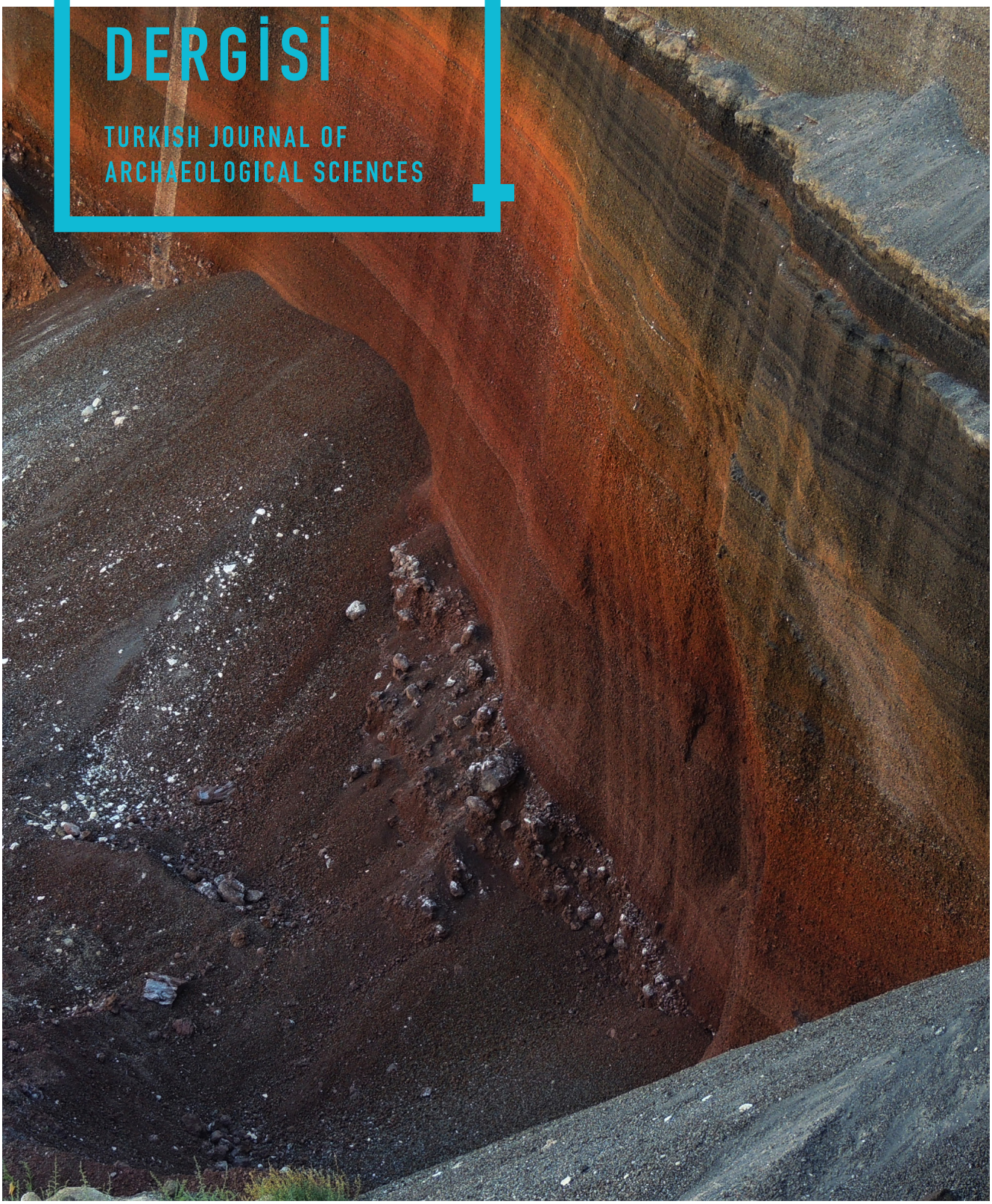
ARKEOLOJİ BİLİMLERİ DERGİSİ

TURKISH JOURNAL OF ARCHAEOLOGICAL SCIENCES

2021

ISSN 2822-2164



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ISSN 2822-2164

Yapım / Production

Zero Prodüksiyon Kitap-Yayın-Dağıtım San. Ltd. Şti.

Abdullah Sokak, No: 17, Taksim / Beyoğlu 34433 İstanbul - Türkiye

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Kapadokya volkan külü birikim kesiti /Accumulation of volcanic ash, Cappadocia, G. Duru.

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İçindekiler / Contents

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Editörlerden

Dünyaya açılmamızı sağlayacak Arkeoloji Bilimleri Dergisi'nin ilk sayısı ile hepinize merhaba diyoruz.

Arkeoloji bir süredir geçmişin yorumlanmasında teknoloji ve doğa bilimleri ile yoğun iş birliği içinde yeni bir anlayışa evrilmekte. Üniversiteler, ilgili kurum ve enstitülerde her yeni gün açılmakta olan "Arkeoloji Bilimleri" bölümleri ve programları, geleneksel anlayışı yavaş yavaş terk ederek değişen yeni bilim iklimine adapte olmaya çalışmaktalar. Arkeoloji disiplininin geçmişi, geçmişte yaşayan insanların yaşam biçimlerini bütüncül bir şekilde anlamaya, hızla gelişen ve yaygınlaşan teknolojilerle her geçen on yılda daha fazla yaklaşıyor. Arkeolojik araştırmalar, sorgulama ve değerlendirme biçimleri, bu yeni bilim üretme biçimine dönüşüyor. Derginin editörleri olarak bizler, bu süreçte, bu dönüşüme katkı sağlayacak bir mecra oluşturmanın önemli olduğu kanısındayız.

Amacımız arkeoloji içindeki arkeobotanik, arkeozooloji, alet ve bina teknolojileri, tarihlendirme, mikromorfoloji, biyoarkeoloji, jeokimyasal ve spektroskopik analizler, coğrafi bilgi sistemleri, iklim ve çevre modellemeleri gibi farklı uzmanlık alanlarının çeşitlenerek yaygınlaşmasına katkı sağlamak ve arkeolojide bilimsel yöntem ve analizlerin geliştirilmesi ve uygulanması üzerine çalışan bilim insanlarını bir araya getirmek. Elbette yeni ve özgün metodolojik ve kuramsal yaklaşımlar üzerine yapılan araştırmalara da yer vereceğiz. Destek, katkı ve ilginizi derginin seyri ve gelişimi adına çok önemli görüyoruz.

Güneş Duru & Mihriban Özbaşaran

ARKEOLOJİ BİLİMLERİ DERGİSİ
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Note from the editors

We would like to take this opportunity to introduce ourselves to the world, and say 'hello' to the archaeological media with the very first issue of our new archaeological journal: The Turkish Journal of Archaeological Sciences.

For the past couple of decades archaeology has been evolving in close cooperation with new technologies and the advances in the natural sciences towards new understandings and interpretations of the past. More and more newly established departments and programs in universities and other relevant institutions focus on "Archaeological Sciences" as they try to adapt to a changing climate, and gradually abandon older traditions. Rapidly developing technological, methodological and analytical advances move us closer to understanding the way of life in past communities in a holistic way. Archaeological research programs, and the many innovative new ways of testing, inquiring and evaluating these all converge into this new way of producing 'science'. As the founding editors of the TJAS, we think it is important to have a medium that will contribute to this transformation.

Our goal is to contribute to the diversification and dissemination of different areas of expertise such as archaeobotany, archaeozoology, tool and building technologies, dating methods, micromorphology, bioarchaeology, geochemical and spectroscopic analyses, geographical information systems, climate and environmental modeling. We aim to bring scholars working on the development and application of scientific methods and analyses together in these volumes. We also seek to include in these pages recent advances in methodological and theoretical approaches. Your support, contributions and engagement with the archaeological science presented here are crucial to the progress and development of the journal.

Güneş Duru & Mihriban Özbaşaran

Can Prehistoric Archaeology be a Scientific Discipline?

Trevor Watkins[a]

Abstract

Archaeologists have continually added new techniques of scientific analysis and interpretation, but the processualist archaeology of Binford and Flannery in the 1960s proposed that the central task was to set prehistoric archaeology within an ecosystems (i.e., ecological, and evolutionary) context. Evolutionary theory has expanded and developed significantly, especially over the last two decades, especially in the areas of gene-culture co-evolution and cultural niche construction theory. This paper proposes that, by using the new and still developing cultural evolutionary frameworks, we can explain our archaeological observations – for example, of the Epipalaeolithic-Neolithic transformation. In this way archaeologists can not only understand the processes at work within the period of our own particular interest, but at the same time we can contribute to the better understanding of where our period of interest fits within the greater scheme of human cultural evolution.

Keywords: Prehistory, Epipalaeolithic, Neolithic, cultural evolution, niche construction theory

Özet

Arkeologlar bilimsel analizlerine ve yorumlamalarına sürekli olarak yeni teknikler eklemektedir. Bu katkının en önemlilerinden biri 1960'larda Binford ve Flannery'nin Süreçsel Arkeoloji çizgisiyle önerdikleri prehistorik arkeolojiyi ekosistem (ekolojik ve evrimsel gibi) bağlamı içine dahil etmek olmuştu. Son 20 yılda evrimsel teori özellikle gen-kültürü, birlikte-evrim, kültürel niş inşa teorisi ile genişletilmiş ve geliştirilmiştir. Bu yazı, yeni ve halen gelişmekte olan evrimsel sistemleri kullanarak arkeolojik gözlemlerimizi açıklayabileceğimizi önermektedir, örneğin Epipaleolitik'ten Neolitik'e geçiş süreci gibi. Böylece arkeologlar olarak sadece üzerinde çalıştığımız dönemi anlamakla kalmayıp, aynı zamanda ilgilendiğimiz dönemin insanın kültürel evrimine ilişkin şemanın neresine oturduğunun anlaşılmasına da katkı sunabiliriz.

Anahtar Kelimeler: Prehistorya, Epipaleolitik, Neolitik, kültürel evrim, niş inşa kuramı

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Introduction

Archaeologists have continually improved the technical quality of their methodology, whether in terms of survey, excavation, or post-excavation analysis, and their methods have certainly become more rigorous in defining questions and recovering and analysing data. Many archaeologists have become expert in their fields of lithic technology, archaeobotany, archaeozoology, or the physical analysis of archaeological materials, answering questions by means of recognized scientific techniques. But we have not given enough attention to the higher level of integration required for the writing of prehistory. We can describe how archaeological material assemblages change from one period to the next, and the next. Across the Neolithic of southwest Asia, for example, we can identify trends, such as that settlement sites became larger, that domestic buildings became larger and architecturally more complex, that cultivated crops and herds of domesticated animals became steadily more important in the subsistence economies of most communities, and that quantities of Anatolian obsidian at settlements increased through the Pre-Pottery Neolithic period. But we have difficulty in going beyond descriptive history and explaining how and why those changes took place.

I will suggest that prehistoric archaeologists have the opportunity to join the growing international multi-disciplinary community of researchers who are developing cultural evolutionary theory. Together, using the new and still developing cultural evolutionary frameworks, we can investigate the evolutionary processes that will explain how our archaeological observations make sense. In that way we can not only understand the processes at work within the period of our own particular interest, but at the same time contribute to the better understanding of where our period fits within the greater scheme of human cultural evolution.

This is not a case of accepting and integrating a new analytical methodology that can be applied to our archaeological material. This is an enterprise in which we should collaborate, contribute, and gain real advances in return. Archaeology is not marginal to the development of better accounts of human social and cultural evolution. The archaeological material is the fundamental raw material that may document the progress of stages in the evolutionary process. And archaeological skills are essential in making primary sense of that material. Archaeologists and the physicists and other scientists who work with us can provide the essential chronological calibration of the processes of change and development. In short, it is my view that prehistoric archaeology must learn to understand these new developments in cultural evolutionary theory, and contribute to this exciting new enterprise: if we do not learn how to contribute, we will leave it to non-archaeologists to write our prehistory for us.

Archaeology and Evolution

The idea of "evolution" was problematic from the start; Darwin delayed the publication of his major book (Darwin 1859), knowing that the idea of a theory of evolution that had implications for humans was likely to provoke strong feelings and fierce arguments. Darwin had close relations with the pioneers of scientific geology; indeed, his theory depended on the idea of a chronology of geological immensity. He mentored his neighbour the young John Lubbock in the scientific methodology of natural history, and later encouraged him to write the first account of prehistoric times in which readers were introduced to the Palaeolithic hunters whose relative chronology could be gauged with reference to the large fauna that they hunted at different stages of the Pleistocene period (Lubbock 1865). There were similar developments in France, where early excavators of Pleistocene cave-deposits sought to establish the context of early humans in geological time. Édouard Lartet, for example was as much a geologist and paleontologist, as a pioneer of Palaeolithic archaeology. Evolution went on to get a bad name, because of its association with the ideas that went under the name of "social Darwinism", promoted notably by Thomas Galton, a cousin of Darwin. Social Darwinism sought to apply biological concepts such as natural selection and survival of the fittest to sociology, economics, and politics. And that soon led to eugenics, racism and anti-semitism in the twentieth century. It is not surprising, therefore, that archaeologists, together with most humanities scholars and social scientists, wanted no part in the application of evolutionary theory.

Evolutionary theory appeared again in prehistoric archaeology in 1960s America with the processualist movement led by Lewis Binford. They wanted an anthropological archaeology that made ecological studies of (cultural) adaptation to environmental change. At the base of their thinking was Leslie White's theory that culture can be defined as the exo-somatic (that is, outside the body, and thus non-biological) means of environmental adaptation for humans (White 1959). Both Binford and Kent Flannery proposed that an exemplary subject for processualist research was the origins of agriculture, and each of them put forward dynamic ecological models to account for it (Binford 1968; Flannery 1969). Flannery's broad-spectrum revolution theory made a link between resource diversification among Epipalaeolithic groups and demographic density, which broke the ecological equilibrium, requiring those hunter-gatherer groups to find ways to adapt to the new situation by means of intensifying the availability of their food resources (by broadening the spectra of plants and animals). They thus initiated the process whereby population continued to grow, and further intensification of plant-foods and meat resources was required until cultivation of crops and herding of animals led to the emergence of farming economies. Flannery's broad-spectrum revolution theory excited many archaeologists; it encouraged much research and some criticism but has continued to be used or discussed (for a detailed review, see Zeder 2012). For us the important point to note is that the

simple evolutionary model that underpins the theories of Binford and Flannery is outdated; we now know that change/adaptation is not necessarily the consequence of external environmental pressure as in the original formulation of the theory of evolution. There were major advances in knowledge, of course, especially with the emergence of the fields of genetics; learning about genes and DNA in the middle of the twentieth century made for such an improvement on Darwin's evolutionary theory that the upgraded theory was called "the modern synthesis", or "the standard evolutionary theory". But advances in evolutionary theory have continued and expanded, which is a subject to which I return later.

I have been concerned with the Epipalaeolithic and Neolithic of southwest Asia, and I will use that period as the case-study here. We can describe that transformation—the emergence of permanently co-resident communities, the focus on storable harvests leading to the emergence of cultivation of crops and the herding of domesticated animals, the increasingly networked super-communities of cultural sharing and exchange, and the very distinctive displays of symbolic forms and rituals—but we need a means of understanding the processes of socio-cultural development if we are to do more than describe. If we are to understand the Epipalaeolithic-Neolithic transformation, we need to know how it relates to, and how it develops from, the earlier Palaeolithic. Over recent years Palaeolithic archaeologists have naturally been concerned with human evolution; if they were particularly interested in the Lower to Middle Palaeolithic, they will surely have been engaged in debates about early hominin evolution, and if they were more focused on the Middle to Upper Palaeolithic periods, they will have been very aware of the debates about "the human revolution" and the emergence in *Homo sapiens* of "the modern mind". The unfortunate social division within archaeology between those who study human evolution and the Palaeolithic and those who work in later prehistory has generally isolated those working in the Neolithic and later periods from the recent developments in cultural evolutionary theory. The case that I wish to make here is that the archaeology of the Epipalaeolithic and Neolithic needs to be re-worked in terms of the available cultural evolutionary frameworks so that it can become part of the long-term process of human cultural evolution. The same can be said for the succeeding periods, at least into protohistoric and early historic times. Indeed, there are initiatives to develop ways of writing "deep histories" that treat the whole of human history in the same social and cultural evolutionary terms (e.g., Turchin 2008; Shryock and Smail 2011; Richerson and Christiansen 2013; Smail 2015).

Long-Term Cultural Evolution

Over and above the morphological changes in the body and the brain in hominin evolution over the last two or three million years, there are three significant, inter-locking trends in human social and cultural evolution. We will then focus on the Epipalaeolithic-Neolithic

transformation, where the same three interlocking trends can be identified in operation, but at a rapidly accelerating rate. Those three inter-related, slow, but accelerating trends are documented: (a) in cultural innovation and change; (b) in the expansion of the range of cultural products, skills, and capacities; (c) and in the growth of population, of population density and the scale of human social groups.

More than twenty-five years ago Robin Dunbar showed that there is a relationship between the size of the brain of primate species, in particular the crinkly outer cortex of the brain, and the size of their social groups. The hominin brain has increased greatly over the two or three million years that the genus *Homo* has been in existence. Fitting increasing hominin brain size, and particularly the ratio of the outer cortex, into that relationship of brains of primates to social groups, Dunbar suggested that the hominin brain has co-evolved with the growth in the size of social groups (Dunbar 1997, 1998). As the social group grows in size arithmetically, the complexity of the web of personal relations that need to be known and monitored expands exponentially. Dunbar showed in a graph how the predicted size of hominin social groups increased through time. This is the basis of his "social brain hypothesis". In the process, Dunbar argues, *Homo* has also evolved the unique human faculty of language to replace the one-to-one grooming that is typical of many primate species. What Dunbar has been talking about is complex gene-culture co-evolution which in addition involves other factors such as extended human infancy, the plasticity of the human brain, the expansion of its cognitive capacities, the capacity for mind-reading. I want to draw attention to another feature of that graph: there is a clearly accelerating upward curve in that graph.

In a different study, Dietrich Stout has argued that cognitive skills, language and the ability to accumulate a sophisticated cultural package of stone tool-making skills have co-evolved (Stout 2011); the positive feedback loops between brain evolution and technical and cultural skills produce an accelerating curve in the range and complexity of chipped stone tools through the long term of the Pleistocene (Stout 2011, 1056, Fig. 2). This research adds practical and conceptual cultural knowledge to the equation of co-evolution of cognition, the scale of social group, language and culture.

Dunbar's social brain hypothesis infers that the expensive investment in the evolution of a much larger and powerful brain enabled early hominins to live in larger numbers of socially interconnected individuals. Another indicator of the increasing scale of hominin social groups is the range over which an individual band obtained some of the raw materials for chipped stone tools. In Middle Stone Age Africa from around 120,000 years ago, bands obtained some raw materials over distances of 300 km and more (McBrearty and Brooks, 2000). The individual forager band may have been small, but what mattered was the larger social group of which each band was a component. Ben Marwick (2003) has discussed the implications for the scale and

nature of social networks by examining the range over which raw materials travelled. At first, as much as 1 million years ago, early hominin groups obtained their raw material from within their own territory. After about 1.2 mya, human groups might obtain some raw materials by means of exchange with other bands within their tribe. Marwick argues that fully modern language emerged among *Homo sapiens* in Africa around 120,000 years ago, because the sophistication of fully modern, syntactical language would have been essential for negotiations among participants in long distance networks of exchange and delayed reciprocity that carried raw materials over hundreds of kilometres, across multiple territories. He shows how the range from which raw materials were obtained grew across the African Palaeolithic, implying that groups began to exchange with more distant and unrelated groups.

Accelerating Scale and Tempo Within the Epipalaeolithic-Neolithic Transformation

For the most part, studies of cultural evolution have concluded either with the emergence of *Homo sapiens*, or around the beginning of the Upper Palaeolithic in European or southwest Asian terms (which is a curious omission in view of the extraordinary amount of both biological and cultural evolution of the last fifty thousand years). Now I want to suggest that we can see those same three characteristics of hominin evolution operating within our Epipalaeolithic-Neolithic transformation, but at an extraordinary rate of acceleration that is completely new when seen against the long term of human evolution. This relatively sudden and dramatic acceleration sets the scene for all that follows in human cultural evolution. It is common to point to the beginnings of agriculture as being the reason for the importance of the Neolithic in human history, but there is much more to the Epipalaeolithic-Neolithic transformation than that, as some non-archaeologists have noted. Paul Seabright, for example, a professor of economics, writes in his book *The Company of Strangers* about "the remarkable strangeness, and fragility, of our everyday lives" in contemporary urban society. He recognizes that we owe "our teeming, industrialised, networked existence . . to an extraordinary experiment launched a mere ten thousand years ago". The "extraordinary experiment" to which he refers is the formation of the first large, sedentary communities of the Neolithic, which had the capacity to devise institutions that enabled social trust. From those networks of Neolithic communities have evolved those institutions such as "cities, armies, empires, corporations, nation states, political movements, humanitarian organizations, even internet communities" that provide the foundations of social trust on such an extraordinary scale in today's world (Seabright 2004, 3). With similar insight the medieval historian Daniel Lord Smail, writing a "deep history" of humankind, explained that such an enterprise must treat of the Palaeolithic together with "the Postlithic", that is everything that follows from the Neolithic, which he labels "the fulcrum of the great

transformation" (Smail 2008, 2-3). Non-archaeologists with such insight into the significance of the Neolithic challenge us archaeologists to explain our period in detail within its context of human history.

The characteristics of human evolution in general that clearly take on a new tempo are (a) the acceleration of the rate of cultural change, (b) the expansion in the range of cultural products, skills, capacities, and (c) the growth in the scale of human societies, and of population density. These can be recognized within the e-Neolithic revolution.

The accelerating rate of cultural change is implicit in the way that we archaeologists have defined our archaeological periods in terms of their changing material culture. Tracing cultural change within the tens of thousands of years of the later Middle Palaeolithic has proved extremely difficult, although archaeologists have studied the chipped stone assemblages carefully to see if they can identify Neanderthal from *Homo sapiens* industrial traditions. By contrast the Upper Palaeolithic is much shorter, while the Epipalaeolithic is half the length of the Upper Palaeolithic. In the Levant the epal is broken down into three main sub-periods (and several more facies of chipped stone). The phases within the Pre-Pottery Neolithic are shorter again. Where we count in tens of thousands of years at the beginning of that sequence, we count in a few centuries for each sub-period towards the end of the Neolithic. The material culture repertoire can equally be seen to expand over time, and over the Pre-Pottery Neolithic new skills were being added.

We can get a proxy handle on the growth of population and population density by means of occupation sites and settlements. Nigel Goring-Morris and Anna Belfer-Cohen (2011) brought together the data on the number of sites in different parts of southwest Asia between the beginning of the Upper Palaeolithic (around 50,000 years ago) and the late Neolithic (around 8000 years ago). For the purposes of graphing the data (Goring-Morris and Belfer-Cohen 2011, 199, Fig. 2, S199, Fig. 2), the number of sites were normalised relative to the duration of each sub-period. For the southern Levant, where the best data has accumulated from more than a century of fieldwork, the number of sites grows steadily from period to period in a roughly straight line. Over recent decades there has been a concentration of salvage archaeology on the upper Euphrates and Tigris rivers; although we do not yet have early sites in that region, the trend from the beginning of the Holocene, the beginning of the Neolithic, is similar. Both curves under-play actual population growth, because across time (a) sites became larger, and (b) they were occupied more permanently, and (c) our archaeological periods through the Epipalaeolithic and the Neolithic get shorter with time. Ian Kuijt (2000) collected data on Neolithic settlement size for the southern Levant. His graph (Kuijt 2000, 83, Fig. 2) shows that site size increases across the Pre-Pottery Neolithic in an accelerating upward curve. He also collected information on the ratio of built space to open space, which shows that, as settlements

grew in size, so did the density of buildings within them, amplifying the crescendo of growth in settlement size and making the acceleration of population growth even more dramatic.

An important feature of successful and resilient societies is their intensive connectivity. Whatever the means by which they assured their internal social cohesion, our Neolithic settlements did not exist in isolation. We have known for a long time about some elements of their systems of exchange by means of the circulation of Anatolian obsidian. Now we know a good deal more about other materials and artefacts that were exchanged. We also know that the connections that made up this extensive network were already in existence in the Epipalaeolithic period, and the steady growth in the amount of obsidian and the range of other materials in the network can be charted. But recent work by Juan José Ibáñez, David Ortega and colleagues takes us much further (Ibañez et al. 2015, 2016; Ortega et al. 2014, 2016). The Spanish group has simulated exchange networks and shown that it is necessary to suppose a "small-world network", in which every settlement is linked with its neighbours, but some participants bypass their neighbours and access "distant links" directly, exchanging with partners up to 180 km from home. The best fit to the archaeological distribution map for the later pre-Pottery Neolithic, however, is called "optimized distant link" networking, in which certain communities emerge as significant distribution centres, and these distribution centres obtain their obsidian direct from other centres that were nearer the Anatolian sources. In other words, the Spanish group are proposing there came into existence in the early Neolithic complex and hierarchical systems of interaction and exchange of symbolically important materials, genes (through exchange of marriage partners), and the pooling of ideas, innovations and experiences.

We Neolithic archaeologists tend to think in terms of the autonomous community represented by a settlement site. We should be thinking in terms of super-communities made up of networked settlements (Watkins 2008). In addition to the proxy evidence of generally increasing population density (more and more settlements), and increasing numbers of people living permanently together (larger and larger co-resident communities), the true measure of the scale of the social group is the regional or supra-regional super-community. We will see later that such a social structure greatly encourages cultural and technical innovation and its efficient and wide dissemination.

Something else was new in the Neolithic, emerging out of Epipalaeolithic prototypes—monumental community architecture. Because of its recent publication, Jerf el Ahmar offers the best example (Stordeur 2015). This small settlement site beside the Euphrates in north Syria was never occupied after the early Pre-Pottery Neolithic. Danielle Stordeur was therefore able to expose most of the settlement of the early Pre-Pottery Neolithic. In an early phase of its existence, at the centre of a cluster of buildings was a massive subterranean construction, 7m in diameter and dug 3m deep into the ground (Stordeur et al. 2000). There was a similar massive building

at an earlier stage in the settlement's history, and there was a succession of similar circular, subterranean buildings, but with open interiors, in later phases. The excavators infer that the cells in the earliest examples had served as a storage facility for the community's cereals and legumes. Around the communal storage building there were several communal kitchen buildings, each equipped with multiple grinding stones—these are stone bases from which the grinding stones have been removed. The houses of the community were smaller, simpler buildings that clustered around this central communal area, Although the community was larger than a typical mobile forager band, and although they were (very probably) engaged in the cultivation of crops (Willcox and Stordeur 2012), the community seems to have continued the sharing ethic of hunter-gatherer societies. Indeed, their communal food storage was monumentalised in this massive central building.

The most dramatic examples of monumental architecture and sculpture have been found at the site of Göbekli Tepe on a bare limestone mountain ridge near Urfa in southeast Turkey (Schmidt 2011). The now famous large, circular buildings of the earlier phase at the site date to the early Pre-Pottery Neolithic, contemporary with the settlements like Jerf el Ahmar that have similarly monumental communal buildings. During the early Pre-Pottery Neolithic Göbekli Tepe seems to have functioned as a "central place"—the excavator, the late Klaus Schmidt, compared it to the neutral ceremonial meeting place of an ancient Greek amphictyony.

I want to turn back for a moment to Jerf el Ahmar, where Danielle Stordeur reported the finding of the first small stone plaques with incised signs on both surfaces. Some of those motifs, like the wriggling snake with the triangular head, are frequently seen on monoliths at Göbekli Tepe. We now have examples of these small stone plaques from a number of early Pre-Pottery Neolithic settlement sites in north Syria and southeast Turkey. It seems likely that the motifs are signs that are elements in a "semasiographic" sign-system, that is a writing system whose signs are symbolic, rather than "logographic" (that is, referencing words, syllables or sounds). The writing systems of the early central American civilizations are now known to be semasiographic, storing complex and detailed information about individuals, events, and calendrical dates. Contemporary mathematicians and theoretical physicists use semasiographic (algebraic) sign-systems that embody some of the most complex and mind-stretching information that humans have contrived to discover. Such sign-systems can function very well as modes of storing and sharing complex information. We can say that, in the early Pre-Pottery Neolithic, there were regional super-communities whose shared "cognitive frames" made their groups of carved signs, sculptures and architecture meaningful.

Within each settlement, each community, and among the communities that together made up the super-community, these—from monumental communal architecture, to small, handheld plaques bearing signs—were the means of ensuring what Jan Assmann called the essential

"cultural memory" (Assmann 1988). Assman's ideas were formed through his study of Egyptian architecture, imagery, and ritual; he concluded that the constant repetition of the representation of physical traditions assured the Egyptians of their "cultural memory", which told them who they were and where that identity came from. The philosopher-sociologist Maurice Halbwachs (1992) similarly recognized the social significance of architecture and ritual in the formation and maintenance of a society's "collective memory".

There is a lot more—some two thousand years—of Pre-Pottery Neolithic after this initial burst of dramatic architecture and art. There are many and varied signs in the archaeological record of the continuing importance of special buildings and ritual practices, especially those concerned with the dead and the ancestors (Croucher 2012; Goring-Morris and Belfer-Cohen 2020). In every way the Pre-Pottery Neolithic is an extraordinarily dynamic period. Through the Pre-Pottery Neolithic everything is scaled up, and the tempo of the processes of cultural change increases with time. Near the end of the Pre-Pottery Neolithic, around the beginning of the Pottery Neolithic, there is a short phase within which, in many parts of the hilly flanks of the Fertile Crescent, and in central Anatolia, there are rapid and major changes in the settlement pattern in many regions, the form of settlements, architecture, the practicalities of farming, and material culture in general. The dramatic changes through the latter stages of the Pre-Pottery Neolithic and the following Pottery Neolithic form a subject in their own right, for which there is not space here.

Advances in Cultural Evolutionary Theory

Over the last 20 plus years evolutionary theory has been expanding and diversifying radically. It has been called "evolution in four dimensions" (Jablonka and Lamb 2005). By contrast with the "modern synthesis" or "the standard evolutionary theory" of the middle of the twentieth century, today's advances (the emergence of epigenetics as a sub-discipline, evolutionary developmental biology, and niche construction theory in particular) have been labelled "the extended evolutionary synthesis" (Laland et al. 2015; Zeder 2017). Directly or indirectly the extended evolutionary synthesis offers us three related components that are very important for thinking about cultural evolution.

We have already encountered gene-culture co-evolution in Dunbar's social brain hypothesis, although Dunbar himself does not use the term. Gene-culture co-evolution can occur when a new cultural practice has the effect of favouring a particular genetic variant, which then increases in frequency to become dominant in that population, in turn favouring the intensification of the cultural practice (Boyd et al. 2010; Feldman and Laland 1996). The frequently quoted example is that of lactase tolerance in adults, a characteristic of some populations that have relied heavily on milk in their diets. Another is the sickle-cell allele that confers resistance

to malaria, which has been traced back to the particular way that certain West African groups cleared forest in order to cultivate their yams, inadvertently creating conditions that favoured mosquito populations (Laland 2017, 220-224).

There are multiple examples of gene-culture evolution, including the theory that the human facility of language has co-evolved with the cognitive evolution of the human brain (Dor and Jablonka 2014). These co-evolutionary feedback loops (labelled "reciprocal causation" by evolutionary scientists) involve a closed-circuit interaction with one another in which each encourages the other, which leads us to the second recently developed component of the extended evolutionary synthesis, niche construction theory. The evolutionary biologist Kevin Laland was one of those who first proposed the theory (Odling-Smee et al. 1996, 2003). The simplest definition of the term appears in a paper in which Laland and archaeologist Michael O'Brien set out to explain the significance of (cultural) niche construction for archaeology: niche construction is "the capacity of organisms to modify natural selection in their environment and thereby act as co-directors of their own, and other species', evolution" (Laland and O'Brien 2010, 303). Niche construction exists throughout the biological world, among many animals which manufacture nests, burrows, webs, and pupal cases, and including plants that change levels of atmospheric gases and modify nutrient cycles, as well as fungi that decompose organic matter, and bacteria that fix nutrients. Humans have become the most active niche constructors because of their capacity for culture. Humans operate within niches which they themselves have formed, and which becomes the effective environment that accommodates them and to which they accommodate (Laland and O'Brien 2011; Laland et al. 2001). Biologists are interested in the backwards and forwards interaction between human practices and the biology of the humans, and the species that humans have taken into their cultural niche with domestication. Psychologists are equally interested in the ways that the humanly constructed cultural niche in turn affects the cognitive functioning of its builders. Linguists interested in the evolution of language, for example, juggle with the co-evolution of the unique human vocal tract, theory of mind (which allows us to take into consideration the situation of the person we are speaking to as we plan what we want to say to them), and the cognitive capacity to attribute significance and meaning to symbols such as words. We also learn to read and write, and developmental psychologists have shown that acquiring the practice of reading changes the way that the brain works. Dietrich Stout's theory, referred to above, concerning the co-evolution of brain size, stone-toolmaking skills and language, Antón et al., thinking in terms of the complex web of interactions within the cultural niche of the earliest *Homo*, bring together increasing brain size, increased tool-making, transport from a distance of quality raw material for stone tools, expansion of diet, and greater developmental plasticity (the capacity to adjust to different or changing environmental conditions (Antón et al. 2014).

Cultural niche construction has been a vital element in human cultural evolution. It enables the third element, cumulative cultural evolution, which is (almost) unique to humans. We are the only species that have evolved forms of cultural niche within which people can not only accurately and safely transmit complex bodies of cultural knowledge, practices and skills (by teaching and learning), but can also continually produce and accumulate cultural innovations. Kim Sterelny is an eminent philosopher whose interest in evolutionary theory and in particular human cultural evolution. In his book *The Evolved Apprentice* Kim traces the long-term development of cooperation, and the evolution of social and cognitive skills embedded in a cultural niche adapted for cultural transmission (Sterelny 2011). Certainly by the time of *Homo sapiens*, young learners had become adept at identifying the best teachers from whom to learn advanced cultural skills, and there were cultural norms that enabled skilled and experienced older people to transmit their skills—what Sterelny calls apprentice learning. *Homo sapiens* cultures of the Upper Palaeolithic were already highly sophisticated, complex and diverse.

On the basis of decades of research teamwork in ethnographic fieldwork and intensive laboratory experiments, Joe Henrich argues that *The Secret of Our Success* lies in the power of the cultural learning niche for the safe inter-generational transfer of complex knowledge and diverse skills (Henrich 2015). The cultural accumulation of innovations is likewise dependent on the existence of very cohesive social groups and a cultural niche that provides for the tutoring, acquisition and practice of complex skills. The sub-title of his book says something very important: "*How Culture Is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter*". His message, as that of a number of researchers, is that the human propensity for prosociality, cooperation and working collectively is more important than individual intelligence.

There is a demographic component to this evolved cultural learning niche: at its most basic level, there must be relatively large numbers of people if there are to be several wise and experienced practitioners of complex skills, such as, for example, building a kayak, making a harpoon, and engaging in hunting seals in the Arctic Ocean. There is also an equally important component in the social structure of populations. Recent anthropological and experimental work shows that small-scale foraging band societies are subtly structured to maximise inter-connections between bands and interactions between non-related individuals or groups (Derex and Mesoudi 2020, which gives a detailed and up-to-date survey with plentiful references). Analysis shows that much innovation involves the refinement of existing things or the recombination of elements from existing things, for which purpose maximizing the ways that people from one group encounter another group improves the chances of the emergence of innovations. Recent experimental work has shown that the best environment for transferring knowledge or encouraging innovation is to set a task to several small groups of people, but to allow individuals to move between groups, comparing notes, as it were, and thus generating insights. These experimental

groups closely mirror the social structures identified in contemporary hunter-gatherer societies, suggesting that hunter-gatherer societies have evolved and retained forms of cultural niche that best fit them for their lives as mobile small-scale bands whose members sometimes visited other bands, or moved from one band to another.

Henrich announces that he has learned that "cultural evolution became *the primary driver of our species' genetic evolution*" (those are his italics: Henrich 2015, 57-58). The process "can be described as *autocatalytic*," he says, "meaning that it produces the fuel that propels it." The multiple positive feedback loops produce a runaway—that is, an accelerating—cumulative process. The Upper Palaeolithic societies, made up of scattered, small, forager bands, were very successful, but arguably they were at the limits of their capacity to sustain sufficiently large numbers of people, who could maintain meaningful contact with one another; the rate of cumulative cultural evolution had reached a plateau.

The leading evolutionary biologist Kevin Laland's research over more than two decades, summarised and expounded in his recent book, *Darwin's Unfinished Symphony*, has converged on Joe Henrich's understanding of the importance of human cultural niche construction for the support of cumulative cultural evolution (Laland 2017). Laland was one of the architects of niche construction theory, and has done fascinating work on the development of cultural niche construction theory. The title of his book alludes to the advances in the understanding of (Darwinian) evolutionary theory, while its sub-title (How culture made the human mind) announces Laland's understanding of the centrality of culture as the driver in human evolution.

There is a growing body of experimental and observational evidence that larger social groups are better able both to sustain a complex cultural heritage, to innovate and incorporate innovations, and to withstand competition. And there has been a massive growth of research papers appearing across an extraordinary range of journals, some of them recently established to represent an emerging sub-discipline. We are fortunate, however, that three of the leading figures in this inter-disciplinary field, each having decades of active research experience, have published very accessible books in recent years (Henrich 2015; Laland 2017; Sterelny 2011). The central thesis of both Joe Henrich and Kevin Laland is the critical importance of the human facility for cumulative culture within an increasingly complex cultural niche. The key features of human cultural and social evolution have therefore been to ensure that there are sufficient, preferably growing, numbers in the population, with maximum interconnectedness: the larger and more complex the body of cultural knowledge, ideas, and behaviours, the greater the scale of population that is required to support it, and the greater the need for intensive sociality and social interaction within that population unit.

It is worth finishing this section with a quotation from Laland's book in which he summarizes what he has learnt about human cultural evolution through his research career: the cultural

niche that humans have evolved at each stage maximises cumulative cultural evolution, with accompanying implications for the co-evolution of cognition and the human brain and mind. His analysis and conclusion closely parallels what Henrich has to say in his book.

"The evolution of the truly extraordinary characteristics of our species—our intelligence, language, cooperation, and technology—have proven difficult to comprehend because, unlike most other evolved characters, they are not adaptive response to extrinsic condition. Rather, humans are creations of their own making … Human genetic data … testified to an unprecedented interaction between cultural and genetic processes in human evolution, fueling a relentless acceleration in the computational power of our brains" (Laland 2017, 30).

The Epipalaeolithic-Neolithic Transformation in Cultural Evolutionary Context

The developments that we see in our Epipalaeolithic-Neolithic transformation, I think, exemplify Sterelny's, Laland's and Henrich's ideas; they are a microcosm within their macrocosm. Their use of the mechanisms of gene-culture evolution and cultural niche construction enabling cumulative cultural evolution offers us the framework within which to explain and better understand the processes in the Epipalaeolithic-Neolithic transformation (Sterelny and Watkins 2015; Watkins 2017, 2018).

The direction of the long-term cultural evolutionary trajectory of humans has been to devise cultural niches that support larger numbers of people living in social groups that maximise their inter-connectedness within the group (for most of the time, forms of mobile foraging band) and between groups. From the beginning of the Epipalaeolithic, at least in the Levant, there were important new developments: the group who left us the site of Ohalo II beside the Sea of Galilee lived there repeatedly and for long seasons of the year, if not year-round. Their exploitation of the diverse options for local food resources is a text-book example of Flannery's broad-spectrum strategy. In addition they were harvesting, drying, storing and processing cereals and grasses (Nadel et al. 2012; Snir et al. 2015). This was the beginning of the move towards sedentism in permanently co-resident communities, which involved, of course, corresponding adaptations to the subsistence strategies. From Jordan we now have early Epipalaeolithic aggregation sites like Kharaneh IV, where different groups came together seasonally, constructing huts, burying some of their dead, and learning and exchanging from each other (Maher 2020; Maher and MacDonald 2020).

We saw earlier the accelerating curve of settlement numbers and settlement size through the Epipalaeolithic and Pre-Pottery Neolithic that accompanies the increasing permanence of settlement. In parallel with the growth and permanence of settlement there was a steadily

expanding growth in the intensity and extent of exchange networks, among whose functions, I have argued, was the sustaining of regional super-communities. Everything worked together to transform the typical Upper Palaeolithic cultural niche into something on a much larger scale, with larger populations more intensively interconnected. The accelerating rate of cultural change, marked by archaeologists in their differentiation of successive archaeological periods and sub-periods, is evidence for impressive new rates of cumulative culture. The cultivation of cereals and pulses, leading to their emergence as domesticated species, and the herding of sheep and goats, again producing domesticated forms, are the most obvious examples of gene-culture co-evolution within the cultural niche, and the growth in the range of skills and cultural practices involved in developing an agricultural economy represent defining characteristics of cumulative culture. In sum, the Epipalaeolithic-Neolithic transformation represents a chapter in the story of recent human cultural evolution, but a chapter within which the pace of cultural evolution moves relatively swiftly into a higher gear. Some cultural evolutionary theorists are experimenting with the idea of punctuated equilibria, pioneered in geology and palaeontology by Gould and Eldredge (1977), in cultural systems (e.g., Kolodny et al. 2015). The experimental models in that study involved theoretical stone tool-kits, and explored the conditions under which a sudden "cultural explosion", a sudden rapid cultural accumulation of new tools might occur. Perhaps what we see in the Epipalaeolithic-Neolithic transformation is something similar, a punctuated burst affecting the whole of the cultural niche as it develops into something new and potentially more productive of cultural growth.

The changing cultural niche came at a cost. The expansion of the scale of the co-resident social group, permanent sedentism, and the sustaining of a high degree of connectivity and shared identity throughout that expanded super-community required new and costly modes of cultural community-building. The modes of material symbolism that we see in our Neolithic, seen particularly in the early Pre-Pottery Neolithic, constitute a very significant development of the cultural niche, because they direct and constrain the cognition of those who were party to the community that shared them. Andy Clark and Steven Pinker are two scientist-philosophers who write about "the cognitive niche" (Clark 2005; Pinker 2010). In both cases they are excited by the way that language materializes thought in words, creating structures that are themselves proper objects of perception, manipulation, and (further) thought.

Clark and Pinker don't differentiate between spoken and written language, as the evolutionary psychologist Merlin Donald emphatically does. Donald labels the third stage in his evolutionary account of culture and cognition "theoretic culture" (Donald 1991, 2001). Although he was thinking primarily—as a good academic should—in terms of written texts as the medium of storage and transmission of all kinds of knowledge, he also discusses the capacity of art and architecture to serve as shared "external symbolic storage" (Donald 2009). Donald argues that

our brains and minds during their development are deeply affected by symbolic elements of the cultural world in which we grow up, to such an extent that the operational structure of the cognitive system can actually be remodelled. What Donald is saying refers to the capacity of humans to make something like the enclosures and sculptures of Göbekli Tepe, or the architecture, furnishing, mosaics and frescoes of a medieval European cathedral, into feedback loop between symbolic material culture and the essential cognitive capacities of a community. What Göbekli Tepe lacks, of course, is what we know of an early church and the way that it would have framed the movements, gestures, words—and the emotions, thinking and beliefs—of those involved in the liturgy. The new forms of expensive investment in material culture, including monumental architecture and highly symbolic sculptures enabled people to share and experience their collective identities as very large social groups—the prototype from which, ultimately, our present world has evolved, in which, as Paul Seabright says, we live in multicultural communities of millions and tens of millions, in the company of strangers.

In one sense it is helpful to be able to see the Epipalaeolithic-Neolithic transformation in historical context, connecting and relating prehistoric processes to our own experience. In another sense, it is enlightening to see that transformation as a dramatic development within the broad context of human cultural evolution. Best of all, however, is the recognition that we can explain that transformation within the framework of cultural evolution, gene-culture co-evolution, niche construction and a continual drive to cumulative culture. And in that multi-disciplinary scientistic endeavour archaeologists can play a key role.

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Documenting Near Eastern Neolithic Architecture: Aspects of 2D and 3D Recording of Built Environments

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Abstract

How do we document architectural contexts? For which purpose do we document them? Why are we documenting in 2D or 3D? By doing so, do we actually document all the aspects of an architectural context that we want to capture? How do we record structural changes over time (building phases)? These and other aspects require consideration when documenting architectural contexts in the framework of archaeological fieldwork. The choice of approaches defines the methods and techniques we apply to achieve the results and final product that we seek or wish to present. Based on a case study from Göbekli Tepe, various aspects of 3D Structure from Motion (SfM) -recording and modelling will be discussed in this contribution.

Keywords: Near Eastern Neolithic architecture, 3D-recording, photogrammetry, Anatolia, Göbekli Tepe, digital data management

Özet

Mimari bağlamları nasıl belgeleriz? Hangi amaçlarla belgeleriz? Neden 2B ya da 3B belgeleme yapıyoruz? Bu şekilde mimariyi bağlamsal olarak elde etmek istediğimiz tüm yönleriyle birlikte belgelemiş olur muyuz? Zamanla meydana gelen yapısal değişimleri (yapı evrelerini) nasıl kaydederiz? Mimari kalıntıları ve onların arkeolojik bağlamını belgelerken konuyu çeşitli biçimlerde ele alan bu gibi soruları dikkate almalıyız. Soruların cevapları ise aslında ulaştığımız sonuçlar ve ihtiyaç duyduğumuz ya da ortaya koymak istediğimiz nihai durum için başvurduğumuz yöntem ve tekniklerle sınırlıdır. Bu bağlamda yazıda üç boyutlu (3B) Hareket ile Nesne Oluşturma/Structure from Motion (SfM) tekniğinin bu konudaki katkıları Göbekli Tepe örneği üzerinden çeşitli yönleriyle tartışmaya açılmıştır.

Anahtar Kelimeler: Yakındoğu Neolitik mimarisi, üç boyutlu belgeleme, fotogrametri, Anadolu, Göbekli Tepe, dijital veri yönetimi

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Makale gönderim tarihi: 25.12.2020; Makale kabul tarihi: 11.01.2021

Introduction

How to document building remains? How to make sense of the remains? Generations of architects and archaeologists have learned how to document buildings with traditional techniques and methods, for example, using 2D-representations of the reality with pencil on paper or with cardboard or plastic sheets and the help of local grid systems and reference points. This documentation process sees the careful selection of sections and positioning of elevation measurements; additional construction details were chosen to represent the buildings as such and to allow their 2D-reproduction in books, on information panels or as architectural models in museums. Once the scale was set, all other parameters—accuracy, precision, level of detailing etc. fell in place. However, drawings, as accurate and precise as they may be, are an interpretation of the reality. Dimensions are given in measurements and the pencil or inked lines represent area borders and traces of tooling or use. Yet, the density of information found in drawings combined with level measurements and annotations is so high that all relevant data can be recorded. In most cases, it is even possible to add data that is not even visible as projections of features above or below the documentation plane.

On the other hand, latest state of the art 3D-recording offers great data sets, which can be revisited whenever necessary and processed, even if the context no longer exists, which is the rule rather than the exception in the case of archaeological fieldwork. Therefore, it is all the more important that the 3D-recording is carried out properly and that the contexts are prepared accordingly. The necessity of this procedure is illustrated below by means of a case study from Göbekli Tepe. For a better understanding of the 3D-recording methods in use today the history and development of the method and the technology will be summarised and the weaknesses and strengths of the various approaches discussed.

Documenting Neolithic Architecture at Göbekli Tepe, Area L09-80 / Space 16/42

Excavations in area L09-80 at Göbekli Tepe[1] undertaken in 2001 (Figure 1) exposed 'rectangular' architecture dating to the Early and Middle Pre-Pottery Neolithic B (mid to late-9th millennium cal. BCE[2]) which was documented using traditional hand drawings in 2001[3] (ground plan; Figure 6) and in the following year[4] (elevations; Figure 7).

1 The Neolithic site of Göbekli Tepe (SE-Turkey) is located northeast of the modern city of Şanlıurfa in the Germuş mountains. Until comparatively recently, excavation (which began in 1995) have focused on the special (monumental) buildings with their T-shaped pillars (Schmidt 2006, 2012; Clare 2020). The architecture around the special buildings (Kurapkat 2014, 2015; Piesker 2014) has not been studied intensively so far (Kinzel et al. 2020; Kinzel and Clare 2020; Breuers and Kinzel in press.).

2 Kinzel and Clare 2020: 32-33.

3 by C. Winterstein.

4 by D. Kurapkat.

The PPNB residential architecture revealed at Göbekli Tepe has seen comparatively little investigation, as it was always overshadowed by the monumental architecture of the "special buildings" (Kurapkat 2015; Kinzel and Clare 2020).

In the course of the construction of a permanent protective shelter over the main excavation area (southeast hollow) of the site in 2017 and 2018, the chance arose to further excavate a PPNB residential unit (Space 16) in area L09-80. These investigations saw the removal of all remaining sediment deposits from this space down to floor level—Locus L09-80-122 (Tvetmarken 2017; Kinzel et al. 2020; Breuers and Kinzel in press; Schönicke in prep.). In addition to traditional recording techniques and hand sketches, during the 2017 field season the area was regularly photographed to produce SfM-based 3D-models. Height levels were taken with a dumpy level and additional reference points were measured with a total station (Leica TS06). It turned out that the architectural context of space 16 was much more complex than expected. The existing documentation barely covered the findings and certainly failed to capture them adequately. For this reason, and in order to get a better understanding of the contexts, we returned to space 16 in 2018. Especially the western walls were cleaned extensively with an industrial vacuum cleaner to clarify stratigraphic relations of the various walls in this area (Figure 2a, 2b and Figure 3). This time, high-resolution images were taken (with a Nikon D700 and D850) to produce a new 3D-model of the area based on the same reference points from 2017. All models were initially processed with Agisoft Photoscan[5] and re-visited for this contribution in Agisoft Metashape[6]. Orthographic scaled screenshots were produced with Metashape or Meshlab (Cignoni et al. 2008) for this contribution. The images were further processed with AutoDesk AutoCAD, Adobe Illustrator and Adobe Photoshop or Affinity photo and Affinity designer. Digital drawing tablets (Wacom intuos) supported the production of vector-based 2D-plans of the presented contexts.

Structure from Motion-Old Wine in New Bottles

Photogrammetry or stereo-photography is not a new method. It was introduced over one hundred years ago and helped to document difficult to reach parts of buildings and inaccessible areas and to reduce the time in the field (Finsterwalder and Hofmann 1968; Schwidefsky and Ackermann 1976; Stylianidis 2019). Photos have to be understood here as scaled representations of the world (Solf 1971). The differences between two photographic representations of the same points can be used to define the position and location of those points mathematically. However,

5 Some of the processing was performed at ABAKUS2.0 at the eScience center at the SDU Odense, Denmark in cooperation with Emiliano Molinaro supported by DeIC and HUMlab at the University of Copenhagen.

6 Agisoft Metashape is the updated version of Agisoft Photoscan.

complex contexts also showed the limits of this technology, as only points in the same plane were in scale and could be used to produce for example a scaled 2D-plan. Photogrammetry had a first revival with the establishment of personal computers and the possibility of using stereo-viewer and CAD-software to produce plans over photos (cf. Almagro 1988). However, most plans based on computer-supported photogrammetry of the late 1990s and early 2000s were lacking the quality of a hand drawing. Draftspersons now could only rely for the drawing on the photogrammetric image and not on the actual building (Petzet and Mader 1993, 162-165). This means optical and visual illusions, distortions or blurs may led to misinterpretations or incomplete records (Mader 2001).

The introduction of 3D-laserscanning presented for the first time a method that promised to provide 'objective' record data (Ioannides et al. 2014; Ioannides et al. 2016; Grussenmeyer et al. 2016; Historic England 2018). The laser scan promised a non-manipulated representation of reality. However, the choice of scanner location, laser width, resolution and density etc. all had a significant influence on the later result of the point cloud produced. The quality of the images taken at the same time could impact the colour of the point cloud or present difficulties when producing a convincing texture on the meshed surface.

Therefore, the laser scan technology was already showing certain limitations. Buildings need to be prepared for such documentation and any form of vegetation should be removed from the structure; generally speaking, any form of 'dirt' (e.g., soil, sediment, collapse material, etc.) resting on wall tops or floors should be cleared and removed to avoid incomplete recordings. However, this should be decided very carefully as "dirt" may actually represent the remains of wall mortar, roofing or floors, which should be documented as well. A clear decision can only be made on a case to case basis (cf. Weferling et al. 2001; Riedel et al. 2006; Heine et al. 2011; Martens and Messemer 2016; as well as Franz and Vinken 2017; Hoppe and Breitling 2018; CIPA 2019). In the case of the context discussed above (Space 16 at Göbekli Tepe), most of the remaining sediment material stemmed from fill deposits, Aeolian sediment and/or eroded Neolithic mortar material.

In contrast to a few years back, 3D-recording techniques based on Structure from Motion (SfM) methodology are used extensively. Structure-from-Motion or SfM is a term used in the field of computer vision and refers to an automatic process that recognises the spatial structure of objects based on corresponding features in images. In the process, two-dimensional images are 'transformed' into three-dimensional point clouds and finally meshed models. Due to the constant pressure of dwindling budgets and time, SfM technology offers a lot of opportunities for field archaeologists. The easy availability in terms of costs and accessibility of SfM software, e.g., as open source software, has made it possible for everybody to perform 3D-recordings from low-end to high-end quality and resolution. In recent years, it has become quite popular

in archaeology and heritage management to use those software tools as an effective, low-cost method for generating detailed three-dimensional models of archaeological sites, features or artefacts. Although SfM-3D-recording leads to a reduction of time spent in the field doing recording work, it also requires more 'office' time to process the data[7]. In reality, enough time should also be allocated to the necessary preparations making a context ready for 3D-recording, i.e., ensuring that the sources of the required data (e.g., walls, contexts etc.) are actually visible to the camera.

In the case of the space 16 in area L09-80 at Göbekli Tepe, a total of eight hours on two days during the 2018 season were allocated to cleaning the context to record the data for a 3D-model with all the walls built in front of each other actual visible on first sight.

The remote control of the data is a weak point in the documentation flow as missing data or inadequate recorded images cannot be added or produced easily once you have left the site. Additionally, a 3D-model produced with SfM-technology is always only a model; due to the randomly selected starting point of the mathematic operation and the applied algorisms, each reconstruction process has a random result. In other words, point comparison of multi-images is a random process and results are in the best case almost similar to each other but not necessarily so. Failure is part of this reconstruction process. Compared to laser scanning, which is the recorded reflection of the emitted laser beam with minimal option of failure, SfM-technology involves a high number of failure rates, e.g., due to extreme light contrasts in the images, blur or low resolution of the digital images, etc. Incomplete datasets or models are a worst-case scenario; the missing data is in most cases lost as the context and findings are removed or modified. Therefore, some precaution should be taken when taking the images.

Technical Aspects – Photos and Mathematics

When SfM-technologies became more widely available, the excitement to be able to produce 3D-models was great and culminated in the production of thousands of digital models based on images, most of which can be regarded as attempts or failed attempts to reproduce contexts. In most cases, the photos are lacking the necessary overlap or differences in the contrast of the images are so high that they result in strange shapes and noise. In addition, most models were made in low resolution to cope with the limitations posed by the available computer hardware, e.g., inadequate graphic cards. Other models were lacking proper reference systems or a scale.

7 Traditionally it was calculated that two third of worktime would be allocated to do hand drawings in the field and one third to produce a final plan at the office. With digital recording technologies, this time scheduler turned: nowadays recording may need one third to fifty per cent for executing the record in the field and fifty per cent to two third of the estimated time for the processing in the data at the office–off field.

It goes without saying that incomplete models are a worst case scenario for (archaeological) documentation.

Remarkably, in the early years of this technology only very few manuals were available; meanwhile, this has changed considerably, though the methods and guidelines are rarely taught (or followed) systematically. This is perhaps even more surprising as most of these manuals, which come from the software developers, e.g., Agisoft Metashape (Agisoft 2021), Meshroom (AliceVision 2020), Visual SfM (Wu 2013), ARC 3D (Tingdahl and Van Gool 2011), or from heritage institutions (e.g., Historic England 2017, 2018; Historic Environment Scotland 2018, Waldhäusl et al. 2013, also Busen et al. 2017), are freely available online.

The quality of the images is directly correlated to the precision and accuracy of the resulting model. Blurriness of images or (digital) noise due to too high ISO can be challenging, often leading to unsatisfying results. Although there can never be too many images, high numbers of photos can challenge the available hardware (memory) and jeopardise model processing. Too few images and images lacking sufficient overlap will eventually lead to incomplete models. High-resolution images may turn out to be too big to process due to computing power limitations (see e.g., Waldhäusl et al. 2013). The time needed for processing the data in high quality can easily stretch over several days or weeks depending on the existing computing power and the size of the available memory.

In practice, 3D reconstruction from images requires much more than just the actual SfM-progression. Current software solutions offer tools for pre-processing of images; such as lens correction and image masking, fully automated image matching, transition from sparse SfM-point clouds to dense Multi-View Stereo (MVS) point clouds and closed surface and colour reconstruction (meshing and texturing) of models. The technology and method needs a bit of practice; especially regarding proper image acquisition with correct sharpness and overlapping of images. When the image acquisition is done properly, the results of a SfM-workflow are comparable in detail, precision, and accuracy to those of hardware-based scanning with special devices (using e.g., terrestrial laser scanners or structured light scanners). SfM-based recording can even catch finer details than laser-scanning due to the higher resolution of the photo-sensible sensors of a camera (Kersten et al. 2014; Kersten et al. 2015).

3D-recording, for what Purpose?

Certainly, there is nothing wrong with storing data that would allow for the processing of higher quality models at later dates. In the case of a crisis (e.g., as in the case of the current pandemic) when it is not possible to conduct on site investigations–high-resolution models allow us to visit the site virtually; Virtual Reality (VR)-technologies mean than we can check details, measures and contexts, and the more detailed the model is, the better it fulfils this function.

Although, VR-systems certainly have their issues when it comes to hi-res-models with dense information, these will likely be remedied by the arrival of more powerful hardware. This strategy may also be of advantage when a site is too fragile to access or if it is located in a remote location; so far this option is still limited and not commonly used.

Therefore, a proper preparation of the contexts in question for documenting on site is needed to ensure that all relevant contexts are visible and not hidden. Finally, the question is always, which features should be recorded and for what purpose?

Field Recording - Preparing a Context

The cleaning of archaeological contexts prior to recording has always been a necessity, even in the case of traditional hand drawings. Digital recording is no exception and also requires a thorough cleaning of the archaeological contexts to ensure that everything that should be documented is actually visible. However, there are different intensities of cleaning; for example, while in traditional recording—e.g., drawings—the human eye can complete joints, shapes and borderlines of stones and it is possible to indicate findings, projections or hidden features with dotted or dashed lines, this is not immediately possible for digital recording. With digital recording, you only can document what the lens of the camera catches or the laser can reach and reflect. This must be considered when preparing a context for documentation. Indeed, one might even decide to make several 3D-recordings to document the different stages of cleaning. In some cases, it may be helpful to use an industrial vacuum cleaner to prepare the context; this has the advantage that the removed sediment is automatically collected and can be processed as well. Still, the features of the context should be carefully assessed to decide what has to be removed and what should stay and be present in the model.

Taking Images for SfM-based Models

In order to produce 3D-models based on photographs, some basic guidelines should be followed: Photos should have an overlap of at least 50-80%; photos should be taken in a convergent fashion; and photos should be taken at various angles, not only with one orientation as this helps to reduce possible distortions in the resulting model. Although not always possible, consideration should also be given to the time of day that the pictures are taken in order to provide the best lighting conditions. As a general guideline, morning and afternoon hours provide the best light for photography work; the light is low and images will not be too bright—thus not obscuring features—and also showing areas entirely in shadow. In general, large variations in brightness should be avoided for the generation of 3D-models. The number of moving objects in the images, e.g., people and animals, should also be limited; on the other hand, current software applications can recognize moving features and will eliminate them from the model.

For the area of L09-80, space 16 at Göbekli Tepe the photographs were first taken in two rounds moving around the entire space, which did not take more than 20 minutes per round. In a second step, the walls were recorded with over-lapping images taken parallel to the wall faces with slightly shifting angles, but with almost similar distance. Finally, some close-up detail shots and random overview shots were taken to fill gaps and to allow details to be visible. The photos were processed with the Agisoft Photoscan workflow into a low-resolution model in the afternoon of the same day to check the general quality of the dataset. This process may take one to two hours, depending on the total number of photos taken. Additional images were taken the following day to minimize the risk of missing data.

L09-80, Space 16: Some Building Archaeological Results

The 3D-recording process improved our understanding of space 16. What was clear from the start was that the building comprises not only space16, but also spaces 18, 96, and most probably the (upper floor?) space 42. The earliest structure in the area is represented by stone walls (L09-80-110, L09-79-50.1, and L09-79-52) which seem to make up the eastern part of a relatively large building (about 32 m^2) with a round to ovoid ground plan. Only the eastern curved wall of this earlier building was incorporated into the later structure when a major rebuilding in the area took place. As a result, a new and slightly smaller rectangular appearing main space 16 and a northern annex 18 were created inside the former ovoid structure. This main room was defined by remnants of the earlier curved wall segment (L09-80-110) to the east and newly built walls to the south, west and north (L09-79-9, L09-80-111/144 and L09-80-71). These new walls were bonded at (almost) right angles resulting in the half-rectangular and half-rounded ground plan of space 16. This room had a good quality and smooth plaster floor (L09-80-108 and L09-80-122) which included crushed, split limestone.

Following some potential earthquake destruction, a further modification of space 16 took place that incorporated an additional new set of walls (L09-80-63, L09-80-44, L09-80-43 and L09-80-65 to the north, east, south and west respectively). The relationship of these walls could only be clarified in the process of preparing the context for the 3D recording in 2018 (Figure 4). How the different walls connect with each other, i.e., the different building events, was only observable after a thorough cleaning of the walls and joints. The walls in question were set against and partly on top of the earlier stone walls. An exception was the southern wall (L09-80-43) which was constructed at some distance from the earlier exterior wall (L09-79-9), thus creating the small and narrow (ca. 1.5 m^2) space 96 and running in the west over the earlier wall L09-80-111/144.

In this building phase the ground floor area of space 16 was limited to ca. 14.6 m^2 (Figure 5), and four T-shaped pillars defined its interior, two of which (PVII and PVIII) were free-standing

and situated in the western part of the room. The remnants of the other two (PIX and PX) were incorporated into the eastern wall (L09-80-44) of space 16. However, it is unclear where these T-shaped pillars originated; the preserved plaster floor shows only the footprints of a set of benches which were obviously removed in the last use phase before destruction or abandonment.

During the documentation process, the walls defining the western limits of space 16/42 were of particularly interest. The preserved wall remains show a series of wall structures placed in front of each other on the ground floor[8] and on the upper floor level. The initial ground floor wall (L09-80-144) is almost double the width of the wall segment belonging to the upper floor (L09-80-146[9]); wall L09-80-144 also connects in a right angle to the northern wall L09-80-71. The later walls L09-80-65 and L09-80-63—built in front of both—show the same feature. The later wall L09-80-15 of space 42 rests on a layer of broken wall stones, fist-sized stones and mixed sediment—possibly representing an earlier floor between space 16 and space 42 or a destruction layer. It is constructed in front of wall L09-80-146, partially resting on the earlier ground floor wall L09-80-144. Obviously, wall L09-80-65 takes over the function as load bearing structural element from the earlier wall to serve as a support for the beams and timbers of the floors/ceiling structure of space 42/16. The fact that this similar arrangement of ground floor- and upper floor walls was rebuilt after a destructive event points towards the re-building of a two-storey house unit.

Space 16 was probably covered by a structural ceiling, thus allowing for the construction of a second storey, namely space 42. This part of the building represents an upper floor which covered an area of at least 22.5 m^2. It was defined by a set of walls to the west, north and east (L09-80-15, L09-80-16 and L09-80-85/L09-80-90 respectively). The southern limit of the space remains unclear due to the bad state of preservation of this part of the building, though it seems likely that it could have been demarcated by the upper part of either the southern wall (L09-80-43) of space 16 or the southern wall (L09-79-16) of space 96. It is also likely that a roof covered this space, too. Interestingly, the superimposed spaces 16 and 42 could have been connected via a portal stone (Obj. GT17-WS-0080) that was found in the room-fill in the south-western corner of space 16. Upper floor space 42 connects to the north with space 18 (with approx. 2.1 m^2) through a wall opening (L09-80-16/L09-80-83).

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8 Some would perhaps call it a basement; however, based on the terminology developed for the southern Levantine steep slope architecture of Basta (Gebel et al. 2006) and Ba'ja (Kinzel 2013), the term "ground floor" is preferred.

9 There is still also the possibility that wall L09-80-146 actually belongs to a neighbouring structure or was shared by two building units.

Another feature of the architecture became much clearer during the recording process and in the later 3D-model were traces of destruction. The bulking, tilting, and general deformation of the upper floor walls clearly indicates that an earthquake led to the destruction of the building and the partial filling of space 16[10].

Conclusion: 2D, 3D and What Next?

The use of digital recording methods is supposed to speed up the process of recording in the field. Additionally, it can provide data for more detailed and easier accessible results. Further, the 3D-models provide stunning visuals which can be used to show diachronic changes in architectural structures.

However, the efforts to produce satisfying 3D-recordings and to build archaeological analyses can easily equal or even exceed the time spent on traditional hand drawings. In fact, the time spent on cleaning and preparing for a digital recording is comparable to the time spent on site for traditional hand drawings and related studies of the building and the traces of its use-life (*Bauforschung*).

In contrast to the two-dimensional hand drawings, digital SfM-recordings can also capture the third dimension; these can provide the basis for a four-dimensional model.

The processing operation of SfM or modelling software is setting parameters that are comparable with decisions made in the drawing process. Which resolution (scale) is best suited to the anticipated purpose? Will the model be the basis for a fine detailed 3D-print; will it serve for a basic topographic model of the site and its built environment; will it be a high-resolution recording to produce later photo plans of archaeological features; and what are the limits presented by the available hardware?

The random calculation process of the software creates some uncertainty in relation to the "accuracy and precision" of a model; a digital model is merely a 3D-reconstruction of a context and not the reality (in contrast to a laser scan!). Each calculation process will result in a slightly different but close to similar result. So, what should be saved and preserved: the final model or the raw data?

What really matters is the raw-data and reference points, scales, and coordinates of models as these allow us to reprocess the data at a later date; lost and/or incomplete raw data cannot be reproduced, especially in respect to archaeological contexts which are in most cases already gone and not reproducible. It may also be good to think of a Plan B for a data backup. Experience

10 For a more detailed debate of the possible scenarios, see Schönicke in prep.

tells us that digital data storage and maintenance can be a challenge, e.g., due to the establishment of new standards, new file or storage formats or incompatible software updates.

In the case of Göbekli Tepe, the combination of traditional recording techniques with state of the art digital recording technologies has been very successful so far. On the one hand, this approach has reduced the actual time in the field, and on the other it has provided an additional record of contexts which may be removed in a later step of archaeological excavation work. This is true also for the documentation of the Neolithic built environment as demonstrated for area L09-80.

SfM/photogrammetry should be seen as an additional tool and not as a full replacement for traditional recording techniques, especially when it comes to the documentation of architecture. However, possessing high-resolution models of archaeological contexts may also help in future to study those contexts and features further, when access to sites is not possible or access is limited (e.g., due to lack of funds, pandemic events or armed conflicts).

Digital technologies also make it possible to consider the factor "time" in 3D models. In order to optimize building processes the building industry has developed so-called Building Information Modelling (BIM) technologies. BIM is used to plan, manage and monitor building sites during the construction process. Such approaches should be explored much more for archaeological contexts, especially as it may help us to simulate and better understand the impact of time on the built environment in the past.

As argued earlier (Kinzel 2008), models and recordings of architecture should reflect and represent time. Therefore, it is essential to understand the complexity of simultaneous site formation processes with different speed and pace contributing to the changes and continuity of Near Eastern Neolithic architecture (Kinzel et al. 2020). The 3D-recordings of space 16 in area L09-80 have not only contributed to a better understanding of the order of (buildings) events but will also enable us to present in future the results of the building archaeological studies in a much more condensed way.

The digital record does not replace the need to study and to understand the recorded structures (Großmann 2010, 75), and a digital 3D-model does not replace architectural documentation. In a nutshell, the digital record is a method and tool that provides the basis for a three-dimensional documentation of architectural and archaeological contexts over time.

Acknowledgements

For the support in the field, I would like to thank my colleague Lee Clare—German Archaeological Institute Istanbul; the Şanlıurfa Museum; and Necmi Karul—Istanbul University. I am grateful for the support of Lars Kjaer-HUMlab-Royal Library of Denmark,

and Emiliano Molinari, eScience SDU/Odense in helping to tame ABAKUS2.0. Thank you to the Danish Institute in Damascus for funding a new camera and SfM software licenses to record Near Eastern Neolithic Architecture (NENA). I would like to thank numerous colleagues for ongoing discussions regarding best practice in recording: Cecilie Lelek Tvetmarken, Devrim Sönmez, Marek Z. Baranski, Antje Kinzel, Yasser Dellal, Julia Schönicke, and Thomas Kersten (HCU Hamburg). For the building documentation and recording works at Göbekli Tepe in 2001, 2002 and 2003, I am indebted to Dietmar Kurapkat and Claudia Winterstein. Finally, I would like to thank the reviewers for their constructive critic and very appreciated comments to make this a better contribution.

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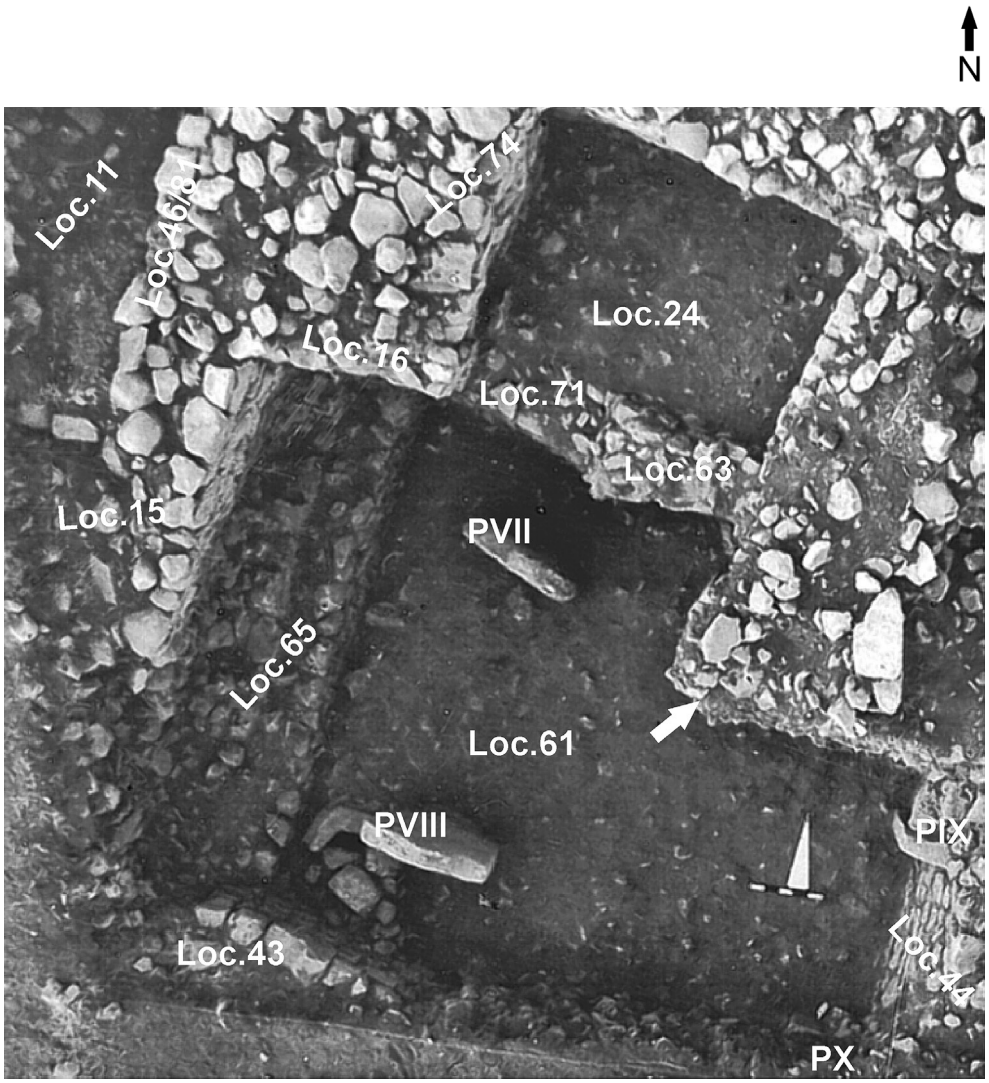


Figure 1. GT1999: L09-80, vertical shot of the area with walls exposed as documented (photo: K. Schmidt/DAI/Göbekli Tepe Archive 1999).

Figure 2. GT: L09-80, (a) wall loci L09-80-65 and L09-80-144 before cleaning (photo: D. Sönmez/DAI, 2017); (b) after cleaning (photo: M. Kinzel/DAI, 2018).

Figure 3. GT: L09-80, Cleaning of wall tops (Loci L09-80-65 and L09-80-144) to prepare for 3D-recording (photo: L. Clare/DAI, 2018).

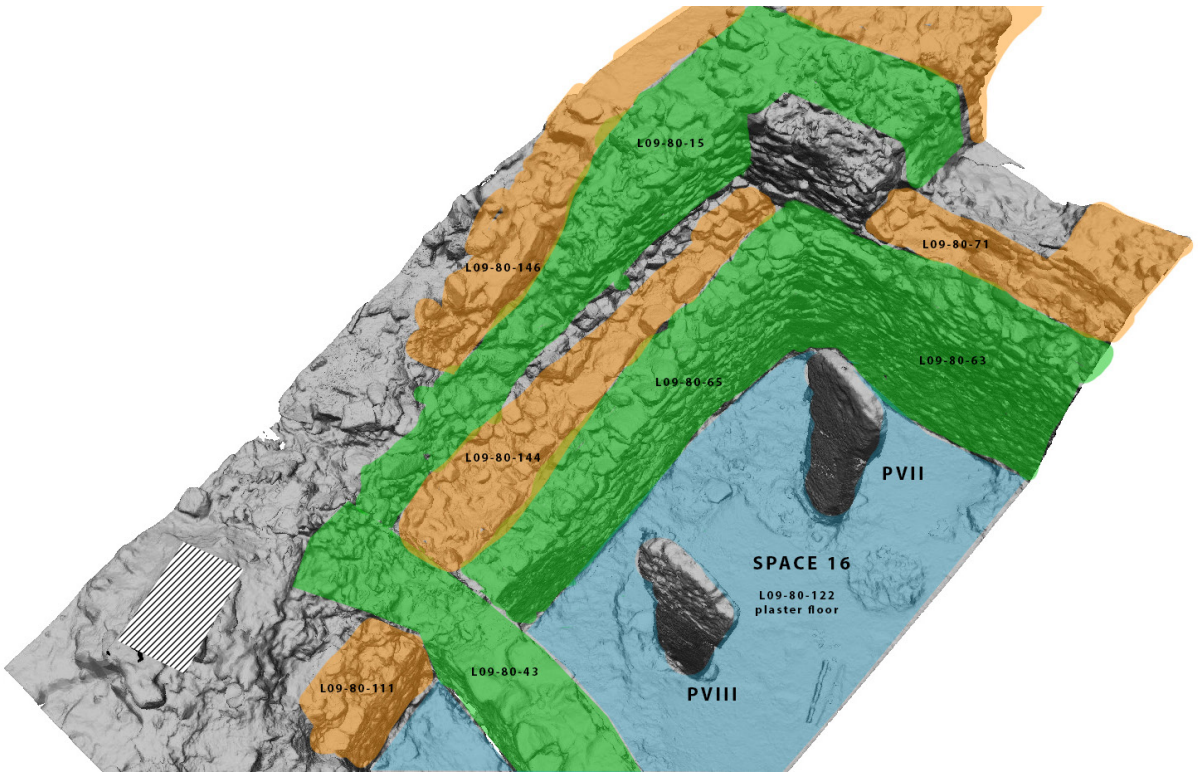


Figure 4. GT: L09-80, 3D-model with building phases of the relevant context discussed here early plaster floor (blue), earlier alterations of the structure (orange), later alteration (green), (M. Kinzel 2020).

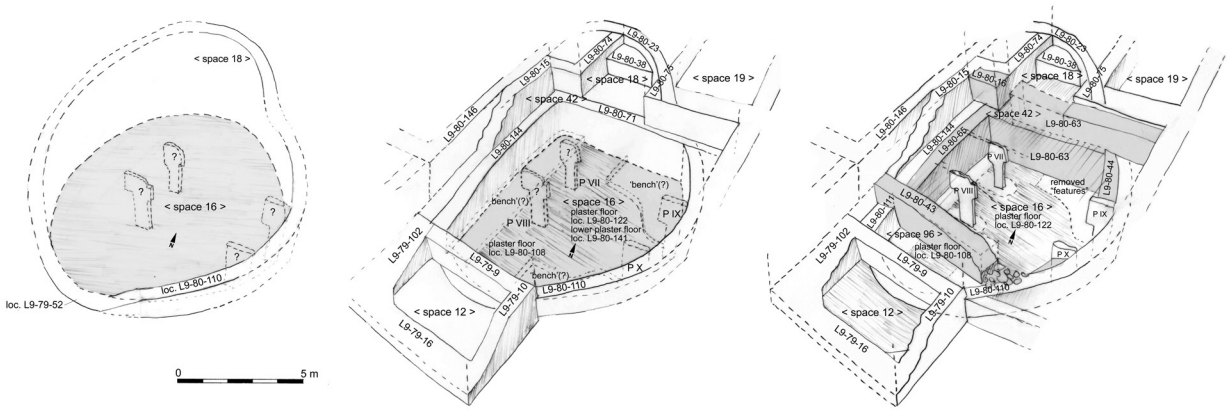
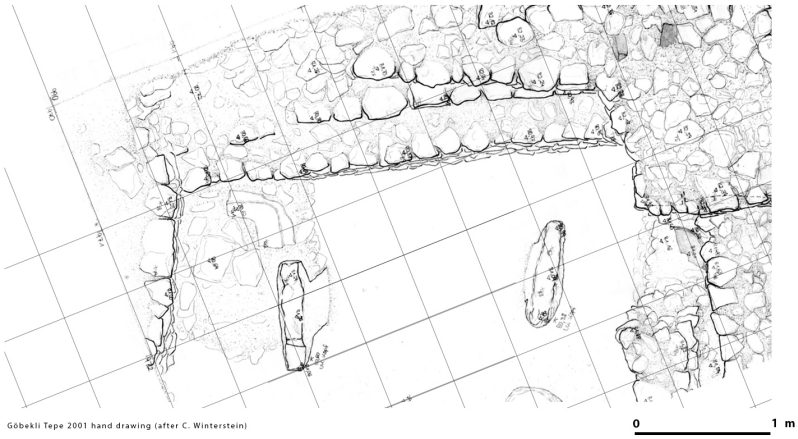
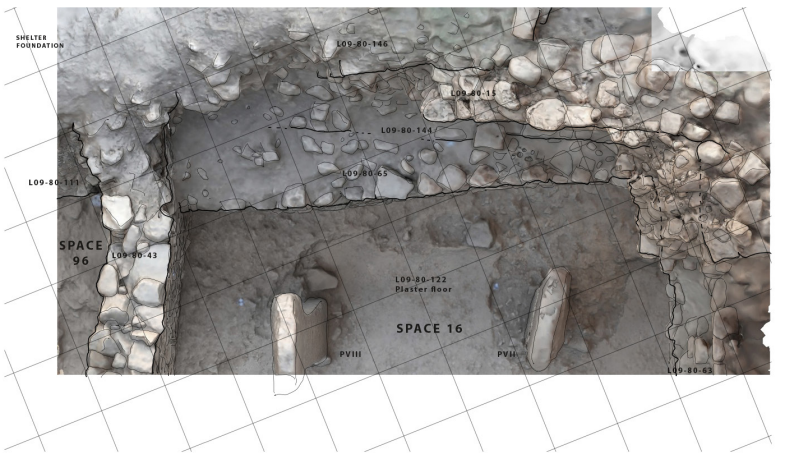


Figure 5. Göbekli Tepe, L09-80 Building development in the area around space 16 (after Kinzel et al. 2020).





Göbekli Tepe 2001 Orthophoto of 3D-model and tracing of stones (after M.Kinzel - D. Sönmez 2017)

Göbekli Tepe 2001 Orthophoto of 3D-model and tracing of stones (after M.Kinzel 2018).

Figure 6. Top: Göbekli Tepe 2002 hand drawing (original scale 1:20) by C. Winterstein (DAI/Göbekli Tepe Project Archive 2001). Middle: Göbekli Tepe: L09-80, space R16/42 SfM Modell 2017 (based on 280 images processed with Agisoft Photoscan – High Quality; by M. Kinzel and D. Sönmez); Göbekli Tepe 2017: L09-80, R16/42 wall loci L09-80-144, L09-80-65, L09-80-146, L09-80-15, L09-80-43, L09-80-63, (Floor Loc. L09-80-122). Bottom: Göbekli Tepe 2019: digital 3D-model of area L09-80 with spaces 12, 16, 18 and 96 (based on SfM-recording by M. Kinzel 2018; processed in 2019 and edited in 2020).

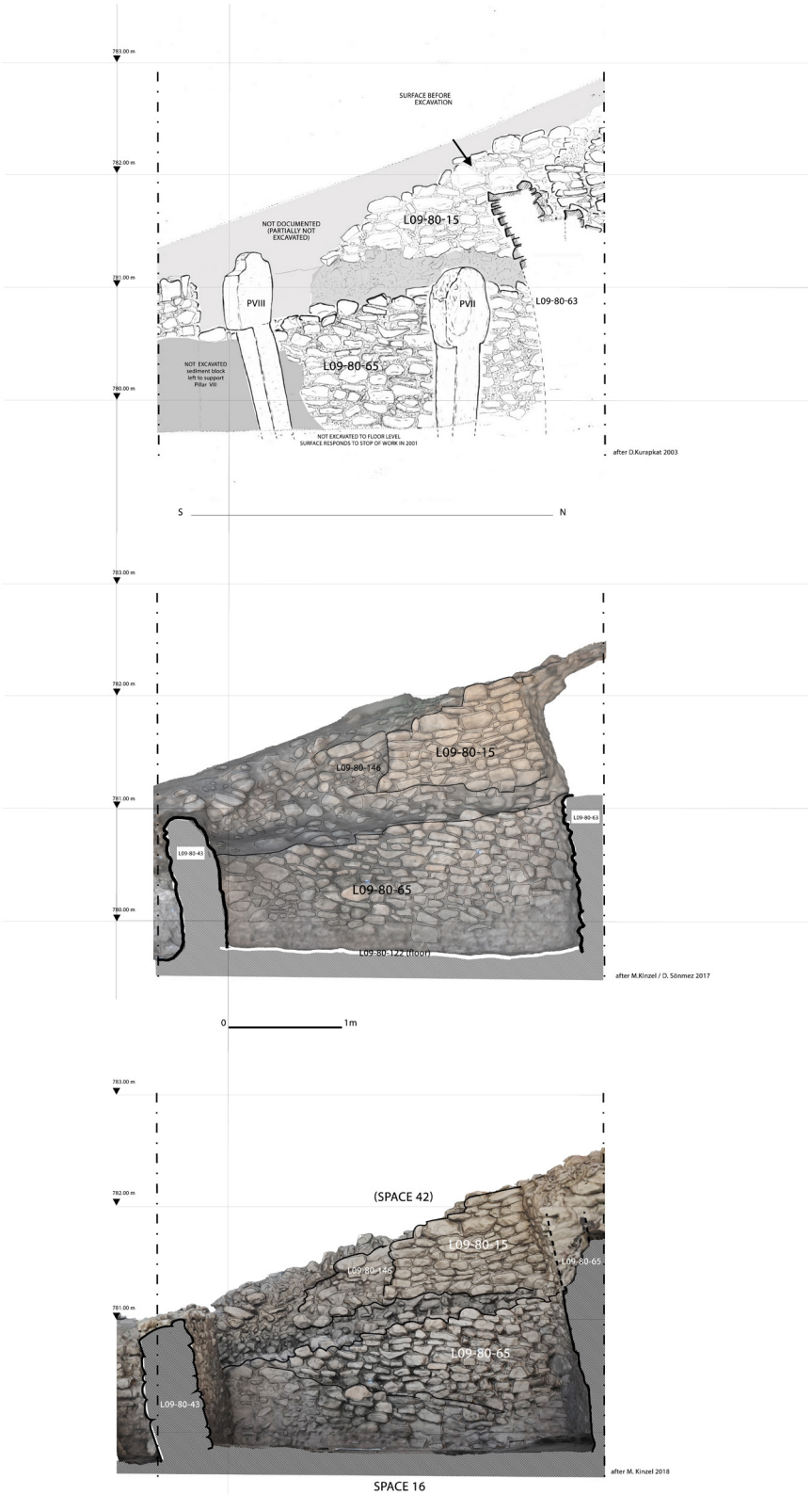


Figure 7. L09-80 elevation of wall L09-80-65/15 and 144 (hand drawing 2002 by D. Kurapkat, 3D-model 2017 by M. Kinzel, D. Sönmez, 3D-model 2018, by M. Kinzel, edited by M. Kinzel 2020).

Mortuary Behavior in Chalcolithic Anatolia: A View from Gülpınar

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Abstract

This work assesses the mortuary behavioral patterns in Chalcolithic Anatolia in the light of recently discovered burial data from the site of Gülpınar in northwestern Anatolia. A total of seven burials unearthed in the Middle Chalcolithic (phase III) occupation at Gülpınar indicate that the dead were deliberately buried on the periphery or just outside the surrounding wall of the settlement, mainly on the walls or in empty spaces between the walls of the preceding phase II structures belonging to the Early Chalcolithic period. The selection of abandoned areas gradually falling out of use on the periphery of the settlement as a burial place relates to social memory; whereby the settlers defined their group identity and linked the deceased with their forefathers. Although the number of burials is admittedly too limited at Gülpınar to reach a firm conclusion, the burial data from the site may demonstrate that male and female adults were buried in the abandoned residential areas or areas being abandoned in the periphery of the settlement, a pattern that has rarely been attested in the archaeological record. However, a high frequency of infants and few adults underneath house floors suggest adults were buried different places.

Keywords: Chalcolithic, Anatolia, bioarchaeology, mortuary behavior, age differentiation

Özet

Bu çalışma kuzeybatı Anadolu Kalkolitik dönem yerleşimlerinden Gülpınar da ortaya çıkarılan mezarların analizinden yola çıkarak Anadolu da bu dönemin ölü gömme davranışlarını değerlendirmeyi amaçlar. Orta Kalkolitik (evre III) Gülpınar yerleşiminde ortaya çıkarılan yedi adet iskelet ölülerin genelde yerleşimin kenarında veya çevre duvarının hemen dışında ya bir önceki Erken Kalkolitik dönemi temsil eden evre II yapılarının duvarları üzerinde ya da duvarlar arasındaki boşluklara bilinçli olarak gömüldüğüne tanıklık eder. Yerleşimin terk edilmiş veya terk

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Makale gönderim tarihi: 10.12.2020; Makale kabul tarihi: 26.01.2021

edilmekte olan alanlarının ölü gömme amaçlı olarak tercih edilmesi bir şekilde halkın yerel kimliklerini tanımlaması ve atalarıyla kurdukları bağların tanımladığı sosyal hafıza ile ilişkili görülebilir. Gülpınar'dan ele geçen mezarların sayısı sınırlı olsa da ele geçen ölü gömme ile ilgili veriler arkeolojik kayıtlarda pek sık rastlanmayan yetişkin erkekler ve kadınlar terkedilen veya terkedilmekte olan alanlara gömüldüğünü gösterebilir. Bununla birlikte, taban altı gömülerinde bebeklerin sıklığı ile az sayıdaki yetişkinler, erişkin bireylerin farklı yerlere gömüldüğünü desteklemektedir.

Anahtar Kelimeler: Kalkolitik, Anadolu, biyoarkeoloji, ölü gömme davranışı, yaşa göre farklılaşma

Introduction

There are various archeological sources regarding the perceptions of belief systems and the afterlife among past communities. Since the deceased were interred and located deliberately, burials constitute one of the most important data sources. Thus, the systematic assessment of data collected from various excavations enable archaeologists to draw inferences about burial customs in prehistoric settlements. An argument often put forward by archeologists and anthropologists regarding the burial customs in prehistoric populations is that the role and status of the individuals play an important part in burial practices, or that burials simply reflect social differences. According to Binford (1971) and Saxe (1970), the treatment of death is reflective of a person's social position, and mortuary analyses therefore reflect social structure, hierarchy and/or status. Hence, the differences and changes in burial customs do not necessarily reflect social change but may be interpreted as part of a wider social practice; the rituals and/or social transformations that constitute communities. It has previously been suggested that mortuary rituals can be regarded as a behavior chosen by actors having a broad perspective and specific beliefs as well as connecting to symbolic themes, rather than being directly reflective of social organizations (Binford 1971; Tainter 1978; Chapman et al. 1981; O'Shea 1984; Kuijt 1996). Variations in mortuary practices reflect the degree of interconnection within and between people on multiple social scales, such as the household, village, or region (Kuijt 2008).

The number of subfloor burials, which were very common during the PPNA and Early PPNB settlements in the Near East, decreased over time. Many of the Late Neolithic settlements do not have enough subfloor burials that would signify these as being representative of their population. This is especially true for the Chalcolithic period (see Erdal 2019a; Balossi-Restelli and Erdal 2019). The Chalcolithic period represents an important step in the cultural history of Anatolia, witnessing significant changes in most aspects of life and material culture. Each sub-region of Anatolia felt these socio-economic and cultural transformations to a different degree. These transformations included changes in settlement organization, developments in technology, the emergence of new pottery forms and styles, a rise in the degree of long-distance

exchange, and the steps taken towards a centralized society particularly towards the late stage of the Chalcolithic period. Assessing the behavioral patterns of the people of this period is one way to get a better picture of these changes and transformations during this crucial transitional period between the Neolithic and the Bronze Ages.

How communities in the Early, Middle and Late periods of the traditional tripartite division of the Chalcolithic period treated their dead has been one of the most curious questions in elucidating the mortuary behaviors adopted by communities in Anatolia. These questions involve many aspects. Where were the dead buried? Were there any social preferences in burying the dead in terms of gender and age? Were internments carried out inside or outside the settlements? What kind of health issues did the Chalcolithic inhabitants of settlements have? What occupations/activities were the deceased involved in during their lifetime? Was there continuity or change between the Chalcolithic and preceding Neolithic burial customs? This study undertakes to answer some of these questions by examining the burials during phase III at Gülpınar in the context of already accumulated mortuary data derived from archaeological excavations conducted in Anatolia.

Gülpınar and the Burial Context

The prehistoric site of Gülpınar, identified beneath the remains of the Greek and Roman Sanctuary of Apollo Smintheus (Smintheion), is located on the outskirts of the synonymous village in the southwestern corner of the Biga Peninsula (ancient Troad) in northwestern Anatolia (Figure 1). Three main occupational phases were identified at Gülpınar. The earliest occupation is phase I representing the Neolithic period. Following a hiatus, the subsequent settlement, phase II, dates to the Early Chalcolithic period and has radiocarbon dates ranging between 5320 and 4940 cal. BCE. The succeeding phase III, the focus of the burials in this study, represents the Middle Chalcolithic period in western Anatolian chronology and dates between 4930 and 4450/4300 BCE. The transitional Middle Chalcolithic period in western Anatolia was clearly an important stage, witnessing a change in most aspects of socio-economic life and cultural pattern, with an increase in population and settlement numbers, adoption of site-location strategies for settlements, developments in technology, and a rise in the degree of cultural interactions and long-distance exchange. Other than Gülpınar, traces of the Middle Chalcolithic cultural horizon have been best documented in the western Anatolian littoral at sites from the Çanakkale region to the northwest and the Antalya region to the southwest (e.g., Sağlamtimur and Ozan 2012; Blüm 2014; Çevik 2018; Derin and Caymaz 2018; Günel 2018; Tuncel and Şahoğlu 2018; Korkut et al. 2018).

Although excavations conducted at Gülpınar identified only seven burials, they are important because they help us to gain information regarding burials customs and the gradual

abandonment of the settlement. This work also assesses the architectural context of the burials and the treatment of the bodies. Three human skeletons were unearthed in Sector 3 (Figure 2), located to the north of the surrounding wall on the periphery of the settlement. In this sector, two of the three burials (Burial 1 and Burial 2) were found around or on the walls of structures representing phase II, while the third was identified inside the debris of phase III close to the surface (Burial 3). The skeletons found in burials 1 and 2 are quite well-preserved compared to Burial 3, which appears to have been disturbed during Roman occupation of the site. All three burials in Sector 3 were found with burial gifts that appear to have been intentionally placed to accompany the deceased. On the other hand, burials 4-7 were excavated in the northwestern part of Sector 1. These burials were all found in the vicinity of the buttressed wall that defines the cluster of buildings in Sector 1 from the north (Figure 3). Three of the burials (4, 6 and 7) were found outside the buttressed wall, while the remaining one (Burial 5) was laid directly on a wall perpendicular to the buttressed wall. The location of Sector 3 only 25 m north of Sector 1 indicates that the burying the dead started in the vicinity of the buttressed wall and extended northwards in the empty spaces and already abandoned buildings.

Basic Data on the Burials

The body in Burial 1, laid upon the walls of a preceding phase II structure, is positioned on its left side with knees pulled up and the hands resting in front of the body (see Table 1, Figure 4). The head of the deceased faces east, and the skeleton is fragmented. One of the distinct features of Burial 1 is that this old adult female was intentionally laid upon a floor formed of beach sand superimposing the stone foundation wall of a preceding phase II structure. Burial 1 contained a complete open-mouthed bowl placed in an upright position in front of the feet (Figure 5a). Besides this bowl, roughly 20 cm. in diameter, Burial 1 also contained objects such as a notched ground stone tool —perhaps a loom weight or fishnet sinker— placed in front of the knees, as well as several small stone beads, flint flakes, and a single piece of Melian obsidian blade found in front of the body.

The bones, represented just by pieces, indicate that the skeleton belongs to an adult female. No longitudinal measurements could be taken due to the badly preserved condition of the skeleton. However, the mental eminence of the mandible and dental remains are well preserved. No caries was observed among the 30 teeth. The maxillary left third molar and mandibular left canine were lost postmortem. According to Brothwell's grades, the attrition score was about 2 and 4+, which demonstrates that attrition was slight (Brothwell 1981). The most severe attrition was observed on the first molars. Small sized dental chippings were seen on both anterior and posterior dentitions. Slightly developed calculi accumulation was observed. These kinds of dental lesions are commonly seen among prehistoric populations. However, compared to

many populations, in which enamel hypoplasia is observed more prominently among anterior dentition, moderate and severe linear enamel hypoplasia was observed on the mandibular and maxillary premolars and molars (Figure 6).

The most intriguing lesion on this individual was observed on the maxillary anterior teeth. The right lateral incisor and central incisors have unusual dental grooves on the incisal edge and lingual surface. The grooves directed buccal to mesiolingual on the distal corner of the incisal edge of the upper lateral incisor were measured as 1.4 mm in width and 3 mm in length. Another groove directed mesiodistally on the lingual surface of the right central incisor and which was close to the cingulum was measured as 1.1 mm in width and 3 mm in length. The groove on the maxillary left central incisor developed on the distal corner of the incisal edge and continued in a distobuccal to mesiolingual direction. These grooves on the incisal edges and lingual surfaces of the maxillary anterior teeth may suggest actions with yarn or cord in textile production, or sinew processing, which might have been passed from one side to the other side of the mouth. This kind of non-alimentary usage of teeth for yarn and cord production is seen in some settlements in Anatolia (Erdal 2008) and in Neolithic settlements in the Marmara region (Alpaslan-Roodenberg 2008, 2011).

In contrast to Burial 1, the deceased in Burial 2 was laid on its right side with knees pulled up and the hands resting in front of the body directly on the virgin soil (Figure 7). The skeleton is almost complete but fragmented like the one in Burial 1. Burial 2 did not contain any gift other than a bowl, which was also placed in front of the feet (Figure 5b). The bowl was initially deposited standing upright but was subsequently slightly tilted when the deceased was covered with earth. The similarities between the bowls in burials 1 and 2 indicate that they represent contemporaneous burials. This is because there is ample evidence from this phase that such bowls that they were typical objects of this period. Radiocarbon analysis of a bone sample taken from the skeleton in Burial 2 provides us with a date to 4500-4455 BCE (Beta-405653). The dating of this skeleton is in accordance with the estimated date for the beginning of the gradual abandonment of the peripheries of the settlement and the remains belong to an old adult female. No pathological changes except severe osteoporosis could be observed on this individual. Burial 2 also contained a bowl with a tab handle roughly 20 cm. in diameter, like the one deposited in Burial 1.

Burial 3, unfortunately, is not preserved as completely as the other two burials found in Sector 3 (Figure 8). It could be deduced from examination of the bones that the deceased was laid on its right side with knees pulled up and the hands resting in front of the body in a position comparable to that of Burial 1. Despite being broken, a nearly complete bowl with uprising handles accompanied by a jug with one uprising handle was found over the chest of the skeleton (Figure 5c). The third pottery vessel included in this burial is a high-footed bowl found in a subsided

position near the feet. In addition, the base of a conical marble rhyton was also recorded near the head of the skeleton. A fragment of a bone taken from the skeleton was also subjected to a radiocarbon dating (Beta-405654). The 4315-4180 BCE date obtained for this bone sample, found during the final year of excavation in 2013, is the latest radiocarbon date to have been found at Gülpınar.

Table 1. Tabulation of human skeletons from phase III burials at Gülpınar.

Burial	Location	Sex*	Age*	Age Group	C-14 Dating (1σ)	Disease
1	Sector 3 Grid H12	Female	-	Old Adult	4500-4455 BCE (Beta-405653)	Dental grooves
2	Sector 3 Grid H12	Female	-	Old Adult	-	Severe osteoporosis
3	Sector 3 Grid H12	Male	-	Unknown Adult	4315-4180 BCE (Beta-405654)	Osteoporosis
4	Sector 1 Grid L11	Male	-	Unknown Adult	-	Slight osteoarthritis Non-specific infectious Treponemal disease
5	Sector 1 Grid L12	Male?	-	Unknown Adult	4675-4545 BCE (Beta-405655)	Fracture on a rib Lateral epicondylitis (Tennis elbow)
6	Sector 1 Grid L12	Male?	-	Unknown Adult	-	Infection on the distal end of tibia
7	Sector 1 Grid K11	Male	35-39 years old	Middle Adult	-	Dental notch, LSAMAT, dental caries, AMTL, tooth fracture, severe dental attrition

*Age and sex of the individuals were determined by standard data collection procedure (Buikstra and Ubelaker 1994).

The skeleton in Burial 3 belongs to an adult male whose age at death is unknown. Although the condition of the skeleton is not as good as the first two skeletons in this sector, fragmented post-cranial bones and a few cranial elements were analyzed. No caries were found on the teeth eight. Slightly developed attrition (from 2 to 4), hypoplasia and dental calculi were observed on the teeth.

Excavations conducted in Sector 1, located 20 m south of Sector 3, also yielded four primary burials and an additional twenty isolated bone remains. Among these, the human skeleton found in Burial 4 is possibly an adult male with unknown age at death. Only the lower

extremities were preserved. Severe subperiosteal new bone apposition was detected all around the diaphysis of the femora and the anterior and lateral surfaces of the tibia, and all around the fibulae. Moreover, infectious lesions were observed on the dorsal surface of the ilium, especially around the acetabulum on the right coxae. However, the infection on the tibia is more severe than on the other bones (Figure 9). Active periostitis is more severe around the muscular attachment areas. The external surface of the preserved long bones showed strong vascular impressions and raised plaques of new bone appeared to bridge over them, specifically in the most affected area of these bones. Postmortem fractured areas of bones show a stratified, or onion shaped structure which is commonly seen in treponemal diseases (Rothschild and Rothschild 1995; Rissech et al. 2013). However, it is not possible to diagnose the treponemal disease without other bones, especially skull and post-cranial bones.

The skeleton in Burial 5 was found next to the interior face of the buttressed wall. This skeleton, which belonged to a male individual, was laid directly upon the wall of a phase II structure. Radiocarbon analysis of a bone sample taken from this skeleton provided us with a date around 4675-4545 BCE (Beta-405655). The contemporaneity of Burial 5 revealed in Sector 1 with Burial 2 found in Sector 3 may indicate that both males and females were buried simultaneously in either already abandoned parts or areas gradually being abandoned in the peripheries of the settlement, indicating that both sexes received the same treatment during this period.

Excavated remains in Burial 5 consist of a fragmented left rib, right arm bones, and lower extremities. This skeleton belongs to an adult male individual. Only the epicondylitis (or tennis elbow) on the right lateral epicondyle and a healed fracture with slight distortion on the angulus costalis of a single preserved rib were observed. Tennis elbow, defined as enthesopathies on the lateral epicondyle, is accepted as an enthesis related to flexion, extension, and pronation of the forearm (Figure 10). The age of the individual could be the reason for the development of tennis elbow. This pathology as an occupational stress marker is important for the assessment of activity patterns in past populations (Spigelman et al. 2012). Studies on present day individuals show that repetitive or forceful tasks create the risk of epicondylitis (Marklin and Monroe 1998; Pascarelli and Hsu 2001). It is not possible to determine the reason behind this lesion on the individual however, as there is a close relation between epicondylitis and daily activities such as yarn and textile production, meat processing, woodcutting, shoemaking, and glassblowing (Werner et al. 2005; Spigelman et al. 2012), where workers undertake repetitious or vigorous tasks.

The skeleton excavated in Burial 6, which was found on the open space near a stone-built small platform to the north of the buttressed wall, consists of only the right femora, and both lower legs. An active infectious lesion was observed on the interosseal surface of the distal end of the left tibia.

The skeleton in Burial 7, also found just in front of the buttressed wall, consists of a cranium, jaws, teeth, and some bones of the lower extremities. Only a slight periosteal reaction on the proximal end of the right tibia was observed. However, some dental pathologies were detected. A mesiobuccal-distolingual directed notch measuring 3.7 mm in width was observed on the maxillary right canine (Figure 11). This unusual notch associated with non-alimentary purposes might be related to biting a hard substance such as wood as a pincer during basket processing (Hillson 1996; Anderson 2002), which is different from the skeleton found in Burial 1. Moreover, all maxillary anterior dentition from the right lateral incisor to the left canine have lingual surface attrition (LSAMAT) LSAMAT, as a specific type of attrition on the lingual surface of maxillary teeth, is related to sucking some foods (see Turner and Machado 1983; Irish and Turner 1987). Beside these, severe abrasions (grade 5) are present on the incisors. In contrast, attrition on the posterior dentition is slight and moderate (grades 3-4). The mandibular right first premolar was broken premortem and as periapical abscess developed in relation to this dental fracture (Figure 12).

While the other teeth have small and medium-sized chippings, a large enamel piece has flaked from the mandibular right second premolar which is a neighbor of the fractured tooth. Maxillary second premolars on the same side were also lost antemortem. In addition to these lesions, caries possibly related to dental trauma were observed on the maxillary right first molar. Slightly developed dental calculus, periodontal disease, and enamel hypoplasia on the anterior dentition can be counted as other dental pathologies of the skeleton in Burial 7.

Each of the seven skeletons found in the single primary burials at Gülpınar belong to adults. The two skeletons found in Burial 1 and Burial 2 in Sector 3 belong to females. The third skeleton found in Sector 3 and the four from Sector 1, on the other hand, belong to males. Additionally, 20 isolated bones scattered around the excavated area —fragments of four femora, one fibula, one tibia, one calcaneus, one radius, five phalanges, four cranial fragments, and three mandible fragments with nine teeth— also belong to male and female adults.

Discussion of Evidence

Bioarchaeological Data

It should be noted that these skeletal remains are insufficient to reconstruct and interpret the bioarchaeological aspects of the Middle Chalcolithic Gülpınar community due to their poor condition and incompleteness. However, dental remains suggest both male and females used their teeth, especially anterior teeth for non-alimentary purposes. Although the male has only a single tooth with a notch, one woman has three teeth with aberrant wear. Anthropological studies on dental remains among Anatolian prehistoric peoples suggest usage of the teeth as a third hand

was very frequent in the PPNA (Körtik Tepe) and PN (Hakemi Use and Bademağacı) groups, but it decreased with time and only a few individuals of the Late Chalcolithic and Early Bronze Age (Arslantepe, İkiztepe) have unusual abrasions (Erdal, under review). However, only women in these Late Neolithic and Chalcolithic people have grooves on their teeth and males have either LSAMAT or notches on their anterior teeth. This suggests an increased sex difference on tooth tool usage in Anatolia. Unusual abrasions in northwestern Anatolia are common and they are frequently found among females, reflecting gender-based labor differences (see Alpaslan-Roodenberg 2008, 2011; Erdal 2008, under review). They could use their anterior teeth during yarn production and to weave materials such as textiles, rugs, and mats. Epicondylitis also supports the yarn and textile production hypothesis (see also Spigelman et al. 2012). This was clearly the case at Chalcolithic Gülpınar. Although there is no actual evidence, such as a piece of woolen cloth or thread made of wool during the archaeological excavations of the Chalcolithic phases at Gülpınar, there is a wealth of indirect evidence regarding weaving activities at the site. Negative impressions observed on over a thousand pot bases from phases II and III at Gülpınar prove that weaving could have been a common domestic craft activity at the site alongside mat making and basketry. In addition, the large number of spindle whorls, pierced pot-sherd disks, stone weights, and bone implements recovered during excavations could also be associated with household weaving being carried out at the site (Takaoğlu and Özdemir 2018).

Other bone lesions such as osteoporosis and osteoarthritis are reflections of normal results of aging and metabolism (Ortner 2003). However, if the diagnosis is true, Gülpınar is the earliest case of treponematosis in the old world. However, the genetic makeup of the population and infectious diseases will be evaluated after aDNA examination of the bones at the HUMAN -G laboratory at Hacettepe University in Ankara.

Bioarchaeological results suggest limited information about daily life and biocultural adaptation of the population. However, even though the number of skeletons is limited, the burials give more detailed and invaluable information about the burial customs of the Chalcolithic people.

Mortuary Behavior

From Subfloors to Abandoned Peripheries

Available mortuary data from the Late Neolithic and Chalcolithic periods in Anatolia reveals a pattern of gradual transition from subfloors to the peripheries in the close vicinity of the settlements. Information about Late Neolithic burials comes mostly from subfloor burials. Compared to Early Neolithic sites, the number of subfloor burials is small and many of them

are represented by subadults, especially infants. For instance, all eleven subfloor burials from Salat Camii Yanı, one of the PN settlements in Anatolia, belong to infants except for one child (Miyake 2008, 2010). In burials at Hakemi Use, 57.9% out of 95 individuals (Erdal 2013), in Bademağacı, a Neolithic settlement in the Lakes Region, 60.4% of 44 individuals (Erdal 2009, 2019b), and 64.6% of the 48 individuals found in Ilıpınar (Alpaslan-Roodenberg 2008) belong to infants and children. Representation of subadults shares almost the same frequency as at Tell Sabi Abyad in northern Syria, which has a very similar cultural pattern to Hakemi Use in southeastern Turkey (Smits and Akkermans 2009; Akkermans 2008) and Tell Ain el-Kerkh in Syria (Hudson et al. 2003). In the first excavation season at Tell es-Sawwan, 13 adults, 71 subadults and 55 infants were found (Campbell 1995). It should be mentioned that almost all these human remains, except at Ilıpınar, represent subfloor/indoor burials.

Actual mortuary data also reveal that representation of subadult individuals unearthed beneath the houses in PN settlements, especially of individuals under the age of one, has more than doubled, reaching up to 60%. Moreover, almost all the remains, consisting over 200 individuals from the Late Neolithic and Early Chalcolithic levels of Köşk Höyük belong to infants (Öztan 2012; Erdal, personal communication, 2013; Özbek and Erdal 2006). Infant remains, mostly under aged less than one year, were excavated within settlements beneath the walls or floors. In Köşk Höyük, where some individuals were interred outside the houses under the eaves (Öztan 2012), only 6 individuals represent adults, and they are mostly females (Öztan 2012; Özbek 2009a, 2009b).

A similar age-based differentiation has also been attested in the Chalcolithic Anatolian sites. Of the 18 skeletons at Çavi Tarlası, recovered mostly from simple graves within the settlement only two are adults (von Wickede and Mısır 1986). At Değirmentepe, almost all the 32 human remains (96.9%) are subadults, ranging from fetuses to juveniles, in the Ubaid layers (Özbek 2001; Özbek and Erdal 2006). Of the 37 individuals from Arslantepe located near Değirmentepe, dating back to Late Uruk Period, 59.5% are perinatal and infants. Only 12 belong to adults, especially females (10 women). Bıçakçı et al. (2012) suggest that there is considerable variability in the Early Chalcolithic burial practices at Tepecik-Çiftlik; indoor inhumations are rare and are confined generally to newborn babies. These graves are simple pits in open areas. They (Bıçakçı et al. 2012) propose that burials encroaching upon common open areas were kept inside in the privacy of the households. At Bakla Tepe, representing the Late Chalcolithic of western Anatolia, no adult remains were retrieved (Erdal unpublished data; Erkanal and Özkan 1999). 26 individuals from Çamlıbel Tarlası Höyük (Late Chalcolithic) included 20 infants and children, and 14 of them were younger than six years old (Irvine 2011). (No adult individual was found in Late Chalcolithic layers at Çadır Höyük (Erdal 2019a).

All these data suggest that the Late Neolithic and Chalcolithic communities had different customs of burying their dead. There is a clear decrease in the number of indoor or subfloor burials, as well as an increased ratio of subadults to adults, and differences in the proportion of females to males. Some researchers explained these differences as due to increased subadult mortality in the Chalcolithic period in Anatolia, where subadults, especially infants, were buried in different areas, such as at Köşk Höyük (Öztan et al. 2009), Değirmentepe (Özbek 2001; Özbek and Erdal 2006), Bakla Tepe (Erkanal and Özkan 1999), Çavi Tarlası (von Wickede and Mısır 1986). This factor cannot be explained by morbidity or mortality because there are few or no adult individuals buried in these settlements.

The Case of Gülpınar

Although the number of skeletons is low at Gülpınar, available human remains suggest that individuals were mainly adults and the sex distribution of these burials is in accordance with the general pattern representing the late Neolithic periods in Anatolia. The phase III settlement at Gülpınar, which represents the Middle Chalcolithic period (4900-4300 BCE) in western Anatolian chronology, is one of those sites where we encounter mortuary evidence particularly in old habitation areas or on the periphery of the settlement, just beyond the surrounding wall (Takaoğlu and Özdemir 2018). The new data from Gülpınar may also be significant in establishing that the burying of adults in the former habitation or disused areas of the settlements was part of an abandonment ritual, a pattern that has not been frequently attested in the archaeological record. Furthermore, the burial of male adults at Gülpınar is in contrast with the general pattern in which mostly females and infants were buried inside or around the habitation areas.

The deliberate re-use of abandoned parts of settlements as a burial place is an issue that has been little investigated in the archaeological record of prehistoric Anatolia. Although the seven burials at Gülpınar alone cannot represent enough data to make explicit statements about this burial custom that is only sporadically attested in the archaeological record, the context of the available burials at the settlement allow us to offer some thought on the subject. The reason behind the use of old habitational areas as a burial place may have been symbolic in nature, resulting perhaps from a desire of settlers to associate themselves with the former population of the settlement and to establish an emotional connection to their predecessors.

There is somewhat-related archaeological evidence from the site of Aktopraklık in Early Chalcolithic northwestern Anatolia showing the use of abandoned settlements as a burial place. The settlement of Aktopraklık C was used as a burial place after settlers moved to Aktopraklık B

(Karul and Avcı 2011, 2; Lichter 2016, 79). However, mortuary evidence from Gülpınar shows that the Middle Chalcolithic inhabitants gradually began to use the abandoned buildings located at the fringe of their settlement, as well as open spaces outside the buttressed surrounding wall, as burial places towards the end of the phase III settlement.

In addition to Gülpınar and Aktopraklık, mortuary remains from Kumtepe A, Uğurlu III and Ege Gübre II also enhance our understanding of the mortuary behavior prevailing in the Chalcolithic of western Anatolia. At Kumtepe, two burials (R1 and R2) were found side by side in a shallow oval pit cut in the bedrock in Trench R of phase A1 and the third (U1) in a shallow with hollowed in the earth in Trench U in phase A2 (Sperling 1976, 311 and 326). Each of these burials preserved skeletons representing female adults buried in a contracted position, slightly on their right side. The area in which these burials R1 and R2 was just outside the settlement at Kumtepe (Sperling 1976, 311). These burials could be accepted as more-or-less contemporary with the ones from Gülpınar when one considers the close similarities between the material remains with which they are associated at both sites. In particular, the marble bowl placed under the chin of the deceased in Burial R1, perhaps as a burial gift, has nearly identical parallels with phase III of Gülpınar.

The burial pit containing 12 skeletons, identified in the courtyard of a communal building at Uğurlu on the island of Gökçeada (Imbros), is another case in the region. This burial pit dated to ca. 5300 BCE can be synchronized roughly with the beginning of the phase II settlement at Gülpınar. Throwing the dead purposely in a single pit rather than placing them more carefully is thought to be part of a local burial custom related to ceremonial sacrifice at Uğurlu (Boz and Erdoğu 2019, 5).

Excavations conducted at Ege Gübre in central western Anatolia, on the other hand, reveal significant evidence regarding the burial of dead outside the settlement. At Ege Gübre, the Chalcolithic burial from phase II at the site contains five skeletons of adults extending in a contracted position (M1-M2, M4-M6) and an additional new-born baby in a jar as the sixth burial (M3) (Yazıcı 2009, 55-57; Sağlamtimur and Ozan 2012, 228). The five adults were buried in shallow pits dug into the earth, some of which were lined with rubble on all sides. Among these five adults, one was reported to belong to a male of 30-35 years old (M4) and two represented females (M5-M6). The remaining two undefined skeletons, the sex of which was not reported, could have also belonged to female adults as the personal ornaments found with them indicate. The recovery of these burials among the remains of Neolithic occupational layers seems to indicate that the actual settlement was within a close vicinity and the deceased were deliberately buried here for some reason. Because we do not know whether there was an archaeological stratum attesting to continuity from the Neolithic to Chalcolithic period in the

other, unexcavated, parts of the site, we cannot explicitly state on whether the Chalcolithic inhabitants also incorporated the custom of burying their dead in formerly occupied parts of the settlement in their mortuary behavior.

At Gülpınar, burial grounds were used solely for adult individuals, a pattern that has already been attested at other Chalcolithic sites such as Aktopraklık (Alpaslan-Roodenberg 2011; Karul and Avcı 2013), as well as Ilıpınar (Alpaslan-Roodenberg 2008) and Pendik (Pasinli et al. 1994; Özdoğan 2013). Alpaslan-Roodenberg and Roodenberg (2020) have published 83 individuals from Aktopraklık and, only two of them belong to infants. Total subadults do not reach to 20%. Aktorpaklık Early Chalcolithic cemetery do not contained infants. At Barçın Höyük, a total of 72 indviduals were analazyed by Alpaslan-Roodenberg and Roodenberg (2020). A huge amount of subadults (29 individuals) were perinatal individuals. Infants were mostly buried under the floors of the houses, but adults were found in the courtyards of these structures. Roodenberg and Alpaslan- Roodenberg (2013, 75) explain "…Neolithic and Early Chalcolithic communities buried their dead in or near the village ground. This may be at the edge of the settlement, as was the case of Ilıpınar…, in built-up plots as shown at the basal layers of Menteşe, or in a separate area – a cemetery outside the village, as was demonstrated by Early Chalcolithic Aktopraklık."

The site of Gülpınar was apparently more-or-less part of this tradition, in which infants and some adult females were buried inside the living structures, while other adults were either buried in extramural cemeteries not far from the settlements, buried in courtyards, or buried in the ruins of the abandoned buildings of a settlement. However, the houses related the adult individual burials were not excavated, and no infant burials were found with adults.

Although only a few of the human skeletons in these burials were found complete at Gülpınar, the state of the preserved bones shows that the main custom was to bury the deceased in a contracted position. The position of the legs and remaining parts of the arms show that the deceased was deliberately placed in a contracted position, as indicated by the well-preserved skeletons in burials 1, 2 and 5. Poor preservation of the skeletons in burials 3, 4, 6 and 7 was apparently due to activities carried out in the Roman period in this part of the settlement. As a result, the skeletons in burials 4-7 contained no identifiable burial gifts due to their deficient state of preservation.

The placement of pottery vessels near the feet of the skeletons in burials 1 and 2, as well as two on the chest of a skeleton in Burial 3 may have been either a sign of certain belief in the afterlife or a reflection of the ritualized funerary meal. Those pottery vessels uncovered intact in burials 1 and 2 containing female adults at first glance leads one to assume that this behavior was gender oriented. Nevertheless, the three pottery vessels uncovered in association with a male adult in Burial 3 shows that there was no distinction between genders in the deliberate placement of

pottery vessels in burials. The only difference is that in Burial 3, a large bowl with uprising handles and a jug with uprising handle was found in a position covering the chest of the skeleton, in addition to a high-footed bowl found in a subsided state near the feet. No sign was found of the intentional smashing of pots in burials being practiced at Gülpınar. Although the deliberate deposition of objects in specific parts of the burials by the mourners was part of a funerary ritual (Pearson 1999, 54) it is not easy to give a meaning to the deposition of the bowls near the feet of the deceased at Gülpınar.

The pottery in burials in Gülpınar burials do not appear to be objects that could specifically be built to accompany the deceased, but rather were mundane objects associated with daily activities which were found in great quantities in the residential units throughout the site. It can be presumed in this sense that the pottery vessels of utilitarian character were used for the last time during the funerary rituals and subsequently placed in specific parts of the burials by the mourners.

Previously, it was argued elsewhere that funerary rituals at Gülpınar may have involved figural pottery vessels with anthropomorphic representations that may have depicted mourning individuals (Takaoğlu 2006, 306; Takaoğlu and Nanoglou, in press). There are two examples of such figural vessel fragments at Gülpınar, one represented by a human protome and the other by a handle in the form of a human head. Both vessels have incised vertical stripes on their cheeks of the faces, indicating tears or scratches. Additional six human protomes from other figural pottery vessels were also at Gülpınar. The common feature of these total of eight figural pottery vessels is that mouths were not marked for a symbolic reason. Although these pieces were not found in relation to a mortuary context to confirm their use in funerary rituals, such figural vessels may be viewed as objects of funerary rituals.

In contrast to the three burials unearthed in Sector 3, no finds that could be designated as burial offerings, possessions of the deceased during life, objects that would serve the dead in the hereafter, or items of funerary rituals were found in burials 4-7 in Sector 1, due in part to their state of preservation.

Gülpınar is also a place where the change observed in the mortuary behavioral pattern involving the location of burial places in relation to the settlements in Chalcolithic Anatolia can be observed. The emerging new pattern here is centered to a great extent on the custom of burying the dead just outside the settlement, using either abandoned parts of the dwellings or areas that are falling out of use on the peripheries. At Gülpınar, this custom shows no variability between genders, as both male and female adults receive the same treatment. It is, however, difficult to state that all the dead were subjected to similar treatment during this period, since the burials discovered so far represent only a small part of the actual population size. It is reasonable to assume from the context of few burials with finds that burying the dead among abandoned

dwellings or areas gradually falling out of use on the peripheries of the settlement may have been an activity practiced at a family or individual level, and not necessarily involved a large social group or the entire community.

Both ethnographic and archaeological record indicates that mortuary rituals were places in which dead are mourned, social memories are created, and local identities and group memberships are claimed (Cannon 1989; Chesson 2001). A study conducted on the various aspects of the mortuary customs of the Andean communities represents a special case showing how the commemoration of the dead in funerary rituals help to establish links between the living and the dead in physical monuments and memories associated with the individuals (Dillehay 1993). Available mortuary evidence from Anatolia demonstrates that the intertwining of the living with the dead was also the case in the funerary rituals taking places in parts of the settlements that presents the memories of the past. It is possible that, in Anatolia, certain adults were specially chosen for this mortuary behavior.

Conclusions

The contribution of the mortuary data from Middle Chalcolithic Gülpınar is twofold. Firstly, the location of the burials either in already-abandoned habitational areas or architectural spaces that gradually fell out of use on the periphery of the settlement or just beyond the surrounding wall delineating the core of the settlement from its immediate surroundings is a phenomenon that is not often visible in the archaeological record. This deliberate use of domestic spaces holding memories of the past as burial places was probably a gesture of remembrance associated with social memory, in which the settlers defined their group identity and linked them with their ancestors and the past. By doing so, the Middle Chalcolithic inhabitants of Gülpınar may have placed themselves under the protection of the former occupants of the settlement. Although one needs to be cautious in formulating hypotheses about the engagement of past populations with their forebears, information derived from the mortuary data often provides insights on this matter. Abandoned areas or areas gradually falling out of use in terms of the history of the settlement at Gülpınar could be viewed as places where the worlds of the living and the dead interacted.

Secondly, the analysis of available mortuary data from Gülpınar allows us to conjecture that there may have not been a major distinction in the treatment of both male and female adults in the Chalcolithic period but was an important differentiation with respect to the age-at-death of the individuals. Infants and small children were buried in the housing area as subfloor burials, while adults, especially males, were buried in the ruins of abandoned areas, courtyards and/or extramural cemeteries during this period in Anatolia.

Acknowledgements

We would like to thank Prof. Coşkun Özgünel, former director of the Gülpınar (Smintheion) excavations for allowing us to study the mortuary remains from the prehistoric excavations. Dr. Meliha Melis Koruyucu and Demet Delibaş also deserve special thanks for their contributions to this work during the stage of the bioarchaeological analyses of the skeletal remains, undertaken at the at the Husbio_L Laboratory at the Department of Anthropology, Hacettepe University in Ankara. We are also thankful to two anonymous referees who reviewed this work and provided us with constructive comments. We are responsible for all the errors that may be found in this work.

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Figure 1. Map locating Gülpınar and other major sites with Chalcolithic finds on the coastal Troad and the adjacent island of Gökçeada (Imbros).

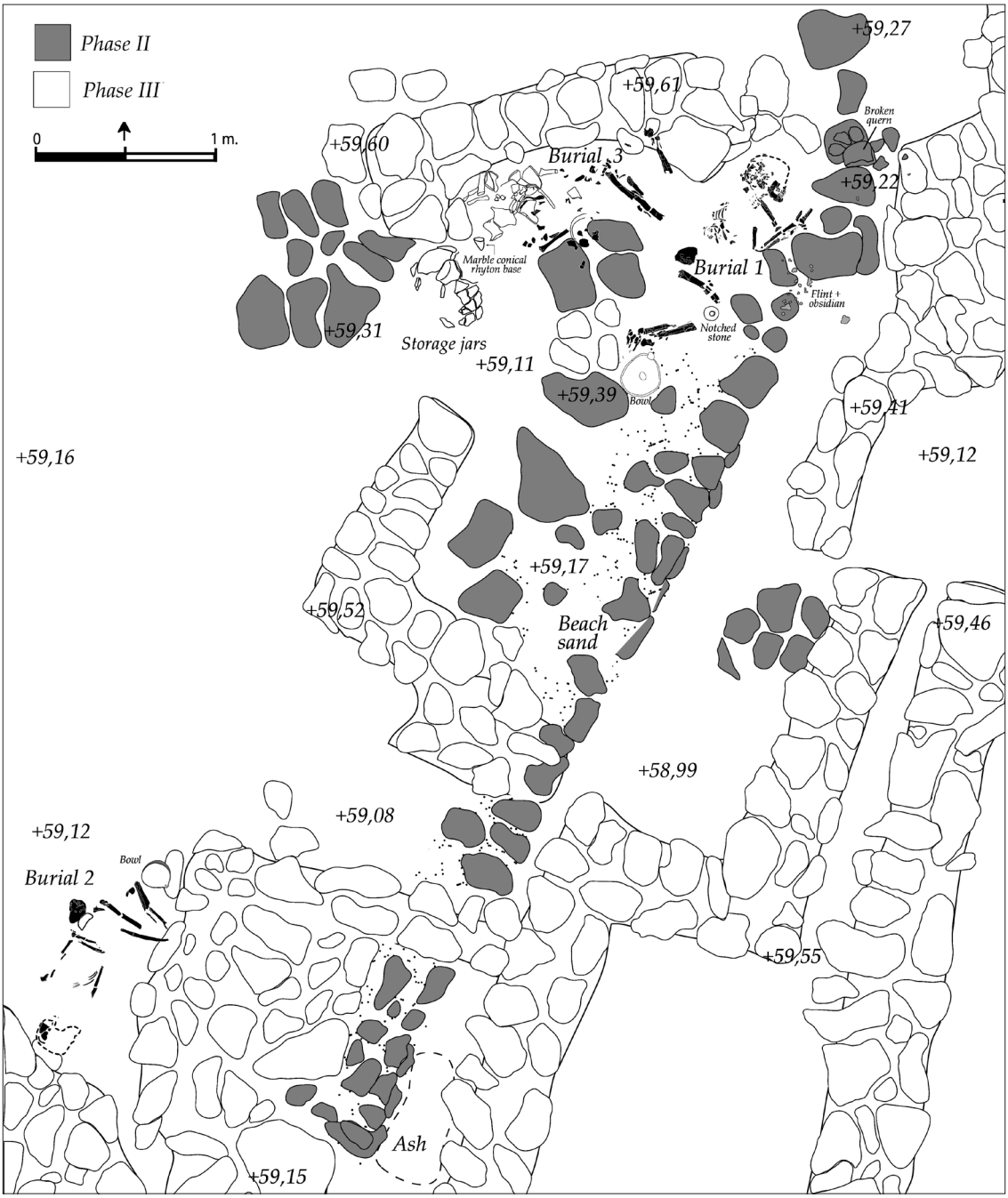

Figure 2. Plan of western part of Sector 3 locating burials 1-3.

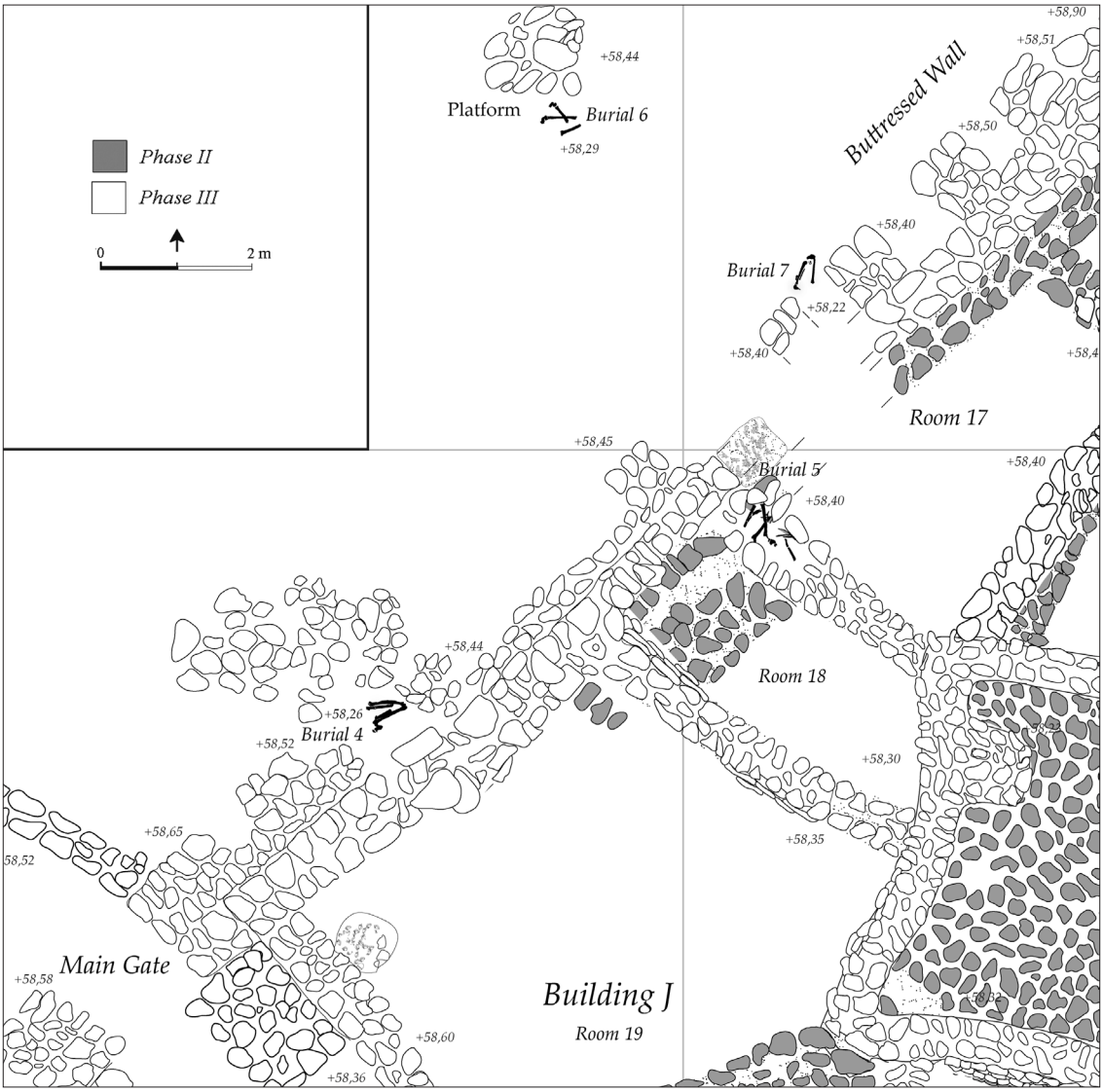

Figure 3. Plan of northwestern corner of Sector 3 showing the location of burials 4-7.

Figure 4. Burial 1 with a female body laid in a contracted position in Sector 3. Note the complete bowl placed in front of feet as offering.

Figure 5. Pottery vessels found near the feet (a-b) or on the chest (c-d) of the skeletons in burials 1-3 in Sector 3 at Gülpınar.
a) Burial 1, b) Burial 2, c-d) Burial 3.

Figure 6. Enamel hypoplasias on premolar and molar teeth of the skeleton in Burial 1.

Figure 7. Burial 2 with a female body laid in contracted position in Sector 3. Note complete bowl with tab handle placed in front of feet as offering.

Figure 8. Topmost layer of Burial 3 in Sector 3 during excavation after nearly complete pots were removed.

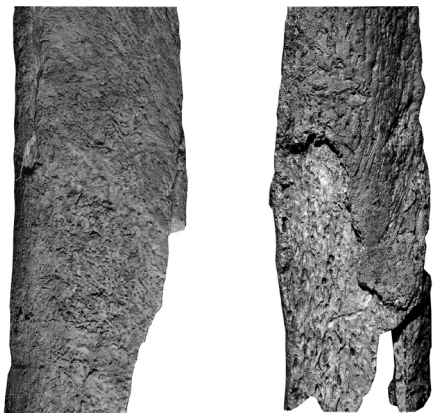

Figure 9. Infectious diseases on tibias of skeleton in Burial 4.

Figure 10. Epycondylitis of the lateral condyle of humerus on the skeleton in Burial 5.

Figure 11. Dental grooves obb the maxillary right canine of the skeleton in Burial 7.

Figure 12. Severe attrition, dental fracture, and periapical abscess of the skeleton in Burial 7.

Yüzey Araştırmalarında Disiplinlerarası Bir Çalışma: Tavşanlı Höyük

Erkan Fidan[a]

Özet

2017 yılında başlayan "Eskişehir ve Kütahya İlleri Tarih Öncesi Dönem Yüzey Araştırması (EKAR)" nın ana hedefi, modern teknikleri kullanarak, bölgedeki tarihöncesi dönemlere ilişkin sorunları ele almak ve büyük yerleşmeler üzerinde yapılan geniş kapsamlı çalışmalarla kronolojik boşlukları doldurmaktır. Bu bağlamda yüzey araştırmalarındaki arkeolojik yöntemlere ek olarak uygulanan jeoarkeolojik ve jeofizik yöntemler sayesinde çalışmalar daha kapsamlı bir şekilde yürütülmüştür. Bu makalede, Kütahya il sınırları içerisinde yer alan Tavşanlı Höyük'te disiplinler arası yürütülen çalışmaların sonuçları tartışılmaktadır. Tavşanlı Höyük'te jeoarkeolojik çalışmalar kapsamında yapılan sondajlardan elde edilen sediman özellikleri ve mutlak tarihleme verileri ile yer radarı verilerinin karşılaştırılması neticesinde ortaya çıkan sonuçların, arkeolojik verilerden farklı sonuçlar ortaya koyması, yüzey araştırmalarında kullanılan geleneksel yöntemlerin güvenilirliğini tartışmaya açmaktadır.

Anahtar Kelimeler: Tavşanlı Höyük, yüzey araştırması, arkeometri, jeoarkeoloji, jeofizik

Abstract

The "Prehistoric Survey of Eskişehir and Kütahya Provinces (EKAR)" Project started in 2017, aiming to conduct comprehensive research with modern techniques on large settlements that can produce new information to bridge some chronological gaps in the prehistory of the region. The project employs archaeological, geoarchaeological, and geophysical survey methods with an interdisciplinary approach. This article focuses on the results from the interdisciplinary research at Tavşanlı Höyük, carried out within the framework of the EKAR Project in the Kütahya province in Central Northwest Anatolia. The data obtained by the geoarchaeological studies, as well as absolute dating results and the georadar dataset, yielded contrasting results to the archaeological data; thus, this article further debates the reliability of conventional methods used during surface surveys.

Keywords: Tavşanlı Höyük, survey, archaeometry, geoarchaeology, geophysics

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Makale gönderim tarihi: 9.12.2020; Makale kabul tarihi: 22.01.2021

Giriş

2017 yılında başlayan "Eskişehir ve Kütahya Tarih Öncesi Dönem Yüzey Araştırması —kısa adıyla EKAR— kapsamında, bölgedeki Tunç Çağı höyüklerine odaklanılmıştır. Burada amaç, MÖ 3. binyıl sonu ile MÖ 2. binyıl başına tarihlenen ve boyut olarak büyük olan höyüklerde *yüzey araştırmaları* yaparak, höyükleri ve höyüklerin çevresel özelliklerini daha detaylı bir şekilde ortaya çıkarmaktır. Bu doğrultuda konu ile ilgilenen bilim insanlarına bir bilgi paketinin bırakılması hedeflenmektedir. *Intensive survey* olarak tanımlanan, Türkçe'ye intensif ya da yoğun/yoğunlaştırılmış yüzey araştırması olarak çevirebileceğimiz yöntemle yapılan arkeolojik araştırmalarda höyükler bir bütün olarak incelenmez; birimlere bölünerek, her birim kendi içinde değerlendirilir ve böylelikle höyük üzerindeki malzemenin dönemlere göre dağılımı belirlenmeye çalışılır (Koparal 2018). Sistematik yüzey araştırması olarak da tanımlanan (Renfrew ve Bahn 2017) bu yöntemin çeşitlemeleri ülkemizde ilk kez 1960'lı yılların sonunda Keban Projesi kapsamında kullanılmaya başlanmıştır (Whallon 1979). Ancak bilindiği gibi tarihöncesi dönemlerde yerleşmeler büyük oranda su kaynaklarının yakınlarındaki verimli alanlarda kurulmuştur. Günümüzde bazı su kaynakları kurumuş olsa da söz konusu yerleşmelere ev sahipliği yapan höyükler hala çoğunlukla verimli tarım alanlarında yer almaktadır. Höyükler, ilgili mevzuatlar kapsamında sit alanı olarak ilan edilip korumaya alınmış olsalar bile, bu alanlarda binlerce yıldır tarım yapılmış olduğu, yerleşmelerin üzerinin sürekli sürüldüğü unutulmamalıdır. Bu durum yüzeydeki arkeolojik malzemenin devamlı olarak alan içinde yer değiştirdiği anlamına gelmektedir. Sadece bu çıkarım bile yüzey araştırmalarında geleneksel arkeolojik yöntemlerle ortaya çıkan sonuçların güvenirliğini sorgulamamıza neden olmaktadır. Bu sebeple, söz konusu yöntemlerle elde edilen sonuçların farklı disiplinli yaklaşımlarla da desteklenmesi gerekir. Bu düşünceden yola çıkarak EKAR projesi kapsamında hem Tavşanlı Höyük hem de Hacıkebir Höyük'te geleneksel arkeolojik yöntemlerle birlikte arkeometrik araştırmalar da yapılmıştır. Bu makale, daha detaylı çalışmaların yapıldığı Tavşanlı Höyük'te yapılan disiplinler arası çalışmaların yüzey araştırmasındaki rolünü konu almaktadır.

Yöntem ve Uygulama

Tavşanlı Höyük, adını aldığı ilçe merkezinin 1.5 km güneyinde yer alan bir Tunç Çağı Höyüğü'dür (Şekil 1). 1930'larda K. Bittel, 1940'larda T. Özgüç ve ardından J. Mellaart burada araştırma yapmış, ilk sistemli çalışmalar ise 1980'li yılların sonunda T. Efe tarafından gerçekleştirilmiştir (Bittel 1939; Özgüç 1944; Özgüç 1946; Efe 1990). EKAR projesi ile birlikte arkeolojik araştırmalar yanında yer radarı çalışmaları ve jeoarkeolojik araştırmalar da ön plana çıkmıştır. Ayrıca jeoarkeolojik delgi sondajlarından elde edilen yanmış odun parçaları sayesinde mutlak tarihlendirme yapılmıştır.

Arkeolojik Araştırmalar: Tavşanlı Höyük'te daha önce yapılan araştırmalar ve belirlenen sit alanı gözetilerek, 450 x 450 metre bir alanda höyük ve çevresi, 50 x 50 metrelik karelere bölünmüş, burada büyük çoğunluğunu çanak çömleklerin oluşturduğu arkeolojik malzeme toplam 81 kare içerisinden toplanmıştır (Şekil 2, Şekil 6). Bu karelerin dışında çanak çömlek parçalarının devam ettiği anlaşılınca, karelerin batısına 82, güneyine 83, doğusuna 84 ve kuzeyine ise 85 numaraları verilerek daha geniş bir alanda çalışılmıştır. Ayrıca az sayıda, taş, kemik ve pişmiş topraktan malzeme de açığa çıkartılmıştır.

İstatistik: Oluşturulan her karede 11-12 kişi, 30 dakika boyunca belirli bir düzen içerisinde yürümüş, görülen her malzeme toplanmış ve incelenerek istatistiği yapılmıştır (Şekil 3). İstatistiksel çalışmalarda, yüzeyden toplanan yaklaşık 11.500 parça çanak çömlek değerlendirilerek, bunlar içerisinde dönemlere göre belirgin özellikler gösteren yaklaşık 2000 parça çanak çömlek kullanılmıştır (Fidan vd. 2019; Fidan vd. 2020).

Jeoarkeolojik Araştırmalar ve Mutlak Tarihleme: Tavşanlı Höyük'ün çevresindeki jeoarkeolojik çalışmaların amacı höyüğün kuruluş yerinin seçiminde rol oynayan faktörleri ve höyük çevresinde zaman içerisinde meydana gelen çevresel değişimleri ortaya koymaktır (Fidan vd. baskıda). İlgili mevzuatlar kapsamında delgi sondajlar, höyük çevresinde sit alanının dışında gerçekleştirilmiştir. Bu doğrultuda, höyüğün hemen doğusunda akmakta olan Orhaneli Çayı'nın alüvyal dolgularından höyüğe doğru uzanan bir hat boyunca ve höyüğün batısında, 50şer metre aralıklarla altı adet delgi sondaj yapılmıştır (Şekil 2). Burada ana amaç, doğudaki dört sondajla (1, 2, 3 ve 5 numaralı) höyük ile akarsu arasında yaklaşık 150 metrelik bir kesit oluşturmak, höyüğün batısındaki iki sondajla (7 ve 8 numaralı) ise söz konusu kesitin batıdaki devamını görmek olmuştur. Ayrıca kültür dolgusunun sınırını anlamak için kuzeyde ve güneyde iki sondaj daha mevcuttur (4 ve 6 numaralı). Söz konusu sondajlarda en fazla 8 metre derine inilmiş olmasına rağmen höyüğün oturduğu zemine veya ana kayaya ulaşılamamıştır.

Delgi sondajlar, Bilecik Şeyh Edebali Üniversitesi Coğrafya Bölümü'nden Dr. Levent Uncu ve Araştırma Görevlisi Ebubekir Karakoca tarafından *Atlas Copco* marka (Cobra Pro Mk1-M20) elle çalıştırılan bir sondaj makinesiyle gerçekleştirilmiş olup, 6 cm çapında ve 1.10 metre uzunluğunda yarı açık uçlu borular yardımıyla alüvyal dolgulardan sediman örnekleri alınmıştır (Şekil 4). Bu sedimanların tane boyu ve renk gibi fiziksel özelliklerine göre şekillenen her ayrı birimden analizler için örnekler alınmıştır. Boruda bulunan yanmış odun parçaları gibi organik kalıntılar ise yaş tayini analizleri için ayrıca paketlenmiştir. Ayrıca höyüğün batı yamacında tarım faaliyetleri esnasında kullanılan pulluğun derin girmesinden kaynaklanan tahribatta gözlemlenen yangın tabakasından da alınan iki örnekle birlikte toplam 15 örnek, C^{14} yöntemiyle TÜBİTAK MAM laboratuvarlarında analiz edilmiştir.

Yer radarı (Jeoradar/GPR) Araştırmaları: Tavşanlı Höyük'te yapılan çalışma için Geoanaliz Yerbilimleri tarafından, jeofizik mühendisi Ortaç Alkan, İsveç yapımı *Geoscanners AB* marka

Akula 9000B Sistem, 300MHz anten ve GC-1 Cart, yer radarı (GPR) kullanmıştır (Şekil 5). Yer radarı, yüksek frekanslı elektromanyetik dalgaların yeraltına gönderilmesi ve yeraltındaki herhangi bir yüzey veya nesneyle karşılaştığında yansıyarak veya kırılarak geri gelen bu dalgaların kayıtçıda kaydedilmesi ile çalışan bir jeofizik yöntemidir. Arazide yapılan ölçümler radagram adı verilen kayıtlar şeklinde kaydedilir. Söz konusu radagramlar özel veri işlem programında işlenmekte ve yorumlanmaktadır. Yer radarı çalışmaları höyük üzerindeki 1.5 hektarlık bir alan ile höyüğün doğusunda jeoarkeolojik sondajların da yapıldığı 100 x 50 metrelik (0.5 hektar) bir alanda gerçekleştirilmiştir. Yer radarı çalışmaları ile yüzeyden 5 metre derinlik hedeflenmiştir ve her 0.25 metre için derinlik haritaları oluşturulmuştur.

Ulaşılan Veriler

Yüzey araştırmalarıyla Tunç Çağı malzemesinin en azından 650 x 680 metrelik bir alana yayıldığı anlaşılmaktadır. Bu duruma göre, yaklaşık 44 hektarlık bir yerleşme söz konusudur. Arkeolojik yöntemlerin sonuçları tek başına değerlendirildiğinde, yüzey araştırmasında İlk Tunç Çağı (İTÇ), Orta Tunç Çağı (OTÇ) ve Son Tunç Çağı'na (STÇ) ait çanak çömlek parçaları gözlemlenmiştir. Ayrıca höyük üzerinde az da olsa Demir Çağı'na ait olabilecek çanak çömlekler ile höyüğün güneydoğusunda yayılımın en dış kesiminde Klasik Dönemlere ait çanak çömlek parçaları tespit edilmiştir (Şekil 6).

Höyüğün özellikle kuzey ve kuzeybatısında yoğunluk gösteren ve arkeolojik yüzey taraması yapılan diğer alanlarda neredeyse hiç karşılaşılmayan İTÇ çanak çömleğinde özellikle kase ve çömlek formları baskındır. En yoğun malzeme grubunu OTÇ'ye geçiş dönemi ve OTÇ çanak çömleği oluşturur. Söz konusu dönem malzemesi höyüğün yamaçları dışında, özellikle doğu kesimde baskın gibi görünmektedir. Bu alanlarda, OTÇ'ye geçiş dönemine ait olduğunu düşündüğümüz yaygın olan boncuk dudaklı (*bead-rim*) kase formları ve OTÇ'ye doğru gelindiğinde ise yassılaşan dudaklı kase formları görülmektedir. OTÇ çanak çömleğinin doğu kesimdeki düzlükte bu kadar yaygın olması sebebiyle daha önce yapılan araştırmalar (Efe 1990) yanında gerçekleştirdiğimiz çalışmalar höyüğün doğusundaki söz konusu geniş alanın MÖ 2. binyılın aşağı yerleşmesi olduğu varsayımını doğrulamıştır. Höyüğün tepesinde ise çok az miktarda gözlemlenen Demir Çağı çanak çömleği dışında tüm malzeme STÇ'ye aittir. Malzeme içerisinde STÇ'ye ait tabak, yonca ağızlı testi ve dışa çekik dudaklı büyük küp formları yer almaktadır (Fidan vd. 2020).

Delgi sondajlardan elde edilen sedimantolojik verilere göre, Orhaneli Çayı'nın hemen yakınında yaptığımız en doğudaki ilk sondajda (TVŞ 1), yüzeydeki pulluk katının altında, yaklaşık 1 metrelik sarımsı renkteki dolgudan sonra bütünüyle taşkın ovası sedimanları görülmüştür. Bu birimin içerisinde tespit edilen, keramik, kerpiç ve yanmış odun kömürü parçaları höyüğe ait kültürel malzemelerin doğudaki Orhaneli Çayı'na kadar devam ettiğini göstermektedir. TVŞ 2

no'lu delgi sondaj ise TVŞ 1 no'lu sondajın 50 metre batısında, Orhaneli Çayı ile höyüğün ortasında yapılmıştır. Bu sondajda da yüzeydeki pulluk toprağının altında sarımsı-açık kahverengi silt çamurları bulunmaktadır. İlk 1 metreden sonra yüzeyden yaklaşık 3.5 metre altta kalın bir yangın tabakasıyla karşılaşılmıştır. Yanık tabakasının altında ise hem sedimanların rengi zeytuni griye dönüşmekte hem de arkeolojik malzemeler belirgin bir şekilde azalma göstermektedir. 7.5 metre derinliğe kadar devam eden bu birim, gerek tane boyu ve rengi gerekse içerdiği yoğun bitki kalıntıları nedeniyle bir ard bataklık-göl ortamında biriktirilmiş olmalıdır. Yaklaşık 7.5 metreden sonra ulaşılan yanmış keramik parçası ise bu dönem sırasında çevrede insanın varlığına işaret etmektedir. Höyüğe daha yakın biçimde daha batıda yapılan TVŞ 3 no'lu sondajda üstteki boşluktan sonra yaklaşık 3 metreden sonra yanık tabakalarda belirgin bir artış olmaktadır. Sondajın daha derin kısmında ise kumtaşlarından oluşan kalın bir antropojenik dolgu tabakası bulunmaktadır. 50 metre daha batıda höyüğün hemen kenarındaki düzlükte yapılan TVŞ 5 sondajı ve höyüğün hemen batısında yapılan TVŞ 8 delgi sondajı da diğer sondajlarla uyumlu sedimantolojik özellikler göstermiştir. Söz konusu delgi sondajlardan yaş tayini analizleri için örnek toplanmıştır. C^{14} sonuçları sayesinde höyük bir yüzey araştırması kapsamında mutlak olarak tarihlendirilebilmiştir. Jeoarkeolojik sondajların da yapıldığı höyüğün kuzeydoğusundaki düzlükte ise sondajların sediman özelliklerine uygun bir biçimde en altta belirli bir boşluktan sonra çeşitli seviyelerde, cadde ve sokakların ayırdığı ev gruplarına ilişkin veriler vardır.

Verilerin Değerlendirilmesi

Tavşanlı Höyük'te geleneksel arkeolojik yöntemlerle elde edilen sonuçların yanında özellikle jeoarkeolojik sondajlar, C^{14} tarihlemeleri ve yer radarı çalışmalarından elde edilen veriler birbirleriyle ilişkilendirilerek değerlendirilmiştir (Şekil 7). Bu şekilde arkeolojik temelli yöntemlerle elde edilen verilerin ötesinde yeni sonuçlara ulaşılmıştır. Çalışmalarla, akarsuya en yakın alanda, yüzeyden yaklaşık 7.5 metre derinlikte MÖ 6000 yıllarına uzanan Geç Neolitik Dönem'e ait bir yerleşmenin varlığı yaş tayini analizleri sayesinde saptanmıştır. Ayrıca C^{14} tarihleriyle, İTÇ'nin bütün evreleri de tespit edilmiştir. Bunun yanında, höyüğün sürülen batı yamacında, yüzeyin hemen altında tespit edilen yanmış tabakadan alınan ahşap parçalarının mutlak tarihlemesi de MÖ 2. binyıl tabakalarının başlangıç seviyesi hakkında bilgiler vermiştir. Bu şekliyle 20 metrenin üzerindeki arkeolojik dolgunun yaklaşık olarak 10'ar metrelik kalınlıkları, MÖ 3. binyıl ve MÖ 2. binyıl tabakalarına aittir.

Bu verileri daha ayrıntılı olarak değerlendirdiğimizde Tavşanlı Höyük'te akarsuya yakın kesimde yapılan delgi sondajlar, yerleşmenin ilk kurulduğu dönemde hemen yakınında bir bataklık-göl ortamının bulunduğunu ve Neolitik yerleşmenin bu su ortamının yakınında kurulduğunu göstermiştir. Yüzeyden yaklaşık 7.5 metre derinlikte elde edilen tarihler MÖ 6074-5988 arasını vermektedir. Bu kesimde Neolitik yerleşmeyi örten bataklık alanının ancak MÖ 3. binyılın

başlarında (İTÇ I) doldurulmaya çalışıldığı anlaşılmıştır. Zira bu tabakalarda kumtaşı parçalarından oluşan kalın bir antropojenik dolgu tabakası tespit edilmiştir. İki farklı delgi sondajla bu tabakalardan alınan beş yanmış ahşap parçasından elde edilen tarihler MÖ 3100 ile 2700 arasını göstermektedir. Arkeolojik buluntunun çok az olduğu bu bataklık-göl ortamı içerisinde gözlemlenen yanık tabakaları su kıyısındaki sazlıkların yanması sonucunda yani doğal yollarla oluşmuş olmalıdır. Bu seviyelerdeki yer radarı verilerinden mimariye ilişkin herhangi bir bulgu söz konusu değildir. Bugünkü yüzeyin 3.5-4 metre altından itibaren ise bu ard bataklık-göl ortamı yerini çok sayıda arkeolojik malzeme ve en az üç yanık tabaka içeren bir kültür tabakasına bırakmıştır. Bu durum, İTÇ I'deki bataklığı kurutma çalışmalarının başarılı olduğu ve İTÇ II ile birlikte höyüğün bulunduğu alanda yoğun bir yerleşimin başladığını kanıtlamaktadır. Taşkın ovası sedimanları içerisinde bulunan çok sayıda arkeolojik malzeme de buna işarettir. Bu tabakalardan üç farklı delgi sondajdan alınan altı yanmış odun parçasının yaş tayini analiz sonuçları MÖ 2700-2400 arasını vermiştir. Ayrıca bu seviyelerdeki yer radarı verileri söz konusu alanda yerleşime ait izler taşımaktadır. Bu seviyenin hemen üzerinde yine yanmış odun parçalarından elde edilen C^{14} tarihleriyle MÖ 2500-2400 arasına tarihlenen kalın bir yangın tabakası tespit edilmiştir. Bunun üzerinde ise yüzeye kadar olan yaklaşık 1.5 metrelik dolgunun sediman özellikleri oldukça steril bir dolguyla karşı karşıya olduğumuzu göstermektedir. Yer radarı verilerinden de bu alanda mimariye ilişkin bir bulgu olmadığı anlaşılmaktadır (Şekil 7). Ancak yüzey araştırmalarında bu kesim üzerinden toplanan çanak çömleğin %80'den fazlası MÖ 2. binyıla aittir. Arkeometrik yöntemlerle elde edilen veriler neticesinde yerleşilmediği düşünülen bu alan üzerindeki yoğun MÖ 2. binyıl çanak çömleğinin höyüğün eteklerinden akmış olduğu ve alanın tamamını kapladığı düşünülmektedir.

Höyüğe doğru kalınlaşan arkeolojik dolgunun tespiti için yapılan TVŞ 5 delgi sondajında da TVŞ 2 sondajı gibi altı adet C^{14} tarihi vardır. Höyüğün doğusunda aynı hat üzerinde birbirleri arasında 100 metre mesafe bulunan iki delgi sondajdan elde edilen veri bu sonucu doğrulamaktadır. Hatta höyüğe yakın olan delgi sondajın en üst bölümünden, diğer sondajdan elde edemediğimiz İTÇ III'e ait sonuçlara da ulaşılmıştır. Böylelikle burada delgi sondajın üst kısmındaki yangın tabakasından elde edilen MÖ 2298-2135 tarihi ile höyüğün doğu yamacında pulluk tarafından tahrip edilen yangın tabakasından alınan iki örnekten gelen MÖ 2300-2000 tarihleri sayesinde, bölge için çok önemli olan İTÇ III'ün höyük yamaçlarındaki varlığı ve MÖ 2. binyıl tabakalarının höyük üzerindeki kalınlığı da tespit edilmiştir.

Sonuç

Daha önce yapılan yüzey araştırmalarıyla, Tavşanlı Höyük'teki yerleşme ağırlıklı olarak MÖ 2. binyıla tarihlenmiş ve höyük dışında doğu taraftaki düzlükler ise bu dönem yerleşmesinin aşağı şehri olarak tanımlanmıştır (Efe 1990). EKAR projesi kapsamında çok daha geniş alanda, uzun

süreli ve detaylı şekilde arkeolojik yöntemle yapılan yoğun yüzey araştırmasının sonuçları da aynı şekilde olmuştur. Ancak yine EKAR projesi kapsamında gerçekleştirilen disiplinler arası çalışmalar neticesinde jeoarkeolojik sondajlardan elde edilen sediman özellikleri ve mutlak tarihleme verileri ile yer radarı verilerinin beraber değerlendirilmesi ortaya farklı sonuçlar çıkarmıştır.

Bugüne kadar alanda geleneksel arkeolojik yöntemlerle yapılan yüzey araştırmalarında az sayıda İTÇ çanak çömleği bulunmuştur. Höyük ve çevresinde toplanan malzemenin %80'den fazlası MÖ 2. binyıla tarihlenirken, sadece %10'u MÖ 3. binyıla işaret etmektedir. Ancak yapılan arkeometrik araştırmalar, yerleşmenin en azından Geç Neolitik Dönem ile başladığını ve sonrasında yerleşmede çok sayıda yangın tabakasına sahip, kalın bir MÖ 3. binyıl dolgusu olduğunu göstermiştir. Söz konusu yangın tabakaları İTÇ çanak çömleğinin altta kilitli kalmasına neden olmuş olmalıdır. Büyük olasılıkla höyükten akan MÖ 2. binyıla tarihlenen çanak çömleğin araştırma yapılan alanlara birikmesi sebebiyle arkeolojik araştırmaların sonuçları yanıltıcı olmuştur.

Sonuç olarak, Tavşanlı Höyük yüzey araştırmalarında kullanılan tüm yöntemlerden elde edilen verilerin birleştirilmesiyle ilk defa İç Batı Anadolu'da bir tarihöncesi yerleşmede kesit temizliği ya da arkeolojik kazı yapılmadan yerleşmenin stratigrafisi büyük oranda belirlenmiştir. Yüzey araştırmalarında disiplinler arası çalışmalarla birlikte farklı yöntemlerin beraber kullanılması ve bu yöntemlere ait verilerin bir bütün olarak değerlendirilmesi sayesinde söz konusu yöntemlerin birbirini tamamlaması ya da birbirlerinin eksiklerini gidermesi artı bir değer olarak düşünülmelidir.

Yüzey araştırmaları, Tavşanlı Höyük'ün Tunç Çağları açısından oldukça önemli bir merkez olduğunu göstermektedir. 2021 yılında makalenin yazarı başkanlığında başlanacak arkeolojik kazıların, hem yüzey araştırmaları verilerini test etmesini hem de bölge arkeolojisi için yeni bilgiler vermesini umuyoruz.

Katkı Belirtme

Yüzey araştırmamız için izin veren ve her zaman desteklerini gördüğümüz Kültür Varlıkları ve Müzeler Genel Müdürlüğü'ne, çalışmalarımızda katkıları bulunan Türk Tarih Kurumu, Tavşanlı Belediyesi ve Luwian Studies Vakfı'na teşekkür ederim. Bu çalışmalar ayrıca 2018-02.BŞEÜ.04-01 ve 2020-01.BŞEÜ.04-01 proje numaraları ile Bilecik Şeyh Edebali Üniversitesi Bilimsel Araştırma Projeleri Birimi tarafından desteklenmiştir.

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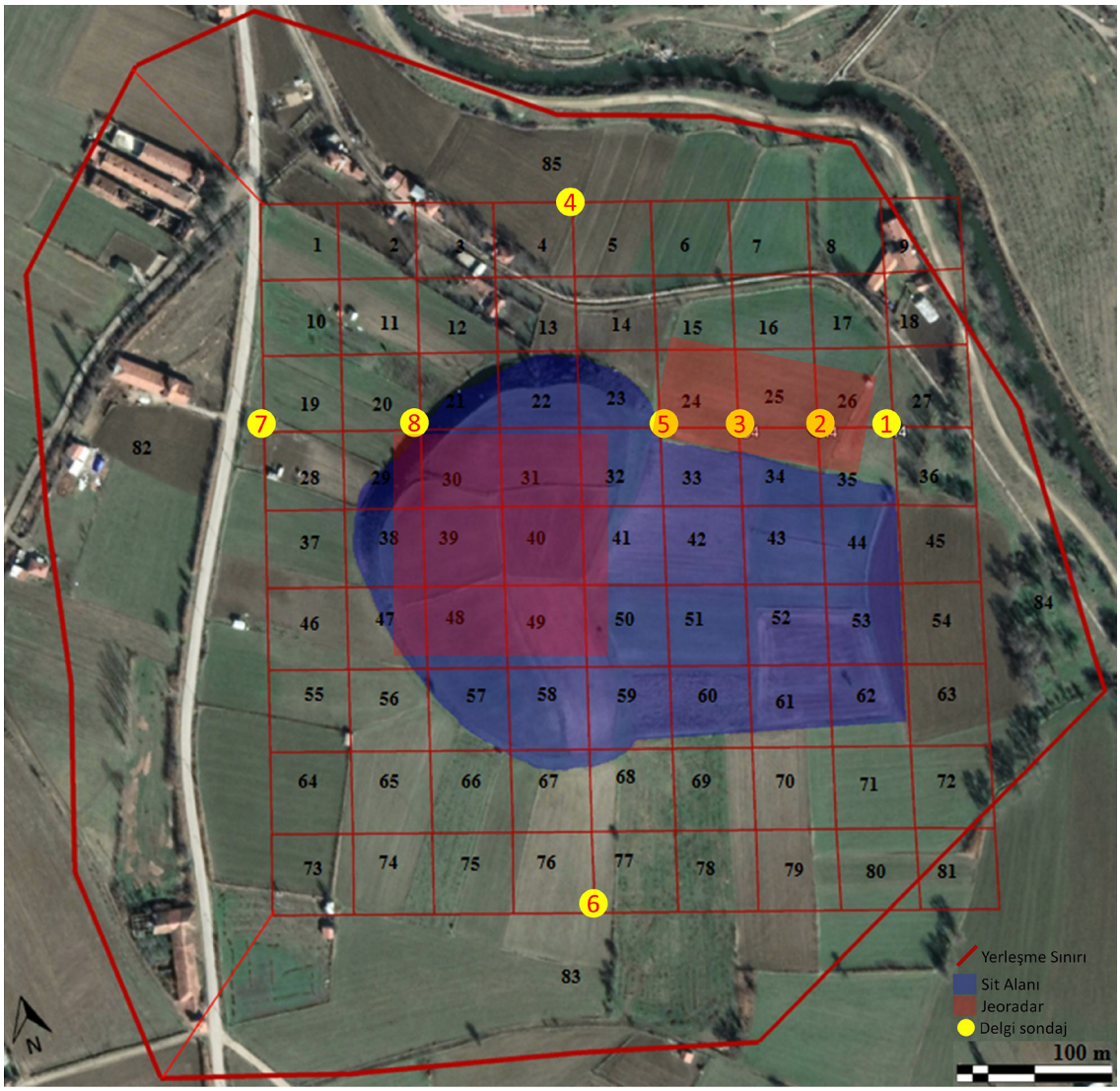
Şekil 1.
Tavşanlı Höyük,
hava fotoğrafı (kuzeyden).

Şekil 2.
Arkeolojik ve arkeometrik
araştırmaların yapıldığı
alanlar.

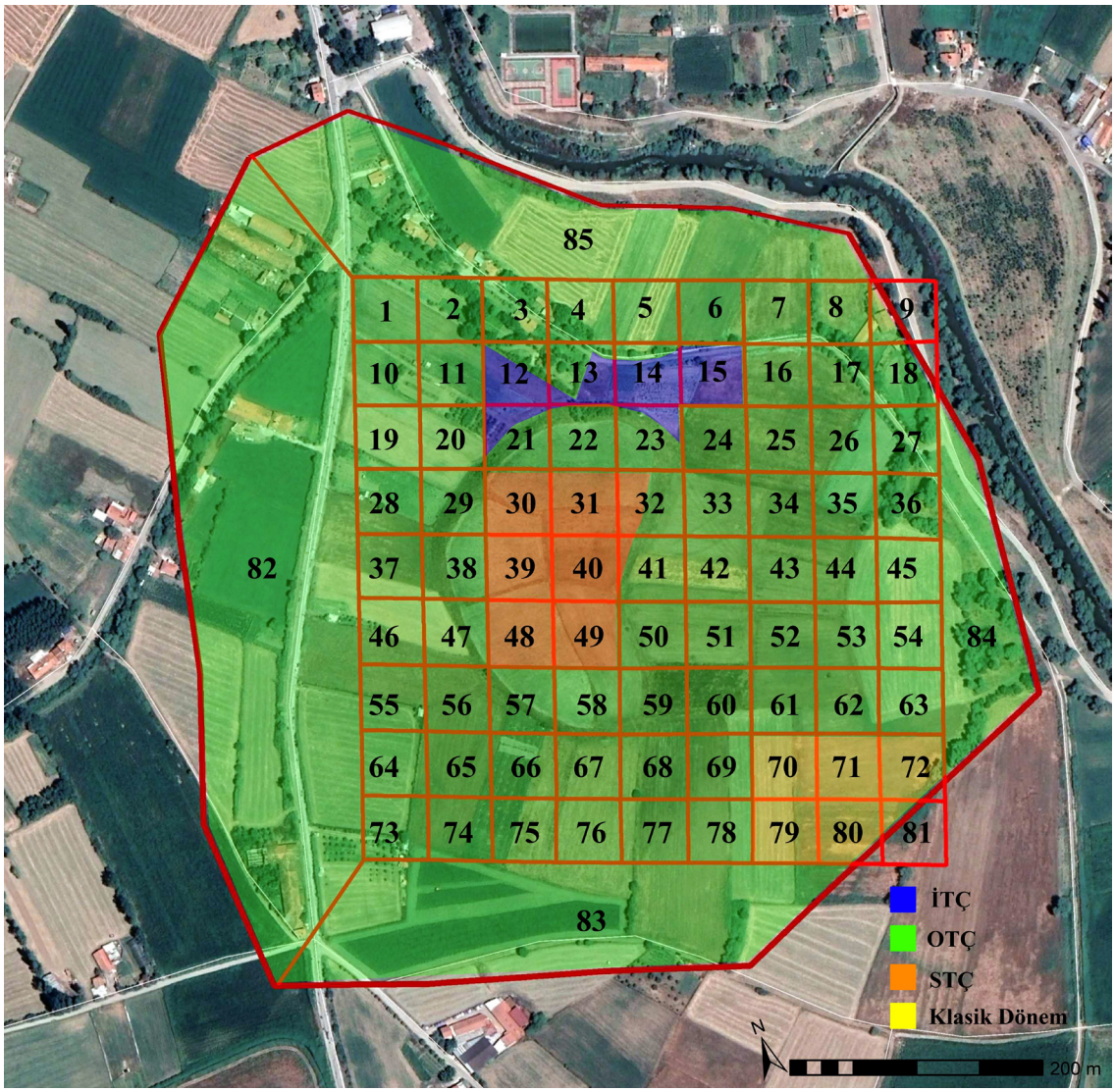


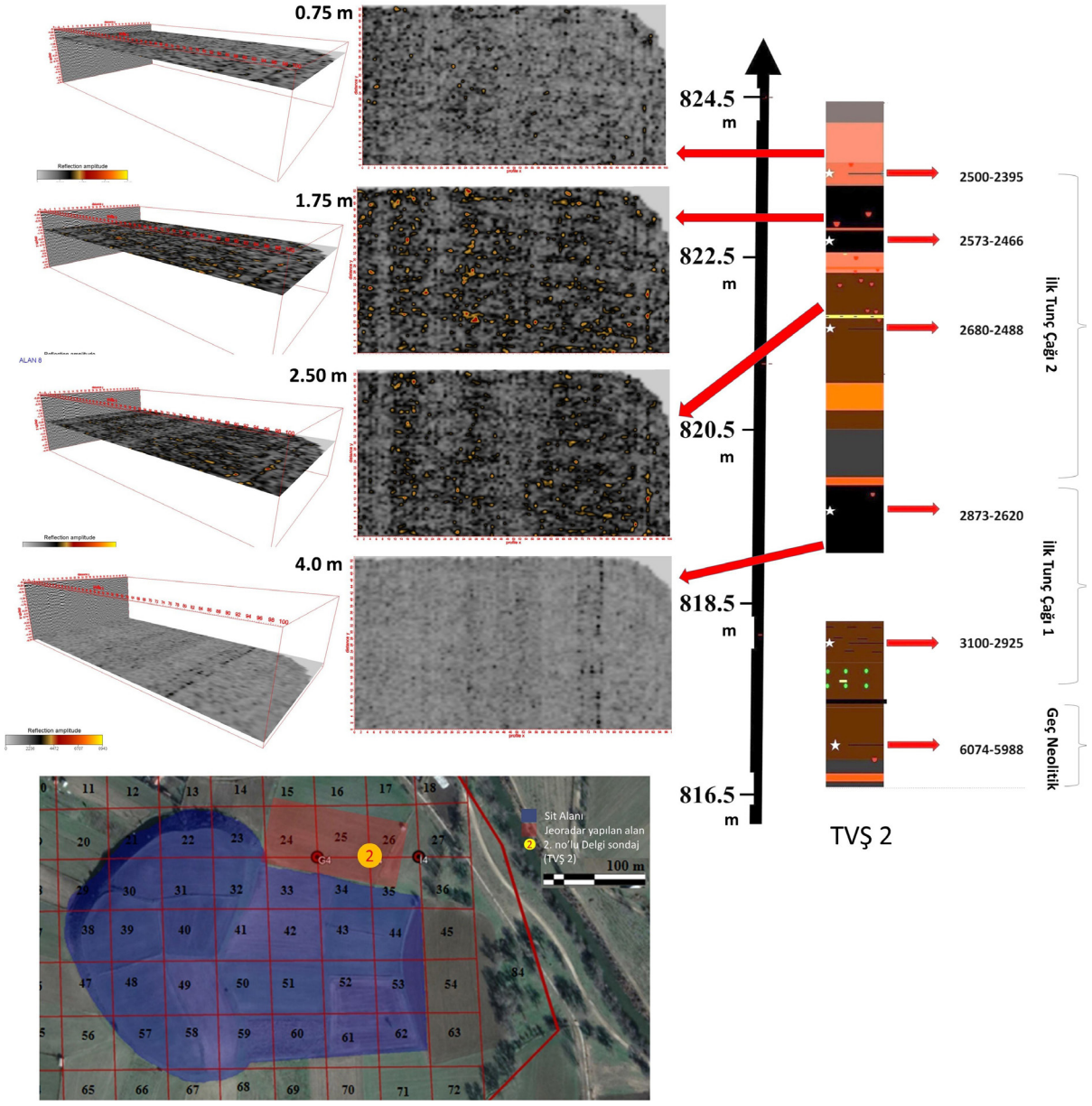
Şekil 3. Yoğun yüzey araştırmaları.

Şekil 4. Jeoarkeolojik delgi sondaj çalışmaları.

Şekil 5.
Yer radarı çalışmaları.

Şekil 6.
Yoğun yüzey araştırmalarında höyük ve çevresindeki çanak çömleğin dönemlere göre yoğun olduğu alanlar.





Şekil 7. Höyüğün kuzeydoğusundaki jeoarkeoloji, yer radarı ve mutlak tarihleme verileri.

Raw Material Characteristics and Production Technology of Chalcolithic and Iron Age Değirmentepe Pottery (Malatya, Turkey)

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Abstract

A series of pottery samples provided from the survey investigations and excavations from Değirmentepe (Malatya), dating to Chalcolithic (Ubaid) and Iron Ages, were investigated by petrographic and X-ray diffraction (XRD) analyses to determine their textures, mineralogical compositions and microstructures. The sample microstructures and chemical (semi-quantitative) compositions were also studied by scanning electron microscope equipped with energy dispersive X-ray spectrometry (SEM-EDX). Although almost all samples consist of rock fragments originating from metamorphic and igneous rocks, larger grain sizes and higher grain to matrix ratios are recorded for Chalcolithic Age samples compared to the samples belonging to Iron Age. XRD investigations on representative samples of the two periods, revealed high abundances of quartz, feldspar, and pyroxene group minerals in all samples, the presence of hematite and mica minerals, as well. In the XRD traces of investigated sherds, the absence of clay minerals both in the bulk and in the clay fractions, supports a minimum firing temperature of around 800-850 °C, while the presence of mullite phase both in XRD and SEM-EDX results showed the possible use of high firing temperatures in the range of 950-1050 °C, starting from the Chalcolithic Age. Few exceptions observed may indicate possible use of different raw material and/or different manufacturing techniques.

Keywords: Değirmentepe, pottery, optical microscope, XRD, SEM-EDX

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Makale gönderim tarihi: 15.12.2020; Makale kabul tarihi: 10.01.2021

Özet

Değirmentepe (Malatya) Höyüğü'nde yapılan yüzey araştırması ve kazı çalışmalarından elde edilen ve Kalkolitik (Obeyd) Çağ ve Demir Çağı'na tarihlenen çanak çömlek örneklerin dokusal, mineralojik ve mikro yapısal özellikleri, petrografik, X-ışını kırınımı teknikleri (XRD) kullanılarak belirlenmiştir. Örneklerin mikro yapıları ve yarı kantitatif kimyasal analizleri taramalı elektron mikroskop (SEM) ve enerji saçınımlı X-ışını (EDX) spektrometri teknikleri ile de çalışılmıştır. Hemen hemen bütün örneklerde gözlemlenen kayaç parçalarının, metamorfik ve volkanik kökenli olduğu ve bunun yanında Kalkolitik Çağ örneklerinin Demir Çağı örneklerine kıyasla daha kaba taneler içerdiği ve daha yüksek tane/ çimento oranına sahip olduğu belirlenmiştir. Her iki döneme ait çanak çömleklerden seçilmiş temsili örnekler üzerinde yapılan XRD analizleri sonucunda, kuvars, feldspat ile piroksen grubu minerallerin bütün örneklerde, hematit ve mika minerallerinin ise bazı örneklerde bulunduğu belirlenmiştir. Kalkolitik ve Demir çağlarına ait hem tüm kayaç hem de kil fraksiyonu örneklerinde yapılan XRD analizlerinde herhangi bir kil mineraline rastlanmamış olması en düşük pişirme sıcaklığının 800-850 °C'lerde olduğunu ortaya koymuştur. XRD ve SEM-EDX analizlerinde ise mullit fazının bulunması 950-1050 °C arası yüksek bir pişirme sıcaklığına Kalkolitik Çağ'dan itibaren ulaşılmış olabileceğini göstermiştir.

Anahtar Kelimeler: Değirmentepe, çanak çömlek, optik mikroskop, XRD, SEM-EDX

Introduction

Değirmentepe, a middle-sized mound covering 100x150 m², was 24 km away from Malatya in Eastern Turkey (Figure 1). The site has been completely submerged underwater due to the construction of Karakaya Dam on the Euphrates valley since 1987. Değirmentepe was firstly investigating during an archaeological survey in 1977 (Özdoğan 1977). The pottery samples collected during this survey belong mostly to the Late Chalcolithic Period. The site, therefore, was dated to Late Chalcolithic—transitional period in the published survey report. Starting from 1978, Değirmentepe was excavated for eight years as a part of Lower Euphrates rescue and assessment projects coordinated by the Middle East Technical University (Özdoğan 1977; Serdaroğlu 1977; METU Reports 1987).

Archaeological research revealed outstanding discoveries concerned with the culture, economy, architecture and religion of Değirmentepe from the Chalcolithic Age (the last half of fifth millennium BCE) to Late Roman—Medieval periods (5th to 15th century AD).

The most prominent levels 6-11 present the distinctive pottery type and architecture of Ubaid Period with the additional evidence regarding the economy, metallurgical activities, flint tool production and social life during the Chalcolithic—Ubaid Period (Esin 1981, 1982, 1984; Esin and Arsebük 1983; Esin and Harmankaya 1985, 1986, 1987; Esin et al. 1987). The level seven provided the main part of the information about the Ubaid Culture in the settlement. The Ubaid

Culture (5500-3800 BCE), which is named after Tell-al'Ubaid in Southern Mesopotamia, plays an important role in the urbanization of the Near East (Erarslan 2008). Ubaid Culture has been principally characterized by its distinctive painted pottery and tripartite dwelling type.

The pottery dated to the Ubaid Period recovered from Chalcolithic Age levels in Değirmentepe mainly consists of light colored pottery with greenish-gray or pink paste and slips, the painted Ubaid pottery and coarse dark colored cooking pots. Coba ware (or flint-scraped bowls) makes the main part of light colored wares which have irregular lines on the surface, probably made by flint tools. Painted Ubaid pottery, on the other hand, has a light colored decorated with geometrical shapes, branch mesh or leafs in red, black or brown color. The next group composed of handmade dark colored, brown or black cooking pots, tempered with chaff and grit (Esin 1986).

Değirmentepe, together with İkiztepe and Tülintepe, were assigned as selected sites that would provide the archaeological materials for the first and foremost archaeometric research in Turkey. These pioneer studies were initiated by The Scientific and Technological Research Council of Turkey (TÜBİTAK) at 1980. Thereafter, the archaeological materials belonging to various periods in Değirmentepe have been extensively studied by several researchers in the fields of anthropology, zooarchaeology, archaeobotany and geomorphology (Esin 1986). Değirmentepe pottery was investigated in detail and discussed in the sense of provenance and production technology by using several techniques like X-ray Fluorescence (XRF), Neutron Activation Analysis (NAA), X-ray Diffraction (XRD), Optical Microscope and Scanning Electron Microscopy-Energy Dispersive X-ray Spectrometry (SEM-EDX).

The primary work included the classification of pottery samples dated to Chalcolithic, Early Bronze and Iron Ages with the help of multivariate statistical methods on trace element concentrations determined by NAA and XRF (Birgül 1981; Esin et al. 1985). The results of this study indicated three different pottery groups which were found to be in good agreement with the typological classification (Esin 1986). The same samples were classified according to mineralogical and petrographic characteristics into three groups (Türkmenoğlu et al. 1985). Later on, X-ray powder diffraction analysis was performed to determine the crystalline phases and clay minerals in bulk powder samples and oriented clay fractions (Türkmenoğlu 1989). The firing temperature of Chalcolithic, Early Bronze and Iron Ages was estimated as 800-1000 °C (Türkmenoğlu and Göktürk 1996). The most recent archaeometric research on Değirmentepe pottery was a Master of Science thesis completed in 2011 (Er 2011). This paper presents the result of this thesis.

The present study is an attempt to explore the potential of more advanced techniques such as SEM-EDX, along with additional intensive petrographic studies and XRD investigations, for characterizing the potteries belonging to Chalcolithic and Iron Ages in order to assist the understanding of technological characteristics of pottery production in Değirmentepe.

Materials and Methods

Samples

Chalcolithic Age pottery samples consist of twenty-two sherds dated to the Ubaid Period. One group of samples (Sample No: 156, 157, 160, 165, 176, 177, 205, 209, 210, N1, N2, N3) were already present in the collection of previous studies in METU (Birgül 1981; Esin et al. 1985; Esin et al. 1989) and the rest (Sample No: E1, E2, E3, S1, S2, S3, S4, S5, S6 and S7) were obtained from the collection of Istanbul University, Prehistory Department.

The Iron Age pottery group consists of seventeen sherds. They were collected from three different grids (16J, 16I and 17I).

The photographs of Chalcolithic samples are given in Figure 2(a) and Iron Age samples are given in Figure 2(b).

Methods

Thin section preparation was carried out at the Thin Section Laboratory of the Geological Engineering Department in METU. The optical examination was carried out in the laboratories of Geological Engineering Department of METU by using Olympus CX31 model petrographic microscope.

X-Ray powder diffraction analyses of all the samples were carried out at the METU Central Laboratory by using "Phillips PW 3710" X-ray diffractometer with Cu Kα radiation with a Ni filter at a scan speed of 2°/min. XRD analyses were performed on nine non-oriented powdered samples and two clay fractions of powder samples (Jackson 2005).

Scanning electron microscope analyses were performed on six samples from Chalcolithic Age (Sample No: 210, N1 and S1) and from Iron Age (Sample No: 230, 246 and 248). Targets prepared using fresh fracture surfaces of pottery samples (approx. 1x1x2 cm) were coated with Au-Pd film to provide the electrical conducting layer to prevent the surface charging. SEM coupled with EDX analyses were performed at the METU Central Laboratory. Quanta 400F Field Emission SEM (FE-SEM) coupled with EDX was used in the measurements.

Results and Discussion

Petrographic and Mineralogical Analyses

Petrographic and mineralogical analyses were performed on three main parts of the clay paste: the non-plastic part (rock fragments, mineral grains and other inclusions), the clay matrix (clay-sized material) and pores which are empty spaces in the clay matrix.

Fragments of metamorphic, volcanic and sedimentary rocks were identified in thin section analyses of all samples (Table 1). Polycrystalline metamorphic rock fragments composed of large feldspar grains and extrusive igneous rock fragments were identified in the most of the samples, regardless of the period (Figure 3).

Table 1. Rock fragments identified in the samples.

Rock Class	Rock Type	Sample No and Age	
		Chalcolithic Age	**Iron Age**
Metamorphic	Schist	S4, S5	244
	Polycrystalline quartz	160, 165, 176, 210, N3	
	Phyllite	205	189
	Unclassified	157, 160, 165, 177, 187, 189, 205, 209, 210, E3, N1, N3, S4, S5	223, 224, 230, 231, 233, 235, 237, 238, 244, 246, 249
Igneous	Intrusive igneous	189, E1	
	Volcanic igneous	189, 156, 157, 165, 176, 177, 210, E1, N1, N2, S1, S2	223, 224, 228, 231, 235, 237, 238, 239
	Unclassified	209, E3, S7	
Sedimentary	Chert	165	231
	Limestone	156, 160, 205, N3, S5	233

Limestone fragments and small calcite grains which are both primary calcites were mostly detected in the Chalcolithic Age samples. Calcite grains dispersed in the clay matrix of three samples (Chalcolithic Age samples 205 and 209 and Iron Age sample 224) indicate the use of calcareous clay for production (Figure 3 and 4). The presence of limestone fragments is notable for estimation of firing temperature of the pottery. It indicates that the decomposition of calcium carbonate could not be completed yet during firing. Observation of reaction rims around calcite grains as in Sample 224 given in Figure 5 also support the uncompleted calcite decomposition (Fabbri et al. 2014).

The fragments of chert and phyllite/schist were also encountered in few samples dated to Chalcolithic and Iron Ages in thin section analysis.

Crystals of feldspar, plagioclase, quartz, pyroxene and hornblende are found in almost all of the samples investigated via thin section analysis (Table 2). Feldspar group minerals are one of the most common mineral groups in the earth's crust and were identified with different grain sizes in all of the samples during thin section analyses as expected. Plagioclase feldspar grains were differentiated with polysynthetic twinning under polarized light. All feldspar grains were identified as natural inclusions which were probably weathered and originated from metamorphic

Table 2. Common and less common minerals detected in thin section analyses. Px= Pyroxene, Hbl= Hornblende, Mca= Mica, Bt= Biotite, Pl= Plagioclase, Fsp= Feldspar, Asf= Alkali Feldspar, Qzt= Quartz.

Sample No	Dating	Px	Hbl	Mca	Bt	Pl	Fsp	Afs	Qzt
187	Iron Age	+				+	+		
189	Iron Age	+	+	+			+		
223	Iron Age					+			
224	Iron Age		+		+		+		
227	Iron Age						+		
228	Iron Age	+					+		
230	Iron Age	+				+	+		
231	Iron Age	+			+	+			
233	Iron Age					+	+	+	+
235	Iron Age	+		+	+	+		+	
237	Iron Age	+		+	+	+	+		
238	Iron Age		+	+	+	+	+		
239	Iron Age	+	+	+	+		+		
244	Iron Age			+			+		+
246	Iron Age	+		+	+			+	
248	Iron Age					+	+		
249	Iron Age	+				+	+		
156	Chalcolithic Age					+	+		+
157	Chalcolithic Age	+				+			
160	Chalcolithic Age	+		+			+		+
165	Chalcolithic Age	+					+		
176	Chalcolithic Age	+				+			
177	Chalcolithic Age								+
205	Chalcolithic Age				+		+		
209	Chalcolithic Age	+	+			+			+
210	Chalcolithic Age	+				+	+		+
E1	Chalcolithic Age		+				+		
E2	Chalcolithic Age				+	+	+		
E3	Chalcolithic Age	+	+			+	+		
N1	Chalcolithic Age		+			+	+	+	
N2	Chalcolithic Age	+	+			+	+		
N3	Chalcolithic Age	+					+		
S1	Chalcolithic Age			+		+	+		+
S2	Chalcolithic Age					+	+		+
S3	Chalcolithic Age	+					+		
S4	Chalcolithic Age			+			+		
S5	Chalcolithic Age						+	+	
S6	Chalcolithic Age	+					+		
S7	Chalcolithic Age						+	+	

Table 3. Three most intense d – spacings* of the minerals used in XRD analysis. Qzt= Quartz, Fsp= Feldspar, Pl= Plagioclase, Di= Diopside, Hem= Hematite, Mca= Mica, Mul= Mullite, Mc= Microcline.

	Qzt	Fsp	Pl	Di	Hem	Mca	Mul	Mc
d-spacing (Å)	3,34	3.74-3.78	4,03	2,98	2,7	10.01-9.96	3,39	3,24
	4,25	6.60-6.30	3.17-3.21	2.51-2.52	2,51	5.00-4.98	3,42	4,22
	1,81	3.45-3.49	2.92-2.95	2,88	3,68	4.48-4.45	5,39	3,37

* In the order of decreasing intensity

and igneous rocks. Quartz is also present in the samples dated to Chalcolithic and Iron Ages. There is no indication of the use of quartz and feldspar as temper. Hornblende grains were detected in thin sections with its strong paleochroism. Mica particles which probably originated from mica bearing schist-phyllite rock were mostly dispersed in clay matrix in Iron Age samples.

Hematite (Fe2O3) is a fully oxidized form of iron oxide and one of the common minerals in the soil. It has a red or reddish brown color in thin sections. The grains of hematite were identified with having red or reddish brown colors in all the samples of Chalcolithic Age (except samples N3 and S4) and Iron Age in thin section analyses (Figure 6). Hematite could also be formed during firing stage. Oxidizing conditions and temperature around 750 °C during firing cause hematite formation which turns the color of the sample to reddish-brown (Maritan et al. 2006; Nodari et al. 2007)which continues to retain iron in a (distorted. Samples N3 and S4 have grayish and dark colors, which can be caused by a reducing atmosphere during firing (Figure 2(a)).

Mullite which is an alumina silicate mineral is rarely found in natural form (Lee and Rainforth 1994). Synthetic mullites which are primary (2Al2O3·SiO2) and secondary mullite (3Al2O3·2SiO2) may be formed at elevated temperatures 950-1000 °C, 1050-1150 °C respectively (Iqbal and Lee 2004; Lee et al. 2008). Diffraction lines of 3.40 and 5.39 Å in XRD patterns of five samples belonging to Chalcolithic Age (S1, 210) and Iron Age (Samples No: 230, 246, and 248) are attributed to mullite (Table 3) (Chen 1977). Although the two split lines expected at 3.39 and 3.42 Å are not observed in their patterns (Figure 7), it has been already reported that those lines may be merged when mullite is newly formed at high temperatures which make their identification difficult (Chakraborty and Ghosh 1978). Supporting the XRD observations, mullite crystals with a distinct needle like shape were also clearly detected in SEM analysis of sample S1 (Figure 8). The result of micro-chemical investigations on those crystals indicating the presence of calcium, magnesium, and iron contents does not support the expectations for the typical stoichiometric 3:2 alumina-silica ratio (Figure 8). This contradiction was already stated in a previous study with a probable cause of the overlapping of the glass and crystal phases (Lee et al. 2008). The identification of mullite in mineralogical and microstructural analyses of pottery samples provides valuable information for the estimation of firing

temperatures. The presence of mullite crystals, especially in Chalcolithic Age samples, indicates that they might have been fired at temperatures above 1050 °C (Tite and Maniatis 1975a).

The existence of elongated pores in samples N3 of Chalcolithic Age and 248 of Iron Age indicates the possible presence of chaff as an inclusion. The EDX analyses of these inclusions indicate the presence of phosphorus (P), chlorine (Cl) and carbon (C) that confirms the results of morphological investigations of these pores and plant traces (Figure 9).

Calcite was observed in samples of Chalcolithic Age (Sample Code: 157, 165, 177, 205, 209, E2, E3, N2, S1, S3, S4) and Iron Age (Sample Code: 224, 233, 237, 246) during thin section analyses and its existence was also confirmed with SEM investigations. These occurrences observed on the pore walls in the form of pore linings are interpreted as micritic (secondary) calcite and are believed to arise from the deposition during burial conditions (Velde and Druc 1999; Fabbri et al. 2014). This conclusion mainly depends on the small crystal shapes cumulated on the surface of the pottery (Figures 10 and 11) and related EDX analysis.

The scanning electron microscopy provides high magnifications (up to X 2-3.000.000 times) and the opportunity to examine the morphology even at the nanometer scale. The degree of vitrification can be determined by the formation of a network of glassy phase and isolated pores or absence of flaky clay particles in the ceramic matrix (Tite and Maniatis 1975b). Nine samples (Sample No: 160, 176, 210, N3, S1 of Chalcolithic Age and 228, 230, 239, 244 of Iron Age) have well vitrified body/matrix and small grain size characteristics when compared to the rest. The developments of glassy phases and glass networks which surrounded the boundaries of mineral grains were clearly observed in SEM analysis (Figure 12).

Considering the matrix color, samples display wide range of colors under cross-polarized light, changing from mostly reddish brown to greenish—beige and occasionally darker colors. A reddish color indicates the use of oxidizing atmosphere due to the formation of ferric oxide (Fe^{3+}) during firing, while a darker color indicates the application of a reducing atmosphere or insufficient air circulation and the presence of ferrous oxide (Fe^{2+}) (Rice 1987; Nodari et al. 2007). Considering these facts, samples N3, S1, S4 and S7 of Chalcolithic Age with dark colors were probably fired in reducing atmosphere, while most of the samples have reddish color indicating oxidizing atmosphere (Figure 2(a)).

Distributions of non-plastic grains (mineral grains and rock fragments) in the studied samples were investigated by examining the thin sections with optical microscope. The investigation suggests that the rock fragments consist of large particle sizes which change from coarse to fine sand sizes (1.00-0.1 mm). On the other hand, sizes of mineral grains have very fine sand sizes (<0.1 mm). Based on these observations, Chalcolithic Age samples have larger grain sizes and a higher grain/matrix ratio than those of the Iron Age. That may indicate the use of different

method of raw material processing for the elimination of coarser particles during ceramic production in the Iron Age.

Production Technology

The results of petro-mineralogical analysis is generally in line with previous grouping by Türkmenoğlu (Türkmenoğlu et al. 1985). The identification of mullite phase in this research contributes to the estimation of firing temperature around 1050 °C.

It can be noted that Iron Age samples have more compact and amorphous bodies when compared to those of the Chalcolithic Age samples. Studies at higher magnifications with scanning electron microscope revealed the presence of spherical pores in Chalcolithic Age samples which are very similar to those seen in Iron Age samples (Figure 13). These spherical pores were probably developed because of the compaction of the ceramic body during firing in the 1100-1200 °C range (Kayani 1996).

Bulk samples of two potteries belonging to Chalcolithic Age (N3, S4) revealed diffraction lines at d values of 14-8 Å proposing a possible presence of some clay fragments in their structure. For this reason, oriented clay fractions of these pottery samples were analyzed by XRD for further investigations. However, clay fractions only contain amorphous structure, which indicates minimum firing temperatures in the range of 800-850 °C. This observation has already been stated in a previous study (Türkmenoğlu 1989). Therefore, the diffraction lines observed in bulk samples of N3 and S4 may be attributed to the presence of mica minerals.

Conclusion

Mineralogical analyses along with microstructural studies and chemical analyses of Değirmentepe (Malatya) pottery belonging to Chalcolithic (Ubaid Period) and Iron ages showed that almost all samples investigated contain rock fragments, originating from metamorphic and igneous rocks. However, larger grain sizes and higher grain to matrix ratios are recorded for Chalcolithic Age samples compared to those belonging to the Iron Age. This indicates the use of different raw material and/or different manufacturing technologies, such as different sieving procedures in both periods.

XRD investigations on selected representative samples of both periods, revealed high abundances of quartz, feldspar, and pyroxene group minerals in all samples and hematite and mica minerals in few samples. The analysis underlies the use of micaceous raw materials mostly in the Iron Age. This evidence may also support the use of different sources for the raw materials in both periods. In the XRD traces of the investigated sherds of Chalcolithic and Iron ages, the absence of clay minerals both in the bulk and clay fractions, supports a minimum firing temperature of around 800-850 °C, while the presence of mullite phases detected by the XRD and

SEM-EDX, a product of chemical reactions occurring around 1050 °C, showed the possible use of high firing temperatures in the range of 950-1050 °C, from the Chalcolithic Age onwards. This type of application usually results in good mechanical properties, low permeability and high chemical resistivity of the pottery. The vitreous-glassy morphology and secondary pores (results of high firing temperature applications) containing needle-like crystal structure of mullite as detected by SEM-EDX investigations of both Chalcolithic and Iron Age samples support these evidences.

All these observations indicate a rather advanced ceramic production technology used in Değirmentepe from the Chalcolithic Age onwards (5th millennium BCE).

Acknowledgements

This paper is originated from a part of the MSc thesis completed by Mehmet Bilgi Er in 2011. The study was supported by the METU Scientific Research Project (BAP-LTP Project No: BAP -07-02-2010-00-01).

We thank the staff of METU Central Laboratory for their help in performing SEM - EDX and XRD analyses.

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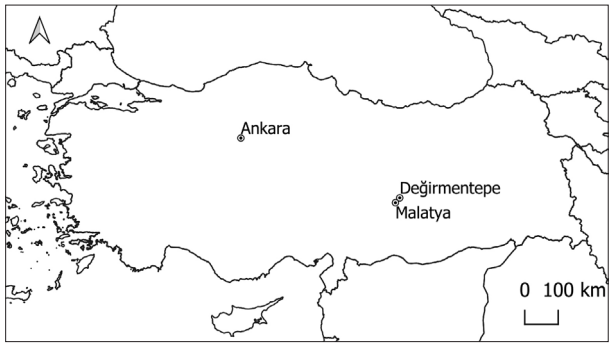

Figure 1.
Map showing the location of Değirmentepe.

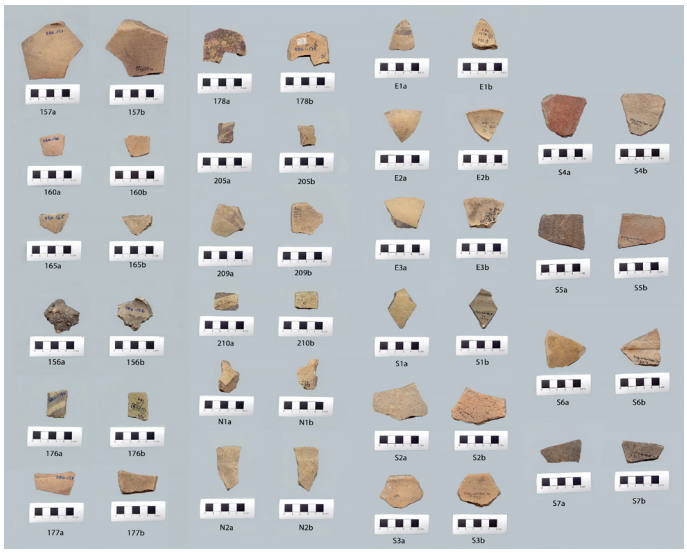

Figure 2(a).
Photographs of Chalcolithic Age pottery samples.

Figure 2(b).
Photographs of Iron Age pottery samples.

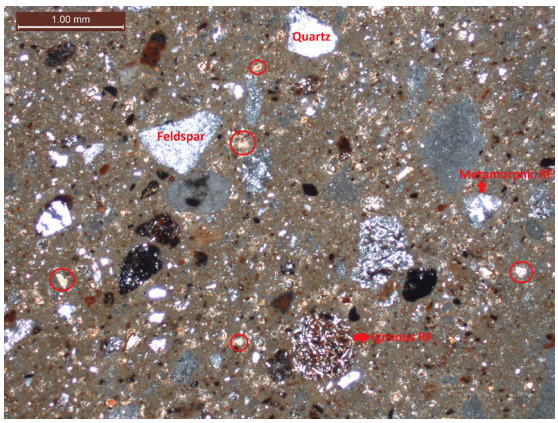

Figure 3. Rock fragments identified in Chalcolithic Age sample 205. Red circle indicates the small calcite dispersed in the clay matrix.

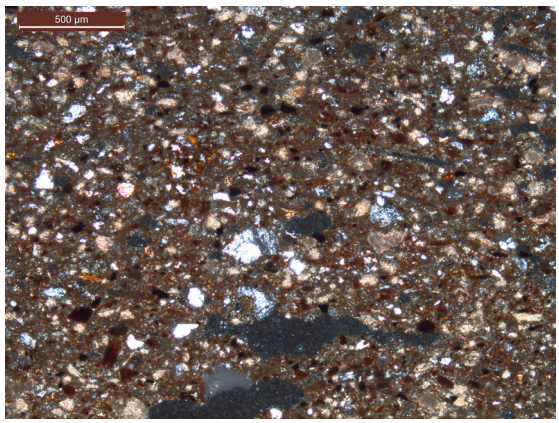

Figure 4. Thin section image shows calcite grains dispersed in clay matrix of Chalcolithic Age sample 209.

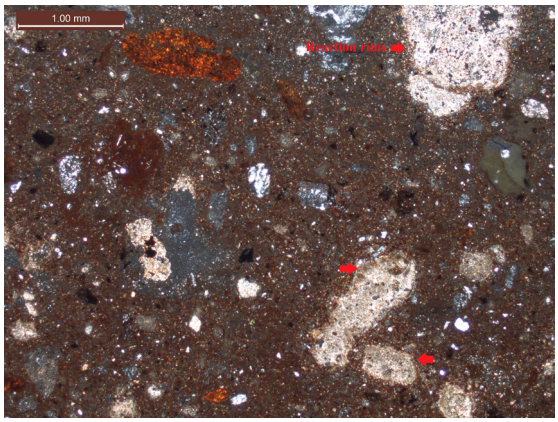

Figure 5. Thin section image shows reaction rims around calcite grain in Iron Age sample 224.

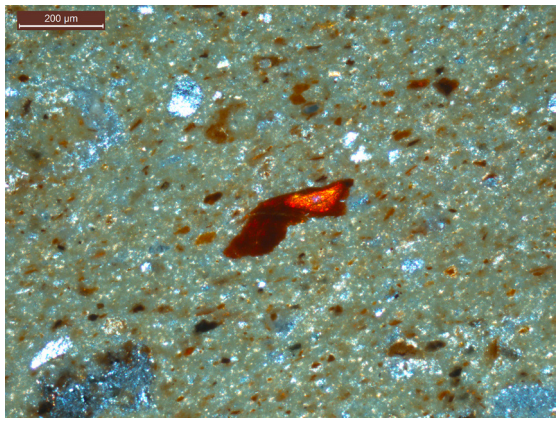

Figure 6. Thin section image shows hematite grains in Iron Age sample 224.

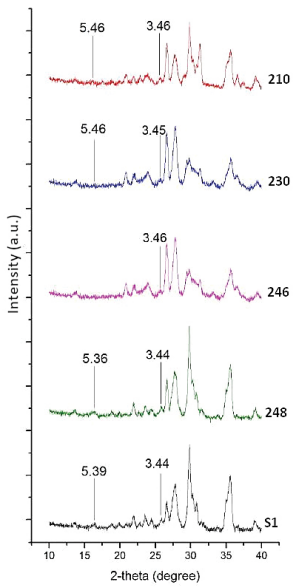

Figure 7. XRD traces of samples S1, 210 (Chalcolithic Age), 230, 246, 248 (Iron Age) indicating the presence of mullite (a.u.=arbitrary unit).

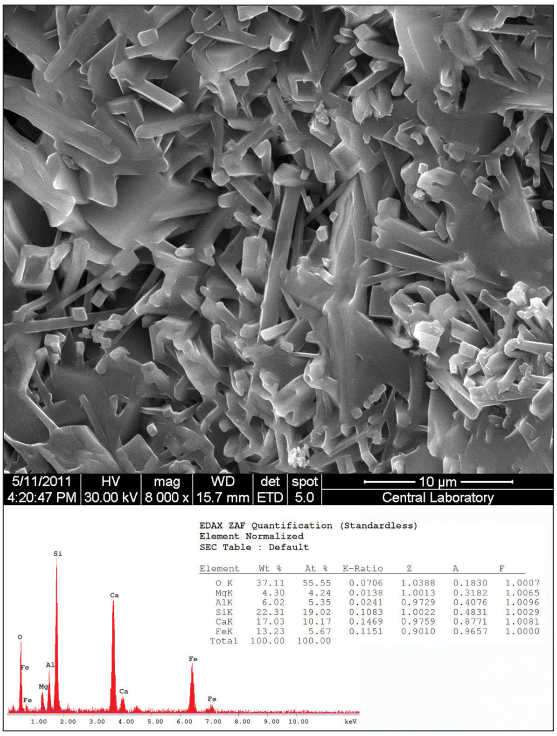

Figure 8. Needle like mullite crystals in glassy matrix in Sample S1 (Chalcolithic Age).

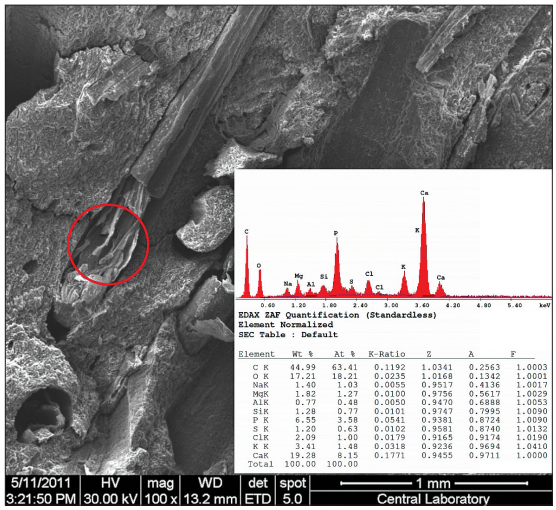

Figure 9. SEM micrograph and EDX analysis of chaff is a possible organic additive in Sample N3 (Chalcolithic Age).

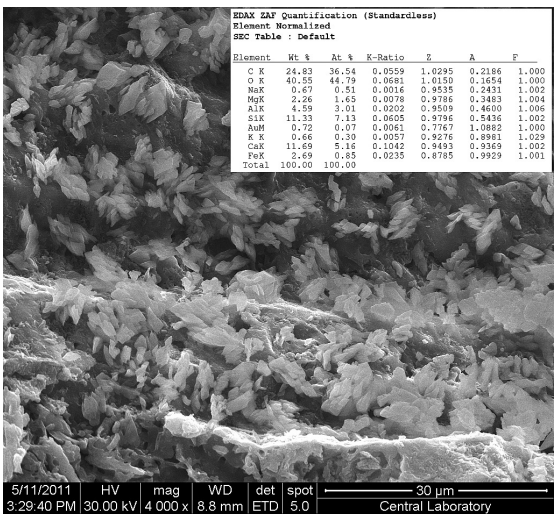

Figure 11. SEM micrograph of micritic calcite formation, Sample 246 (Iron Age).

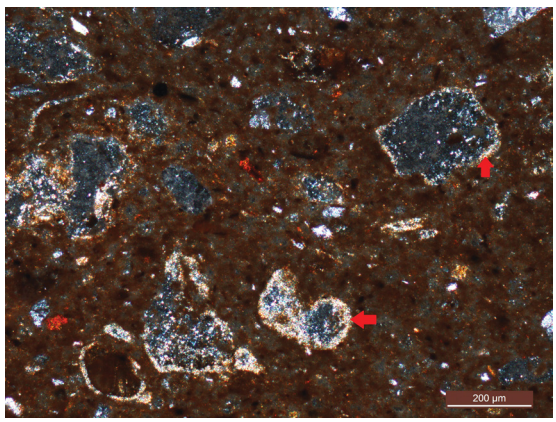

Figure 10. Photomicrograph of secondary calcite formation, Sample 246 (Iron Age).

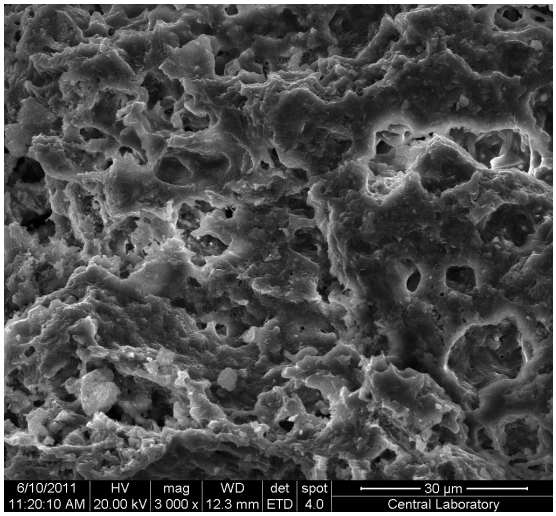

Figure 12. SEM micrograph of vitrified body, Sample 210 (Chalcolithic Age).

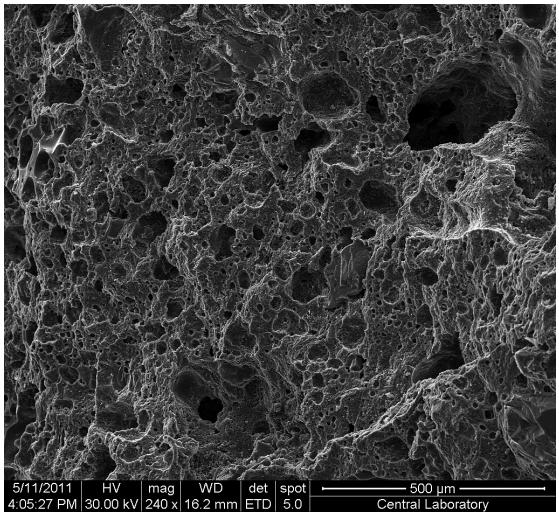

Figure 13. SEM micrograph of spherical pores, Sample S1 (Chalcolithic Age)

From Beazley to Forensic Labs: Investigating Ancient Fingerprints in Classical Archaeology

Tuna Şare Ağtürk[a], Kimberlee Sue Moran[b]

Abstract

This essay is about an experimental methodological study that explores the potential of ancient fingerprint analysis left on terracotta objects in revealing ancient manufacturers' identities and production processes. A general overview of methods used to trace the artisans' 'hands' on ancient clay artifacts from the Beazley-Method to modern forensic approaches to ancient fingerprints is followed by a case study on a group of terracotta figurines discovered from a 4th century BCE tomb at Assos. This case study has revealed traces of fingerprints left on the clay surfaces of the figurines. Formally known as friction ridge detail (FRD), fingerprints left as impressions on the clay became permanent after the firing of the mostly mold-made figurines. After a technical documentation, we studied these fingerprints in order to understand their production and reveal some aspects of the identity of the workers involved in the manufacturing process. The initial goal in this case study was to find an FRD of an individual left on two stylistically different figurines to test the contemporaneous production of different-styled figurines by the same artisan. Unfortunately, although present, most recorded FRD on the figurines were insufficient in detail for comparison to find a "match" on different figurines. However, the areas on the figurines where FRD were found revealed some aspects of the production processes of the artisans. Furthermore, the overall methodological approach we applied to the material has shown the potential of fingerprint analysis as a new research field in Classical archaeology.

Keywords: ancient fingerprints, terracotta figurines, Assos, Classical Archaeology

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Makale gönderim tarihi: 23.11.2020; Makale kabul tarihi: 14.01.2021

Özet

Bu makale, antik dönem zanaatkarlarının kimliklerini ve üretim süreçlerini ortaya çıkarmada ürettikleri pişmiş toprak nesnelerde kalan parmak izlerinin analizini araştıran deneysel bir metodolojik çalışmayı içerir. Antik seramiklerde zanaatkarın ayırt edici el izini tespit etme üzerine kurulu Beazley Method'undan, forensik bilimin etkisinde gelişen antik parmak izi araştırmalarına kadar bu yaklaşımın tarihsel gelişimi değerlendirildikten sonra Assos'ta, MÖ 4. yüzyıldan kalma bir mezarda bulunan bir grup pişmiş toprak figürin üzerinde yaptığımız bir vaka çalışması sunulmuştur. Assos figürinlerinin yapım aşamasında kil yüzeylerinde kalan ve bilimsel literatürde sürtünme sırtı detayı (FRD) olarak adlandırılan parmak izleri, figürinlerin fırınlanmasından sonra kalıcı hale gelmiştir. Figürinlerin üretimlerini anlamak ve üretim sürecine dahil olan işçilerin kimlik özelliklerini ortaya çıkarmak için üzerlerindeki parmak izleri teknik olarak incelenmiş ve belgelenmiştir. Bu vaka çalışmasındaki öncelik amaç, aynı zanaatkar tarafından farklı tarzdaki figürinlerin eşzamanlı üretimini test etmek için stil açısından farklı iki figürin üzerinde bırakılan tek bir kişiye (zanaatkara) ait FRD'leri bulmaktı. Ne yazık ki, mevcut olmasına rağmen, figürinler üzerinde kaydedilen FRD'lerin çoğu, karşılaştırma yapmak ve farklı figürinler üzerinde bir eşleşme bulmak için yetersiz kalmıştır. Ancak, birer alet izi gibi, figürinlerdeki FRD izleri zanaatkarların farklı üretim süreçlerinin bazı yönlerini ortaya koymuştur. Ayrıca, malzemeye uyguladığımız genel metodolojik yaklaşım, Klasik Arkeoloji'de yeni bir araştırma alanı olarak parmak izi analizinin potansiyelini göstermiştir.

Anahtar Kelimeler: antik parmak izi, terrakotta figürinler, Assos, Klasik Arkeoloji

Introduction

When we think of the concept of tracing the hands of artisans on ancient Greek pots, the first person that will come to mind is Sir John Beazley and his method of identifying Attic vase painters which changed the course of scholarship on Classical art and archaeology in the 20th century (Robertson 1991; Oakley 1998; Driscoll 2019). Inspired from Morelli's method for studying Italian Renaissance painting and in the absence of signatures, Beazley distinguished the hands of individual vase painters on stylistic grounds and documented and ordered them for comparison[1]. His method, later applied to all types of Greek painted pottery, led to a large archive still used to classify ancient Greek pottery[2]. The Beazley-Method, which is driven by the concept of 'connoisseurship' (to find which artist painted a particular painting and when and how in order to give it a market value) of 20th century art history, has been under attack in recent scholarship (Beard 1991; Whitley 1997). Scholars are now using a variety of

1 Oakley (1998, 2009) in favor of Beazley, argues that he was not inspired by Morelli as commonly thought but German scholars especially Hartwig, who were already making attributions to signed Greek vases in the 1940s.

2 For an extensive online database established with the method Beazley initiated, see Beazley Archive Pottery Database of the University of Oxford https://www.beazley.ox.ac.uk/pottery/default.htlm

new approaches to understand the production and consumption of such clay vases in the ancient world. Semiological methods, for example, are being used to understand the imagery on the vases, and chemistry and petrography come into action to understand clay compositions and thus manufacturing processes and trade links (Marconi 2004; Oakley 2009). A fairly new method, which also involves the tracing of the artisans' hands on clay pots and figurines of the Classical period, is fingerprint analysis. Inspired by forensic science, the study of ancient fingerprints left on clay and stone artifacts has become more and more popular over the last decade.

Historiography and the Scope of Ancient Fingerprint Studies

Prior to the advent of DNA, fingerprints were the only method known to positively identify an individual. Whilst a few rudimentary studies of fingerprints took place prior to the late 19th century, the formal establishment of dactylography (the study of fingerprint patterning) took off with the work of Henry Faulds, Francis Galton and others in the 1880s and 90s (Galton 1892; Henry 1900; Wilton 1938; Cummins and Midlo 1961). Indeed, it was Henry Faulds who first developed an interest in fingerprints through the examination of ancient Japanese pottery (Faulds 1880).

In the early 20th century as fingerprinting became a stalwart of criminal investigation within the new field of forensic science, dactylography began to grow within and parallel to fields such as physical anthropology and medical research (Asen 2018a, 2018b). Unique to the individual, the FRDs of the fingertips and palmar regions were seen as phenotypic clues to genetic questions. At their most benign, fingerprints were used to detect genetic conditions and disorders such as congenital heart disease and Down's Syndrome (Cummins et al. 1950; Alter 1967; Asen 2018b)[3]. However, fingerprints were also used to reinforce racist ideologies of the time enabling studies that sought to sort populations into racial categories and hierarchies based on fingerprint patterning (Asen 2018a). With the advent of genetic sequencing, often, confusingly referred to as DNA fingerprinting, dactylography was largely abandoned. Though more time-consuming and infinitely more expensive, DNA is much more objective, quantifiable, and easily subjected to statistical analysis.

Within archaeology, FRD on clay was recognized in the first half of the 20th century as a viable form of artifactual data (Wilton 1938; Cummins 1941; Badé 1934; Crawford and Austin 1935). FRD serves as a toolmark, evidence of how clay was shaped, manipulated, and formed. In some instances, FRD appears to be used as a maker's mark or as a measure of authentication, intentionally cast and preserved. However, it is unlikely that the act was in recognition of a fingerprint's uniqueness (Cummins 1941, 394; Polson 1950). Rather, it has been likened

[3] Dactylography is seeing a modest renaissance today as a rapid means of genetic diagnosis.

to "making one's mark" in the form of an "X" on a document for those without a signature (Åström and Eriksson 1980).

More recently, ancient fingerprint (paleodermatoglyphics) studies have focused on gleaning data from the morphology of the FRD in an effort to assign the maker an age and sex (Acree 1999; Králik and Novotny 2003; Bennison-Chapman and Hager 2018; Lambert et al. 2018; Sanders 2015; Kanter et al. 2019; Fowler et al. 2019; Fowler et al. 2020). Friction ridges form a series of parallel lines and the assumption is that the space between ridges, the epidermal ridge breadth, expands as the fingers grow from birth to adulthood (Hecht 1924; Cummins and Midlo 1961; Castex 1994; Kamp et al. 1999; Gillam et al. 2008, Fowler et al. 2020). Broadly speaking, this is true, but robust, large-scale, cross-population research has not been conducted to determine the rate of expansion, whether that rate is constant, at what age expansion ceases, and whether there is any contraction of friction ridges as one ages. It is also not well understood how much human variation is displayed in the distance between ridges. Some studies have measured the distance between ridges on artifacts and found that the measurements clustered into groups (Sjöquist and Åström 1991; Kantner et al. 2019). The groups have been interpreted as displaying different ages of workers but without an understanding of how much variation is within a population, it is a speculative conclusion, especially when distinguishing between adolescents and adults (Fowler et al. 2019; Fowler et al. 2020). Finally, the impact of the clay medium will affect FRD. If clay contracts during drying or firing, the result will make any measuring of ridge spacing unreliable. Shrinkage corrections may be applied to ridge measurements, but accuracy is dependent on a thorough study of the specific medium.[4]

Similar to age, the assignment of sex based on FRD faces many of the same problems. More robust population studies have found an indication of a measurable bimodal difference in ridge density, the number of ridges packed within a square millimeter of a fingerprint, between males and females (Acree 1999; Sanders 2015; Suwarno and Santosa 2017)[5]. However, at most, these studies have examined 400-800 subjects within the same population (Stücker et al. 2001; Gungadin 2007; Nayak et al. 2010; Kaur and Garg 2011; Gnanasivam and Vijayarajan 2019). Issues of human variation within and across populations and the effects of aging have not been systematically studied. While the impacts of clay shrinkage are accounted for in some studies (Králík and Novotný 2003), it is not consistently addressed (Bennison-Chapman and Hager 2018) nor is the issue that the different clay types may produce difference shrinkage rates. Age

4 Clay composition, moisture levels, and firing temperatures will impact shrinkage. In order to calculate shrinkage rates, an experimental approach is necessary: researchers should acquire clay that is the same as that of the artifacts under investigation and not attempt to use a proxy substrate.

5 The size of the square depends on the study. At least one study counted the number of ridges with $5mm^2$ (Sanders 2015); most others have used $25mm^2$ based on Acree (1999).

and sex assignment based on FRD holds promise but more research is needed before the methodologies can be consistently used with a high degree of reliably.

The context of clay artifacts and the quality of the FRD on them are vital for making any sort of interpretation as to the nature of the craft production organization and the identity of the crafters who left their unique marks on clay. A recent study on a group of clay figurines and oil lamps deposited into two Roman cisterns as the waste of a single workshop active around 300 AD at Beit Nattif (Israel) for example, provided scholars a closed context for investigation (Lichtenberger and Moran 2018). Of about 140 areas of FRD recorded on these clay figurines and oil lamps, some were high quality with many minutiae points for comparison. The forensic analysis showed that many of the fingerprints belonged to one single individual producing both oil-lamps and figurines in the same workshop at Beit Nattif. Furthermore, the fingerprint impression consistently left on the lower left quadrant of the spout on oil lamps showed the artisan's individual production technique; he/she held the mold in the left hand and pressed the clay in counterclockwise motion with the right hand in a well-practiced fast method.

The Case of Tomb 4

The so-called Tomb 4 was discovered in 1995 at the Western Necropolis of Assos, a major Classical city in the southern Troad on the Aegean coast of Turkey (Figure 1). The modest Late Classical cist grave for a middle-aged woman and an adolescent girl surprised the excavators with the rich cache of grave goods inside (Şare Ağtürk and Arslan 2015; Figure 2).[6] Of the 62 well-preserved artifacts, around 50 of them were terracotta figurines of various types including seated female musicians and a dancer, goddesses, comic actors, female mask protomes, and animals. Our detailed analysis of these figurines also revealed basic steps used in their manufacturing: Most of the figurines were cast by applying wet clay to the front and back molds; details were incised with tools; further details were applied after the clay had been removed from the molds; front and back halves were attached to each other with slip; small handmade details/appliques were attached; the figurines were either left open at the bottom or vent holes opened in the back for the firing process in the kiln (Şare Ağtürk and Arslan 2015, 28-31)[7]. On the

[6] Since the late 19th century, over 300 hundred terracotta figurines of various types have been found in the Western Necropolis at Assos. The typological range of these figurines, including deities, seated and standing females, reclining and standing males, male riders, seated children, busts, protomes, a variety of animals, grotesques, and articulated dolls, indicates the popularity of these burial gifts from the Archaic to the Hellenistic period at Assos. There has never been a scientific research on the provenance of their clay, but the discovery of several molds at Assos indicates that most of these figurines were local products cast from molds using the clay produced from nearby clay beds. For details of the craft of the coroplasts at Assos see Şare Ağtürk and Arslan 2015, 16-23.

[7] Also see Uhlenbrock 1990, 16 for a general process followed in the manufacturing of terracotta figurines.

basis of a plastic lekythos and a comic actor figurine, both imported from Athens, the burial is dated to the first half of the 4th century BCE. The discovery of these Attic imports with three Archaic-style terracotta mask protomes of the 6th century in the same tomb was puzzling. Their co-existence is explained possibly either as the continued use of archaic-styled protomes in the 4th century BCE, or as due to the fact that archaic-styled protomes were in the possession of the same family for over two generations when women were buried (Şare Ağtürk and Arslan 2015, 23-38).

During the close examination of the figurines several areas of FRD were observed. Through a later forensic analysis of the observed FRD, we initially hoped to find a matching fingerprint on two of the stylistically different figurines from the same tomb to show the co-existence and production of both styles by the same workshop. This would have challenged the traditional art historical method of dating a burial on the bases of the style of its goods. If tracing age or sex through fingerprints were reliable, finding the fingerprint of a 'female' manufacturer for mostly female figurines dedicated in the tomb of two females, would of course also be revolutionary.

Methodology

In a three-day operation at the Troia Museum in Çanakkale in August 2020, we recorded traces of 25 fingerprints on 20 of the terracotta figurines found in the Tomb 4. A magnifying glass and a raking light system to reveal the texture of the surfaces helped during the analysis. Areas of FRD or suspected FRD were photographed under normal lighting conditions using a macro photography camera. A cm scale was included in each image and the location on the figurine of each area of FRD was noted. In total, 149 images were analyzed.

The goal of the analysis was to determine whether any of the areas of FRD could be determined as coming from the same source, i.e., a "match". To do so, an assessment of "value" for comparison was conducted of each area of FRD following standard forensic guidelines (SWGFAST 2013, OSAC FRS 2020). Value/no value determinations are based on the clarity of the mark(s), visible characteristics (such as ridge endings and bifurcations), and the number of visible characteristics and/or minutiae available for comparison. While fingerprint examiners follow a quantitative–qualitative threshold model when establishing a threshold for the minimum number of minutiae required for a comparison, a mark with less than four distinguishable minutiae would be considered to have insufficient detail for a comparison (VanderKolk 2011).

Once FRD was determined to be of "value", minutiae were annotated digitally (OSAC FRS 2020). Since the assemblage of FRD images was rather small, images containing discernable minutiae could be compared manually side-by-side on a computer screen. Minutiae type, location, and spatial relationship with other minutiae was compared to determine whether they were in agreement between two objects.

Results

Of the 149 images, 137 images were of "no value". 12 images, representing five distinct areas of FRD were rated as having value, though none had more than six visible minutiae. Among the "no value" images, 20 were of marks that were not FRD. These marks were created by an instrument or fingertip being dragged across the clay to smooth it, leaving a series of parallel striations.

All of the images contained small patches of friction ridge details, many no more than $1cm^2$ in size. However, none of the images contained high level details of a full fingerprint pattern. Of the five areas of FRD rated as having value, one was composed of a large area of palmar impressions. The other four areas were made using the tip of a finger. Comparison of the five areas of FRD resulted in source exclusions, meaning that none of marks "matched" each other.

Discussion

While none of the marks could be matched, their location and presence as a tool mark provided useful information regarding the manufacture of the figurines. Traceable fingerprints were usually on small appliques and bases or at the backs of the figurines which were not meant to be seen up close. Besides fingers, a stick-like object was also used to shape/flatten the surfaces. Disk-shaped appliques on the bench of the three seated grotesque figures or on the chair of a seated female musician for examples were definitely made in hand and pressed with a fingertip into their position (Figure 3 and Figure 4). The marks on the seat of a warrior show that the seat was also made independent of a mold and the artisan used his/her palm to shape it (Figure 5). The marks on the hems of the dress of an oklasma-dancer were generated by a finger trying to smooth a surface in a horizontal and vertical fashion, after the clay figurine was taken out of its front mold (Figure 6). Imprints of two fingertips on the backside of the crown of an archaic protome show where the artisan pressed the clay into the mold (Figure 7).

Conclusion

Unfortunately, the quality of the fingerprints on the terracotta figurines of the Tomb 4 at Assos, were not high enough to find a match, and their quantity (only 25 fingerprints in total) was not enough to produce any sort of statistically significant conclusions regarding age/sex. Yet, the overall study showed that a wider documentation of FRD data on terracotta figurines or pots (which serve as tool marks in the manufacturing process) in the future has a potential in revealing the production processes, workshop organizations, and trade relations in the Classical World. Further research on a much larger data is needed for the identification of the age (through analysis of ridge breadth) and the sex (through analysis of ridge density) of FRDs,

but once a reliable methodology is established, such a research could open new doors for the investigation of the social aspects of labor in the Classical World. In this respect, recording the details of FRD on ancient clay figurines and pots discovered from different cities of the Mediterranean world and establishing a computerized system with a data of electronical images (based on the basic principles of automated fingerprint identification systems used by governmental institutions for various purposes all around the world) could provide new research opportunities within Classical Archaeology.

Acknowledgements

We would like to thank Assos Excavation Director Nurettin Arslan, Troia Museum Director Rıdvan Gölcük and all the staff in the museum for making this research possible.

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Figure 1. Aerial View of the Western Necropolis of Assos with Tomb 4 marked with a red star.

Figure 2. A selected group of terracotta figurines from Tomb 4.

(All images © Assos Excavation and Troia Museum)

Figure 3. Three grotesque figurines (eating or offering bread) seated on a bench, fingertip imprint on the disk applique at the left corner of the bench (Cat. no. 8104).

Figure 4. Seated musician, fingertip imprint on the disk applique at the left corner of her stool (Cat. No. 8145).

Figure 5.
Seated warrior, detail of the base he is seated on with marks of a palm (Cat. no. 8123).

Figure 6.
Oklasma dancer with imprints of a finger used to smooth the clay surface of the hem (Cat. no. 8093).

Figure 7. Archaic protome, with fingertip imprints on the backside of the crown (Cat. no. 8141).

Gender in the Analysis of Domestic Space: A Theoretical and Methodological Approach

Selin Gür[a]

Abstract

Gender archaeology began to be discussed in the 1970s in Norway and then spread throughout the world due to the influence of feminism. It has been the focus of many studies especially in recent years. Gender studies in archaeology are intended to understand social structures by analyzing how roles change due to gender in material culture. This study describes the development of the theories of gender archaeology, its methodological difficulties, and its influence on the analysis of domestic spaces.

Keywords: gender archaeology, feminist archaeology, theoretical archaeology, gender roles, household archaeology

Özet

Toplumsal cinsiyet arkeolojisi dünyada ilk kez 1970'lerde Norveç'te tartışılmaya başlanmış ve zamanla, feminist akımların da etkisiyle dünyaya yayılmıştır. Özellikle son yıllarda dikkat çeken ve çalışılan bir konudur. Maddesel kültür kalıntıları aracılığıyla rollerin cinsiyetlere göre nasıl değiştiğini analiz ederek toplumların sosyal yapısını anlamayı hedefler. Bu çalışma toplumsal cinsiyet kuramlarının gelişimini ve metodolojik açıdan karşılaştığı zorlukları anlatmanın yanı sıra bu kuramların günümüz arkeolojisine ve hane analizlerine etkilerini de sunacaktır.

Anahtar Kelimeler: toplumsal cinsiyet arkeolojisi, feminist arkeoloji, kuramsal arkeoloji, cinsiyet rolleri, hanehalkı arkeolojisi

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Makale gönderim tarihi: 14.12.2020; Makale kabul tarihi: 22.01.2021

Introduction

The definition of gender has evolved over the years. Initially, socially constructed behaviors and the effects of temporal and spatial factors on human behavior were not adequately considered by archaeologists. This led to the assumption that gender was a constant phenomenon. However, feminist perspectives in archaeology have challenged this view and shown that a more nuanced approach is needed to understand the dynamic relationships between sex, gender, and social identity (Bolger 2013, 4). Feminists have discussed gender inequality, emphasized the social roles of women in the past, and demonstrated that the past has been interpreted from an androcentric perspective. Gender began to be discussed as a social construct with implications that transcend innate biological differences, i.e., sex. This discussion included determinants such as ethnicity, dynamic interaction in societies, social norms, values, and status. With the spread of the notion that gender is shaped by experience, sex and gender began to be evaluated separately, and previously ignored issues such as gender ambiguity, multiple genders, and queer identities began to be discussed (Geller 2009). Together with socio-political influences, the objective of gender archaeology is to develop a better understanding of the social identities of past societies (Bolger 2013, 6).

Until the feminist perspective won its place in archaeology, the need to define gender was ignored because it was believed that the current gender structures of western societies were ubiquitous (Brumfiel 2006). However, gender and its variations are of great importance in the social behaviors of people and societies. In the 1980s, Conkey and Spector said that there were serious methodological and theoretical deficiencies, and a total lack of direct studies of gender in archaeology, and that, when it comes to understanding gender behaviors, dogmatic beliefs were standing in for factual information. Since dogmas cause an unconscious bias, this is a critical problem (Conkey and Spector 1984, 2).

This study will show how gender theories have emerged and developed, present criticisms of gender archaeology today, and discuss gender's effects on the analysis of domestic space.

The Theoretical Development of Gender Archaeology

Aspects of gender in archaeology began to be discussed in the 1970s in Norway (Dommasnes 1992; Sørensen 2000). However, this discussion did not spread to English-speaking countries until the early 1980s due to a lack of translations (Trigger 1989, 458; Wylie 1991). Stereotyped opinions in archaeology must have affected the delay in gender studies, too (Wylie 1992). After the publishing of Gero's article, "Gender Bias in Archaeology: A Cross-Cultural Perspective", and Conkey and Spector's article, "Archaeology and the Study of Gender", gender studies began to gain importance in American archaeology (Gero 1983; Conkey and Spector 1984). Conkey and Spector's article was a significant critique of androcentrism in archaeology, and it constituted

the basis for subsequent feminist archaeological studies (Voss 2000, 182). These approaches to women and their role in societies can be better observed through social movements. The feminist movement aims to abolish the idea of patriarchalism (Funari and Camargo 2018, 31). Feminism was promulgated in three waves and their views of feminism differ among themselves.

The first wave of the feminist movement began in the early nineteenth century. In the early twentieth century, the goals of feminism were increasingly aligned with those espoused by Wollstonecraft, in her "A Vindication of the Rights of Women", which was one of the first feminist treatises acknowledged by English-speaking countries (Wollstonecraft 1792; Monroe 1987, 143; Funari and Camargo 2018, 31-32). Wollstonecraft's treatise argued in favor of egalitarian political rights and economic opportunities (Funari and Camargo 2018, 31). As the feminist movement began to develop, archaeological theories also progressed in tandem with the political situations of their times (Wylie 1992). Spencer-Wood refers to first-wave feminism as "feminist egalitarian liberal theory" (Spencer-Wood 2006, 66). The theory says that the modern world has projected its gender roles onto the entire history of humanity, that women have taken on various public and domestic roles, and that they should have a prominent place in the social sphere (Humm 1990; Spencer-Wood 2006).

Gender archaeology, in its fullest sense, developed on the basis of concerns raised during the second wave of feminism which began in the 1960s in the United States (Rivers 2017). It was inspired by De Beauvoir's "*Le Deuxième Sexe*" (De Beauvoir 1949; Funari and Camargo 2018, 32). De Beauvoir argued that political and legal equality were insufficient, and that sexism pervaded every aspect of life (Funari and Camargo 2018, 32). The movement claimed that the entirety of social life was male-oriented and that women's contributions to history were not taken into consideration either (Gilchrist 1999, 2-3). The Marxist-feminist theory also emerged as a sub-group of second-wave feminism[1]. It claimed that women's labor is ignored by the capitalist system and that men are favored by its division of labor (Spencer-Wood 2006, 74). Second-wave feminism broadly coincided with processual archaeology[2], so while environmental factors gained importance in archaeological research, gender dynamics were still being ignored[3].

The third wave of feminism emerged in response to the second wave. The third wave shares parallels with post-processual archaeology which tries to achieve a better understanding of societies by evaluating them in a broader social context together with concepts such as ethnicity, class, and age, while also arguing that gender is too complex to be associated with any social group (Trigger 1989, 459; Gilchrist 1999, 3; Spencer-Wood 2006, 76). The lack of interest in

1 For further information see also, Nelson 2006.

2 See also, Trigger 1989; Wylie 1996.

3 e.g., Binford 2001.

the individual began to receive more criticism with the rise of this theoretical movement and it accentuated the subjectivity of archaeological understandings (Wilkie 2016).

Although feminism has had a great effect on archaeology, gender archaeology should not be confused with feminist archaeology. Gender archaeology examines the representation of different gender roles, while feminist archaeology offers theoretical and political perspectives that are essential for criticizing masculine prejudices in the interpretation of gender roles and data concerning them[4]. Considering that gender roles cannot be explained by biological reductionism and that social roles reflect cultural differences, the feminist critique of archaeological studies examines androcentric gender studies thoroughly (Sørensen 2000). It dedicates its efforts to develop a more tolerant approach to diversity (Conkey and Gero 1997, 429). Spencer-Wood explains "all feminist research is concerned with gender, but not all gender research applies feminist concepts, theories, or methods" (Spencer-Wood 2006, 59). With feminism, archaeologists engage more critically with concepts such as women's role in and contributions to archaeology (Conkey 2003, 876). Meskell sees the development of gender archaeology as a set of three projects: criticizing androcentrism, rediscovering women and their contributions both in ancient societies and in the history of archaeology, and reconceptualizing the discipline itself (Meskell 1999).

There is still a lack of information about the effects of women in daily life, social life, and domestic life in Near Eastern societies. More detailed studies are needed to comprehend societies' perspectives on gender and to evaluate the contributions of women. Spector created an analytical scheme called a task-differentiation framework, to systematize observations of gender behaviors and to reevaluate the data from written sources (Spector 1983, 78). She claims that these activities should be discussed as dynamics of gender. Together with cross-cultural studies, Spector's framework can create a more neutral perspective and yield more reliable information (Conkey and Spector 1984, 24-25). Spector says that task-differentiation by gender has four interrelated aspects: the social, the temporal, the spatial, and the material (Conkey and Spector 1984, 25). This analytical scheme constitutes an ideal research paradigm especially for the Near East due to its applicability to different economic, ecological, and social groups.

Space, Culture and Gender in House and Household Archaeology

House and household archaeology sees houses as individual social units and focuses on them and their households to establish cross-cultural approaches (Hendon 1996, 45)[5]. Until the early

4 For further discussion of feminism in archaeology see also, Engelstad 2007.

5 Houses are not static entities; they are dynamic formations. It should be taken into consideration that the concept of the house has changed over the centuries to adapt to environmental conditions and climate changes, and houses have evolved to meet the needs of their occupants (Madella et al. 2013, 2). In general, a household comprises a group of persons who occupy a common house as a social unit where they share common activities, which, in effect are economic relationships (Foster 2009, 72).

1980s, studies were not referred to as house and household archaeology, however, the domestic structures of societies and groups were part of a variety of studies[6]. Flannery (1976) collected the theories and approaches mentioned in these studies of the internal and external factors in domestic groups in his edited volume on the Oaxaca Valley (see also, Foster and Parker 2012, 2). He and the contributing authors discussed house structure, specialized and gender-specific activity areas, and they examined economic exchange both at the local and regional scales (Foster and Parker 2012, 2). In 1982, Wilk and Rathje published an article on household archaeology in the journal *American Behavioral Scientist*. In this article, they tried to fill the gap between theories about cultural change and evolution, and practical archaeology. They argued that households and social groups interact directly with economic and ecological processes and therefore they can help in understanding processes of adaptation (Wilk and Rathje 1982). Interest in household archaeology has grown steadily and processual archaeology's interest in cultural differences has increased its appeal (Gero and Conkey 1991). Its main objective has been to find basic indications about human existence connected to daily life (Briz et al. 2012, 23), by focusing on the activities of people and their roles in the place where they lived, thus in a particular social context (Gero and Conkey 1991; Allison 1999).

Post-processual archaeology has made it possible to obtain more detailed information about human activities and human social life, as well as socio-cultural interactions within and between settlements. This led to the development of household archaeology. At the same time, it has also contributed to the research about site formation and the differences in human activities in dissimilar places (Madella et al. 2013, 2).

Tringham (1991) suggested implementing gender in household archaeological studies to obtain a better understanding of gender and status in societies. Since feminist criticism made archaeologists realize that they had transformed women into "faceless blobs" (Tringham 1991, 97), this contributed to significant steps in prehistoric archaeological research and the emergence of gendered spaces in archaeology. The studies started at the microscale, studying households separately, and men, women, and children and the division of labor among them began to be examined (Tringham 1991). Several studies have shown the importance of this approach, including those of Hastorf (1991) and Gilchrist (1993).

Hastorf demonstrated the importance of understanding gendered spaces in her study of the spatial distributions of food to see whether gender roles could be determined by analyzing the use of domestic space. She obtained information about household relationships based on food residues and interpreted the social status of women and men by looking at their dietary

6 The studies by Whiting and Ayres (1968), Rapoport (1969) and Clarke (1972) are excellent examples (Foster and Parker 2012).

intakes in order to understand Inka political influence in the Andes. She then compared the results with burials in the Montaro Valley and found that the diets of men and women were similar until the Inka influence appeared and differences in corn consumption became apparent (Hastorf 1991, 133). Women became more involved in the production of corn, and men grew more involved in its consumption. This claim is also supported by ethnohistorical sources, but women only continued these production activities in certain locations. Thus, gender roles must have been realigned after Inka control of the valley ended (Hastorf 1991). This study exemplifies pioneering use of material distribution to understand the relationships between gender, space, and politics.

Gilchrist's work in Medieval nunneries offers another great example of gendered spaces. Gilchrist set out to compare gendered social structures and demonstrated the importance of the relationships between time, class, and identity in archaeology. She showed the inadequacy of research on material culture in nunneries, and she tried to analyze the relationship between gender and space. She determined that material culture emerges as a result of the blending of social norms and cultural influences and is therefore important for understanding gender identity and that space is also a form of material culture. Gilchrist demonstrated that gender identity in Medieval monasteries was depersonalized and that nuns shared a common identity (Gilchrist 1993).

The phenomenon of gendered space has been widely discussed, yet there have also been biased approaches. Males have been often associated with the public sphere and females have been often associated with the private sphere[7]. This is because the stereotypical view of hunter-gatherer societies, sees men as the hunters who bring meat home, and women are seen as the gatherers who look after the house, forage, and raise the children (Moore 1988). Although this is no longer commonly accepted, many studies have been taken this view. Steadman says that this distinction is related to earlier biological distinctions. Since men are thought to be biologically stronger, heavier jobs are associated with men, while women are assigned safer roles such as taking care of the house and children. Therefore, intensive and heavy agricultural work can be given as a job example for men. Moreover, the idea that women provide for the continuity of generations may lead people to assign women to safer areas (Steadman 2016). These kinds of stereotypes make the division of labor more difficult to understand. In past studies, since certain activities and objects were directly related to specific genders and were not called into question or considered to have any other purposes, places were gendered based on these objects. To avoid this and to overcome stereotypes is not easy; however, interpreting the past based

7 Nevett (2015) discusses the gendered use of space in Olynthos. Earlier studies had defined some spaces as *andron*, men's quarters. However, finds associated with women were found throughout the site, which led Nevett to think that women also used these spaces at times. This demonstrates the importance of the distribution of finds on the concept of gender.

on today's conditions should no longer be done. These considerations directly affect the way archaeologists interpret the past. The understanding of particular artifacts and objects varies according to culture, too. Feminists argue that these roles should be discussed equally.

In order to differentiate between public and private spaces, the analysis of domestic space is necessary. This requires the determination of variability in dwellings by size, contents, and location (Bruck and Goodman 2012, 154). Specific spaces inside dwellings are assigned for household tasks, which makes it possible to derive information about households such as the interaction of their members, production, consumption, task division, and time management[8]. Hypotheses based mostly on ethnographic sources say that women were responsible for the tasks done inside the house, however, this remains only a theory (Hendon 1996). Bird's work is important for recognizing gender bias and cultural diversity. Bird documented his research in Aboriginal communities in Australia and showed that women were also involved in the production of stone tools (Bird 1993). Other ethnographic studies have shown that there are communities where women also hunt, thus confirming the importance of an objective approach to assessing and interpreting information (Bliege-Bird and Bird 2008). Conkey and Spector make important criticisms of previous studies of this subject. They describe the pestles in a series of burials. Pestles buried with women were interpreted as a part of women's cooking activities. However, pestles excavated from male burials were interpreted as indicating that men were involved in the production of these tools. The possibility of women taking part in the production or the exchange of these materials was overlooked due to masculine prejudices[9]. They described this as a "false notion of objectivity" (Conkey and Spector 1984, 6).

Apart from daily life, Giddens proposes that the human life-cycle and long-term time that transcends generations are also parts of the human comprehension of time and space. However, defining this is difficult because cultural groups may perceive it in other ways, and it may also vary by gender. Men and women may perceive time and space differently due to cultural norms and the differentiation of gender roles. In addition to the division of labor in daily life, gender also affects lifestyles in general (Giddens 1981, 19; Lyons 1992, 21). Since ways of life and the division of labor can change, not just according to culture, but also according to gender, both should be taken into consideration when examining societies.

8 For further discussion about household dynamics and activity areas cf. Bourdieu 1977 and Kent 1984.

9 Kehoe (2016) mentions a 3,000-year-old cemetery in Wisconsin. Comparing grave sites, various expensive copper finds and a piece of obsidian glass imported from a remote location in Wyoming were found in the graves of women and children, suggesting that the situation is not what most archaeologists thought it was and that ancient societies were more egalitarian (Kehoe 2016, 106-107).

Discussion and Conclusion

Gender initially began to be discussed in feminist treatises, and by the 1970s it was being included in archaeological research. By the 1980s, gender studies spread throughout English-speaking countries. Meanwhile, archaeology was criticized for apparently believing that all people in a society share the same values and that each society distinguishes itself from others by its values, thereby, deeming societies' identity to be innate and constant while ignoring individual identity. This began to change with feminist treatises (Funari and Camargo 2018, 33-34). When the second wave of feminism began, the importance of environmental factors in the interpretation of archaeological data began to be discussed (Binford 2001, 24; Funari 2003, 51). The third wave emphasized the importance of material culture and started to examine it along with factors such as ethnicity, social class, and age, which made identity a variable factor, too (Funari and Camargo 2018, 34). Archaeological research has not only focused on societies in general but also individuals (Kent 1990).

The concept of gender was not approached impartially due to masculine prejudices, especially in early research. Studies of hunter-gatherer societies considered men to have the role of hunters and women were considered gatherers. For this reason, men were associated with public spaces, and women were associated with more sheltered private spaces, and their activities were interpreted accordingly. The cultural identities of the societies were ignored at this stage, and it was thought that every settlement had the same social dynamics. The delayed participation of women in archaeological studies must have been one of the important reasons for this initial lack of objective interpretations (Trigger 1989; Gero and Conkey 1991; Nelson et al. 1994).

It is difficult to understand the domestic spaces where households spend time and work, the distribution of their tasks, and how roles and responsibilities may have differed. However, objective interpretations of material cultural remains in the analysis of space can prevent misdirection. It is thus important to determine research questions that avoid stereotypes. As with Conkey and Spector's burial examples, finds should not be schematized directly as the assigned activity of a particular gender. The cultural differences of societies, beliefs, and rituals should be approached from a broad perspective. A great example of this today is the Mosuo. The Mosuo are a small ethnic group, mostly matriarchal, living near China's border with Tibet, and their household decisions are made by elderly women (Hua 2001). This community, which has adopted an understanding of life that differs from the traditions and norms of the communities that surround them, is one of the best examples of variation in cultural identity.

Providing a case where both gender roles and domestic relations vary with the vicissitudes of time, such as the rise and fall of an empire, Hastorf (1991) sets a significant example for understanding the phenomenon of gendered spaces in the use of domestic space and proves the importance of temporality and spatio-temporal relationships in archaeological research.

Gilchrist's (1993) work on nunneries supports the idea that gendered spaces change over time. Feminist studies have taken the role of women on a wider scope, focusing on how spaces affect our understanding of gender roles. This has challenged the understanding of the public sphere as male and the private sphere as female, which is a stereotypical prejudice, and contributed to raising awareness about how the genders differ and how they are experienced.

Studies carried out over time have enabled the research to draw down from the macro-scale to the micro-scale. Studies of women and their roles in societies have moved to the household basis and a focus on how gender was distributed in domestic spaces. The temporal dimension is also included, and it has been acknowledged that social organization can change and adapt to different circumstances over time. Theories can be inherently gendered by the influence of the people who produce them. The main problem here is that fewer women participate in archaeological studies than men. In 2007, Conkey studied the issue of gendered theories by reviewing four readers of archaeological theory and she found that only 27% of the authors were female (Conkey 2007). This problem seems to persist right up to the present[10]. For this reason, theoretical archaeology needs to be thought more inclusively, and women should be encouraged to contribute to its theoretical framework. Only then, will it be easier to approach archaeology from different perspectives, to interpret it in diverse ways, and to avoid the pitfalls of stereotyping. This will increase archaeology's intellectual credibility by making it a more equitable discipline.

Acknowledgements

I would like to thank Prof. Dr. Mirko Novák for inspiring my interest in gender archaeology. I would also like to thank the anonymous reviewers for helping me to improve the manuscript. This work is supported by the Federal Commission for Scholarships for Foreign Students (FCS) of Switzerland [2018.0546].

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[10] For example, see *Journal of Archaeological Method and Theory 27* (2020). It includes only a single female lead author out of 12 articles.

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The Hand of Man – Oswald Spengler's Thoughts on Cultural Morphology and its Benefits for Current Archaeological Debates

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Abstract

Oswald Spengler, a brilliant yet controversial philosopher of history, is probably best known for his seminal "Decline of the West". In this book, Spengler boldly claimed to not only to contextualize world history, but also predict future developments on the basis of understanding cultures as cyclical entities with dynamics akin to those of organic beings. Misread, shunned, and finally subject to academic oblivion in the second half of the 20th century, aspects of cultural morphology are currently rediscovered by a variety of disciplines including palaeoanthropology, ancient history, and ancient Near Eastern studies as potentially powerful tools to review regional or supra-regional phenomena like crisis, change, and adaption from a different, "Spenglerian" angle. This contribution argues that aspects of morphological thought as outlined in the "Decline", but also in his later works can be immensely beneficial to scrutinize the mechanisms of change and apotheosis—the original meaning of "decline" in Spengler's work!—in prehistoric contexts. Case studies from archaeology are used as a backdrop to highlight the possibilities and limits of cultural morphology as a methodological baseline to engage in current archaeological debates.

Keywords: Near Eastern archaeology, philosophy, history, cultural morphology, Oswald Spengler

Özet

Parlak ama tartışmalı tarihçi-felsefeci Oswald Spengler, en çok, "Batı'nın Çöküşü" isimli meşhur kitabı ile bilinir. Spengler, bu eserde biyolojik varlıkların yaşam sürelerine benzeyen

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Makale gönderim tarihi: 2.12.2020; Makale kabul tarihi: 27.01.2021

döngülerden oluşan dünyanın tarihini çok farklı bir gözle okunmakla kalmamış, gelecek ile ilgili öngörülerde de bulunmuştur. 20. yüzyılın ikinci yarısında, yüzeysel okunması nedeniyle akademik dünya tarafından aforoz edildikten sonra; kriz, değişim ve uyum ile ilgili fenomenlerin daha derinden anlaşılabilmesi ve "Spenglerian" bakış açısıyla değerlendirilebilmesi için, kültürel morfoloji yaklaşımının bazı kavramları bugün paleoantropoloji, eskiçağ tarihi ve eski Yakındoğu araştırmaları tarafından yeniden keşfediliyor. Bu makale, Spengler'in "Çöküş" ve "İnsan ve Teknik" adlı kitaplarında uygulanan morfolojik düşünce tarzından yola çıkarak, prehistorik dönemlerdeki değişim ve tamamlanma gibi kavramların daha kapsamlı anlaşılabilmesi için çok faydalı olacağını savunuyor ve arkeolojik tartışmalarda kültürel morfoloji yaklaşımının sunabileceği imkânları ve kısıtlılıkları daha net gösterebilmek için arkeolojiden bazı örnekler paylaşılıyor.

Anahtar Kelimeler: Yakındoğu arkeolojisi, felsefe, tarih, kültürel morfoloji, Oswald Spengler

The Long Shadow – Spengler's Work, its Reception, and Recent Reappraisal

The past century—an "age of extremes" indeed (Hobsbawn 1994)—does not necessarily count as a centennial depraved of controversial scholars. Still, Oswald Spengler obtains a particularly awkward position within the realm of modern historians and philosophers, since he dramatically challenged the conventional approaches to philosophy and history alike. The publication of the first edition of his monumental "Decline of the West (*Der Untergang des Abendlandes*)"[1] (Spengler 2007) could not have been timed—by coincidence or not—more appropriately: it was released on September 18, 1918, just a few weeks before the official ending of World War I (Fink and Rollinger 2018b, 1), with a title then being read like a gloomy epitaph on the yet unparalleled devastation and carnage having ravaged through Europe, leaving millions dead, displaced, injured and severely traumatized.

Oswald Spengler, who advocated an explicit "non-scientific", holistic approach to "history, whose immanent language still has to be deciphered" (cf. Spengler 2007, 10; also see below) was convinced that the last surviving of world civilizations -their occidental, western derivative- was on the brink of fulfilment and would soon be succeeded by a nascent Asian civilization (Aksakal 2013, 283).

Spengler's opus magnum, however, cannot be merely simplified as a resigned farewell to occidental civilization that once believed in never-ending progress and prosperity. Its depth and

[1] Spengler's *opus magnum*, originally published in three separate volumes (two text volumes and one volume with indices), is referenced here after the reprint published by Albatros Publishers in 2007 (Spengler 2007). This complete edition in one single volume follows the 33.-47. revised edition of the first volume (published originally 1923) and the 31.-42. edition of the second volume (published 1922). All other sources were available to the author as original editions.

gravity lie in the unprecedented—and for his academic contemporaries outrageous—treatment of all cultures as fundamentally equal entities that rise, prosper and decline akin to the biological life cycle of living matter (Engels 2019, 3-4). In this utterly deterministic perspective, any nascent civilization inevitably bears the grain of demise, even in its seemingly most influential and flourishing period. This radical approach explicitly digresses from a common Eurocentric, nation-state-based, thus chauvinistic historiography (Christian 2015, 5; Sachsenmaier 2015, 71; Fink and Rollinger 2018b, 2-4) in favour of a system with cultures experiencing synchronized trajectories, but chronological offsets. The big merit acknowledged by eminent historians as Eduard Meyer lies in the abandonment of historical "monodimensionality" in favour of parallel cultural developments (Krebernik 2018, 240). Since no cultural cycle on the global timeline is in any sense "superior" to another, the "decline" is no judgemental label forced on a particular geographical, social or political body, but the inevitable "fulfilment", or apotheosis of its life cycle—a term (*Vollendung*) that Spengler himself eventually used synonymously for his concept (cf. Engels 2018-2019, 17).

To decipher the internal and external dynamics that set one cycle into motion and nudge it towards the tipping point, Oswald Spengler employed sources, disciplines, and methodologies as diverse as human evolution, religious studies, psychology, musicology, and linguistics to formulate his grand historical exegesis (Aksakal 2013, 283). After all, the "Decline" constitutes the last serious attempt to write a holistic, universal history of humankind. Needless to say, such a bold approach stirred up very mixed responses from the relevant academic units: Spengler's (nowadays challenged) historical model of only eight major "cultures", with three of them scrutinized in detail and labelled "Apollonian", "Faustian" and "Magian" (for general outline cf. Spengler 2007, 234-281; cf. also Gunter 2018, 189), already triggered, with the backdrop of a growing political radicalization in the wake of the post-World War convulsions, vivid debates in the early 1920s (Schröter 1922; Fink and Rollinger 2018b, 2-3).

His ardent criticism of National Socialist racial politics[2] and "Führer" euphoria[3], presented in his work titled "*Jahre der Entscheidung*" (Spengler 1933, published in English as "The Hour of Decision" (Spengler 1934)) ostracized him for good in the early Hitler regime, after initially having been elected senator for the German Academy in 1933 (Kidd 2012, 21-22; Engels 2019, 4-6). He predicted, not without a scent of clairvoyance, the catastrophic downfall of the

2 "But in speaking of race, it is not intended in the sense which it is the fashion among anti-Semites in Europe and America to use it today. Darwinistically, materially. Race purity is a grotesque word in view of the fact that for centuries all stocks and species have been mixed […]" (Spengler 1934, 219).

3 "The levelling out of brains is complete: one meets 'in the mass', wills 'in the mass', thinks 'in the mass'. Those who do not think with it, who think for themselves, are felt to be enemies" (Spengler 1934, 200).

"Reich" in not more than ten years shortly before he died of a heart attack in Munich on May 8, 1936 (Engels 2019, 6).

Another cataclysmic world war, destroying the lives of millions not even half a century after cannons were silenced in 1918, and the succeeding ideological and geographical divide between different world systems striving for supremacy seemed to have rendered Spengler's reading of world history anachronistic and obsolete at last. His legacy was only sporadically subject to discussion and largely restricted to specialized academic studies, without any major repercussion in mass media or the general public (cf. Zumbini 1976; Fisch 1985; exceptions like the monograph authored by Armin Baltzer (1956) prove the rule). In Turkey, Spengler's "fatalist" approach, which is surprisingly compatible with traditional Ottoman historiography and the likewise cyclical Islamic "*Weltanschauung*" (cf. Fisch 1985)[4], was sure enough at odds with a positivist, pro-Western historical agenda as endorsed by Arnold J. Toynbee, which was enthusiastically embraced by the political left in the early days of the Turkish Republic (Aksakal 2013, 284-285). He found, however, a small but devoted readership amongst conservative intellectuals who handpicked the passages from Spengler's works critical of occidental superiority, to back their national conservative, at most Islamic and anti-Western sentiment (Aksakal 2013, 290-297).

It was not until rather recently, however, that the apparent crisis of (western) liberal democracies, the distinct rise of authoritarian regimes, and violent clashes in urban centres fuelled by intercultural tensions triggered a renaissance in the critical acclaim of Spenglerian thought—not necessarily limited to a sarcastic acknowledgement of his most dismal predictions (cf. Glaser 2019).

An ever-growing output of both academic compilations and monographic contributions especially since the past two decades not only reviews the reception of Spengler in different political and academic environments (cf. Demandt 2017; Strasser 2018; Engels et al. 2018; Fink and Rollinger 2018a for more recent contributions). Some also succeed in adapting cultural morphology to current historical debates, while simultaneously performing the challenging, however beneficial balancing act to point out obvious errors and misconceptions in Spengler's original contributions without discarding the whole of his approach (cf. Engels 2018). That

[4] It would be exciting to explore further whether Islamic scholars like Ibn Khaldun, who likewise advocated a worldview with cyclic successions of civilizations (Alataş 2015; Önder and Ulaşan 2018), had a profound influence on Oswald Spengler's reasoning. The at first sight striking similarities, however, lose much of their obviousness when being scrutinized further: Unlike Spengler, Ibn Khaldun argues that every society experiences similar challenges; that aside, technology, a major concern for Spengler, plays a rather marginal role for Ibn Khaldun, while the effect of external attacks, a decisive issue for Ibn Khaldun, is negligible for Spengler (Önder and Uluşan 2018, 247-250).

aside; a variety of contributions boldly goes beyond the mere historical contextualization of Spengler's reading of history, and actively attempts to apply aspects of Spenglerian thought to a variety of ancient historical and current affairs debates (cf. Engels 2014). The windfall of this output for intimately related disciplines like paleoanthropology, ancient Near Eastern studies, and prehistoric archaeology seems to be still rather modest. However, a number of studies already embarked on the adventure of reconciling cultural morphology with archaeological or anthropological data, proving that certain aspects of Spengler's approach are far from being fringe broodings of a cultural pessimist, but well worth considering indeed.

"Nature Should be Treated Scientifically; History Should be Written as Poetry" – A Selection of Recent Spenglerian Approaches in Archaeological and Anthropological Contributions

Elite gift exchange, ritualized gift-giving and the accumulation of wealth in pre- and early historic times is a rewarding topic treated in numerous contributions (for Late Bronze Age source texts cf. Cochavi-Rainey and Lilyquist 1999 with references, e.g., Doğan and Michailidou 2008; Kelder 2009) ever since its profound socio-political dimension was defined by scholars like Bronislav Malinowski (esp. 1920, 1953) and Marcel Mauss (1950). A broadly set cross-cultural, cross-chronological comparative approach, as presented by Ann Gunter (2018), is using Spenglerian cultural synchronisms as a backdrop. Her essay can be read indeed as a fruitful alternative to more conventional studies, given the relative scarcity of diachronic and cross-spatial comparative studies in our field (Smith 2012; Gunter 2018, 191). Gunter's evaluation of the Neo-Assyrian and Inca empires' elite heritage—divided in time and space, but fatally united in morphologically determined mechanisms of status enhancement—beautifully highlights the role of state control and high culture formation processes with special reference to a chronologically indifferent consumption of aesthetic values (Gunter 2018, 198-201).

Spengler's "Romanticist essentialism" (Høyrup 2018, 221)[5] may not stand the test of historical and prehistoric data accumulated since the second half of the 20th century; it remains, however, particularly inspiring in its cross-cultural diversity, especially considering his thoughts on the diachronic morphological mechanisms of emerging early scientific thought, as prominently represented in ancient mathematics. Whereas other historians of science apply a probably no less "essentialist" one-track view of the evolution of numbers and formula from ancient Near Eastern origins until today, the plurality of mathematics within a cultural entity at a certain

[5] This expression, eventually coined by Jens Høyrup, implies that certain aspects of Spengler's train of thought are explicitly deterministic, as to say inherent Platonism, hence advancing towards a unchangeable goal. They, however breathe the spirit of a holistic, however likewise deterministic approach to nature, culture and civilization, which might be best circumscribed as "romanticism" (cf. Høyrup 2018, 221).

stage of its "Spenglerian wheel of destiny" is considered a stimulating counterweight (Høyrup 2018, 221-223).

Spengler's primary concern was to review—and forecast—the fate of cultural entities in an advanced stage of cultural and political complexity. A larger part of his work is therefore devoted to historical periods, empires, and nation-states, with written sources and contemporary historiographies as the backbone for their morphological autopsy. His considerations on early, prehistoric periods of human agency, albeit no less important to him, remained partly fragmentary, and are partly anachronistic in argumentation and scope. After initial scrutiny, and peeling off the layers of confirmed erroneous thought, certain facets of Spengler's grand morphological model reveals itself to be once more a fruitful arena to enrich current archaeological debates. In this context, his later (Spengler 1931, 1932) and also posthumously published work (Spengler 1965, 1966) is of particular interest, since it balances his underlying—and much-criticized—pessimistic view on world history at large with an alternative anthropological narrative, defining technology and its modern application as the pinnacle of humankind's cognitive and cultural evolution (Kidd 2012, 19-20).

Talking of which, Spengler's staunch opposition to the principles of Darwinian evolution and his persistent refusal to acknowledge a timescale extending over eventually millions of years to allow for the emergence of distinct human physical and mental features are sure enough a wrong and fruitless track. This cul-de-sac emerges due to our physical incapability to experience the geological *longue durée* of things (cf. Sloterdijk 2007, 18-19), and is advocated nowadays only by religious zealots and related tribal agglomerations of ill-informed creationism.

Spengler's rejection of evolution as the fundamental principle of nature—a rejection eventually coherent with the still meagre and dissonant (palaeo)anthropological database as of 100 years ago (Jöris 2018a, 103)—remains a major, in the light of his revolutionary reading of early, prehistorical human agency as presented in "Man and Technics" (Spengler 1932), however pardonable flaw. Clearly ahead of his times is the emphasis of environmental changes for shaping and enhancing the individual haptic and cognitive abilities of humans (Jöris 2018a, 103, 2018b, 11)—or ethology through the backdoor, as one might muse at that point, given Spengler's clear-cut opposition to pure Darwinian thought. Spengler's extensive deliberations on the role of the hand as the key to excel in a given environment, to interact with it, and eventually trigger changes that defy refined adaptions to enter a new "step" is a historical-philosophical framework that can be—and actually is—tapped by experts in the field of Pleistocene archaeology and Palaeoanthropology to put their own research into a more comprehensive perspective (cf. Jöris 2018a, 2018b).

Considerations involving morphological mechanisms, however, are not limited to a critical reappraisal of Spenglerian thought, or a cursory re-reading to extract the remaining value for

current debates[6] on a general level. Göbekli Tepe, for instance, being in the bright spotlight ever since its mass media-fuelled elevation to a primordial temple site at the "zero point of history", offers an ideal arena for rethinking its emergence, scope, and actual place within a post-Pleistocene society using a "Spenglerian" frame of reference.

The Last Glorious Fortress, or Cultural Morphology in Action – The Case of Göbekli Tepe

The site, located in the district of Şanlıurfa, Turkey, as a widely visible flattened peak embedded in the Germuş mountains ridge, rose to prominence after late field director Klaus Schmidt reevaluated the lithic material retrieved from a much earlier survey in this region (Benedict 1980; Dietrich et al. 2015) and recognized the significance of this site being primarily an early Holocene site, promising new insights into the earliest sedentary communities in this region (Schmidt 1995, 1998, 2000). The expectations were dramatically surpassed by the features unearthed already in the first field season, jointly organized by the Orient Department of the German Archaeological Institute and the local museum at Şanlıurfa (Schmidt 2000; Dietrich et al. 2015): the excavations revealed large circular or oval structures adorned with limestone pillars, many of them plain, but some decorated in high and low relief, amongst other sculptured elements. Most of them comprise architectural elements of buildings labelled "A"-"D" from "building level III" (but see Clare 2020, 85-86; Clare and Kinzel 2020, 32-33 for a probably necessary revision of Klaus Schmidt's stratigraphic assessment) which became the most iconic and still best-known features of the site (recent conspectus in Clare et al. 2019)—with an avalanche of pseudoscientific pulp in the wake of the first official broadcasts and publications that keeps distorting the view of this place and its cultural embedding (Zimmermann 2021).

Already Klaus Schmidt—and Harald Hauptmann as the initial project director back in the 1990s—pointed to the explicitly male, aggressive, and gloomy character of the site's iconography, which to an overwhelming degree consists of male teeth-gnashing carnivores and depictions of other potentially venomous creatures like scorpions and snakes (Schmidt 2009; Hodder and Meskell 2011; Dietrich 2017); a place, therefore, that rather renders the impression of a nightmarish panopticon to trigger responses like fear and disgust rather than awe-inspiring contemplation. The popular media, however, keeps perpetuating the narrative of an all-accessible, communal place of peaceful worship, foreshadowing the dawn of monotheistic belief systems and therefore being the cradle of modern Abrahamitic faiths (Zimmermann 2021, 145-146).

This ill-informed legacy of open-air sanctuaries loses further credibility when considering the fact that the prominent circular buildings were all roofed end entrenched, being hidden from

6 For a comprehensive overview on archaeological theories, reasoning and thought cf. Trigger 2003, 2014.

plain sight and therefore by no means widely visible landmarks but reclusive gathering spots (Banning 2011; Dietrich and Notroff 2015; Kodaş 2015; Kurapkat 2012, 2015).

The de facto absence of women in the artistic world of Göbekli Tepe, except a pornographic sketch of a naked female in the (later, or partly contemporary? See Clare 2020, 85-86) rectangular structure of "building level II" (space 38) (Dietrich et al. 2016; Hodder and Meskell 2011, 239; 241) is profoundly contrasting the ever-presence of ithyphallic renderings of mammals, little statuettes of males with erect penises and many other variations of male reproductive organs hewn into rock (Peters and Schmidt 2004, 204-205; Becker et al. 2012, 35). Therefore, the community that was actively using these structures for many centuries and formerly thought to be the founding fathers of institutionalized religion is now labelled a group resembling more and more a staunch secret society, performing some potentially wacky coming-of-age rituals in shadowy subterranean cult spaces (Dietrich 2017).

So, how to read all this within the frame of cultural morphology?

The artefact assemblages retrieved from Göbekli Tepe testify, together with the accumulated zoological remains, to a post-Pleistocene hunter-gatherer community being present at the spot for many centuries (Schmidt 1995, 1998, 2000). Until further notice, there is no unambiguous evidence for the domestication of plants or animals from neither the third nor the second occupation phase (Peters and Schmidt 2004). Recent evidence for domestic structures, some of them known from the initial fieldwork but never prominently presented (Clare 2020, 83-84), testifies to an early Neolithic village that emerged besides the popular ritual buildings. The overall character of the material culture, however, betrays a community dependent on hunting and gathering all along.

The complexity of Epipalaeolithic and Early Holocene nomadic societies, their ancestral heritage, rich mythology, and ability to create monumental works of art (with the towering wooden sculpture from Shigir, Southern Russia, now dated to 9600 cal BCE as one outstanding example) is a subject that rose to reinvigorated prominence in recent years (Arnold 1996; Sassaman 2004; Hoffecker and Hoffecker 2018; for Shigir cf. Zhilin et al. 2018; Bobrov in press). Their dispersal over vast, untamed patches of land, their immediate, occasionally dramatic exposure to climatic and environmental fancy (see also Spengler 2007, 593-595) eventually shaped a mindset and cognitive abilities referred to in Spengler's "*Der Mensch und die Technik*" (1931): the essential human, still untouched and untamed by Faustian technology, struggling to cope with the hardships and challenges of a changing early Holocene environment, and contextualize them through a staunch anachronistic celebration of his predatory legacy (Spengler 1931, 18-20).

The plot thickens that Göbekli Tepe, together with the ever-growing number of contemporary sites in the region bearing similar or identical features (Çelik 2011, 2016; Moetz and Çelik 2012), marks the apogee and gradual apotheosis of a historical cycle, hence the condensed cultural legacy of an epoch peopled by Late Pleistocene mobile hunters and gatherers. The monuments of Göbekli Tepe—and other sites still awaiting archaeological excavation—may therefore mark their fulfillment and decline, accompanied by a desperate perpetuation and glorification of past legacy and lore; literally the last stand of dwindling hunter and gatherer communities before ostracizing, or gradually assimilating them into the world of the Early Neolithic—a world with a very different economy, ecology, and iconography (Zimmermann 2020, 14-15). Such an alternative, "Spenglerian" interpretation, understanding Göbekli Tepe not as the exceedingly popular "zero point in history", but as the awe-inspiring "last stand" of a declining tribal migratory society might still be an isolated voice. A voice, however, that starts getting amplified in most recent contributions devoted to put places like Göbekli Tepe into a larger cultural-historical context (cf. Clare and Kinzel 2020, 65). Was then, at the end, staunch conservatism -and the desire to preserve a way of life that was doomed to fade- the driving force of this innovative Upper Mesopotamian *Spätzeit* hunter-gatherers that spawned such amazing monuments? The Harran plain with its ample evidence for sites with T-shaped steles (cf. Moetz and Çelik 2012) might then be understood as the final retreat for hunter-gatherer bands to perpetuate their conservativism. Spengler, not necessarily known as a flamboyant character, would probably entertain the idea of a wry smile in that case.

"History is Direction, But Nature is Extension" – Concluding Remarks

All previous considerations do by all means not claim to present a *deus-ex-machina* model for explaining the variety of phenomena mentioned in the text. Spengler's monumental oeuvre underwent—and still has to undergo—a rigid scrutiny to rectify his proven misconceptions that undoubtedly permeate his works (Engels 2018). His conceptual framework, however, is much too valuable and inspiring to be hijacked by modern apologetics of far-right ideologies. Nor should it be shunned, or even cancelled, by equally ardent block leaders from the opposite political spectrum—liberal only by name, but stuck in the straightjacket of post-modern arbitrariness.

Approached with an open, critical mind, "Spengler's long shadow" might—*mutatis mutandis*—turn out to be a beneficial guiding light, allowing for a fresh, alternative interpretation of pre- and early historic phenomena in a contextual frame where traditional methodologies would soon meet their limits. Other cases that seem ripe to test Spenglerian hypotheses, like the fate of Early Bronze Age elites, or the renaissance of "Hittite" legacies in the Early Iron Age, might then well be in focus for future studies.

Acknowledgements

The final version of this essay was submitted in February 2021. I am indebted to István Aranyosi, Bilkent University, for having proofread the text. I would also like to thank the two anonymous reviewers for their immensely valuable comments and suggestions.

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Dergi makalesi:

Bickle, P. 2020. Thinking Gender Differently: New Approaches to Identity Difference in the Central European Neolithic. *Cambridge Archaeological Journal* 30(2), 201-218. https://doi.org/10.1017/S0959774319000453

Kitap içi bölüm:

Esin, U. 1995. Aşıklı Höyük ve Radyo-Aktif Karbon Ölçümleri. A. Erkanal, H. Erkanal, H. Hüryılmaz, A. T. Ökse (Eds.), *İ. Metin Akyurt - Bahattin Devam Anı Kitabı. Eski Yakın Doğu Kültürleri Üzerine İncelemeler*, İstanbul: Arkeoloji ve Sanat Yayınları, 135-146.

Kitap:

Peterson, J. 2002. *Sexual Revolutions: Gender and Labor at the Dawn of Agriculture*. Walnut Creek, CA: AltaMira Press.

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Her iki yazarın soyadı ve yayın yılı (Dinçol ve Kantman 1969, 56).

Dergi makalesi:

Pearson, J., Meskell, L. 2015. Isotopes and Images: Fleshing out Bodies at Çatalhöyük. *Journal of Archaeological Method and Theory* 22, 461-482. https://doi.org/10.1007/s10816-013-9184-5

Kitap içi bölüm:

Özkaya, V., San, O. 2007. Körtik Tepe: Bulgular Işığında Kültürel Doku Üzerine İlk Gözlemler. M. Özdoğan, N. Başgelen (Eds.), *Türkiye'de Neolitik Dönem. Yeni Kazılar, Yeni Bulgular*, İstanbul: Arkeoloji ve Sanat Yayınları, 21-36.

Kitap:

Dinçol, A. M., Kantman, S. 1969. *Analitik Arkeoloji, Denemeler*. Anadolu Araştırmaları III, Özel sayı, İstanbul: Edebiyat Fakültesi Basımevi.

Üç ve daha çok yazarlı dergi makaleleri ve kitap içi bölümler

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İlk yazarın soyadı, "vd." ve yayın yılı (Özbal vd. 2004).

Dergi makalesi:

Özbal, R., Gerritsen, F., Diebold, B., Healey, E., Aydın, N., Loyet, M., Nardulli, F., Reese, D., Ekstrom, H., Sholts, S., Mekel-Bobrov, N., Lahn, B. 2004. Tell Kurdu Excavations 2001. *Anatolica* 30, 37-107.

Kitap içi bölüm:

Pearson, J., Meskell, L., Nakamura, C., Larsen, C. S. 2015. Reconciling the Body: Signifying Flesh, Maturity, and Age at Çatalhöyük. I. Hodder, A. Marciniak (Eds.), *Assembling Çatalhöyük*, Leeds: Maney Publishing, 75-86.

Editörlü kitaplar

Metin içerisinde:

Yazar(lar)ın soyadı ve yayın yılı (Akkermans ve Schwartz 2003).

Akkermans, P. M. M. G., Schwartz, G. M. 2003. (Eds.) *The Archaeology of Syria. From Complex Hunter-Gatherers to Early Urban Societies (c. 16.000-300 BC)*. Cambridge: Cambridge University Press.

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- Only the first letter of each word in titles and subtitles should be capitalized.

References

Cf.: In-Text Citations and References

- In-text citations should appear inside parenthesis (Author year, page number).
- Footnotes and endnotes should not be used for references. Comments should be included in footnotes rather than endnotes.
- The footnotes should be written in Times New Roman 10-point font, justified and single-spaced, and should be continuous at the bottom of each page.

Figures and Tables

- Please provide a caption list for figures and tables following the references. Provide credits where applicable. Each figure and table should be referenced in the text (Figure 1, or Table 1), but please do not include figures in the text document.
- Each figure should be submitted separately as a jpg or tiff file.
- Images should be submitted in the dimensions in which they should appear in the published text and their resolution must be over 300 dpi.
- Please avoid editing the figures in Photoshop or similar programs but send the raw version of the figures if possible.
- Tables and graphs prepared in Excel should be sent as both PDF and Excel documents.

Dates and Numbers

- Please use BCE/CE and please avoid using dots without dots (i.e., BCE instead of BC or B.C.).
- Please use a dot for numbers and dates with 5 or more digits (i.e., 10.500 BCE).
- Please avoid using dots for numbers and dates with 4 or less digits (i.e., 8700 BCE).
- Please spell out whole numbers from 0 to 10 (e.g., “the floor was renewed eight times” instead of “the floor was renewed 8 times”).

Punctuation

- Please prefer em dashes (—) for parenthetical sentences: “Children were buried with various items, the adolescents—individuals between the ages of 12-19—had the most variety in terms of grave goods.”
- Please prefer an en dash (-) between page numbers, years, and places: 1989-2006; İstanbul-Kütahya.

Abbreviations

- Commonly used abbreviations:

Approximately:	approx.	Figure:	Fig.
Confer:	cf.	*Id est:*	i.e.,
Circa:	ca.	*Exempli gratia:*	e.g.,
Calibrated:	cal.		

Special Fonts

- If a special font must be used in the text (e.g., Greek or Arabic alphabet or hieroglyphs), the text in the special font and the original manuscript should be sent in separate PDF files.

In-Text Citations and References

- Each article should contain a list of references in a section titled "References" at the end of the text. Please ensure that all papers cited in the text are listed in the bibliography.
- Citations in the text may be made directly, e.g., 'as shown by Esin (1995) ...' or in parenthesis, e.g., 'research suggests ... (Esin 1995)'.
- References within the same parenthesis should be arranged chronologically and separated with a ";", e.g., '... (Dinçol and Kantman 1969; Esin 1995; Özbal et al. 2004).'
- In references to the studies by the same author from different years, please use the last name of the author once, followed by the years of the cited studies, each separated by a ",", e.g., '... (Peterson 2002, 2010).
- More than one reference from the same author(s) in the same year must be identified by the letters 'a', 'b', 'c' placed after the year of publication.
- When dealing with multiple papers from the same author, single authored ones should be written before the studies with multiple authors.
- When dealing with papers where the first author is the same, followed by different second (or third, and so on) authors, the papers should be listed alphabetically based on the last name of the second author.
- When dealing with multiple single-authored papers of the same author, the papers should be listed chronologically.
- Please provide the doi numbers of journal articles.

Below, you may find examples for in-text citations and references.

Single-authored journal articles, book chapters, and books

In-text:

Last name and publication year (Esin 1995).

If the page number is indicated:

Last name and publication year, page number (Esin 1995, 140).

Journal article:

Bickle, P. 2020. Thinking Gender Differently: New Approaches to Identity Difference in the Central European Neolithic. *Cambridge Archaeological Journal* 30(2), 201-218. https://doi.org/10.1017/S0959774319000453

Book chapter:

Esin, U. 1995. Aşıklı Höyük ve Radyo-Aktif Karbon Ölçümleri. A. Erkanal, H. Erkanal, H. Hüryılmaz, A. T. Ökse (Eds.), *İ. Metin Akyurt - Bahattin Devam Anı Kitabı. Eski Yakın Doğu Kültürleri Üzerine İncelemeler*, İstanbul: Arkeoloji ve Sanat Yayınları, 135-146.

Book:

Peterson, J. 2002. Sexual Revolutions: *Gender and Labor at the Dawn of Agriculture*. Walnut Creek, CA: AltaMira Press.

Journal articles, book chapters, and books with two authors

In-text:

Last names of both authors and publication year (Dinçol and Kantman 1969, 56).

Journal article:

Pearson, J., Meskell, L. 2015. Isotopes and Images: Fleshing out Bodies at Çatalhöyük. *Journal of Archaeological Method and Theory* 22, 461-482.
https://doi.org/10.1007/s10816-013-9184-5

Book chapter:

Özkaya, V., San, O. 2007. Körtik Tepe: Bulgular Işığında Kültürel Doku Üzerine İlk Gözlemler. M. Özdoğan, N. Başgelen (Ed.), *Türkiye'de Neolitik Dönem. Yeni Kazılar, Yeni Bulgular*, İstanbul: Arkeoloji ve Sanat Yayınları, 21-36.

Book:

Dinçol, A. M., Kantman, S. 1969. *Analitik Arkeoloji, Denemeler*. Anadolu Araştırmaları III, Özel sayı, İstanbul: Edebiyat Fakültesi Basımevi.

Journal articles and book chapters with three or more authors

In-text:

Last name of the first author followed by "et al." and the publication year (Özbal et al. 2004).

Journal article:

Özbal, R., Gerritsen, F., Diebold, B., Healey, E., Aydın, N., Loyet, M., Nardulli, F., Reese, D., Ekstrom, H., Sholts, S., Mekel-Bobrov, N., Lahn, B. 2004. Tell Kurdu Excavations 2001. *Anatolica* 30, 37-107.

Book chapter:

Pearson, J., Meskell, L., Nakamura, C., Larsen, C. S. 2015. Reconciling the Body: Signifying Flesh, Maturity, and Age at Çatalhöyük. I. Hodder, A. Marciniak (Eds.), *Assembling Çatalhöyük*, Leeds: Maney Publishing, 75-86.

Edited books

In-text:

Last name(s) of the author(s) and publication year (Akkermans and Schwartz 2003).

Akkermans, P. M. M. G., Schwartz, G. M. 2003. (Eds.) *The Archaeology of Syria. From Complex Hunter-Gatherers to Early Urban Societies (c. 16.000-300 BC)*. Cambridge: Cambridge University Press.

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Last name, Initial of the first name. Title of the web page. Title of the website. Institution (where applicable), publication date. Access date. URL.