, J.L. 2020. Degrowth and a sustainable future for archaeology. *Archaeological Dialogues* 27: 159–71. https://doi.org/10.1017/S1380203820000203

ranging from not doing as instructed, to unionisation and inflating the time needed to accomplish a task properly.[17]

Most archaeologists are likely to reject such future scenarios as too radical, risky and utopian. Some may also dismiss the whole fast/slow science debate as too binary. But we should at least recognise that these discussions are taking place in and around archaeology, and that they have implications for the quality of archaeological science being published in this and other academic journals. Such thinking might even influence your decision to attend this month's Society for American Archaeology conference in Denver, what sessions to participate in, and whether to take up our invitation to pause for a chat at the *Antiquity* stand.

Robin Skeates
Durham, UK, 1 April 2025

[17] Zorzin, N. 2021. Is archaeology conceivable within the degrowth movement? *Archaeological Dialogues* 28: 1–16. https://doi.org/10.1017/S1380203821000015