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Animal Footprints on Roman Tiles from Perge and Aizanoi

BAHAR OĞUŞ*

Abstract

For many years, tremendous interest has been reserved for the most beautiful, the largest, and the most spectacular of finds. This is especially true in the field of Classical archaeology. This has often resulted in an unfortunate disregard for other finds such as traces. Indeed every object from the past has valuable information to convey to us. The task of archaeologists is to examine the object at hand without prejudice. This study focuses on terracotta building materials with such traces. Examples from Perge and Aizanoi are analyzed from an ichnoarchaeological viewpoint, and interpretations regarding the environment and the economy of the relevant time period are offered on the basis of this analysis. The finds revealed that the environment surrounding the workshop area in Aizanoi was wider than the one in Perge. In this period, it is thought that Aizanoi had an open geography with little forestation and climatic conditions similar to current times.

Keywords: ichnoarchaeology, animal footprint, brick, tile, Perge, Aizanoi

Öz

Uzun yıllar boyunca, özellikle klasik arkeoloji alanında, en güzele, en büyüğe, en gösterişli olana ilgi gösterilmesi, ortaya çıkarılan bazı malzemelerin kenarda kalmasına yol açmıştır. Öte yandan, geçmişe ait her nesnenin bize aktaracağı bilgiler vardır. Arkeoloğa düşen görev, nesneye önyargısız bir şekilde yaklaşmaktır. Bu çalışmada, Perge ve Aizanoi'a ait, üzerinde "iz" bulunan pişmiş toprak yapı malzemeleri ele alınmış, izler *ikhnoarkeoloji* bakış açısıyla irdelenmiş ve elde edilen sonuçlardan, nesnenin üretildiği dönemdeki çevresel koşullara ve ekonomik duruma ilişkin yorumlar yapılmaya çalışılmıştır. Elde edilen bulgular, MS 2. yüzyılda, Aizanoi'daki atölyeyi çevreleyen ortamın, Perge'dekinden çok daha vahşi olduğunu ortaya çıkartmıştır. Bu dönemde, Aizanoi'un etrafı açık, seyrek ağaçlı bir coğrafyaya ve bugünküne benzer iklim koşullarına sahip olduğu da söylenebilir.

Anahtar Kelimeler: ikhnoarkeoloji, hayvan ayak izi, tuğla, kiremit, Perge, Aizanoi

Many artefacts revealed in excavations are often not included in the final analysis. Among these artefacts are terracotta building materials that contain traces routinely labelled as "faulty / imperfect" by some researchers in our country. This study focuses on these materials with traces, often considered unworthy of examination based on the argument that traces were

* Ph.D. (cand.) Bahar Oğuş, İstanbul Üniversitesi, Sosyal Bilimler Enstitüsü, Arkeoloji Doktora Programı, 34116 İstanbul, Türkiye. E-mail: ogus.bahar@gmail.com; https://orcid.org/0000-0002-6151-1627

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randomly formed during the drying process. Nevertheless, it is still worthwhile to give attention to this subtle material from the past, as it can speak to the actual lives behind its creation. The discipline of Classical archaeology predominantly adopts an art history methodology. However, the greater application of the study of traces will better support the overall aim of the science of archaeology: the reconstruction of the past and our understanding of it.

Ichnology is the study of traces left by organisms on or within a substrate. The field examines both the formation processes of the trace and the trace itself.[1] Analyzing trace fossils offers notable and substantive contributions to the fields of paleoenvironment, paleoanthropology, stratigraphy, archaeology, etc.[2] However, it is not easy to draw a clear line between archaeology and ichnology based on physical evidence. Baucon et al. established a framework for the application of ichnological methods in archaeology by presenting them as ichnoarchaeology.[3] As examples, an oil lamp is obviously an archaeological artefact, while dinosaur footprints present ichnological evidence. In a more complex example, borings in a marble pillar left by a mollusk can be interpreted within an ichnoarchaeological framework as a bioerosion trace,[4] but could also be interpreted as an indicator of sea-level variations.[5] Similarly, hoof traces found inside thick layers of dung that had piled up and pressed against each other indicate the limited number of sheep / goats that were kept in the Aşıklı Höyük, the ninth millennium BC settlement in Anatolia.[6] Horse footprints unearthed in the Bronze Age settlement of Qatna provide very important data on the use of horses as pack animals.[7]

Within the context of Classical archaeology, animal footprints in bricks and tiles have been examined in the Roman fortress of Vindolanda in England, Brigetio in Pannonia, Kefar 'Othnay in Israel, and Cibalae in Croatia. Information about the fauna around these settlements has been obtained from these finds. The analyses revealed cat, dog, red fox, wolf, badger, marten, sheep, goat, cattle and pig footprints in Vindolanda;[8] dog, cat, goat or sheep, and chicken footprints in Brigetio;[9] two different species of dog, cat and badger footprints in Kefar 'Othnay;[10] and two different species of dog, fox and roe-deer footprints in Cibalae.[11] The discovery of traces on stoneware vases / amphora in Kefar 'Othnay shows that terracotta building materials are not the only kind of artefacts that can bear traces on them. In Brigetio, human footprints were examined alongside animal footprints.[12] It is also suspected that not all traces were accidentally formed, and some may have been inserted deliberately in connection with particular superstitious beliefs.[13]

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1 Buatois and Mángano 2011, 5. For further information about Ichnology, see Ekdale et al. 1984; Bertling et al. 2006; Baucon 2010; Baucon et al. 2012; Mángano and Buatois 2012.

2 Baucon et al. 2008, 43-45; Mángano and Buatois 2012; Çokay-Kepçe 2018, 205-6.

3 Baucon et al. 2008.

4 Baucon et al. 2008, 44.

5 Lyell 1854, 513.

6 Uzdurum and Mentzer 2018, 93.

7 Baucon et al. 2008, 48-49.

8 Higgs 2001, 50-61; Bennett 2012, 8, 17-19, 30.

9 Dobosi 2016, 117.

10 Bar-Oz and Tepper 2010, 244-46.

11 Lučić et al. 2014.

12 For further information on this topic, see Dobosi 2016, 125-27.

13 Dobosi 2016, 124. The footprints discovered at the Neolithic site of Barçın Höyük are also a subject of discussion regarding their possible symbolic meaning; see Atamtürk et al. 2018, 164, 171. On the other hand, the general opinion for now is to not include deliberate traces in ichnoarchaeological analysis.

While studying traces in the context of archaeology and art history, it is important to note that the physical evidence was probably transported, whereas that is rarely the case with trace fossils. Thus, any conclusion based on the physical evidence properly concerns the place it was produced, not the place it was unearthed.[14]

Methodologically, the article first presents a quantitative analysis of the terracotta building materials in question. Then, within the framework of the *chaîne opératoire,*[15] the stages of manufacturing operation were identified and the formation process[16] of traces scrutinized from the viewpoint of ichnoarchaeology. The ichnoarchaeological approach allowed us to make interpretations regarding the environmental conditions at the time the object was produced. The inquiry also takes into account how artefacts were used in context and discusses the possible circumstances that may have necessitated the use of a "faulty" designation. It is clear that not all of these questions can be answered with certainty, given the quite complex web of entanglements. The aim of the study is rather to make some remarks about the environmental conditions in Perge and Aizanoi in the second century AD and to provide data for further research on related topics.

Animal Footprints from Perge and Aizanoi

Terracotta building materials commonly bear deliberate markings such as stamps or signs. Sometimes it is possible to find random traces on them. Random traces occur during the drying phase after molding when the outer part of the material is still damp and exposed to the external elements. These elements may include animals passing through the area, nearby trees and plants, site workers, and natural occurrences such as rain or hail.

This study reviews animal footprints on flat-surfaced pieces found amongst terracotta building materials from the excavations at Aizanoi and Perge.[17] The excavations also revealed many terracotta building materials that have fingerprints on them, but these are left out of the scope of the study. Out of 33 examples analyzed, 13 were discovered in Aizanoi and 20 in Perge. Ten of them were spotted and recorded during visits to the excavation sites to review the existing examples.

The ichnological analysis revealed that all examples belong to the biogenic sedimentary trace category and, again, all of them are bioturbation traces. These traces were left by animals walking and running on them, after the prepared terracotta building materials had been left to dry and the mold was still soft. It can be confidently claimed that these traces are all

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14 Baucon et al. 2008, 45-47.

15 The *chaîne opératoire* defines the process of selection, the shaping of the core material, and its transformation to the final product. The chain is not a linear production line, but one consisting of intertangled circles. This kind of research allows the reconstruction of the connections between the circles and the relations of causes and effects. It helps us to understand the temporal and spatial developments. For further information on this topic, see Schlanger 2013.

16 This concept involves all the human-induced mechanical, physical, and chemical processes that modify the artefact between the point when it is first produced and when it is later discovered and examined. For further information on this topic, see Lamotta and Schiffer 2013.

17 Flat-surfaced terracotta building materials are bricks, *tegulae, tegulae mammatae* and *tubuli*. In the archaeological finds published so far, there are no *imbrices* on which animal footprints have been detected. The first explanation researchers offer is that *imbrices* were dried on a platform, hence they were more protected from unwanted elements. Another possibility is that, because the *imbrices* constituted the visible section of the roof, people did not prefer poor quality *imbrices* so faulty ones were likely to be discarded; see Dobosi 2016, 118.

locomotion traces.[18] These interferences caused a disfigurement on the surface of the product without spoiling the overall texture.[19] In terms of terracotta preparation, the building materials were fired after being first dehydrated, and the traces became permanent at the end of this physicochemical process. In some examples, hair pressed under the foot of the animals was actually transferred to the brick surface. In 11 of these 33 examples, the traces are multiple: one on top of the other or side-by-side. Considered collectively, these traces unmistakably reflect the walking patterns of the animal. If an example fails to deliver a simple defined pattern, the traces were attributed to more than one animal.

In order to ascribe the traces to certain species of animals, a synapomorphy analysis was performed, spoor catalogues were reviewed, and the opinions of wildlife experts were taken. In this evaluation process, the fact that bricks may have had different levels of moistness when they were marked and that terracotta materials may shrink about 10% during firing was also taken into account.

Thirteen terracotta building material examples from Aizanoi contain 20 traces belonging to dog, wolf, hyena, lynx / caracal and heron. Twenty different examples from Perge present 33 traces affiliated with dog, jackal, weasel, badger, domestic cat, snake, and goat. 75% of the total of 53 traces belongs to carnivores.[20] 63% of these carnivore traces are ascribed to the family *canidae* (dog, jackal, wolf). Out of this group of *canidae* traces, 64% are thought to be left by dogs, 28% by jackals, and 8% by wolves.

The *canidae* footprints are similar to each other. Hence the sizes are the main criteria for the identification of the exact species (fig. 1) along with toe alignments.[21] Claw marks are also an indicator. For example, the length of the forefeet of dogs is approximately 10% larger than their width, which gives the foot an oval appearance.[22] Jackal footprints are longer and narrower than wolf and dog footprints.[23] If the claw mark is wide and the tip of the claw mark is away from the toe, it likely belongs to a dog.[24] Additionally, dog claws point in different directions.[25] Further, the trace could be associated with jackals if the claw mark is narrow, while the tip is sharp and closer to the toe.[26] The claws of the middle fingers of jackals usually point toward each other.[27] Also, long claw marks for dogs implicate a domestic animal that does not hunt much.[28]

Within the scope of this study, nine dog footprints in Aizanoi (fragment nos. 1-2) and six in Perge (fragment nos. 3-4) are examined. The width of the footprints in Aizanoi is between 4.8-9 cm; in Perge it is between 4.7-5.6 cm. The distribution of dog footprints (fig. 2) demonstrates that a group of dogs from Perge and Aizanoi have similar lengths and widths in their feet. Another group from Aizanoi exhibits obvious differences from this group in terms of foot

18 *Repichnia*

19 *Ichnofabric*

20 Traces formed by snakes, herons and badgers are not included in this group.

21 Kütükçü 2016, 38.

22 Higgs 2001, 50-61; Bennett 2012, 21.

23 Bennett 2012, 21.

24 Bennett 2012, 20.

25 Elbroch 2003, 133.

26 Elbroch 2003, 129-33.

27 Elbroch 2003, 133.

28 Bennett 2012, 28.

width. Despite the fact that the width of the footprint may change according to the level of moistness of the brick and the way the dog apportions its weight to its feet,[29] this discrepancy in the distribution more strongly suggests an alternate explanation. It indicates the presence of two different dog species in Aizanoi: one with a relatively common medium size and another that is bulkier and possibly wilder.[30]

Since dogs are popularly regarded as the best friend of humans, finding them in an environment with a human population is not unexpected. But how can these traces be accommodated within an ichnoarchaeological framework? Bennett, in her examination of a number of dog footprints, conducted an archaeozoology study in Vindolanda and concluded[31] that the majority of the dogs measured 70-75 cm in height.[32] Following this conclusion, she suggests that the brick / tile workshops used to keep dogs around for the purpose of protection.[33] Although there are no similar morphological studies for Aizanoi and Perge yet, a research study performed in Pessinus, a town 250 km away from Aizanoi, reveals that the height of dogs in the area ranged from of 25 to 63 cm.[34] Research on kangal dogs raised in modern-day Anatolia reports an average height of 73-75 cm.[35] Based on this data, it is plausible to suggest that the traces, especially those from bigger dogs, could have been left by guard animals.

Jackal footprints are encountered only in Perge (fragment nos. 5-7). The width of seven different traces varies between 4.1-5.4 cm. The middle fingers approach one another, and the claws point towards each other. Additionally, the claws are near the fingertips and quite sharp. Jackals wander around alone or in a pack to find food. They are usually night hunters and able to live in any environment (forest, scrub, delta) in lowland areas.[36] Today they inhabit the Antalya region[37] but are threatened with extinction due to habitat loss and overhunting.[38] The fact that jackal traces are only observed in Perge and not in Aizanoi can be explained by their tendency to occupy lowlands. Although the 1000 m altitude of Aizanoi is in line with this claim, new information may become available on this topic when ongoing studies are concluded.

Two overlapping footprints classified as wolves were discovered in Aizanoi (fragment no. 8). The size of the middle toe, the alignment of the toes, and the claw structure are considered crucial in the classification, together with the width and length of the traces.[39] Wolves can live anywhere except vast lowlands and coastline plains. They usually hunt at night and walk around in packs. Their main source of food is split-hoofed animals.[40] Taken together with the

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29 Bennett 2012, 11-12.

30 The studies at Vindolanda and Brigetio establish that the maximum foot width of domestic dogs is 6.9 cm; see Higgs 2001, 50-61; Bennett 2012, 20-23; Dobosi 2016, 121-22. The study of Ledoux and Boudadi-Maligne (2015, 29) that aimed to distinguish dog / wolf traces found in Chauvet Cave in France concluded that the average foot width of seven big dog species existing today is 7.26 cm.

31 Bennett 2012, 27-28.

32 Height at the withers.

33 Bennett 2012, 32.

34 De Cupere 1995, 161.

35 Yılmaz 2006, 154.

36 Kütükçü 2016, 8.

37 Antalya Çevre ve Şehircilik İl Müdürlüğü 2017, 79-81.

38 Kaçar and Erdoğan 2010, 26.

39 Kütükçü 2016, 7, 38.

40 Kütükçü 2016, 7.

earlier presumption about wild dogs in Aizanoi, these wolf traces help us locate the workshops in a rural area.

Eight traces associated with weasels were discovered in Perge. One of the artefacts is a brick with six traces that show the walking pattern of the animal. The pattern is included in the classification procedure with the addition of its dimensions and the general shape of the foot (fragment nos. 9-10).[41] That the details of the foot are hardly visible implies that the animal passed over the brick when it still retained some water. The other example reveals the details of the toes, the paw pad, and the claw more clearly, since the trace was formed after the material was more hardened. Greek and Roman texts refer to weasels as hunters of mice and insects.[42] Following this remark, some researchers suggest that weasels were used in insect control before cats became widespread.[43]

Another trace found in Perge is thought to be formed by a badger. A crack obscured a significant portion of the trace, so only the middle toes and some of the claws are discernible (fragment no. 11). Badgers have long and firm claws,[44] and the example shows claws situated away from the toes, as expected. Nevertheless, since it is impossible to measure the exact size of the trace, further analysis beyond identification remained inconclusive.

One trace in Perge and two in Aizanoi are assigned to *felidae*. The foot structure of cats is simpler in comparison to dogs. The width of the foreleg is bigger than the length, giving the trace almost a circular appearance. Cats can open their toes much wider; therefore, there is a significant space between toes.[45] The differentiating feature of cat traces is the paw pads. The metacarpal pad is bigger than the other parts; the leading edge is bilobate; the posterior edge has three lobes; and its general appearance is trapezoidal. There is virtually a C-shape between this part and the toes.[46] Cats have retractable claws which they extend only while climbing, hunting and on slippery surfaces. This is why the claws are not often clear in cat traces, or they are very thin.[47]

One trace in Perge (fragment no. 12) is assigned to a pet cat based on both the shape and size. The paw pads are quite big, and the claw mark is quite small.

It is widely known that cats were first domesticated in Egypt in the fourth millennium BC. Nevertheless, a cat jawbone found in southern Cyprus dates to the sixth millennium BC. Some cat bones discovered in Jericho date to the Pre-Pottery Neolithic Age, and cave paintings in Jordan date to the sixth millennium BC. This evidence suggests that cats may have been domesticated long before it is thought.[48] Cats were introduced to Europe by the Greeks. In the Roman era, domesticated cats became widespread throughout Europe. Nevertheless, they were rarely represented in Greek and Roman arts,[49] and archaeological excavations have revealed very few skeletal remains.[50] There may be different explanations for the lack of cat traces and

41 Kütükçü 2016, 12.

42 Plin., *HN* 29.16

43 MacKinnon 2014a, 168.

44 Kütükçü 2016, 13; Elbroch 2003, 181.

45 Bennett 2012, 20.

46 Elbroch 2003, 211.

47 Elbroch 2003, 211.

48 Lentacker and De Cupere 1994, 70-71.

49 Thomas and Higgs 2013-2015, 7-8.

50 Ervynck and Pieters 1993, 192; Lentacker and De Cupere 1994, 73; Castro Álvarez and García-Lomas 1996, 9; Bennett 2012, 19-20; Fabis 2017, 381.

bones in the Roman period. Many researchers claim that cats were usually kept in houses to kill rodents,[51] but this does not explain the lack of feline bones in excavations. Some researchers suggest that the domestic cat population in Rome was limited, hence it was a luxury to own a pet cat.[52] Lentacker and De Cupere justify the few examples of bones found in excavations by the fact that cats tend to go far from humans to die.[53] No doubt, there is a wide variety of possible interpretations. The frequent discoveries of cat bones beginning from the Medieval period imply that the situation in Rome requires further assessment with different perspectives.[54]

The *felidae* traces found in Aizanoi are ascribed to bigger / wilder cats. Two traces found side-by-side (fragment no. 13) were first classified as lynx because of their general appearance and size. However, caracal and lynx have very similar morphological traits. Lynxes inhabit forested regions and highlands. Caracals, on the other hand, prefer sparsely forested areas, steppes and scrubs. They hunt at night and feed on rodents. Given the environmental conditions and the assumption that workshops were close to the city, some observations now follow. Since Aizanoi today is not in a forested region, the traces could belong to a caracal. Another possibility is that the city was surrounded by a forest during the Roman period. This forest could have become smaller in time and eventually disappeared.[55] Lastly, there might have been more than one workshop manufacturing terracotta building materials located in different locations and with different environmental conditions. However, 95% of the material discovered in Aizanoi and analyzed for this study is assigned to 7.5YR 7/4 and 7.5YR 7/3 groups in the Munsell soil color system. Although it is conceivable that different workshops could use the same clay source, this could have affected the production costs. In addition, workshops located away from the city would warrant increased logistical costs. The civic administration would obviously avoid higher construction costs, so the probability of this last scenario is very low.

Four *hyaenidae* traces were found in Aizanoi, and they were classified based on both the size of the traces[56] and the general shape of the footprints (fragment nos. 14-15). Hyena footprints have almost no separation between the toes and the middle part of the paw pad, and the toes are quite plump.[57] Hyenas are generally observed in savannahs, rock terrains and sparsely forested areas. They are mostly necrophagous, but they also eat rabbits, rodents and reptiles. Based on these characteristics, the habitat of Aizanoi today is suitable for hyenas. Nevertheless, there is no conclusive information regarding their habitat during the Roman period.[58] On the other hand, if it is assumed that the *felidae* traces found belong to a caracal, then this classification would also be in accord with hyena traces.

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51 Ervynck and Pieters 1993, 192; MacKinnon 2014b, 275; Dobosi 2016, 123.

52 Lentacker and De Cupere 1994, 74.

53 Lentacker and De Cupere 1994, 75.

54 Lentacker and De Cupere 1994, 73.

55 William Harris argues that humans have been increasingly damaging the forests since the Neolithic Age. He points especially to the population rise and intense urbanization and production between c. 850 BC and AD 700 in geographies dominated by Greece and Rome as causing significant destruction of forests; see Harris 2013.

56 Kütükçü 2016, 20.

57 Kütükçü 2016, 20.

58 De Cupere's research on animal finds from the Pessinus excavations found no tracks from forest ecosystem animals. However, the presence of animals living in steppes, meadows and open fields is proven. Following this, the study concludes that during the Roman period, Pessinus was located in an open field with no forest; see De Cupere 1995, 164.

Another animal trace found in Aizanoi is classified as a medium-sized heron based on its general structure, size and the shape of its spur[59] (fragment no. 16). Herons are migratory birds so are summer visitors in some regions. They scavenge for food and then fly back to their breeding site.[60] As an aquatic ecosystem species, herons are carnivorous and hunt at the edge of lakes and freshwater. They can also find sustenance in reed fields or between herbaceous plants in the wetlands.[61] The ideal months for brick production in Aizanoi are July and August, based on today's climate.[62] A study on changes in climate during the Roman period suggests that it started getting warmer around 250 BC,[63] and between 100 BC and AD 200 the climate became quite favorable.[64] Following this conclusion, the climate conditions in the second century AD were presumably similar to those today.[65] In this case, most brick production in Aizanoi probably was completed in July and August. The spawning period of herons is between March and August, and chicks hatch between June and August.[66] Around 35-40 days of growth are necessary before migration.[67] In this light, it can be confidently assumed that herons used to arrive in Aizanoi as visitors towards the end of August.

Another example found in Perge is classified as a snake (fragment no. 17). The snake moved over the material by making lateral undulations. However, since the terracotta building material is broken, it cannot be interpreted exactly where the trace started or ended. On the other hand, it appears that the trace does not start or end at the edges of the brick. The snake may have dropped from an animal's mouth or was somehow engaged with an animal moving across the brick. Or it may have fallen from a tree above the brick drying area.

Despite the numerous carnivore traces discovered in Aizanoi and Perge, herbivore traces are only located in Perge. Eight traces found in Perge are assigned to goats (fragment nos. 18-19), but no data was obtained that can clarify if the goats were domesticated or wild. Nevertheless, a graphic showing a goat footprint (fig. 3) offers an impressive inference. Seven of the eight traces are very similar in size, but the last one is noticeably smaller than the others. This implies that the trace may belong to a kid. Based on this conclusion, it can be interpreted that the terracotta canal lid bearing the traces was manufactured in the spring or at the beginning of the summer.[68] This argument is also supported by a climatological perspective. Present-day Perge is located within the municipal boundary of Antalya, and the current seasonal characteristics of the region make it possible to produce bricks in the spring months.[69] If we accept that the climatic conditions in the first and second centuries AD, when there was intense building activity

59 Brown et al. 1993, 52.

60 Durmuş and Adızel 2011, 35.

61 Durmuş and Adızel 2011, 35-36.

62 Data on the climate of Kütahya between 1971-2014 demonstrates that July and August are the most arid months; June and September are semi-arid. The rest of the year is categorized as humid; see Karbuz 2015, 419.

63 Haldon 2016, 220-21.

64 McCormick et al. 2012, 203.

65 The dating procedure acknowledge that 92% of the examples examined in Aizanoi come from the Bath-Gymnasium complex. Earlier studies state that the construction of the complex started in the middle of the 2nd century AD; see Taşkıran 2013, 100.

66 Uzun and Helli 2014, 55-56.

67 Durmuş and Adızel 2011, 36-37.

68 Natural selection has determined the breeding season of goats. This time frame is optimal for the health of the mother and the offspring in terms of temperature and availability of the food; see Dellal and Cedden 2002, 64.

69 The temperature in Antalya reaches up to 18 degrees Celsius in March; see Yılmaz 2008, 25.

in Perge,[70] were similar to those today,[71] then the bricks were most probably produced in the spring months. The goat traces in Perge suggest the existence of goat farms close to the workshop or that the workshop owners raised them for their own daily needs.

Other Traces

Some other traces were seen in the examples that cannot be analyzed within an ichnoarchaeological framework. For example, raindrop traces are detected in two examples from Aizanoi (fig. 4). Vitruvius stated that the best seasons for brick production were spring and autumn.[72] Some researchers, nevertheless, report that brick production can continue throughout the year, but the drying area should be kept covered to protect the bricks from the rain.[73] These examples from Aizanoi imply that the drying area was not covered. The ideal time for brick production for ancient Aizanoi is July and August in today's climatic conditions. Besides this, just 12% of the annual precipitation occurs during the summer.[74] If the climate in the second century AD was similar to today's climate, as claimed earlier, the bricks were probably produced in July or August and exposed to unexpected rain.

Another interpretation to be drawn from these raindrop traces is that during the Roman period the increased use of bricks would have accelerated serial production. Research in this area offers some data regarding brick production, including the amount needed and the duration of construction. For example, to construct a *thermae* with dimensions of 106 x 76 m, the required *tegulae* and *imbrices* are calculated to total 67,556.[75] The roof tiles for the *thermae* alone would take 11 weeks to be prepared.[76] Following this, it is possible to argue that a quite long preparation period was essential before construction could begin in the Roman era. The season for the production of building materials in Aizanoi was short; therefore, we may assume that the workshops may have pushed these seasonal limits by beginning production in June and ending in September. This may have increased the likelihood of rainfall on manufactured bricks. This situation could also be explained as faulty materials being sent to customers. Due to short production season, the assessment of material fault might have been overlooked or mitigated. Quality problems with materials not readily apparent may have regarded as negligible and not as a flaw to expedite commerce.

Conclusion

Terracotta building materials with traces on them found in Perge and Aizanoi are reviewed with an ichnoarchaeological viewpoint. The web of entanglements[77] surrounding the artefact is unfolded on the basis of its interdependent and connected character, as well as its past and its context. Interpretations based on what the artefact has to offer is presented alongside descriptions and explanations.

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70 Özdizbay 2012.

71 It is claimed that the climate conditions were very favorable between c. 100 BC and AD 200; see McCormick et al. 2012, 203.

72 Vitr., *De arch.* 2.3.2

73 Adam 2005, 108; Minke 2006, 65.

74 Karbuz 2015, 420.

75 Janek 2017, 90-91.

76 Duch 2017, 202; Janek 2017, 91-93.

77 Hodder 2018, 170.

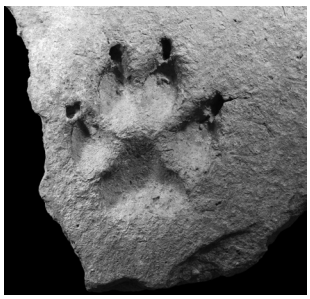
The remarks on the fauna do not necessarily mean that these animals lived around the cities mentioned. It is possible that terracotta building materials were transported to the site from their place of production. Nevertheless, given the difficulty of logistics in ancient times, it is highly likely that the brick workshops were located around the city.

The relations between the detected traces provide valuable information as well. For example, it can be argued that the environment surrounding the workshop in Aizanoi was wilder than the one in Perge. The fauna around the workshop was possibly a source of concern and hardship on the owners, so they felt the necessity to have large dogs to protect the production areas, workers and their homes. Similarly, it can be claimed that Aizanoi was surrounded by an open, sparsely forested geography in the second century AD, just like it is today. Additionally, heron footprints and raindrop traces on the bricks imply that Aizanoi at that time had similar climatic conditions to today.

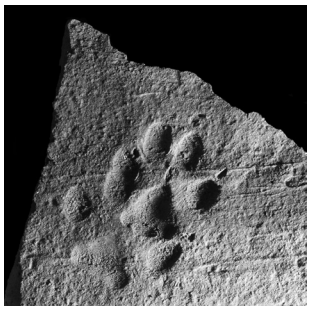
These conclusions regarding the fauna, flora and climate are, no doubt, drawn from quite a limited data set. Further studies on this topic will provide more solid ground for the arguments and broaden our knowledge.

Apart from these arguments and conclusions, the article deals with some underlying questions such as "What does faulty mean?" and "Can faulty artefacts give us new information?" As briefly summarized above, what is often classified as faulty can indeed provide significant information. On the other hand, it is also important to respond to the question: "Was an artefact that is considered faulty today considered flawed in the past as well?" Faulty artefacts, like the ones inspected in the study, are frequently encountered in many excavations. In such cases we can readily say that, even though this material is perceived as faulty, it is still useful. This also raises new questions such as: "If the past resembled today, did the producer offer a discount on the faulty product?" or "Did the seller remain silent and not reveal the defect?" And: "Was there a consequence for the seller if the buyer realized the situation?" Obviously, only further research into written evidence could help resolve these issues. Given the highly complex web of relations regarding the production, sale, and use of terracotta building materials, it would be unrealistic to expect answers to all questions posed in this article. Nevertheless, the examination of trace remains can indicate promising paths that may bring about some surprising conclusions. More studies in the same vein in upcoming years and cross-analysis of them will allow us to see the past from a multidisciplinary perspective and to gain new information.

Selected Catalogue



No	**:**	**1**
City	:	Aizanoi
Size of Fragment	:	30 x 21 x 5.7 cm
Clay Color	:	2.5YR 8/4
Type of Footprint	:	*Canidae (Canis familiaris)*
Size of Footprint	:	7.2 x 9 cm
Description	:	Complete footprint of a dog.



No	**:**	**2**
City	:	Aizanoi
Size of Fragment	:	19.6 x 20.2 x 5 cm
Clay Color	:	7.5YR 7/3
Type of Footprint	:	*Canidae (Canis familiaris)*
Size of Footprint - Down	:	(-) x 7.28 cm
Size of Footprint - Up	:	6.1 x 6.55 cm
Description	:	Two footprints, partially overlapping each other. Upper one is deeper.



No	**:**	**3**
City	:	Perge
Size of Fragment	:	18.7 x 11.2 x 3.25 cm
Clay Color	:	2.5Y 8/2
Type of Footprint	:	*Canidae (Canis familiaris)*
Size of Footprint - Above	:	6.25 x 5.2 cm
Size of Footprint - Below	:	(-) x (-)
Description	:	Two footprints, pointing the different direction. One is complete while the other has only three toes; its claws are visible.



No	**:**	**4**
City	:	Perge
Size of Fragment	:	14.5 x 24.5 x 4.4 cm
Clay Color	:	5Y 8/3
Type of Footprint	:	*Canidae (Canis familiaris)*
Size of Footprint - Down	:	(-) x 4.7 cm
Size of Footprint - Up	:	4.7 x 4.7 cm
Description	:	Brick inscribed with reversed Greek letters **Γ** and **E**. Left of them are two overlapping footprints.

No	**:**	**5**
City	:	Perge
Size of Fragment	:	28.5 x 28.5 x 5 cm
Clay Color	:	2.5Y 8/2
Type of Footprint	:	*Canidae (Canis aureus)*
Size of Footprint - Left	:	5.8 x 5 cm
Size of Footprint - Right	:	5.15 x 4.15 cm
Description	:	Deep footprints located side-by-side, pointing the same direction.



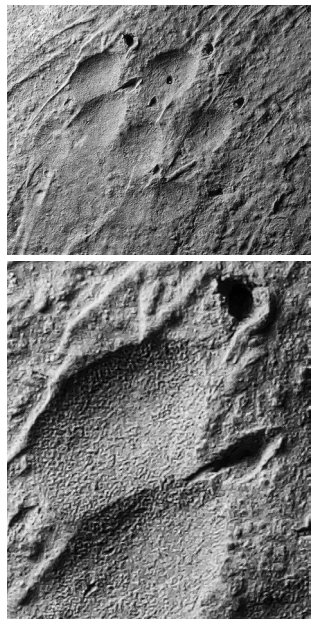
No	**:**	**6**
City	:	Perge
Size of Fragment	:	10 x 15.7 x 4 cm
Clay Color	:	2.5Y 8/2
Type of Footprint	:	*Canidae (Canis aureus)*
Size of Footprint	:	6.8 x 5.4 cm
Description	:	Complete and deep footprint.



No	**:**	**7**
City	:	Perge
Size of Fragment	:	14.65 x 11.2 x 4.8 cm
Clay Color	:	2.5Y 8/2
Type of Footprint	:	*Canidae (Canis aureus)*
Size of Footprint	:	5.5 x 4.5 cm
Description	:	Complete and deep footprint.



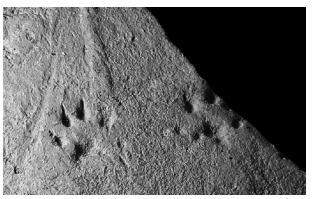
No	**:**	**8**
City	:	Aizanoi
Size of Fragment	:	17.3 x 18 x 7.3 cm
Clay Color	:	7.5YR 7/4
Type of Footprint	:	*Canidae (Canis lupus)*
Size of Footprint - Down	:	(-) x 7.6 cm
Size of Footprint - Up	:	(-) x 5.9 cm
Description	:	Two footprints overlapping each other. In each trace, four toes and claws are visible. The paw pad of the upper one is not fully transferred to the brick surface.



No	**:**	**9**
City	:	Perge
Size of Fragment	:	23.8 x 28.5 x 4.5 cm
Clay Color	:	2.5Y 8/2
Type of Footprint	:	*Mustelidae (Mustela nivalis)*
From down to up		
Size of Footprint - 1st	:	1 x 0.65 cm
Size of Footprint - 2nd	:	1.3 x 0.8 cm
Size of Footprint - 3rd	:	1.1 x 0.7 cm
Size of Footprint - 4th	:	1.35 x 0.6 cm
Size of Footprint - 5th	:	1.3 x 0.5 cm
Size of Footprint - 6th	:	1.15 x 0.6 cm
Description	:	A trackway is on the brick. Details not visible; for this reason, it is thought that weasel passed over the freshly made brick.



No	**:**	**10**
City	:	Perge
Size of Fragment	:	19.5 x 22.5 x 4.25 cm
Clay Color	:	5YR 7/3
Type of Footprint	:	*Mustelidae (Mustela nivalis)*
Size of Footprint - Left	:	2 x 1.9 cm
Size of Footprint - Right	:	2 x (-) cm
Description	:	Footprints located side-by-side, pointing the same direction. Five toes, a paw pad and claws are visible.



No	**:**	**11**
City	:	Perge
Size of Fragment	:	14.7 x 19.5 x 4.2 cm
Clay Color	:	2.5Y 8/2
Type of Footprint	:	*Mustelidae (Meles meles)*
Size of Footprint	:	(-) x 4.2* cm
Description	:	Incomplete footprint. Four toes and two claws are visible. Between claws and toes are slight scratches.

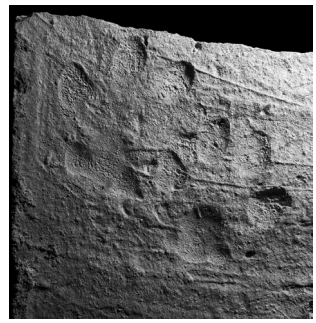


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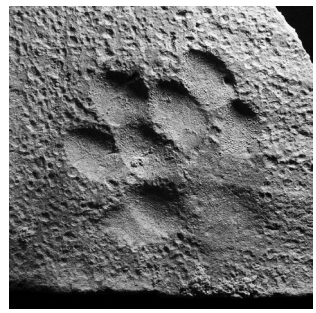
No	**:**	**12**
City	:	Perge
Size of Fragment	:	29 x 20.4 x 5 cm
Clay Color	:	27.5YR 8/2
Type of Footprint	:	*Felidae (Felis domesticus)*
Size of Footprint	:	3.8 x 3.15 cm
Description	:	Footprint with only one claw mark. Claw mark is quite small, and trace slipped both left and down.



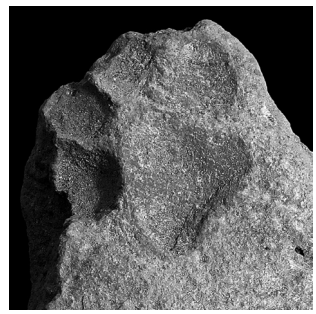
No	**:**	**13**
City	:	Aizanoi
Size of Fragment	:	16.5 x 17.2 x 4.65 cm
Clay Color	:	7.5YR 7/4
Type of Footprint	:	*Felidae (Lynx lynx or Caracal caracal)*
Size of Footprint - Down	:	6.7 x 6.35* cm
Size of Footprint - Up	:	6.45 x 6.15 cm
Description	:	Two footprints are superimposed on each other. Only one toe is on the overlapping area.



No	**:**	**14**
City	:	Aizanoi
Size of Fragment	:	18 x 17.9 x 4.5 cm
Clay Color	:	7.5YR 7/4
Type of Footprint	:	*Hyaenidae (Hyaena hyaena)*
Size of Footprint - Down	:	(-) x (-)
Size of Footprint - Up	:	8.6 x 7.4 cm
Description	:	Two overlapping footprints. Paw pad of the upper one is not fully transferred on to the brick.



No	**:**	**15**
City	:	Aizanoi
Size of Fragment	:	16.8 x 10.4 x 4.55 cm
Clay Color	:	7.5YR 7/4
Type of Footprint	:	*Hyaenidae (Hyaena hyaena)*
Size of Footprint	:	4.6 x 5.45*cm
Description	:	Only the lower part of the footprint is clearly visible. The upper parts are broken.

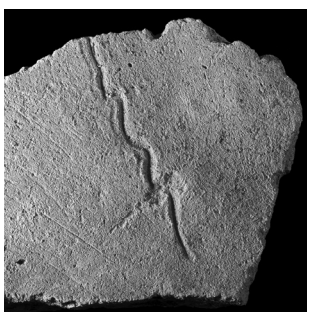


* The exact size could not be measured.

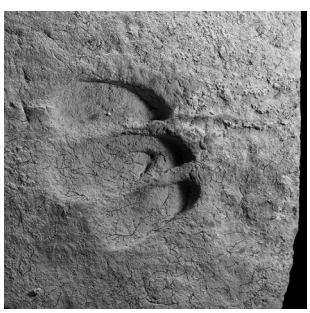
No	**:**	**16**
City	:	Aizanoi
Size of Fragment	:	34.3 x 18 x 5.95 cm
Clay Color	:	7.5YR 7/4
Type of Footprint	:	Ardeidae
From down to up		
Size of Footprint - 1st	:	6.3 x 5.8* cm
Size of Footprint - 2nd	:	5.75 x 6.95 cm
Size of Footprint - 3rd	:	5.9 x 6.25 cm
Description	:	Three footprints are lined up in a walking pattern. Two are complete, while only the upper part of the third is visible.



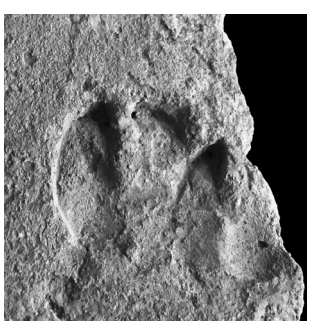
No	**:**	**17**
City	:	Perge
Size of Fragment	:	9.5 x 11.6 x 2 cm
Clay Color	:	5YR 7/4
Type of Trace	:	*Serpentes*
Size of Trace	:	7.2 x 0.5 cm
Description	:	A snake moved on the brick by making lateral undulations.



No	**:**	**18**
City	:	Perge
Size of Fragment	:	22 x 21 x 4.8 cm
Clay Color	:	7.5YR 7/4
Type of Footprint	:	*Bovidae (Capra hircus)*
Size of Footprint - Down	:	5.6 x (-) cm
Size of Footprint - Up	:	7 x 5.4 cm
Description	:	Two hoof prints are superimposed; only the left part of the down hoof is visible.



No	**:**	**19**
City	:	Perge
Size of Fragment	:	18.7 x 18.3 x 4.4 cm
Clay Color	:	2.5Y 8/1
Type of Footprint	:	*Bovidae (Capra hircus)*
Size of Footprint - Down	:	5.2 x 4.26* cm
Size of Footprint - Up	:	4.5 x (-) cm
Description	:	Two hoof prints are superimposed, only the left part of the up hoof is visible.



* The exact size could not be measured.

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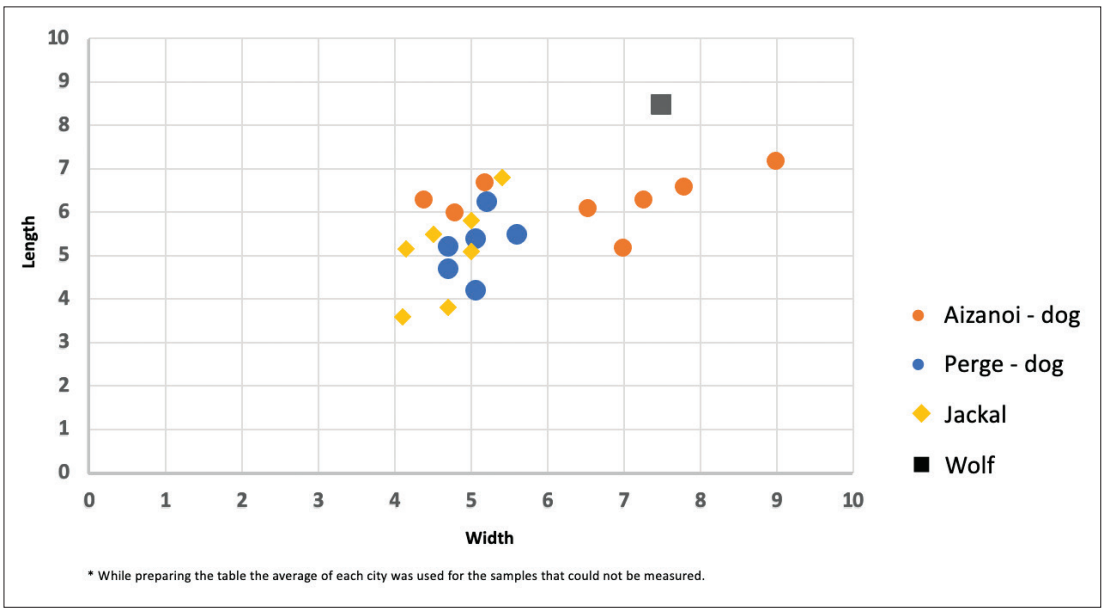


FIG. 1 Canidae footprints distribution.

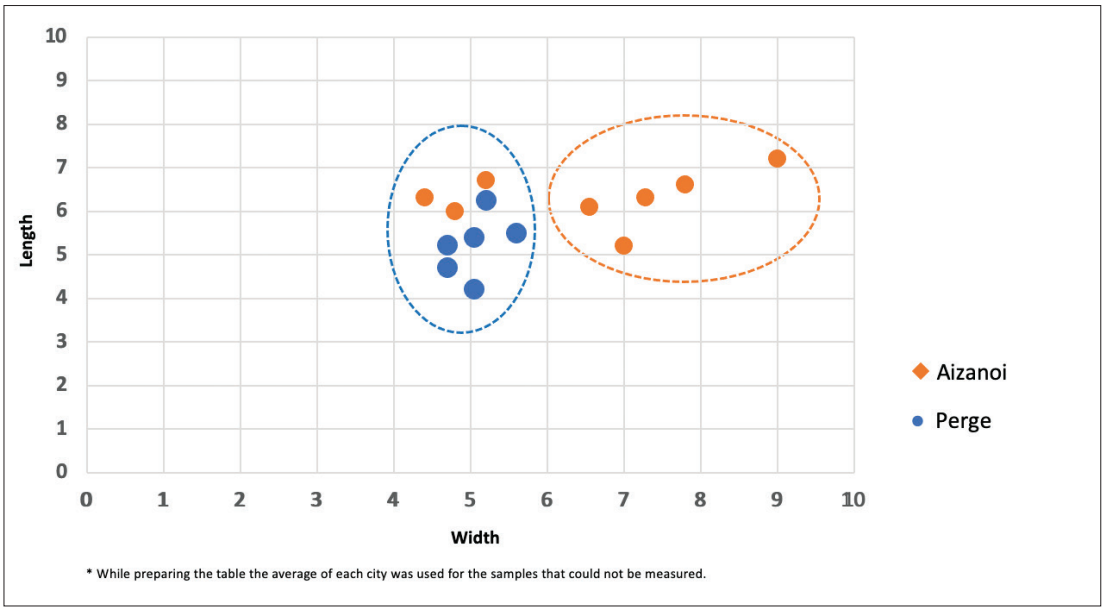


FIG. 2 Dog footprints distribution.

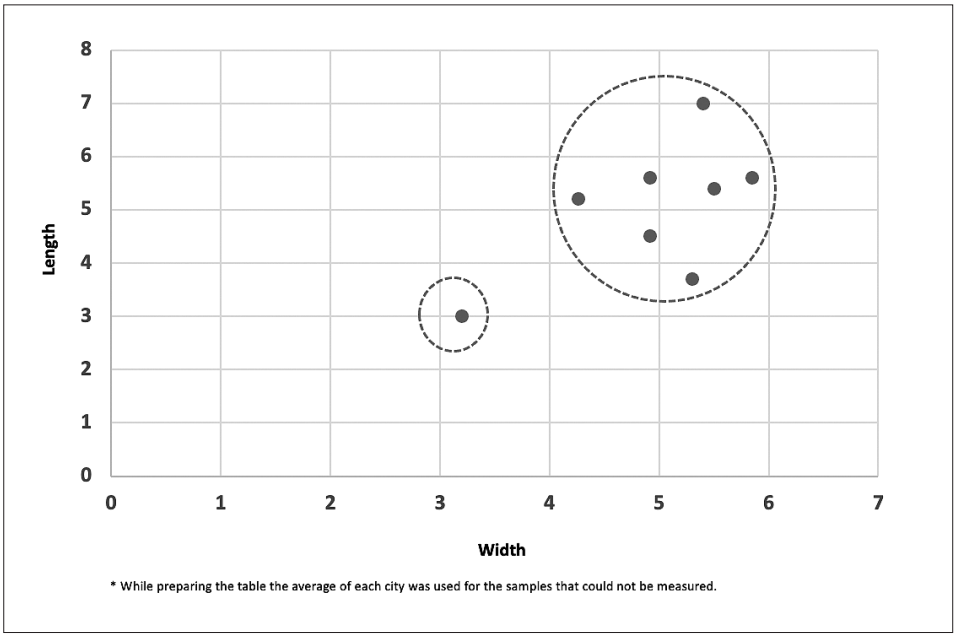


FIG. 3 Goat footprints distribution.



FIG. 4 Raindrop traces.