

# A Pottery Study Approach to Small Find Analyses

## The Zoomorphic Clay Figurines from Tell Abraq (Umm al-Quwain, UAE)

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### *Abstract*

Recent excavations at Tell Abraq (Umm Al-Quwain, UAE) yielded an unexpectedly rich corpus of zoomorphic clay figurines, ranging in date from the beginning of the Iron Age II period (c. 1100/1000 BC) to the Late Pre-Islamic Period (up to the 2<sup>nd</sup>–3<sup>rd</sup> century AD). With a few exceptions coming from stratified contexts, the majority was found in disturbed, superficial sand layers not linked with any occupational remains.

Nevertheless, all the fragments were studied and will be presented here. Some are of difficult interpretation due to excessive fragmentation, yet all the figurines but one could be identified as representing either horses or camels, despite the fact that more than half of them consists of isolated animal legs that could not be re-joined to the body.

At the basis of these results stands the application of methods traditionally used for pottery studies – such as fabrics characterization and technological analysis – that allowed the inclusion of the figurines into a chronotypology that is not based solely on morpho-stylistic analysis.

The results show the perdurable fashion of the represented subjects, while highlighting the changing materials and techniques used to create these figurines over time, arguably mirroring the changing taste of the communities to which these products were destined. At the same time, they offer an insight into possible contact with, and influences from, the wider Arabian Peninsula and beyond – finally underlining the importance of this class of ‘small finds’.

## 1 Introduction

Recent excavations at Tell Abraq (Umm al-Quwain, United Arab Emirates) yielded an unexpectedly rich corpus of clay figurines, dominated particularly by zoomorphic figurines, ranging in date from the Iron Age II period (c. 1100/1000–600 BCE) to the Late Pre-Islamic Period (up to the 1<sup>st</sup>–2<sup>nd</sup> century CE). With a few exceptions coming from stratified contexts, the majority was found in disturbed, superficial sand layers not linked with any occupational remains.

Some of them are of difficult interpretation due to excessive fragmentation, yet all the zoomorphic figurines but one could be identified as representing either horses or camels, even though more than half of them consist of isolated animal legs that could not be re-joined to the body.

Due to the highly fragmented nature of the assemblage, the size and composition of each figurine calls for the application of methods traditionally used for pottery studies, such as fabric characterization and technological analysis. This choice allowed the inclusion of the figurines into a typo-chronology that is not based solely on morpho-stylistic analysis.

After a brief overview of the recent archaeological work carried out by the Italian Archaeological Mission in Umm al-Quwain (IAMUQ) and a concise presentation of the corpus of figurines brought to light, an attempt will be made to explore and question the heuristic potential of a particular concept, the *chaîne opératoire*, applied to the study of a clay figurines corpus. Inherited from the field of anthropology of techniques and used in ceramology, this method was applied to the study of zoomorphic clay figurines to try and find a convincing and discriminating method to include the most fragmentary figurines in the examined dataset. This method raises questions about their materiality and manufacturing techniques, as well as their production context and producer-consumer interactions.

## 2 The zoomorphic figurines of Tell Abraq: archaeological and material context

### 2.1 The site of Tell Abraq: location, history of excavation and chronology

The site of Tell Abraq, located on the border between the emirates of Umm al-Quwain and Sharjah (Fig. 1), was first intensively investigated by Daniel T. Potts between 1989 and 1998<sup>1</sup> and then by an international team led by Peter Magee between 2007 and 2017.<sup>2</sup> It has indeed become a key site for the comprehension of the chronology of south-east Arabian archaeology thanks to its rich and continued chronological sequences expanding from c. 2500 BCE to 300 CE.

Since 2019, the Italian Archaeological Mission has resumed stratigraphic excavations in the Umm al-Quwain part of the site.<sup>3</sup> The major aim of this research is the investigation of the Late Bronze Age/Iron Age I period transition and the nature of the late pre-Islamic occupation of the site.

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1 Potts 1990; Potts 1991; Potts 1993; Potts 2000.

2 Magee et al. 2017.

3 Degli Esposti et al. 2022; Degli Esposti et al. 2023.

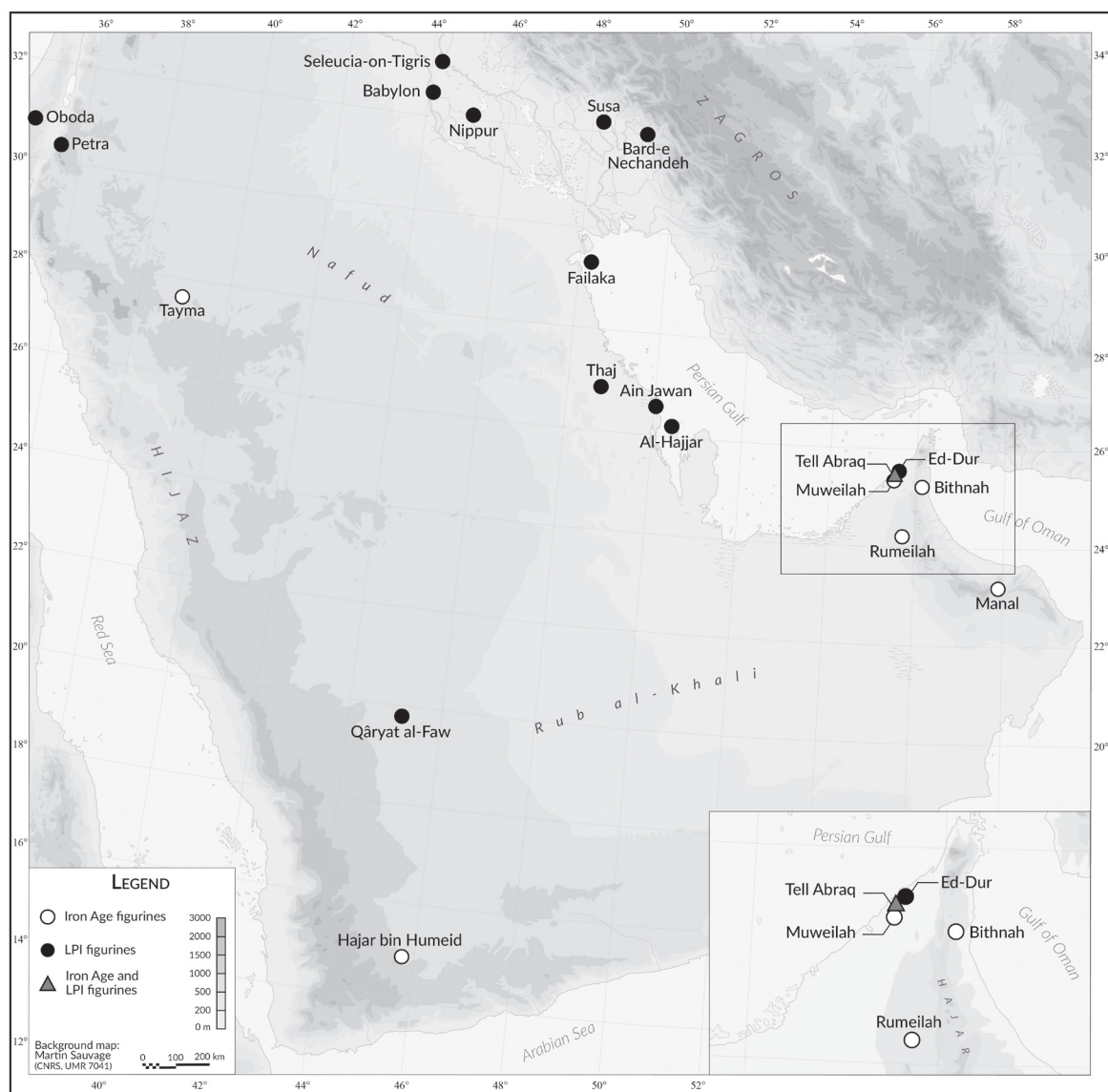


Fig. 1: Map showing the location of Tell Abraq and the other sites mentioned in the text (background map: M. Sauvage; adapted map: C. Abric)

The work of the Italian Mission entailed the excavation of several trenches targeting different areas along the eastern slope of the site's mound and near its northern edge (Fig. 2). They bear witness to a range of different features that belong to different periods in the site's long history, with no need to replicate their description here.<sup>4</sup>

4 Degli Esposti et al. 2023.



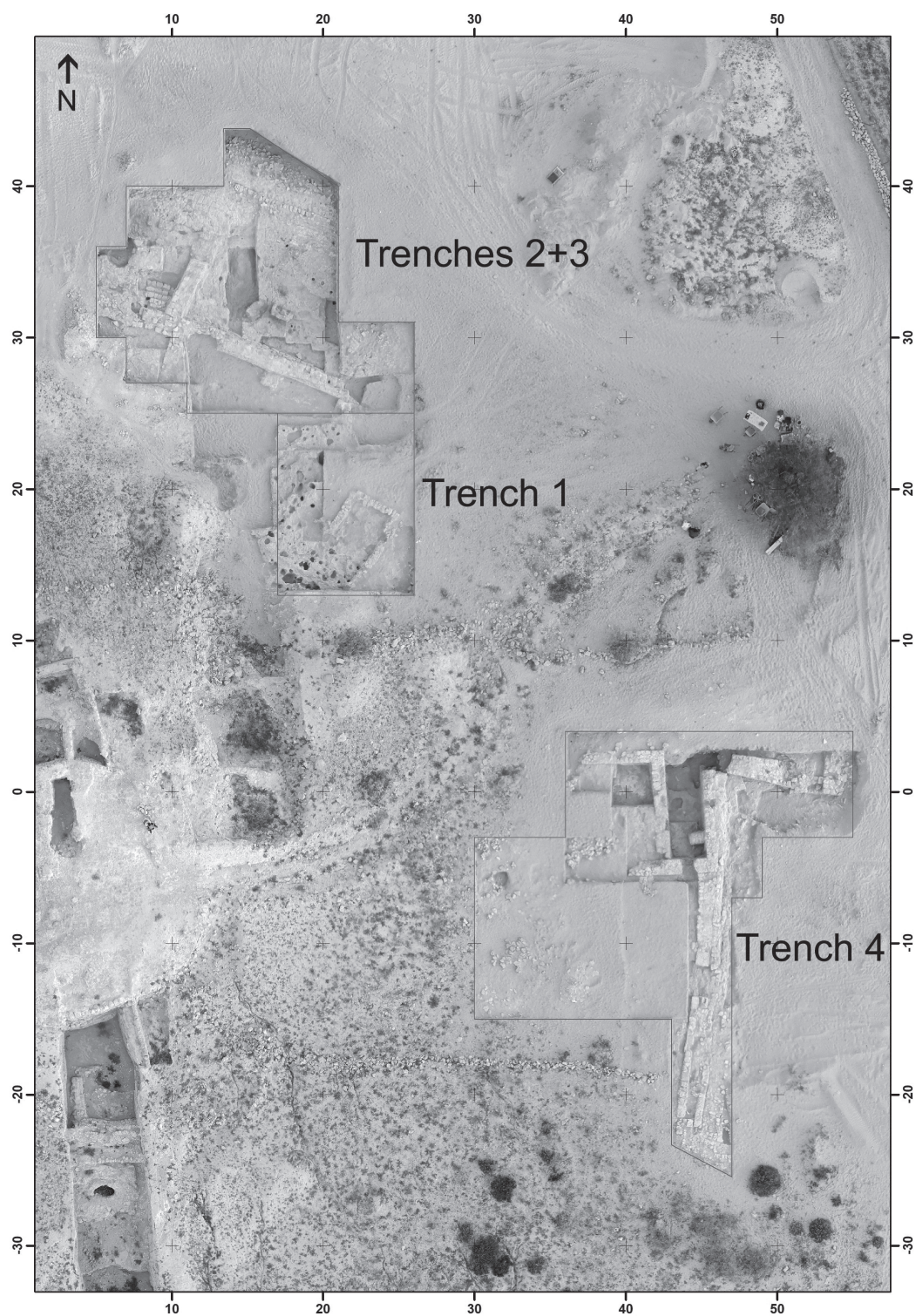


Fig. 2: Aerial view of the trenches excavated at Tell Abraq by IAMUQ in November 2020.  
The grid is at 10 m intervals (orthophotograph F. Borgi)

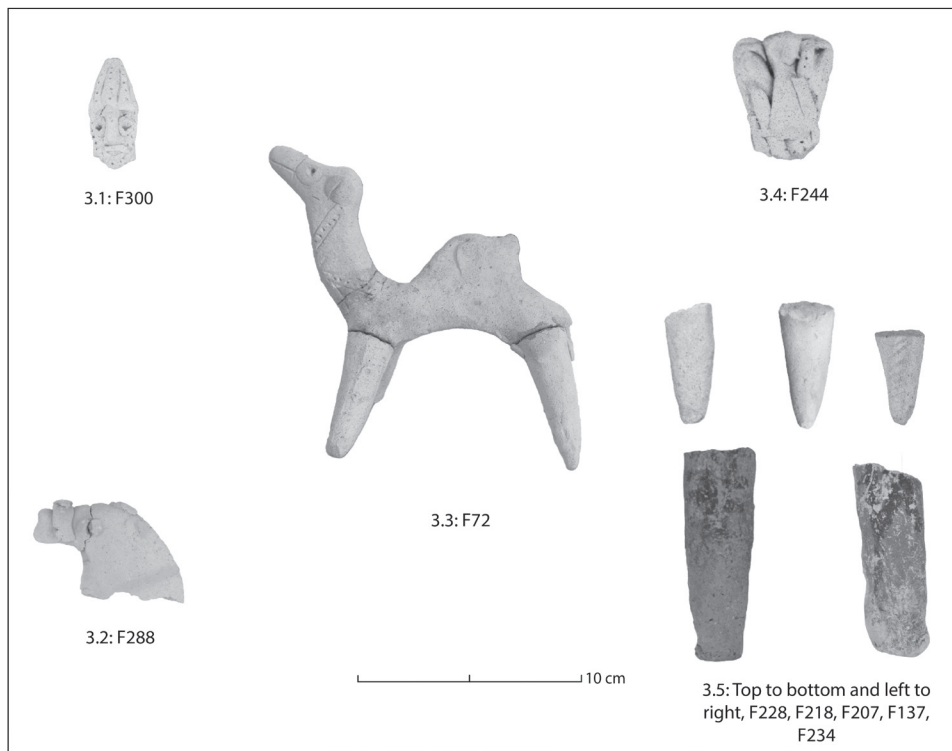


Fig. 3: A rich iconographic repertoire with anthropomorphic and zoomorphic figurines, accessories and non-diagnostic fragments (photographs: C. Abric, M. P. Pellegrino, N. Gilbert)

## 2.2 The figurine corpus

During the 2019, 2020 and 2021 field seasons, a total of 57 clay figurines were discovered. The iconographic repertoire of the corpus is remarkably rich. Several typological classes are represented (Fig. 3 and Tab. 1<sup>5</sup>): anthropomorphic figurines (n=11, Fig. 3.1), zoomorphic figurines (n=14, Figs. 3.2 and 3.3) and accessories for the latter (n=2, Fig. 3.4). It is also interesting to note that the zoomorphic figurines represent almost exclusively<sup>6</sup> camels (n=9) and horses (n=4).

Nevertheless, the majority of the specimens (n=30, Fig. 3.5) are fragments which, at first sight, are not diagnostic and cannot be connected to a specific category of figurine. To add to the difficulty of interpreting this corpus, the majority of these figurines come from topsoil or demolition contexts with mixed material. Despite this, it can be noted that they are absent from contexts earlier than the Iron Age II period while they are found in Late Pre-Islamic contexts datable to the 1<sup>st</sup>–2<sup>nd</sup> century CE.

5 Note that Tab. 1 includes only the figurines studied in this article. It therefore does not include anthropomorphic figurines or non-diagnostic fragments that are too small.

6 Apart from F18, a painted zoomorphic figurine from the Iron Age II, whose species could not be determined. Also noteworthy is the undetermined fragment F295, whose shape and decoration are very reminiscent of the applied decoration depicting snakes found on certain Iron Age II vessels (see for example at Bithnah: Benoist 2007: 48, figs. 11–12).

Tab. 1: List of figurines from Tell Abraq studied in this article

Inv. Number	Campaign	Sector	SU	Group	Sub-group
F1	2019	T2	SU 6	Zoomorphic	Camel
F203	2020	T3	SU 119	Zoomorphic	Camel
F214	2020	T4	SU 43	Zoomorphic	Camel
F68	2020	T4	SU 82-SU 95	Zoomorphic	Camel
F326	2020	T4	SU 43	Zoomorphic	Camel
F331	2021	T3	SU 119	Zoomorphic	Camel
F363	2021	T2	SU 197	Zoomorphic	Camel
F221	2020-2021	T4	SU 43	Zoomorphic	Camel
F236	2020-2021	T4	SU 43	Zoomorphic	Camel
F72	2020-2021	T4	SU 43-SU 95	Zoomorphic	Camel
F137	2020	T4	SU 108	Zoomorphic	Horse
F288	2021	T4	SU 220	Zoomorphic	Horse
F291	2021	T4	SU 43	Zoomorphic	Horse
F297	2021	T4	SU 43	Zoomorphic	Horse
F295	2021	T4	SU 43	Zoomorphic?	Snake?
F18	2019	T2	SU 17	Zoomorphic	Undetermined
F207	2020	T3	SU 119	Undetermined	
F216	2020	T4	SU 43	Undetermined	
F218	2020	T4	SU 43	Undetermined	
F330	2020	T4	SU 43	Undetermined	
F224	2021	T4	SU 43	Undetermined	
F225	2021	T4	SU 43	Undetermined	
F228	2021	T4	SU 43	Undetermined	
F229	2021	T4	SU 43	Undetermined	
F230	2021	T4	SU 43	Undetermined	
F232	2021	T4	SU 43	Undetermined	
F234	2021	T4	SU 43	Undetermined	
F284	2021	T4	SU 95	Undetermined	
F285	2021	T4	SU 220	Undetermined	
F289	2021	T4	SU 43	Undetermined	
F299	2021	T4	SU 218	Undetermined	
F301	2021	T4	SU 218	Undetermined	
F303	2021	T4	SU 43	Undetermined	
F329	2020-2021	T4	SU 43-SU 220	Undetermined	
F313	2020	T4	SU 43	Saddle	
F244	2021	T4	SU 43	Saddle	

### 2.3 Dating the zoomorphic figurines: the Iron Age and Late Pre-Islamic periods

Such zoomorphic figurines are frequently found on other sites of the Arabian Peninsula (Fig. 1). For instance, similar examples of camel figurines can be found in the Arabian Peninsula at the Iron Age sites of Muweilah,<sup>7</sup> Manal,<sup>8</sup> Tayma,<sup>9</sup> Hajar bin Humeid,<sup>10</sup> and Rumeilah.<sup>11</sup> Similarly, they are known from the Late Pre-Islamic (LPI) sites of Ed-Dur,<sup>12</sup> Qaryat Al-Fâw,<sup>13</sup> Thaj,<sup>14</sup> Tell Khazneh (Failaka Island),<sup>15</sup> and Ain Jawan.<sup>16</sup> For the same period, camel figurines were also discovered outside the Gulf region<sup>17</sup> but differ in their manufacturing and decoration from the ones from Tell Abraq, suggesting a different tradition.<sup>18</sup> On the other hand, comparable LPI horse figurines in the Arabian Peninsula seem to be scarcer.<sup>19</sup> However, some horses' figurines were discovered at Ed-Dur,<sup>20</sup> in the necropolis of al-Hajjar,<sup>21</sup> and at the site of Failaka.<sup>22</sup> In fact, whether associated with camels or horses, figurines of riders seem to be increasingly common at this time.<sup>23</sup> Overall, the distribution of these animal figurines seems to outline a horizon of visual representations shared by the populations of the Arabian Peninsula of the times, lasting several centuries with no evident hiatus.

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7 Magee 1996: 210, fig. 28; Magee 2007, fig. 30; Magee 2015: 263, fig. 11.

8 Elmahi/Ibrahim 2003: 92, fig. 16.

9 Eichmann et al. 2010: pl. 4.27.

10 Van Beek 1969: 301, fig. 125.e and 375, pl. 54.a.

11 Boucharlat/Lombard 1985, pl. 65.4–10.

12 Daems 2004a: 231–234, figs. 3–4.

13 Al-Ghabban et al. 2010: fig. 148.

14 Eskoubi/Abu al-Aila 1985: pl. 36A–C; Gazdar/Potts/Livingstone 1984: 75, pl. 80B.

15 Calvet/Caubet/Salles 1985: 26, figs. 7.9–10.

16 LeBaron Bowen 1950: 40, fig. 21D.

17 Nabatean camels dated to the 1<sup>st</sup> century AD are found at Petra and Oboda (see Parlasca 1986: 200–213, figs. 1–10). Parthian examples are found at Seleucia-on-the-Tigris (Van Ingen 1939: pl. 76, fig. 557).

18 Daems 2004a: 230. See also Parlasca 1986: 203.

19 They are nevertheless found in nearby regions, such as Susa, Iran, in the Seleuco-Parthian period (Martinez-Sève 2002: 504–515, figs. 816–839) and Sassanid period (Martinez-Sève 2002: 644, fig. 110). They are also documented in Bard-e Nechandeh (Ghirshman 1976: pl. 11, Fig. 6) and Babylon (Karvonen-Kannas 1995: pl. 82, figs. 634–636; 643–644; 651–652; 671).

20 Daems 2004a: 234, figs. 11–12.

21 Lombard 1999: fig. 341.

22 Salles 1986.

23 On importance of riding in pre-Islamic Arabia, see Daems 2004b: 97.



### 3 Methodology: a multiscale approach

#### 3.1 The need to study terracotta figurines between iconography and materiality

Quite frequently, the products of coroplasty are primarily considered as iconographic supports and, therefore, most usually interpreted using methods specific to art history studies, such as iconographic or symbolic analyses.<sup>24</sup> But what about their materiality? What importance should be given to their properties, such as the nature of the clay, the gestures that produced them and the context in which they were used?

Over the past few years, several researchers have tackled these questions and have developed innovative approaches to the study of terracotta figurines.<sup>25</sup> These problems seem to be of growing interest to archaeologists, who are becoming aware of the theoretical paucity of the field of study of figurines. Indeed, there is no established protocol commonly shared and used by the scientific community for figurine analysis,<sup>26</sup> unlike what happens, for example, in ceramology.

#### 3.2 Aims and theoretical frame of the study

In this respect, the protocol chosen for the study of the Tell Abraq figurine corpus falls within the scope of this new impetus. The aim was to investigate these distinctive objects in the framework of their materiality, insofar as they are manufactured objects made of a specific material: clay. The latter has its own particularities, linked to the cultural choices made by the producers, both in terms of the paste recipe used and the gestures and tools employed to shape them. In addition, the Tell Abraq figurines are fired: as in the case of ceramics, they undergo a firing process that transforms the raw clay material into terracotta, which has the advantage of fixing in the mass the stigmata left intentionally or not by the producers, providing information on how these objects were manufactured. These particular stigmata can thus be decoded thanks to the technological approach and the concept of *chaîne opératoire*.<sup>27</sup>

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24 Bolognani/Knudsen 2022: 1.

25 As illustrated by the workshop organized by Barbara Bolognani and Nadeshda B. Knudsen during the 12th International Congress on the Archaeology of the Ancient Near East (ICAANE) in 2021 with presentations focusing notably on experimental archaeology, archaeometry and semantic studies applied to figurine analysis (Bolognani/Knudsen 2022).

26 Despite several books or manuals, whether general (such as Insoll 2017) or on more specific subjects or chronological periods but with an interdisciplinary approach (Darby/de Hulster 2021).

27 For a more comprehensive historical account of this theoretical concept, see in particular Pigeot 2011. For a critical historiographical approach, see Djindjian 2013.



This notion originates from the anthropology of techniques and the works of French anthropologists such as Marcel Mauss<sup>28</sup> and André Leroi-Gourhan,<sup>29</sup> who both emphasize the processual and sequential nature of any technical activity. Robert Creswell then sets out the commonly accepted definition in 1976.<sup>30</sup> In his words, a *chaîne opératoire* is “a series of operations that transforms any raw material into a finished product, whether it is an item of consumption or a finished tool.”<sup>31</sup>

As early as the 1980s, under the impulse of ethnoarchaeological studies and anthropology of techniques, several ceramologists such as Sander van der Leeuw,<sup>32</sup> Owen Rye,<sup>33</sup> or Valentine Roux<sup>34</sup> suggested using this concept to study ceramic production in their diachronic and synchronic variability, as well as the anthropological implications of adopting a particular *savoir-faire*.<sup>35</sup>

Therefore, describing the *chaîne opératoire* of ceramic production consists in identifying the main steps necessary to obtain a finished product: selection and preparation of the clay material, shaping the vessel, surface finishing, surface treatments, and firing. The variability of each of these steps depends on the technique chosen by the potter. Theoretically, these can be identified thanks to the traces left unintentionally or on purpose during production. These marks are called macrotraces, and it is precisely their reading and systematization that allow us to account for the production processes.

Testing this particular approach on the zoomorphic figurine assemblage of Tell Abraq appeared potentially relevant for several reasons. One main question lies at the basis of this investigation: does this approach help the interpretation of non-diagnostic fragments that, if only considered from a typological perspective, would have been ignored? In addition to this methodological reasoning, this particular approach also allows us to address other questions of a more anthropological nature regarding the persons who produced them.

In fact, although the notion of *chaîne opératoire* has been applied in a limited but growing way in the field of figurine studies, it seems to be increasingly implemented in archaeological studies, particularly with regard to techno-social questions.<sup>36</sup>

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28 Mauss 1923-1924.

29 Leroi-Gourhan 1943; Leroi-Gourhan 1945, and especially Leroi-Gourhan 1964 and Leroi-Gourhan 1965.

30 Creswell 1976.

31 Creswell 1976: 13. In the original: “série d’opérations qui transforme une matière première en un produit fini, que celui-ci soit un objet de consommation ou un outil fini”.

32 Van der Leeuw 1984; van der Leeuw 1993.

33 Rye 1981.

34 Roux 2010; Roux/Courty 2016; Roux/Courty 2019.

35 See also Lemonnier 1983; Lemonnier 1993; Balfet 1991; Dobres 1999; Dupont-Delaleuf 2023.

36 Pizzeghello et al. 2015; Kreiter et al. 2021; Arntz 2022; Forte/Miniaci 2023.

### 3.3 Combining multiple observation protocols and criteria

The following methodology was systematically applied to all figurines, regardless of their degree of fragmentation. Three criteria of observation were adopted on a macroscopic scale, and then combined: clay fabrics, macrotraces, stigmata of production processes, and, finally, typology.

#### 3.3.1 Fabrics

Ceramic pastes were observed using a x20 magnifying glass. Several observational criteria were taken into account when defining the different types of paste in the Tell Abraq zoomorphic figurines assemblage. First, the colour of the inner and outer surfaces of the fragment, along with its core, were examined. Next, the percentage of non-plastic elements was taken into account as well as their nature. When they were visible, a brief description of their morphology and colour was provided.

In some cases, it was found useful to further subdivide the main fabric groups, while awaiting further petrographic and/or chemical analyses that might enable us to group them.<sup>37</sup>

#### 3.3.2 *Chaînes opératoires* analysis

All macrotraces specific to the production processes were observed and described on each fragment. The descriptive lexicon used follows the suggestions made by Valentine Roux and Marie-Agnès Courty in their pottery technology manual.<sup>38</sup> The features observed included surface topography, networks of cracks, hollows and bumps, breakage morphology and location, and the appearance and layout of surface striation networks. As in the case of pottery sherds, fractures were also observed on a macro- and meso-scale: voids and vacuoles layout, as well as the internal layout of the fine fraction and the orientation of non-plastic particles present in the clay were also described.

All these elements bear witness to specific technical actions which, when systematized and organized together, allow the reconstruction of *chaînes opératoires*, corresponding to the stages preferentially followed by craftspeople in their production.

#### 3.3.3 Typology

A typological discrimination was carried out. To do so, the most complete specimens were selected, along with those from other sites documented in the archaeological literature. Formal

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37 Several studies on figurines have taken into account the analysis of clay fabrics, based on different archaeometric methods and petrography, in order to characterize the nature of the raw material (see Ignat et al. 2018; Braekmans et al. 2019).

38 Roux/Courty 2016.

elements such as the shape of the body, legs, head, and tail were combined as well as saddles and decorative elements.

### 3.3.4 Establishing techno-morpho-stylistic categories

In order to test its heuristic potential for this category of small finds, the Tell Abraq figurine corpus was studied according to a method inherited from pottery technology studies.<sup>39</sup> Consequently, the figurine assemblage was studied using a combination of three successive stages of analysis: analysis of the technical groups by observing the traces that provide information on the production methods used by the craftsperson; macroscopic examination of the raw materials used to describe their characteristic, as well as the preparation of the paste; and the morpho-stylistic characteristics of the assemblage. Nevertheless, to be complete, the fabric analysis should include a petrographic study, which has not yet been carried out for the Tell Abraq corpus.

Therefore, after an observation process, these three criteria were hierarchized, crossed and classified to define major techno-morpho-stylistic groups. As mentioned above, most of the objects come from superficial topsoil stratigraphic contexts. *A priori*, it would then be impossible to cross-reference these data with chrono-stratigraphic information. However, it is precisely this method, combined with published data from figurines found in relevant stratigraphic contexts, that has enabled us to propose a relative dating, and therefore gather archaeological information, for these figurines.

## 4 Results

This procedure led to the following observations on the assemblage:

### 4.1 Fabric Groups

Six main fabric groups were identified within the whole assemblage, most probably corresponding to different paste recipes used by the craftspeople. If we exclude the anthropomorphic figurines, which are beyond the scope of this study, along with small unidentified fragments, five fabric groups are represented (G1, G2, G4, G5 and G6).<sup>40</sup> A brief description of each fabric group is given in Tab. 2.

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<sup>39</sup> Roux/Courty 2016; Roux/Courty, 2019.

<sup>40</sup> G3 has only been identified on anthropomorphic figurines.

Group 1 is by far the most common since it constitutes 61% of the studied assemblage (Fig. 4). Group 4 is the second largest, accounting for 22%. Finally, Groups 2, 5, and 6 all account for 6%.

In the absence of more petrographic or chemical analysis, it has not been possible to propose an identification of the mineral inclusions, except mica. Nor has it been possible to determine whether these mineral inclusions were genuine tempering agents added deliberately by the craftspersons, or if they were naturally present in the clay. It was also impossible to establish whether the preparation of the clay paste involved decantation or purification stages. Nevertheless, it is possible to conclude that, in certain fabric recipes, producers voluntarily added a vegetal temper (Groups 2, 4 and 6).

Tab. 2: Fabric description and associated number of figurines

Group Name	Characteristics	Number of individuals
G1	Beige to light orange. Compact and semi-fine. Numerous small brown and dark grey mineral grits and micas.	22
G2	Dark red. Compact and fine. Abundant vegetal temper. No visible mineral inclusions.	2
G4	Beige. Compact and sandy. Abundant vegetal temper.	8
G5	Dark orange to light brown. Compact and coarse. Brown to dark grey grits, mica and large angular red mineral inclusions.	2
G6	Orange to red. Compact and very fine. No visible mineral inclusions and very scarce vegetal temper.	2

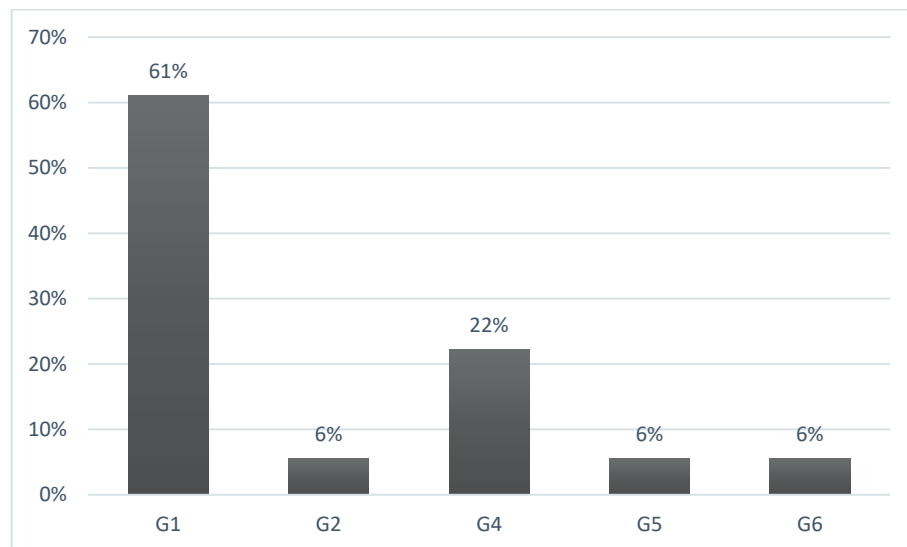


Fig. 4: Percentage of figurines per fabric group

## 4.2 Technical analysis: production steps

Macrotraces indicated the use of several techniques to produce the zoomorphic figurines, for each stage of production steps, which are shaping, finishing touches, surface treatment, and firing process.

### 4.2.1 Shaping

The shaping of the body always entails the preparation of separate elements that are later joined together. This technique, however, comprises two variants (Fig. 5).

The first technique (S1) consists in deforming a lump of clay by stretching it to form altogether the body and the legs. A lump of clay is indeed stretched sideways and then bent slightly. In this case, the fractures are characteristic: they often occur in the central part of the body (Fig. 5.1). This precise spot constitutes a point of weakness as it constitutes the centre from which the shaping force is exerted. Another lump of clay is then added to shape the saddle. The figurine is then flipped a first time, resting on the saddle, which causes the characteristic compaction and flattening of the surface (Fig. 5.2). The shaping of the legs is probably done during this step. They are thinned and reshaped, as indicated here again by the nature of the breakage (Fig. 5.3), which suggests another point of weakness. The head is probably the last element to be added, as suggested here again by the characteristic breakage (Fig. 5.4).

In the second technique, S2, the body, the legs, and the head are shaped separately using small lumps of clay and then joined. In this case, the breakage is also characteristic: they affect the legs in their proximal part, where they are attached to the body (Fig. 5.5). The section of some of the breaks display a particular organization of the non-plastic particles, following a circular movement (Fig. 5.6). This suggests that they have organized themselves according to the movement in which they were rolled between the craftsperson's hands and fingers. This interdigital rolling is also evidenced by the aspect of the surface topography, which displays an alternating pattern of bumps and hollows arranged in a spiral movement (Fig. 5.7). The shape of the foot is then either refined by small pinches to obtain a more or less pointed end or flattened directly against the support surface to obtain a flat one (Fig. 3.5). The elements are then joined together by smoothing, as indicated by the presence of striations and overflowing of the paste.

The head is always added at a later stage and is made from a gradually deformed coil of clay. Nevertheless, there is some ground to suggest the existence of a mixed technique combining a hand-modelled body and a moulded head. In fact, the care taken in shaping the head of certain camel figurines compared to the rest of the body (Fig. 5.5) and the striking regularity of their dimensions (Fig. 5.7) could suggest the use of this type of technique, that is also documented from other sites such as Nippur, in southern Mesopotamia.<sup>41</sup> After moulding the

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41 See the Parthian horse and rider figurine (B15473) from Nippur currently housed at the Penn Museum, Philadelphia ([https://www.penn.museum/collections/object\\_images.php?irn=287508#image1](https://www.penn.museum/collections/object_images.php?irn=287508#image1)).



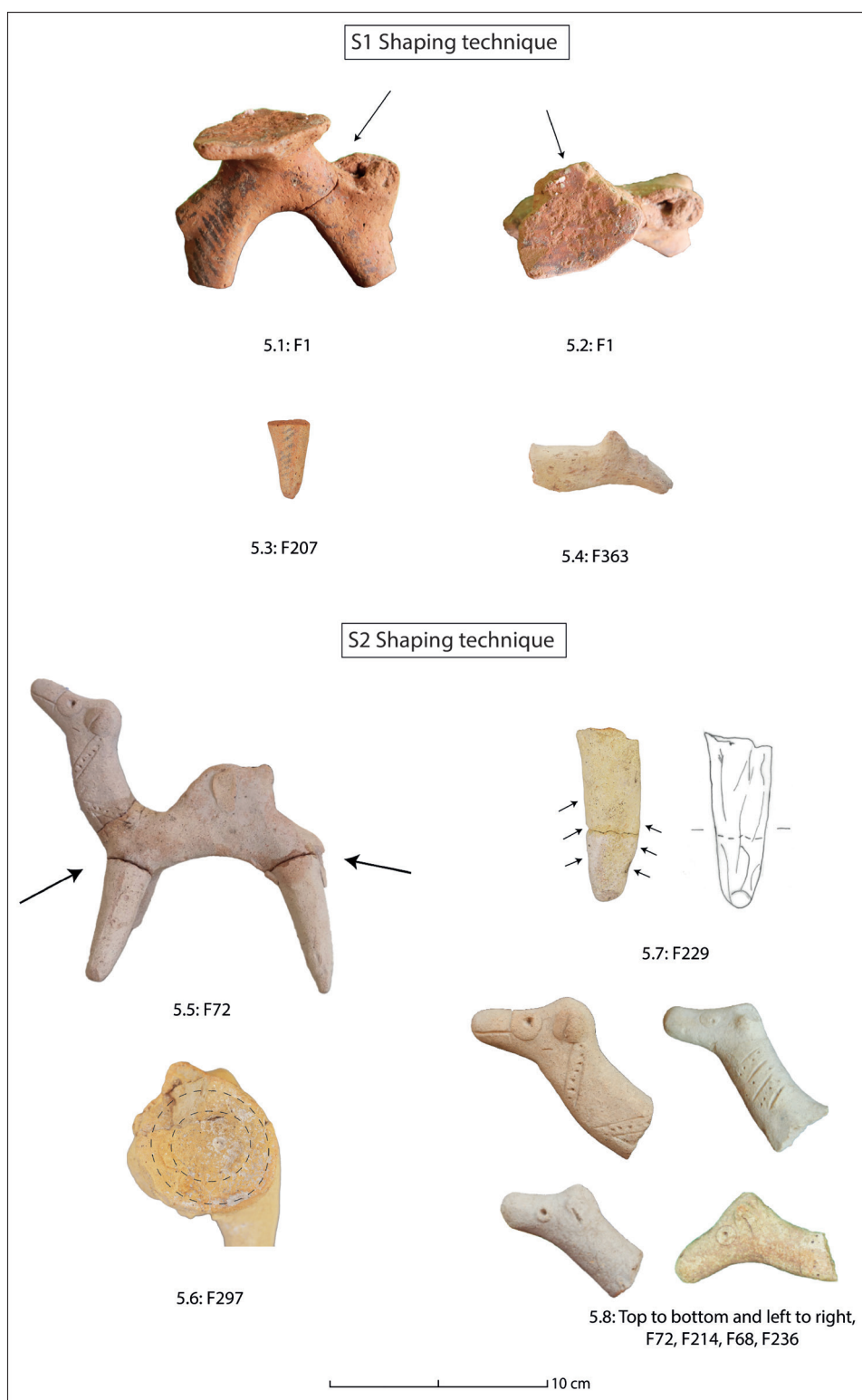


Fig. 5: Shaping technique macrotraces (photographs: C. Abric, M. Degli Esposti, M. P. Pellegrino. Drawing: N. Gilbert)



Fig. 6: Finishing touches macrotraces (photographs: C. Abric)

matrix, the artisan would then add the decoration, incised in the case of these camel heads from Tell Abraq. Experimental archaeology could confirm or refute this hypothesis. In any case, if this is indeed hand-modelling and not a mixed technique combining moulding and hand-modelling, the homogeneity of this type of production testifies to great technical mastery on the part of the producers.

#### 4.2.2 Finishing touches

After the shaping step, the figurines underwent a finishing stage that aims to regularize the surface and mask any defects. The majority of the figurines thus show streaks of careful scraping with a tool (Fig. 6.1) or smoothing (Fig. 6.2), probably with the hand. It is associated with a compact aspect of the surface topography, which could indicate these operations were done at the leather consistency stage (Fig. 6).

#### 4.2.3 Surface treatments

The surface treatments are primarily decorative. Indeed, no slip or other coating techniques were observed. However, the surface of some fragments displays a greenish colour that contrasts with the original colour of the clay, still visible in the core section of broken fragments (Fig. 7.1). Is it a decayed coating due to taphonomic conditions? One could also wonder about the possible presence of a now lost greenish glaze, as shown by the decayed surface of some

glazed terracotta figurines from the site of Susa, in Iran, dating from the Seleuco-Parthian period.<sup>42</sup> As the case may be, several decorative surface treatments can be distinguished.

1. Painted decoration: several figurines show either a preserved painted decoration or ephemeral traces of paint (black and dark red as in Fig. 7.2, and sometimes purplish as in Fig. 7.3), applied following a continuous or discontinuous gesture. In the latter case, geometric patterns or possible real elements (such as the horse harness) are represented.
2. Modelled decoration: the decorative details can be directly shaped in the clay mass, as suggested by the absence of limits associated with bumps and hollows, corresponding to the continuous or discontinuous pressure applied to the clay mass by the artisan's fingers or a tool. For instance, the clay is finely pinched to suggest horses' mane or camels' ears (Fig. 7.4).
3. Applied decoration: many small details are shaped with small lumps of clay firstly shaped separately and then applied to the main body in a second step. This technique is mainly used for the eyes, tail, or elements such as bridles (Fig. 7.3). Sometimes these elements have detached, leaving only their negative impression (Fig. 7.5).
4. Incised decoration: many figurines are incised with a pointed tool and combine straight lines and punctuations (Fig. 7.6, see also Figs. 5.5 and 5.8). A dotted and impressed decoration is also often used to represent the eyes (Fig. 5.8).

These different types of decorations can also be combined, as perfectly illustrated by a detached camel saddle (Fig. 7.7). Its components are skillfully arranged together before a fine-applied decoration is added to represent the accessories belonging to the rider. Moreover, on the same item, some areas are decorated with impressed dots.

#### **4.2.4 Firing process**

Regardless of the fabric group, the surface colour of the figurines is quite light, ranging from beige to red ochre, suggesting that they were fired in an oxidizing atmosphere. However, it is not possible to define whether the figurines were baked in an open fire or a kiln.

Nevertheless, for the figurines of Group 1, the hardness and compactness of their paste suggest a kiln firing, with high temperatures. Likewise, if the traces found on certain figurines are indeed glaze and not just slip, then this technique requires a very high temperature, only reachable in a kiln to trigger the vitrification process.

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<sup>42</sup> See the following figurines currently housed at the Louvre, Paris (SB 3605: <https://collections.louvre.fr/ark:/53355/cl010177534>; SB 3553: <https://collections.louvre.fr/ark:/53355/cl010177498>; SB 8650: <https://collections.louvre.fr/ark:/53355/cl010181320>).

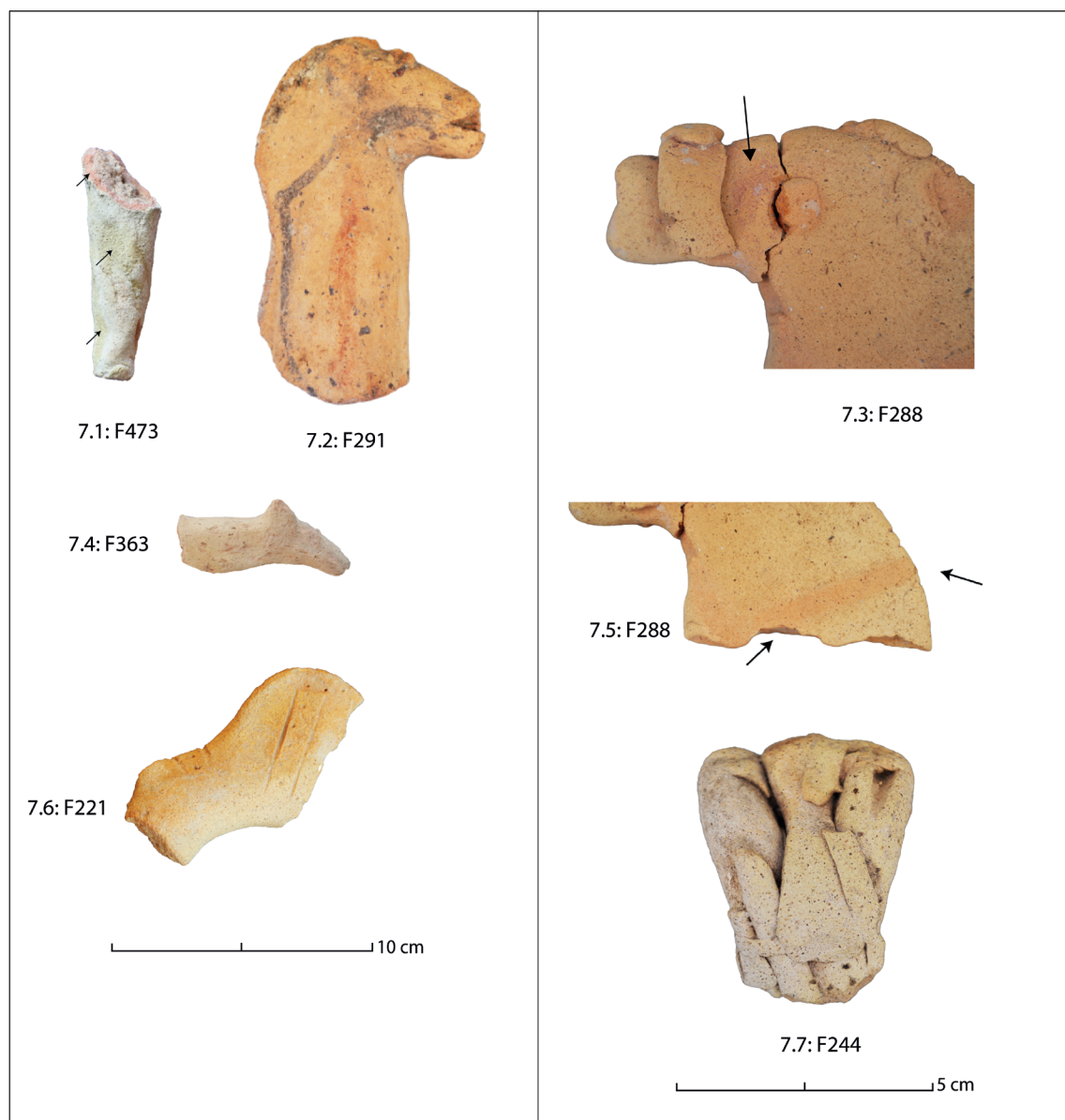


Fig. 7: Different types of surface treatments (photographs: C. Abric, M. P. Pellegrino)

#### 4.2.5 Reconstructing *chaînes opératoires*

Based on the observations discussed above, several *chaînes opératoires* have been identified. They are mainly divided according to the method used to shape the body of the figurine (S1 or S2), the surface treatment<sup>43</sup> and the fabric group (Fig. 8).

<sup>43</sup> To keep the analysis as simple as possible, we decided not to include the modelled decoration as a diagnostic feature in its own right but rather to consider it as part of the figurine's main clay mass.

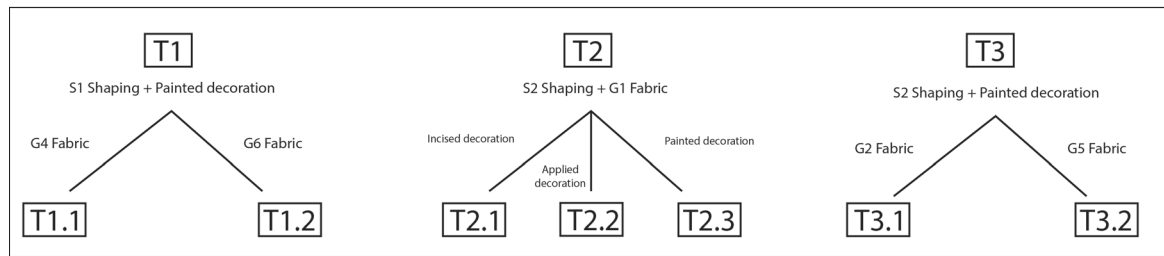


Fig. 8: Schematic representation of the *chaînes opératoires*

The first one (T1)<sup>44</sup> combines S1-type shaping and painted decoration. It is divided into two sub-groups depending on the paste used: T1.1 when Group 4 is used and T1.2 when Group 6 is used.<sup>45</sup>

The second *chaîne opératoire* (T2) combines S2-type shaping and Group 1-type fabric, with several variants depending on the decoration used: T2.1 when incised, T2.2 when applied, and T2.3 when painted.

Finally, a third *chaîne opératoire* (T3) has been identified, combining S2-type shaping and painted decoration. Variant T3.1 uses a Group 2 fabric and T3.2 a Group 5 fabric.

### 4.3 Typology

Lastly, typologically speaking, apart from one figurine that could not be identified,<sup>46</sup> two major classes are represented within the assemblage: camels (in fact, one-humped *camelus dromedarius*) and horses (Fig. 9).

#### 4.3.1 Camel figurines

Camels all have a single hump, sometimes hidden by the saddle (Fig. 9.1). Some feature the surface for a lost rider (Fig. 9.2), while others are associated with a saddle that can be placed directly on the figurine (Fig. 9.3). There are two main types of saddles: either flat and sub-circular (Fig. 9.4) or rounded and semi-circular (Fig. 9.5). The heads are also of two types: elongated with a long muzzle and small pointed ears (Fig. 9.6), or straight with a round muzzle, rounded ears and sometimes incised and dotted eyes (Fig. 9.7). The tail can be placed on one side (Fig. 9.8) or between the legs (Fig. 9.9). Nevertheless, the main constant of this category is the shape of the legs that, despite a small variability, are generally conical and pointed (Fig. 9.10).

<sup>44</sup> 'T' stands for 'tradition', as each *chaîne opératoire* corresponds to a specific way of doing things, i.e. a technical tradition, see Roux/Courty 2019.

<sup>45</sup> It is also worth noting the relative proximity of the nature of these two fabric groups, with similar colours and the common presence of an added vegetal temper, although the quantity seems to differ. Only a petrographic study can confirm or refute this apparent difference.

<sup>46</sup> Figurine F18.



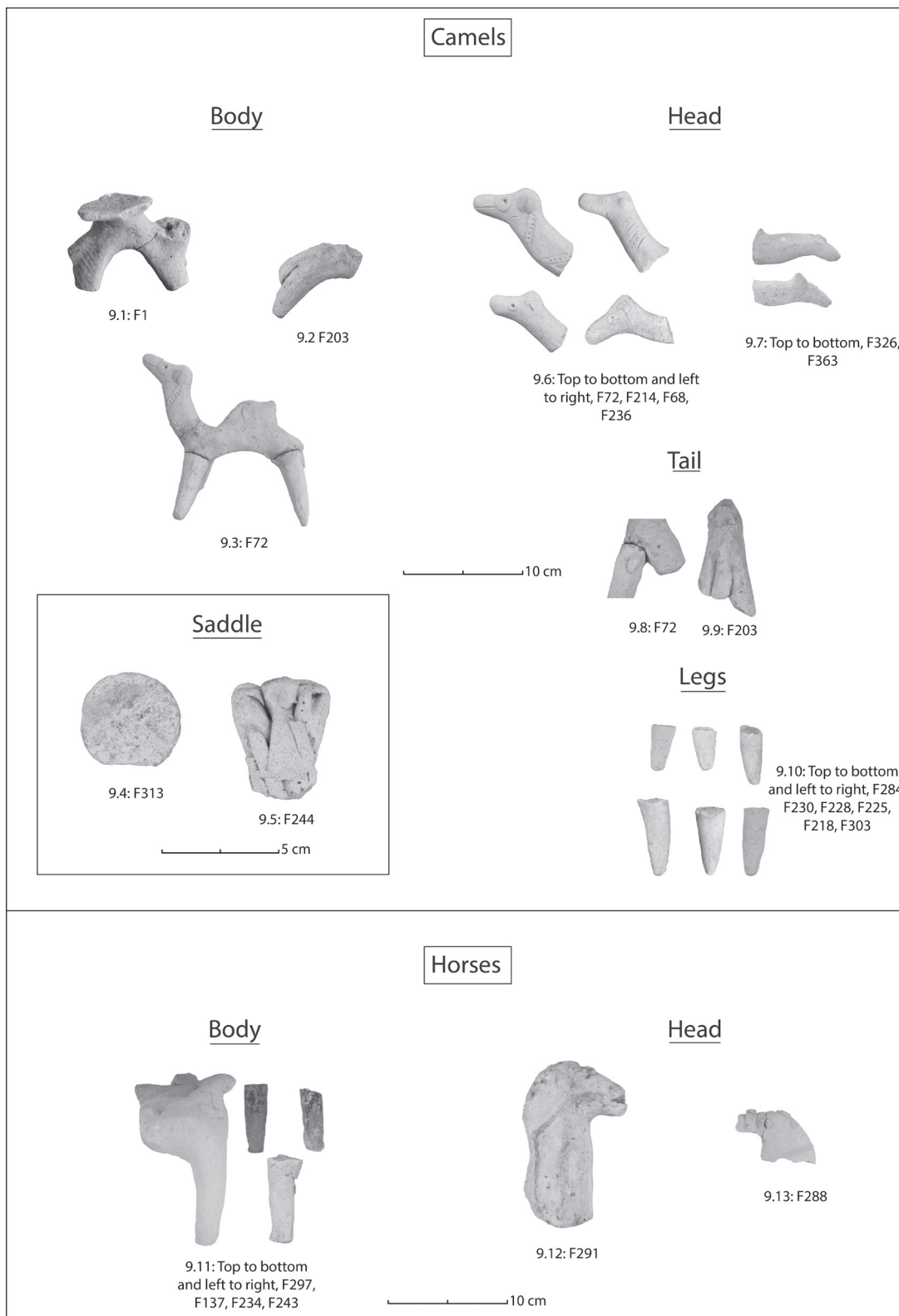


Fig. 9: Typological categories (photographs: M. Degli Esposti, C. Abric, M. P. Pellegrino, N. Gilbert)

### 4.3.2 Horse figurines

The horse figurines are rarer. The legs are again the main discriminating typological element as they are all cylindrical, of regular thickness and with a flattened foot (Fig. 9.11). The heads are of 2 types: rounded (Fig. 9.12) or flat (Fig. 9.13). The eyes, the ears, the mane, and the bridle are always indicated.

## 4.4 Techno-morpho-stylistic categories

In an attempt to link the non-diagnostic fragments to broad categories, several techno-morpho-stylistic groups have been identified according to the parameters previously presented. The three main *chaîne opératoires* identified were then combined with the various typological classes (Fig. 10).

The first broad category (C1) comprises figurines belonging to the T1 *chaîne opératoire*, along with sub-variants T1.1 et T1.2, *i.e.* those whose body and legs are shaped together with a head added later and painted decoration, probably lost due to taphonomic conditions for the ones that bear no trace of it. This *chaîne opératoire* concerns only camels with pointed legs and ears, and elongated heads. A typological difference should be noted, however: figurines made according to *chaîne opératoire* T1.1 have a rounded saddle while the T1.2 types have a hump surface prepared to host a rider.

The second and third categories (C2 and C3) comprise figurines made according to *chaînes opératoires* T2 and T3, *i.e.* those whose parts are shaped separately and then joined in a second step. C2 concerns the camel figurines and C3 the horses.

First, all camels belonging to the C2 category fall within the scope of *chaîne opératoire* T2: they thus all follow the same production process and were made using a clay of G1 group. Interestingly, they all belong to the sub-type T2.1 (*i.e.* with incised decoration), except saddle F244 which features a mixed decoration (incised and applied). Morphologically speaking, they are very homogeneous and all display pointed legs, rounded muzzles, dotted eyes, and a bump sometimes including a separated saddle.

The *chaîne opératoire* of horse figurines included in the C3 category, all of which have rounded and flat legs but differ typologically in the shape of their heads, is variable. In fact, they can have both a painted decoration, in the case of pastes belonging to groups G2 and G5, or an applied decoration in the case of group G1. It is also worth noting the peculiar case of a flat horse's head (F288), whose fabric belongs to G1 and the surface treatment seems to combine painted and applied decoration.

Based on stratigraphic information from Tell Abraq and comparisons with data from other sites in the wider Arabian region, it is possible to assert that the figurines belonging to the C1 category are more ancient and can be dated to the Iron Age II period (c. 1000/1100–600 BCE). In the case of categories C2 and C3, a chronology into the Late Pre-Islamic period (up until the 1<sup>st</sup>–2<sup>nd</sup> century CE) is proposed. Thus, not only can the scattered leg fragments be linked to a particular assemblage, but their reliable dating is possible.

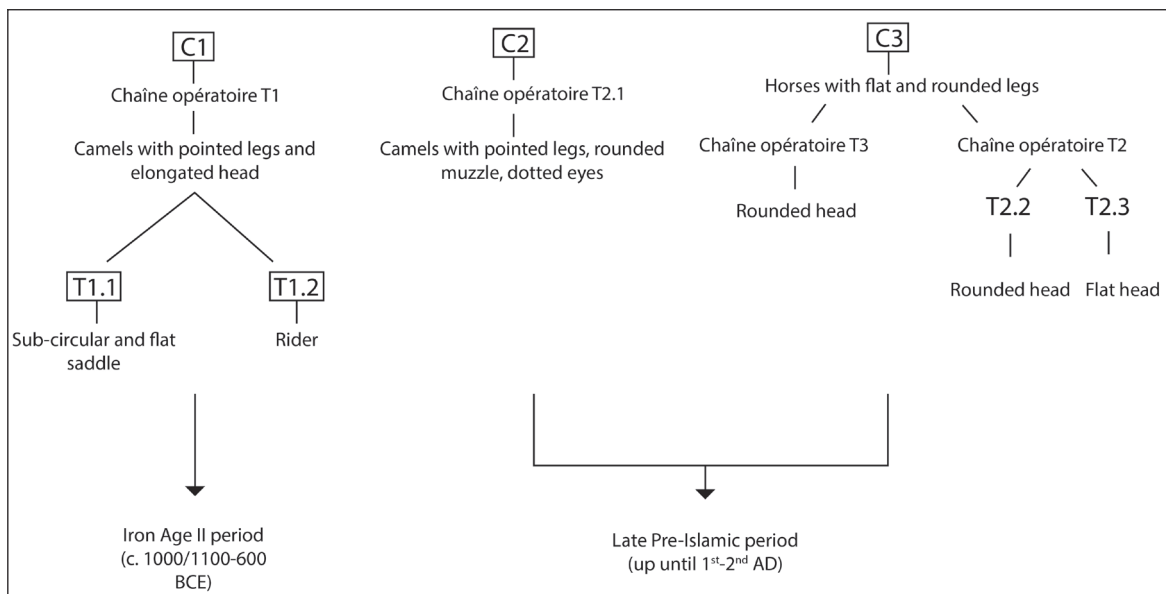


Fig. 10: Schematic representation of the techno-morpho-stylistic categories with their associated chronology

## 5 Discussion

Beyond chrono-stratigraphic considerations, useful to date a stratigraphic unit or a site's occupation, this kind of cross-disciplinary approach also raises techno-social questions concerning modes of production and organization of ancient societies. But, at the same time, as iconographic supports and objects *a priori* manipulated or, at least, manipulable, figurines could provide an opportunity to consider how ancient populations perceived and experienced their environment.

Nevertheless, it is important to avoid excessive over-interpretation, especially in the case of Tell Abraq figurines, since most of them are not associated with a reliable stratigraphic context. Several questions can, however, be raised, meant, for the time being, to provide suggestions and food for thought.

### 5.1 Who produced these figurines?

Studying technical processes, particularly in ceramology, allows profiling the individuals who produced these finished products,<sup>47</sup> individuals whose existence is often diminished by the sources and for whom archaeology reveals only minute traces in the absence of genuine testimony. Applied to figurines and combined with other methods such as the study of fingerprints,

47 Roux/Courty 2016; Roux/Courty 2019.

it is possible to restore a semblance of life to these producers and to envisage the organization of these productions and their status in society.<sup>48</sup>

It is worth noting a persistent presupposition about hand-made figurine production: as a miniaturization of the real world,<sup>49</sup> and sometimes with a simplification of it, they would be produced by children. They could produce them either as toys or as a way to familiarize themselves with clay as part of a particular apprenticeship, notably that of the potter.<sup>50</sup> However, the contribution of ethnoarchaeology<sup>51</sup> or experimental archaeology<sup>52</sup> would be necessary to support this hypothesis. In fact, in the Tell Abraq assemblage, zoomorphic figurines display a certain degree of standardization, as well as *chaînes opératoires* that require the mastery of specific gestures and techniques.

It is also impossible to determine whether the same person shaped a figurine of Tell Abraq and decorated it. In any case, whether the decoration is painted, applied or incised, its execution requires a certain technical mastery. It would seem that firing LPI figurines with G1 paste requires a certain amount of expertise in terms of controlling the firing atmosphere and temperature stages, all the more so if certain figurines turn out to be glazed. In any case, all these clues point to specialized craftsmen<sup>53</sup> rather than apprentices or even children.

## 5.2 Why produce these figurines?

Without a sound stratigraphic context, historical texts or ethnoarchaeological study, it is difficult to know why a figurine was produced. They are often interpreted as children's toys or ritual objects.<sup>54</sup> At Tell Abraq, it is impossible to decide which of these interpretations (or another) applies to zoomorphic figurines. However, the specimen with a detached saddle (F72 and F244) might suggest a toy. Similarly, a camel's head muzzle is perforated (F236), perhaps to thread a cord through the hole. Here again, the mimicry of such a leash could suggest a toy function, even if there is not, for the moment, any comparable example from other contemporary sites.

In addition, several studies focus on the voluntary or involuntary destruction of figurines, perhaps in a ritual context.<sup>55</sup> In the case of Tell Abraq corpus, we consider that this is not the case, or at least that there is not enough evidence to support it. Here, the breakage is preferential and conditioned by the modes of production already explained above.

In any case, even if the function of these figurines cannot be demonstrated, they seem to offer a glimpse into the mental landscape of Southeast Arabian populations during the

48 Sanders 2015; Dyowe Roig et al. 2023; Forte 2023.

49 On this subject, read Davy/Dixon 2019.

50 See Murphy 2020.

51 Bugarin 2005; Ember/Cunnar 2015; Fassoulas/Rossie/Procopiou 2020.

52 Murphy 2020.

53 Moreover, the links between figurine and pottery production are yet unknown.

54 Tooley 1991; Quirke 1998; Langley/Lister 2018.

55 Murphy 2018; Forte 2023; Miniaci 2023.

Iron Age II and LPI periods. Indeed, the camel and horse figurines provide insights into the processes of domestication of these animals and their integration into human-environment dynamics.

According to scholars, the domestication of the camel in the Arabian Peninsula was mastered around 1000 BCE, as shown by the cross-referencing of representational, textual, and archaeozoological data,<sup>56</sup> and Tell Abraç itself provided supporting evidence for a shift between the end of the Bronze Age and the start of the Iron Age.<sup>57</sup> The camel was used for economic and transport purposes, and then gradually as a war mount. The horse was used for the same purposes. As Aurelie Daems clarifies, however, the horse was been better represented in regions bordering the Arabian Peninsula (Mesopotamia, southwestern Iran) than in the region itself, as it would have probably been less suited to the arid desert climate.<sup>58</sup> In any case, horses are less represented in the Tell Abraç assemblage than camels and only appear in the LPI period. This is likely consistent with the general introduction of the horse in the area.<sup>59</sup>

In addition, the morphology of camel saddles may provide information on the evolution of mounting methods. The flat saddles of the Iron Age II period may simply represent a cushion placed on the camel's hump.<sup>60</sup> In contrast, during the LPI period the artisans represented a very detailed saddle, with all the details necessary for a long crossing journey (or battle?). It appears to be a saddle placed at the rear of the camel's hump, as is still the case today in Bedouin communities in the southern Arabian Peninsula.<sup>61</sup> Interestingly, the decorations found on camel figurines, whether painted, incised, or applied, could just as well represent a harnessing system as ritual or symbolic decorations.<sup>62</sup> In the case of the horses, however, the decoration clearly indicated harnessing elements.

## 6 Conclusion

Combining three complementary methods (the reconstruction of the *chaînes opératoires*, the macroscopic characterization of the fabrics, and the typological approach) in order to create a techno-morpho-stylistic typology allows a cross analysis which provides distinctive but complementary data. In the case of our study, it provided us with a chronological context for the figurines and thus allowed us to link even the most fragmented items to a precise production context, a precise corpus, and to include them in the analyses.

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56 Magee 2015.

57 Uerpmann 2001: 228; Uerpmann/Uerpmann 2002.

58 Daems 2004a: 273.

59 See Schiettecatte/Zouache 2017.

60 Bulliet 1990: 80-85.

61 Baum 2018.

62 Tecirli 2018.



The proposed methodology also has limits and needs to be tested on a larger assemblage. The Tell Abraq corpus remains statistically limited and therefore hampers any precise seriation suggestion. We intend to test this method on the anthropomorphic figurines from the site in order to try and link the two sub-assemblages and detect the possible existence of common features, thus further indicating a possible joint production, especially for camels and possible riders. It would also be interesting to deepen this study with experimental archaeology and to attempt to recreate such figurines according to the observed techniques.

From a broader perspective, we believe that this method could also enable a re-evaluation of figurines from ancient excavations. Besides, when applied at a regional scale, it could help in pointing out possible shared technologies and *chaînes opératoires*. Intriguingly, while providing insights on figurine production at the intra-level scale, the application of this method can raise questions which beg for new efforts in search of possible answers: do the *chaînes opératoires* differ from site to site for a given period? Or does it depend on a chronological difference at the regional level? And what would be the economic and anthropological implications for the populations of the time? Terracotta figurines, both fascinating iconographic support and used manufactured items, remain ambiguous objects that deserve to be studied from production to museum, from a biographical perspective.<sup>63</sup>

## References

- Appadurai 1986: Appadurai, A. (ed.), *The Social Life of Things. Commodities in Cultural Perspective*, London/New York 1986.
- Arntz 2022: Arntz, M., *Beyond Meaning: Employing an Artefact Approach to Study Figurines as Functional Items. A Case Study from Çatalhöyük (Turkey)*, in: *Papers from the Institute of Archaeology* 33(1), 2022.
- Balfet 1991: Balfet, H. (dir), *Observer l'Action Technique: des Chaînes Opératoires, Pour Quoi Faire?*, Paris 1991.
- Baum 2018: Baum, D., *The Art of Saddling a Camel*, in: *AramcoWorld* 69(6), 2018, 26–29.
- Benoist 2007: Benoist, A., *An Iron Age II Snake Cult in the Oman Peninsula: Evidence from Bithnah (Emirate of Fujairah)*, in: *Arabian Archaeology and Epigraphy* 18, 2007, 34–54.
- Bonnot 2015: Bonnot, T., *La biographie d'objets: Une proposition de synthèse*, in: *Écouter la musique ensemble* 25, 2015, 165–183.
- Boucharlat/Lombard 1985: Boucharlat, R./Lombard, P., *The Oasis of Al-Ain in the Iron Age: Excavations at Rumeilah 1981-1983. Survey at Hili 14*, in: *Archaeology in the United Arab Emirates* 4, 1985, 44–73.

63 Appadurai 1986; Bonnot 2015.

- Bolognani/Knudsen 2022: Bolognani, B./Knudsen, N. B., Standardising Creativity. Analytical Tools for the Study of Clay Figurines in the Mediterranean and Near East, in: *Les Carnets de l'ACoSt* 22, 2022, 1–5.
- Braekmans et al. 2019: Braekmans, D./Boschloos, V./Hameeuw, H./Van der Perre, A., Tracing the Provenance of Unfired Ancient Egyptian Clay Figurines from Saqqara through Non-Destructive X-Ray Fluorescence Spectrometry, in: *Microchemical Journal* 145, 2019, 1207–1217.
- Bugarin 2005: Bugarin, F. T., Constructing an Archaeology of Children: Studying Children and Child Material Culture from the African Past, in: *Archaeological Papers of the American Anthropological Association* 15(1), 2005, 13–26.
- Bulliet 1990: Bulliet, R. W., *The Camel and the Wheel*, Columbia 1990.
- Calvet/Caubet/Salles 1985: Calvet, Y./Caubet, A./Salles, J.-F., French Excavations at Failaka, in: *Proceedings of the Seminar for Arabian Studies* 15, 1985, 11–26.
- Creswell 1976: Creswell, R., Techniques et culture, les bases d'un programme de travail, in: *Techniques et Culture* 1, 1976, 7–59.
- Daems 2004a: Daems, A., The Terracotta Figurines from ed-Dur (Umm al-Qaiwain, U.A.E.): The Animal Representations, in: *Arabian Archaeology and Epigraphy* 15(2), 2004, 229–239.
- Daems 2004b: Daems, A., The Terracotta Figurines from ed-Dur (Umm al-Qaiwain, U.A.E.): The Human Representations, in: *Arabian Archaeology and Epigraphy* 15(2), 2004, 92–104.
- Darby/de Hulster 2021: Darby, E. D./de Hulster, I. J. (eds), *Iron Age Terracotta Figurines from the Southern Levant in Context*, Leiden 2021.
- Davy/Dixon 2019: Davy, J./Dixon C., What Makes a Miniature? An Introduction, in: Davy, J./Dixon, C. (eds), *World in Miniature. Contemplating Miniaturisation in Global Material Culture*, London, 2019, 1–17.
- Degli Esposti et al. 2022: Degli Esposti, M./Borgi, F./Pellegrino, M. P./Spano, S./Abric, C./Kannouma, R. H., Renewed Excavations at Tell Abraq, Umm al Quwain, 2019–2020 – Insights into the Site's Occupation from the Mid-Second Millennium BC to the Late Pre-Islamic Period, in: *Proceedings of the Seminar for Arabian Studies* 51, 2022, 141–156.
- Degli Esposti et al. 2023: Degli Esposti, M./Borgi, F./Pellegrino, M. P./Kannouma, R. H./Abric, C./Barchiesi, F., Another Side to the Story: Preliminary Results from the Renewed Excavations on the Eastern Flank of Tell Abraq (2021–2022), in: *Advances in UAE Archaeology. Proceedings of Abu Dhabi's Archaeology Conference 2022*, Oxford, 2023, 183–208.
- Djindjian 2013: Djindjian, F., Us et abus du concept de “chaîne opératoire” en archéologie, in: Krausz, S./Colin, A./Gruel, K./Ralston, I./Dechezleprêtre, T. (eds), *L'âge du Fer en Europe. Mélanges Offerts à Olivier Buchsenschutz*, Bordeaux 2013, 93–107.
- Dobres 1999: Dobres, M. A., Technology's Links and Chaînes: The Processual Unfolding of Technique and Technician, in: Dobres, M. A./Hoffman, C. R. (eds), *The Social Dynamics of Technology: Practice, Politics and World Views*, Washington 1999, 124–146.
- Dupont-Delaleuf 2023: Dupont-Delaleuf A., *Sur les traces des potiers*, Paris 2023.

- Dyowe Roig et al. 2023: Dyowe Roig, A. E./Esterabanz-Sánchez, F./Martínez L. M./Molist Montaña, M., Analysis of Fingerprints on a PPNB Figurine from the Tell Halula site, Syria, in: *Archaeological and Anthropological Sciences* 15(4), 2023, 1–13.
- Eichmann et al. 2010: Eichmann, R./Hausleiter, A./al-Najem, M. H./al-Saia, S. F., Tayma – Autumn 2004 and Spring 2005, 2<sup>nd</sup> Report on the Joint Saudi-Arabian-German Archaeological Project, in: *ATLAL: The Journal of Saudi Arabian Archaeology* 20, 2010, 101–147.
- Elmahi/Ibrahim 2003: Elmahi, A. T./Ibrahim, M., Two Seasons of Investigations at Manāl Site in the Wādī Samāyil Area, Sultanate of Oman, in: *Proceedings of the Seminar for Arabian Studies* 33, 2003, 77–98.
- Ember/Cunnar 2015: Ember, C. R./Cunnar, C. M., Children’s Play and Work: The Relevance of Cross-Cultural Ethnographic Research for Archaeologists, in: *Childhood in the Past* 8(2), 2015, 87–103.
- Eskoubi/Abu al-Aila 1985: Eskoubi, K. M./Abu al-Aila, S. R., Thaj Excavations, Second Season 1404/1984, in: *ATLAL: The Journal of Saudi Arabian Archaeology* 9, 1985, 37–53.
- Fassoulas/Rossie/Procopiou 2020: Fassoulas, A./Rossie, J.-P./Procopiou, H., Children, Play, and Learning Tasks: From North African Clay Toys to Neolithic Figurines, in: *Ethnoarchaeology* 12(1), 2020, 36–62.
- Forte 2023: Forte V., Made it for Breaking it? Assessing Fragmentation of the Lahun Figurines (Egypt, MBA II, c. 1800–1700 BC), in: Miniaci, G. (ed.), *Breaking Images: Damage and Mutilation of Ancient Figurines*, Oxford 2023, 243–258.
- Forte/Miniaci 2023: Forte, V./Miniaci, G., Profiling the people behind clay figurines: Technological trace and fingerprint analysis applied to ancient Egypt (Lahun village, MBA II, c. 1800–1700 BC), in: *Journal of Anthropological Archaeology* 72, 2023, 1–22.
- Gazdar/Potts/Livingstone 1984: Gazdar, M./Potts, D. T./Livingstone, A., Excavations at Thaj, in: *ATLAL: The Journal of Saudi Arabian Archaeology* 8, 1984, 55–108.
- Al-Ghabban et al. 2010: Al-Ghabban, A.I./André-Salvini, B./Demange, F./Juvin, C./Cotty, M. (eds), *Routes d’Arabie: Archéologie et Histoire du Royaume d’Arabie Saoudite*, Paris 2010.
- Ghirshman 1976: Ghirshman, R., Terrasses sacrées de Bard-è Néchandeh et Masjid-i Solaiman. L’Iran du Sud-Ouest du VIII<sup>e</sup> s. av. n. ère au Ve s. de n. ère, *Mémoires de la Délégation Archéologique en Iran* 45, Leiden 1976.
- Ignat et al. 2018: Ignat, T./Bugoi, R./Constantin, F./Parnic, V./Lazăr, C., Identifying the chaîne opératoire of Prehistoric Clay Figurines Using Experimental Archaeology and Imaging Methods, in: *International Journal of Modern Physics* 48, 2018, 1–10.
- Insoll 2017: Insoll, T. (ed.), *The Oxford Handbook of Prehistoric Figurines*, Oxford 2017.
- Karvonen-Kannas 1995: Karvonen-Kannas, K., The Seleucid and Parthian Terracotta Figurines from Babylon in the Iraq Museum, the British Museum and the Louvre, Firenze 1995.
- Kreiter et al. 2021: Kreiter, A./May, Z./Petó, A./Tóth, M./Bajnóczi, B./Máté, L./Viktorik, O./Szabó, L./Sklánitz, A./Mészáros Kis, Z./Gödény, M./Cseri Z./Raczky P., Bucrania revisited: Exploring the chaîne opératoire of Bucranium Figurines of the Körös Culture from the 6<sup>th</sup> Millennium, in: *Journal of Archaeological Science, Reports* 37, 2021, 1–17.

- 
- Langley/Lister 2018: Langley, M./Lister, M., Is It Ritual? Or Is It Children? Distinguishing Consequences of Play from Ritual Actions in the Prehistoric Archaeological Record, in: *Current Anthropology* 59(5), 2018, 616–643.
- LeBaron Bowen 1950: LeBaron Bowen, R., *The Early Arabian Necropolis of Ain Jawan. A Pre-Islamic and Early Islamic Site in the Persian Gulf*, New Haven 1950.
- Leroi-Gourhan 1943: Leroi-Gourhan, A., *Évolution et technique. I. L’homme et la matière*, Paris 1943.
- Leroi-Gourhan 1945: Leroi-Gourhan, A., *Évolution et techniques. II. Milieu et techniques*, Paris 1945.
- Leroi-Gourhan 1964: Leroi-Gourhan, A., *Le Geste et la parole. I. Technique et langage*, Paris 1964.
- Leroi-Gourhan 1965: Leroi-Gourhan, A., *Le Geste et la parole. II. La mémoire et les rythmes*, Paris 1965.
- Lemonnier 1983: Lemonnier, P., L’étude des systèmes techniques, une urgence en technologie culturelle, in: *Techniques et Culture* 1, 1983, 11–34.
- Lemonnier 1993: Lemonnier, P., *Technological Choices: Transformation in Material Cultures since the Neolithic*, London/New York 1993.
- Lombard 1999: Lombard, P. (ed.), *Bahreïn, la civilisation des deux mers: de Dilmoun à Tylos*, Paris 1999.
- Martinez-Sève 2002: Martinez-Sève, L., *Les figurines de Suse. De l’époque néo-élamite à l’époque sassanide*, Paris 2002.
- Mauss 1923–1924: Mauss, M., Essai sur le don. Forme et raison de l’échange dans les sociétés archaïques, in: *L’Année sociologique*, 1923–1924, 143–279.
- Magee 1996: Magee, P., Excavations at Muweilah. Preliminary Report on the First Two Seasons, in: *Arabian Archaeology and Epigraphy* 7(2), 1996, 195–213.
- Magee 2007: Magee, P., Excavations at Muweilah (Sharjah) 2004–2007, in: *Sharjah Antiquities* 11, 2007, 1–53.
- Magee 2015: Magee, P., When was the Dromedary Domesticated in the Ancient Near East?, in: *Zeitschrift für Orient-Archäologie* 8, 2015, 252–277.
- Magee et al. 2017: Magee, P./Händel, M./Karacic, S./Uerpmann, M./Uerpmann, H.-P., Tell Abraq during the Second and First Millennia BC: Site Layout, Spatial Organization, and Economy, in: *Arabian Archaeology and Epigraphy*, 28(2), 2017, 209–237.
- Miniaci 2023: Miniaci, G. (ed.), *Breaking Images: Damage and Mutilation of Ancient Figurines*, Oxford 2023.
- Murphy 2018: Murphy, C., Solid Items Made to Break, or Breakable Items Made to Last? The Case of Minoan Peak Sanctuary Figurines, in: *Les Carnets de l’AcoSt* 17, 2018, 1–10.
- Murphy 2020: Murphy, C., Ceramicists, Apprentices or Part-Timers? On the Modelling and Assembling of Peak Sanctuary Figurines, in: *Exarc Journal* 3, 2020.
- Parlasca 1986: Parlasca, I., Die nabatäischen Kamelterrakotten. Antiquarische Aspekte und kulturgeschichtliche Bedeutung, in: Lindner, M. (ed.), *Petra. Neue Ausgrabungen und Entdeckungen*, München 1986.

- Pigeot 2011: Pigeot, N., Chaînes opératoires: contexte théorique et potentiel cognitif, in: Treuil, R. (ed.), *L'archéologie cognitive*, Paris 2011, 149–171.
- Pizzeghello et al. 2015: Pizzeghello, A./Vidale, M./Salemi, G./Tinè, V./Di Pilato, S., De-constructing Terracotta Female Figurines: a Chalcolithic Case-Study, in: *Interdisciplinaria Archaeologica* 6(1), 2015, 7–17.
- Potts 1990: Potts, D. T., A Prehistoric Mound in the Emirate of Umm al-Qaiwain, U.A.E. Excavations at Tell Abraq in 1989, Copenhagen 1990.
- Potts 1991: Potts, D. T., Further excavations at Tell Abraq. The 1990 Season, Copenhagen 1991.
- Potts 1993: Potts, D. T., Four Seasons of Excavation at Tell Abraq (1989–1993), in: *Proceedings of the Seminar for Arabian Studies* 23, 1993, 117–126.
- Potts 2000: Potts, D. T., *Ancient Magan. The Secrets of Tell Abraq*, London 2000.
- Quirke 1998: Quirke, S., Figures of Clay: Toys or Ritual Objects, in: Quirke, S. (ed.), *Lahun Studies*, 1998, 141–151.
- Roux 2010: Roux, V., Lecture anthropologique des assemblages céramique: fondements et mise en œuvre de l'analyse technologique, in: *Les Nouvelles de l'Archéologie* 119, 2010, 4–9.
- Roux/Courty 2016: Roux, V./Courty, M.-A., *Des Céramiques et des Hommes*, Nanterre 2016.
- Roux/Courty 2019: Roux, V./Courty, M.-A., *Ceramics and Society: A Technological Approach to Archaeological Assemblages*, Berlin 2019.
- Rye 1981: Rye, O. S., *Pottery Technology: Principles and Reconstruction*, Washington 1981.
- Salles 1986: Salles, J.-F., Tell Khazneh: les figurines en terre cuite, in: Calvet Y./Salles J.-F. (eds), *Failaka, fouilles françaises 1984–1985*, Lyon 1986, 143–200.
- Sanders 2015: Sanders, A., Fingerprints, Sex, State, and the Organization of the Tell Leilan Ceramic Industry, in: *Journal of Archaeological Science* 57, 2015, 223–238.
- Schiettecatte/Zouache 2017: Schiettecatte, J./Zouache, A., The Horse in Arabia and the Arabian Horse: Origins, Myths and Realities, in: *Arabian Humanities* 8, 2017, 1–38.
- Tecirli 2018: Tecirli, B., Bling Your Camel, in: *AramcoWorld* 69(6), 2018, 24–26.
- Tooley 1991: Tooley, A. M. J., Child's toy or ritual object?, in: *Göttinger Miszellen* 123, 1991, 101–111.
- Uerpmann 2001: Uerpmann, M., Remarks on the animal economy of Tell Abraq (Emirates of Sharjah and Umm al-Qaywayn, UAE), in: *Proceedings of the Seminar for Arabian Studies* 31, 2001, 227–233.
- Uerpmann/Uerpmann 2002: Uerpmann, H. P./Uerpmann, M., The Appearance of the Domestic Camel in South-East Arabia, in: *Journal of Oman Studies* 12, 2002, 235–260.
- Van Beek 1969: Van Beek, G. W., *Hajar Bin Humeid: Investigations at a Pre-Islamic Site in South Arabia*, Baltimore 1969.
- Van der Leeuw 1984: Van der Leeuw, S. E., Dust to Dust: a Transformational View of the Ceramic Cycle, in: Van der Leeuw, S. E./Pritchard, A. C. (eds), *The Many Dimensions of Pottery. Ceramics in Archaeology and Anthropology*, Amsterdam 1984, 707–773.

- 
- Van der Leeuw 1993: Van der Leeuw, S. E., Giving the Potter a Choice. Conceptual Aspects of Pottery Technique, in: Lemonnier, P. (ed.), Technological choices. Transformation in material cultures since the Neolithic, London 1993, 238–288.
- Van Ingen 1939: Van Ingen, W., Figurines from Seleucia on the Tigris, Michigan 1939.