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Grand challenge: Environmental archaeology as intersectional, translational and inclusive practice

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What is environmental archaeology?

Environmental archaeology is concerned with the multi-dimensional character of human-environment relationships in the past; namely, how human activities were influenced by their environments and, in turn, how human activities have changed those environments (Dincauze, 2000). These relationships are recursive and mutually structuring, albeit with different emphases through time. For most of hominid and human history, the types of activities undertaken were largely contingent upon the environment, especially resource availability within the landscape, with varying degrees of resultant disturbance, degradation and denudation to those environments. During the Holocene, people increasingly transformed environments through the temporal accumulation of the effects of their practices onto the landscapes within which they lived. In different parts of the world, the rates of these transformations have increased markedly over the last few millennia, centuries and decades.

Environmental archaeology also studies how the material remains of past human-environmental relationships are expressed and preserved, whether at the scale of continents, landscapes, sites and features, or in terms of macroremains (such as artifacts, bones, shells, seeds, charcoal, and so on), microremains (such as soil, pollen, phytoliths, and so on) and molecules (such as isotopes, omics, ancient DNA, lipids, and so on). Our understanding of the past requires an engagement with the temporal processes through which landscapes are created and sites are formed (Schiffer, 1987), as well as the taphonomic processes and material properties of associated artifacts and proxies (Allison and Bottjer, 2011). Often, we are only able to retrieve a partial and fragmented record, which we then use to reconstruct a narrative about the past; yet which past do we choose to create?

Environmental archaeology bridges the humanities and the sciences. It draws on techniques in the biological and physical sciences and applies them to questions concerning human-environmental interactions in the past (Butzer, 1971; Waters, 1992; Brown, 1997; Evans and O'Connor, 1999; Dincauze, 2000; Branch et al., 2005). In contrast to the Quaternary sciences (Lowe and Walker, 1997; Williams et al., 1998), environmental archaeology emphasizes the human dimension of these interactions. As such, environmental archaeology does not consider humans as one-dimensional proxies of environmental change, rather human agency in the past needs to be unfolded as a social practice.

Just as we need to engage with the theories, methods and practices of the biological and physical sciences, we also need to engage with the concepts, methods and practices of the social sciences and humanities. In doing so, we need to develop and articulate conceptualizations for understanding different types of social processes for different types and scale of society in the past, whether small bands, tribes, confederations, kingdoms, empires or states and for communities who lived in rockshelters, long-houses, villages, towns, and cities.

Arguably the social dimensions of environmental archaeology have been neglected (although see Evans, 2003). There has been a tendency to focus on advances in archaeological science, such as methodological refinement and ever-expanding frontiers of technological application, and a concomitant tendency at reductionism and simplification in our understanding of social processes. Yet, we need a balanced social perspective to understand the long-term historical processes that have led to current global challenges of widespread environmental degradation, species extinctions and climate change, as well as of uneven development, social injustice and cultural survival. Although these global challenges are often considered as separate environmental or social problems, they are plausibly inter-related with shared and deep historical roots. Environmental archaeology has a unique disciplinary charter that allows us to engage with and shed light on the mutually constitutive character of environmental and social processes in the past and to track these processes into the present.

Here space allows for brief outlines of three attributes that *Frontiers in Environmental Archaeology* can promote. These focus upon environmental archaeology as intersectional, translational and inclusive practice. The intention is for *Frontiers in Environmental Archaeology* to embrace and extend traditional spheres of environmental archaeological practice.

Intersectional research

Environmental archaeology is intersectional, namely, most research draws on multiple sub-disciplines from the biological and physical sciences to address an archaeological problem. For instance, our understanding of the evolution of hominids in southern Africa is reliant upon bioarchaeological identification of hominid fossils, chronometric dating of the fossils and associated stratigraphic contexts, and geoarchaeological assessment of site stratigraphy (Herries et al., 2020); while understanding how hominids adapted to their landscapes requires zooarchaeology of associated faunal remains (Adams et al., 2016) and archaeobotany of plant macrofossils and microfossils (Larbey et al., 2019). Similar types of intersectional studies have tracked the dispersal of early modern humans to Island Southeast Asia (Barker, 2013; Barker and Farr, 2016) and Australia (Clarkson et al., 2017; Florin et al., 2022), and the adaptation of people to diverse environments in the Americas (Dillehay et al., 2008; Levis et al., 2018). Each sub-discipline of environmental archaeology provides key lines of evidence that together provide a robust basis for historical interpretation.

Here, I draw on three examples from my own research and that of my research students to demonstrate the intersectional character of environmental archaeology and show how complementary sub-disciplines can augment archaeological interpretation.

Investigations of early sedentism

Multi-scale and mixed-method geoarchaeological investigations have clarified early transitions to sedentary living in different types of environment, hereby exemplified with reference to the Natufian site of Wadi Hammeh in Jordan (occupied c.14,600-13,600 cal BP) and the "neolithic" site of Loc Giang (occupied 3980-3270 cal BP) in Vietnam. Both sites had been excavated over multiple field seasons with a range of associated archaeological analyses, especially dating and material cultural studies (see Edwards, 2013; Piper et al., 2017 respectively). Although both sites were identified as settlements, the character of construction materials during different phases of occupation was only determined following detailed microstratigraphic investigations including thin section microscopy, QEM-EDS and suites of auxiliary microarchaeological analyses. Geoarchaeological analyses augmented previous interpretations to identify trampling and a range of earthen construction materials during the Early Natufian in Southwest Asia (Prossor, 2022, 2023) and lime mortar floors and waste management during the "neolithic" transition in Southeast Asia (Grono et al., 2022a,b). Here, geoarchaeology added value to prior research and enabled more refined archaeological interpretation of the building techniques and lifestyles associated with transitions to sedentary living.

Domestication of vegetatively propagated crop plants

Animal and plant domestication is often tracked from the relative proportions of wild and domestic morphotypes in well-dated zooarchaeological (bones and teeth; Sánchez-Villagra, 2022) and archaeobotanical assemblages (mostly seeds, fruit stones and nut shells, as well as other plant macrofossils and microfossils; Fuller et al., 2023), respectively. In recent years, morphotypic-based inferences regarding domestication have been augmented by ancient DNA of animal and plant remains (Frantz et al., 2020; Allaby et al., 2022 respectively). A much neglected area of enquiry has been the domestication of vegetatively-propagated field crops, including globally important root crops (such as potato, sweet potato, yams, and taro), banana and sugarcane, which are especially important for tropical and subtropical subsistence agriculture (McKey et al., 2010; Denham et al., 2020). Root cops can be investigated using archaeological parenchyma (Hather, 2000), but limited research has been undertaken on the discrimination of wild and domestic morphotypes (see Ménard et al., 2013). Although traditionally undertaken using optical microscopy and scanning electron microscopy (SEM) (Hather, 2000; Kubiak-Martens, 2016), new and complementary applications of micro-computed tomography (microCT) have enormous potential to enable greater qualitative and quantitative investigation of archaeological parenchyma fragments (Barron et al., 2022; Barron, 2023). Here, the transfer of a technique from material science has

expanded the horizons of archaeological enquiry to address a long-standing problem, namely, using archaeological parenchyma to investigate the domestication of root crops.

The emergence of agriculture

The investigation of early agriculture requires a suite of complementary analyses: archaeological excavation of agricultural features, sites and landscapes; robust dating of significant finds, features and deposits; archaeobotanical and/or zooarchaeological remains of cultivated plants and/or managed animals; geoarchaeological evidence of cultivated soils and/or animal enclosures; and, palaeoenvironmental reconstruction of transformations associated with the emergence of agriculture, such as local deforestation (Denham, 2018; also see Arbuckle and Hammer, 2019). Intersectional lines of evidence from different subdisciplines of environmental archaeology are brought together to address a key question, namely, the emergence of agriculture. However, these robust multidisciplinary records are also transformational: the well-grounded chronology of agricultural practices in the highlands of New Guinea highlights the practical basis for early agriculture and draws away from archaeobotanically-reliant definitions of early agriculture (such as Harris, 1989; Smith, 2001). From this perspective, practices are conceptually and methodologically prior to any derived morphotypic changes in cultivated plants and husbanded animals. Here, detailed environmental archaeological investigations provide a basis for reconceptualising early agriculture as a social practice, thereby opening discursive spaces for more inclusive understanding of the emergence of agriculture in different parts of the world (Denham et al., 2007).

An intersectional and multi-disciplinary perspective is a core attribute of environmental archaeology. The field brings techniques and expertise together to add value to archaeological interpretations, to enable new types of question to be investigated, and to reconceptualise major themes in human history. *Frontiers in Environmental Archaeology* is organized according to broad sub-disciplines and also designed to explore cross-disciplinary research topics.

Translational potential

Archaeology has the capacity to shed light on the processes that contributed to some of the world's seemingly intractable problems, such as climatic and environmental changes (Stephens et al., 2019), over-fishing (Jackson et al., 2001), terrestrial and aquatic deforestation (Steneck et al., 2002) and species extinctions (Boivin et al., 2016). Yet, these problems cannot be solved solely by studying the past; they require 21st century solutions that address the needs of a rising global population with increasing social needs (especially in Africa, Kelechi Dinwobi et al., 2021). So, how can environmental archaeology contribute?

Foremost, debates concerning major environmental and social problems are often the purview of hybrid, inter-disciplinary research teams. For instance, anthropogenic global warming is a major environmental issue that has enormous social ramifications for communities around the world. In many ways, the science of climate change is well-documented (IPCC, 2023), yet there is much less research on the differential social impacts of global warming on communities in different parts of the world and even less political agreement on how to address these impacts. Training in environmental archaeology, like geography, provides a flexible, historical and holistic perspective on human-environment interactions in the past that can be applied to the present and future (Burke et al., 2021). Environmental archaeologists bridge the humanities and sciences, are familiar with the concepts and methods in both, have acquired a hybrid way of thinking and employ a skillset that can be re-tasked to address complex, real-world problems.

A transdisciplinary perspective is invaluable in translating archaeological knowledge about the past into the present. Archaeological research can provide information on lost crops, adaptation of cultivation practices to different environments, resilience and risk management, and forms of Indigenous Technical Knowledge (Swiderska and Ryan, 2021). These archaeological perspectives complement ethnographic and historical records, which in many parts of the world only reach back decades or hundreds of years, and are thereby invaluable for understanding how quickly traditional cultivation practices and agrobiodiversity can change (Ryan et al., 2022). Indeed, rates of agrobiodiversity loss—including landraces and cultivars, together with associated Indigenous Technical Knowledge—are a global concern, and environmental archaeologists can meaningfully shed light on long forgotten crops and practices (Ulian et al., 2020; Fuks et al., 2023). Archaeologists are also contributing to a wide range of other contemporary issues, such as carbon sequestration in soils (Mao et al., 2012), veterinary studies (Fiddaman et al., 2023), and health and medicine (Sykes and Shaw, 2022).

Looking forward, it seems likely that environmental archaeologists are well-placed to contribute to several contemporary issues facing modern societies. Although the ways in which our understanding of the past may be relevant in the present are not always apparent, they can often emerge through cross-disciplinary dialogue with colleagues in cognate disciplines. *Frontiers in Environmental Archaeology* will provide a transdisciplinary forum for translational dialogue.

Inclusive discourse

Environmental archaeology is not just a practice that occurs within a social vacuum. We need to constantly reflect on the character of that practice, on the knowledge we produce, the ways we construct subjects in our discourse, and the social contexts of our work. *Frontiers in Environmental Archaeology* provides a platform to broaden the voices represented and heard within environmental archaeology.

There are many ways that archaeologists can give voice to people in their research. At the most fundamental level, the ways in which we construct narratives about the past gives agency to, and voices to, different groups of people in the past (Foucault, 1972, 1977). The ways we form subjects in our reconstructions of the past are not merely academic issues; groups of people excluded from,

or marginalized within historical discourse can be denied social efficacy and significance that directly translates into how they are perceived and treated in the present (Spivak, 1988). The first step in promoting archaeological inclusivity is thus to develop inclusive conceptions of social groups and processes in the past.

There are disproportionate geographical and socio-economic biases within global archaeology (reviewed in Stephens et al., 2019). There are longer histories and greater investments in archaeological practice in some regions, such as Australia, China, Europe, North America and Southwest Asia, whereas other regions are relatively under-studied, especially large parts of Africa, South America and Southeast Asia-New Guinea. Although the situation is changing rapidly, it is important to provide more opportunities for inclusion of hitherto marginalized voices from the "Global South."

As significantly, archaeologists need to engage with Indigenous communities—together with other marginalized social groups—on whose lands and cultures they work. Although partnerships of archaeologists and Indigenous communities are becoming more common in many parts of the world, Indigenous voices are still rarely heard within environmental archaeology (for an example see Williams et al., 2020), as well as more broadly within archaeology (see Watkins, 2005). Even though co-publication does occur, often we are left wondering who really holds the pen (after Marcus, 1991)?

Associated with concerns of inclusivity are questions of ethical practice. Today, environmental archaeology is mostly undertaken with the permission of national and regional institutions, as well as Indigenous groups, landholders, and other relevant parties. This was not always the case; a tainted legacy contextualizes archaeological practice in many parts of the world today. However, meaningful engagement is a process that requires free and informed consent by all partners, especially marginalized social groups whose voices are not ordinarily heard. Consent requires constant renegotiation and can change over the lifetime of research projects due to shifting social contexts and research findings (AIATSIS, 2020). Consent for research to continue or to be published can be withdrawn at any stage of the research process. Inclusivity is thus not just about giving a voice to others, it is also a behavior; namely, inclusivity is how we comport ourselves in our archaeological practice.

Frontiers in Environmental Archaeology is intended to provide an inclusive platform that promotes research from the "Global South"; gives opportunities to Indigenous and marginalized perspectives within, as well as on environmental archaeological practice; and, is committed to ethical research.

Looking to the future

Here, there is space to allude to only three sets of issues that frame the remit of *Frontiers in Environmental Archaeology*. These are not exhaustive, either in terms of scope or depth of exposition; they are solely indicative. As the journal grows and changes, the grand challenges faced will need to be rewritten. In the meantime, a measure of the journal's success will be the degree to which environmental archaeology becomes a more intersectional, translational and inclusive practice over the next decade.

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