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İçindekiler / Contents

Studying Fingerprints in Archaeology: Potentials and Limitations of Paleodermatoglyphics as an Archaeometric Method

Aysel Arslan[a]

Abstract

Fingerprints are commonly found in archaeology, especially on objects made of clay such as pottery and figurines. It is possible to gain information about the individuals who left these prints through paleodermatoglyphics, the study of ancient fingerprints. This field of study combines forensic anthropology with archaeology and is useful in estimating the age and sex of the individuals who left the fingerprints as well as finding matching sets of fingerprints. These analyses have the potential to illuminate the nature of labor division in past societies. This article introduces paleodermatoglyphics and discusses its potentials and limitations as an archaeometric method.

Keywords: Fingerprints, paleodermatoglyphics, clay, age and sex estimations, labor division

Özet

Arkeolojik nesnelerde parmak izleri, özellikle çanak çömlek ve figürin gibi kilden yapılmış objelerde yaygın olarak karşımıza çıkmaktadır. Arkeolojik parmak izlerinin incelenmesini kapsayan paleodermatoglifik çalışmalar sayesinde bu izleri bırakan bireyler hakkında bilgi edinmek mümkündür. Adli antropoloji ile arkeolojiyi birleştiren bu çalışma alanı, parmak izlerini bırakan kişilerin yaşını ve cinsiyetini tahmin etmenin yanı sıra eşleşen parmak izi setlerini bulmakta da faydalıdır. Bu analizler, eski toplumlardaki iş bölümünü aydınlatma potansiyeline sahiptir. Bu makalede paleodermatoglifik yöntemler tanıtılmakta ve arkeometrik bir analiz yöntemi olarak sahip oldukları potansiyel ve kısıtlamalar tartışılmaktadır.

Anahtar Kelimeler: Parmak izleri, paleodermatoglifik çalışmalar, kil, yaş ve cinsiyet tahmini, iş bölümü

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Introduction

As humans, one of the ways we interact with the world is through touch. We hold and grasp the objects around us thanks to the furrows that cover the palms of our hands and soles of our feet. These furrows sometimes leave marks called friction ridges or epidermal ridges on the surfaces we interact with. Such imprints of epidermal ridges from human hands and feet are commonly found in archaeology, especially on clay surfaces. These prints have the potential to provide invaluable information about the people who left them, yet imprints have only been studied by relatively few researchers in the last few decades. By studying these prints, it is possible to identify specific individuals in a certain production area or reconstruct labor divisions by estimating the approximate age and sex of those who left them.

Paleodermatoglyphics deals with analyzing archaeological fingerprints. This article aims to introduce paleodermatoglyphics, a relatively unexplored methodological approach in understanding the organization of craft producers in archaeological contexts, and the most common methods that have been used by researchers in the last two decades. Therefore, I first briefly introduce the nature and development of fingerprints, then delve into the study of ancient fingerprints. Here, I introduce three main methodologies developed to infer patterns of labor division in past societies.

The Nature and Development of Fingerprints

Although fingerprint technically only refers to the impressions on the last finger joints, the term fingerprints is used interchangeably with epidermal ridges or friction ridges from anywhere on the palms and fingers in archaeology. Therefore, whenever fingerprints are mentioned in this article it refers to epidermal ridges in general and not only the prints on the last finger joints.

Epidermal ridges have been formed by evolutionary development over the millions of years and can be found in human hands and feet and in other primates—and where applicable, embedded in prehensile tails (Daluz 2015, 4). They are formed during gestation by the fourth month of prenatal development. This occurs as the fetus places pressure on the fingers to touch, thereby creating friction ridges. While developing in the womb, fingerprints form one of the three main pattern types: an arch, a loop, or a whorl (Figure 1). Each individual's epidermal ridges are considered unique and durable because once fingerprints are formed, they do not change. Therefore, in the last century, they have become the primary source of personal identification in the modern world. Both genetic and environmental factors affect the formation of fingerprints, which is why each fingerprint is unique. Not even identical twins, who share the same DNA, have identical fingerprints (McRoberts and McRoberts 2011).

Friction ridges are made of hundreds of friction ridge units, each containing a sweat gland and a sweat pore (Daluz 2015, 36-37). These do not always follow the same contour while being

formed as three main types of minute details called minutiae are formed during this process: bifurcations, ending ridges/short ridges, and dots (Figure 2). *Bifurcations* are forking or splitting one primary ridge into two. *Ending ridges* and *short ridges* are formed when the development of that primary ridge starts closer to the termination of ridge development during gestation. The length of the short ridge can sometimes be as small as only one friction ridge, which is usually called a *dot*. Another critical premise for fingerprint identification is the notion that fingerprints are permanent throughout an individual's lifetime. Thanks to the permanent nature of fingerprints, the minutiae are used to find matching sets of fingerprints in forensic investigations and archaeological research in order to identify individuals.

Although their shape and arrangement would never change, age is a factor that affects the sharpness of epidermal ridges as they become flattened, the skin becomes wrinkled and the size of the sweat pores and the hands increase when people get older (Maceo 2011, 16; Nagesh et al. 2011; Silva et al. 2016; Sánchez-Andrés et al. 2018). These result in wider epidermal ridge breadth as age increases.

Analyzing Fingerprints from Archaeological Contexts: Paleodermatoglyphics

Fingerprints offer an invaluable source of information for archaeologists. Paleodermatoglyphics, the study of ancient fingerprints, combines forensic anthropological analyses of fingerprints within the scope of archaeology. Once investigated thoroughly and with a large enough sample, it is possible to chronologically date objects if matching sets of fingerprints can be found, estimate the age and sex of those who left these fingerprints, and investigate on-site specialization.

Fingerprints can be commonly found in archaeological contexts. Objects made of clay are especially rich in retaining fingerprints thanks to clay's plasticity. Once dry, baked clay becomes chemically stable, enabling the prints to become permanent (Králík and Novotný 2003, 6). However, not all clay objects can retain fingerprints as the surface treatment of the object is crucial in the preservation and condition of the prints. If the object were wiped, smoothed, burnished, or polished after it was shaped, fingerprints would not preserve well. Apart from clay, archaeological fingerprints can be found on organic substances such as glue or wax, paper, photographic films, glass plates, brass or bronze objects, corroded metals that contain copper, paintings, sculptures, and various ethnographic objects, as well as the skin of mummies (Králík and Nejman 2007; Mull et al. 2011).

The earliest fingerprints, probably from a Neanderthal individual, were spotted on birch resin that was utilized to make arrows in Germany date to ca. 80.000 BP (Koller et al. 2001). The Gravettian open-air sites in Pavlov in Czechia and Krems in Austria from 27.000 to 24.000 BP, however, provide the earliest friction ridge impressions that belong to modern humans

(Svoboda et al. 2004, 256; Králík and Novotný 2005; Králík and Einwögerer 2007). These fingerprints, the most famous of which is the one on the back of the Dolní Věstonice female figurine (Králík et al. 2002), were unintentionally left on these objects such as anthropomorphic and zoomorphic figurines and amorphous clay blobs.

When people started using fingerprints as a form of identification is currently beyond our knowledge, but archaeological records suggest that this practice might have considerable antiquity, perhaps as old as thousands of years. The Chinese were the first to use epidermal ridge impressions for personal identification during the Qin dynasty, with the earliest examples dating to 221 BCE (Xiang-Xin and Chun-Ge 1988 in Barnes 2011, 9). Fingerprints were impressed on both sides of sealings in Ancient China to verify one's identity further (Berry and Stoney 2001, 13). The practice was intended to prevent people from breaking the seal and thus ensure the confidentiality of the message.

Some of the earliest research on fingerprints in the western world stems from impressions of fingerprints on the archaeological material (e.g., Faulds 1880; Galton 1892), yet archaeological fingerprints had been addressed in publications only sporadically until the 1980s (Badè 1934; Cummins 1941). Archaeologist Paul Åström in collaboration with the fingerprint specialist Sven Arne Eriksson did the first significant systematic work on fingerprints on the archaeological objects. They focused on fingerprints from Greece, Crete, and Cyprus, especially Mycenean pottery and Linear B tablets (Åström and Eriksson 1980). Ever since, there has been a steadily growing body of literature that focuses on different aspects of fingerprints in paleodermatoglyphics. These studies can be mainly divided into three categories: studies that focus on finding matching fingerprints, those that concentrate on age estimations by analyzing how hands grow through time, and those that focus on sex estimations from fingerprints. Some recent studies combine age and sex estimations to obtain a more holistic picture in the lives of past societies as well.

Fingerprint Matching

Fingerprints are used as forensic evidence to tie someone to a particular location or a crime thanks to their permanent nature. On the same premise, it is possible to look for individuals who left their fingerprints on multiple objects in archaeological assemblages by comparing and matching the minutiae of the preserved fingerprints. Especially if an automated fingerprint identification software is used, this method holds great potential to identify specific individuals working in a production area. It is also possible to chronologically match different objects because the fingerprints need to be left during the lifetime of the individual in question. However, this is a challenging task because fingerprints from archaeological contexts are usually fragmentary, and the degree of their preservation is not always very good.

Several researchers have been working on finding matching sets of fingerprints among the archaeological assemblages but with relatively limited success (Branigan et al. 2002; Lichtenberger and Moran 2018; Şare Ağtürk and Moran 2021). Keith Branigan, Yiannis Papadatos, and Douglas Wynn (Branigan et al. 2002) examined epidermal ridges on pottery from Ayia Kyriaki (cemetery site) and Fournou Korifi (settlement site) in Southern Crete, in order to identify matching sets of fingerprints. In the end, however, the researchers were restricted by the small number of well-preserved fingerprints. The dataset was too small and fragmentary; thus, they could not securely identify matching sets of prints. A similar problem occurred in Tuna Şare Ağtürk and Kimberlee Sue Moran's (Şare Ağtürk and Moran 2021) work on the ancient fingerprints on terracotta figurines from Assos. The researchers aimed to match 25 fingerprints located on 20 figurines from the same tomb (Tomb 4) in the Assos necropolis, but the fingerprints were not detailed enough to yield comparable results (Şare Ağtürk and Moran 2021, 101).

Some researchers have successfully found matching sets of fingerprints in archaeological contexts. Ancient oil lamps and figurines from the Late Roman ceramics workshop at Beit Nattif in Israel yielded numerous fingerprints on their internal surfaces left during the production process (Lichtenberger and Moran 2018). The researchers managed to match a single fingerprint with an arch pattern on multiple oil lamps, and these were located on the same spot and in the same orientation in each lamp (Figure 3). Their results show that the same individual made these lamps, and they also provide us with important information about their production process. Based on the location and orientation of these fingerprints, they deduced that the maker was holding the mold with their left hand and pressing the clay into the mold with their right hand. The same fingerprint was also found on a figurine, suggesting that the oil lamp specialist also worked with figurines.

Age Estimations

While the presence of children and the concept of childhood were mostly overlooked in archaeological interpretations until thirty years ago (Lillehammer 1989), the body of literature that tackles these topics have been gradually growing with more studies focusing on the presence and development of children in the past as well as their contribution to the archaeological record (Sofaer-Derevenski 1994, 2000; Park 1998, 2005; Crawford 1999; Kamp et al. 1999; Gilchrist 2000; Grimm 2000; Kamp 2001a, 2001b; Baxter 2005; Keith 2005; Smith 2005; Ardren and Hutson 2006; Lopiparo 2006; Menon and Varma 2010; Rockman 2013; Romero 2017; Stróżyk et al. 2018; Gagné 2019; Blaževičius 2019; Fernández-Navarro et al. 2022). Various theoretical and methodological approaches have been developed to look into the living conditions of children in the past.

Paleodermatoglyphics is yet another method through which children and childhood can be studied because the developmental stages until adulthood can be observed by studying fingerprints (Kamp et al. 1999; Králík and Novotný 2003; Králík et al. 2022). By measuring the breadth of the epidermal ridges in a specific area, it becomes possible to calculate the mean epidermal ridge breadth (MRB). In order to do this, one measures the distance between the edge of one epidermal ridge to the other in a predetermined length that goes through perpendicular to the epidermal ridges and then divides this measurement by the number of ridges it cuts (Cummins and Midlo 1943, 74; Králík et al. 2022, 380). Although the initial patterns of the prints do not change throughout someone's life, the distance between each epidermal ridge increases as they grow up until they reach adulthood. Therefore, by measuring the MRB of fingerprints, it is possible to estimate the approximate age of children and juveniles. However, once they become adults and stop growing, their MRBs do not change.

The work on figurine and pottery production among the Sinagua, an ancestral Puebloan group in northern Arizona, by Kathryn Kamp and their colleagues (Kamp et al. 1999) was the earliest study that focused on age estimations from fingerprints on archaeological finds. Their study compared 26 animal figurines and 31 corrugated vessels from Sinagua. In order to perform the analyses, they collected and measured inked fingerprints from 107 individuals aged between 36 months to adulthood (Kamp et al. 1999, 311). They developed the following regression equation to estimate the age of the individuals based on Mean Epidermal Ridge Breadth (MRB) to identify child and adult potters:

$$KA: Age\ (month) = 614 \times MRB\ (mm) - 112$$

Based on this equation, they suggested that those who made the figurines were between 8.5-18 years old with an average age of 11-13, while those who made the pots were mainly adults; only occasionally child prints were identified on pottery.

Building on Kamp et al.'s work, Miroslav Králík and Vladimír Novotný (Králík and Novotný 2003) developed various methods and equations to estimate age and sex from epidermal ridge breadth. They did a blind study on estimating age and sex from fingerprints taken from modern clay objects at a ceramics workshop. This study contains three different groups. The first group consists of 56 children; the second group of 20 adult professional skilled ceramicists; and the third group of non-professional, unskilled adults and subadults. Since the surface of the artifacts made by these groups were complex, just like archaeological objects, most of the fingerprints were fragmentary. The samples were collected and analyzed blindly (i.e., without knowing whose fingerprint was found on the surface of the objects). When they applied Kamp et al.'s (1999) model to estimate age, researchers realized that the results were inconsistent because Kamp et al. did not consider the clay shrinkage rate. The results became consistent once this data point was added to the calculations (Králík and Novotný 2003; Figure 4). They also

proposed an adjusted age estimation model with the shrinkage rate of clay in mind that became the primary method for estimating age in future publications worldwide:

$$ModKA: Age\ (month) = 614 \times 1.08108 \times MRB\ (mm) - 112$$

One of the studies that applied Králík and Novotný's regression model for estimating age is the work by Povilas Blaževičius (Blaževičius 2019). This work explored the scale and nature of child labor in the production of ceramic objects by analyzing the finger and palm prints on clay artifacts from the 13th to 18th centuries in the Vilnius Lower Castle, Lithuania. Out of more than 23.000 clay objects, including bricks, roof tiles, floor tiles, stove tiles, and household wares, only 1.47% yielded epidermal ridges. Their results suggest that child prints were relatively few between the 13th and 16th centuries (ca. 33%) as opposed to the 17th and 18th centuries (ca. 66%), with an average of 12-13 years. The analyses show that children started working from the ages of eight or nine. After 11-12, the number of children in the workforce grew considerably, up to 25% of total production.

Sex Estimations

Apart from age, many researchers have also focused on sex estimations in order to gain knowledge about sex-based labor division in the past (Hruby 2007, 2011; Kantner et al. 2019). Labor division, especially in pottery production, has been an important discussion topic in archaeology. The mainstream views link pottery production at the household level with females while they suggest that males were producing the standardized pottery at workshops (Arnold 1985, 106). This hypothesis stems from gender-biased ethnographic research without much conclusive proof especially regarding prehistoric communities. Paleodermatoglyphics can be useful to prove or disprove such assumptions. While the equations that calculate the Mean Ridge Breadth (MRB) can be used for age estimations for children and juveniles, they do not yield conclusive evidence for sex estimations for adults. In principle, within a population, adult males tend to have larger hands and fingers due to sexual dimorphism, which means that the MRBs of adult males are larger than adult females on average (Králík and Novotný 2003, 21). This makes it possible to identify adult males to some extent. However, the adult female range is somewhere between the adolescents and adult males, making interpretations more challenging (Figure 4).

Since the 1920s, researchers have known that epidermal ridges have sex-based differences (Hecht 1924; Cummins et al. 1941; Ohler and Cummins 1942), but the number of studies that focus on identifying that difference increased in the last two decades (Acree 1999; Gungadin 2007; Gutiérrez-Redomero et al. 2008, 2013, 2014; Kanchan et al. 2013; Öktem et al. 2015; Dhall and Kapoor 2016; Rivaldería et al. 2016; Sánchez-Andrés et al. 2018). These studies focus on estimating the Mean Epidermal Ridge Density (MRD) instead of the abovementioned method. This method measures the number of ridges in a predefined area (Gungadin 2007) of usually

25 mm^2 and shows that males' and females' mean epidermal ridge density differ significantly within the same population (Acree 1999; Gungadin 2007; Gutiérrez-Redomero et al. 2008, 2014; Öktem et al. 2015).

Several studies made use of the MRD method to gain information about sex-based labor division in the past. The first of these was Akiva Sanders' work on the organization of pottery production at Tell Leilan (Sanders 2015). He takes the shrinkage rate of clay into account in his analysis and shows that while ceramic production was not a gendered task before state formation, it became an exclusively male-dominated task with the rise of urbanism. Another study worth mentioning is by Lucy Bennison-Chapman and Lori Hager (Chapman and Hager 2018). They employed Reflectance Transformation Imaging (RTI) on clay objects from the Pre-Pottery Neolithic site of Boncuklu Höyük in order to understand the nature of labor division at the site. They report that the majority of the fingerprints belonged to females with much fewer male prints suggesting a sex-based labor division at Boncuklu in the production of clay objects. However, it should be noted that this study does not take the shrinkage rate of the clay into account, which might skew the results towards females.

Despite the difficulties in sexing adult fingerprints by measuring MRBs, John Kantner and their colleagues successfully applied this method to their dataset and obtained interesting results. Their work aims to understand the sex-based division of labor in pottery production, especially in making the corrugated vessels, in the Ancestral Puebloan community dating to the 10th and 11th centuries CE at Chaco Canyon (Kantner et al. 2019). Since corrugated vessels were made by pinching coiled clay together, the makers left many fingerprints on the surface. The researchers examined fingerprints on 985 corrugated pottery sherds from the Blue J Ancestral Puebloan community (Figure 5) with Králík and Novotný's model (2003) and concluded that about 47% fall into the adult male category while about 40% belong to adult female or juvenile category with an overlap of 12.5% that might belong to either males or females. Their analysis suggests that both males and females were involved in the production of corrugated vessels at the Blue J Ancestral Puebloan community. However, when examined chronologically, data suggests that older corrugated vessels (produced before 1040 CE) were made primarily by males, while both sexes were equally involved in making the later ones (Kantner et al. 2019).

Last but not least, Kent Fowler and their colleagues examined pottery sherds from the Early Bronze Age site of Tell eṣ-Ṣâfi/Gath in Israel by combining the MRB and MRD methods to understand the organization of crafts production (Fowler et al. 2019, 2020). They developed an age/sex identification matrix and took the shrinkage rate into account. Their analyses suggest that men tended to be more involved in the production process than women, yet potters from both sexes probably made almost all vessel types (Fowler et al. 2020). They could also demonstrate the work of multiple people on the same vessels with older adolescent or adult

prints together with young members of the potters, possibly apprentices. Their results suggest that males, females, and teenagers of both sexes were involved in pottery production to some extent at the site.

Discussion and Conclusion

Despite the promising results published in anthropology, especially in the last two decades, fingerprint matching or sex and age estimations through fingerprints have attracted little attention from archaeologists so far. Even scholars criticizing gender-based assumptions in studies on prehistoric divisions of labor do not discuss the information gained from paleodermatoglyphic analyses (see for example, Bolger 2013), possibly due to the relatively unknown nature of the method among archaeologists. Nonetheless, there is a growing body of literature in archaeology that utilizes paleodermatoglyphics, especially in the last five years (Hruby 2007, 2011; Sanders 2015; Bennison-Chapman and Hager 2018; Dorland 2018; Lichtenberger and Moran 2018; Stróżyk et al. 2018; Blaževičius 2019; Fowler et al. 2019, 2020; Kantner et al. 2019; Arslan 2022; Fernández-Navarro et al. 2022). These will undoubtedly accelerate the improvement and fine-tuning of the methodologies discussed above and the invention of new ways to examine fingerprints from archaeological contexts.

Analyzing fingerprints from archaeological contexts can help researchers to reconstruct not only the age and sex-based labor divisions in the past but also infer the minimum number of individuals working in a specific production area. However, each method discussed above has some limitations when applied to archaeological fingerprints. The age estimation equations were developed for archaeological samples with the clay shrinkage issue in mind. Still, one of the drawbacks of the method is the lack of comprehensive reference sets apart from the one provided by Králík and Novotný in their 2003 study discussed above. This reference comes from the modern Czech population and the results might not be applicable to other parts of the world or past populations. The MRD method for sex estimations was also developed to study differences within the same population, so it requires a large enough sample to work successfully. Moreover, forensic studies established this methodology for modern populations whose fingerprints are recorded with traditional methods on a flat surface such as with ink and paper. As they do not use imprints on clay, the shrinkage rate of clay is not an issue they factor in their analyses. Applying the MRD method to archaeological clay objects requires an additional step of calculating the shrinkage of the clay being used, which sometimes gets overlooked. Shrinkage is not an issue when it comes to epidermal ridges left on other types of materials such as paper, photographic films, glass, paintings and metal objects, because they would not shrink. Therefore, fingerprints found on such surfaces can be directly measured and compared to modern samples.

It is possible to differentiate male and female fingerprints by measuring various parts of hand and fingers, yet these measurements need to be taken from the exact location on all samples to ensure the results are not skewed (Dhall and Kapoor 2016; Králík et al. 2022). Moreover, a recent study compared the MRB measurements from 58 positions of the hands of 90 school children and demonstrated that the region of the hand the measurements are taken might also significantly affect the outcome (Králík et al. 2022, 393). It is, however, seldom possible to consistently find the exact location of the hands or even fingers imprinted on clay in the archaeological record. Then, estimating age or sex from epidermal ridges on archaeological materials is not as conclusive as doing it on samples from modern populations. Therefore, research on more refined methods that can be better applied to archaeology continues.

Despite the decades-long history of research on ancient and modern fingerprints, dermatoglyphics and paleodermatoglyphics are still developing fields of research. Researchers continue to refine methods and equations to estimate sex and age both among modern and ancient populations. Therefore, it holds much potential to provide more information about the people who lived in the past.

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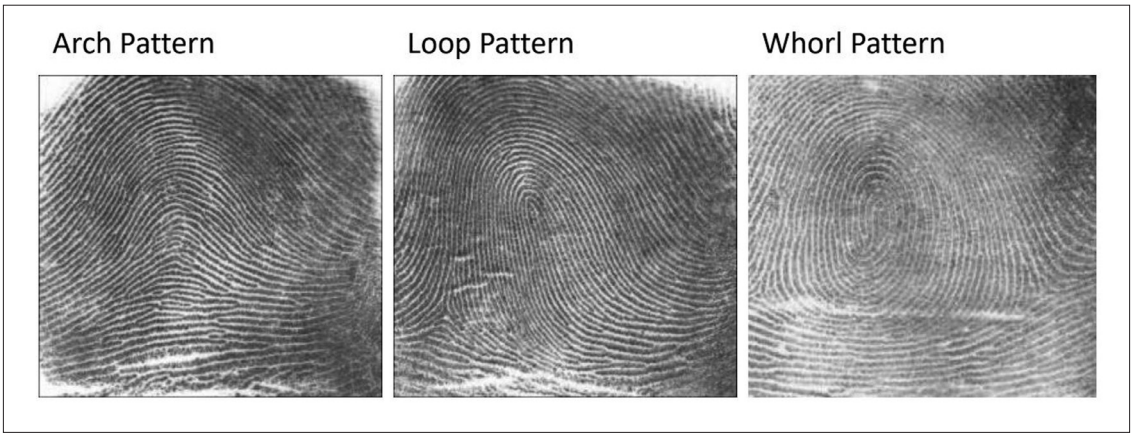

Figure 1. Basic fingerprint pattern types: arch, loop, whorl.

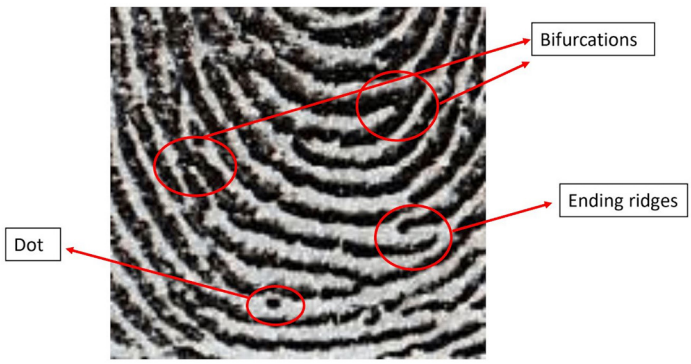

Figure 2. Minutiae on a fingerprint: Bifurcations, ending ridges and a dot are visible.

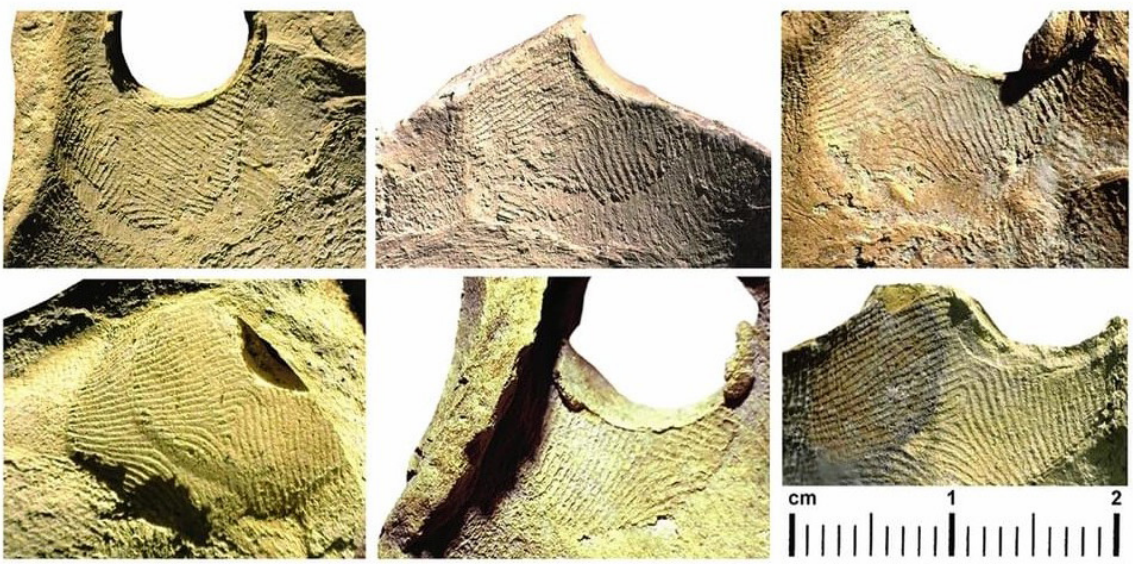

Figure 3. The same fingerprint with an arch pattern on multiple oil lamps from a Late Roman workshop at Beit Nattif in Israel (Lichtenberger and Moran 2018, Fig. 4b)

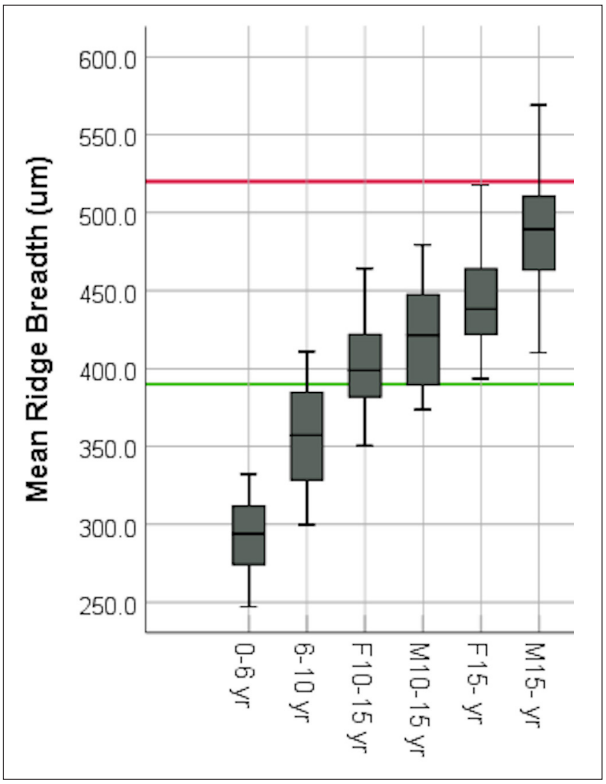

Figure 4.
Boxplot showing the Mean Ridge Breadth (MRB) measurements of the reference from the modern Czech population provided by Králík and Novotný 2003. 0-6yr are children up to 6 years old, 6-10yr are children between 6 and 10 years old, f10-15yr are females between 10 and 15 years old, m10-15yr are males between 10 and 15 years old, f15-yr are adult females over 15 years old, and m15-yr are adult males above 15 years old.
The red horizontal line and above represents only adult males, below the green line are only adolescents and children below 15 years old.

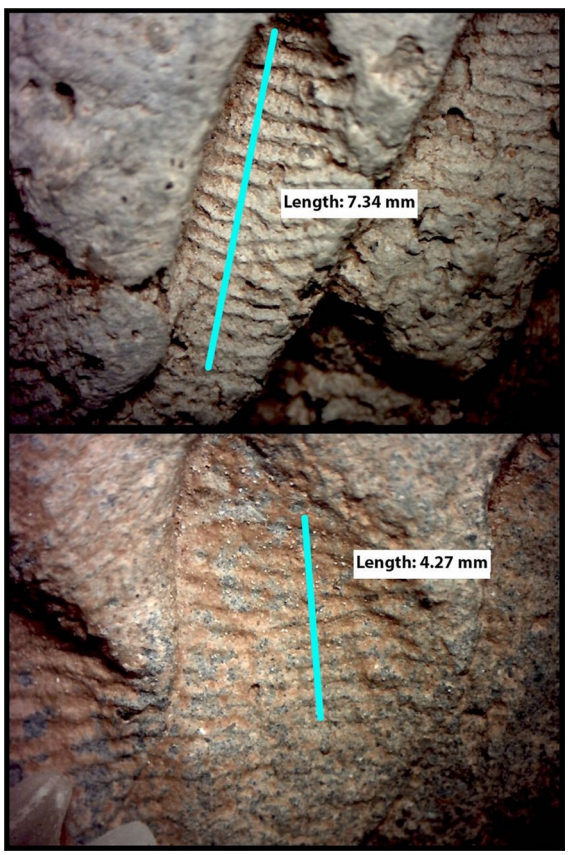

Figure 5.
Fingerprints on corrugated vessels from the Blue J Ancestral Puebloan community. Measurements the Mean Ridge Breath (MRB) are taken perpendicular to the epidermal ridges (Kantner et al. 2019, Fig. 3).

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- Makalede özel bir font kullanıldıysa (Yunanca, Arapça, hiyeroglif vb.) bu font ve orijinal metnin PDF versiyonu da gönderilen dosyalar içerisine eklenmelidir.

Metin içi Atıflar ve Kaynakça Yazımı

- Her makale, metin içerisinde atıf yapılmış çalışmalardan oluşan ve "Kaynakça" olarak başlıklandırılan bir referans listesi içermelidir. Lütfen metin içerisinde bulunan her referansın kaynakçaya da eklendiğinden emin olun.
- Metin içerisindeki alıntılar doğrudan yapılabilir: '…Esin (1995)'in belirtmiş olduğu gibi' ya da parantez içerisinde verilebilir: 'analiz sonuçları gösteriyor ki … (Esin 1995).'
- Aynı parantez içerisindeki referanslar yayın yılına göre sıralanmalı ve ";" ile ayrılmalıdır: '… (Dinçol ve Kantman 1969; Esin 1995; Özbal vd. 2004).'
- Aynı yazarın farklı yıllara ait eserlerine yapılan atıflarda yazarın soyadı bir kere kullanılmalı ve eser yılları "," ile ayrılmalıdır: '... (Peterson 2002, 2010).'
- Aynı yazar(lar)ın aynı yıl içerisindeki birden fazla yayınına referans verileceği durumlarda yayın yılının yanına harfler 'a', 'b', 'c' gibi alfabetik olarak koyulmalıdır.
- Tek yazarlı kaynakları, aynı yazar adıyla başlayan çok yazarlı kaynaklardan önce yazınız.
- Aynı yazar adıyla başlayan fakat farklı eş yazarlara sahip kaynakları ikinci yazarın soyadına göre alfabetik sıralayınız.
- Aynı yazara ait birden fazla tek yazarlı kaynak olması durumunda kaynakları yıllara göre sıralayınız.
- Dergi makaleleri için doi bilgisi varsa kaynakçada mutlaka belirtiniz.

Aşağıda, farklı kaynakların metin içerisinde ve kaynakçada nasıl yazılacağına dair örnekler bulabilirsiniz.

Tek yazarlı dergi makaleleri, kitap içi bölümler ve kitaplar

Metin içerisinde:

Yazarın soyadı ve yayın yılı (Esin 1995).

Sayfa sayısı bilgisi verilecekse:

Yazarın soyadı ve yayın yılı, sayfa sayısı (Esin 1995, 140).

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.

İki yazarlı dergi makaleleri, kitap içi bölümler ve kitaplar

Metin içerisinde:

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

Metin içerisinde:

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.

Web kaynağı:

Soyad, Ad. Web Sayfasının Başlığı. Web Sitesinin Adı. Yayınlayan kurum (varsa), yayın tarihi. Erişim tarihi. URL.

ARKEOLOJİ BİLİMLERİ DERGİSİ

TURKISH JOURNAL OF ARCHAEOLOGICAL SCIENCES

Submission and Style Guideline

Submission Criteria for Articles

The content of the manuscripts should meet the aims and scope of the Turkish Journal of Archaeological Sciences (cf. Aims and Scope).

Manuscripts may be written in Turkish or English. The translation of articles into English is the responsibility of the author(s). If the author(s) are not fluent in the language in which the article is written, they must ensure that the text is reviewed, ideally by a native speaker, prior to submission.

Each manuscript should include a Turkish and an English abstract of up to 200 words and five keywords in both Turkish and English. Citations should not be included in the abstract.

If the author(s) are not fluent in the language of the manuscript, a translation of the abstract and the keywords may be provided by the editorial board.

Manuscripts, figures, and other files should be sent via wetransfer or e-mail to **archaeologicalsciences@gmail.com**

Submission Checklist

Each article must contain the following:

- Authors (please provide the name-last name and contact details of each author under the main title of the manuscript)
- Affiliation (where applicable)
- E-mail address
- ORCID ID

The manuscript should contain:

- Title
- Abstract (in English and Turkish)
- Keywords
- Text
- References
- Figures (when applicable)
- Tables (when applicable)

Scientific Standards and Ethics

- Submitted manuscripts should include original research that has not been previously published or submitted for publication elsewhere.
- The manuscripts should meet scientific standards.
- Manuscripts should use inclusive language that is free from bias based on sex, race or ethnicity, etc. (e.g., “he or she” or “his/her/their” instead of “he” or “his”) and avoid terms that imply stereotypes (e.g., “humankind” instead of “mankind”).

Style Guide

Manuscript Formatting

- Manuscripts should be written in Times New Roman 12-point font, justified and single-spaced. Please submit the manuscript as a word document.
- Words in foreign and ancient languages should be *italicized*.
- Titles and subtitles should appear in **bold**.
- Titles and subtitles should not be numbered, italicized, or underlined.
- 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.

Web source:

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