In Search of the Origins of Lower Egyptian Pottery:
A New Approach to Old Data

Agnieszka Mączyńska

POZNAŃ ARCHAEOLOGICAL MUSEUM

In Search of the Origins of Lower Egyptian Pottery: A New Approach to Old Data

For Dominik, Tymoteusz
and Jowita

Studies in African Archaeology
Vol. 16

MUZEUM ARCHEOLOGICZNE w POZNANIU

Poznań Archaeological Museum

In Search of the Origins of Lower Egyptian Pottery: A New Approach to Old Data

Agnieszka Mączyńska

Poznań 2018

Studies in African Archaeology
vol. 16

Editor-in-chief of Poznań Archaeological Museum publications
Marzena Szmyt

Reviewers of volume
Krzysztof M. Ciałowicz, E. Christiana Köhler

Translation
Michał Cieślak

Proofreading
Paul McNamara

Typeset by
Tomasz Kasprowicz

Cover design
Ewa Wąsowska

Cover image
Lake Qarun. Photo by Maciej Jórdeczka

PL ISSN 0866-9244
ISBN 978-83-60109-61-8

Published as a part of the project 'The Development of the Early Neolithic Societies in Lower Egypt in the 5th Millennium BC and their Interactions with the Southern Levant" financed by the National Science Centre in Poland (No. UMO-2014/13/B/HS3/04874).

61-781 Poznań, ul. Wodna 27
tel. +48 61 852 82 51, fax. +48 61 853 10 10
e-mail: muzarp@man.poznan.pl
www.muzarp.poznan.pl

Printed by
Drukarnia cyfrowa ESUS
ul. Południowa 54, 62-064 Plewiska

Table of Contents

Lists of Maps, Tables, Figures and Abbreviations

List of Maps

List of Tables

List of Figures

List of Abbreviations

ACACIA – Arid Climate, Adaptation and Cultural Innovation in Africa
CPE – Combined Prehistoric Expedition
IFAO – Institut français d'archéologie orientale
ITCZ – Intertropical Convergence Zone
PPN – Pre-Pottery Neolithic
PPNA – Pre-Pottery Neolithic A
PPNB – Pre-Pottery Neolithic B
PPNC – Pre-Pottery Neolithic C
pXRF – Portable X-ray fluorescence spectrometer
RUG – Rijkuniversiteit Groningen
UCLA – University of California, Los Angeles
UOA – University of Auckland

Preface

In Search of the Origins of Lower Egyptian Pottery: A New Approach to Old Data is an account of studies that were conducted from 2015 to 2018, as part of a project entitled *The Development of the Early Neolithic Societies in Lower Egypt in the 5th Millennium BC and their Interactions with the Southern Levant*, financed by the National Science Centre Poland. However, the idea to search for the origins of Neolithic pottery in Lower Egypt had emerged earlier. For many years, I had been studying the relationships between Egypt and the southern Levant in the 4th millennium BC. From 2011 to 2015, I was involved in a project entitled *The Nile Delta as a Centre of Cultural Interactions between Upper Egypt and South Levant in the 4th Millennium B.C*, which was financed by the Foundation for Polish Science. The project was part of the Parent Bridge programme aimed at providing assistance to young parent-researchers returning to professional work after a parenting break. My studies of the interrelations between these two regions at the time when the Egyptian state was being formed relied mostly on ceramic assemblages. In this way, I realised how little is known about the earliest relationships between Egypt and the southern Levant, as well as about the origins of Neolithic communities in Lower Egypt. Given the presence of the typical Levantine Neolithic package in Egypt (domesticated plants and animals and some technological innovations, including pottery), the hypothesis assuming that Neolithic communities in Lower Egypt developed under Near Eastern influences used to be generally accepted. As the Latin saying *Ex oriente Lux* goes, the introduction of the Neolithic package was a turning point for Lower Egyptian communities, as it initiated social and economic processes that eventually led to the formation of the Egyptian state. An attempt at a closer look at this issue made me realise that the archaeological evidence on which the above hypothesis is based is very poor and calls for further, more detailed studies. I decided that going back to the 6th and 5th millenniums BC would be a good idea for another research project. Its key objective would be to collect archaeological evidence confirming the role of Levantine elements in the development of Lower Egyptian Neolithic communities. Once again, I chose pottery as the subject of my studies. If pottery had indeed been an element of the Neolithic package introduced to Egypt from the Near East, it could be considered as important evidence confirming relations between both regions in this early period. As such, it would point to the Near East as the main source of the Egyptian Neolithic.

However, as my research progressed, I had to revise my views. Despite having access to Neolithic pottery from Lower Egypt and the Late Neolithic ceramic assemblages from the southern Levant, I was unable to find new, previously unknown links between pottery production in both regions. In my research I did not go beyond the theses previously proposed by other scholars, based on similarities in vessel forms, surface treatments or decoration. Thus, my studies did not contribute any new evidence but merely confirmed the theses already known in Egyptian archaeology since the early 20th century. Under such circumstances, I concluded that the only chance for continuing the project was by verifying another hypothesis, namely that linking the beginnings of the Neolithic communities in Lower Egypt with migrations from the Western Desert in the second part of the 6th millennium BC. What makes this hypothesis less popular is the fact that the history of studies on the Egyptian part of the eastern Sahara is much shorter. Furthermore, the proponents of this theory include, first and foremost, research involved in explorations of the desert. With no access to ceramic assemblages from the desert and given the limited number of publications, researching this issue was far from easy. An important role in this context was also played by the most recent discoveries from the Fayum and Wadi Gamal, regularly published over the last couple of years. A new approach to the Neolithic period in Lower Egypt, extending beyond the Near Eastern model generally accepted for the period in question, helped me look at the oldest Lower Egyptian pottery from a broader perspective, incorporating the pottery production of north-eastern Africa. At a certain point of my studies, I accepted the possibility that the Neolithic pottery of Lower Egypt may be rooted in the Western Desert, where pottery had been known from the beginning of the Holocene epoch. Unfortunately, also in this case, comparative analyses did not offer any archaeological evidence that would directly confirm the above hypothesis. Consequently, at the end of my studies, I was facing two hypotheses on the origins of Lower Egyptian Neolithic pottery. Both were supported by similar arguments and neither of them could be confirmed or disproved.

As a graduate student, I was attracted to systems theory. I used this approach in my MA thesis and in my doctoral dissertation (see Mączyńska, 2013). The excellent book by D. Arnold on pottery production (1989), based on the systems paradigm, has been in my ‘toolbox’ for years. Since the factors analysed by Arnold are prerequisites to pottery production and most of them are relevant in its initial phase, I concluded that by analysing these factors in three cultural contexts (Lower Egypt, the southern Levant and the Western Desert) could help me overcome the impasse in which I was stuck during the project.

In Search of the Origins of Lower Egyptian Pottery. A New Approach to Old Data is the result of this realisation. Ceramic theory thus helped me propose a new hypothesis, according to which the pottery production of Lower Egypt could be rooted both in north-eastern Africa and in the southern Levant. I do hope that readers will find this new approach to old data useful and feel inspired to look beyond traditional views that have dominated Egyptian archaeology since the beginning of studies on the Neolithic period.

Acknowledgements

This book could not have been written without the help and friendly support of many people. I am particularly grateful to those who offered me access to Neolithic pottery collections in many places all over the world. Without their consent and support I would not have been able to complete the project, carry on with my studies and finish this work. In particular, I would like to thank:

- Dr. Alois Stuppner, Institut für Urgeschichte und Historische Archäologie, Universität Wien
- Carolin Johansson, Medelhavsmuseet in Stockholm
- Eman Amin, Morwa Mohamed and Mohamed Abdel Meged, the Egyptian Museum in Cairo
- Pia Edqvist and Dr. Alice Stevenson, the Petrie Museum of Egyptian Archaeology, University College London
- The Department of Ancient Egypt and Sudan, the British Museum in London
- Prof. Avi Gopher, Tel Aviv University
- Prof. Yosef Garfinkel and Dr. Katharina Streit, the Hebrew University of Jerusalem
- Prof. Isaac Gilead and Dr. Peter Fabian, the Ben-Gurion University of the Negev, Beer-Sheva
- Dr. Edwin van den Brink, the Israel Antiquities Authority
- Natalia Gubenko, the National Treasures Department in Bet Shemesh, Israel

I would also like to thank the Dominican Friars from L’Ecole biblique et archéologique française de Jérusalem, who hosted me during my two study vis-

its to Jerusalem. In particular, I am grateful to the Polish fathers of St. Stephen's Priory Province of Poland, including Fr. Paweł Trzopek, O.P., Fr. Stanisław Gurgul, O.P. and Fr. Jakub Bluj, O.P. as well as Polish nuns for their help, friendship, conversations and time spent together.

Special thanks are in order for my two reviewers – Prof. Krzysztof M. Ciałowicz and Prof. E. Christiana Köhler, whom I greatly respect and whose research and publications have strongly influenced my entire research career. My first encounter with Egyptian prehistory was nearly 20 years ago, under the guidance of Prof. Ciałowicz whose assistance and friendly support I have always felt.

For many years, Prof. Köhler has been an unparalleled role model as a scholar. In the last couple of years, we have met and talked on many occasions and she has always shown me new paths of development and out-of-the-box solutions.

The feedback from both of my reviewers was invaluable and largely improved the quality of the book as a whole.

Since I have worked on this project in the capacity of an employee of Poznań Archaeological Museum, I would also like to thank Prof. Dr. hab. Marzena Szmyt, the manager of the museum, for her support before and during the project.

Furthermore, I am grateful to my colleagues from Poznań Archaeological Museum, including, in particular, Dr. Marek Chłodnicki, who, 20 years ago, attracted me to Egyptian archaeology, and Dr. Paweł Polkowski for his assistance in obtaining access to Western Desert publications.

I owe special thanks to Michał Cieślak, my long-standing Polish to English translator, for his patience and for making my English writing reader-friendly and correct.

The book was proofread by Paul McNamara, a native speaker of English. I wish to thank him for finding a while for polishing the text at a time when he was actively participating in many other projects. I do appreciate his thorough involvement in the proofreading work.

All my efforts would not matter at all, had it not been for the three people I cannot imagine living without – my husband Dominik and my two children, Tymoteusz and Jowita. Thank you so much for always being there for me.

In Search of the Origins of Lower Egyptian Pottery:
A New Approach to Old Data
Studies in African Archaeology 16
Poznań Archaeological Museum 2018

Chapter 1
Introduction

The oldest Lower Egyptian pottery has been recorded at sites on the northern shore of Lake Qarun in the Fayum Depression and is dated to the middle of the 6th millennium BC. The area was inhabited by groups known in archaeological studies as the Fayumian or Fayum A culture, the first farming and breeding communities in Egypt (see Krzyżaniak, 1977: 57-68; Midant-Reynes, 2000: 100-108; Tassie, 2014: 227-238). During the Neolithic period, clay vessels became common utensils and today constitute an important part of archaeological assemblages from all known Neolithic sites in the areas of the Fayum, Merimde, Sais, and Wadi Hof.

1.1. Aims and outline of the study

Theories explaining the emergence of the first pottery in Lower Egypt have been largely affected by its coexistence with the remains of domesticated plants and animals. The concepts of making and using new types of containers were supposed to have been introduced to Lower Egypt from outside, as an element of the Neolithic package. Such a hypothesis matched the classical model of the Neolithic spreading westwards from the Levant. Newcomers from the Near East were supposed to have introduced new subsistence strategies to Lower Egypt, together with other elements of the Neolithic package, such as clay vessels.

Apart from Levantine hypotheses, an assumption pointing to the eastern Sahara as a source of the Neolithic pottery of Lower Egypt has been proposed. This links Lower Egyptian ceramic assemblages to pottery known from the central and northern part of the Western Desert dated to the final stage of the Holocene humid phase.

The introduction of pottery into the northern part of Egypt supposedly followed migrations of hunter-gatherers and herders from the eastern Sahara, caused by its desiccation. Even though the desert hypothesis is only moderately popular and has rather few supporters, in recent years possible Saharan influences on the development of Lower Egyptian communities have been mentioned more and more often.

This study explores the problem of the origins of Lower Egyptian Neolithic pottery and is aimed determining the direction from which pottery was introduced to Lower Egypt. The point of departure of this study are two already-existing hypotheses, assuming either a Levantine or Saharan origin of Lower Egyptian Neolithic pottery (i.e. Childe, 1935: 48-49; Hayes, 1965: 92, 96-97; Arkell, 1975: 13; Smith, 1989: 75; Midant-Reynes, 1992: 107; Hope, 2002: 57; Kuper, 2002: 9; Warfe, 2003; Tassie, 2014: 184-185; Muntoni & Gatto, 2014: 457; Streit, 2017). The investigation will essentially consist of comparative analyses of ceramic assemblages from Lower Egypt, the Egyptian part of the eastern Sahara and the southern Levant. The results of these analyses will be used to verify these hypotheses or to present a new hypothesis on the origin of Lower Egyptian Neolithic pottery. Finally, a model of pottery introduction into Lower Egypt in the middle of the 6th millennium BC will be proposed.

Chapter 1 presents the aims of the study, as well as its geographic, chronological and cultural frameworks. A brief description of the physical geography of Lower Egypt, the Egyptian part of the eastern Sahara and the southern Levant is presented. An overview of the chronology and the cultural backgrounds of the study is also outlined. The climatic conditions of the Early and Middle Holocene periods in each region discussed in the thesis are described concisely as they had a significant impact on human occupation and cultural development.

Chapter 2 contains a short overview of existing theoretical approaches to the problem of the origins of pottery. Moreover, the author discusses her own theoretical approach, as well as the method used in the study.

In Chapter 3, the state of research on the origin of Lower Egyptian Neolithic pottery is presented. The author starts with a short overview of the origins of pottery among prehistoric societies all over the world. Subsequently, the two possible origins of Lower Egyptian pottery (the southern Levant and the Western Desert) are discussed.

Chapter 4 reviews in detail the cultural situation of north-eastern Africa and the southern Levant during the Early and Middle Holocene periods. Different cultural units of Lower Egypt, the Egyptian part of the eastern Sahara and the southern Levant are discussed, while the corresponding state of research is presented.

In Chapter 5, the ceramic assemblages dated to the Early and Middle Holocene periods from Lower Egypt, the Egyptian part of the eastern Sahara and the southern Levant are examined in detail.

Chapter 6 aggregates the data presented in Chapters 4 and 5 in order to compare the ceramic assemblages from Lower Egypt against those from the southern Levant, on the one hand, and those from the eastern Sahara, on the other. Essentially, the author describes different ceramic assemblages using the same pattern, in line with the theoretical approach of the study. In this way, she presents insights into how pottery production was organised in each region, which makes comparative analyses much easier. In the summary, similarities and differences in the pottery assemblages are evaluated.

In Chapter 7, the author proposes a model of the origins of Lower Egyptian pottery on the basis of the results arrived at in Chapter 6.

Chapter 8 summarises the study and outlines the conclusions.

The Appendix at the end of the book contains short descriptions of all Neolithic pottery collections from Lower Egypt studied by the author.

1.2. Geographic background

The present study encompasses three regions, namely Lower Egypt, the eastern Sahara and the southern Levant (Map 1). The main study area is Lower Egypt, whereas the other two regions – the eastern Sahara and the southern Levant – constitute an important addition providing some comparative evidence. None of these areas are isolated, while their borders are either adjacent or overlapping. Lower Egypt is separated from the southern Levant by the Sinai Peninsula, which does not constitute a geographical barrier. Likewise, there are no major obstacles between the northern part of Egypt, on the one hand, and the Western and Eastern Deserts, on the other, constituting part of the eastern Sahara, one of the most arid environments on Earth.

Lower Egypt, the Western and Eastern Deserts and the Sinai Peninsula are located in today's Arabic Republic of Egypt in north-eastern Africa. The southern Levant is located in today's Israel, Jordan, Palestinian Autonomous Territories, southern Syria and southern Lebanon in south-western Asia. Both the southern Levant and Egypt are part of the Middle East, a geographical region that encompasses south-western Asia and north-eastern Africa.

1.2.1. Lower Egypt

Lower Egypt stretches southwards from the Mediterranean Sea to the 30th parallel north of the equator. Its constituent parts include the Nile Delta, the northern part of the Western Desert with the Siwa, Qattara, Wadi el-Natrun, Wadi el-Rayan and Fayum Depressions and the northern part of the Eastern Desert. Currently, the Nile Delta occupies an area of 22,000 km^2 and stretches from Abu Quir headland at Alexandria in the west, to Port Said in the east (Hamza, 2009: 87). The tip of the Delta is located north of Cairo, where the Nile branches into channels, only two of which currently exist, namely the Rosetta and the Damietta. In the northernmost part of the Delta there are coastal lakes, lagoons and marshes, while the area slopes downwards into the Mediterranean. An important geomorphological feature in the other parts of the Delta are *geziras*, or 'turtle-backs', mounds of sand up to 12 m in height. They are remains of structures originally formed by the activity of ancient channels (Butzer, 1976: 22-25; Midant-Reynes, 2000: 18).

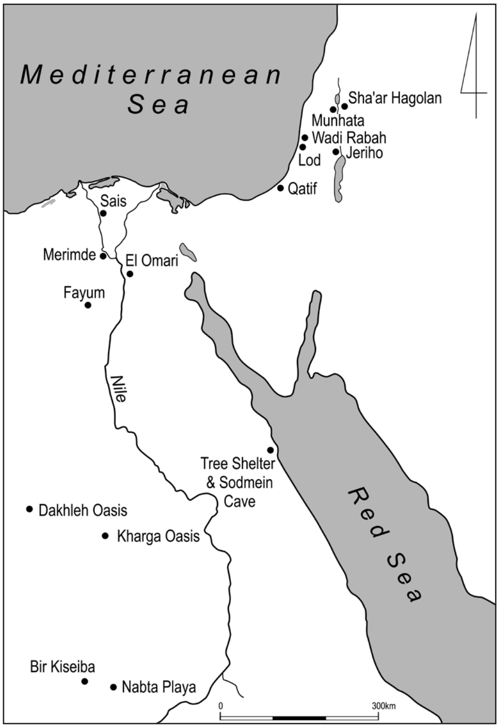
The present study is based on materials from four archaeological sites located within the confines of Lower Egypt (Map 2). Two of them, Merimde Beni Salame and Sais, are located in the Nile Delta, and, specifically, in its western part. Merimde Beni Salame lies on the desert edge at the western side of the Nile Delta, some 2.5 km west of the Rosetta branch of the Nile (Rowland & Bertini, 2016). Sais lies on the eastern bank of the Rosetta, approximately 112 km north-west of Cairo. The el-Omari culture was identified in Ras el-Hof and Wadi Hof in the area west of Helwan, now part of Cairo, at the border between the Nile Delta and the Eastern Desert. The Fayumian sites are located on the northern shore of Lake Qarun in the Fayum Depression, west of the Nile, some 80 km south-west of Cairo.

1.2.2. The eastern Sahara

The part of the eastern Sahara known as the Western Desert represents approximately ⅔ of the entire territory of Egypt. It is a vast and flat limestone plateau, although its landscape is not uniform and features plateaus, depressions, sand dunes, and plains. Except for the south-western part of Gilf Kebir and Jebel Ouenat with altitudes exceeding 1000 m above sea level (asl) at some points, the area is rather low-lying, not exceeding 300-400 m asl. The Western Desert features large depressions, transformed into oases by artesian springs. All oases have similar structures and consist of an escarpment in the north and a floor descending gently southwards, gradually reaching the level of the surrounding desert (Midant-Reynes, 2000: 21-22; Embabi, 2004: 4-5).

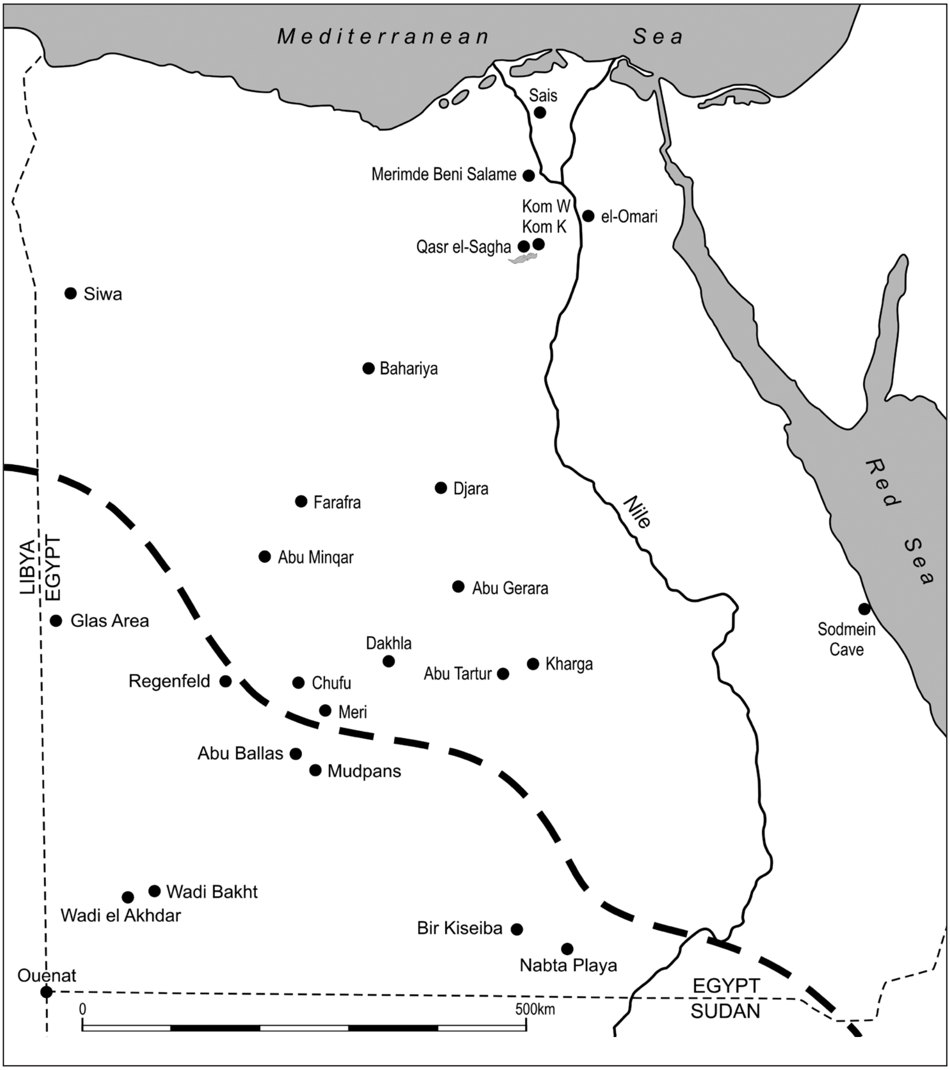
The sites mentioned in this study are spread over a few different locations. Most of them are either near or within the oases of Dakhleh, Kharga, Farafra, Bahariya and Siwa and along a north-south transect of some 1,500 km between Siwa Oasis and the Wadi Howar in Sudan (Map 3). The recorded sites reflect merely the state of research in this very area and it is possible that human activity in the past also extended beyond it.

The Eastern Desert represents approximately a quarter of the entire territory of Egypt. It is made of igneous and metamorphic massifs and features mountains, plateaus, and large wadis. There are a number of drainage networks in this area, which drain water towards the Red Sea or the Nile (Embabi, 2004: 7) The topography of the Eastern Desert is different from that of the Western Desert. Together



Map 1. Map of north-eastern Africa and the southern Levant

Map 2. Map of Lower Egypt showing the location of sites mentioned in the text



Map 3. Map of the Egyptian part of the eastern Sahara showing the location of sites mentioned in the text (dotted line – boundary between the Bifacial technocomplex and the Khartoum-style technocomplex; Riemer *et al*., 2013: fig. 3)

with the Sinai Peninsula, it forms a single geomorphologic entity (Midant-Reynes, 2000: 20). The sites covered by this study are located in the Red Sea Mountains area and in a small wadi tributary of the Sodmein Valley.

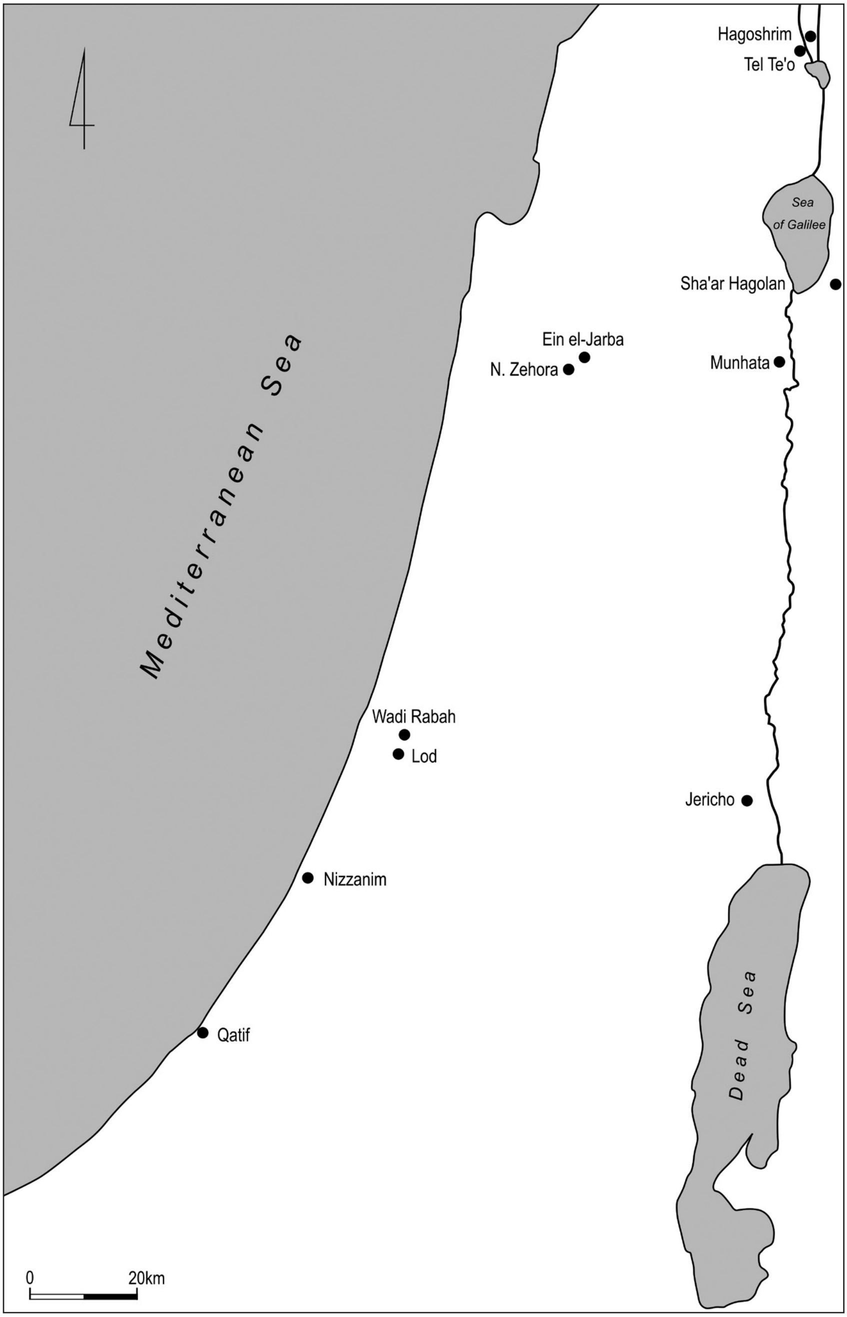
1.2.3. The southern Levant

The southern Levant is split by the northern end of the Great Rift valley, running northwards from the Gulf of Aqaba. The rift formed the Jordan and the Beq'aa valleys and accommodates the Dead Sea and Lake Tiberias. There are a number of different ecological zones in this area, including a coastal region and a hilly zone that rises as high as 100 m. The Dead Sea, the Earth's lowest elevation on land, is located in the Jordan Valley. However, the Transjordan Plateau on the eastern edge of the valley, in the southern part of the region, reaches an elevation of 1700 m, while the Anti-Lebanon Mountains in the north of the valley are even higher. Finally, these two areas slope into the Syrian and Arabian deserts. Some desert areas can also be found in the southernmost Levant in the Negev and the Sinai (Twiss, 2007). Moreover, the Sinai Peninsula is divided into two regions – the high mountains in the south and the great plateau sloping downwards to the Mediterranean in the north.

Sites of the Pottery Neolithic Yarmukian and the Lodian cultures have been recorded in the Mediterranean zone, along the Rift Valley, in the coastal plain, as well as on the edges of major alluvial valleys. Wadi Rabah settlements are located in the Mediterranean zone only, while Qatifian sites have been recorded in the northern Negev (Map 4) (Goring-Morris & Belfer-Cohen, 2014: 161-162). Furthermore, mobile pastoral groups from the period in question operated in the Negev and the Sinai.

1.3. Chronological and cultural background

The Lower Egyptian, Saharan or Levantine pottery investigated as part of this research is dated to the 6th and 5th millenniums BC (Table 1). Although each of the regions addressed in the study is characterised by a different pace of cultural change, a single term, namely the Neolithic, is used to describe the period in question in all these areas. Currently, the term continues to be one of the most commonly debated issues among archaeologists. The Neolithic can take on different meanings, referring to chronology, culture, technology, economy, population, social structure and even conceptual systems (Whittle, 1996). According to J. Thomas, it may encompass "a chronological horizon, a stage in an evolutionary scheme, a form of economy, a set of social relations or a cultural phenomenon" (Thomas, 1999: 13). In the case of Lower Egypt and the southern Levant, the term is used in the traditional sense and refers to the period when the first farming and animal breeding societies appeared. However, the use of the term Neolithic



Map 4. Map of the southern Levant showing the location of sites mentioned in the text

with reference to the Western or Eastern Desert has been debated for many years (i.e. Garcea, 2004; Smith, 2013a; Barich, 2016). The herders from the eastern Sahara hardly fit into this concept with their unique subsistence strategies encompassing mobility, domesticated animals, the use of wild plants and pottery production. As a result, two different 'schools of thought' concerning the use of the term Neolithic seem to exist among researchers working with desert materials. Some researchers use the term Neolithic with regard to the Early and Middle Holocene occupation in north-eastern Africa but extend its meaning beyond the traditional definition so as to address the different, unique character of African food producers (Wendorf & Schild, 2001; Barich, 2016). Members of the other group, however, avoid the term and prefer to use a more general chronological concept, namely the Holocene epoch and its phases. This approach is particularly clearly visible in the works of the German researchers of the ACACIA (Arid Climate, Adaptation and Cultural Innovation in Africa) project, who additionally use the term 'Epipalaeolithic' when referring to the Early Holocene period (e.g. Gehlen *et al.*, 2002; Kuper & Kröplin, 2006; Riemer, 2009; Kuper & Riemer, 2013; Riemer *et al.*, 2013). In this study, the term Neolithic will not be used with regard to evidence from the eastern Sahara.

1.3.1. Lower Egypt

It is generally agreed that the first communities with domesticated plants and animals emerged in Lower Egypt approximately in the middle of the 6th millennium BC. Their appearance is believed to mark the end of an occupation gap of some 600 years that followed the activity of the Qarunian culture in the Fayum. A new form of subsistence, the introduction of pottery and a sedentary lifestyle have been named as the main features distinguishing this period from the preceding Epipalaeolithic. Eventually, the term Neolithic appeared in the archaeology of Lower Egypt to encompass this period. On the basis of discoveries, three cultural units were identified and are currently known as the Fayumian, the Merimde, and the el-Omari cultures. Lower Egyptian Neolithic units were located in different parts of Lower Egypt and overlapped only in certain periods. It is generally agreed that domesticated plants and animals, together with other parts of the Neolithic package, were introduced into Lower Egypt from the southern Levant. The first farmers and herders from this region are associated with migrants from the east. The issue of Western Desert influences on the Lower Egyptian Neolithic has been discussed in Lower Egyptian archaeology very rarely.

The timing of the discoveries of Neolithic sites in Lower Egypt (early 20th century) had a major effect on today's idea of the prehistoric communities who occupied this region in the period in question. The culture-historical approach, widely accepted at the time of the discoveries, resulted in dissecting the Neolithic occupation of Lower Egypt into three isolated cultural units characterised by a limited quantity of available data. Meanwhile, the author's studies on Neolithic pottery from Lower Egypt suggest the existence of a single, region-wide, cultural tradition constituting an underlying foundation for all distinguished cultural units. This cultural tradition evolved, underwent changes and was probably influenced by external sources. Therefore, this division into archaeological cultures does not really reflect the actual divisions of the past and should be treated as an artificial system created for the purpose of archaeology (Mączyńska, 2017).

The chronology of the Lower Egyptian Neolithic has not been clear since the very beginning of research in this area. According to O.F.A. Menghin, the oldest Neolithic culture was the Merimde culture (Menghin, 1961/63: 144). For Menghin, the Fayumian culture was contemporaneous with Merimde III, while the settlement el-Omari, established around 4,000 BC, was contemporaneous with the Upper Egyptian Badarian and Naqada I cultures. Even W. Kaiser considered the Fayumian culture as contemporaneous with the later phases of the Merimde site (Kaiser, 1985: Abb. 10). J. Eiwanger, who explored the Merimde site, also struggled with determining the chronology, despite C14 dates (Eiwanger, 1988: 74). In his opinion, C14 dates for the Urschicht phase were too late and phase I of the Merimde site was older than the Fayumian culture (ca. 5,500 BC). Additionally, he noticed some flint analogies between the younger phases of the Merimde and the Fayumian cultures (Eiwanger, 1992: 62, 74).

The chronological position of the el-Omari site and its relationship to the Fayumian and Merimde cultures were not obvious for many years. Strikingly, the site was sometimes dated to the Early Dynastic or Naqada I or II periods (for details, see Hoffman, 1979: 194-195). Finally, its researchers positioned it between the Merimde and Maadi cultures (Debono & Mortensen, 1990: 80-81). According to B. Mortensen, in terms of absolute chronology, el-Omari was contemporaneous with the Merimde levels IV-V and with the youngest Fayum Neolithic (Mortensen, 1992: 173). However, she also observed some similarities between el-Omari materials and earlier levels of the Merimde site. In terms of relative chronology, el-Omari was treated by B. Mortensen as contemporaneous with the Koms K and W sites in the Fayum and Merimde II cultures (Mortensen, 1992: 173). Moreover, the site's excavators acknowledged a gap between the disappearance of the el-Omari site and the younger site at Maadi.

Currently, it is the prevailing view among researchers to consider the Fayumian culture as the oldest Neolithic unit in Lower Egypt (see Wendorf & Schild, 1976; Ginter *et al.*, 1980; Ginter & Kozłowski, 1983; Kozłowski & Ginter, 1989). Until recently, the C14 datings from the Fayum region indicated that the Neolithic in Lower Egypt began in the middle or the second half of the 6th millennium BC (Table 1). In the opinion of S. Hendrickx (1999), the Fayumian culture could be dated to between 5,400 and 4.400 cal. BC. N. Shirai suggests 5,480-4,260 cal. BC as a possible time span of the Fayumian culture (Shirai, 2010: 49). Based on Bayesian modelling of the sequences of radiocarbon dates from Qasr el-Sagha (QS I/79, QS X/81), K. Streit suggests that the earliest occupation of the site can be calculated to 5,436–5,241 cal. BC at 68.2%, and to 5,772–5,125 cal. BC at 95.4% (Streit, 2017: 408-411). The newest study results from the Fayum have not only made it possible to determine a more detailed chronology for the Fayumian culture but have additionally demonstrated human activity on the shore of Lake Qarun during the occupation gap between the Epipalaeolithic and the Neolithic periods. A number of age determinations from the later part of the Early Holocene period indicates frequent human activity across the northern shore of Lake Qarun from approximately 8,500-7,500 until 6,000 cal. BP (Holdaway *et al.*, 2016: 176-177). The above-mentioned issue calls for further research, particularly in the context of the results of lake sediment analyses implying that the lake dried out during the 8.2 kiloyear BP cold event (Welc, 2016).

The beginnings of the settlement at Merimde Beni Salame are dated to before the 5th millennium BC, during the occupation of the sites on the shore of Lake Qarun (Table 1). Radiocarbon evidence covers the late 6th and most of the 5th millenniums cal. BC (e.g. Hendrickx & Vermeersch, 2000; Tristant, 2005; Köhler, 2010; 2011; Mączyńska, 2013). The end date of the site is estimated at approximately 4,000 cal. BC (Hendrickx, 1999).

Regarding the el-Omari culture, a time range of between 4,600 and 4,400/4,300 cal. BC has been proposed on the basis of radiocarbon determinations (Table 1) (Debono & Mortensen, 1990: 80-81; Hendrickx, 1999). However, unlike the case of the Fayumian and Merimde cultures, it is currently impossible to verify this chronology as the sites are inaccessible and may have been destroyed.

The cultural map of Lower Egypt from the period in question is full of blank spots while all known Neolithic sites probably represent only a small proportion of the actual Neolithic presence in Lower Egypt. Fortunately, the Neolithic period in Lower Egypt has once again become a popular research subject and our knowledge is likely to be enriched with new contributions.

1.3.2. The eastern Sahara

Human occupation of the desert at the beginning of the Holocene epoch was determined by climatic changes. In the Early Holocene period (approx. 9,000 cal. BC), the desert changed into a dry savannah, as a result of an abrupt northward shift of the tropical rainfall belt. Despite milder conditions, the human presence in this area still depended on a few important elements, such as water, vegetation, and animals. Since they were not equally accessible across the entire desert during the Holocene humid phase, human groups with a lifestyle based on hunting-gathering developed various strategies for adaptation to environmental and climatic conditions, characterised by a highly variable mobility pattern. The Middle Holocene period began in the 7th millennium BC. The most important change was the introduction of domesticated animals (ovicaprines and cattle), followed by a gradual shift from hunting to herding. However, hunting continued to be an important food supply strategy, while cattle, sheep, and goats were a minor component of these groups' economy. The Middle Holocene was also a period of a more intensive use of wild plants (Gehlen *et al.*, 2002: 88-91; Kuper & Riemer, 2013: 45-46).

The 6th millennium BC saw the final part of the Holocene humid phase. Two major cultural traditions/technocomplexes were distinguished in the Western Desert in this period (Riemer *et al.*, 2013). In the north, the Bifacial technocomplex emerged, consisting of sites on the Abu Muhariq Plateau and oases on its southern fringe. The activity of herders representing this complex has also been recorded in the Eastern Desert (Sodmein Cave, the Tree Shelter). In the south, researchers have differentiated the Microlithic/Khartoum-style complex, which covered the regions of Abu Ballas scarp-land, the Great Sand Sea, Gilf Kebir, Nabta Playa and Bir Kiseiba.

The present study covers only the Bifacial technocomplex. Its constituent groups shared a common cultural background, manifesting itself in certain common features, such as lithic or ceramic technology, occupational structures or subsistence strategies. Undoubtedly, constant mobility in search of water and food in this period prevented herder groups from isolation. Studies in the central and northern part of the Western Desert show that the area in question was regularly travelled by hunter-gatherers and herders. Particularly important were oases, as they offered reliable access to water, which made them perfect stop-over points allowing for interactions between different groups. Seasonal or episodic movements were conducive to inter-group contacts and to the exchange of goods or ideas. The activity of groups representing the Bifacial technocomplex extended beyond the Western Desert, as their traces have also been recorded in the Eastern Desert.

In the archaeology of this region, local herder groups have been labelled in a variety of ways. Groups belonging to the Djara B people (5,900-5,300 BC) operated on the Abu Muhariq Plateau. The Dakhleh Oasis in the 6th and 5th millenniums BC has been linked to the activities of the Late Bashendi A (6,100-5,650 cal. BC) and Bashendi B people (5,400-3,800 cal. BC). The Kharga Oasis was occupied by herders known as the Early (6,300-5,600 cal. BC) and Late Baris (5,200-3,800 cal. BC) (McDonald, 2009; 2013; 2016; Riemer & Schönfeld, 2010; Tassie, 2014). With regard to the Farafra Oasis, B. Barich proposed a three-phase cultural sequence for the Middle Holocene period, namely: Wadi el Obeiyid A, B and C (6,600-2,500 cal. BC), of which late A, B, and very early C coincide with the 6th and 5th millenniums BC (Barich & Lucarini, 2014: 470-481).

From around 5,300 BC, a declining number of C14 datings from the Western Desert have been recorded, suggesting a decline in settlement activity (Riemer *et al.*, 2013). This change has been linked to the southward withdrawal of monsoonal rains and the onset of desiccation of the Egyptian Sahara. The climatic changes triggered the movement of people and thus caused a migrational shift to the north (the Fayum, the Delta), to the Nile Valley, to southern Egypt, and to northern Sudan. The Bifacial and Microlithic traditions established in the Western Desert in the Middle Holocene began to separate. In the oases, isolated from northern and southern influences, new cultural traditions began to develop (e.g. Sheikh Muftah). Moreover, the area between the Nile and the desert was criss-crossed by pastoral groups who stopped over in locations ensuring easy access to water and pastures in the Nile Valley or in oases (e.g. Tasa groups in the Kharga Oasis). The disappearance of settlement activity in the eastern Sahara in the second half of the 6th millennium BC coincided with the beginning of this activity in the Delta and in the Nile Valley.

1.3.3. The southern Levant

Domesticated animals and plants appeared in this region approximately 10,000 cal. BC, although not all elements of the Neolithic package emerged all at once. A sedentary, or a partly sedentary way of life, was known to have existed at the end of the Epipalaeolithic. Moreover, pottery was neither produced nor used by the first farmers and herders. The Neolithisation in the southern Levant should be viewed as a multi-linear process that had already begun during the Epipalaeolithic and had involved not only subsistence strategies but also other elements, such as the management of fire, water, plastic materials, and even ritual or social activities (Goring-Morris & Belfer-Cohen, 2014).

The Neolithic period in the southern Levant was divided into two main phases. The first is referred to as the Aceramic Neolithic, Pre-Pottery Neolithic or Early Neolithic. The other phase also has a few labels, namely Ceramic Neolithic, Pottery Neolithic or Late Neolithic. The author has chosen to use the term Pre-Pottery Neolithic (PPN) in reference to the first phase of this period and Pottery Neolithic (PN) when referring the other.

For many years, it was the presence of clay vessels that served as a criterion for determining site chronology. As no pottery was thought to have been manufactured in the first phase of the Neolithic period, it has been treated as a hallmark of Pottery Neolithic sites. Recent research has shown that people had already mastered pottery making skills towards the end of the Pre-Pottery Neolithic. Furthermore, pottery was probably linked to plaster production, which was well known and practiced in the PPN.

It used to be generally accepted that between both phases of the Neolithic an occupation gap of approximately one millennium (or even more) had existed.

However, the discoveries of the last three decades disprove the collapse of PPN communities and seem to suggest their transformation caused by multiple social and cultural factors (Verhoeven, 2002: 10; 2004: 259; 2011; Goring-Morris *et al.*, 2009: 216-217). While many settlements were indeed deserted (in particular those west of the River Jordan), people did not disappear altogether from the southern Levant, although their social, economic and even symbolic organisation evolved greatly.

The 7th, 6th and 5th millenniums BC have been linked to the Pottery Neolithic in the southern Levant, and three main archaeological cultures identified in that period, namely: the Yarmukian, the Jericho IX/Lodian and the Wadi Rabah, as well as two smaller ones – the Nizzanim and the Qatifian (Table 1). Unfortunately, researchers investigating this period have failed to agree on the chronology of the Pottery Neolithic units and their mutual relations. According to Y. Garfinkel, the Yarmukian and Jericho IX cultures were contemporaneous with each other (Garfinkel, 1993: 130). They were located in separate geographic regions – the Yarmukian culture in the north and centre of Israel and the Jericho IX culture in its southern part. However, in the opinion of A. Gopher and R. Gophna, the Lodian/Jericho IX culture is an independent younger phenomenon, filling a gap between the Yarmukian and the Wadi Rabah cultures (Gopher & Gophna, 1993: 324-326; see also Rowan & Golden, 2009; Gopher, 2012c: 1530). Similarly, the Nizzanim culture is a matter of debate. For Garfinkel it is an independent pottery tradition that coexisted with the Yarmukian and the Lodian cultures (Garfinkel, 1999: 97). In their turn, Gopher and Gophna suggest that it belonged to, and was a variant of the Lodian culture (Gopher & Gophna, 1993: 317-318; Gopher, 2012c: 1539). In addition, the chronological position of the distinguished units is rather unclear. Garfinkel (1999) suggests that the Wadi Rabah culture is not really a Pottery Neolithic entity, as, in his opinion, it belongs to the Chalcolithic culture (see also Bourke, 2007). According to him, the Qatifian culture postdates the Wadi Rabah culture and should be treated as a Middle Chalcolithic unit (Garfinkel, 1999: 189; Streit & Garfinkel, 2015: 865). In the opinion of Gopher, the Qatifian culture was contemporaneous with the later phase of the Wadi Rabah culture (Gopher, 2012c: 1533). The determination of the respective chronologies of each cultural unit has been affected equally by disputes among researchers and by the small number of C14 dates. In this book, however, the Wadi Rabah and Qatifian cultures are treated as those of the Pottery Neolithic.

The Yarmukian and the Lodian cultures began in the second part of the 7th millennium BC and lasted for ca. 500-400 years. Various date ranges have been suggested so far. According to Gopher, the Yarmukian culture can be dated to between 8,500/8,400 and 7,800 cal. BP and could have lasted even some 500-600 years (Gopher, 2012c: 1532). In his opinion, the Lodian culture appeared after the Yarmukian culture, which existed for approximately 200-300 years and can be dated to between 7,900/7,800 and 7,700/7,600 cal. BP. In 2007, E. Banning proposed a new chronology for Pottery Neolithic entities on the basis of Bayesian analyses of available radiocarbon evidence. In his opinion, the Yarmukian culture began around 6,527-6,376 cal. BC and ended around 5,988-5,762 cal. BC. It thus lasted for anything between 441 and 724 years and overlapped with the PPNC and the Wadi Rabah. The same researcher put forward a date of 5,985/5,832 cal. BC as the beginning of the Lodian culture, assuming that it preceded the Yarmukian culture. The end of the Lodian culture supposedly occurred around 5,654-5,450 cal. BC, assuming a small overlap between the end of the Lodian culture and the beginning of the Wadi Rabah culture.

At archaeological sites, Wadi Rabah layers are positioned above those of the Yarmukian and/or Lodian cultures. In the opinion of Gopher, the Wadi Rabah lasted for some 700-900 years, i.e. from around 7,600-7,500 cal. BP to 6,800 cal. BP (Gopher, 2012c: 1533). However, E. Banning sees the beginning of the Wadi Rabah as occuring between 5,746 and 5,578 cal. BC and its end between 5,288-5,118 cal. BC (Banning, 2007: 88-89).

In this study, the chronology of the Pottery Neolithic cultures as proposed by Streit is followed and which suggests a range of approximately 6,350–5,800 cal. BC for the Yarmukian culture and 6,200–5,800 cal. BC for the Lodian culture (Streit, 2016; 2017). As for the Wadi Rabah culture, this has been placed in the 6th and 5th millenniums BC, while its duration has been estimated at anything between 200 and even 800 years. According to Streit (2017), it should be dated to between 5,700 and 5,200 cal. BC (see also Garfinkel, 1999: 307–308; Rowan & Golden, 2009: table 1; Gopher, 2012c: 1533).

1.4. Climatic background

The environment and climate are the most frequently mentioned factors among those with the greatest effect on human activity in prehistoric times. All three regions analysed in this study saw major climatic changes affecting the character of human activities before and during the 6th and the 5th millenniums BC.

1.4.1. Lower Egypt

The emergence of the Neolithic occupation of Lower Egypt is linked to two main climatic changes which occurred in north-eastern Africa and the eastern Mediterranean, namely the onset of the drying trend in the Sahara around 5,300 BC (Kuper & Kröplin, 2006; Riemer, 2009: 128-131), and the southward movement of the Mediterranean winter rains during the Early and Middle Holocene periods (Phillipps *et al.*, 2012; Holdaway & Phillipps, 2017). Moreover, in the case of the Fayum, the water level of Lake Qarun should also be seen as a factor influencing human activity. Because of the lake's connection with the Nile, its water level changed in line with the changes to the river flow, which in its turn was related to climatic changes in the southern part of Egypt (Hassan *et al.*, 2011; Marks *et al.*, 2016; 2017 Welc, 2016; Zalat *et al.*, 2017).

It has been suggested that the northern part of Egypt was not influenced by the Intertropical Convergence Zone (ITCZ), the northern limits of which did not reach this area during the wettest phase of the Holocene (Phillipps *et al.*, 2012). However, changes in the Sahara that began around 5,300 cal. BC influenced not only the life of desert herders but, probably indirectly, the human occupation of Lower Egypt as well. The southward withdrawal of monsoonal rains triggered the desiccation process of the Egyptian Sahara. As a result, climatic changes reduced the accessibility of water, plants, and animals in the desert and forced people to move to areas offering more favourable conditions. This migrational shift was probably directed to the north (the Fayum, the Delta), to the Nile Valley, to southern Egypt and to northern Sudan. As a matter of consequence, the onset of settlement activity in the Delta and in the Nile Valley in the second part of the 6th millennium BC may be attributable to the exodus from the desert, even though the climatic changes in the southern part of Egypt did not have a direct influence on human activity in that area.

During the Early and Middle Holocene periods, the northern part of Egypt, including the Fayum, received more winter rainfall. According to R. Phillipps *et al.* the change was caused by the Arctic oscillation, affecting the global climate (winds, temperature and winter precipitation), which pushed the winter cyclonic rainfalls of the eastern Mediterranean further south (Phillipps *et al.*, 2012: 72; see also Artz *et al.*, 2003; Holdaway & Phillipps, 2017; Holdaway *et al.*, 2017: 219-220). In the opinion of Phillipps *et al.*, cereal cultivation in the Neolithic Fayum was made possible by the Mediterranean rains (Phillipps *et al.*, 2012; Phillipps *et al.*, 2016b: 9). As domesticated grains from the Levant were winter crops, their cultivation depended on water availability from November to April (see also Marshall & Hildebrand, 2002: 122). The climatic changes also made it possible to introduce domesticated plants and animals in the middle of the 6th millennium BC.

The Neolithic Fayum should be analysed in the context of Lake Qarun. Since the lake was connected with the Nile, its water level depended on the river flow. Fluctuations of the Nile were affected by global climatic changes, including, in particular, the movement of the ITCZ (Hassan *et al.*, 2011; Welc, 2016). While the water level in the lake during the Early Holocene did fluctuate, it was nevertheless higher, with the lake's surface having been far greater than today. The lake was fed both by rainfall and water from the Nile. The shoreline was vast, with shallow depressions (basins) in the north which, when flooded, formed rich ecological niches (Welc, 2016: 186; 221). A dramatic decrease in the water level of the lake (or perhaps its complete disappearance) was recorded around 8.2 kiloyears BP, which is attributable to its disconnection from the Nile. In the opinion of F. Welc, the change should be linked to the global climate episode of 8.2 kiloyears BP (Welc, 2016: 187; 224). Between 8 and 7.2 kiloyears cal. BP, the connection with the Nile was restored and the depth and surface area of Lake Qarun was greater than ever. Towards the end of the period in question, despite more intensive rainfall, the lake gradually became more and more shallow as a result of a reduced influx of river water (Welc, 2016: 189). Around 6 kiloyears cal. BP, the water level in the Nile decreased and the connection with the lake was cut off. Undoubtedly, both river and lake water level fluctuations had an effect on the presence of aquatic and terrestrial plants and animals, and thus on human activity in this region. The arid and probably cold 8.2 kiloyear BP event may have limited the activity of Qarunian hunters and gatherers in the region. Although the high water level and vast shoreline between 8 and 7.2 kiloyears cal. BP were favourable to the activity of Fayumian groups, the reduced water level in the lake from 6,000 BP on probably led to the disappearance of settlements on its northern shore.

Water level changes in the lake have been commonly associated with the exposure of land suitable for cultivation and the access to rich aquatic resources (Hassan, 1984b; 1997; Williams, 2009). Particularly interesting are recent topographic analyses of the northern basins of Lake Qarun. They show that relatively small changes in lake water levels may have exposed or inundated the lake's northern shore. Depressions (basins) located in this part of the lake offered both easy access to lake resources and space for farming. Water came mostly from the Nile inundations, as well as from winter rains. The western basins were deeper and offered an environment more suitable for fish, especially those typical for well-oxygenated water (Nile Perch). The shallow eastern basins were probably more suitable for cultivation, as their gentle sloping gradient allowed sufficient annual exposure of moist sediments (Phillipps *et al.*, 2016b: 8-9). The eastern basins could constitute a habitat only for shallow water fish (catfish and tilapia) while the Nile connection was active, since during other periods fish would not have survived in such a deoxygenated environment. The foregoing assumption has been confirmed by archaeozoological studies indicating late summer as the main fishing period. The behaviour and abundance of fish in the lake were also influenced by the salinity levels, linked to the status of the Nile connection and the river flow (Phillipps *et al.*, 2016b: 8; Holdaway & Phillipps, 2017).

To conclude, the Neolithic occupation in the northern part of Egypt coincided with climatic changes that affected the nature of that occupation. Moisture and cooler conditions caused by the southward shift of the Mediterranean winter rains probably allowed for the successful introduction of domesticated plants and animals into Egypt. Although the movement of the ITCZ did not have a direct effect on the Neolithic communities in Lower Egypt, it indirectly influenced water flow in the Nile, and thus water levels in Lake Qarun. This rich ecological niche became a place where a new subsistence strategy developed, combining wild resources (mostly fish) with newly domesticated plants and animals.

1.4.2. The eastern Sahara

Around 12,000 years ago the Holocene humid phase began, during which the Sahara, today the largest hot desert in the world, turned into a green savannah-like environment, habitable for plants, animals, and people. In the classical approach, the Holocene humid phase has been linked to increased northward penetration of the ITCZ during the northern hemisphere's summer monsoon season caused by orbitally forced summer heating (Holmes & Hoelzmann, 2017). The northward movement of the tropical rainfall belts brought more intensive rainfall to the Sahara, with precipitation increasing from less than 10 mm to a maximum of 50-100 mm per year. Importantly, the climatic conditions during the Early and Middle Holocene in the desert area were not fully stable, and the period was interrupted by colder episodes (such as the 8.2 kiloyear cal. BP cold event) of increased aridity, affecting human activity in this area (Brookfield, 2010; Welc, 2016: 224).

With increased surface runoff, numerous reservoirs (lakes and playas) were formed in depressions in the escarpment foreland. Pans appeared within, or at the end of the palaeodrainage system. Dune barriers made water accumulation possible within wadis, while water stored in Pleistocene megadunes could supply episodic or periodic shallow ponds (Kuper & Kröplin, 2006; Bubenzer & Riemer, 2007).

The onset of a humid period caused a reoccupation of the Western Desert around 9,000 cal. BC. Despite milder conditions in the desert, the human presence still involved some risk and depended on access to water, plants and animals. People had to adopt a flexible way of life, characterised by mobility and movement in search of the resources necessary to survive in such an environment.

During the Middle Holocene (7,000-5,300 cal. BC), the maximum humid conditions in the Western Desert stabilised, resulting in its more intensive occupation (Riemer *et al.*, 2013: 160). Furthermore, the northern and central parts of the eastern Sahara found themselves within reach of eastern Mediterranean winter cyclonic rainfalls. Winter rains, together with summer monsoon rains, made plant vegetation possible nearly all year round in areas north of the Dakhleh Oasis. In the period in question, the central oases, namely Dakhleh, Kharga, and Farafra, saw an increase in sedentism manifesting itself in the emergence of settlements suggesting a probably permanent occupation, or at least occupations with only very short intervals (Bubenzer & Riemer, 2007: 610).

Climatic changes associated with the Holocene humid phase are also visible in the Eastern Desert in the Red Sea Mountains. Between 7,500 and 6,100 cal. BC precipitation and freshwater runoff increased in this region. However, in the opinion of P. Vermeersch *et al.*, the local climate was unstable (Vermeersch *et al.*, 2015: 496-499). Between 6,500-6,200 cal. BC the conditions became too dry and inhospitable for humans which, according to Vermeersch, is attributable to the cold and dry global 8.2 kiloyear BP cold event. Subsequently, favourable conditions in the Red Sea Mountains area were restored, thus making the presence of humans and animals possible again. In addition, the period in question saw the activity of ovicaprine herders at the Tree Shelter and Sodmein Cave.

What made the Eastern Desert different from the Western Desert was the lack of playas, and thus the absence of surface water sources around which humans and animals could concentrate. Detailed analyses of seeds and fruits in ovicaprine dung pellets recorded at the sites of the Tree Shelter and Sodmein Cave indicate the presence of well-developed herbaceous vegetation in this area, which probably appeared after winter rains and made this area attractive for herders with animals that were more resistant to drought and limited water resources. Although the savannah-like landscape offered pasture for animal herds, limited accessibility to water probably affected human activity in this region. According to E. Marinova *et al.* (2008), the lack of cattle remains accompanied by the presence of ovicaprine remains can be explained by water shortages.

The earliest signs indicating the return of drier conditions in the eastern Sahara are visible around 5,300 cal. BC. Aridification followed the southward retreat of the monsoonal summer rain belt. In this period, archaeologists have noted a drop in C14 dates from excavations, interpreted as a symptom of reduced human occupation in the desert caused by the onset of arid conditions. Areas located far away from permanent water resources (e.g. the Great Sand Sea) were deserted first (Kuper & Kröplin, 2006; Riemer *et al.*, 2013: 160). People moved to more favourable areas with access to water, namely the oases, the Nile Valley, the Nile Delta or southern Egypt and northern Sudan. The only exception was Gilf Kebir, where a rich ecological niche was formed thanks to rainfalls in the final stage of the Holocene humid phase. Thus, the conditions it offered for human occupation were more favourable than in the Early Holocene period. In the Eastern Desert, the Holocene humid phase also lasted longer as the region enjoyed heavy rains, mostly in the Red Sea Mountains area.

The drying process of the eastern Sahara was rather uneven. Humid conditions returned between the 5th and 3rd millenniums cal. BC. However, after 3,500 cal. BC, rains ceased in the Western Desert and the area became depopulated (Kuper & Kröplin, 2006; Riemer *et al.*, 2013: 160-165). In the Eastern Desert, very dry conditions returned in approximately 4,200 cal. BC, while the level of aridity known today had begun by 3,600 cal. BC (Vermeersch *et al.*, 2015: 496).

1.4.3. The southern Levant

The Holocene began in the southern Levant with temperatures and rainfall levels roughly similar to today's levels in this area and progressed steadily to warmer and more humid conditions until reaching a long-term optimum beginning around 9,000 cal. BC (Rosen & Rivera-Collazo, 2012). Moist and warm conditions with increased precipitation in the Early Holocene are clearly demonstrated by higher water tables, terrace aggradation and the accumulation of colluvial, alluvial and spring deposits through the southern Levant (Maher *et al.*, 2011). Grasslands reached their greatest extent while the boundary of the Negev Desert moved southwards (Borrell *et al.*, 2015). Indeed, an increase in Pistacia pollen recorded at that time prompted M. Rossingnol-Strick (1995; 2002) to label the period as the Pistacia phase. After 7,000 cal. BP, the climatic conditions became more arid, similar to those seen today (Rosen & Rosen, 2017).

The wetter and warmer conditions have been treated as factors exerting a major influence on the economic and socio-cultural transformations during the Neolithic period in the southern Levant, namely an increase in sedentism, as well as the emergence and spread of new subsistence strategies reliant on domesticated plants and animals.

Despite the general long-term trends, the climate of the eastern Mediterranean was unstable and was being disrupted by global cold-dry events. Recently, one of the most often discussed events of this kind is the 8.2 kiloyear BP cold event, dated to between 8,250 and 8,000 cal. BP, which also influenced temperature and precipitation rates in the eastern Mediterranean (Flohr *et al.*, 2015). The 8.2 kiloyear BP cold event in the southern Levant supposedly caused drier and cooler conditions, with temperatures dropping by as much as 1 degree Celsius (Maher *et al.*, 2011: 8). However, the effect of this climatic change on human activity in the southern Levant is debatable. Some archaeologists are of the opinion that the 8.2 kiloyear BP cold event with its dry and cool conditions affected the Middle\Late PPNB/PPNC societies in the southern Levant (e.g. Weniger *et al.*, 2006; Bar-Yosef, 2009; see also Roffet-Salque *et al.*, 2018). Recently, however, arguments claiming the lack of any relationship between the Neolithic occupation in the area and this cold event have been presented (Maher *et al.*, 2011; Flohr *et al.*, 2015). According to P. Flohr *et al.*, (2015), there is no clear evidence for the collapse or abandonment of sites, or for large-scale migration, or for any uniform regional or local cultural change during the 8.2 kiloyear BP cold event. Such a situation may have had a few underlying reasons. Climatic changes may not have been severe enough to influence human activity. Moreover, people, plants, and animals may have already been adapted to a more adverse climatic condition. Finally, the flexibility of early farming groups may have neutralised the impact of climatic conditions on their life. The 8.2 kiloyear BP cold event, with its cool and dry conditions, has also been linked to migrations from the southern Levant to Egypt and the introduction of domesticated plants and animals to the African continent (Eiwanger, 1984: 61-63; Rossignol-Strick, 2002: 165; Bar-Yosef, 2013: 242-243). However, no clear evidence for any movement of people between the two areas from the period in question has been recorded. Thus, the issue of the presence of Levantine migrants in Egypt still remains unanswered, despite the confirmed Levantine origin of domesticated plants and animals.

In Search of the Origins of Lower Egyptian Pottery:
A New Approach to Old Data
Studies in African Archaeology 16
Poznań Archaeological Museum 2018

Chapter 2
Theoretical approaches to the origins of pottery

Over the last 20 years, the issue of the origins of pottery has been analysed by a number of researchers, both from the perspective of archaeology and that of cultural anthropology. As a result, many theories explaining the above-mentioned issue have been proposed, alongside general theoretical approaches used in studies on pottery. The emergence of pottery has been considered both in the context of ecology/environment, and economic or social organisation/life, or even symbolic/ritual behaviours. In ecological approaches, pottery is seen as a tool that helped people adapt to the environment. Such an approach is most visible in the ceramic theory proposed by D.E. Arnold (1989). Importantly, Arnold did not focus on the emergence of pottery per se, but rather on the processes/factors which favoured or hindered pottery production and its further evolution (Arnold, 1989: 19). An economic approach to the origin of pottery was proposed by J.A. Brown (1989), who treated both its invention and its further innovation as a product of new demand. P. Jordan and M. Zvelebil, who studied pottery adaptation by prehistoric Eurasian hunter-gatherers, proposed to consider early pottery production as a social practice or part of the social life of past societies (Jordan & Zvelebil, 2010: 34). In their deliberations, they concentrated both on the issue of the invention of pottery and on the later spread of this new technology. The placement of early pottery production among the symbolic/ritual behaviours of past societies is prominently featured in the works of B. Hayden (1995). Early pottery is considered by Hayden as a prestige technology, while its emergence is linked to the need for demonstrating health, power or control over labour and resources by aggrandising individuals.

General theories on the origins of pottery are accompanied by models aimed at explaining a specific case of the emergence of pottery, defined in time and space. While they have been created and tested on the basis of specific data, they may be helpful in understanding the origins of pottery in other contexts as well. Particularly worthy of attention are studies by J. Eerkens, addressing the issue of relations between pottery production and a mobile way of life, covering prehistoric groups that occupied the Mojave Desert and the North American Great Basin in the United States (Eerkens, 2001; 2008). Another valuable contribution are general remarks by K. Gibbs (2012) on the disposable character of pottery among mobile groups.

2.1. Ceramic theory

The ceramic theory proposed by Arnold (1989) is based on two theoretical approaches - the systems paradigm and the culture ecological approach. In the view of Arnold, although pottery is part of the material culture, it is also closely related to the environment. It belongs in the techno-economic subsystem and, as a highly specialised part of this subsystem, it is involved in the process of adaptation to (or even modification of) the environment. For Arnold, the relationships between pottery, environment and culture should be viewed as processes that contributed to the emergence of pottery and its subsequent development. On this basis, he proposed general models based on ethnographic observations that may be used in archaeological studies on the pottery of past societies. The factors/processes that influenced the emergence and development of pottery production identified by Arnold are related to the environment and to culture understood as a system. They include raw material resources, weather and climate, possible scheduling conflicts, the degree of sedentariness, demand, human-land relationships and technological innovations.

According to Arnold, raw material resources are one of the more important factors in this regard. Their analyses should include the quality and availability of materials used in pottery making, such as clay, tempers, slips, as well as the firing fuel and water necessary for the production process. An attempt at determining the distance to raw material sources should also be made, as this particular factor has an effect on material choices and, thus, on the entire pottery making process.

Other important environmental factors are weather and climate. Temperature, humidity, wind, and rain had a tangible effect on pottery production, including, in particular, drying and firing processes. Excessively low temperatures, high humidity and frequent precipitation could make it difficult or impossible to properly dry vessels before firing. The same factors could also have had an adverse effect on firing itself, particularly in open fireplaces, but also in ovens.

A factor related to both the environment and culture – as seen by Arnold – is the scheduling conflict between pottery production and other activities, especially those linked to food procurement or production. Such a situation could have taken place when the weather allowed for subsistence activities and pottery production to take place simultaneously. Under such circumstances, the involvement of some people in making pots may have adversely affected the amount of food procured or produced, and thus on food reserves available for the entire group.

The emergence and production of pottery may have been related to the lifestyle of a given community. In the traditional culture-historical approach, pottery is generally linked, first of all, to farming communities and to sedentism. A mobile way of life was a factor that rendered pottery making impossible. However, as part of ceramic theory, Arnold considers mobility merely as an impeding factor that was in conflict with technological requirements, such as access to raw materials or the time necessary for the process, including, in particular, adequate vessel drying before firing.

The demand for ceramic containers was an important cultural factor that had an effect on pottery production and its development as such production is closely related to the need for containers of this kind in a given community. Such needs may have been determined by the utilitarian functions of pottery, by the way pottery was used (which, in turn, determined the breakage rate), by population growth, or even by symbolic behaviours. The common use of pottery for food processing purposes by past societies contributed to the prevalence of culinary hypotheses in explaining the origins of pottery in farming communities. The new type of containers is generally believed to have been used for processing a new type of food.

The last two factors indicated by Arnold are linked to the development of pottery production and growing specialisation. Human-land relationships are best visible when a population exceeds the land's ability to sustain it and moves on to other occupations, for instance to pottery making. Population pressure produced in such a situation may have led to specialisations in many activities, including pottery production. The last distinguished factor that largely affected the overall pottery making strategy are technological innovations that increased the speed and efficiency of production and were thus conducive to population growth. Improvements introduced at the stage of forming, drying or firing could limit negative impacts and improve production efficiency, thus positively affecting the quality and quantity of the pottery produced. As a result, all of these changes fostered the formation of pottery specialists in the community.

2.2. An economic approach to the origins of pottery

In the opinion of Brown, "the adoption of pottery as a container form has been a response to conditions in which the rising demand for watertight, fire-resistant containers is coupled with constrains in meeting this demand" (Brown, 1989: 213). In his approach, this demand was a response to social, economic and environmental changes. The emerging demand for a new type of containers may have been caused by population growth, changes in subsistence strategies, food processing, storage or even serving. Brown (1989: 216) is of the view that clay vessels had a number of advantages over other containers (such as baskets) and could thus better respond to the newly created demand. Although pottery production is considered to be one of the more challenging technologies, owing to its flexible character and possible 'stop-and-start' operation, it could be adapted to existing work patterns. As a result, scheduling conflicts with other activities could be avoided. Brown additionally drew attention to the low cost of pottery making, in terms of both raw materials and human involvement. In Brown's opinion, multi-stage pottery production made it possible to reduce the overall production time and increase output by introducing technological innovations in the process of forming, drying and firing. Employing the term 'the economy of scale', in Brown's approach, pottery is the only industry that could respond to the growing need for all-purpose containers without increasing the necessary time or workload (Brown, 1989: 219). While in the case of basketry the production time grows in line with the number of baskets produced, an increase in the number of ceramic vessels does not necessarily require a correspondingly greater amount of time.

According to Brown, the emergence of pottery production should be linked to trends towards sedentism that existed in past societies, which eventually increased the range of food sources available. New processing needs for new food, including, in particular, small-sized plant foods and grains, created a greater demand for new containers, or pottery. In Brown's view, only pottery production was capable of meeting such demands owing to its low cost and flexible production process compared with other container-making technologies.

2.3. Pottery technology as a social tradition

Jordan and Zvelebil (2010) see pottery as a cultural tradition whose role extends beyond that of an "adaptive tool". In this approach, a pottery tradition is part of social life and consists of a set of technological practices forming the entire production sequence, from collecting raw materials over to firing them into a durable vessel. The dispersal of pottery and its adaptation into the life of past societies may have been linked to processes of transmission, learning, invention, creation or inheritance. The incorporation of a pottery tradition into the life of past societies was gradual and occurred at various intervals and in a variety of ways. In this approach, the character of a pottery tradition is dynamic, since once introduced it may have been passed between generations and communities, which resulted in innovations and transformations. Furthermore, its introduction also modified traditions and practices that existed previously.

The emerging hunter-gatherer ceramic dispersal model proposed by Jordan and Zvelebil was originally developed with Eurasian groups in mind (Jordan & Zvelebil, 2010: fig. 1.4). However, it may also be useful in the case of research on the origin and adaptation of pottery in other parts of the world. This refers both to situations in which pottery was first introduced and adapted, and to those in which it was further dispersed. The model proposed by Jordan and Zvelebil focuses on the causes and consequences of pottery's emergence (Jordan & Zvelebil, 2010: 72-74). In their opinion, the introduction and adaptation of pottery may be attributable to the practical benefits offered by the new technology of making food containers. However, the earliest pottery may have also had a social or symbolic value. As an element of social practice, it may have denoted the status or prestige of its producer, user or owner. It could also express the social identity of an entire society. Another element of the model in question are the consequences caused by the introduction of pottery into the social structure. The use of clay containers may have involved an improvement in the quality and quantity of one's diet and the greater security of food reserves. As a matter of consequence, it may have had a significant impact on the entire community, in terms of its health, size and survival rates.

In addition, Jordan and Zvelebil identified four key stages in their pottery introduction and dispersal model (Jordan & Zvelebil, 2010: 72-74). At the first stage (*experimentation*), pottery was a new tradition, gradually introduced into everyday practice, alongside other container-making technologies. At this stage, pottery is likely to have been a minor practice, additionally used for ritual or symbolic purposes. The second stage (*intensification*) involved the development of pottery production. The main characteristics of this stage include technological improvements and greater practical use of pottery. Pottery production was a cheap and efficient method of making vessels used for food storage and processing. At the third stage (*integration*), the role of pottery vessels extended beyond having a utilitarian function, as they became permanently present in the social practices of past societies, often related to their social identity and status. This is how ceramic containers gained a social and symbolic function. At the fourth stage (*dispersal and differentiation*), pottery spread outside its core area. It may have become a prestige technology and may have been even used as gifts. Furthermore, this stage could see further improvements and changes in this technology.

2.4. Early pottery as a prestige technology

In the view of Hayden (1995), early pottery needs to be considered as a prestige technology that was used to denote one's wealth, and power or control over labour and resources. Its advent was linked to the emergence of economically based competition caused by socioeconomic inequalities among hunter-gatherers. Social changes were connected with the intensification of food resources and modifications in securing access to them. Ceramic vessels would have been used for containing special foods in competitive prestige display events. As a novelty, clay vessels were perfectly suitable for this purpose owing to their physical properties. The very process of fire-induced transition from a soft raw material to a hard vessel coupled with the use of surface treatments or decoration patterns may have largely contributed to building the image of pottery as a prestige technology. Hayden additionally draws attention to the particular character of the entire production process that was labour-intensive and required specialist skills and knowledge (Hayden, 1995: 261).

As seen by Hayden, a prestige technology may have evolved towards a practical technology owing to improvements that saved workload and processing time (Hayden, 1995: 262). As a result of technological innovations, pottery may have lost its symbolic function, becoming a practical utensil used for cooking or storage of food. Furthermore, as a result of the spread of pottery technology, clay vessels may have been readily adapted as practical items in those socioeconomic systems where the need for rivalry or demonstrating one's position was non-existent. In 1999, P. Rice presented a very detailed overview of the studies on the origins of pottery. She also compared a number of cultures where early pottery had appeared. The analysis of contexts in which pottery had emerged and the character of early pottery, including its technology and function, inspired her to follow the theory first proposed by Hayden, which – in Rice's view – explains the emergence of pottery among other forms of containers (Rice, 1999: 44-45). Indeed, Rice identified two stages of early ceramic production: "subceramic" (figurines) or "softceramic" (containers made without firing) that preceded the production of high-fired vessels. In her opinion, both stages suggest that pottery production should be seen as a prestige technology. The early non-container forms may have served ritual functions. Furthermore, according to Rice, early ceramic containers seem to have been more useful as serving vessels rather than as cooking or storage vessels (Rice, 1999: 45). Since early pottery containers appeared in archaeological contexts of rich, diverse, tropical/subtropical and riverine/coastal locations inhabited by complex hunter-gatherer communities, their use as prestigious objects is consistent with Hayden's theory. In this theory, the emergence of pottery is combined with the intensification of food resources and asserts a transition from generalised to complex hunter-gatherers with unequal access to food resources and differences between various social roles.

2.5. Pottery and mobility

The relationship between pottery and mobility has been analysed by Eerkens (2001; 2008). While his interests focused on prehistoric groups occupying the Mojave Desert and the North American Great Basin in the United States, the theoretical model developed as part of his research can be also useful in analysing materials from other regions, such as north-eastern Africa (see Riemer, 2011 regarding the Sheikh Muftah cultural unit). Eerkens identified five main problems entailed by pottery making that had to be faced and solved by mobile or pastoral communities before pottery production could be successfully commenced.

The first of these problems is the weight of clay vessels – an aspect of particular importance for groups that were constantly on the move. In this case, even the use of pack animals did not solve the problem due to the increase in energy required for transport compared with containers made of organic materials, such as baskets or skin pouches. Moreover, the fragility of pottery and the ensuing high breakage rates during movement did not favour – according to Eerkens – the production and use of clay vessels by mobile societies (Eerkens, 2008: 309).

In the view of Eerkens, one of the more important factors in the context of the 'mismatch' between mobility and pottery making could be a group's inability to stay in one location for a time sufficient to complete the entire pottery-making process, from clay collection through to firing (Eerkens, 2001: 7-8; 2008: 309-310). However, Eerkens additionally consulted the results of certain ethnographic studies that indicate a rather broad pottery-making timeframe, namely that the time from raw material collection to the first use of a vessel would vary from 2 or 3 days, on the one hand, to a few months, on the other. If the production process was simple and well organised, and if environmental conditions were favourable (dry and warm climate), then probably the entire process could be relatively short and would not affect the group's mobility.

Another obstacle to pottery making by mobile groups may have been scheduling conflicts with other activities, including, in particular, gathering. The dry and warm seasons that made vessel forming and firing easier also offered an abundance of nuts and berries, gathered and stored as an important part of people's food supply (Eerkens, 2008: 310). Thus, making pottery and gathering food at the same time may have had an adverse effect on the quantity of stocked supplies.

Pottery production may have also been limited in, or rejected by mobile groups due to little or no demand for it. Here, Eerkens follows Brown (1989) and his economy of scale approach (Eerkens, 2001: 8; 2008: 310). In his view pottery production could be 'profitable' only if the number of manufactured vessels was adequately high, given the necessary 'fixed costs' (raw material, energy and time). If only a small number of containers were required, they could be made using another technology (such as basketry) that was both simpler and 'cheaper'.

Despite problems with, and conflicts existing between a mobile way of life and pottery making, both archaeological and ethnographic data indicate the presence of clay vessels among certain mobile groups. According to Eerkens, pottery could have been successfully made if the problems discussed above had been solved and if pottery production had been modified so as to fit a group's mobile lifestyle (Eerkens, 2008: 313). One possible solution was caching pots, which helped avoid the problem of the weight and fragility of ceramic containers during transport. Caching pots could be left in locations used as fixed stopover places on regular routes travelled by mobile groups, ensuring relatively stable and predictable water and food resources. The problem of time necessary to make and fire vessels may have been solved by modifying the travelling routine – the group would either stay a little longer on the production site or return to it more often. However, Eerkens drew attention to the fact that both caching pots and changes in travelling routines eventually tethered people to certain locations and permanently modified their way of life (Eerkens, 2008: 316-317). He also remarks that once pottery had begun to be used by mobile groups (after the aforementioned problems had been solved), pottery production would have been continued and would no longer have been affected by the mobile way of life (Eerkens, 2008: 319).

The mismatch between pottery production and mobility has also been analysed by K. Gibbs (2012). In his opinion, in some contexts the existing conflict could have been solved by making pottery with a short use-life, or simply disposable pottery. Such an approach to pottery production supposedly had an effect on the entire production process, as it was not aimed at ensuring durability or longevity of ceramic vessels. Hence, vessels could be made even during cold and humid periods while the production process itself could be short, with little preparation of raw materials and no special tools. Likewise, the drying and firing processes could be reduced to the bare minimum. The outcome would be 'ugly' low-fired pots, discarded after use rather than transported to the next stopover. While the proposal formulated by Gibbs may be seen as yet another attempt at finding common ground for pottery production and a mobile lifestyle, Gibbs himself drew attention to the problem of the identifiability of disposable pottery in the archaeological evidence (Gibbs, 2012: 88). Although its function and short-use life may have been obvious to their makers and users, our ability to determine such functions merely on the basis of technological features and archaeological contexts seems rather limited.

2.6. The theoretical approach and method of the study

As pottery first appeared in, and was adapted to a variety of cultural contexts, there is no general theory or single method to explain this phenomenon. Moreover, the multitude of reasons why clay vessels began to be used does not make the researcher's task any easier. Each of the approaches presented above has its advantages and disadvantages. Although they address the same problem and take into account the same or similar elements (i.e. environment, subsistence pattern, a way of life), in each of them the origin of pottery is explained from the perspective of only one key element. For Arnold (1989), pottery is a way of human adaptation to, and a modification of the environment. For Brown (1989), however, the main reason for the emergence of pottery is demand, caused by new food resources, new subsistence strategies and new ways of life. Jordan and Zvelebil (2010), on the other hand, treat pottery as a social practice introduced for its practical benefits or symbolic values. Finally, as Hayden (1995) sees it, early pottery should be treated only as a prestige technology, although its introduction could also be connected with changes taking place in the environment (and thus in subsistence strategies).

The choice of the research method for this study depends on the character of the available archaeological evidence. The scientific value of existing data on Lower Egyptian Neolithic pottery varies considerably. The pottery from the excavations of G. Caton-Thompson and E. Gardner in the Fayum Depression underwent a typical early-20th-century selection process. Although the latest analyses of Fayumian pottery by J. Emmitt are very valuable, it should be remembered that they are based on assemblages selected during excavations from the first half of the 20th century (Emmitt, 2011; 2017; Emmitt *et al.*, 2018). The pottery collection from the excavations by H. Junker at Merimde Beni Salame is similarly fractional. It was only after the research of J. Eiwanger in the 1980s that our knowledge of the pottery tradition of the Merimde site was thoroughly enriched. Moreover, explorations currently being held at Sais make it possible to analyse ceramic assemblages of the Merimde culture in compliance with contemporary standards of archaeological research. Although the el-Omari pottery was excavated during the Second World War and soon thereafter, the results of these excavations were only published in the 1990s. The excavation methods available in the 1940s and 1950s, sometimes in harsh wartime conditions, as well as the rather long delay between actual explorations, on the one hand, and the publication of results, on the other, must have impacted the nature of these pottery assemblages.

The nature of the desert assemblages, including, in particular, their small size and a limited amount of detailed publications, has also been taken into account in selecting the most appropriate method. Southern Levantine pottery seems to be the best understood variety, which is due to state-of-the-art research and numerous publications. However, different views on the chronology and cultural connections between the Pottery Neolithic cultures cause some difficulties. In addition, comparisons and parallels are made difficult by considerable site-to-site diversification of pottery assemblages.

The main goal set by the author is to determine the direction from which pottery was introduced to Lower Egypt. Comparative analyses of ceramics of Lower Egyptian pottery, on the one hand, and that from the southern Levant or the Western Desert, on the other, were selected as the main method of investigation.

The results of these analyses will be used to verify the hypothesis indicating the southern Levant or the eastern Sahara as a possible place of origin of Egyptian pottery or, alternatively, to present a new hypothesis on the origin of Lower Egyptian Neolithic pottery.

Given the nature of the available data, a comparative analysis was carried out taking into account the principal stages in pottery production, as proposed by C. Orton *et al.*, (2010; see also Rice, 2005). It addressed the basic characteristics of pottery, i.e. technology (fabric, shaping method, surface treatment, firing) and typology (shapes, decoration).

Additionally, the analysis took into account the influencing factors defined by Arnold (1989) as part of ceramic theory. Five of the seven factors have been analysed in detail, namely: raw material resources; weather and climate; possible scheduling conflicts; the degree of sedentariness; and demand. Their analysis will make it possible to determine how pottery production was organised in the regions in question. The other two other factors in the Arnold's model, i.e. human-land relationships and technological innovations, will not be taken into account. As they primarily relate to the further development of pottery-making (i.e. from household industry mode to a full-time craft), they are irrelevant from the perspective of the early stage of production.

Moreover, in the view of this author, pottery production should be treated as a cultural tradition.[1] Once introduced into the life of the past societies, pottery production became its constituent part, while the adaptation process of these new traditions also involved some cultural modification. In this approach, pottery ceases to be merely an adaptive tool as proposed by Arnold. Once it has been incorporated into a cultural tradition, it becomes dynamic and subject to change as it can be passed between generations and communities, resulting in innovations and transformations. Such an approach is followed in the model that describes the introduction of pottery production to Lower Egypt.

In addition, reflecting a mobile way of life of desert groups and probably a partly mobile way of life of Neolithic societies from Lower Egypt, this monograph also refers to theoretical considerations concerning the relationship between pottery production and mobility as proposed by Eerkens (Eerkens, 2001; 2008). Particular attention is paid to solutions applied by mobile societies in order to eliminate obstacles preventing or hindering pottery production.

[1] A similar approach has already been used by the author in studies on the development of pottery production in Lower Egypt during the Neolithic (Mączyńska, 2017).

Chapter 3
The state of research on the origins of Lower Egyptian pottery

In European archaeology, the emergence of clay vessels and their use by prehistoric societies has often been linked to the transition from hunting and gathering to farming and animal husbandry. Such an approach has a long tradition in culture-historical archaeology. It was H.L. Morgan (1877: 12-14) who claimed that pottery, alongside art, was a feature that distinguished the upper savage from the lower barbarian. However, the first researcher to link the presence of pottery to domesticated plants and animals was Sir John Lubbock. In his division, these three elements became the features that distinguished the Neolithic from the preceding Palaeolithic. In 1923 V.G. Childe (1936) coined the term "Neolithic revolution", seeing this particular period as a breakthrough in human history. Thus, in his opinion, the introduction of domesticated plants and animals marked a fundamental change in people's lives while the emergence of pottery among Neolithic societies was linked to the technological and social progress taking place at that time. The connection between pottery, on the one hand, and farming, animal husbandry and sedentism, on the other, has generally been accepted in archaeology. Pottery, alongside domesticated plants and animals and a sedentary lifestyle, became a key element of the so-called "Neolithic package" – a broadly defined collection of features differentiating farmers from hunters and gatherers (see Çilingiroğlu, 2005). This approach was not changed even by the discoveries of pottery among non-farming communities in Northern Europe. Its emergence and use among hunters and gatherers was considered as a peripheral practice and was linked to contacts or exchange between foragers and farmers. Since the presence of clay vessels was a diagnostic element in traditional research on farming dispersal, the approach in question led to misunderstandings, namely on the basis of the presence of pottery some communities were defined as agricultural, while its absence led to other traces of farming and herding being ignored.

The last 20 years of discoveries all over the world have shown that pottery was known and used before the domestication of plants and animals, as well as sedentism, in many different contexts of specific and distinct ecological, economic and social settings. The cultural diversity of locations in which pottery has been discovered shows that its origin cannot be explained using a single scheme and that its emergence in farming communities inspired by new types of food and new needs is just one of many possibilities (e.g. Jordan & Zvelebil 2010; Gibbs, 2015).

3.1. The origins of pottery amongst prehistoric societies – a short overview

From our contemporary perspective, the introduction of clay vessels into human life was "the smartest thing to do". Pottery partially replaced containers made of organic materials, while its emergence involved multiple practical potential advantages and benefits. However, the reasons why people began to make and use clay vessels are still being investigated. The multitude of contexts in which the first pottery artefacts were found translates directly into a multitude of theories. Undoubtedly, those which are dominant link pottery to food and the methods of its preparation and storage. The popularity of the so-called culinary hypothesis is partially attributable to the connection between pottery and farming which is so deeply rooted in archaeology. New types of food and new ways of its processing and storage called for new types of containers as those made of organic materials were deemed no longer useful (Brown, 1989: 213; Skibo & Schiffer, 2008: 40). The frequently emphasised connection between the origins of pottery and food processing additionally takes into account the benefits of using pottery. Clay vessels were supposed to detoxify foods and make them more palatable, which had obvious effects on the state of the community (i.e. better health, improved neonatal survival rate). Furthermore, pottery used for storage offered greater protection of food reserves (Arnold, 1989; Barnett & Hoopes, 1995: 3-4; Rice, 1999; Jordan & Zvelebil, 2010: 54).

The introduction of ceramics has also been attributed to symbolic and social practices (Jordan & Zvelebil, 2010: fig. 1). In the opinion of Hayden (1995), pottery was a prestige technology. The first clay vessels were supposed to be prestige food-serving containers that appeared in the context of social or economic competition (Hayden, 1995; Rice, 1999: 11; Jordan & Zvelebil, 2010: 61-65). Early pottery was also supposed to play an important role as a symbol of one's ethnicity and social group identity (e.g. Barnett, 1990).

It is not impossible that the invention of pottery resulted from many co-existing factors, while its practical and symbolic functions could have been interlaced (Skibo & Schiffer, 2008). This claim has been confirmed by research by Gibbs who has investigated two pottery emergence centres, namely those in East Asia and the Near East (Gibbs, 2016; Gibbs & Jordan, 2016). This research showed that, in both cases, the underlying reasons for the emergence of ceramics were different and depended on various economic, social and environmental factors. The new technology may have served a variety of needs and uses and was one of the elements of social development.

The loosened links between farming, sedentism and pottery in archaeology had considerable influence on the research concerning how the idea of pottery making spread. The Near East is no longer considered the only centre of pottery invention from where this technology (as an integral element of the Neolithic package) was introduced to Europe. The current state of research makes it possible to identify three main centres where the technology of pottery emerged (Jordan & Zvelebil, 2010: 68-72; Jordan *et al.*, 2016). The oldest pottery known today comes from East Asia (southern China) and is dated to 18,000 cal. BP, or even earlier. More recent pottery from Japan and the Russian Far East (the Amur River valley) is dated to approximately 16,500 cal. BP and is seen as an effect of a diffusion of know-how from China by mobile hunter-gatherers (Jordan & Zvelebil, 2010; Gibbs & Jordan, 2013; 70; Jordan *et al.*, 2016: 595; Gibbs, 2016). In the model of pottery technology dispersal proposed by Jordan and Zvelebil, pottery may have spread west and north from East Asia, thus reaching as far as the edges of Eastern Europe, the eastern Baltic and northern Scandinavia (Jordan & Zvelebil, 2010: 70-71; Gibbs & Jordan, 2013; Jordan *et al.*, 2016).

Some 12,000 years BP, pottery first appeared in North Africa, with the oldest finds known from Saggai in Sudan bring dated to 11,663 cal. BP (Caneva, 1983; Close, 1995; Silva & Steele, 2014: 724), followed by those from Nabta Playa-Bir Kiseiba in the Western Desert of Egypt (site E-79-8) (Jórdeczka *et al.*, 2011) and Ounjougou in Mali, both dated to 11,000 cal. BP (Huysecom *et al.*, 2009). Although the present state of research does not allow one to conclude whether there were one or more centres of pottery invention in Africa, most researchers tend to support the view of pottery having multiregional origins (Close, 1995; Jesse, 2003; 2010; Tassie, 2014: 80-82). Undoubtedly, however, pottery technology spread quickly within a 4,000 km strip running through the southern Sahara and the northern Sahel. In the model of pottery technology diffusion across Afro-Eurasia proposed by Jordan *et al.* (2016), the early African pottery tradition is also indicated as a possible source of pottery technology in the Neolithic period of the Near East. The model is in keeping with a hypothesis assuming an African contribution to the pottery technology of the western Mediterranean (Gronenborn, 2010: 232). However, this issue requires more investigation and further studies.

For decades, the Near East used to be treated as the only source of pottery technology. Today, the emergence of ceramics in the Near East is dated to approximately 10,500-8,800 cal. BP in the Pre-Pottery Neolithic B (PPNB) context (Kfar HaHoresh), although clay vessels became widespread at the start of Pottery Neolithic (PN) around 9,000 cal. BP, being present in the area stretching from central Anatolia, across Upper Mesopotamia to Zagros (Gibbs & Jordan, 2016: 5). Only from 6,500 BC on, did the idea of the Neolithic economy begin to spread from the Near East to Europe. Pottery accompanied domesticated plants and animals and was gradually adapted, thus becoming one of the most common utensils and, eventually, one of our most abundant archaeological sources. Taking into account the facts described above, it is reasonable to assume that European pottery may have many different roots, including those that originated from East Asia and North Africa. The reasons for the unrelated emergence of pottery in different places, possible links (if any), as well as the methods and ways of dispersal, all need further research.

The diversity of contexts in which the first clay vessels emerged requires each such case to be analysed separately. Human choices depended on many environmental, social and economic factors. Furthermore, the emergence of pottery alone did not necessarily lead to its adaptation. The existing social system had to be modified accordingly. Since pottery making involved a few steps, each such step had to be integrated into the existing system. Thus, the emergence and use of clay vessels eventually required changes to existing traditions and practices.

3.2. The origins of pottery in Lower Egypt

Theories explaining the emergence of the first pottery in Lower Egypt have been affected by its coexistence with the remains of domesticated plants and animals. New types of containers were supposed to have been introduced to Lower Egypt by newcomers from the Near East together with new subsistence strategies. Research on the origins of Lower Egyptian pottery has been dominated by hypotheses linking it to southwest Asia, although their proponents fail to agree on the size of groups that reached Lower Egypt, or on their cultural identity, chronology and reasons that forced them to leave their homelands.

Apart from the Levantine hypotheses, another theory has been proposed that points to the Western Desert as a source of Lower Egyptian Neolithic pottery. Despite having rather few supporters, in recent years possible Saharan influences on the development of Lower Egyptian communities have been mentioned more and more often (e.g. Kuper, 2002; Riemer & Schönfeld, 2010; Shirai, 2010; Muntoni & Gatto, 2014).

3.2.1. The southern Levant as a source of Lower Egyptian pottery

Research by G. Caton-Thompson and E. Gardner on the northern shore of Lake Qarun in the 1920s yielded many significant discoveries. Fayum A and Fayum B were introduced to the archaeological map as two new archaeological cultures. Caton-Thompson realised the importance of these discoveries, linking them both to the Levalloisian hunters, who – in her opinion – were the first to settle near the lake in the Pleistocene era, and to farmers who had developed community life in villages. Despite errors committed in the interpretation of chronology and the selection of artefacts , *The Desert Fayum*, published in 1934, continues to be an important source of knowledge on the prehistoric settlements on the northern shore of Lake Qarun, presenting a vast diversity of finds ranging from pottery to very well-preserved items made of organic materials. In this publication, Caton-Thompson and Gardner focused primarily on the interpretation of finds and on attempts at determining their chronology by comparing them with materials from other sites (Merimde, Tasa, Badari). The problem of the origin of Fayumian farming communities, including the origin of their pottery, was, however, considered to be of secondary importance and was mentioned briefly only towards the end of the book. While Caton-Thompson admitted that in the light of agricultural knowledge then it was reasonable to look for the origins of the farming communities from the Fayum in the east, she eventually considered this option as "unpromising" and spoke in favour of the "autochthonous Delta origin" of the Neolithic groups inhabiting the shores of Lake Qarun.

A similar approach to Neolithic materials from Lower Egypt was followed by H. Junker who ran an excavation project at Merimde Beni Salame from 1929 to 1939. The project provided new evidence concerning Neolithic settlement patterns in the north, with Junker paying particular attention to determining the site's relative chronology. In his papers, the materials from Merimde Beni Salame are compared with earlier finds from both Lower and Upper Egypt. The pottery from Merimde is set together with the pottery known from the Fayum and Maadi, as well as that from Badari or Naqada. Junker's comparative analyses, not unlike those made by Caton-Thompson and Gardner, were confined to the Nile Valley, while his interest in neighbouring areas is visible only in attempts at determining the origin of certain raw materials and items, but not pottery.

The discovery of the Neolithic sites in Ras el-Hof and Wadi Hof also took place in the early 20th century. Results of their brief explorations with a description of features and finds were published in 1926 by Fr. P. Bovier-Lapierre (1926a; 1926b). It seems that Bovier-Lapierre realised the importance of these discoveries, rightly noting that "un ensemble complet", consisting of a settlement accompanied by a cemetery, had been discovered in the Nile Valley for the first time. However, his publications do not mention the origin of the communities occupying this area.

In many ways, the explorations of the Neolithic sites in the Fayum, Merimde and Wadi Hof should be seen as pioneering. Indeed, the attention of archaeologists reached beyond the Pharaonic civilisation and towards the Predynastic period only in the late 19th/early 20th century, which is why archaeological knowledge concerning this field was rather modest and grew significantly with each subsequent discovery. Furthermore, archaeologists initially concentrated, first of all, on Upper Egypt, regarding the Delta and the whole of Lower Egypt as uninhabited swamplands of little interest in terms of archaeology. After the discoveries of sites in the north, containing previously unknown materials that differed considerably from those found in Upper Egypt, the area in question earned a permanent place in the minds of researchers investigating Egyptian prehistory. Most research projects carried out back then were aimed at archaeological reconnaissance and at determining chronology. Researchers were not interested in searching for external analogies or in the precise identification of origins, instead concentrating on the typology of finds and on comparative analyses aimed at defining relative chronologies of artefacts, sites or cultures. The primary objective of their efforts, therefore, was to understand the prehistory of the area under investigation.

The 1920s saw the first publications by Childe (1925; 1928) featuring his concept of a Neolithic revolution. Newly discovered sites with remains of domesticated plants and animals along with ceramics in Badari, the Fayum, Merimde and Wadi Hof also attracted his attention as the best example of the Neolithic culture in Egypt (Childe, 1928: 51-63; 1935: 35-41). These discoveries were compatible with the theory that assumed a gradual spread of new forms of social and economic life from a place of origin located in the Near East (Childe, 1925: 23). In *New Light on the Most Ancient East*, Childe used ceramics as a starting point for facing the unclear origin of Egyptian farming (Childe, 1935: 48-49). Having analysed the similarities between the oldest pottery from Merimde and that known from the Levant, he considered it likely that domesticated plants and animals, as well as other Neolithic elements, were introduced to Egypt from the east. However, he remarked that the Asiatic tradition had blended with local "African-Aterian traditions", thus emphasising the autochthonic character of the Neolithic societies from Lower Egypt. The theory on the eastern origins of domesticated plants and animals together with other 'arts', including pottery, was commonly accepted and its popularity has not waned ever since.

The publication of works on Neolithic materials from Lower Egypt by Caton-Thompson and Gardner, Junker, Bovier-Lapierre, as well as those of Childe, brought these materials into a broader discussion, thus making it possible to compare them against materials from neighbouring areas, including, in particular, the southern Levant. Pottery was one of the key aspects to be researched. Already in 1942, in a section dedicated to "the Pre-Gerzean period" in her article on early relations between Egypt and Asia, H. Kantor pointed out the similarities between the pottery from Merimde Beni Salame and the Ghassulian pottery from the southern Levant (footed vessels and clay ladles). Although Kantor did not propose any detailed explanations for these similarities, she noted that they may have resulted from "casual, intermittent contacts" or the same origins (Kantor, 1942: 174-175). A similar view was proposed in 1959 by J. Kaplan who, in his brief study on the connections between Egypt and Palestine, suggested the existence of similarities between footed vessels/chalices and ladles from Merimde and Palestine, as originally proposed by Kantor (1942). Although the 1950s saw a growing interest in relationships between Egypt and the Levant, the Neolithic period – due to the lower quality and quantity of materials – did not attract much attention. After a series of discoveries of imports in the territory of both Egypt and Israel, archaeologists focused on, and intensively researched relationships between these regions during the 4th and 3rd millenniums BC (for details, see Mączyńska, 2013: 37-45).

The post-war period in Egyptian archaeology saw researchers returning to already-known Neolithic sites and a general intensification of excavation projects in both Upper and Lower Egypt. The scope of archaeologists' attention was also expanded to include assemblages from pre-war research projects. The materials excavated by Junker at Merimde Beni Salame, stored in the collections of Stockholm's Egyptska Museet were subsequently analysed by H. Larsen (Larsen, 1957; 1958; 1959; 1960; 1962). His attention was drawn, for instance, to the herringbone pattern visible on the oldest Merimde ceramics, which he linked to decorations recorded at the Neolithic site in Jericho among materials from Stratum VIII (Larsen, 1958: 45-48).

Furthermore, the post-war period was a time of the first monographs taking a holistic look at Predynastic Egypt. Thus, in 1955, E.J. Baumgartel published *The Cultures of Prehistoric Egypt*, also featuring Neolithic sites from Lower Egypt (the Fayum and Merimde). However, Baumgartel considered it erroneous to use the term Neolithic when referring to Predynastic Egypt, including the materials from Merimde (Baumgartel, 1955: 14-15). Furthermore, she proposed to supplement Merimde and Fayum pottery analyses with flint analyses in studies on chronology and cultural relations. In Baumgartel's view, both pottery and flint assemblages indicated that the settlement at Merimde was founded at a time when the Naqada II culture already existed in Upper Egypt (Baumgartel, 1955: 17-18). On the same basis, materials from the Fayum were dated to Naqada I (Baumgartel, 1955: 25). Moreover, she saw the origins of Naqada I communities in the south while linking the Fayumian materials with the Early Khartoum culture. Additionally, Baumgartel saw southern influences in the materials from Merimde. Currently, although many of her theories are considered incorrect and controversial, it is the poor state of contemporary research on the Predynastic period that should be blamed for such imperfections.

An important breakthrough in the research on the origins of the Neolithic communities in Lower Egypt came with the introduction of radiocarbon dating. In 1965, W.C. Hayes published *Most Ancient Egypt*, dedicated to the prehistory of Lower Egypt alone and taking into account the first C14 dates. For Hayes, it seemed "inevitable" that the Neolithic culture with all its elements, including ceramics, was introduced to Egypt from southwest Asia (Hayes, 1965: 92, 96-97). Furthermore, in the pottery from Merimde, Hayes saw strong cultural ties (herringbone pattern, ladles, footed vessels) with the Neolithic B pottery from Jericho (Hayes, 1965: 114). Hayes' views were shared by other researchers. Indeed, A.J. Arkell linked the origins of the Fayumian culture with Asia; in his opinion "a knowledge of pottery must similarly have come to the Fayum from Palestine" (Arkell, 1975: 13; Arkell & Ucko, 1965: 147). L. Krzyżaniak (1977), in his work entitled *Early Farming Cultures on the Lower Nile*, also drew attention to the similarities between Merimde pottery and materials from Jericho Stratum VIII. In addition, for M.A. Hoffman the inhabitants of Merimde were immigrants from southern Palestine or the Libyan coast (Hoffman, 1979: 188). However, as far as the Fayumian culture is concerned, he considered the local community to be an endogenous culture that adapted the Neolithic way of life, with ties to the Sahara.

The discoveries important for the research on Fayumian origins were made by a Polish mission and by an American expedition during the 1980s. At the sites at Qasr el-Sagha, B. Ginter and J.K. Kozłowski identified two phases of Neolithic occupations, differing in terms of ceramic and flint assemblages (Ginter & Kozłowski, 1983: 67; Kozłowski & Ginter, 1989). In their opinion, settlers from the earlier phase were related to southwest Asia, while Saharan origins were suggested for the later occupation phase. In the light of the American research, R. Wenke suggested that the farming Fayumian societies could have originated from multidirectional influences, namely both from southwest Asia and from North Africa (Wenke *et al.*, 1988: 47). Moreover, the transition from hunting and gathering to farming and herding was likely to have been more complex, with a stage of pre-adaptation (Wenke & Casini, 1989).

In the 1970s and 1980s, researchers also returned to the site at Merimde Beni Salame. The modern research methods used by these expeditions offered new insights into the Neolithic communities of Lower Egypt, particularly with regard to their origins (Eiwanger 1984; 1988; 1992; Hawass *et al.*, 1988). In 1984, materials from the site's oldest phase, known as the Urschicht phase, were published. Referring to the origins of ceramics, J. Eiwanger accepted the hypothesis put forward by Larsen, claiming that the herringbone pattern on pottery had come from the east. Moreover, Eiwanger suggested a connection between the Merimde I pottery assemblage and the Yarmukian pottery of the Pottery Neolithic on the basis of decoration patterns, loop and lug handles, as well as a bifacial surface retouch, early forms of polishing and, finally, clay figures (Eiwanger, 1984: 61-63). Moreover, he linked the origins of the Merimde culture to groups arriving from the east because of droughts occurring in southwest Asia around 7,000 BC. The inhabitants of the affected areas were forced to migrate to more humid regions, with the first to reach Merimde being a kind of reconnaissance group who came to the Delta in search of new inhabitable areas. Owing to the favourable location of the areas surrounding Merimde (fertile valleys and desert pastures), they decided to establish a permanent settlement there, particularly along the main branch of the Nile, where the abundant resources of the river, namely transport and fertile silt-rich soils were easily available.

The 1980s saw a soaring interest in food production in Egyptian archaeology, inspired by new discoveries in the Western Desert. Particularly noteworthy are the works of F. Hassan, as they cover a broad context including both North Africa and the Levant, create a radiocarbon dating framework for Egypt, as well as present correlations between cultural changes and climatic changes (Hassan, 1980; 1984a; 1984b; 1985; 1998; 2002a; 2002b). Already in 1984, Hassan was of the opinion that the emergence of farming in Egypt had resulted from a "demographic fusion between the inhabitants of the Nile Valley and the refugees from the desert regions adjacent to the Nile Valley", including the Sinai and the Negev (Hassan, 1984b: 222-223). According to Hassan, farming was introduced to the Delta by drifters and refugees. However, their movement was not linked to mass migrations from southwest Asia. In fact, Lower Egypt is claimed to have been gradually infiltrated by such drifters and refugees over a relatively long period of time (some 500 years or more). In his opinion, the change in subsistence was almost imperceptible, and thus peaceful and gradual. Levantine farmers easily adapted to local hunter-gatherers, with the adaptation process being facilitated by a flexible social organisation and a probably exogamous marriage pattern followed by autochthonous communities. In the light of this hypothesis, pottery may have reached northern Egypt together with migrants from the east.

In 1989, A. Smith compared available evidence on the connections between North Africa and the Levant in the period in question. Taking into account the most recent data from the Sinai and the Negev, he pointed to the Qatifian culture as a possible source of the Fayumian ceramics. In his opinion, pottery may have been introduced to Lower Egypt through pastoral contacts with North Africa (Smith, 1989: 75). Furthermore, Smith claimed that there were some similarities between lateral polishing on flaked stone axes from Qatif and those from the central Sahara. According to Smith, such similarities confirm a mutual exchange of ideas having occurred between North Africa and the Levant during the Early and Middle Holocene periods.

The question of linking the Neolithic pottery tradition with the Levant was also raised after the publication of materials of the el-Omari culture from Wadi

Hof (Debono & Mortensen, 1990). According to F. Debono and B. Mortensen, some aspects of el-Omari pottery production correspond well to the Pottery Neolithic pottery tradition from the Levant. In their opinion, vessel shapes were similar to the ceramics of Jericho (bowls, hole-mouth jars, necked jars, concave bases). Moreover, Debono and Mortensen suggested a link between Egyptian and Levantine pottery traditions visible in the use of different clays, the mixing of clays, the use of straw, calcite and sand tempers, wet-smoothing, thick red slip and burnishing, as well as control of oxidizing conditions during the firing process (Debono & Mortensen, 1990: 40). The flint industry may also be associated with the Yarmukian culture (Debono & Mortensen, 1990: 53). According to Debono and Mortensen, the origins of the el-Omari culture were local, although its pottery, lithics, constructions and burial customs show strong links to the southern Levant. In their opinion, just as in the case of the Merimde settlement, a group of Levantine herders may have settled in the Wadi Hof region.

Intensive research on the Predynastic and Protodynastic periods in the 1980s and 1990s yielded a growing amount of new evidence that needed to be systematically analysed. As a result, a number of important monographs addressing those two periods and, additionally, the Neolithic were published. Thus, B. Midant-Reynes (see also 2000), in her 1992 work entitled *Préhistoire de L'Égypte. Des premiers hommes aux premiers pharaons*, presented the state of research on the Neolithic communities of Lower Egypt. She pointed out the eastern origins of domesticated plants and animals, in both the Fayum and Merimde. In the case of the Fayumian culture, she also suggested a Near Eastern origin of bifacial knapping with polishing. According to Midant-Reynes, the Fayumian culture emerged at a junction of three influences, namely from the Near East, the Sahara and the Nile Valley (Midant-Reynes, 1992: 107). By analysing materials from the Urschicht phase at Merimde Beni Salame (including pottery), the French researcher linked their origins to the Near East. In her opinion, the settlement at Merimde, unlike the Fayumian sites, has a typically eastern character. She also attributed Levantine origins to the communities of the el-Omari culture. In the opinion of Midant-Reynes, the pottery of this culture displays a significant affinity to that known from the Pottery Neolithic in the Levant (Midant-Reynes, 1992: 119). Similar views were presented by Midant-Reynes in her 2003 work entitled *Aux Origines de L'Égypte* (Midant-Reynes, 2003: 66-79). Another specialist in Egyptian prehistory, K.M. Ciałowicz, has also suggested a Near Eastern origin of the early Neolithic communities from Lower Egypt and migration from the east (Ciałowicz, 1999: 91-103).

The theory on the Levantine origins of the Lower Egyptian Neolithic (including domesticated plants and animals, pottery, as well as certain flint items), one well established before the Second World War, has remained relatively unchanged in studies on Egyptian prehistory. The lack of new discoveries has not attracted researchers' attention and has been counterproductive to the growth of knowledge on farming communities inhabiting northern Egypt before the 4th millennium BC. Moreover, research has been limited to presentations of the current state of knowledge and earlier hypotheses proposed by other researchers (e.g. Wetterström, 1993; Wengrow, 2006; Mączyńska, 2008).

However, an important contribution to the research on the first farming communities in Egypt came from N. Shirai (2005; 2006). In his opinion, the Neolithisation process in Lower Egypt was closely linked to the Near East. Shirai's attention was drawn to the sites of the Fayumian culture and to flint materials excavated by Caton-Thompson and Gardner. On the basis of this analysis, he concluded that already from the 8th millennium BC on, there had existed a sociocultural network linking Egypt with the Levant and enabling a steady flow of technical knowledge, stylistic information and symbolic beliefs. He was of the opinion that this network also allowed for the diffusion of concepts concerning farming and herding into Lower Egypt (Shirai, 2010; 2013a; 2013b; 2015; 2017). Although he assumed that migrants from the east had come to Egypt, he also admitted that there is no evidence directly confirming their presence. Moreover, Shirai also noticed that in contrast to lithics, the pottery of the Fayumian culture differs from the Levantine pottery of the Pottery Neolithic period in terms of shape, surface treatment and decoration, and thus should rather be linked to the North African pottery tradition. However, he also claimed that the herringbone pattern from Merimde, as well as the variety of body shapes and sizes of Lower Egyptian ceramic assemblages, can be linked to the Yarmukian culture (Shirai, 2005: 13; 2010: 312-314).

An interesting hypothesis on the origins of the north-eastern African pottery, based on the relationship between pottery and food traditions, was put forward by R. Haaland (2007). Taking into account archaeological and ethnographic data, on the one hand, and the division into wheat-barley bread-eating Near East and sorghum-porridge-eating Africa, on the other, Haaland placed Egypt in the Near Eastern tradition, thus pointing to the Near Eastern origins of the entire Egyptian pottery tradition, additionally including the Western Desert.

Both the African and Levantine roots of Lower Egyptian pottery were noticed by G. Tassie (Tassie, 2014: 184-185). Even though he points out the similarities between Fayumian and Merimde pottery, on the one hand, with that from the Western Desert, on the other, he also notices some differences. In Tassie's opinion, the pottery from Lower Egypt – in the light of its technological sophistication – must have been introduced from outside, probably from the Levant. Thus, the Nile Delta must have been reached by farmer-herders from the Nizzanim variant or Wadi Rabah culture (Tassie, 2014: 194).

The spread of farming and herding, as well as other Neolithic elements from the Levant to Egypt, has been rather rarely addressed by researchers working in

Israel. This moderate level of interest has resulted from the lack of access to materials in Egypt, on the one hand, and from their poor quality and low quantity as compared with evidence from the Levant dated to the same period, on the other hand. O. Bar-Yosef (1987) supported the view claiming the existence of contacts between communities inhabiting the Levant and Egypt already in the Pleistocene epoch. In his opinion, the geographical proximity and lack of natural barriers on the Sinai were conducive to the exchange of people and ideas. However, he pointed out the maritime migration route from the Levant to the Nile Delta, linked to the collapse of the PPNB society and the 8.2 kiloyear cal. BP cold event (Bar-Yosef, 2009; 2002; 2013).

The most recent hypothesis on the origins of Lower Egyptian pottery has been proposed by K. Streit (2017). Having analysed materials from the Neolithic sites in Lower Egypt and having compared them with assemblages from the Levant, she concluded that pottery was first introduced to Egypt by migrants representing the Wadi Rabah culture from the Levant. According to Streit, parallels can be seen among pottery shapes (hole-mouth jars, simple bowls), surface treatments (slip and burnishing) and decoration (herringbone pattern). Moreover, she also noticed some similarities in flint assemblages and among small finds (animal figurines). Streit's hypothesis is based on radiocarbon dating and Bayesian modelling. On this basis, she concluded that only members of the Wadi Rabah culture could have had contacts with groups inhabiting Lower Egypt in the 6th millennium BC.

Human migrations from the Levant to northeast Africa at the time of the Neolithic transition have been confirmed by genetic studies (Arredi *et al.*, 2004; Kujanová *et al.*, 2009; Smith, 2013b). Moreover, the latest discoveries from northern Morocco have prompted researchers to suggest that the introduction of domesticated plants and animals and pottery to that area took place between 5,500 and 5,000 cal. BC as a result of the same diffusion process from the Levant that had previously reached Lower Egypt (Morales *et al.*, 2016).

By way of conclusion, it should be remarked that the Levantine origins of Neolithic Lower Egyptian ceramics are closely related to the origins of domesticated plants and animals introduced to Lower Egypt from the east. Commonly accepted as an element of the so-called Neolithic package, pottery is seen as a Levantine contribution to the development of Ancient Egyptian civilisation. Hypotheses suggesting the eastern origins of pottery are based on the origins of farming and herding, on the one hand, and/or on stylistic or technological similarities, on the other. Domesticated plants and animals, as well as assemblage items (pottery, flints, figurines) with analogies in southwest Asia, are the key arguments in discussions on the early connections between Egypt and the Levant. However, the very process of their introduction to Egypt continues to be puzzling. Questions about when and how the Levantines reached northern Egypt remain unanswered.

So far, not a single foreign item (ceramics or flint) has been found in any of the Neolithic sites that could serve as evidence confirming the presence of foreign groups in this area. Furthermore, stylistic analyses of material culture (including ceramics) aimed at highlighting similarities are inconsistent, as they link the first Egyptian farmers to different cultural groups from the Levant. Undoubtedly, research is not made any easier by the low quality and quantity of the available data. The currently known Neolithic sites in Lower Egypt surely represent but a fraction of the actual settlement activity in the period in question. The traces left by the first farmers and herders may be covered by a thick layer of silt or may have already been destroyed in the prehistoric period.

3.2.2. The Western Desert as a source of Lower Egyptian pottery

From the very beginning of Neolithic research, it has been a common practice to link the Neolithic in Lower Egypt to the Levant on the basis of the presence of domesticated plants and animals, as well as other elements of the Neolithic package, including pottery. However, already among the first researchers, there were those suggesting hypotheses of a local (African) origin of Egyptian Neolithic communities on the basis of flint assemblages. Indeed, Caton-Thompson and Gardner (1934) were of the opinion that the communities who occupied the lakes of Lake Qarun were autochthonous. Even Childe admitted that, next to new Asiatic elements (domesticated plants and animals, pottery), local "African-Aterian traditions" were still present in flint industries (Childe, 1935: 45-46, 48-49).

The local character of flint assemblages also drew the attention of some post-war researchers. Indeed, Baumgartel associated the sites in the Fayum and Merimde with "the first settlers in Egypt" who came from the south, a view based, first of all, on the bifacial flint industry (Baumgartel, 1955: 37-38, 49). Furthermore, she saw a close connection between the Fayumian and the Early Khartoum cultures. The Lower Egyptian Neolithic was also claimed to have had African origins by J. Mellaart (1965: 161). In commenting on a paper by A.J. Arkell and P.J. Ucko (1965), he stressed the lack of links between the Fayum/Merimde and their eastern neighbours. In his opinion, ceramics may have been invented by Egyptians and there was no reason to suggest that Egyptian pottery must have necessarily originated from the Near East. The bifacial arrowhead industry, along with the hollow-based arrowheads of the Lower Egyptian Neolithic, were also associated with the Aterian culture by J.L. Forde-Johnston (1959). Similar views were presented by K. Butzer in 1976 in his *Early Hydraulic Civilisation in Egypt* (Butzer, 1976: 10-11). Moreover, M.A. Hoffman considered the Fayumian culture as comprising endogenous communities that changed after the Neolithic revolution (Hoffman, 1979: 188). Nevertheless, most researchers are of the opinion that ceramics, as an element of the Neolithic culture, came to Lower Egypt from south-east Asia, while flint assemblages could be of local origin.

An important event in the research on the origins of Neolithic cultures in North Africa was the intensification of explorations of the eastern Sahara. The discoveries made by archaeologists in the Western Desert caused a profound change in the way of thinking about food production, animal domestication and early pottery production in this region. Numerous traces of the use of wild cereals (storage pits, grinding stones), the remains of domesticated animals and fragments of pottery vessels were recorded at Early and Middle Holocene desert sites. They all showed that the Near Eastern model of the Neolithic is not the only model possible and that the elements of the so-called Neolithic package may have emerged independently of south west Asian influences.

The last decades of research conducted in the Western and Eastern Desert have made a tremendous contribution to our knowledge about Early and Middle Holocene communities inhabiting these regions. Attention has been drawn to the non-isolation of communities living in the desert and in oases (and probably also in the Nile Valley) and to their long-distance contacts owing to annual rounds through the desert (Kindermann, 2002; Riemer & Kindermann, 2008; Riemer *et al.*, 2013). Researchers have also identified correlations between the timing of certain events, namely: the beginning of the desiccation of the Egyptian Sahara; the large-scale exodus from the desert; the emergence of the farming community in the Fayum in the 6th millennium BC; and the rise of human occupation along the Nile around 5,000 BC (Kindermann, 2003; Kuper & Kröplin, 2006: 805-806; Riemer & Kinderman, 2008; Riemer *et al.*, 2013). As climatic changes in the Sahara forced people to move to more favourable areas during the final part of the Holocene humid phase, societies from the Western Desert probably headed towards the Nile Valley, the Nile Delta and the Fayum, using previously known routes (Riemer, 2013: 170; Tassie, 2014: 193). According to H. Riemer *et al.*, certain similarities in the assemblages of the bifacial tradition of the desert and the early Neolithic tradition in Lower and Upper Egypt could be identified as evidence of the cultural links between these regions (Riemer *et al.*, 2013: 172).

The discoveries in the eastern Sahara have influenced Lower Egyptian prehistory. Most hypotheses proposed in the 1980s placed the Neolithic communities from Lower Egypt (including in particular the Fayumian culture) at the junction of influences from the Western Desert and the Levant. Some have even suggested the movement of people (Hassan, 1984b: 222-223; Wenke *et al.*, 1988; Smith, 1989; Wenke & Casini, 1989; Midant-Reynes, 1992; 2000; 2003: 76-77; Tassie, 2014: 184-185). Saharan influences on the Neolithic cultures in Lower Egypt were additionally confirmed by research conducted by a Polish expedition at the Qasr el-Sagha sites (Kozłowski & Ginter, 1989: 176-179). In the light of the discoveries from the 1980s, one particularly remarkable hypothesis is that proposed by F. Wendorf and R. Schild that took into account their own exploration of the area of Nabta Playa-Bir Kiseiba and the Fayum (Wendorf & Schild, 1984: 428). Both researchers linked the origins of the Fayumian culture directly to the migration of cattle-keepers from the Sahara. They also associated the pottery of the Fayumian culture with that known from the Great Sand Sea area, suggesting that the sites at Lake Qarun are in fact remains left by Saharan groups that "moved to the Fayum basin seasonally in order to fish" (Wendorf & Schild, 1984: 428).

Over the last 30 years, only a few opinions clearly linking the pottery traditions of the Sahara and Fayum have been proposed. The affinities between the pottery of the Fayumian culture and that of the Western Desert were commented on by R. Kuper in 1996. In his view, there is a large degree of similarity between the pottery from the site of Lobo near Abu Minqar and the pottery of the Fayumian culture (Kuper, 1996: 89; 2002: 9). The affinity of Bashendi B ceramic forms from the Dakhleh Oasis and those from the Fayum and Merimde II was also noticed by C. Hope (2002: 57) who stated that "the Egyptian Sahara could be a possible source of various features of Nile Valley ceramics". The similarities identified by him included some vessel shapes (deep bowls) and smoothed brown ware. The question of connections between the Dakhleh Oasis and the Lower Egyptian Neolithic was also addressed by A. Warfe (2003). However, after a thorough analysis that also included ceramics, he concluded that only a few links between the Lower Egyptian Neolithic and the desert groups could be identified. These were supposed to include thin-walled and fine-tempered pottery (Warfe, 2003: 193).

The question of the African origins of Neolithic pottery is rather rarely discussed. Research is not made any easier by the dominance of the hypothesis assuming its Levantine origins, or by poor evidence. Despite a number of exploration projects in the Western Desert, in recent years there have been no discoveries that could strongly support the hypothesis linking the Sahara to Lower Egypt. In this context, the only study of note is the analysis of pottery of the Farfara Oasis from a site known as Sheykh el-Obeiyid 99/1. On this basis, I. Muntoni and M.C. Gatto suggest the pottery's similarity to materials from the Fayum (Muntoni & Gatto, 2014: 457). As no traces of pottery production to the north of the Farfara Oasis have been discovered so far, the roots of pottery production of the Lower Egyptian Neolithic are commonly seen in the east and linked to the newcomers from the Levant.

3.3. Summary

Research on the origins of Lower Egyptian pottery has been dominated by hypotheses linking it to southwest Asia. Newcomers from the Near East were supposed to have introduced new subsistence strategies to Lower Egypt, together with other elements of the Neolithic package, including clay vessels. The origins of Neolithic Lower Egyptian pottery are very closely linked to the origins of the Neolithic way of life and the process of its spread from the core area in the Near

East. Although researchers have never really agreed on the size of groups that reached Lower Egypt, or on their cultural identity, chronology and reasons that forced them to leave their homelands, the hypothesis based on the Levantine origin of Neolithic pottery is quite deeply rooted in the prehistory of Egypt.

Research on the prehistoric occupation of the Western Desert has a much shorter tradition than that on the oldest history of Lower Egypt. However, its intensity and modern research methods have yielded some discoveries that have forced researchers to reconsider their views on the roots of Egyptian civilisation. Today, the area in question is nearly devoid of any permanent human presence (except for oases) due to high temperatures and limited access to water. However, during the Holocene humid phase, it was inhabited by mobile groups of hunter-gatherers and herders. The 'Green Sahara' offered water, wild plants, animals, and pasture, which gave rise to the development of various strategies of human adaptation. In the light of research on the eastern Sahara, the Near Eastern model has become merely one of the possible solutions.

At first glance, both hypotheses presented above differ significantly from each other. However, if we look more closely at the arguments used to support them, we will notice that they are, in fact, similar. Neither of the two hypotheses is based on evidence that directly points to the source from which clay vessels were adapted. In the Levantine hypothesis, pottery is an element of the Neolithic package introduced to the northern part of Egypt together with new subsistence strategies by newcomers from the Near East. In the Saharan hypothesis, ceramic vessels are part of the African heritage introduced into Lower Egypt by migrants from the desert. Moreover, both hypotheses are based on the technological or typological similarity of the vessels (surface treatment, forms, decoration). If one realises that the popularity of the hypothesis proclaiming the Levantine origin of Lower Egyptian pottery largely results from its long history of research, the arguments presented in both hypotheses will seem similar and equally valid.

Chapter 4
The cultural situation in north-eastern Africa and the southern Levant during the Early and Middle Holocene periods

4.1. The Neolithic period of Lower Egypt

At the early stage of archaeological research in Egypt, the entire terminology concerning its chronology and periodisation was adapted from Europe. The term Neolithic, originally devised in 19th century Europe, was accepted also for Egypt. At the turn of the 19th and 20th centuries, two terms – Prehistoric/Predynastic and Neolithic – were closely interconnected in Egyptian archaeology. They both generally encompassed all finds dated to the period preceding the emergence of the Pharaonic civilisation. Already towards the end of the 19th century, J. de Morgan considered materials from Predynastic sites (including Naqada and Ballas) as Neolithic (de Morgan, 1896: 67-167). In the opinion of W.M.F. Petrie, the Neolithic encompassed a period below S.D. 60 the highest level of his famous Sequence Dating seriation method (Petrie, 1901: 28–29). Although the Neolithic was officially introduced into the periodisation of Ancient Egypt, it attracted little interest. Archaeological works focused mostly on Upper Egyptian cemeteries while the interest of researchers was directed towards finds and their chronology within the Predynastic period, along with their cultural affinity and classification/typology. At the very beginning of the 20th century, the terms Prehistoric/Predynastic replaced the term Neolithic. It was only thanks to finds directly related to domesticated plants and animals (in the Fayum and Badari) that the term Neolithic returned to Egyptian prehistory.

The history of research on the Lower Egyptian Neolithic began in the 1920s and 1930s, when new sites in the Fayum, Merimde Beni Salame, and Wadi Hof were discovered and excavated, providing new materials standing out from those known from other sites in Egypt (Map 2). For the first time, archaeological works conducted on the northern shores of Lake Qarun yielded the remains of domesticated animals and grains of domesticated plants, indicating the presence of subsistence strategies other than hunting, gathering, and fishing (Caton-Thompson & Gardner, 1934). The presence of bones of domesticated cattle, sheep, goats and probably pigs and dogs, as well as grains of emmer wheat and hulled six-row barley, began to be quoted in the context of early agriculture in the Nile Valley and the Delta.

Research into the Neolithic period of Lower Egypt has been conducted for the last 100 years. Although our knowledge is now different from that a century ago, it is still the least known period in the whole history of Egyptian civilisation. However, over the last decade, interest in Lower Egyptian farming communities has been growing. New research projects have, on the one hand, focused on the analysis of materials originating from earlier excavations (Shirai, 2010; 2015; 2016a; 2016b; Emmitt, 2011; 2017; Emmitt *et al.*, 2018) while, on the other hand – owing to excavations and new forms of archaeological reconnaissance and the use of new research methods – they have provided new evidence enriching our modest level of knowledge. These projects include the Egypt Exploration Society excavations at Sais, the UCLA-RUG-UOA Fayum project, and the Imbaba Governorate Prehistoric Survey (Wilson *et al.*, 2014; Rowland & Bertini, 2016; Holdaway & Wendrich, 2017).

4.1.1. The Fayumian culture

In the 1920s, on the northern shore of Lake Qarun, G. Caton-Thompson and E. Gardner identified a number of archaeological sites dated from the Palaeolithic to Roman times. These pioneering discoveries contributed to a better understanding of the communities inhabiting this part of Egypt in prehistoric times. However, their importance is caused, first of all, by the fact that they proved human activity had existed in this area before the emergence of the Egyptian state. Among the sites recorded at that time, particular attention should be paid to two Neolithic settlements named Kom K and Kom W and two concentrations of storage pits known as the Lower and Upper K Pits. At these very sites remains of the activities of the earliest farming societies in Egypt were found. Pottery, bifacially retouched flint tools, grains of domesticated plants and bones of domesticated animals provided a basis for Caton-Thompson and Gardner to identify an archaeological culture referred to as the Neolithic A group. Assemblages containing no pottery or domesticates but standing out for microlithic elements were classified as the Neolithic B group. Since both researchers assumed that the water level in the lake had kept on lowering in the Neolithic, they also assumed that the sites' location indicated their relative chronology. On this basis, they concluded that the Neolithic A group[1] preceded the Neolithic B group[2]. The Neolithic sites were dated to the period before 5,000 BC, and were occupied for approximately 800 years (Caton-Thompson & Gardner, 1934: 93). Although Caton-Thompson and Gardner realised the importance of the discoveries, the mistaken interpretation of water level changes (and thus the incorrect relative chronology of sites and cultures) led to erroneous interpretations. In the opinion of both researchers, the communities who occupied the northern shore of Lake Qarun regressed rather than progressed over time. They considered the Fayumian B groups as more primitive and poorer than their predecessors, the Fayumian A groups.

From the very beginning of research, storage structures and diverse artefacts made of flint, stone, clay and organic materials were remarkably different from finds from other sites known thus far in Egypt. The publication of research results together with the description and analysis of finds in *The Desert Fayum* from 1934 continues to be an important source of information on Neolithic communities in northern Egypt. It introduced the Fayumian sites to a broader discussion on the origins of food-producing societies in Egypt and in the Near East. At that time, the discoveries in the Fayum were commented on by H. Junker, who explored Merimde, another Neolithic site from Lower Egypt. He used the materials from the northern shore of Lake Qarun as a comparative base.

The discoveries in the Fayum initiated research on food producing societies in Egypt. The presence of domesticated plants and animals started to be quoted in the context of early agriculture in Egypt and the Near East (Childe, 1928; 1935). Moreover, the presence of pottery as a typical Neolithic element on the shore of Lake Qarun perfectly matched the Near Eastern farming community model. However, certain features differentiating the groups in the Fayum Depression were visible from the very beginning. Researchers did not record any graves or remains of settlement structures pointing to another important feature of farming communities, i.e. conducting a sedentary way of life. Furthermore, the Fayumian communities relied on abundant food resources offered by the lake and its surrounding areas. Hunting, fishing, and gathering played an important role in food procurement, supplemented by plant cultivation and animal breeding.

After the Second World War, the Fayumian culture took up a permanent position in synthetic studies covering prehistoric Egypt (Hayes, 1965; Arkell, 1975). However, the still-limited availability of data sometimes led to mistaken interpretations. E.J. Baumgartel associated the Fayumian A culture with the Naqada I period on the basis of flint assemblages and saw its origins in the south, even suggesting connections to the Early Khartoum culture (Baumgartel, 1955: 25, 49).

1 Further referred to as the Fayumian A culture.
2 Further referred to as the Fayumian B culture.

Until the 1970s, the chronological sequence of the Fayumian A and B cultures was generally accepted, as was the regressed development of farming communities on the shores of Lake Qarun (Hayes, 1965: 98-99).

Archaeologists returned to the Fayumian culture towards the end of the 1960s and in the 1970s. An Italian expedition headed by S.M. Puglisi came first (Puglisi, 1967; Casini, 1984). Having analysed the archaeological assemblages, M. Casini suggested a local origin of the Fayumian A farming societies. In her opinion, the transition from gathering and hunting to food production had resulted from evolution and the specialisation process, allowing for adaptation to new environmental conditions.

However, it was research conducted by the Combined Prehistoric Expedition in the Fayum Depression headed by F. Wendorf that significantly changed our knowledge of the Neolithic period in this region and the chronology of sites. In 1969, a survey along the northern border of the Fayum Depression was carried out, involving test excavations at eight sites dated from the Palaeolithic to the Old Kingdom. On the basis of C14 dates, a detailed examination of site stratigraphy and the geological structure of the Fayum Depression, F. Wendorf and R. Schild proposed a new chronology for the cultures identified by Caton-Thompson and Gardner. In their opinion, the Fayumian B, now named the Qarunian culture, should be dated to the Epipalaeolithic period and predated the Neolithic Fayumian A culture (Wendorf & Schild, 1976: 157-228). The new C14 dates also showed a 1,200-year gap between the Epipalaeolithic and the Neolithic, interpreted as a hiatus in settlement activity caused by a sharp decrease of the lake's water level. Wendorf and Schild suggested the arrival of external farming societies to the Fayum; thus, they did not associate their origins with the Qarunian hunters-gatherers (Wendorf & Schild, 1976: 317-319).

In 1979 and 1980 the sites at Qasr el-Sagha located in the Fayum Depression were explored by Polish scholars from the Jagiellonian University in Kraków. One of the greatest achievements of these explorations was the identification of two phases of Neolithic settlement activity with different origins, namely an older Fayumian and a younger Moerian phase. For the older phase, the researchers suggested the presence of Near Eastern elements, while the younger phase may have been linked to the Saharan tradition (Kozłowski & Ginter, 1989: 176-179). Furthermore, B. Ginter and J.K. Kozłowski verified the Neolithic character of flint assemblages of the Fayumian. The lithics originating from the British research in the early 20th century consisted, first of all, of core and bifacial implements. Meanwhile, the excavations in Qasr el-Sagha showed that the flint industry of the Fayumian was flake-oriented.

In the early 1980s, an expedition from the University of Washington headed by R. Wenke began to explore the Fayum Depression. The researchers focused on the lesser known south-western side of the lake, and their interests concentrated, first of all, on the issue of the origins of agriculture in Lower Egypt, as well as on the transition from hunting and gathering to farming. On the basis of data collected through surveys and excavations covering both archaeological assemblages and faunal remains, Wenke reached conclusions similar to those of Wendorf and Schild, suggesting the lack of cultural links between the Epipalaeolithic and the Neolithic groups from the Fayum.

Intensive archaeozoological research on materials from sites located on the shores of Lake Qarun was carried out in the 1980s. D. Brewer (1989) attempted to develop a resource exploitation model by analysing faunal remains in association with cultural assemblages of the Epipalaeolithic and the Neolithic. According to Brewer (1989), fishing was the main source of food for the people of both the Qarunian and the Fayumian cultures. People of these cultural groups consumed the same fish species and used the same strategies at the same time of the year. Consequently, fish remains prevail at sites of the Epipalaeolithic and the Neolithic periods. A differentiating feature of the Neolithic sites was the presence of domesticates. Brewer also agreed with the hypothesis of Wendorf and Schild (1976) concerning the lack of affinities between the Qarunian and Fayumian cultures. Markedly profound differences in flint assemblages, despite a lack of change in the resource exploitation models, were considered as indicators of the non-local character of the farming communities from the Fayum.

After a long break, archaeologists returned to the Fayum Depression in 2003. Research carried out by the UCLA-RUG-UOA Fayum project continued until 2013 and contributed to a number of important discoveries that changed our knowledge of the Epipalaeolithic and the Neolithic of the Fayum.[3] Particularly remarkable are the works of N. Shirai, a member of the expedition team (2003-2005), relying on analyses of flint materials from new explorations and on flint implements from the excavations of Caton-Thompson and Gardner (Shirai, 2010; 2015; 2016ab). The research conducted by Shirai (2005; 2006; 2013a; 2013b; 2015a) covered several issues, including the transition between the Epipalaeolithic and the Neolithic periods in the Fayum, the process of adaptation of new subsistence strategies, and their origin. His book *The Archaeology of the First Farmer-Herders in Egypt. New Insights into the Fayum Epipalaeolithic and the Neolithic*, appearing in 2010 as a published version of his doctoral thesis, constitutes a rich source of information on the Neolithic period and the Neolithisation process, not only in Lower Egypt. One of the achievements of this Japanese researcher was the calibration of available C14 dates which made it possible to rearrange

3 The project was initiated and directed by faculty of the University of California, Los Angeles, USA (UCLA) and the Rijksuniversiteit Groningen, the Netherlands (RUG), partnering with others, such as Auckland University, New Zealand (UOA) and the Vrije Universiteit.

the chronology of the Qarunian, Fayumian, and Moerian cultures, and which eventually contributed to a reduction in the gap between the Epipalaeolithic and the Neolithic from 1,200 to 600 years. Shirai also presented a comparative study of the lithic implements in a broad context, taking into account evidence from both the Levant and the Western Desert (see contra McDonald, 2013). He proposed a model of the Neolithisation process for the Fayum, indicating the Levant as the main source of farming and herding. Shirai also suggested: „a steady flow of technical knowledge, stylistic information and symbolic beliefs from the southern Levant to north-eastern Africa" already from the 8th/7th millenniums BC, i.e. well in advance of the introduction of domesticates into Egypt (Shirai, 2010: 334-335). Moreover, the regular contacts continuing since the Epipalaeolithic contributed to the diffusion of these new subsistence strategies into Egypt in the 6th millennium BC. According to Shirai, the 600-year occupation gap between the Epipalaeolithic and the Neolithic in this region can be explained by both an actual interruption in human occupation in the 6th millennium BC and/or the current state of research. Unlike earlier researchers who concentrated on the transition between the Epipalaeolithic and the Neolithic (e.g. Wendorf & Schild, 1976; Wenke & Casini, 1989), Shirai suggested possible continuity between the two periods. In his opinion, the emergence of a new subsistence strategy was "a result of humans' effort to adapt foreign domesticates to the local environment". Thus, the Fayumians embraced the innovations and adapted them to their local environment (Shirai, 2013a: 215). Shirai found that the flint assemblage had diversified considerably in the Neolithic and many elaborate and innovative tools (bifacially pressure-flaked sickle blades and bifacially flaked axes) had appeared in the Neolithic Fayum (Shirai, 2013a: 225–226; 2016a; 2017). In his opinion, people had invested an unprecedented amount of time and labour in tool-making in order to make farming and herding successful.

The broad scope of the UCLA-RUG-UOA Fayum project included climatic, botanical, faunal, ceramic and lithic evidence. One of the more notable achievements of the expedition involved the identification of links between the successful adaptation of farming and herding in Lower Egypt and local conditions, namely climate and environment. According to R. Phillipps *et al.* (2012), the data from the Fayum indicates a reliance on crops grown in winter. Colder climatic conditions between 6,700-5,800 BC in northern Egypt caused by the high level of the Mediterranean winter cyclonic rainfall made it possible to use domesticates and to cultivate the land. Research also showed that Middle Holocene occupation in the Fayum was not linked to the southward movement of the ITCZ (Phillipps *et al.*, 2012).

An important contribution to the development of knowledge of human activity on the shores of Lake Qarun was made by new radiocarbon determinations obtained as part of the project. They showed that from the Early Holocene period until 6,000 BP activity was frequent on the northern shore. It also turned out that the gap between the Epipalaeolithic and the Neolithic was attributable to the state of research, and not to an actual occupation hiatus (Wendrich *et al.*, 2010; Holdaway *et al.*, 2016; Holdaway & Wendrich, 2017).

New research from the UCLA-RUG-UOA Fayum project on the faunal remains from the Fayum confirmed earlier observations on the prevalence of fish remains at prehistoric sites in the Epipalaeolithic and the Neolithic periods, indicating the use of the abundant resources of the lake, and thus adaptation to the local environment. Even though the oldest evidence for domesticated ovicaprines is dated to ca. 5,600 cal. BC and research has shown that the emergence of domesticates predates the 5th millennium BC, scholars are of the opinion that the exact timing of domesticates' introduction into the Fayum depression cannot be determined due to the still incomplete picture of human activity in this area (Linseele *et al.*, 2014; 2016). Detailed analyses also showed low numbers of sheep, goat, cattle and pig bones in the Neolithic Fayum, suggesting a minor role was played by domesticated animals (Linseele *et al.*, 2014). According to S. Holdaway *et al.*, and Phillipps *et al.* (2016a; 2016b), this could have been related to environmental and socio-economic processes – i.e. the availability of fish in certain periods, fluctuation of the lake's water level and movement of people in the area where the resources were located (Holdaway *et al.*, 2016: 178; see also Holdaway & Wendrich, 2017).

Researchers from the Fayum project also focused on the settlement pattern and mobility of the early agricultural groups in the Fayum Depression. In the absence of the traditional markers of mobility and sedentary occupations, they decided to analyse the artefact movement as an indication for human mobility and the distribution of artefacts and features (Holdaway *et al.*, 2010; Phillipps & Holdaway, 2016; Phillipps *et al.*, 2016a). In the opinion of Phillipps *et al.*, the occupation of the northern shore of Lake Qarun was "spatially extensive" and characterised by movement (Phillipps *et al.*, 2016a: 288). The dispersed settlement pattern consisting of short-lived features and storage facilities required the movement of human groups across this area (Holdaway *et al.*, 2016: 178). However, Phillipps and Holdaway (2016) suggest a decrease in mobility from the Early to Middle Holocene on the basis of the movement of flint cores. Such a change could reflect socio-economic changes linked to access to wild food resources, the production of pottery and bifacials, or even the introduction of domesticated plants and animals. Holdaway *et al.* is of the opinion that the Fayumian north shore may have been just a part of a spatially more extensive settlement system, additionally encompassing the Delta and the Nile Valley, with human groups moving across it and adapting to local environments as they encountered them (Holdaway *et al.*, 2016: 179). Researchers from the Fayum project claim that the settlement pattern, mobility and use of wild resources bring the Fayumian Neolithic groups closer to north-eastern African communities than to the farming societies in the southern Levant, commonly accepted as the source of the new subsistence strategies (Holdaway & Phillipps, 2017; contra Shirai, 2017). The UCLA-RUG-UOA Fayum project was summarised in a publication entitled *The Desert Fayum Reinvestigated. The Early to Middle Holocene Landscape Archaeology of the Fayum North Shore, Egypt*, published in 2017 (Holdaway & Wendrich, 2017).

In the context of research carried out by the UCLA-RUG-UOA Fayum project, attention should also be drawn to studies by Joshua J. Emmitt, one of the members of the expedition. His master's thesis on *Investigating ceramics from the Neolithic occupation of Kom W, Fayum, Egypt*, defended in 2011, was aimed at studying the duration of occupation and site use at Kom W on the basis of the ceramic assemblages from the excavations by Caton-Thompson and Gardner (1934), along with those by Wendorf and Schild (1976). In his estimation, the number and variety of ceramics suggest the intensive occupation of Kom W. As the larger vessels and their permanence indicate that the site was used for storage, it could have been either permanently occupied or returned to periodically. This research by Emmitt is consistent with mostly later hypotheses on the settlement pattern and the movement across the northern shore (Holdaway *et al.*, 2010; Phillipps & Holdaway, 2016; Phillipps *et al.*, 2016a; 2016b; Holdaway & Wendrich, 2017). In 2017, Emmitt defended his doctoral thesis entitled *The Neolithic Pottery of Egypt. Investigating settlement pattern in the Middle Holocene northeast Africa with ceramics*. Thus, the character of occupation on the northern shore of Lake Qarun was once again the subject of research on the basis of the ceramic assemblages. The novelty in this research were pottery analyses conducted with the aid of a portable X-ray fluorescence (pXRF) spectrometer. Their results confirmed the movement between the location of the Fayumian groups and their mobile character (see also Emmitt *et al.*, 2018).

The history of research on the Fayumian culture began in the 1920s. The discoveries by Caton-Thompson and Gardner permanently changed the way of thinking about Egyptian prehistory. Lower Egypt was no longer considered as an uninhabited swampland, while Upper Egypt lost its dominant position in this field of research. Over the last 100 years, the picture of the Neolithic in the Fayum has changed. Each subsequent research project on the shores of Lake Qarun has brought discoveries enriching our knowledge. Improved research methods, including the introduction of radiocarbon dating and new methods of artefact analysis, has also made it possible to reanalyse materials from earlier excavations. The understanding of prehistoric occupation in the Fayum has also been influenced by other research projects and discoveries, both in north-eastern Africa and in the Levant. The importance of discoveries in the Fayum has been appreciated from the very beginning with the Fayumian culture having been present in all synthetic studies of Egyptian prehistory (Baumgartel, 1955; Hayes, 1965; Krzyżaniak, 1977; Hoffman, 1979; Midnat-Reynes, 1992; 2000; 2003; Ciałowicz, 1999; Wengrow, 2006; Tassie, 2014) and is commonly quoted in the context of the Neolithisation process and the spread of domesticated plants and animals beyond the Near East.

4.1.2. The Merimde culture

Merimde Beni Salame, another important Lower Egyptian site dated to the Neolithic, was also discovered in the 1920s. It was found by H. Junker during a survey of the 'West Delta Expedition' by the Austrian Academy of Science in Vienna. Excavations at Merimde Beni Salame were carried out between 1929-1939. Junker uncovered approximately 6,400 m² of a suggested total area of 200,000 m². His research included both settlement structures and human graves within the settlement area. In certain parts of the site, deposits were nearly 3 m thick. However, the research methods of early 20th century archaeologists differed greatly from those used today. No attention was paid to stratigraphy while artefacts were subjected to a selection process. Towards the final stage of excavations, Junker identified three layers of occupation. The results of his research were published in short reports (Junker, 1929-1940) which currently constitute a limited source of information on pre-war explorations of the site. Junker realised the importance of his discoveries and the difference between Merimde and other Predynastic sites from Upper and Lower Egypt known at the time. However, as he was digging in large vertical units and did not respect horizontal stratigraphy, materials from various levels representing different stages in the development of this huge settlement became intermixed. However, the discoveries of Junker enriched the modest knowledge of early 20th-century archaeologists on the settlement organisation and burial customs of Neolithic societies in Lower Egypt. Drawings of dwellings and other structures discovered during these excavations were published in reports together with layouts and concise interpretations on the organisation of the village. The reports additionally featured brief analyses of artefacts, including pottery, lithics and bone items. A large share of the reports is dedicated to the exploration of graves and burial customs. Junker, taking contemporary knowledge and available research methods into account, tried to explain the prevalence of women and children among the dead, the lack of grave offerings and the presence of graves within the settlement. His research was accompanied by an analysis of a small portion of skeletal, plant and animal remains. Although Junker never published a comprehensive analysis of materials from his research, the inhabitants of Merimde, as presented in his reports, appear to be a typical Neolithic farming community, cultivating crops and breeding animals, making tools and weapons first of all from clay, stone and bone in a typical Neolithic way.

A considerable contribution to understanding the Merimde culture was provided by the works of H. Larsen published in the 1950s, covering the materials from Junker's research from the collection of the Egyptiska Museet in Stockholm. Although Larsen (1957; 1958; 1962) focused, first of all, on pottery analysis, his attention was also drawn to stone and bone items (Larsen, 1959; 1960). He not only analysed typological artefacts, but also tried to put them in a wider archaeological context, looking for analogies with other sites both in Egypt and beyond. Due to the fact that documentation from Junker's research was destroyed during the Second World War, the works of the Swedish researcher are an important resource on objects discovered before the war.

In 1976, Merimde once again attracted archaeologists' attention. First, the site was explored by Z. Hawass on behalf of the Egyptian Department of Antiquities (Hawass *et al.*, 1988). The objective was to verify the site's stratigraphy and chronology. C14 dates and analyses of stratigraphy and finds including pottery, flints as well as faunal and botanical remains made it possible to confirm the site's Neolithic chronology. In the same year, the site began to be explored by archaeologists from the German Archaeological Institute. For five seasons, from 1976 to 1982, research was carried out by J. Eiwanger, in compliance with contemporary standards. Stratigraphy analysis allowed Eiwanger to identify five strata and three settlement phases. Analyses of features and artefacts made it possible to link phase I (the so-called Urschicht phase) to Levantine influences and phase II to Saharan influences. In Eiwanger's estimation, in phase III the settlement was inhabited by a local community contemporaneous with the Fayumian A culture. Eiwanger suggested a settlement hiatus caused by the arid phase of the 6th millennium BC between phase I (Urschicht) and phase II. Despite the use of modern methods, including C14 dates, the chronology of the Merimde site was not easy to establish. Although radiocarbon dates for phase I pointed to the 5th millennium BC, Eiwanger believed that Merimde I was older and should be dated to the 6th millennium BC (Hassan, 1985; Eiwanger, 1988: 54). Consequently, he dated phase II of the site to the period between 5,500-5,400 BC. Radiocarbon dating, however, did not confirm a link between phase III and the Fayumian A culture. Nowadays, the beginnings of the settlement at Merimde Beni Salame are dated to before the beginning of the 5th millennium BC while the demise of the site is estimated at approximately 4,000 cal. BC (Hendrickx, 1999; see also Hendrickx & Huyge, 2014).

This German research project at Merimde revealed the enormity of the settlement and the richness of the Neolithic culture. The detailed publication once again introduced the Merimde culture to the prehistory of Lower Egypt. The long period of the settlement's occupation made it possible to track changes taking place in the society settled at Merimde, both in its social or economic organisation and in its material culture.

An important event in the history of research on the Merimde culture came in 2000 when pottery with a characteristic Merimde herringbone pattern was recorded in Sais, a site located in the western Delta. Remains of Neolithic settlements were deposited below a Chalcolithic settlement layer linked to the Lower Egyptian cultural complex (the Maadi-Buto culture). This newly recorded Neolithic site confirmed archaeologists' assumptions that our knowledge on the Neolithic in Lower Egypt was severely limited and that the sites known thus far represented merely a portion of the actual settlement network from the 6th and 5th millenniums BC. Moreover, P. Wilson *et al.*, suggest that the communities from Merimde and Sais were socially and economically linked (Wilson *et al.*, 2014: 162-163). Sais, as the fish-catching station, could have been a daughter site for the Merimde settlement, providing pasturing for animals and fishing opportunities. The site could also have been a potential location for migrants who had decided to leave the mother site and had travelled along a branch of the Nile in order to find a more hospitable location to live. Thus, the Egypt Exploration Society excavation at Sais, as one of the few ongoing projects investigating Neolithic settlement activity in Lower Egypt, can help us understand human activity in the period and region in question.

Poor understanding of the Neolithic occupation in the western Delta has attracted researchers specialising in the prehistory of this region. In 2013, the Imbaba Governorate Prehistoric Survey began in Meridme Beni Salame with the aim of surveying the western Delta hinterland around the Neolithic settlement (Rowland & Tassie, 2014; Rowland, 2015; Rowland & Bertini, 2016). The activities of the researchers involved in the project aimed at recreating the local environment and determining the role of humans in this environment in its prehistory. The researchers focused on the transition between the Epipalaeolithic and the Neolithic in order to understand the adaptation of farming and herding in Lower Egypt. Even though the project is still underway, they have already managed to collect information about human activity in this area from the Middle Palaeolithic and to extend the area occupied by the Neolithic settlement at Merimde. Attempts at collecting new AMS radiocarbon dates also seem promising, as they can help fine-tune the site's chronology. Particularly remarkable is the fact that, as in the Fayum, the community inhabiting the Merimde settlement was not fully sedentary, and probably utilised the area around the Wadi Gamal and exploited available resources for hunting, food processing and working tools (Rowland, 2015).

4.1.3. The el-Omari culture

The area around Helwan had already attracted researchers' attention in the 19th century as a result of numerous flint findings (Debono & Mortensen, 1990: 8). After 1918, the surroundings of Cairo (including Helwan) were regularly explored by the French archaeologist, Fr. P. Bovier-Lapierre. In 1924, his protégé Amin el-Omari, a young Egyptian mineralogist, discovered a Neolithic site on a gravel terrace in Wadi Hof near the rocky spur known as the Ras el-Hof, which he subsequently began to explore. After his sudden death, the works were finished in 1925 by Bovier-Lapierre, and the site was named after the young researcher. Although Bovier-Lapierre realised the importance of the discoveries, he only published two brief reports (Bovier-Lapierre, 1926a; 1926b). He rightly noted that for the first time ever "un ensemble complet" had been discovered in the Nile Valley, consisting of a settlement and an accompanying cemetery. In 1936, the French scholar asked F. Debono to explore the area in order to date and define the character of the flint industry. As a result, several small separate camps with non-homogenous flint industries were identified. Debono returned to Helwan during the war when the site was at risk of destruction and, in 1943 and 1944, explored it on behalf of the Egyptian Department of Antiquities. When the war ended, excavations were continued in 1948 and 1951. However, the results of works carried out at this Neolithic settlement were only published in 1990.

The chronology of the el-Omari site was a matter of discussion for years. Finally, thanks to C14 dates, a range of between 4,600-4,400/4,300 BC was proposed for the occupation of the site and the duration of the cultural unit. The el-Omari culture was placed between the Merimde and Maadi units (Table 1) (Debono & Mortensen, 1990: 80-81).

Despite a considerable delay in publishing the excavation results, F. Debono and B. Mortensen (1990) prepared a reputable monograph, analysing not only artefacts but also geology, as well as human, faunal and botanical remains. With such a broad approach, the researchers successfully presented a detailed, albeit very traditional picture of the Neolithic society of the el-Omari culture. For Debono and Mortensen, the inhabitants of the settlement were sedentary and depended on agriculture and domestic animals (Debono & Mortensen, 1990: 78-82). In the researchers' opinion, the settlement's structures denoted adaptation to local environmental conditions. Moreover, pottery, flint assemblages, and other small finds suggested the adaptation of humans to local resources. Debono and Mortensen also proposed the Near Eastern origin of the Egyptian Neolithic on the basis of discernible Levantine influences in the pottery, lithic industry, settlement pattern and burial customs of the el-Omari community. Both researchers also emphasised the strong likelihood of settlement continuity in this region from the Epipalaeolithic to the Neolithic periods.

Unfortunately, further research on Neolithic settlement activity in Wadi Hof/Ras el-Hof is impossible. In 1952, the area was taken over by the Egyptian army and its remains of prehistoric societies were lost to archaeology forever.

4.1.4. The Neolithic societies of Lower Egypt - a summary

In the beginning of the 20th century, when sites with remains of domesticated plants and animals were discovered in Lower Egypt, their interpretation was consistent with the generally accepted picture of Neolithic communities, developed through a culture-historical approach. People who inhabited these sites adopted a sedentary lifestyle in permanent villages, while their main subsistence strategies were the cultivation of crops and breeding of domesticated animals. Furthermore, they were characterised by Neolithic technologies, namely pottery production and stone and flint tool-making. This traditional picture is clearly visible in all early synthetic studies on Egyptian prehistory (e.g. Arkell & Ucko, 1965; Hayes, 1965; Arkell, 1975; Krzyżaniak, 1977; Hoffman, 1979). While the revisiting of Neolithic sites in the 1970s and 1980s with modern research methods revealed more data about the Neolithic in Lower Egypt, it changed little in the way this period was interpreted (e.g. Ciałowicz, 1999; 2001; Midant-Reynes, 2000). Only the recent years, thanks to new projects, re-analyses of the old evidence and new theoretical approaches have seen a change in the way of thinking about the Neolithic societies from northern Egypt (Rowland & Bertini, 2016; Holdaway & Wendrich, 2017).

The latest discoveries in the Fayum indicate that the lack of traditional settlement structures associated with a traditional farming society probably results from the movement of humans and animals across this region. The mobile way of life linked to the exploitation of various resources was not conducive to permanent occupation of the area. Although resources in the lake, including primarily fish, attracted people, their presence was related to the water level in the lake. Sites in the area were probably short-term hunting or fishing stops, consisting of a hearth surrounded by a concentration of lithics and pottery, as well as bigger seasonal base camps with one or two hearths, sometimes lined with stone slabs, lithics, pottery and probably a separate debitage zone for flint knapping. Another part of the mobile pattern were storage facilities used by groups moving across this area (Holdaway & Phillipps, 2017). The lack of graves at Fayumian sites may be attributable to the mobile way of life and to operating over a vast territory. The early Fayumian people were probably pastoralists herding domesticated sheep, goats and cattle. The oldest evidence recorded in the Fayum for domesticated ovicaprines is dated to ca. 5,600 cal. BC (Linseele *et al.*, 2016). These animals, although of Near Eastern origin, could have been introduced to Fayum from the Eastern and Western Deserts, where their presence is unquestionable in the 6th millennium BC (Tassie, 2014: 236; Brass, 2018). Since the flint assemblage of the Fayumian has many common features with materials from the Egyptian Sahara, the Fayum may have been visited by groups of herders travelling across the desert together with animals in search of water and food resources. At a certain point in time, the inhabitants of the northern shore of Lake Qarun adapted domesticated plants (barley, wheat, flax). Their introduction may have originated from the Delta area, where farming settlements already existed at Merimde Beni Salame and Sais (Tassie, 2014: 236). The earliest cultivated crops found so far in the Fayum are dated to ca. 4,500 cal. BC (Wendrich & Cappers, 2005). However, on the basis of analyses of axes and sickle blades from the Fayum area, Shirai suggested that cereal cultivation appeared there as early as in the beginning or middle of the 6th millennium BC (Shirai, 2016b; 2017). Admittedly, it was of experimental nature and involved the use of small plots, difficult to recognise among archaeological remains (see also Cappers, 2013: 114-118). In the beginning, domesticated plants as food were probably only an addition to the resources offered by the lake, still intensively exploited. This is particularly true with regard to fish constituting 99% of the identified faunal remains (Linseele *et al.*, 2014). It is probable, at that time, that pigs and dogs were introduced in addition to previously existing domesticates (Tassie, 2014: 231). These changes were accompanied by a reduction in the degree of mobility of the Fayumian communities. However, in the context of the most recent research on the Fayum, the movement of people was characteristic for all periods of occupation in the Fayum while "people moved into, out of and across a landscape rather than settling within it" (Holdaway *et al.*, 2017: 222, 224).

In the archaeological assemblages recorded at the sites, two groups of artefacts are particularly noteworthy, namely pottery and flints. The Fayumian people produced and used simple ceramic vessels made of local clays. Although the lithic assemblage includes flake tools, the number of blades and bladelet tools grows over time. It contains elements characteristic for the Western Desert and the Levant (Shirai, 2010: 119; 2016b; 2017). Characteristic features of the Fayumian culture are bifacially-retouched flint tools (axes, serrated sickle blades, concave-based arrowheads), even though they are a minor component of the lithic assemblages (Shirai, 2010: 47).

According to Holdaway *et al.*, many features of the Fayumian community (settlement pattern, grain storage system, mobility, small proportion of domestic animals and use of wild resources) bring this community closer to groups who occupied north-eastern Africa, rather than to the aforementioned Pottery Neolithic Levantine societies (Holdaway *et al.*, 2016; Holdaway & Phillips, 2017).

Another Lower Egyptian location where domesticated plants and animals were recorded is the site at Merimde Beni Salame, interpreted as a place where farmers and herders with some unclear affinities to the Levant settled because of favourable conditions. The semiarid pasture outside the Delta, along with the wadi's plant and animal resources and the Nile must have attracted people. The settlement established around the beginning of the 5th millennium BC was probably occupied for the next 1,000 years. Although the site itself occupies a considerable area of approximately 200,000 m², the occupation was limited to certain areas only while people probably moved within these areas due to changes in the course of the branch of the Nile. Another site of the Merimde culture was identified at Sais and has been interpreted as a fish midden and a daughter site of the Merimde settlement. It not only offered access to the abundant resources of the river but also to pastures for animals. The distance between Merimde and Sais is not great and probably did not discourage people who were often on the move. Research by Phillipps (2012) on the lithics from Sais confirms that the groups occupying the site were highly mobile. Furthermore, fish species and size indicate that people were present at the site at different seasons. Both sites may have been part of a larger settlement pattern based on using different resources in different periods. Simple settlement roofed structures and community storage pits, typical for phase I at Merimde may have been a result of a mobile way of life. However, one particular feature of the settlement at Merimde, differentiating it from the site at Lake Qarun, is the presence of graves within the settlement. The dead were buried probably in its abandoned part, in oval, shallow pits in the foetal position, usually without any grave offerings.

In terms of the subsistence pattern, the earliest Merimdians resemble people from the Fayum. It seems that they were at least partially mobile and used available food resources, including, in particular, fish from the river (Rowland, 2015). Fish remains are fairly numerous and represent 12.7% of all faunal remains in phase I of Merimde Beni Salame and 96.7% at Sais. Archaeozoological analyses indicate that hunting played a minor role. Wild hunted animals included hippopotamus, hartebeest, gazelle and aurochs. Bones of domesticated animals were recorded at Merimde and Sais. Sheep and goats prevail among the domesticated animals at Merimde, followed by cattle and pigs. At Sais, the predominance of cattle and pigs over ovicaprines was recorded (Linseele *et al.*, 2014). Among domesticated plants, barley and wheat were identified at Merimde. As in the case of the Fayumian culture, domesticated plants and animals were probably adapted into an existing subsistence pattern based on the exploitation of wild resources.

Approximately in 4,850 BC the settlement at Merimde was deserted due to a cold hyper-arid period. People moved to areas offering better conditions, such as Sais, where they continued to rely on the wild resources of the Nile. However, around the middle of the 5th millennium BC, the site was resettled, which was followed by an increase in the permanence and density of occupation with more stable settlement structures. The resettling of Merimde may have been connected with the arrival of people from the Western Desert in this area who were forced to leave the ever more inhospitable Sahara. During phases II and III, the dimensions of the settlement grew, while a variety of stable settlement structures appeared, including circular huts, grouped in compounds. Family storage pits for grains were built near houses. While farming and herding provided the bulk of food products for inhabitants, fishing continued to be an important source of protein-rich food (42.8% of all remains for Merimde II). Wild game meat became just an addition to the now dominant meat of domesticated animals. In phases II and III of the Merimde, the social and technological transformation is clearly visible in archaeological assemblages. The development of pottery production and bifacial lithic production can be confirmed (Mączyńska, 2017). G. Tassie also suggests that craft activity, specialisation and ideology appeared during this time (Tassie, 2014: 212-216). In his opinion, the finds from the younger phases of Merimde Beni Salame also point to vertical and horizontal social relationships within the community from Merimde.

Approximately in the middle of the 5th millennium BC, people appeared in Wadi Hof. The el-Omari site covers an area between 260,000 and 375,000 m^2, which probably results from the fact that the human habitation zone shifted over time. Initially, the site served merely as a storage zone which subsequently transformed into a habitation zone with stable settlement structures represented by semi-subterranean dwellings dug into wadi deposits, accompanied by light-weight structures and various pits lined with clay and basketry. Graves with poor offerings were located within the abandoned part of the settlement. According to Tassie, the inhabitants of the el-Omari site were initially mobile farmer-herder-foragers who developed into more sedentary farmer-herders (Tassie, 2014: 226). The early stage of farming is clearly visible through the diversity of carbonised grains of several types of wheat recorded at the site and the use of other plants (Midant-Reynes, 2000: 122-123; Cappers, 2013: 114). Archaeozoological analyses indicate that domesticated animals were an important source of food while hunting supplied only approximately 12% of animal proteins. However, due to the site's distance from the Nile, the large quantity of fish among archaeozoological remains found at the site is also surprising, suggesting the importance of this type of food (66.3% of all faunal remains) (Linseele *et al.*, 2014). The recorded evidence clearly shows that the inhabitants of the el-Omari settlement exploited the available resources of their environment, including plants, animals, and fish.

People from el-Omari also used raw materials available nearby, namely local clay to produce pottery and local pebbles to produce lithic tools. Imported flint or Nile clay were also used. Moreover, the ceramic and lithic assemblages changed in a pattern similar to that observed at Merimde.

The limited availability of evidence on the Neolithic communities in Lower Egypt, together with the deeply rooted traditional approach to the period in question, has had a significant effect on the interpretation of the societies in this region. However, the results of the latest studies on the northern shore of Lake Qarun, regularly published in recent years, have shown the Fayumian culture in a completely different and new light. Recent interpretations deviate considerably from the prevailing concepts of early farming-herding groups from Lower Egypt, developed through a cultural-historical approach over the last 100 years. Not only do they inspire discussion, but they also show a clear need for reconsideration of the views on the entire Neolithic period in Lower Egypt. Certain features of the communities from Merimde Beni Salame, Sais, and the el-Omari site denote their mobility and bring to mind associations with the groups from the Fayum. Intensive exploitation of wild resources from the occupied environments seems to be a common feature of all communities inhabiting Lower Egypt in the 6th/5th millenniums BC. It is becoming likely that the Delta and the Fayum were occupied by mobile groups exploiting local resources, who additionally adapted domesticated plants and animals into their subsistence pattern at a certain point in time, thus supplementing the food resources available to them. The social and economic transformation within these communities resulted in a growth of sedentism, the emergence of a more stable settlement pattern, and an increase in complexity and specialisation during the 5th and 4th millenniums BC.

4.2. The Holocene humid phase in the eastern Sahara

For many years the interest of archaeologists has focused on areas in the vicinity of the Nile or in the Delta. Although it was generally accepted that the Sahara was occupied (i.e. Winkler, 1938; 1939; Caton-Thompson, 1952), the desert had been excluded from comprehensive archaeological research for many years until the 1970s. Only research conducted during the last 40 years has contributed to a better understanding of this region's prehistory. In the 1970s, intensive archaeological explorations of the Western Desert began, including both the desert and its oases. Major expeditions operating in the area began in this period, namely: the Combined Prehistoric Expedition; the Dakhleh Oasis Project; the B.O.S./ACACIA project; and the Italian Archaeological Mission. Archaeologists also explored the area of the Eastern Desert, east of the Nile in the Red Sea Mountains area (Map 3).

4.2.1. The Western Desert

As part of the eastern Sahara, the Western Desert, known also as the Libyan Desert, corresponds to approximately 2/3 of the entire area of Egypt. Today, it is one of the most arid environments on Earth. However, during the Holocene humid phase, rain provided increased surface freshwater pools which attracted people and made their presence in this area possible.

Research in the area of the Egyptian part of the eastern Sahara has concentrated on a few locations. Intensive explorations have been carried out in the region of Nabta Playa-Bir Kiseiba and along a north-south transect of ca. 1,500 km between Siwa Oasis and the Wadi Howar in Sudan. Investigations have also covered the area of the following oases and their surroundings: the Dakhleh; Kharaga; Farafra; Bahariya; and Siwa (Map 3). However, the most intense research has been carried out in centrally located oases.

The Nabta Playa-Bir Kiseiba area

Discovered by chance in 1973, the sites in the palaeolake basin known as Nabta Playa had already begun to be investigated in 1974 by the Combined Prehistoric Expedition (CPE) (i.e. Schild & Wendorf, 2002; Wendorf & Schild, 1980; 1984; 1998; 2001; 2006). The purpose of the CPE's explorations was to understand the cultural development of this area in the Early and Middle Holocene periods. Through a comprehensive approach including artefact analysis, as well as geomorphological, palaeoclimatic, palaeobotanic and archaeozoological studies, Wendorf and Schild proposed certain cultural, geomorphic and climatic development sequences for this part of the Western Desert (Wendorf & Schild, 2001: 648-675).

The discoveries in Nabta Playa showed that from the beginning of the Holocene, the southern part of the Western Desert witnessed intensive settlement activity of hunter and gatherer groups. Although the human presence in the harsh conditions of a desert resembling a dry savannah depended on rainfall and access to drinking water, wild plants and animals, archaeologists observed several modes of adaptation. Sites concentrated around the basin and their location and character were linked to water levels which changed over time in the Early and Middle Holocene periods. The occupation of the Nabta Playa-Bir Kiseiba area also depended on climatic changes in the Holocene humid phase, when periods of humidity were interrupted by arid episodes (Schild & Wendorf, 2013; Welc, 2016).

The oldest Early Holocene remains of human activity in this area are dated to as early as the 9th millennium BC. The Early Neolithic El Adam (9,500-8,700 BP; 8,800-7,700 cal. BC[4]) and El Ghorab people (8,600-8,200 BP; 7,600-7,100 cal. BC) were foragers and cattle-keepers. The sites from this period take the form of lithic concentrations with hearth remains (e.g. site E-06-1). They were occupied seasonally, as they were located in the lower part of the basin and were flooded during summer rains. Some of them may have been reoccupied several times. The El Adam lithics are represented mostly by backed bladelets, geometrics, microburins and endscrapers and are similar to Arkinian lithics. The El Ghorab assemblages stand out for their elongated scalene triangles with small short sides and straight-backed pointed and shouldered bladelets. Items recorded at sites from both phases include grinding equipment, ostrich eggshell bottles and beads, as well as wild plant seeds and remains of animals (wild and domesticated). In the opinion of Wendorf and Schild (2001), these finds indicate a few adaptation strategies (exploitation of wild plants, hunting and cattle keeping), making survival in the desert possible.

The savannah-like environment offered a wide variety of plant resources around seasonal lake shores during the Early Holocene period. From the very beginning of the Holocene humid phase, people began to take advantage of seeds and fruits.

4 All BP dates for the Nabta Playa-Bir Kiseiba region calibrated by Brass (2018: table 1).

Although plant remains evidence at El Adam sites is scarce, the presence of numerous grinding stones suggests that plants were an important source of food. The availability of wild plants depended on rainfall, which is why their relative importance as food grew significantly towards the end of the Early Neolithic, during a local climatic optimum (Wendorf & Schild, 2001; Schild & Wendorf, 2013).

Another source of food for the inhabitants of the Nabta Playa-Bir Kiseiba region from the El Adam phase were wild mammals, including, first of all, the Dorcas gazelle and the Cape hare. As great numbers of ostrich eggshells were found at these sites, they are believed to have been another important source of food. The lack of ostrich bones indicates that ostrich meat attracted little interest (Jórdeczka *et al.*, 2013). Moreover, the bones of *Bos primigenius* have also been found at Early Holocene sites in the Nabta Playa-Bir Kiseiba area. This discovery sparked a lengthy and still ongoing discussion on the origins of cattle domestication in Africa and the issue of relationships between humans and cattle in the Early Holocene. Researchers exploring the Nabta Playa-Bir Kiseiba area are of the opinion that *Bos primigenius* bones must have come from domesticated cattle as these animals would not have survived in the still-inhospitable Sahara without human support (i.e. Gautier, 1984; Wendorf & Schild, 2001; Jórdeczka *et al.*, 2013; Brass, 2018). As the bones are dated as early as the 9th and 8th millenniums BC, they are the earliest known possible domesticated animal remains from Egypt, as old as (or older than) those in the Near East (Linseele *et al.*, 2014). In the view of Wendorf and Schild, cultural control over cattle must have existed before the Western Desert opened up to settlement activity (Wendorf & Schild, 2001: 657). The Holocene humid phase saw a deepening mutual dependence and relationship between humans and animals (cattle depended on water provided by people, while people depended on cattle secondary products – milk and blood). Already in the El Adam phase, cattle had become one of the key sources of human food in this part of the Western Desert. The hypothesis on the African domestication centre has its supporters and opponents. On the one hand, DNA test results suggest an independent African centre of cattle domestication, while, on the other, they also confirm the existence of one Near Eastern centre of taurine cattle domestication (Hanotte *et al.*, 2002; Edwards *et al.*, 2004; Gifford-Gonzalez & Hanotte, 2011; Jórdeczka *et al.*, 2013: 278-279; Zeder, 2017: 282; Brass, 2018).

Pottery belongs to another important group of artefacts from Early Neolithic sites in the Nabta Playa-Bir Kiseiba area. It is generally accepted that the emergence of pottery in Africa was independent of Near Eastern influences. However, ceramic containers were adopted, rather than invented in this region. The idea of pottery production first appeared in the present-day Sahel-Sudanese belt, from where it was introduced to the central Sahara and then further north (Close, 1995). A small amount of the oldest pottery may suggest that it was used for special occasions (Gatto, 2002: 77). It also seems probable that it could have been an inclusion into the toolkit of mobile hunter-gatherers/cattle keepers (Jórdeczka *et al.*, 2011). From the El Ghorab phase on, pottery is believed to have gained a more utilitarian function. In periods of intensive plant gathering, it could have been used for plant processing, although the absence of surface marks disproves its use for cooking purposes (see Dunne *et al.*, 2016).

A major change in the mode of human adaptation in the area of Nabta Playa-Bir Kiseiba is visible during the El Nabta and El Jerar phases (8,100-7,300 BP; 7,060-6,200 cal. BC). According to Wendorf and Schild, different economies and technologies appeared during these phases (Wendorf & Schild, 2001: 658). The El Nabta settlements feature large oval huts, smaller round huts, as well as numerous bell-shaped storage pits and large deep wells (e.g. site E-75-6). As they were located in the lower part of the basin, they may have been inhabited for most of the year, namely autumn, winter and spring. However, people must have abandoned them before floods during summer rains. The lithic assemblage of El Nabta and El Jerar groups featured burins, retouched or notched blades, perforators and geometrics. Items characteristic for El Jerar assemblages also include tanged points. Sites from both phases also yielded pottery in quantities clearly larger than in earlier phases, as well as grinding equipment and ostrich eggshells (containers and beads). In both phases, basic foods included seeds, fruits and tubers and large quantities of their carbonised remains were found at the sites. Numerous grinding stones also confirm the importance of plants in the human diet. Grass seeds, including wild sorghum and two millet varieties, constitute approximately 20% of all discovered seeds. Seeds would have been ground into flour, mixed with water and cooked. Intensive harvesting and gathering are likely to have taken place in autumn and winter and owing to the ability to store surplus plant foods in bell-shaped pits, this type of food was also available in the lean period of late winter and early spring. Based on her own observations, K. Wasilikowa suggests that wild sorghum could have been grown in Nabta Playa (Wasilikowa *et al.*, 2001: 582). She believes that plant food may have been supplemented with the meat of small game animals and with secondary cattle products (milk and blood).

The next phase known as El Ghanam (7,200-6,600 BP; 6,050-5,555 cal. BC) is already part of the Middle Neolithic and differs significantly from the Early Neolithic phases. The number of sites from this period is far lower and includes, first of all, winter camps with wells indicating surface water shortages (e.g. site E-79-6). Their inhabitants were highly mobile and relied on a mixed pastoralist economy based both on cattle and ovicaprines introduced into the Western Desert. Archaeological research indicates that seeds still supplemented the human diet. However, the relative importance of plant food decreased, probably due to the introduction of sheep/goats. Lithic assemblages from the El Ghanam sites include, first of all, retouched tools on flakes, denticulates, notched pieces, basal truncated flakes and bladelets, small short lunates and segments. The most common examples of bifacial tools that emerged in this area for the first time are arrowheads (leaf or lozenge-shaped, tanged and barbed). Some changes are also observed in pottery, mostly affecting fabrics and decoration patterns.

During the Late Neolithic El Baqar phase (6,500-5,850 BP; 5,480-4,700 cal. BC) aridity grew in the area of Nabta Playa-Bir Kiseiba. However, the settlement pattern indicates that humans adapted to such conditions. The sites are numerous but dispersed, with poorly represented assemblages. Characteristic features include simple houses or shelters, hearths, and wells (e.g. site E-75-8). These remains suggest frequent movement of human groups and their herds in order to avoid overgrazing. The Late Neolithic lithic assemblages are similar to those used in the previous phase with a prevalence of notches, denticulates, retouched blades, lunates, triangles, trapezes and bifacial projectile points. However, Late Neolithic pottery differs from Middle Neolithic pottery in terms of both technology and decoration. Wendorf and Schild (2001) suggest that it is similar to Early Neolithic Badarian pottery from the Nile Valley (see also Nelson & Khalifa, 2010). The question of possible links between both regions requires further research. Almost no plant remains other than charcoal were recovered from El Baqar sites. Nevertheless, even these scarce findings, together with seed imprints on pottery and the presence of grinding equipment, indicate that plants could have continued to be part of food resources.

Late Neolithic groups were probably pastoral, primarily concentrating on cattle and sheep. High frequencies of cattle bones have been recorded at sites from this period, which is interpreted to have resulted from an increase in symbolic activity. Cattle as a symbol of prestige may have been sacrificed or reserved for symbolic feasts. The Final Neolithic phase, known as El Ansam, does not differ greatly from the El Baqar phase. The sites and assemblages are reminiscent of those known from the preceding period, while the subsistence pattern remains unchanged.

The CPE research revealed a unique feature of the societies occupying the desert during the Late and Final Neolithic periods. The tumuli, calendar, stele alignments and megalithic constructions erected by the cattle herders in the area concentrating around the western shores of the lake denote the presence of early complex societies with a religious/political control over human resources for an extended period of time (Schild & Wendorf, 2002: 17-18; Wendorf & Schild, 2001: 674). Moreover, it is also suggested that the herdsmen from Nabta Playa were able to make astronomical observations and use astronomical knowledge during the construction of megaliths, steles, human and cattle burials (McKim Malville *et al.*, 2008).

During the existence of the ceremonial centre in Nabta Playa, the first farming societies appeared in the Nile Valley. The Nabta ceremonial centre may have played an integrative role between both regions, as their contacts are confirmed by the presence of raw materials and pottery. The Final Neolithic cattle herders were the last inhabitants of the Nabta Playa, except for its short occupation by the C group.

The Nabta Playa and Bir Kiseiba region continues to attract archaeologists. Excavations in the Final Neolithic cemeteries in Gebel Ramlah, located approximately 20 km south of Gebel Nabta, began in 2001 (Kobusiewicz *et al.*, 2010; Czekaj-Zastawny & Kabaciński, 2015). As only a few human burials have been recorded in this part of the Western Desert, the research in Gebel Ramlah allows for a more in-depth understanding of the burial customs of the communities inhabiting the southern part of the Western Desert in the 5th millennium BC. Particular attention should be drawn to the discovery of the earliest newborns' cemetery yet known in this region (Czekaj-Zastawny *et al.*, 2018).

In 2017, another Polish expedition headed by M. Kobusiewicz from the Polish Academy of Sciences began to explore Berget El Sheb in the Nabta Playa-Bir Kiseiba region. Although this area has been researched continuously since the 1970s, many aspects of the communities inhabiting the Western Desert remain unknown and call for further research.

The north-south transect of the eastern Sahara

The environmental and cultural development of the Western Desert in the Early and Middle Holocene periods has also been researched by German archaeologists from the University of Cologne. In 1980, they launched the B.O.S. project (*Besiedlungsgeschichte der Ost-Sahara* [The Settlement History of the Eastern Sahara]), transformed in 1995 into the ACACIA project. It covered 40 research areas in eight geographically different regions along a north-south transect of ca. 1,500km between the Siwa Oasis in Egypt and Wadi Howar in Sudan (Kuper, 2006; Riemer *et al.*, 2013). Data collected in the course of explorations, including more than 400 C14 dates, allowed the researchers to come up with a sequence of eastern Sahara occupation in the Early and Middle Holocene. The discoveries made by the German team showed that although they can be chronologically correlated with CPE discoveries in the Nabta Playa-Bir Kiseiba area, both areas are characterised by a different cultural development. Due to their enormous geomorphological and environmental diversity, the regions investigated as part of the ACACIA project required from their inhabitants more diverse forms of adaptation to local conditions. Each of the investigated regions was also characterised by a distinct and unique regional development sequence (Gehlen *et al.*, 2002).

The works of archaeologists from the University of Cologne concentrated in a few regions of the Egyptian Sahara, namely: the Abu Muhariq Plateau; the Abu Ballas scarp-land; the Great Sand Sea; Gilf Kebir; and Jebel Ouenat (Map 3; i.e. Gehlen *et al.*, 2002; Riemer, 2003; 2009; Kindermann, 2010; Riemer *et al.*, 2013;

2017). Intensive archaeological explorations – excavations and surveys – were accompanied by geomorphological, climatical, palaeobotanical and archaeozoological studies, contributing to our knowledge of human activity in the eastern Sahara in the Holocene humid phase.

On the basis of the ACACIA project research, R. Kuper proposed four main phases of occupation for the Western Desert, namely: reoccupation (8,500-7,000 BC); formation (7,000-5,300 BC); regionalisation (5,300-3,500 BC); and marginalisation (3,500-1,500 BC) (Kuper, 1996; Kröplin & Kuper 2006: 803). The oldest Early Holocene sites, linked to the reoccupation phase, were recorded in the central Great Sand Sea (the Regenfeld area) and are dated to the second half of the 9th millennium BC. Their small dimensions are indicative of short, infrequent hunting-related visits, as hunting was the main subsistence pattern. Groups of hunter-gatherers from this period were characterised by high mobility and spatial flexibility, which reflected a specific way of adaptation to an environment with an unpredictable supply of water and other resources (Riemer, 2000; 2009; Gehlen *et al.*, 2002: 100-103). Unlike in the southern part of the Western Desert, no traces of domesticated cattle in the Early Holocene have been recorded in this region (Riemer, 2009). The small quantity of grinding equipment found at these sites suggests that the gathering of wild cereals was a marginal food source in this period (Gehlen *et al.*, 2002: 100-103).

Epipalaeolithic hunter-gatherers of the Early Holocene also appeared in Gilf Kebir, which, due to the presence of deep wadis and barrier dunes, offered favourable conditions for human activities (Linstädter & Kröplin, 2004). Numerous arrowheads and bones of various wild animals, as well as grinding stones, indicate that hunting and gathering were the main subsistence strategies (Gehlen *et al.*, 2002: 108; Linstädter & Kröplin, 2004). The German researchers also managed to record a few traces of Early Holocene occupation in the Djara area (Abu Muhariq Plateau) and the Eastpans area (Abu Ballas scarp-land), suggesting hunter-gatherer activity (Gehlen *et al.*, 2002; Kindermann, 2004; Kindermann & Bubenzer, 2007). The Eastpans 95/1 site is particularly remarkable owing to the presence of lithics made of non-local raw materials (flint and quartz). According to Gehlen *et al.*, the primary raw material sources could be identified some 100 km to the north (flint) and even 400 km in the Desert Glass Area of the western Great Sand Sea (quartz) (Gehlen *et al.*, 2002: 93). These discoveries are evidence of the high degree of mobility of the hunter-gatherers in the Early Holocene.

Despite differences in the intensity of Early Holocene human activity in the area investigated as part of the ACACIA project resulting from environmental and geomorphological variability within this huge region, a few important similarities can also be observed, namely: the prevalence of hunting; the marginal role of wild plant use; and the highly mobile character of human groups. The resemblance is also visible in lithic assemblages used by hunter-gatherers in this part of the Sahara. Early Holocene sites are characterised by backed elements (points, bladelets, blades), notched and strangulated blades and elongated scalene triangles, although their relative shares in assemblages from each site may have been different (Gehlen *et al.*, 2002).

Changes in the organisation of hunter-gatherers' groups in the ACACIA project area are easily discernible in sites dated to the Middle Holocene period during the formation phase. The most important change was the introduction of domesticated animals, namely ovicaprines and cattle, followed by a gradual shift from hunting to herding. However, the presence of domesticated animals in the desert still depended on the environment; in areas of high aridity and restricted water sources, such as the sites of Mudpans and Regenfield, domesticated animals did not appear at all (Riemer, 2007: 112-112; 2009: 146). In the opinion of H. Riemer, the eastern Saharan hunter-gatherers adopted cattle, sheep, and goats as a minor component of their economy (Riemer, 2007: 134-135). Hunting continued to be an important food supply strategy. The Middle Holocene is also a period of a more intense use of wild plants, manifesting itself in a growing number of grinding elements recorded at given sites, e.g. in the Djara area (Gehlen *et al.*, 2002: 88-91; Kuper & Riemer, 2013: 45-46).

During the Middle Holocene, the settlement pattern of hunter-gatherers was modified. The period in question saw an increase in the number of sites, which indicates longer stays and more intensive exploitation of resources, namely plants and animals (Gehlen *et al.*, 2002: 91). Some regions saw functional differentiation appear at sites, such as specialist hunting or killing sites. They accompanied larger base camps located near playa pools (e.g. the Great Sand Sea) (Riemer, 2009: 150). Analyses of archaeological assemblages also revealed changes in the material culture. In lithics, the blade industry lost its relative importance and was superseded by the flake industry for blank production. The prevalence of facially and laterally retouched arrowheads, transverse arrowheads, edge retouched or notched tools and backed elements is clearly visible. Middle Holocene assemblages are not as homogenous as those from the Epipalaeolithic period. Researchers have also observed regional diversity, probably linked to higher population density. Each region (or even site) is represented by unique toolkits reflecting the local adaptation strategy and exploitation of available resources. The presence of arrowheads confirms the continuing importance of hunting in the food supply, despite the introduction of domesticated animals. Sites where the share of arrowheads exceeds 10% are considered as hunters' sites. It thus seems likely that hunter-gatherers adopted domesticates without changing their general subsistence strategies (Riemer, 2006).

By analyzing lithics from the final part of the Holocene humid phase (6,000-5,300 BC) archaeologists differentiated two major cultural traditions/technocomplexes (Riemer *et al.*, 2013). In the north, the Bifacial technocomplex was distinguished, consisting of sites on the Abu Muhariq Plateau (including the Djara unit) and the oases on the southern fringe of the plateau. In the south, however, researchers differentiated the Microlithic/Khartoum-style complex. This covered the regions of the Abu Ballas scarp-land, the Great Sand Sea, Gilf Kebir and the Nabta Playa-Bir Kiseiba area. According to Riemer *et al.*, differences between both complexes can be seen in flaking, modification techniques and tool types, especially in the production of arrowheads (Riemer *et al.*, 2013: 166). The northern tradition with bifacial modification is characteristic for leaf-shaped and stemmed points with many sub-types made from small flakes. The southern tradition is characterised by the presence of transversal insets (short triangles and trapezes) and segments (lunates) made from blades or elongated flakes using microlithic techniques.

Middle Holocene sites are also characteristic for the presence of clay vessels. As in the case of lithic assemblages, visible differences between pottery originating from the southern and the northern part of the Western Desert may be easily recognized. The pottery of the northern tradition is undecorated, with roughly burnished thin-walled vessels being the most characteristic. Red polished pottery, occasionally with black rims and traces of rippling, has also been recorded. The southern tradition is characterised by pottery with Khartoum-style decoration, namely Packed Dotted Zigzag pottery, sometimes combined with Dotted Wavy Line pottery and Incised Wavy line pottery (in the southern corner of Egypt).

Research carried out by the ACACIA project demonstrated that the two traditions were not isolated in the final part of the Holocene humid phase and were intertwined owing to the mobile way of life of hunter-gatherers. These researchers managed to identify two zones of intensive contact in the Dakhla region and in the Nabta Playa-Bir Kiseiba area, where elements of both traditions were recorded. The crescent formed by the Egyptian oases may have served as a conduit for contacts between north and south. Elements of both traditions were also recorded at sites in the Chufu and Meri areas, located in the Great Sand Sea. Numerous non-local artefacts (lithics and pottery) discovered during the explorations suggest a non-local origin of their creators and users (Riemer, 2006). According to Riemer (2009), people who occupied the sites came from the Dakhleh Oasis located approximately 80-100 km from the site in question and belonged to the northern tradition, although the intrusion of southern elements was also observed in pottery. The presence of hunter-gatherer-herders on the desert margins in the areas of Chufu and Meri was probably linked to seasonal or episodic movement, as these areas benefitted from both summer and winter rains.

Interregional contacts were also recorded in the area of the Abu Muhariq Plateau at the sites of Djara and Abu Gerara. According to Riemer (2003), the Djara site could have served as a stepping stone between the Nile Valley and the desert/oasis. Groups from the Djara area may have stayed at the river for part of the year, and then exploited desert resources after the rainy winter season when conditions in the desert were more favourable to people and animals (Riemer & Kindermann, 2008: 611-613). However, at the site of Abu Gerara people may have had close contact with the Dakhleh-Kharga Oases, which is suggested by the considerable affinity of pottery and lithic assemblages. The sites in the Djara and Abu Gerara area belong to the northern tradition and suggest interregional contacts through the Abu Muhariq Plateau. However, the direction of these contacts varied, as local assemblages indicate. Attention should also be drawn to the sites at Abu Tartur, situated on the Abu Muhariq Plateau, between the oases of Dakhleh and Kharga, on the basis of analyses of materials collected in the 1980s by the mining engineer Siegbert Eickelkamp in this area. H. Riemer and P. Schönfeld (2006) suggest the sites on the Abu Tartur Plateau were used by hunter-gatherers during the Early and Middle Holocene periods.

The German researchers recorded a declining number of C14 dates for a period beginning in 5,300 BC, suggesting a decrease in settlement activity. This change has been linked to the southward withdrawal of monsoonal rains and the onset of desiccation of the Egyptian Sahara. The earliest symptoms of reduced human activity are observed in arid areas with difficult access to water sources, namely the Great Sand Sea, the Abu Ballas region and the Abu Muhariq Plateau (Kuper, 2006: 267; Kröplin & Kuper, 2006; Riemer *et al.*, 2013: 168). Only the Gilf Kebir and Jebel Ouenat areas witnessed long-term occupation until 3,200 BC because of the continued availability of water resources and vegetation. At Gilf Kebir researchers even noted an expansion of the settlement to the plateau during the time of retreating monsoonal rains. According to J. Linstädter and S. Kröplin, Middle Holocene winter rainfall produced more favourable conditions for pastoral groups than that in the Early Holocene, thus making it possible to occupy this region until the final desiccation towards the end of the 4th millennium BC (Linstädter & Kröplin, 2004: 774-775).

According to Kuper, the process of desert desiccation marks the beginning of the regionalisation phase in the cultural sequence of this area (Kuper, 2006: 268). A key change for humans in this period was their adaptation to a fully-fledged pastoral way of life (Riemer, 2007: 134; Kuper & Riemer, 2013). Climatic changes triggered the movement of people and thus caused a migrational shift to the north (the Fayum, the Delta), to the Nile Valley, southern Egypt and northern Sudan. The Bifacial and Microlithic traditions established in the Western Desert in the Middle Holocene began to separate. In the oases, isolated from the influences from the north and the south, new cultural traditions began to develop. The 'exodus' from the Sahara is also linked to the beginning of settlement activity in the Delta and the Nile Valley. According to Riemer *et al.*, it is possible to identify certain similarities in the assemblages of the bifacial tradition of the desert and the early Neolithic tradition in Lower Egypt (flint technology) and Upper Egypt (pottery) (Riemer *et al.*, 2013: 172). Thus, people from the desert had some influence on the formation of farming culture then emerging in Egypt.

The marginalisation phase is the last phase in the cultural development of the Egyptian Sahara. Only on the southern fringes of the desert have the remains of cattle pastoralist activities been confirmed (Laqiya, Wadi Howar). At the same time, the Egyptian civilisation began to emerge in the Nile Valley. Fully-fledged desert conditions returned to the Egyptian Sahara in ca. 3,500 BC. Cattle herders practised their nomadic way of life in the Sudanese Sahara.

In the period from 2009 to 2011, German archaeologists returned to the Gilf Kebir-Jebel Ouenat region as part of the Wadi Sura project aimed at investigating petroglyphs and their relationship to the landscape. Although rock art is outside the subject-matter of this study, it should be remarked that it was the inhabitants of this region in the Middle Holocene who created rock art, which indicates the existence of an ideology and social structure in these communities (Linstädter, 2007; Riemer & Kuper, 2013; Riemer *et al.*, 2017). It seems that it was thanks to the favourable conditions in this area in the Middle Holocene that the rich culture of cattle keepers could flourish at a time when settlement activity was reduced in other regions (Kuper & Riemer, 2013: 47; 51-54).

Despite intensive research carried out as part of the ACACIA project, and the huge number of findings, our knowledge of the human presence in the eastern Sahara during the Holocene humid phase seems still incomplete. Indeed, the multitude and diversity of adaptation strategies to desert conditions recorded by archaeologists renders it impossible to define them using any rigid framework.

4.2.2. Oases

At this point, a human presence in the eastern Sahara was possible only in oases located west of the Nile, owing to permanent groundwater charge of the Nubian Aquifer (Embabi, 2004: 4). Permanent access to water also made oases an important spot for mobile hunter-gatherers or herders moving across the desert during the Holocene humid phase. Although monsoon rains sustained plant vegetation in the desert and filled temporary reservoirs with water, the occupation of the Western Desert by people was still exposed to considerable risk. The well-watered environment of the oases attracted people in the past. As a result, numerous traces of human occupation have been recorded in the Dakhleh, Kharaga, Farafra, Bahariya and Siwa Oases. In the Middle Holocene period, oases north of Dakhleh found themselves within reach of the Mediterranean rain regime, which made plant vegetation possible nearly all year round. In this period, an increase of sedentism was also observed, manifesting itself in the emergence of settlements suggesting likely permanent occupation, or at least occupation with only very short intervals. In the view of Riemer, the oases may have served as central points/camps where people kept coming back for the presence of water. Such points/camps were also places of contact, or even exchange between groups (Riemer, 2003: 89).

Climatic changes in the second half of the 6th millennium BC caused by the southward withdrawal of the monsoon zone and the northward shift of the Mediterranean rains also had an effect on the human presence in oases, despite the availability of artesian springs. In approximately 5,300 cal. BC, the oases became refuges for some human groups forced to leave the desert due to its desiccation. Owing to their specific conditions and isolation, they became a place where culturally distinct groups were gradually formed, differing from those who settled in the Nile Valley and the Delta. Nevertheless, some of the oases continued to serve as stepping stones for pastoral groups moving between the Nile and the eastern Sahara.

The Dakhleh Oasis

Although late Prehistoric finds in the Dakhleh Oasis had been first reported in the first half of the 20th century, researchers returned to the oasis only in the 1970s, at a time of extensive investigations in the Egyptian part of the Sahara. In 1972, the Dakhleh Oasis attracted the attention of the members of the Combined Prehistoric Expedition conducting archaeological investigations in the southern part of the Western Desert. However, in the absence of any 'exciting' prehistoric remains, the expedition chose not to explore this region any further, concentrating, first of all, on the Nabta Playa-Bir Kiseiba area (Schild & Wendorf, 2002: 11). The year 1978 saw the start of the Dakhleh Oasis Project, headed by A. Miles. This is a long-term regional study of the interaction between environmental changes and human activity in the closed area of the Dakhleh Oasis, including the larger area of the palaeoasis. In 1979, the project was extended to investigate prehistoric settlement activity of the Early and Middle Holocene, which has been subsequently continued by M. McDonald. Since the 1970s, hundreds of archaeological sites have been recorded as part of the Dakhleh Oasis Project, most of which are dated to the prehistoric and Roman period.

People had already appeared in the Dakhleh Oasis in the Early Holocene. The oldest traces of a human presence are dated to 8,300 cal. BC and are linked to the Epipalaeolithic Masara cultural unit, divided by McDonald into three main groups (A, B and C), based on archaeological assemblages and site types (McDonald, 2009: 8; 2013; 2016: 185).[5]

Masara A sites are scattered across the oasis and atop the plateau. These were short-term camps with hearths, lithics and grinding stones. They were left by mobile hunter-gatherers who relied on local food resources (wild animals and plants), similar to those living in other parts of the Western Desert at the same time. Lithics were made of good quality nodular chert imported from outside the oasis. Recorded tools include denticulates, scrapers, perforators, microliths, and stemmed points made from blades (McDonald, 1993: 199).

Masara C sites are located in the south-eastern part of the oasis. In most sites, some stone structures have been recorded, consisting of clusters of stone rings, oval or round (crescent-shaped in some cases), with diameters ranging from 2 to 4 m. Surface remains were usually made of a single tier of vertical sandstone slabs. Pits and storage bins were discovered during their exploration (McDonald, 2009: 11-14; 2015: 276-277). According to McDonald, most of them are remains of semi-subterranean structures (McDonald, 2009: 20; 2016: 185). Unlike in the Masara A unit, lithics were made of local chert. Typical tools are thick-section endscrapers, nibbled notches and denticulates, concave-sided triangles and trapezoids, and Harif points. Palaeobotanical and faunal remains suggest a broad spectrum hunting-gathering adaptation to the local, well-watered environment (McDonald, 2015: 276).

The Masara A and C cultural units (8,300-6,500 cal. BC) are treated as contemporaneous while the differences recorded between them probably reflect different ways of life. Stone structures, heavy grinding equipment, the use of local chert, the core reduction sequence, some manufacturing activities (eggshell beads, arrowheads) typical for the Masara C are interpreted to have resulted from increased sedentism in the Early Holocene period in the Dakhleh Oasis (McDonald, 1991; 2009; 2016). According to McDonald, the Masara C sites were not permanent camps but may have served as long-term base camps of hunter-gatherers or semi-sedentary groups, who exploited rich local resources offered by the marshy conditions of the oasis (McDonald, 2009: 21).

In the Middle Holocene (6,400 cal. BC), Bashendi groups appeared in the oasis area (Table 1). However, research completed so far has not shown any continuity between the Masara C and Bashendi cultural units. The Early Bashendi A people were mobile hunter-gatherers with traces of their activity including sites

[5] Originally, M. McDonald distinguished three phases of the Masara cultural unit (A, B and C) on the basis of site location, site features, lithics and other artefacts (McDonald, 1991: 11). However, since she interpreted the Masara B remains as locations occupied briefly for only a few hours, she treated them as a specialised component of the more widespread Masara A (McDonald, 2003: 43). In 2009, she focused on only two main groups (A and C) distinguished on the basis of artefacts and site types (McDonald, 2009: 8).

consisting of scattered hearths and artefacts. At the subsequent stage of development of the communities inhabiting the Dakhleh Oasis, namely Late Bashendi A (6,100-5,650 cal. BC), adaptation to local conditions changed. Archaeologists have recorded an enormous increase in the number, size, and diversity of sites. In the opinion of McDonald, thanks to the bimodal rainfall pattern (winter-summer) the conditions in the oasis were more humid and thus favourable for human occupation (McDonald, 2015: 277). One characteristic feature of this period are slab structures, found in numerous clusters, indicating some form of social organisation. In the view of McDonald, such slab structures suggest a certain degree of sedentism among the Late Bashendi A groups (McDonald, 2009: 26). Indeed, Locality 270, where 200 such slabs were recorded, is being interpreted as a home base regularly occupied in different seasons of the year. Because the Late Bashendi A sites are located in the southeast basin area, plentiful wild food resources in this region may have significantly influenced the human presence in, and returns to this area. McDonald also points to possible advancements in social complexity in this period, as evidenced by the number, size, and organisation of sites, as well as by archaeological assemblages (the emergence of prestige technologies) (McDonald, 2009: 27).

Items recorded at the Late Bashendi A sites include lithic assemblages made of flakes with numerous bifacial arrowheads, knife- and foliate-shaped bifaces, ostrich eggshell beads, labrets, grinding equipment and a few pieces of ceramics (undecorated and decorated). In McDonald's estimation, the people of this period intensively exploited wild resources (e.g. sorghum, millet, animals), but also herded cattle and sheep/goats which had appeared in the eastern Sahara by this time (McDonald, 2016: 186).

In the middle of the 6th millennium BC, probably due to climatic changes and the southward shift of the ITCZ, the people inhabiting the oasis left their settlements and reverted to a mobile way of life. The Bashendi B people (5,600-3,800 cal. BC) were mobile herder-foragers who relied on resources available in the oasis but also crossed the Western Desert during the rainy season with cattle and ovicaprines (their remains have been recorded at Abu Muhariq Plateau, Meri, Chufu, Nabta Playa, and the Farafra Oasis). Sites from this period take the form of camps with clusters of hearths and assemblages – lithics (small bifacial arrowheads, knives, tranchets, and scrapers), stones (small polished axes or celts, palettes, toggles, beads) and undecorated pottery.

Despite climatic changes, artesian springs available in the Dakhleh Oasis enabled a human presence in this area after 5,300 cal. BC. The oasis probably became a refuge for local groups, thus quickly becoming over-populated. Despite access to water, people who stayed in the oasis had to adapt. Some of them formed pastoral groups, left the oasis and followed the monsoon belts moving towards the south. Some groups moved to the Nile Valley and probably took part in the emergence of the Predynastic civilisation. Others stayed on in the oasis (pastoral Sheikh Muftah groups), exploited locally available resources and probably also hunted in the areas located to the north and to the west of the oasis. Indeed, the Dakhleh Oasis was occupied by pastoral groups until the arrival of Ancient Egyptians from the Nile Valley in the Old Kingdom period (McDonald, 2016: 189).

Research conducted on the Dakhleh Oasis has made it also possible to discover petroglyphs created by people who occupied and visited the oasis from prehistoric to modern times (Kobusiewicz & Kuciewicz, 2015). It is generally believed that the Masara and Bashendi people created a large amount of rock art specimens. Most drawings depict typical desert or savannah animals, as well as abstract elements. Indeed, the petroglyphs may be evidence of a sophisticated world of symbolic meanings of Early and Middle Holocene hunter-gatherers and herders (Polkowski, 2016; 2018).

The Kharga Oasis

Unlike the Dakhleh Oasis, the Kharga Oasis had already attracted archaeologists' attention by the 1930s, when Caton-Thompson and Gardner discovered many prehistoric sites and established a geoarchaeological and palaeoenvironmental sequence for this area (Caton-Thompson, 1952). In 1976, researchers from the Combined Prehistoric Expedition recorded a number of Early and Middle Holocene sites in the Kharga Oasis. Since then the area has been regularly investigated by various archaeological missions (for details, see McDonald, 2009: 8). The Kharga Oasis Prehistoric Project, whose concession corresponds to the area explored by Caton-Thompson and Gardner in 1931-1933, began in 2000. Its objective was to reassess the original cultural and environmental development sequence using previously unavailable methods (Kleindienst *et al.*, 2006; McDonald, 2006: 479).[6]

Research carried out on the escarpment along the eastern edge of the oasis lead to the discovery of Early and Middle Holocene sites in two main locations, namely atop the plateau and in two embayments within the escarpment at Midauwara and Refuf (McDonald, 2006; 2015). Analyses of the remains showed that the cultural sequence originally developed for the Dakhleh Oasis could also be ap-

[6] In September 2018 the results of research of IFAO in the Kharga Oasis were published online (Dachy *et al.*, 2018). On the basis of radiocarbon dates and archaeological evidence a new regional sequence for the oasis was proposed . Four phases, labelled as Kharga A, B, C and D, were proposed. Since the results were published at a time when the study was actually completed, it was not possible to take them into account. However, the author is aware of their great importance for understanding human presence on the Western Desert in the Middle Holocene period.

plied to the Kharga Oasis. According to McDonald, both oases (connected via the plateau escarpment) constituted a single cultural entity throughout much of the Early and Middle Holocene periods (McDonald, 2006; 2009: 10).

At Midauwara, two cultural units were distinguished on the basis of artefacts and site types, namely the Epipalaeolithic Midauwara for the Early Holocene and the Baris for the Middle Holocene. For the Epipalaeolithic, three site types were recorded, namely: sites with slab structures; sites with clusters of fire-cracked rock and artefacts; and blade-knapping stations (McDonald, 2006: 481; 2009: 28-29). In terms of form, they resemble sites belonging to the Masara C unit, known from the Dakhleh Oasis. Moreover, flint assemblages from these sites are similar to those known from the neighbouring oasis (i.e. Harif points, microliths, denticulates). In the view of McDonald, part of the Midauwara sites may be contemporaneous with the Masara C unit. Nevertheless, the relative dating of artefacts suggests that some of these sites may have been occupied during a gap recorded at the Dakhleh Oasis between two sedentism episodes of the Masara C and Late Bashedni A cultural units (McDonald, 2009: 32).

The Middle Holocene remains were divided by McDonald into two phases, namely Early (6,300-5,600 cal. BC) and Late Baris (5,200-3,800 cal. BC) (Table 1). Early Baris sites are characterised by the presence of scatters of large mound hearths, slab structures and artefacts – lithics, grinding equipment, ostrich eggshell beads and a few pottery sherds. The assemblages are similar to those of the Dakhleh Late Bashendi A. Sites MD-18 and MD-24 are similar in terms of form and finds to Locality 270 from the Dakhleh Oasis (McDonald, 2006). At the younger Late Baris sites, hearth mounds and a few slab structures were found. Moreover, in this period slabs were also used for erecting other structures, e.g. special hearths in the form of platforms. Among artefacts found at the Middle Holocene sites, lithics, grinding stones and pottery are similar to those known from the Bashendi B and early Sheikh Muftah cultures of the Dakhleh Oasis. Some ceramic imports from the Nile Valley were also collected, e.g. Badarian ripple ware (McDonald, 2006: 491). Late Baris sites also were recorded beyond Wadi El-Midauwara, on the edge and atop of the plateau.

Slab structures were confirmed, not only in both oases but also in other locations in the central part of the Western Desert at Abu Ballas, Regenfeld, Meri and the Farafra Oasis. However, so far they have not been recorded north-east of the oases, namely in the Abu Gerara and Djara regions, although in both of them traces of interregional contacts between people of the Abu Muhariq Plateau and the Dakhleh Oasis were found.

In the estimation of McDonald (2009), as in the case of the Dakhleh Oasis, the structures discovered in the Kharga Oasis suggest a prolonged episode of sedentism spanning a period of about two and a half millennia. In the case of the Kharga Oasis, however, one is dealing with a longer and probably more continuous period of sedentism as some sites are dated to the gap identified at the Dakhleh Oasis after 6,500 cal. BC. However, the issue of sedentism is still poorly understood and requires further research.

Climatic changes that began in the second half of the 6th millennium BC forced groups occupying the eastern Sahara to change their way of life. The Kharga Oasis, not unlike the Dakhleh Oasis, also became a refuge for people searching for more hospitable living conditions. As in other regions of the desert, people reverted to a mobile way of life. Late Baris groups became mobile herder-hunter-gatherers. The end of Late Baris sedentism in the Kharga Oasis took place in the early 5th millennium BC when a civilisation based on the model adopted from the Near East developed in the Nile Valley. However, the particular location of the oasis, halfway between the eastern Sahara and the Nile Valley, as well as the presence of artesian springs, made it a useful place for groups moving between the life-giving river and the desert. Traces of occupation associated with fossilised springs were discovered by French archaeologists from the IFAO at the stratified site known as KS043, where hearths, pits, querns, pottery, numerous ovicaprine and cattle bones, as well as palaeobotanical remains were discovered (Briois & Midant-Reynes, 2010; Briois *et al.*, 2012). As access to drinking water from the springs was important, when the spring activity decreased and eventually disappeared, people made the effort necessary to drill an artesian head and then turn it into a well. The site was used by pastoral groups moving across the desert together with animals. Apart from products offered by domesticated animals, their sources of food included plant seeds and fruits available in the oasis. Very small quantities of emmer grains were also recorded at the site. They probably originated from the Nile Valley and were brought to the oasis by people. Another aspect linking groups visiting the oasis with the Nile Valley groups is the pottery recorded at the site in great amounts. In the opinion of F. Briois *et al.*, based on vessel forms and its characteristic decoration, the pottery was identified as diagnostic of the Tasa culture (Briois *et al.*, 2012: 188). In the opinion of these French researchers, Tasa groups constitute an important cultural link between the Nile Valley and the eastern Sahara. A similar view was expressed by D. Darnell (2002), who suggested – on the basis of discoveries in the Tasa burial cave in the Wadi el-Hôl in the Qena Band region – that the Tasa culture originated from the Western Desert. Since the cave is located on a route leading to and from the Western Desert, the Tasians are regarded as an important link between the Nile and the desert area.

The area to the north of the Kharga Oasis has also been subjected to geoarchaeological research. As a result, Pleistocene and Holocene sites have been recorded along the Libyan Plateau, thus indicating that prehistoric sites are not only restricted to the oases near fossil springs on the floor of the Kharga Depression.

Earlier observations suggesting that the human presence in both the Pleistocene and the Holocene depended on water strongly tied to pans were confirmed (Mandel & Simmons, 2002).

As in Dakhleh, petroglyphs were also recorded in the Kharga Oasis. In the northern part of the oasis, researchers discovered numerous rock art specimens, most of which depict animals. S. Ikram dated them from the Prehistoric to the Dynastic period (Ikram, 2009a; 2009b; 2018). It seems that not unlike in other places in the Western Desert, the Early and Middle Holocene hunter-gatherers and herders also left traces of their presence and evidence of a sophisticated symbolic culture in the Kharga Oasis.

The Farafra Oasis

Exploration of the Farafra Oasis by the Italian Archaeological Mission began in 1987. The project's objective was to reconstruct a broad archaeological and palaeoenvironmental landscape of an area almost completely unknown to archaeologists. Research has shown that although people had been present in the oasis area from the final phase of the Pleistocene, the most important discoveries were dated to the Middle Holocene. Remains of human activity in the Holocene humid phase were discovered not far from Qasr Farafra and in the Wadi el-Obeiyid/el Bahr region (Barich, 2014a). The Italian researchers successfully located camps of Early Holocene hunter-gatherers in three main areas of the Wadi el-Obeiyid, namely Bir el-Obeiyid Playa, the nearby Sheikh el-Obeiyid and the part of the Northern Plateau which overlooks the Hidden Valley. Moreover, sites dated to the same period were recorded in the surroundings of Qasr Farafra (Ain e-Raml and Abu Kasseb) (Barich & Lucarini, 2014: 468). According to B. Barich, the size of the sites and lithic assemblages (high blade index, the presence of backed bladelets, burin spalls) suggest sporadic and short-term visits (Barich, 2014a: 47). The highly mobile way of life of groups that appeared in the Early Holocene in the Farafra Oasis was linked to limited access to water, namely lakes and pools that refilled seasonally (Barich & Lucarini, 2014).

An important climatic change affecting people inhabiting the region took place in the Middle Holocene period. Areas north of the Dakhleh Oasis experienced the Mediterranean rain regime, which moved southwards at that time. Water sources became more stable, and winter and summer rains ensured access to diverse plants nearly all year round. Middle Holocene occupation was recorded around temporary lakes at the Hidden Valley, el-Bahr, and Bir el-Obeiyid Playas or within the Northern Plateau at Sheik el-Obeiyid and the Hidden Valley Plateau. Taking into account the pace and character of sedentism in the Farafra Oasis, Barich proposed a three-phase cultural sequence for the Middle Holocene, namely: Wadi el-Obeiyid A (6,600-5,700 cal. BC) linked to the beginning of sedentism in this period and its stabilisation in places with access to water and food recources; Wadi el-Obeiyid B (5,600-5,200 cal. BC), characterised by the so-called *Steinplätze*, considered to be places of seasonal occupation; and Wadi el-Obeiyid C (5,200-2,500 cal. BC), linked to the southward shift of the monsoon belt and the desiccation of the desert, which forced people to revert to a mobile way of life and to adopt pastoralism (Table 1) (Barich & Lucarini, 2014).

At the el Bahr/Wadi el-Obeiyid playa, researchers discovered concentrations of lithic artefacts, widely scattered without any stone structures, workshops or hearths and a stone slab structure, all belonging to Wadi el-Obeiyid phase A. From the perspective of changes that took place between the Early and Middle Holocene periods, particularly important are the discoveries from site BH-88-2A, dated to the Early Middle Holocene. The flint assemblage from this site indicates a technological shift between both periods. The reduction and gradual disappearance of microliths is accompanied by an increase of macro-tools – scrapers and denticulates used for scarping and cutting. These changes could be related to the transition from a mobile way of life to a more stable model linked to the exploitation of abundant plant resources available in the playa area. In all concentrations dated to the Middle Holocene, scrapers and denticulates made up more than 40-50% of all recorded tools, used probably for plant and vegetable material processing. Together with perforators/borers, which were another significant tool type, they were made on the spot, as and when needed. Furthermore, lithic assemblages also included carefully made high-quality tools, such as tranchet axes, gouges, and knives, probably made outside this area and used for longer periods. B. Barich interprets these sites as the remains of open-air occupation linked to the exploitation of resources of a lacustrine environment, available for a limited period of time (Barich, 2014b: 101-102).

Important discoveries linked to the Middle Holocene occupation (Wadi el-Obeiyid phase A) were also made in the Hidden Valley area, where a large village located on the fringe of a playa was recorded. Although the site consists of remains from several repeated occupation episodes, it is treated by Barich as a stable settlement because of its very close intervals between occupation phases (Barich, 2014c: 203). The first settlers came to the Hidden Valley area in the middle of the 7th millennium cal. BC. Although remains from this period include hearth pits, during subsequent phases more stable settlement structures were confirmed. Encouraged by a more favourable climate, people invested more effort and energy into the settlement. Human activities (domestic and manufacturing) concentrated around hearths made of stone. Superstructures were erected as well. In the opinion of Barich, people lived in this area on a seasonal basis (Barich, 2014c: 207). Settlement activity in this region still depended on the water level in the playa and, consequently, on available food resources. However, despite intervals in the settlement activity determined by access to water, human groups kept coming back to this area throughout the Middle Holocene until the complete desiccation of the lake in the second half of the 5th millennium BC.

The reason why the Hidden Valley attracted people was access to food resources. Researchers recorded a large palaeobotanical sample with 30 different taxa identified. For the entire period of its occupation, the Hidden Valley had a savannah habitat with a combination of grasses, aquatic plant species, as well as acacia and tamarisk trees. Sorghum was the most common of grasses which may have grown around the playa. A considerable quantity of grass remains found inside cooking pits combined with grinding equipment suggests that these plants were intentionally used as food (Fahmy, 2014; Lucarini, 2014). Furthermore, archaeologists researching the Hidden Valley also recorded tamarisk and acacia wood in large quantities, which may have been used as fuel, as a material for building hut superstructures or for manufacturing various types of utensils. Research by G. Lucarini (2014) indicates that lithic assemblages from the village may have been used for cutting down wild plants and for wood working.

Unlike plant remains, the faunal sample from the Hidden Valley is rather homogenous. According to A. Gautier, people from the Hidden Valley hunted large game (mainly gazelles, Barbary sheep) and also herded sheep and goats, which appeared quite early in the Farafra Oasis, probably before their introduction to the southern part of the Western Desert (Gautier, 2014: 373). An important part of food consumed in this area were ostrich eggs, which have a high nutritional value and additionally provide shells, used in the Farafra Oasis as containers for liquids and as a material for bead making (Cristiani, 2014).

Remains of human activity in the Farafra Oasis during the Middle Holocene were also recorded in nearby Sheikh el-Obeiyid (Wadi el-Obeiyid A phase). Researchers found clusters of 30 oval or circular stone slab structures with diameters ranging from 3 to 7 m, reminiscent of slab structures known from the Dakhleh and Kharga Oases. The Italian researchers interpreted them as places occupied by herders with a broad-spectrum exploitation of this area and link them with growing settlement stability resulting from favourable climatic conditions and plentiful food resources (Barich & Lucarini, 2014: 476). The researchers' attention was also drawn by two other structures, namely circular tumuli containing two cist structures with an elongated rectangular plan, interpreted as primitive cenotaphs or symbolic burials. Moreover, painted and carved images (i.e. animal figures, hands) recorded inside Wadi el-Obeiyid Cave 1 were created in this period. They are believed to have symbolic meaning (Barich & Lucarini, 2014: 477).

The Wadi el-Obeiyid phase B is connected with the emergence of more elaborate hut structures with stone foundation circles in the Hidden Valley village. Furthermore, this period is also characterised by the presence of the *Steinplätze* –

hearths appearing on the surface as scattered pebbles or fragments of fire-cracked rocks partially covered by Aeolian sand, forming small mounds. Together with dwellings in the base-camp, the *Steinplätze* probably formed a settlement system connected with increased mobility. Adaptation to a pastoral way of life forced the movement of human groups, and thus short and repeated stays in one location (Barich & Lucarini, 2014). The *Steinplätze* were recorded in a few areas in the Farafra Oasis – in the Hidden Valley, el-Bahr, Bir el-Obeiyid Playa, Sheikh el-Obeiyid (Barich *et al.*, 2012). Apart from flint assemblages typical for the period, containing bifacial knives, spear points, gouges, arrowheads as well as side-scrapers, notches and denticulates, some pieces of pottery were recorded at the Hidden Valley 2 site and at Sheikh el-Obeiyid.

During the Wadi el-Obeiyid phase C, settlement activity in the Farafra Oasis was significantly reduced due to climatic changes and the resulting limitations in access to water. Not unlike in other areas of the Western Desert, the number of C14 dates after 5,300 cal. BC decreased significantly, suggesting a reduction in human activity. The pastoral way of life required movement in search of water and food sources. However, the Farafra Oasis witnessed a new wet phase around 4,500 cal. BC, becoming once again a place of human activity in a period when civilisation was being formed in the Nile Valley. At that time, occupation shifted towards peripheral areas and the plateau, probably situated along routes leading to more favourable areas in the Nile Valley or to the south. The oasis became an important point of contact and exchange between groups from the desert and the river (at Sheikh el-Obeiyid and at Rajih/Bir Murr) (Barich *et al.*, 2012; Barich & Lucarini, 2014).

The Bahariya Oasis

The first archaeological reconnaissance in the Bahariya Oasis area took place between 1938 and 1945. Its result in the form of descriptions and plans of the most important sites and monuments from this area were published by A. Fakhry. In the 1970s, F. Hassan (1979) conducted a small-scale survey which revealed some prehistoric finds. The sites discovered in the southern part of depression were dated probably to the Middle Holocene. Characteristic findings from these sites include endscrapers, burins, notches, denticulates, bifacial tools and unifacial arrowheads. Other items recorded at these sites include grinding equipment and ostrich eggshells. A Middle Holocene chronology is confirmed by the date of 7,000 BP for the Ain Khoman site.

In 2003, an expedition from the Czech Institute of Egyptology of Charles University in Prague began to explore the oasis. Its concession covered the entire el-Hayz Oasis in the northern part of the depression. Detailed investigation allowed the Czech researchers to identify sites dated to prehistoric times and then over to

Pharaonic, Ptolemaic, Roman/Byzantine periods, and even to the Middle Ages (Dospěl & Suková, 2013; Bárta & Brůna, 2013).

The earliest human presence in the Bahariya Oasis is connected with the Acheulian culture. However, human occupation reached its maximum in the Middle Stone Age. After a hiatus caused by an arid period, the oasis was resettled at the beginning of the Holocene epoch. Sites dated to 7,000-6,000 cal. BC are linked to fossil lakes and playas (e.g. at Umm el-Okhbayn, the 'Under the tooth' playa and the GPS playa). Epipalaeolithic remains were either scattered or clustered. The archaeological assemblage included lithics, grindstones, and fragments of ostrich eggshells. The most characteristic lithics are elongated microlithic triangles, blades, and microblades, retouched or backed. Grinding stones found on the Epipalaeolithic sites at lake shorelines were isolated from other remains. According to J. Svoboda, they may have been placed in special activity zones linked to seed grinding or other types of plant food processing (Svoboda, 2013: 54). The presence of ostrich eggshells may be indicative of the use of eggs as food and eggshells as containers. Apart from camps linked to stays of hunter-gatherers, the Czech archaeologists also discovered a specialised blade and microblade making workshop near a chert outcrop located at the edge of the escarpment of Gabalat el-Gharbi. The same chert was identified at other Epipalaeolithic sites in this area. Thus far, the Czech archaeologists have not found any remains of the Middle Holocene occupation. No ovicaprine bones and no traces of sedentism were recorded. According to Svoboda, subsequent settlement activity in the Bahariya Oasis is not impossible, and its remains may have been obliterated either naturally or as a result of intense human activity in later periods (Svoboda, 2013: 58). One possible hint may be a tanged point found at the Bir 'Ayn Naga', interpreted as Middle Holocene and considered by Svoboda to be a Neolithic intrusion (Svoboda, 2013: 50).

Undoubtedly, the human presence in the oasis during the Holocene humid phase was influenced by climatic changes in the second half of the 6th millennium BC. The northward shift of the Mediterranean rain zone and the southward shift of the monsoon belt reduced vegetation and access to water sources. People returned to the oasis only in the Old Kingdom period (Bárta & Brůna, 2013: 23).

The Siwa Oasis and other northern depressions

The Siwa Oasis seems today to be the least understood oasis of the Western Desert. In the period preceding the Second World War, it was explored by a few researchers-collectors (e.g. H.W. Seton-Karr) (Fakhry, 1973). Proper archaeological investigation of the oasis began only in the 1970s. In 1975 and 1977 during surveys of the Siwa Oasis and the Gara Oasis on the western border of the desert, F. Hassan (1976; 1978) recorded 35 sites dated to the Epipalaeolithic and the Neolithic (Tassie *et al.*, 2008). Thanks to C14 dates obtained during the survey, two phases of occupation dated to 9,000-8,000 BP and 6,800-5,000 BP were distinguished (Hassan & Gross, 1987). The Epipalaeolithic flint assemblage included, first of all, burins, double burins, microburins, Krukowski microburins, backed bladelets, blades, denticulates, endscrapers, side scrapers, notched pieces, leaf and stemmed points and bifacial elements (Hassan, 1976; Tassie *et al.*, 2008). According to Hassan (1976; 1978), this resembles the 'Libyco-Capsian' tradition and the Qarunian tradition of the Fayum. Other items recovered from these sites included grinding stones, ostrich eggshells and probably pottery (at two sites) (Tassie *et al.*, 2008). Researchers also discovered two fire-places and a stone circle. According to F. Hassan and G.T. Gross, all of these remains indicated the presence of mobile hunter-gatherers in this area (Hassan & Gross, 1987: 91). No pottery was recorded at the Neolithic sites, while the flint assemblage featured primarily bifacial tools, endscrapers, composite tools and raclettes.

In the 1970s, the northern part of the Qattara depression was explored by the Combined Prehistoric Expedition (Cziesla, 1989: 206). However, its research confirmed that remains of human activity in this region were scarce, which is attributable to the still active sedimentation and the expanding dunes of the Great Sand Sea.

In 1983 and 1985, the Qattara-Siwa area was investigated by German archaeologists from the University of Cologne as part of the B.O.S. project (Cziesla, 1989; 1993). These researchers then recorded a few sites in the area of Sitra Lake. Particularly remarkable is an extensive settlement area marked as Sites 83/11 and 83/12. In the opinion of E. Cziesla, all of these remains point to the existence of a permanent or recurring settlement with *Steinplätze*, flake middens and areas of different tool assemblages (Cziesla, 1989: 212). In the northern part of Site 83/11 predominantly bifacial tools, probably made for a special task, were recorded. In the southern part of the site, however, tools were poorly represented. According to Cziesla, the site should be interpreted as a 'production area', where dark-grey hornstone was intensively processed (Cziesla, 1989: 208). Site 83/12 requires particular attention because of its very high number of burins, representing 45% of all modified artefacts. C14 dates obtained for this level indicated a date of ca. 5,000±350 BC. A high percentage of burins at sites dated to this period is infrequent and was recorded in Haua Fteah (the upper half of the VIII layer) (McBurney, 1967), at Site 75/31 recorded in the Siwa Oasis by Hassan (Hassan, 1976: 20), and at two other sites explored by the B.O.S. project (81/55 and 81/61) beyond the Siwa Oasis.

Interesting observations were also made at another site (85/05), where four clusters of lithics were found on the edge of a natural depression. Probably, they were leftovers from a workshop of stone-knapping specialist(s) where blades were manufactured using a core rejuvenating technique (Cziesla, 1993: 194).

The German archaeologists also managed to obtain C14 dates for *Steinplätze* (Sites 86/06 and 85/14) indicating that they were used mostly between 6,800-6,400 BP. No remains of *Steinplätze* younger than 6,000 BP were found. Undoubtedly, climatic changes affected the water level in and around the oasis, thus influencing the human presence after 5,300 cal. BC. According to Hassan, the oasis was again occupied between 4,000 and 3,000 BP, which, in his opinion, is suggested by the hearths recorded on dune tops (Hassan, 1976: 29).

4.2.3. The Eastern Desert

The Eastern Desert occupies approximately a quarter of the entire territory of Egypt. It is a region of mountains, plateaus, and large wadis. There are a number of drainage networks in this area, which drain towards the Red Sea or the Nile (Emadi, 2004: 7). Compared with the Western Desert situated west of the Nile, our knowledge of human activity in the Early and Middle Holocene periods in this area is very poor. It seems, however, that natural conditions in this territory during the Holocene humid phase were similar to those in the Western Desert. Areas situated near the Red Sea Mountains additionally benefitted from torrential rains occurring in this region.

The Tree Shelter and Sodmein Cave

The Belgian Middle Egypt Prehistoric Project of Leuven University operating in the Red Sea Mountains area in the 1990s discovered two archaeological sites, namely the Tree Shelter and Sodmein Cave, with traces of a human presence dated to the Holocene humid phase. The first of these two sites is located in a small wadi tributary of the Sodmein Valley. The other is in the Red Sea Mountains, 3 km south of the Tree Shelter (Map 3).

Remains of human occupation at the Tree Shelter are visible in the form of a large number of hearths and dense horizontal scatter of lithics, as well as botanical and faunal remains. Two out of the five levels at the Tree Shelter are linked to the Middle Holocene (6,800-4,900 BC). Visits of mobile stock-keepers to Sodmein Cave are dated between 6,200 to 4,300 cal. BC. Due to the nature of the site, a greater thickness of deposits was recorded, with a clear stratigraphic sequence. Remains of human occupation included hearths and lithics, and botanical and faunal remains. The flint assemblage is flake-oriented and dominated by simple tools – retouched flakes, denticulates and notched flakes. A large share of the assemblage is constituted by arrowheads, including Ounan points. In levels dated to the second half of the 5th millennium BC, pottery fragments were also recorded.

Both sites are contemporaneous with the Middle and Late Neolithic in the Nabta Playa-Bir Kiseiba area (Marinova *et al.*, 2008; Linseele *et al.*, 2010). Since the depopulation of the Eastern Desert caused by climatic changes began later (probably due to the proximity of the Red Sea Mountains with frequent rainfall), the end of the Tree Shelter occupation is dated to 3,700 cal. BC (Vermeersch *et al.*, 2015).

One of the more important discoveries at both sites were ovicaprine bones recorded in levels dated to the 7th millennium BC. While researchers struggle with their precise analysis and only goats were certainly present, these bones seem to be the oldest known ovicaprine remains in all of Africa. Apart from bones, accumulations of animal droppings deposited by the domestic goats and/or sheep were found at both sites. Indeed, the vast amount of dung indicates that the herd size must have been far larger than suggested by the faunal remains. The Belgian expedition did not record any cattle bones. The researchers are of the opinion that their absence was due to the fact that there were no playas in the area and access to surface water sources was difficult. Environmental conditions may have also contributed to the prevalence of goats, as this species is better adapted to arid conditions than sheep.

Remains found at the Tree Shelter and Sodmein Cave sites indicate that both of them were repeatedly visited for short stays by people and animals. Human groups using both sites were mobile and probably visited the area near the site because of vegetation appearing after rains, which allowed them to feed their herds. The large number of undigested seeds and fruits in dung pellets and macrobotanical evidence suggest well-developed herb vegetation in this area. It is likely that domesticated animals themselves were not an important food source, which is suggested by the small number of their bones. Instead, people relied on meat and other products obtained through hunting. While the presence of arrowheads may suggest the importance of hunting, it is not confirmed by the number of wild animal bones found at the sites (Marinova *et al.*, 2008; Linseele *et al.*, 2010; Vermeersch *et al.*, 2015).

The Tree Shelter and Sodmein Cave are very often quoted in the context of the dispersal of ovicaprines in the African continent. As ovicaprines are not endemic species and their wild ancestors never lived in Africa, their introduction through the corridor into Egypt from the southern Levant through the Eastern and then the Western Desert could be one possible explanation of a goat presence at these sites. However, this question calls for more investigation as the data we currently possess is insufficient for identifying the exact route (Wengrow, 2006: 25; Muigai & Hanotte, 2013; Tassie, 2014: 157; Vermeersch *et al.*, 2015: 497).

Wadi Atulla

A human presence in the Eastern Desert is also testified by discoveries dated to the first half of the 5th millennium BC in Wadi Atulla, where a grave with offerings typical for the Tasa culture was recorded (Friedman & Hobbs, 2002). Tasian materials are known from other localities in the Western Desert, e.g. at Gebel Ramlah, Wadi el-Hol, the Kharga Oasis. On the one hand, all these finds indicate a high degree of mobility of the pastoral Tasa people, while, on the other, they suggest links with the desert traditions developed during the Holocene humid phase, rather than with the Nile Valley.

4.2.4. Early and Middle Holocene hunter-gatherers and herders of the eastern Sahara – a summary

The multidisciplinary character of investigations in the Egyptian part of the eastern Sahara, covering not only the remains of human occupation but also the environment and climate, has enabled a much better understanding of human activity in this area in the Holocene humid phase. In the Early Holocene, the desert changed into a dry savannah, as a result of an abrupt northward shift of the tropical rainfall belt. Despite milder environmental conditions, maintaining a human presence still involved considerable risks and depended on rain and access to drinking water sources, vegetation and animals. Groups of hunter-gatherers inhabiting various locations within the desert developed different strategies of adaptation to environmental and climatic conditions with a highly variable mobility pattern. The environmental diversity of the desert translated into differences in access to water, thus affecting human adaptation strategies. People stayed for longer in places where water sources were available. However, if the water was scarce, the human presence became shorter and involved searching for its sources. Consequently, human adaptation models in the desert were not uniform. On the one hand, each region explored by researchers is a source of a unique set of archaeological remains, which is attributable to unique environmental conditions. On the other hand, however, hunter-gatherers or herders of the Holocene humid phase do have certain common features (lithics or ceramics, occupation structures) implying a common cultural background resulting from constant mobility in search of food and water, and thus from a lack of isolation.

In the archaeology of the eastern Sahara, the hunter-gatherers and herder groups whose traces dated to the Early and Middle Holocene were recorded in the desert, have been labelled in a variety of ways (e.g. Masara, Djara, Bashendi A and B, Baris, Gilf Kebir), depending on the chronology and location. However, all these labels denote desert groups moving over considerable distances. Therefore, the various labels proposed by researchers may, in fact, refer to groups with a shared cultural background, periodically crisscrossing the desert.

The Early Holocene in the Western Desert is linked to the activity of hunter-gatherer groups, whose traces (remains of short-stay camps) have been found near water sources, such as playas, pans or springs. Hunting was their basic subsistence strategy, and the role of wild plants depended on their availability, gradually increasing in the course of the Holocene humid phase. Early Holocene sites are characterised by backed elements (points, bladelets, blades), notched and strangulated blades and elongated scalene triangles, although their relative proportions in assemblages from each site may have been different. The presence of pottery vessels, however, has only been confirmed in the southern part of the Western Desert.

A special place during the Early Holocene was the Nabta Playa-Bir Kiseiba area. Its specific environmental and climatic conditions had a significant impact on the trajectory of the development of human groups which occupied this area. This is where the oldest traces of domesticated cattle and intensive exploitation of wild plants were found. The special relationship between humans and animals, as well as the possibility of collecting and storing wild plant grains, allowed people to survive in the harsh conditions of the savannah. It was here that the oldest, richly decorated Egyptian ceramics of African origin appeared and it is from here that it probably was adapted to other parts of the Egyptian Sahara.

The Middle Holocene saw an improvement of climatic conditions and, consequently, an intensification of human activity in the eastern Sahara, with a growing number of sites across the entire region in places with access to water. Traces of an extended human presence were recorded as well, interpreted as an episode of sedentism (e.g. Dakhleh Oasis, Farafra Oasis). However, mobility continued to guarantee survival, and people travelled in search of water, animals, and plants over long distances. During this period the importance of wild plants increased and traces of their intensive exploitation can be observed in the archaeological assemblages. Undoubtedly, an important event was the emergence of domesticated animals – ovicaprines and cattle. Their importance was initially insignificant while hunting still provided a large part of the food. However, people started to move not only in search of water and food but also in search of pastures for animals. Not only the Western Desert but also the Eastern Desert was within distances normally travelled by these groups. The relationship between humans and animals, which began at the time, led to the development of a pastoral economy at the end of the Holocene humid phase.

During the Middle Holocene period, in lithics, the blade industry lost its relative importance and was superseded by the flake industry for blank production. The prevalence of facially and laterally retouched arrowheads, transverse arrowheads, edge retouched or notched tools and backed elements is clearly visible. The presence of arrowheads confirms the continuing importance of hunting. During the Middle Holocene, there is also a visible spread of the pottery technology to the north of the eastern Sahara. Although in this period clay vessels continue to account for a small part of the inventory, the technology as such was successfully adapted in different areas. In the 6th millennium BC, in the area of the Dakhleh Oasis, thin-walled undecorated pottery appeared next to Khartoum-style decorated pottery. According to K. Kindermann and H. Riemer (in press), this new pottery tradition developed locally from the decorated ceramics tradition.

During the final part of the Holocene humid phase, there is a clear division of the eastern Sahara into two cultural traditions distinguishable by their lithics and ceramics. In the southern part of the desert, the so-called Microlithic/

Khartoum-style technocomplex was identified, as opposed to the Bifacial technocomplex in the north. The presence of transversal insets and segments made on blades or elongated flakes using microlithic techniques and the Khartoum-style decorated pottery were characteristic for the southern tradition. Bifacial modifications on leaf-shaped and stemmed points, as well as thin-walled undecorated pottery, were the typical features of the northern tradition. Both complexes were not isolated, and cyclical movements of mobile herder groups made them intertwined. The separation of the two traditions did not take place until the end of the 6th millennium BC when climatic change triggered the desiccation process in the Sahara. Archaeologists recorded in the Western Desert a declining number of C14 dates in approximately 5,300 cal. BC, which indicates that herder groups became less active. Reduced access to water forced them to move in search of survival sites. The adaptation of pastoral strategies by desert groups at that time was also a response to the worsening climatic conditions. Towards the end of the 4th millennium BC, the human presence was confined to ecological niches, guaranteeing access to water (e.g. Gilf Kebir). However, the desert conditions known today returned to the eastern Sahara in around 3,500 BC, thus expelling people from the area.

4.3. The Pottery Neolithic of the southern Levant

4.3.1. Pre-Pottery Neolithic / Pottery Neolithic transition

For many years, the Pottery Neolithic in the southern Levant attracted relatively little attention from researchers. The remains of human occupation from this period were scarce, poorly preserved and – compared with remains from other periods – not very attractive. Another reason for the lack of interest was the generally accepted hypothesis concerning the collapse of Pre-Pottery Neolithic B societies attributable to social fragmentation, segmentation and depopulation. Most researchers agreed with the theory proposing a hiatus in the southern Levant continuing for a millennium or even more after the PPNB (De Vaux, 1966; Perrot, 1968; Moore, 1973; Kenyon, 1970). A number of reasons for this have been pointed out, such as climatic changes and degradation of the natural environment caused by population growth, intensive exploitation and stress related to overcrowding (i.e. Gopher & Gophna, 1993; Banning, 1998: 229-230; 2012: 406; Kuijt, 2000: 95; Verhoeven, 2002: 10; 2004: 259; Bar-Yosef, 2009; Rosen & Rosen, 2017). However, the discoveries of the last 20 years have forced researchers to reassess their views on the nature of the changes that took place between the Pre-Pottery Neolithic and Pottery Neolithic periods. Undoubtedly, a transformation was caused by multiple social and cultural factors (Verhoeven, 2002: 10; 2004: 259; Goring-Morris *at al.*, 2009: 217). Although many settlements were deserted (including, in particular, those to the west of the River Jordan), human communities in the southern Levant did not disappear altogether, while their social, economic and even symbolic organisation underwent considerable changes. It is now indisputable that there is no clear-cut border between the Pre-Pottery Neolithic and the Pottery Neolithic. In some cases, it is even possible to notice that some PPNB traits continued into the Pottery Neolithic (Verhoeven, 2004: 259-260).

The gap between the PPNB and the Yarmukian culture was filled with the discoveries at the site of 'Ain Ghazal in Jordan. Researchers identified a new cultural unit referred to as the Pre-Pottery Neolithic C, believed to have been a result of human adaptation to changes that took place towards the end of the PPNB (Rollefson *et al.*, 1992). According to E. Banning, the PPNC should be treated as part of the Pottery Neolithic due to the lack of continuity between the final PPNB and the PPNC, whether in burial practices, lithic assemblages, or even in economic features (Banning, 2012: 406). Furthermore, such a chronological position seemed to be confirmed by visible convergences of the PPNC and the Yarmukian culture, including, in particular, the emergence of pottery at PPNC sites. Importantly, however, the character of PPNC communities in the southern Levant has not been fully explained and requires further research.

The social, economic and symbolic transformation between the Pre-Pottery Neolithic and Pottery Neolithic led to the formation of communities of a unique character, settling in the southern Levant throughout the 7th and 6th millenniums BC. On the one hand, the traces left by these societies show a continuity of certain elements, while, on the other hand, they point to new characteristic features attributable only to Pottery Neolithic groups.

So far, the Yarmukian and the Wadi Rabah have been the most thoroughly researched of all the Pottery Neolithic cultural units identified in the southern Levant. However, some researchers consider the latter as an entity that belongs to the Chalcolithic (e.g. Garfinkel, 1999; 2014; Bourke, 2007). Moreover, the character of the other cultures of this period, namely the Jericho IX/Lodian, Qatifian and particularly the Nizzanim culture, is also debatable.

4.3.2. The Yarmukian culture

Although the first Yarmukian pottery and lithics were excavated at Megiddo in the 1930s, this cultural unit was defined only in the 1950s by M. Stekelis at the site at Sha'ar Hagolan (Stekelis, 1951; 1972). He dated it to the Pottery Neolithic period and treated as contemporaneous with Jericho IX and the 'Néolithic ancient' of Byblos. In his opinion, Yarmukian pottery was the earliest known in the southern Levant. Although initially, researchers tended to disagree with the proposed chronology, after Yarmukian remains were discovered at more sites (e.g. Habashan street in Tel Aviv, Munhata, Hamadiya, 'Ain Ghazal), the position of this cultural unit in the relative chronology of the southern Levant was eventually established. Yarmukian layers are present under all remains of other Pottery Neolithic cultures and above the remains of Pre-Pottery Neolithic occupations – the PPNC (e.g. ʻAin Ghazal) or the gap after PPNB (e.g. Munhata). However, the debate continues on the cultural position of the Yarmukian and other Pottery Neolithic cultures. According to Garfinkel, the Yarmukian and Jericho IX/Lodian were contemporaneous entities situated in separate geographic regions – the Yarmukian in the north and centre of Israel and the Jericho IX in its southern part (Garfinkel, 1993: 130). However, in the opinion of Gopher and Gophna, Jericho IX is an independent younger phenomenon, filling the gap between the Yarmukian and the Wadi Rabah cultures (Gopher & Gophna, 1993: 324-326; Rowan & Golden, 2009; Gopher, 2012c: 1530). Recent discoveries have shown that the sites of both cultures extend beyond the territory outlined by Garfinkel and appear concurrently in several regions, namely the Jordan Valley, the Jezreel Valley, Israel's Coastal Plain and the Shephela. Furthermore, remains of both cultures were recorded at Nahal Zehora II. Despite these new discoveries, researchers fail to agree on the relationship between the two Pottery Neolithic units. This situation also affects attempts at determining their absolute chronology. Limited radiocarbon determinations are not helpful either. According to Gopher, the Yarmukian can be dated between ca. 8,500/8,400-7,800 cal. BP and may have lasted even some 500-600 years (Gopher, 2012c: 1532). In 2007, Banning proposed a new chronology for the Pottery Neolithic entities on the basis of Bayesian analyses of available radiocarbon evidence. In his opinion, the Yarmukian culture began in approximately 6,527-6,376 cal. BC and ended in around 5,988-5,762 cal. BC. If these dates are correct, the culture continued for roughly 441-724 years and overlapped the PPNC and the Wadi Rabah culture. Although in Banning's estimation the Yarmukian and Jericho IX cultural units were contemporaneous, the beginning of the Jericho IX culture cannot be clearly determined due to the scarcity of C14 dates. Recently K. Streit (2017) has suggested a range of approximately 6,350–5,800 cal. BC for the Yarmukian culture (Table 1).

Yarmukian sites have been found along the east-west axis of the central parts of the southern Levant in the Mediterranean coast, in the area from Akko Plain in the north to Tel Aviv in the south, in the mountainous ridge, the Jordan Rift Valley from Lake Tiberias and in the Lower Galilee valleys down to the Dead Sea in the south, as well as in the Transjordanian Plateau. Among the sites discovered so far, particular attention should be paid to Sha'ar Hagolan and Munhata, both of which have contributed significantly to a better understanding of the Yarmukian culture. They also stand out for their remarkable structures and rich assemblages. Another important site is Nahal Zehora II, explored in the 1980s and 1990s by Gopher. The presence of Lodian and Wadi Rabah remains alongside those of the Yarmukian culture makes this site special (Map 4).

Yarmukian sites feature both simple pit-houses and more elaborate structures. Circular or oval stone-founded buildings are fairly common. They have been recorded, for instance, in Munhata or ʿAin Ghazal. However, excavations at the site of Sha'ar Hagolan revealed a much more sophisticated spatial organisation of the settlement. Particularly remarkable are building complexes incorporating numerous rooms arranged around courtyards of a surface area ranging from 225 to 700 m², separated by alleys and streets. According to Garfinkel, the structure of the Sha'ar Hagolan settlement may point to a three-tier social hierarchy, consisting of the nuclear family, the extended family and the community at the top (Garfinkel, 2002; Garfinkel *et al.*, 2002b; Garfinkel & Ben-Shlomo, 2002; 2009). Each nuclear family probably occupied a single dwelling room with an accompanying storage room. A few such units were clustered around a courtyard where a variety of activities could take place. Indeed, such compounds may have been inhabited by extended families (Banning, 2010: 73-74; Gibbs & Banning, 2013: 365-357). Moreover, in the opinion of Banning, each compound could have served as a single decision-making unit in the community (Banning, 2010: 73). Similar structures are known from ʿAin Ghazal, although building complexes at that site were not as dense as in Sha'ar Hagolan. One's attention is drawn to an apsidal structure constructed on a previously existing PPNC plaster floor. On the basis of a large stone (orthostat) placed at the centre of the apse and the presence of exclusively fine pottery in the fill of the room, this apsidal structure has been interpreted as a cultic building (Banning, 1998: 224; 2010: 54-55).

Burials have been found within Yarmukian settlements at ʿAin Ghazal, Jericho and Sha'ar Hagolan, including a child burial encircled by stones, tightly flexed adults with or without skulls and secondary adult burials (Banning, 2012: 408). Their small number may suggest the existence of a burial practice that has escaped the attention of archaeologists.

The characteristic pottery and lithic assemblages of the Yarmukian culture provided the basis on which the culture was identified. Although in some places in the southern Levant people had already learned how to make pottery in the PPN, it became commonly used only in the PN. Vessels were hand-made of a local raw material. There was a great diversity of forms, including jars, bowls, cups of different sizes. Characteristic Yarmukian decorations feature triangular, red-painted fields separated by bands delimited by two incised lines with an incised herringbone pattern between them. Pottery with painted decoration only and undecorated pottery has also been found (Gopher & Gophna, 1993: 311; Garfinkel, 1999: 16-17).

Lithic assemblages are dominated by flakes. Unretouched flakes were used as basic tools. Blades were used, first of all, to produce sickles, drills and projectile points (Gopher & Gophna, 1993: 308; Banning, 1998). Typical Yarmukian sickle blades have a coarse denticulation on the edges, fashioned with pressure flaking. Among projectile points, new types called Haparsa and Herzliya are present alongside subtypes of Byblos and Amuq arrowheads (Garfinkel, 1993: 121-123; Gopher & Gophna, 1993: 308-311). Lithic tools were made first and foremost of local raw materials. Moreover, the Yarmukian lithic assemblage from Sha'ar Hagolan features 38 artefacts made of obsidian originating from southern Cappadocia and eastern Anatolia (Carter *et al.*, 2017). The presence of non-local raw materials implies that the community of this site was involved in a broader exchange system, although it is unclear whether the connections were direct or mediated.

Yarmukian sites also yielded a fairly large quantity of stone tools such as grinding slabs, mortars, grinding stones, pestles and hammers, used for processing grains and other seed crops. Despite the high popularity of pottery, limestone bowls were still in use (Garfinkel, 1993: 123-126; Gopher & Gophna, 1993: 314).

Particularly remarkable are anthropomorphic stone and clay figurines of the Yarmukian culture believed to have a symbolic meaning. Garfinkel identified four basic types of figurines, namely: anthropomorphic clay figurines with 'coffee-bean' eyes; male cylindrical figurines; anthropomorphic pebble figurines; and incised pebbles (Garfinkel, 1993: 124-126).

Thus far, the best evidence for figurines comes from Sha'ar Hagolan and Munhata sites and the Nahal Qanah cave. A number of interpretations have been proposed to explain their occurrence. Figurines have been associated with fertility, magic, a female deity, a deified ancestor, a 'matron' (Gibbs & Banning, 2012: 359-360; Gopher, 2012c: 1562-1567). A. Gopher and E. Orelle (1996) linked figurines with 'coffee bean' eyes to the relationships between the sexes and the mutability of gender. Moreover, they consider pebbles to be a means of defining different stages of female physical development. The multitude of interpretations, however, does not bring us any closer to understanding the role of figurines in Yarmukian societies. However, their association with symbolism indirectly confirms the unique character of the first communities of the Pottery Neolithic in the southern Levant.

4.3.3. The Lodian (Jericho IX) culture

The Jericho IX cultural unit was first defined by J. Garstang on the basis of his research in Jericho in the 1930s (Garstang *et al.*, 1935; 1936). When excavations in Jericho were resumed by K. Kenyon (1957; 1960), she discovered a layer parallel to Garstang's Jericho IX, which she called the Pottery Neolithic A. The name Lodian was eventually proposed by Gopher in order to avoid the use of the "limiting stratigraphic term 'Jericho IX'" after his excavations in Lod. Today, all three names are often used in reference to the same culture.

The origin of the Lodian cultural unit is not fully clear. It is believed that it may have derived from the Yarmukian culture. However, as already mentioned, researchers fail to agree on the mutual relationship between the two cultures. The disagreement on the relationship between the Yarmukian and the Lodian cultures results, first of all, from the immense degree of similarity between the two cultures. The origin of the Lodian culture, closely connected with the Yarmukian culture, may explain the cultural convergences of the two units. For Garfinkel, the similarities, including, in particular, those in pottery and lithics, are the strongest arguments speaking in favour of the contemporaneous existence of both cultures, while the differences between them result from their geographic diversity (Garfinkel, 1999: 101). However, Gopher claims that the differences visible in the *chaîne opératoire* of pottery and lithics, in the burial customs, architecture and symbolic items are sufficient enough to treat the Yarmukian and the Lodian as two separate cultures (Gopher, 2012c: 1541).

In the view of Gopher, the Lodian appeared after the Yarmukian culture, continued for around 200-300 years and can be dated to between 7,900/7,800-7,700/7,600 cal. BP (Gopher, 2012c: 1532). However, determining the absolute chronology of the Lodian culture is rather challenging. Banning has pointed to the meagre radiocarbon evidence of the Lodian culture as the reason why arriving at satisfactory results was difficult in Bayesian analyses (Banning, 2007: 88). Although he proposed a date of 5,985/5,832 cal. BC as the beginning of the Lodian culture (assuming that it began after the Yarmukian), he simultaneously noted that this was not a realistic estimate. According to Banning, the demise of the Lodian culture took place approximately in 5,654-5,450 cal. BC, assuming a small overlap between the end of the Lodian and the beginning of the Wadi Rabah culture. According to Streit (2017), the available radiocarbon dates indicate a range stretching from approximately 6,200 to 5,800 cal. BC (Table 1).

So far, Gopher has identified 22 Lodian sites across the entire southern Levant (Gopher, 2012c: 1547; fig. 1549). In his opinion, the geographic range of the Lodian culture was greater than that of the Yarmukian culture and covered the territory up the Hula Valley in the north, parts of the Dead Sea area and the southern parts of the coastal plain in the south (Map 4). He also considered sites identified as the Nizzanim variant to be Lodian (Bar-Yosef & Garfinkel, 2008: 169-170).

In terms of location and structures, Lodian sites do not differ from those of Yarmukian settlements. Typical features are numerous pits. More sophisticated structures have been recorded at Jericho, where straight and curvilinear walls built of stones and bun-shaped mudbrick were recorded in Stage XXIX. They are the remains of a compound consisting of a few rooms and a courtyard (Banning, 2010: 57). At Lod, a circular pit house dug into a sand dune was found. It had a diameter of 2-3 m and was lined with mudbricks. Furthermore, researchers also identified a variety of domestic facilities, including a hearth or an oven (Gopher & Blockman, 2004: 44; Banning, 2010: 57). Although at Nahal Zehora II no clear house plans were identified in the Lodian layers, researchers found two large complexes consisting of open spaces and many walls, probably constituting parts of houses (Gopher, 2012a: 278-279). In the estimation of Gopher, the houses were rectangular and had stone walls. Compared with Yarmukian architecture, the walls were narrower and made of smaller stones with faces finished in a more meticulous manner.

As in the case of the Yarmukian culture, only a small number of Lodian burials have been discovered. Although Garstang and Kenyon did not find any graves in Jericho's layer IX, Lodian graves are known from the sites in Nizzanim, Teluliyot Batashi, Lod, Tel Te'o (strata X and IX), Abu Gosh, Ha-Gosherin in the Hula Valley and Nahal Zehora II. The dead were buried within settlements, sometimes under house floors. Their bodies were placed in pits, in the foetal position. In a few cases, burials were covered with stones or pebbles. One case of an infant jar burial and a few burials covered with pottery sherds are known from Tel Te'o, where graves containing bodies without skulls have also been found. However, burial offerings are absent in the Lodian culture (Gopher & Eshed, 2012: 1405-1406).

The subsistence strategies of the Lodian culture were based on farming and herding. The reduction of the economic importance of hunting that began at the beginning of the Pottery Neolithic continued into the Lodian period. The sites of this culture contain far fewer remains of wild animals, while some of them do not contain such remains at all. Although arrowheads are still present in lithic assemblages, their quantity decreases. They still include Naparsa, Nizzanim and Herzliya points, some transversal points and also less numerous subtypes of Amuq and Byblos points. Among sickle blades, narrow denticulated forms disappear, while new, relatively short and wide forms emerge. Blade production faced further limitations in the Lodian culture, while flakes were used even as projectile points or sickle blades. Intensive use of the pressure-flaking technique is still clearly visible. Lodian assemblages contain a fair share of massive bifacial tools – axes, adzes, chisels (Gopher & Gophna, 1993: 318-319; Gopher & Barkai, 2012: 1112; 1125).

The use of crops by the Lodian people is also reflected in the presence of numerous tools used for crop processing, such as grinding slabs, mortars, grinding stones, pestles, and hammers. In the stone assemblages, limestone and bowls and pedestaled bowls are still present (Gopher & Blockman, 2004: 42; Gopher, 2012b: 1035-1100).

Although in many ways the pottery of the Lodian culture resembles that of the Yarmukian, it has many distinctive features as well. Vessel types used by the Yarmukian and Lodian cultures are the same, although in the latter new forms appeared (Garfinkel, 1999: 75). According to Garfinkel, the most characteristic feature of Lodian pottery is decoration, including painted and burnished narrow or wide red/brown lines applied on top of creamy/whitish slip (Garfinkel, 1999: 68). However, Gopher believes that the differences between Yarmukian and Lodian pottery are far deeper than that suggested by Garfinkel. Thus, they are visible not only in their decoration but also in the choice of raw materials and in the introduction of new forms (Gopher & Gophna, 1993: 324; Gopher & Eyal, 2012c: 727-728). In the estimation of A. Gopher and N. Blockman, Lodian pottery "has lost certain «archaic» elements" (Gopher & Blockman, 2004: 45).

The number of figurines and other imagery items found at Lodian sites is clearly lower than at Yarmukian sites. In the opinion of A. Gopher and R. Eyal, the Lodian imagery assemblage is characteristic for its lack of a unique character (Gopher & Eyal, 2012d: 1238). Although various figurines and objects were recorded e.g. at Jericho or Lod, their number and character may imply that symbolic expression was shifted to some other media. Moreover, K. Gibbs links the decline in the number of figurines and other forms of human representation evident at Lodian sites to a general shift to more ambiguous symbolism (Gibbs, 2013: 77).

4.3.4. The Wadi Rabah culture

The Wadi Rabah was defined as an independent culture by J. Kaplan in the late 1950s and 1960s on the basis of his research in the Tel Aviv area (Wadi Rabah, Teluliyot Batashi, Lod, Habashan Street, Kefar Gil'adi, and Ein el-Jarba). He classified the Wadi Rabah as a Chalcolithic culture (see also Garfinkel, 1999: 104-109; Bourke, 2007; Streit, 2016), although today most researchers see this cultural unit in the Pottery Neolithic period (Banning, 2007; Gopher, 2012c: 1542-1543; Gibbs & Banning, 2013). The difference of opinions on the culture's affiliation with one period or the other does not really affect its character, and it is indirectly linked to views on the nature of the relationships between the Wadi Rabah culture and the later communities of the Ghassulian period. Those who would rather see this culture as Pottery Neolithic stress its strong ties with the Yarmukian and the Lodian cultures. In the opinion of Gopher and Gophna, the Wadi Rabah culture is the result of the development of the rural agriculture system that emerged in the southern Levant at the beginning of the Pottery Neolithic (Gopher & Gophna, 1993: 346).

In relation to other cultures found at archaeological sites, the Wadi Rabah layers are positioned above Yarmukian and/or Lodian layers. In the view of Gopher, the Wadi Rabah culture began around 7,600-7,500 cal. BP and ended approximately in 6,800 cal. BP, which means that it lasted for some 700-900 years (Gopher, 2012c: 1533). Banning, however, has pointed to the existence of a small overlap between the Lodian and the Wadi Rabah cultures, continuing for 67 to 255 years (Banning, 2007: 88-89). On the basis of Bayesian analyses of available radiocarbon determinations, he also suggested that the Wadi Rabah culture began between 5,746 and 5,578 cal. BC and ended around 5,288-5,118 cal. BC. Recently, Streit proposed an approximate date range for this culture of between 5,700 and 5,200 cal. BC (Table 1) (Streit, 2016: 213).

The area of the Wadi Rabah spread from Upper Galilee through the northern valleys, the coastal plain and the Shephela down to the Soreq Valley (Map 4). A total of 53 sites of the Wadi Rabah culture have been identified, 44 of which have been excavated and nine of which have been surveyed (Streit, 2016: tab. 6.2). Gopher and Gophna divided the Wadi Rabah into normative and variant groups, with the latter being different from the former, particularly in terms of ceramic assemblages (Gopher & Gophna, 1993: 334-341). Furthermore, normative sites are present only in a limited area, namely in the Jezreel Valley, the Soreq Valley, the Upper Galilee and the Huleh Valley. Compared with the Yarmukian and Lodian cultures, the Wadi Rabah cultural unit is characteristic for its greater diversity and spatial segregation.

As the amount of available evidence is limited, little is known about the settlement organisation of the Wadi Rabah cultural unit. Its sites are dominated by rectilinear structures, two types of which have been identified, namely free-standing broad room houses and long houses consisting of a few adjacent rooms (Banning, 2010; Gibbs & Banning, 2013: 357; Streit, 2016: 222). Small rounded houses are still present, although they are the exception rather than the rule. House walls were made of stone and probably served as a basis for mudbrick superstructures. In the opinion of Gibbs and Banning, a decline in the use of common spaces and the segregation of domestic activities is visible in the settlements (Gibbs & Banning, 2013: 358).

As in the case of the other Pottery Neolithic cultures, the Wadi Rabah people buried their dead within their settlements. So far, only 14 graves have been discovered, among which pit burials, cist burials in stone-built box-shaped graves, as well as group burials were identified. Infant jar burials constitute a new practice found at a few settlement sites, either outside structures or between them. Grave offerings are present, albeit rarely. Only in one grave, the skull was missing, which could be probably connected with a symbolic practice known from the PPNB and additionally recorded in some cases in the Yarmukian and Lodian cultures (Streit, 2016: 250-255).

The communities of the Wadi Rabah were fully agricultural. Cereal cultivation and animal husbandry were rarely supplemented with wild food resources. Sheep, goats, cattle, and pigs were already fully domesticated (Streit, 2016: 257). The main cereal was emmer wheat followed by barley. In the opinion of Gopher, it was during the Wadi Rabah period that the final stage of the second Neolithic revolution took place, involving adaptation of the full agricultural package (Gopher, 2012c: 1577). Wadi Rabah groups also reached beyond the basic food products offered by domesticated plants and animals. According to Gopher and Gopna, the churn prototype from Nahal Zehora I may suggest that dairy products were already being used in this period (Gopher & Gophna, 1993: 334). Moreover, intensive use of olives may have begun on the coastal plain (Gopher, 2012c: 1517; Streit, 2016: 258).

The changes in the production of some tools that began in the initial phase of the Pottery Neolithic are even more explicit in the case of the Wadi Rabah culture. Flakes are the dominant component of all assemblages, while the pressure-flaking technique is no longer used. Blade production became uncommon, supplying wide and thick specimens. Arrowheads of the Harpasa, Nizzanim, and Herzliya types, as well as transverse arrowheads, have rarely been recorded at these sites. Changes also affected the production of sickle blades. Typical Yarmukian and Lodian specimens were replaced with backed, rectangular sickle blades, truncated on both ends with a finely denticulated cutting edge. Bifacials include adzes, axes, and chisels. Adzes with the maximum width at the centre, a thick cross-section, and a rather narrow working edge are typical for the Wadi Rabah culture (Gopher & Barkai, 2012: 1112-1113; Streit, 2016: 241-242).

Compared with the Yarmukian or the Lodian cultures, the pottery assemblage of the Wadi Rabah culture is clearly different in terms of raw material choices, shaping techniques, surface treatments, forms, and decoration. On the basis of studies at the site of Nahal Zehora II, Gopher suggests there was the development of pottery technology and an improvement in potters' skills (Gopher, 2012c: 1557). In his opinion, Wadi Rabah pottery marked the peak of the Pottery Neolithic technology. The use of locally available and easily manipulated raw materials allowed potters to use the time and energy previously consumed by paste preparation for other stages of pottery production. An analysis of the pottery of the Wadi Rabah culture shows great attention to vessel forming and surface treatment. Elaborate red or black slip and burnishing are also very common and imply full control of the kiln firing process (Garfinkel, 1999: 108-109). Forms already known from the Yarmukian and Lodian cultures are accompanied by new ones (Gopher & Eyal, 2012c: 728-729). However, the greatest changes are visible in the decoration of Wadi Rabah pottery, made using a variety of techniques (Garfinkel, 1999: 147; Gopher & Eyal, 2012c: 729; Streit, 2016: 232-233).

Various stone tools have been recorded at Wadi Rabah sites. Among other things, they include grinding slabs, mortars, grinding stones, pestles and hammers, and bowls. In terms of form, they do not differ from those known from Yarmukian and Lodian sites (Streit, 2016: 245-248).

Figurines and other objects linked to symbolic behaviours are an important element of all Pottery Neolithic assemblages. In case of the Wadi Rabah culture, a decline in their quantity and changes in their form are visible (Streit, 2018: 17). Typical anthropomorphic figurines are very rare. Traditional clay or stone figurines are accompanied by newly introduced forms, namely stone trapezoids and lozenges, as well as patinated figurines. So-called Yarmukian pebbles are still present at Wadi Rabah sites. Anthropomorphic figurines are accompanied at Wadi Rabah sites by zoomorphic figurines – backed clay objects and stone-carved horned figurines (Gopher & Eyal, 2012d: 1238-1239; Streit, 2016: 260-265). The available evidence may indicate that the symbolism of the Wadi Rabah culture underwent a transformation and shifted towards more ambiguous concepts (Gibbs, 2013; Gibbs & Banning, 2013: 361). Moreover, Streit argues this change "reflects an institutionalization of gender inequalities" and, in her opinion, a shift to stylised female figurines should be viewed in the context of "a canonization of gender perception" (Streit, 2018: 21).

According to Streit (2015ab), the Wadi Rabah culture shows many traces of interregional connections. Although the exchange of raw materials had already been observed during the Yarmukian period, it was probably only in the second part of the Pottery Neolithic that contacts and exchange intensified. The presence of obsidian imported from Anatolia and Cappadocia found at Nahal Zehora II, the discoveries of 22 Halaf seals at the site of Hagoshrim, as well as chlorite vessels (also from Hagoshrim), all point to intensive contacts between the southern Levant, on the one hand, and the northern Levant and Anatolia, on the other. These contacts resulted in the exchange of both goods and ideas. Thus, foreign northern influences are visible in lithics, figurine and pendant designs as well as in pottery (Rosenberg *et al.*, 2010). Streit (2015b) goes as far as to suggest influences from the eastern Mediterranean on the basis of the decoration on a hole-mouth jar from the site at Ein el-Jarba.

4.3.5. Nizzanim variant/phase/ware

Apart from the three cultural units described above, another frequently discussed cultural unit is the Nizzanim variant/phase/ware. This is very poorly defined on the basis of pottery recorded at merely three sites on the southern coastal plain, namely: Nizzanim (Map 4) (Yeivin & Olami, 1979); Giva't Haparsa (Olami *et al.*, 1977); and Ziqmim (Garfinkel *et al.*, 2002). Researchers fail to agree on its interpretation and chronology. For Garfinkel, the Nizzanim was an independent pottery tradition that coexisted with the Yarmukian and the Lodian cultures (Garfinkel, 1999: 97). However, Gopher and Gophna believe it belonged to the Lodian culture as its variant (Gopher & Gophna, 1993: 317-318; Gopher, 2012c: 1539). According to Streit (2017), the only date from the Nizzanim (Hv-8509: 6,790±90 BP; 5,767-5,619 cal. BC at 68.2 % or 5,878–5,541 cal. BC at 95.4%), derived from tests conducted on a short-lived bone sample before being calibrated, indicates a position parallel to the Wadi Rabah culture, which, in Streit's estimation, is contradicted by the lithic assemblage. The relative and absolute chronology of the Nizzanim, not unlike its relationship with the other cultural entities of the Pottery Neolithic, undoubtedly requires further research.

According to Garfinkel, the pottery of the Nizzanim culture is simple in terms of technology and typology, with a low proportion of decoration (Garfinkel, 1999: 97; Garfinkel *et al.*, 2002: 88). J. Golden points out the presence of traits that were later found in the Early Chalcolithic, namely hole-mouth-type rims, ledges, as well as knob handles and pierced lug handles (Golden, 2016: 13). According to Streit (2017), the stone assemblage of the Nizzanim is characteristic for its great number of arrowheads, sickle blades (Yarmukian and Lodian types) and perforators, with considerable affinity to the PPNC tradition. Notwithstanding, in the opinion of Golden, the character of the lithics is "post-Yarmukian" (Golden, 2016: 13).

4.3.6. The Qatifian culture

This culture was distinguished on the basis of materials excavated at the site of Qatif (Map 4). Although C. Epstein, its first excavator, suggested a Pottery Neolithic chronology, it was only I. Gilead who defined this cultural unit and dated it to the later part of the Pottery Neolithic (Epstein, 1984: 218; Gilead, 1990; 2007; Gilead & Alon, 1988). The relationship of this culture with that of the Wadi Rabah is still not fully clear. According to Garfinkel, the Qatifian postdates the Wadi Rabah culture and should thus be treated as a Middle Chalcolithic cultural unit (Garfinkel, 1999: 189; see also Streit & Garfinkel, 2015: 865). However, Gopher suggests that the Qatifian was contemporaneous with the later phase of the Wadi Rabah culture (Gopher, 2012c: 1533). Furthermore, Gopher and Gophna believe that the Qatifian culture (together with another culture known as the Besorian) fills in the gap between the Pottery Neolithic and the Early Chalcolithic period (Gopher & Gophna, 1993: 337).

According to Gilead, the Qatifian culture covers a time span of approximately 5,400 to 5,000/4,900 cal. BC (Gilead, 2009: 339). In 2007, Banning, on the basis of his Bayesian models, proposed a later date for the beginning of the Qatifian culture (approx. 5,034 cal. BC) and an earlier date for its demise (approx. 4,781 cal. BC) (Banning, 2007: 89). Thus, the relative and absolute chronology of the Qatifian culture is still poorly defined while our knowledge of this cultural unit is rather scanty.

Qatifian sites are ranged over a fairly vast area, namely at Nahal Besor Herzliya, Teluliyot Batashi, Tell Wadi Feinan and 'Ain Waida (Gilead & Alon, 1988; Najjar *et al.*, 1990; Kujit & Chesson, 2002; Streit, 2017). Y. Goren (1990) remarks that Qatifian sites are located mainly in the arid southern regions of Israel and Jordan. However, he also suggests a wide distribution including the core area of the later

Ghassulian culture, although this particular view has been challenged by other researchers (Gilead, 2009: 339; Golden, 2016: 14).

The low number of sites does not make it any easier to understand the nature of the Qatifian culture. Pits, hearths, paved areas and postholes are known from the sites. At 'Ain Waida, rectilinear architectural remains were unearthed (Gopher & Gophna, 1993: 337; Streit, 2017). A large percentage of domesticated animal bones (of sheep, goats, cattle, and pigs) found at the sites may indicate that animal husbandry played an important role among the Qatifian people (Golden, 2016: 14).

Nonetheless, it was the archaeological assemblages of the Qatifian culture (pottery and lithics) that served as a basis for distinguishing it as an independent cultural unit. The pottery is coarse and crudely shaped. One of the characteristic features is a dark core resulting from poor firing and high content of organic temper. Vessel surfaces were probably grass-smoothed. In some cases, burnishing on red or reddish-brown slip occurs. Most vessels are not decorated, although plastic motifs were recorded in a few cases. Vessel forms include, first of all, jars with slightly everted necks, hole-mouth jars with loop handles and thick bases, bowls with straight walls (Goren, 1990: 101*; Gopher & Gophna, 1993: 337; Garfinkel, 1999: 189-199; Gilead, 2009: 338-339; Golden, 2016: 14). The lithic assemblage is dominated by flakes. Tools include broad and flat sickle blades (similar to those known from the Wadi Rabah culture), notches, denticulates, burins, and scrapers. A few bifacial axes and adzes have also been found at Qatifian sites (Gopher & Gophna, 1993: 337).

4.3.7. The Pottery Neolithic of the southern Levant – a summary

At the beginning of the Pottery Neolithic, southern Levantine societies entered a new stage of development. Although in the light of the latest discoveries the word 'collapse' must no longer be used in reference to the transition between the Pre-Pottery Neolithic and the Pottery Neolithic, the changes that took place at this time had an immense influence on the overall shape of all Pottery Neolithic societies. Despite some links between the Pre-Pottery Neolithic and the Pottery Neolithic, the groups that emerged in this area in the 7th millennium BC developed a new way of adapting to local conditions. This transformation encompassed all the cultural systems of past societies – social, economic and symbolic. Furthermore, all of the cultures distinguished by archaeologists evolved throughout their respective time spans and underwent changes. As rightly pointed out by Gopher, the cultures of the Pottery Neolithic lasted for centuries: 500 years in the case of the Yarmukian culture, 200-300 years for the Lodian culture and 900 years for the Wadi Rabah culture (Gopher, 2012c: 1537-1538). Thus, as a matter of consequence, they could not have remained unchanged.

Moreover, Gopher believes that the differences between the PPNB and the PN are most visible in subsistence strategies and social organisation (Gopher, 1998: 223). The Pottery Neolithic society included both pastoralists in desert and steppe areas and farmers in river valleys and around lakes (Simmons, 2007: 224-225). Pottery Neolithic farming groups relied on domesticated grains and pulses, as well as on the secondary products of domesticated or tamed sheep, goats, pigs, and cattle. It has been suggested that the economic importance of goats increased (Gibbs & Banning, 2013: 359). The presence of a "churn" from the later part of the Pottery Neolithic may be indicative of dairy production. Furthermore, numerous spindle whorls found at sites suggest textile production relying on goat and sheep hair. Olives were probably also used during this period. A small quantity of wild animal bones, accompanied by a gradual decrease in the number of arrowheads in archaeological assemblages (as compared with the PPN), has been interpreted as a symptom of the reduced importance of hunting. In the view of Orrelle and Gopher, the Pottery Neolithic saw the final stage of the important process of transition to total food production that had begun in the PPN (Orrelle & Gopher, 2000: 236).

Compared with the Pre-Pottery Neolithic, the sites of the Pottery Neolithic (with a few exceptions, such as 'Ain Ghazal, Sha'ar Hagolan, Jericho) are small and transitory. The most common remains are pits and pit-houses (Simmons, 2007: 224). Although they were built in various settings, all of them ensured access to water, farmland, and pasture. Settlements may have been inhabited permanently or seasonally, while the differences in size denote a kind of hierarchy in the settlement system with small farmsteads, larger villages and mega sites (Gopher, 2012c: 1552). Most structures recorded in the settlements are rectilinear or subrectangular, and are both single or multi-roomed. A few Pottery Neolithic settlements at 'Ain Ghazal and Sha'ar Hagolan or Jericho imply a sophisticated internal spatial organisation (Banning, 2010; Gibbs & Banning, 2013: 365-357).

Information on Pottery Neolithic burial customs is rather scarce due to the small number of graves. It may be assumed that people were also buried outside settlements. The dead were interred in a flexed position with their skulls intact. Graves were located inside settlements, between or within houses or other structures. Although offerings are either non-existent or scarce, their quantity grows over time (Simmons, 2007: 217; Banning, 2012: 407; Gibbs & Banning, 2013: 361-362).

The evidence for rituals and symbols from PN sites seems poor when compared with that from PPN sites. One's attention is drawn to figurines found at Pottery Neolithic sites, usually associated with fertility, magic or female deities (Gopher & Orelle, 1996; Garfinkel *et al.*, 2010; Gibbs, 2013). Decorated pottery is also believed to have some symbolic meaning (Orelle & Gopher, 2000; Gibbs & Banning, 2013: 361).

The changes that took place between the PPN and the PN are clearly visible in the material culture. Pottery Neolithic lithics are dominated by tools linked to agricultural activities. Some changes are also visible in the types and frequencies of projectile points as the importance of hunting decreased. Lithics became less standardised and most tools were formed rapidly. Debitage was dominated by flakes and there is a visible decline in the number of blades in the assemblages (Banning, 1998: 203-204; 2012: 407). However, simple tools were still accompanied by specimens made by highly skilled knappers (e.g. invasively pressure-flaked projectiles, knives, polished axes, and adzes).

Pottery is treated as a hallmark of Pottery Neolithic groups. For a long time, researchers were of the opinion that it was in the Pottery Neolithic that pottery first emerged. Even though pottery was also known from PPNB and PPNC sites of Transjordan, it was identified mostly as part of large installations (ovens, silos). The latest discoveries at the site of Kfar HaHoresh showed that pottery containers may have been known and used earlier. However, it was in the Pottery Neolithic period that ceramic vessels began to be used commonly. The only exceptions are areas in the southern desert: pastoral groups operating there did not make ceramic containers at all (Goring-Morris & Belfer-Cohen, 2014: 161-162; see also Goring-Morris, 1993).

Improvements in pottery production are visible throughout the Pottery Neolithic, as the choice of raw materials, forming techniques, surface treatments, vessel forms, and decoration continued to change. Technological developments and the related refinement of potters' skills were probably the driving force behind these changes. Other important aspects included social and symbolic factors difficult or even impossible to record in assemblages (symbolism, function, preference, fashion). According to Gopher (2012c), pottery technology reached the peak of its development in the later part of the Pottery Neolithic.

Stone tools found at the above-mentioned sites were probably used for processing agricultural products. Unlike pottery or lithics, they did not change much throughout the Pottery Neolithic, which was probably linked to their long-life span and utilitarian character.

The Pottery Neolithic societies of the southern Levant were not isolated. A connection with Egypt in this period and the introduction of the Neolithic package into the Nile Valley from the Levant during the 6^{th} millennium BC is often suggested by many scholars. Some evidence also suggests ties with areas in the north. The presence of obsidian at Yarmukian and Wadi Rabah sites may be attributable to the involvement of Pottery Neolithic communities in interregional contacts. Incised stamps and tokens known from Wadi Rabah sites also point to an interregional exchange system (Goring-Morris & Belfer-Cohen, 2014: 163; Streit, 2015b; Carter *et al.*, 2017). Indeed, Streit suggests that the Wadi Rabah culture together with the Halaf culture and the Amuq C occupation phase took part in a regular exchange of raw materials, finished products, and even ideas, which manifests itself in similarities in the material culture (Streit, 2015a: 339 2015b).

The archaeology of the Pottery Neolithic in the southern Levant has been dominated by the culture-historical approach. The traditional view on this period assumes the existence of several archaeological units, distinguished on the basis of their material culture, mostly including pottery and lithics. However, such an approach sheds little light on the cultural situation in the 7th and 6th millenniums BC in this area. Researchers who investigate this period rarely agree on the relative chronology of individual cultures and the mutual relationships between them. The limited availability of C14 dates is another limiting factor, as it renders the determination of the absolute chronology difficult. As a result, the Pottery Neolithic has been dissected into a few segments which are purely artificial and have little in common with the actual cultural situation in the past. In this approach, cultures become independent monolithic units, defined solely from the perspective of features visible in the material culture, combined with their place of origin and chronology. Furthermore, their absolute position on the time axis and their relative position among other cultures are not permanent and may change depending on researchers' views.

Chapter 5
Early and Middle Holocene pottery of north-eastern Africa and the southern Levant

5.1. Lower Egypt

In the middle of the 6th millennium BC, people in Lower Egypt started to use containers made of clay for the first time. Although this new technology had probably appeared from outside, it was adapted to local conditions. Thus far, pottery has only been recorded at four locations with Neolithic occupation, namely on the northern shore of Lake Qarun in the Fayum, at Merimde Beni Salame and Sais, as well as at Wadi Hof. The evidence presented below comes from research conducted at various intervals throughout the 20th century, as well as in the 21st century. The excavation methods employed, on the one hand, and the quality of pottery analysis and publication, on the other, have had an effect on the value of the current research. The pottery from the excavations of G. Caton-Thompson and E. Gardner underwent a typical early 20th-century selection process. Complete or nearly complete vessels, along with diagnostic sherds, were documented and then distributed among various institutions all over the world (see Appendix). Vessel fragments, accounting for most of the pottery existing at settlement sites, were ignored, thus reducing the value of the collected material for future research on the pottery tradition. Importantly, F. Wendorf and R. Schild (1976), while exploring Trench 2 located near the British excavation site at Kom W in the Fayum, did not find any complete vessels, while their collection featured only ceramic fragments with a high percentage of bodysherds. J. Emmitt made an attempt at estimating the missing assemblage on the basis of the CPE excavation data (Emmitt, 2011: 97). In his estimation, 26,847 ceramic fragments from the trench explored by Caton-Thompson and Gardner at Kom W had not been preserved. Moreover, in his opinion, the potential number of ceramic vessels of this site is 821 (Emmitt, 2011: 126).

The pottery collection from the excavations by H. Junker at Merimde Beni Salame is similarly fractional. Moreover, Junker's disrespect for stratigraphy had an immense effect on the research value of the ceramic assemblage. Thanks to the research conducted by J. Eiwanger in the 1980s, our knowledge of the pottery tradition of the Merimde site was thoroughly enriched. Only the explorations currently being conducted at Sais and at Merimde make it possible to analyse ceramic assemblages in compliance with contemporary standards of archaeological research.

Although the el-Omari pottery was excavated during the Second World War and soon thereafter, the results of these excavations were published only in the 1990s, in accordance with contemporary standards. However, it must be remembered that the site itself was explored using methods available in the 1940s and 1950s, sometimes in harsh wartime conditions, which must have impacted the recording and selection of materials. Similarly, the rather long delay between actual exploration, on the one hand, and the publication of results, on the other, could have also detracted from the research value of the ceramics collected at Wadi Hof. Moreover, due to the fact that the area has now been seized by the Egyptian army, it is now impossible to verify the pottery of the el-Omari culture.

5.1.1. Fayumian pottery

As the origin of the Fayumian pottery is not clear, the simplicity of the pottery-making process without the need for any special skills or equipment could indicate that the craft was introduced from outside and then developed locally. It is generally accepted that the oldest Neolithic pottery of the Fayumian culture was made of Nile clay. By analysing a sample of Fayumian pottery with a portable X-ray fluorescence (pXRF) spectrometer, Emmitt identified four different materials used in pottery production in the Fayum, originating from different sources (Emmitt, 2017: 149-150; Emmitt *et al.*, 2018). A mixture of materials, namely silts and minerals, which could be both natural and artificial, is the most common type (73%). Moreover, 11% of the analysed materials were made of Nile silts. Another 8% belongs to two different mixtures of Nile silt and marl clays. Although the identification of sources of raw materials used in Fayum was not possible, in the view of Emmitt, the presence of multiple raw material sources indicates movement from outside the Fayum (Emmitt, 2017: 152-153; 243-244; Emmitt *et al.*, 2018). Thus, these analyses are treated by the researchers concerned as an indication of the mobile way of life of the Fayumian people.

The greatest degree of temper variability has been observed in the pottery of the Fayumian culture. Mineral and vegetal inclusions were added to the clay. According to Emmit, sand, quartz, limestone, and bones were also used (Emmit, 2017: 202-204). Moreover, Kom W pottery analyses by Emmitt demonstrated that over 90% of ceramic vessels were tempered with both mineral and organic materials, although pottery with only sand or only chaff is also known (Emmit, 2017: 202).

Fayumian pottery was made of coils joined together by hand. Some examples of pinching and drawing of a lump of clay have also been recorded (Wodzińska, 2010: 29-40; Emmitt, 2011: 110). Vessel walls were usually thick and uneven. According to Caton-Thompson and Gardner, the surface of most vessels was covered with red slip, now obliterated by post-depositional processes (Caton-Thompson & Gardner, 1934: 35). In their estimation, most sherds classified as rough-faced actually belonged to red burnished ware. A small group of pottery was also classified as black-burnished ware and as unburnished slipped and smoothed ware (Table 2). Indeed, Emmit made the same observations concerning surface treatment (Emmit, 2011: 100-102). In addition, he identified pottery that had just been covered with a slip or only burnished (Emmitt, 2017: 200-201). Apart from red and black slip, orange slip has also been recorded.

The uneven surface colouration of most vessels suggest a simple open firing process and its incomplete control, with interrupted access to oxygen. The likely firing temperature is approximately 600°C. According to Emmitt, fire-clouds identified on part of the ceramics indicate that vessels were surrounded with fuel during the firing process (Emmitt, 2011: 107-108). He also suggests the use of dung as fuel. In Emmit's view, pottery production at Kom W was not routinised while vessels were made only when necessary (Emmitt, 2011: 131-132). Kom K is also indicated as a possible place of its production, given the presence of an unfired clay vessel found at the site, vessels that were too large for transport and hearths which could have been used for pottery firing (Emmitt, 2017: 243-244).

Some additional information on the pottery-making process was obtained by a Polish expedition to the region of Qasr el-Sagha, exploring sites QSI/79 and QSV/79, chronologically contemporaneous with the Fayumian culture (Ginter *et al.*, 1980: 114–120; Ginter & Kozłowski 1983: 37–38). These researchers confirmed that most pottery was made of Nile silts tempered with sand and straw. Additionally, they indicated that the clay used for pottery originated from the Hawara Depression. Thanks to more detailed analyses, four groups of ceramic vessels were distinguished. A combination of sand and straw was not always added to clay while in some sherds, the presence of sand temper only was confirmed (variants A2, B2, C1-2). Sherd surface colour was brown to reddish while the dominant group of sherds had smoothed surfaces. No traces of slip were recorded. Although the firing temperature was about 600°C, traces of oxidizing and reducing firing conditions were recorded. Due to poor quality firing, some sherds had split into layers. At sites QSI/79 and QSV/79, sherds made of lake sediments and lake silts were also found, indicating the use of local raw materials other than Nile silt. Findings from the Qasr el-Sagha region indicate that potters probably had a good understanding of the vessel making process. However, it should be mentioned that this data was obtained by analysing a limited number of sherds discovered during the Polish research expedition.

The number of shapes recorded in Fayumian pottery by Caton-Thompson and Gardner (1934) is rather modest. Open forms prevailed over closed vessels (Table 3). According to P. Rice (1999), the dominance of open forms in societies where pottery was a novelty could be linked to the fact that potters were poorly skilled and vessels were multifunctional. They were treated as utilitarian objects which could be used for different purposes. The most numerous types (e.g. 30 out of 65 from Kom W) of the Fayumian culture are hemispherical, spherical or conical bowls and deep jars with a restricted mouth, resembling hole-mouth jars (groups 1 and 2 by Caton-Thompson & Gardner, 1934: 35) (Figs. 1:1-5; 2:1-2; 3:1-3; 5:1; 11:1-6, 11-12; 12-15). The last group was interpreted by the excavators as cooking or storage jars. The other three distinguished groups are represented by rectangular bowls, vessels on a raised base and vessels on 'knobbed feet' (Figs. 4:1-3; 11:7-10, 13). Similar shapes, namely hemispherical, spherical and conical bowls, vessels on a raised base and deep vessels with a restricted mouth known as hole-mouth jars, were also recorded at Fayumian sites in the region of Qasr el-Sagha (Ginter *et al.*, 1980: 118-119; Ginter & Kozłowski, 1983: 38) (Fig. 5:15).

Emmitt suggests a preference for unrestricted vessels with flaring and straight rims in the Fayumian culture (Table 3) (Emmitt, 2011: 99-100). Approximately 70% of all vessels from Kom W studied by Emmitt are unrestricted forms (Emmitt, 2017: 193). However, in the Upper K Pits, restricted vessels represent 60% of the studied assemblage. Moreover, the research showed that 63% of all recorded rims were round, while pointed rims represented 25% of all rims and only 7% of rims were flat. Emmit also recorded a high percentage of flat bases. According to him, the high variability of shapes and sizes of Kom W pottery indicates that the occupation of this site was relatively long or that the site was more probably periodically revisited (Emmitt, 2017: 2014). Neolithic pottery is rarely decorated. Indeed, in the Fayumian culture, knobs constitute the only form of decoration.

5.1.2. Merimde pottery

The pXRF analyses of Merimdian pottery indicate that 93% of the sample was made of Nile silt (Emmitt, 2017: 153). However, Emmitt also suggests this assemblage is the most diverse in terms of materials used in pottery production and that the clay may have been obtained from a number of different places (Emmitt, 2017: 155; Emmitt *et al.*, 2018: 429). Interestingly, in the oldest Merimde ceramic assemblages there are no traces of added tempers. At Sais, untempered pottery is the most dominant group among Neolithic materials from phase I, comparable with Merimde I. Sherds made of clay tempered with straw and sand also occurred, although in a smaller quantity (Wilson *et al.*, 2014: 118-119). Chaff temper was introduced in phase II of Merimde Beni Salame. B. Mortensen linked its usage to improvements in pottery production and a wet climate as it could improve drying and prevent shrinkage of wet unfired vessels in humid conditions (Mortensen, 1992: 174). The use of this temper was also confirmed in the Merimde III phase. During his analyses, Emmitt also identified gravel, sand, quartz, limestone, and shells among tempers of the studied Merimde assemblage (Emmitt, 2017: 219-220). He also suggests that the frequency of using sand and gravel tempers decreased over time.

As regards surface treatment, pottery collections from Merimde I and Sais I are comparable. The surface was covered by red, brown or even black slip, either burnished or smoothed (Eiwanger, 1984: 22–23; Wilson *et al.*, 2014: 118). Burnished surfaces prevail at both sites (Table 2; Merimde I – 62.5%; Sais I – 67.25%). Some changes in surface treatment between the Urschicht phase and phases II-III of Merimde could be observed (Table 2). In phase II, the percentage of burnished ware decreased from 62.5% to 53% while that of smoothed ware grew from 33.7% to 46.7%. In phase III, this ratio remained almost unchanged (Eiwanger, 1992: 19, Abb. 4).

The firing process at the beginning of the Merimde settlement was in open fireplaces and probably similar to that known from the Fayum culture. The emergence of grey-coloured vessel surfaces in phase II and, additionally, black surfaces in phase III could be interpreted as progress in pottery firing, attributable to improved control of firing conditions and oxygen availability during the process. However, it should be stressed that red surfaces, easy to obtain during open firing in the case of Nile clay, are dominant in both younger phases of the Merimde site. Vessel forms in the oldest phase of Merimde seem to be very similar to those of the Fayumian culture. They include hemispherical, spherical and conical bowls, vessels with vertical walls or deep vessels with a restricted mouth (Figs. 1:5-7; 2:3-4; 3:6-8, 11; 16:4-12; 17-19). Open forms prevail among both burnished (43.9%) and smoothed ware (53.3%) (Table 3). Eiwanger distinguished vessels with vertical walls as a separate group, which, in fact, could be classified as open or closed forms, depending on the rim position. In Sais I, closed forms (ca. 40%) prevail over open forms (18.7%). Apart from the shapes known from Merimde, conical bowls with everted and sometimes thickened rims have also been recorded. Additionally, some fragments of broad jars, known from younger phases of Merimde are also known in Sais I (Wilson *et al.*, 2014: 118-121, figs. 113-114).

In phase II of the Merimde settlement, one can notice an increase in the number of closed forms and a decrease in number of open forms in burnished ware (Table 3; Figs. 1:8-10; 2:5-6; 3:9-10, 12-14; 4:4-5; 5:2, 4-5; 6:8-9). In the group of smoothed ware, open forms (51.8%) continue to prevail over closed forms (31.4%). In the last phases of Merimde, although the domination of closed forms over open forms is still visible in the group of burnished ware, open and closed forms were recorded in similar numbers in smoothed ware (Figs. 1:11-12; 2:7-8; 3:15-16; 4:6-8, 11; 5:3, 6-9; 6:1-2). In younger layers of the Merimde site, new forms of closed vessels appeared in the ceramic assemblage. Newly introduced types include jars with an S-shaped profile (Merimde II, Sais I, Figs. 5:7-8; 16:14; 20:1) or burnished jars with a globular body and a long neck (Merimde III; Figs. 6:1-2, 4, 7; 16:15; 20:3, 6).

The oldest pottery of Merimde was decorated with an incised herringbone pattern. This kind of decoration is present on burnished vessels, either under the rim or in the upper part of the vessel. The area with decoration is not burnished (Fig. 22). The pottery of Merimde II was not decorated, except for knobs identified on a few vessels. In the assemblage of phase III, decorated pottery was recorded, demonstrating different techniques and motifs. Among incised decorations, a variety of horizontal, vertical and diagonal patterns were found. In layer IV (Schicht IV) of Merimde, impressed decorations of round, oval or even crescent-shaped indentations were identified for the first time. From layer IV on, plastic decoration becomes more diversified. Knobs come in various shapes (round, oval or crescent) forming a variety of patterns (Eiwanger, 1992: 35-42) (Figs. 16:4-5; 18:5; 20:9).

Owing to the long occupation sequence at Merimde, its pottery clearly shows the gradual development of potters' know-how, skills, and experience. Although on the basis of stratigraphy Eiwanger noticed a gap in the settlement's occupation between phases I and II and, additionally, some technological changes (i.e. introduction of straw temper, increased vessel wall thickness, greater variety of vessel forms, disappearance of decoration), he also suggested the continuation of pottery production (Eiwanger, 1988: 51). The inhabitants of Merimde II were probably the ancestors of those of Merimde I who had been forced to move by climatic change e.g. to a daughter site at Sais. Eiwanger attributed the differences between phases I and II to factors influencing the site from different directions, namely from the southern Levant in the Urschicht phase, and from the Western Desert in phase II.

5.1.3. El-Omari pottery

The pottery assemblage at the site was not made of Nile clay, but of two kinds of local calcareous raw materials present in the vicinity of the wadi. There is also evidence of mixing different kinds of clay, which, in turn, allowed the el-Omari people to produce four kinds of paste used in vessel making. Some sherds made of Nile silt were also recorded (approx. 1%. together with marl sherds). Local potters probably also knew of other raw materials useful for making pottery, but did not use them due to the distance to their sources. The most common temper in the el-Omari sherds was straw, although sand was also used in some cases. The crushed fibres of papyrus were recorded as well. More detailed pottery analyses showed that potters' understanding of clay was very good. Thus, to obtain a red/reddish-brown colour, which is not natural for calcareous clay, they mixed clay with ochre, which is easily available locally (Debono & Mortensen, 1990: 25; Hamroush & Abu Zied, 1990: 117–127).

El-Omari pottery was made of coils or clay strips by hand. The dominance of burnished vessels covered by slip is clearly visible in the el-Omari assemblage (Table 2). More than two-thirds of all vessels were burnished, while the rest were wet-smoothed. Vessels were fired in simple conditions, but at a relatively high temperature of ca. 800°C, with uncontrolled oxidation. There is a surprising difference between potters' understanding of clay properties (mixing different clays, the addition of ochre), on the one hand, and irregular vessel shaping and poor surface treatment techniques (burnishing), on the other. The addition of red ochre to obtain the red colour typical for vessels made of Nile clay is also puzzling. In this context, the imitations of black-topped vessels mentioned by F. Debono and B. Mortensen (1990: 26) should be noted. However, they could also be interpreted as cooking pots blackened with fire or soot. On a few occasions, the excavators underlined its experimental character which improves over time during the site's existence.

At the site of el-Omari, open forms (41%) prevail over closed forms (29%). Interestingly, the percentage of vertically walled vessels is also high (approx. 30%) (Table 3). Among the most numerous shapes, there are restricted spherical vessels (some with S-shaped profiles) and vessels with vertical walls (groups III and V; Figs. 2:9-11; 3:17; 5:10-14; 21:1-3, 8-9). Conical bowls with flat bases are numerous as well (group VII; Fig. 1:13-15). Vessels with long necks and rims everted outwards, similar to Merimde III bottles, are also present (Fig. 6:3, 5-6). The rather low number of jars with distinguishable necks could indicate an early stage of their production (groups I and II) (Fig. 21:4-6). Some fragments of pottery with a knobbed base, known from the Fayumian culture, were also recorded (Figs. 4:9-10, 12; 21:7). El-Omari pottery is not decorated.

5.1.4. The Neolithic pottery tradition of Lower Egypt - a summary

Pottery making in Lower Egypt in the 6th/5th millenniums BC is not homogenous. Each cultural unit and site represents a unique pottery-making style influenced by many external and internal factors (see Arnold, 1989; Rice, 2005). In the opinion of the author, however, at the foundation of pottery production of all known Neolithic cultural units there lies a single Lower Egyptian pottery tradition. The lack of homogeneity results from changes the pottery tradition underwent through time and space, influenced by many factors (Mączyńska, 2017).

The origin of Lower Egyptian Neolithic pottery is not clear. However, it should be treated as an innovation rather than invention. It was probably introduced from the outside and adapted to local conditions. Clays and tempers originated from local resources, namely widely available Nile clay or other local clays, as well as mostly organic and vegetal tempers. The lack of straw or sand tempers in the oldest Merimde pottery and the dominance of untempered ceramics at Sais is puzzling. The underlying reasons could include many different factors, such as raw material quality, the origin of the pottery-making process, weather, human preferences, or potters' knowledge and experience.

Neolithic people made pottery in very simple ways, by coiling or pinching and drawing. Covering the vessel surface with slip and burnishing was observed at all Neolithic sites. This type of surface treatment prevailed over smoothed and rough ware, although over time the number of smoothed ware vessels also increased (Table 2). Moreover, Eiwanger observed a decrease in burnished ware accompanied by a decline in burnishing quality. It seems probable that this change may have been linked to the increased efficiency of the pottery-making process. Burnishing could have been reduced to an activity which made walls compact and inhibited liquid penetration.

Initially simple open forms – mostly spherical or hemispherical bowls, typical for the Fayumian culture and the first phase of the Merimde site, were made probably as multifunctional utilitarian objects and used for many different activities (processing, cooking, and storage). The presence of fire blackening on the vessels from the Fayum and Merimde (80.7%) suggests that they were used in direct contact with fire – i.e. for food preparation (Emmitt, 2017: 199; 215). Larger vessels of the Fayumian culture may have been used for storage (Emmitt, 2011: 129-135; 2017: 242). This function seems to be confirmed by their location in the storage pits at Kom W and at the Upper K Pits.

At Merimde Beni Salame, the process of vessel shape development towards closed forms is clearly visible over time (Table 3). In red burnished ware, however, closed forms became the dominant shape from phase II on, while in smoothed ware, open forms prevail over closed forms in phase II and are present in similar quantities in phase III. In phase II of the Merimde site, vessels with S-shaped profiles first appeared. Moreover, production of long-necked bottles began in phase III.

It is worth mentioning that in Sais I, contemporaneous with Merimde I, closed vessels prevail over open forms while vessels with short vertical necks appeared earlier than at the Merimde site. The differences between Merimde I and Sais I could be possibly linked to the special function of the Sais site as a fish midden, which could have influenced the forms of vessels used there. At the el-Omari site, open forms prevail over closed forms, although the number of vessels with vertical walls was fairly high.

The changes in surface treatment and vessel forms at Merimde Beni Salame were probably linked to their function and to local demand. The application of slip and burnishing reduce permeability and porosity and make the vessels useful for long-term storage, especially of liquids (Rice, 2005: 231). Vessels with smoothed walls have reduced permeability but will, nonetheless, remain porous. This feature is desired in case of short-term storage (e.g. water). Additionally, porosity is also required during cooking, to reduce thermal stress. Greater demand for smoothed vessels in phases II and III, most of which are open vessels, could have resulted from their function as vessels for cooking, serving, or short-term storage. Burnished closed forms were probably used mostly for long-term storage of liquids, which influenced their life-span. Cooking and serving vessels were used more frequently and thus broke more often. Their life-span was, therefore, shorter and, for this reason, they were probably produced in greater numbers than storage jars.

The firing process at Neolithic sites took place in open hearths where vessels could be surrounded by fuel. The firing temperature was at least 600°C, which is sufficient to produce a solid vessel. However, at the el-Omari site temperatures as high as 800°C have been suggested. In Neolithic pottery production, the skills of el-Omari potters deserve special attention, first of all, because of the relatively high temperature needed for firing calcareous clays, and also due to the use of ochre added to clay in order to obtain red colouration. We are, however, unable to establish whether potters wanted to imitate Nile clay vessels or simply responded to a special demand for red vessels in el-Omari society.

Once introduced, the new technology was quickly adapted to local conditions and became common and widespread in Lower Egypt. After the adaptation of pottery production to local conditions, potters determined its further development by their own choice of raw materials, tempers and firing conditions. Undoubtedly, pottery production was also influenced by the demands of ceramic vessel users. Although in the beginning people used very simple vessel shapes for a wide range of activities, over time vessel forms became more differentiated and their function became more restricted. Moreover, we can observe an increase in the significance of relationships between vessel shapes, surface treatment and function in the Neolithic pottery-making process. One of the stages of development of Neolithic pottery production is the introduction of vessel decoration. The herringbone pattern known from Merimde Beni Salame (Fig. 22) and Sais was probably introduced at the beginning of the adaptation of a new technology and could be linked to external influences. However, in the later period, the emergence of other decoration patterns could be linked to users' demand for this feature of ceramic vessels or even its symbolic meaning.

5.2. Eastern Sahara

Pottery emerged in North Africa in the 10th millennium BC. Although the current state of research does not make it possible to determine whether there existed one or more centres of pottery invention, the prevailing view assumes multiregional origins of pottery (Close, 1995; Jesse, 2003; 2010; Tassie, 2014: 80-82). After its invention, the pottery technology spread quickly within a 4,000 km strip in the southern Sahara and the northern Sahel. The oldest clay vessel fragments in southern Egypt were recorded at sites dated as far back as 9,000 cal. BC, linked to Early Holocene occupation. While early pottery is a rather rare finding, it does confirm that herders who appeared in the desert in the Early Holocene humid phase had mastered the skill of making clay vessels. Over time, pottery spread to an increasingly large territory, covering nearly the entire Western Desert, reaching as far as the Farafra Oasis. Ceramic vessels have also been recorded in the Eastern Desert. However, even at Middle Holocene sites, ceramic sherds are uncommon and, in some areas, no pottery traces have been recorded at all, despite the presence of other remains of human occupation.

5.2.1. Nabta Playa-Bir Kiseiba

Pottery recorded at Early Neolithic sites in the Nabta Playa-Bir Kiseiba area is the oldest known pottery in Egypt. Although its quantity is rather small, researchers are of the opinion that it is fairly advanced technologically (Nelson, 2001; Gatto, 2002; Zedeño, 2002; Jórdeczka *et al.*, 2011). In the absence of any older examples of pottery making in this area, ceramics from Nabta Playa-Bir Kiseiba is considered as an innovation adapted from outside.

The earliest evidence of pottery was recorded at sites dated to the El Adam phase (e.g. sites E-75-9, E-77-7, E-06-1). Pottery was made using a local raw material available at the edge of the playa. Local granite and mica or sand were added to the paste as tempers. According to K. Nelson and E. Khalifa, the limited variability in pottery tempers in a given area with a wide availability of different tempering materials reflects an informed choice made by pottery makers (Nelson & Khalifa, 2010: 135). Vessels were made of coils, although traces of a combination of padding and coiling have also been found. Wall thicknesses range from 4.5 mm to 10 mm. Vessel surfaces are smoothed, while the most common surface colours are grey and black, although reddish fragments have also been found. Due to the small size and quantity of sherds, vessel forms are difficult to reconstruct. Probably, they were deep open spherical vessels with slightly incurving rims (Jórdeczka *et al.*, 2011: 101-104). A particular feature of the pottery of the El Adam phase is a decoration of closely packed horizontal or vertical impressions all over the vessel's surface (Gatto, 2002; Nelson, 2002; Jórdeczka *et al.*, 2011: 104). Such decorations were probably made using a pottery disk with a notched rim (Jórdeczka *et al.*, 2011: 106-107, figs. 10-12).

Pottery was still very rare at the sites of the next El Ghorab phase, and does not differ from that of the previous phase in terms of fabric. M.C. Gatto identified the stem and leaf pattern, as well as the wolftooth pattern (Gatto, 2002: 72). As the same patterns were used to decorate eggshell bottles in the previous El Adam phase, their use on pottery in the younger phase may indicate the same function for these two types of containers (Gatto, 2002: 72). During this period, vessel rims began to be decorated with deep oval punctuation (Wendorf & Schild, 2001: 654).

Pottery becomes more plentiful at the sites of the El Nabta phase. Granite is still used as temper while the prevailing form seems to be a large, deep spherical vessel with incurving rims. However, El Nabta pottery decoration shows greater variability, with such patterns as dotted wavy lines, spaced zigzags, stem and leaf, as well as fishnets (Nelson, 2001: 535; Gatto, 2002: 73).

During the next El Jerar phase, ceramic vessels were still made of local clay tempered with granite and granodiorite. Surface colours range from yellowish red to reddish brown. As regards forms, two main vessel types were recorded, namely a large vessel with a wide mouth and almost straight walls, and a spherical bowl with incurving rims (Nelson, 2001: 536). According to Gatto, El Jerar pottery differs more clearly from that known from the previous phases (Gatto, 2002: 73-74). For the first time, decorations in the form of dotted zigzags impressed across the entire surface were made only using the rocker-stamp technique.

In terms of fabric and surface treatment, Middle Neolithic El Ghanam pottery from the Nabta Playa-Bir Kiseiba area is reminiscent of pottery from Early Neolithic phases. Recorded forms include, first of all, deep vessels with straight walls and flat and thick rims. However, according to Wendorf and Schild, vessels are bigger and have thicker walls (Wendorf & Schild, 2001: 663). While the rocker-stamp technique was used to decorate vessels, unlike in the Early Neolithic period, decoration patterns are spaced and random and do not cover the entire surface. Towards the end of the Middle Neolithic there appeared pottery with roughly smoothed external surfaces. In the view of Wendorf and Schild, despite the differences between the Early and Middle Neolithic pottery of Nabta Playa, certain common features of both assemblages suggest the existence of strong cultural links between groups occupying this area in both periods (Wendorf & Schild, 2001: 665).

Late Neolithic El Baqar pottery shows far greater differences in terms of fabric, surface treatment, shape and decoration when compared with Middle Neolithic pottery (Nelson & Khalifa, 2010: 138). Although the paste is mostly fine, clays could come from different locations (alluvial clay, Nile clay). Sand or ash were used as tempers, while fibre/dung was identified on a few occasions. In a few sherds, plant seeds were also found. Moreover, untempered sherds have also been recorded. While sherd surfaces were mostly smoothed or burnished, plain and unburnished surfaces have also been documented. Some vessels also had blackened interiors. Vessels with black tops were common as well, while red or reddish-brown slip and self-slip have been recorded. The period in question saw progress in the firing technique, ensuring higher temperatures and oxygen flow control. Late Neolithic forms include simple bowls and slender jars with conical bases. Thus far, no rocker-stamp impressions have been found on vessels from this phase. The similarity of some of Late Neolithic pottery to Badarian pottery (black topped and red slip pottery) has been suggested (Wendorf & Schild, 2001: 666). In the estimation of Nelson and Khalifa, changes in pottery production between the Middle and the Late Neolithic period in the Nabta Playa-Bir Kiseiba area reflect broader social, economic and cultural changes that occurred in the Western Desert in the Middle Holocene (Nelson & Khalifa, 2010: 139-140). The desertification process and increased mobility of human groups were conducive to interactions between people, including potters from different communities. Consequently, pottery became far less diverse in many ways and began to exhibit some common features over a large area (e.g. A-group, Badarian, Tasian assemblages).

The Final Neolithic El Ansam pottery of the Nabta Playa-Bir Kiseiba area displays only partial affinity to the previous period. It was made of two types of clay, namely yellow primary clay mined from Cretaceous bedrock and red primary clay, or fine alluvial clay. In addition, Gatto identified shale ware (Gatto, 2010; 2013). Vessel forms are more diversified: thus, incurving deep bowls, shouldered bowls, spherical jars and jars with flaring rims have been distinguished. As a result of explorations of the Final Neolithic cemetery at Gebel Ramlah, other new vessel forms were recorded in graves, including spouted bowls, bowls with flat bases and beakers. Particularly remarkable are caliciform beakers and deep bowls with small flat bases (Gatto, 2010: 152-153). Richly decorated pottery also emerged in this period. Apart from rim tops decorated with milled impressions or notches, vessel walls are decorated with incised geometric patterns or rocker-stamp plain zigzags. Wendorf and Schild, as well as Gatto (2010), also suggest the presence of rippling on some vessels made of alluvial clay (Wendorf & Schild, 2001: 666). Many features of Final Neolithic pottery production imply relationships between people occupying the Nabta Playa-Bir Kiseiba area and those from Nubia and Upper Egypt (Badarian, A-Group, and Nubian Neolithic) (Gatto, 2010: 156). Climatic changes, reduced access to water sources, as well as pastoralism and the high level of mobility of human groups, fostered the exchange of ideas and patterns among them.

5.2.2. Gilf Kebir and Jebel Ouenat

Both decorated and undecorated ceramic materials have been recorded in the Gilf Kebir-Jebel Ouenat region. The earliest occupation (Gilf A) is known from Gilf Kebir, where two localities, namely Wadi el-Akhdar and Wadi el-Bakht, are particularly worthy of attention. At site 83/33 in Wadi el-Akhdar, sherds with packed dotted zigzags and incised wavy lines were recorded. While pottery with the first of these decoration patterns, tempered with organic temper, seems to be linked to the Middle Holocene occupation, the chronology of incised wavy-line pottery is far more puzzling (Riemer & Jesse, 2006: 68). Despite the successful identification of two C14 dates – for one decorated sherd and one undecorated piece believed to be a fragment of a decorated vessel – the large time gap between these dates has rendered chronology determination difficult. The first of the two dates is 5,338±71 BC, whereas the other is much older, i.e. 8,310±61 BC (Gehlen *et al.*, 2002: 105). In the view of H. Riemer and F. Jesse, assuming that the fragments did not come from the same vessel, the incised wavy line pottery from Gilf Kebir could be dated to the second part of the 6th millennium BC (Riemer & Jesse, 2006: 68). However, the question of the presence of the oldest pottery associated with the Gilf A cultural unit, remains unanswered (Gehlen *et al.*, 2002: 105; Jesse, 2003).

The sites of the subsequent Gilf B cultural unit in Wadi el-Akhdar, dated to 6,500-4,300 BC, are fairly abundant in undecorated pottery (e.g. sites 80/7-1; 82/21). According to B. Gehlen *et al.*, it has many common features, such as undecorated walls, notches on rims, an average wall thickness of 8 mm, simple surface treatment and poor firing (Gehlen *et al.*, 2002: 105). At site 80/7-1, numerous sherds of a fairly large vessel with a mouth diameter of 37 cm were found. In Wadi el-Bakht, similar undecorated pottery is known from only two sites, one located in the foreland and the other one on the plateau (site 82/21). Similar sherds are also known from two sites located at the exit of Wadi Maftuh and at the upper end of the northern branch of this wadi (Wadi Maftuh Plateau 00/72 and 00/73) (Linstädter, 1999; 2003; Linstädter & Kröplin, 2004: 768).

Gilf B occupation has also been recorded at Wadi Sura. According to Riemer, given that 98% of all recorded sherds and 97% of all vessels are linked to Khartoum-style pottery, this area was occupied mainly in the Gilf B phase (Riemer, 2013: 39). In the first part of the Gilf B phase, only mineral temper was used, while the second part of this phase also features plant-tempered pottery (Riemer *et al.*, 2017: 20).

Pottery is an important element of archaeological assemblages from Gilf C sites dated to between approximately 4,300 and 3,500 BC, both in Wadi el-Akhdar and in Wadi el-Bakht. All sherds are thin-walled, well-fired and contain mineral temper. Incised and impressed decoration in the form of bands under the rim is a particular feature of this period, with comb impressions and herringbone patterns being the most common. Researchers reassembled three vessels and successfully reconstructed their shape, i.e. hole-mouth jars with pointed bases (Schön, 1996: 118-119; Gehlen *et al.*, 2002: 107; Linstädter, 2003: 137; Linstädter & Kröplin, 2004: 770).

Already towards the end of the Gilf C unit, human occupation was probably restricted to Wadi el-Bakht, due to the progressing aridification of the eastern Sahara. At Wadi Sura, only 2% of all sherds could be dated to this phase. The sites are extremely small and transitory (Riemer *et al.*, 2017: 18). Likewise, traces of human activity between 3,300-2,700 BC (Gilf D unit) are rather scarce in the Gilf Kebri area. Although pottery is present at the sites from this period, it is fragile, organically tempered and covered with impressions (Gehlen *et al.*, 2002: 107).

5.2.3. The Great Sand Sea

Regenfeld area

In the Regenfeld area, Early and Middle Holocene sites have been recorded mostly at the edge of the playa basin. Undecorated pottery is known from site Regenfeld 96/1 dated to the Middle Holocene (Riemer, 2000: 26, fig. 6; Gehlen *et al.*, 2002: 102). Nine sherds tempered with very coarse angular quartz grains were found. Two of them were rim fragments and probably came from bowls.

Abu Minqar/Lobo

Middle Holocene pottery was identified at site Lobo 81/55, located on the eastern margins of the Great Sand Sea. F. Klees (1989) mentioned the presence of some sherds of light brown handmade pottery with organic temper, found together with ostrich eggshell fragments and beads, grinding stones and lithics. In the opinions of Kless and R. Kuper, there is a high degree of similarity between the pottery from Lobo and that of the Fayumian culture (Kless, 1989: 231; Kuper, 2002: 9).

Glass Area

Pottery has been identified at sites situated in the Desert Glass Area located on the western margin of the Great Sand Sea. The greatest collection comes from the so-called 'Willmann's Camp' (B.O.S. site Glass Area 81/61), where two types of pottery (undecorated and decorated) were recorded (Gehlen *et al.*, 2002: 96; Riemer & Jesse, 2006: 67). They were made of the same fabric tempered with straw, quartz and, in a few cases, organic fibre and shale. Additionally, undecorated pottery was tempered with a mineral filler not used in decorated vessels (Riemer & Jesse, 2006: 67). The wall thicknesses of both sherd groups range from 5 to 10 mm.

Particularly remarkable is a large collection of Khartoum-style decorated pottery, consisting of 160 sherds from this site. Researchers successfully identified only one decoration motif – a packed dotted zigzag. In most cases, the zigzag decoration is coarse and rough while the impressed dots are rectangular or round. In the opinion of Riemer and Jesse, decorated pottery could be dated to the Middle Holocene (Riemer & Jesse, 2006: 67). The same chronology was proposed for undecorated pottery.

5.2.4. The Abu Ballas scarp land

Mudpans

A rich assemblage of pottery was discovered at site Mudpans 85/56. In the lower layers only decorated pottery was recorded, in contrast to the upper layers where a mixed assemblage of decorated and undecorated pottery was unearthed (Kindermann & Riemer, in press). The decorated sherds are covered with a packed dotted zigzag motif. Researchers successfully reassembled from collected sherds a vessel with nearly complete decoration (Kuper, 1993: 217). Its 8-mm-thick walls were made of a paste tempered with quartz. The vessel's surface was brown to pale brown (Gehlen *et al.*, 2002: 96; Riemer & Jesse, 2006: 64). As the entire sequence of site 85/56 covers ca. 500 years between ca. 6,500-5,900 cal. BC, Kindermann and Riemer suggest that the site is evidence for the local development of a pottery tradition (Kindermann & Riemer, in press).

Eastpans

Pottery was also recorded in Eastpans, close to the western shore of the depression at site 95/1. It did not come from Epipalaeolithic layers, but instead from the overlying layer, dated to 6,350 BC. In the opinion of Gehlen *et al.*, this assemblage is only slightly younger than the Epipalaeolithic occupation of the site (Gehlen *et al.*, 2002: 95). The ceramic assemblage consists of several sherds with packed dotted zigzags. According to Riemer and Jesse, in terms of fabric, these sherds resemble the pottery from Mudpans 85/96 (Riemer & Jesse, 2006: 64). They are quartz tempered while surface colours range from brown to pale brown. At site Eastpans 95/2, 4 km to the west of Eastpans 95/1, a quartzite potter's comb was found. It may have been used for the decoration of pottery from Eastpans 95/1.

A large amount of undecorated pottery was also collected at site Eastpans 95/2 and in its surroundings. Fabrics with a few temper types were recorded, namely sand and seeds, sand and shale, as well as sand only. All sherds are parallel to thin-walled pottery known from the Dakhleh Oasis (Bashendi B) or the sites on the Abu Muhariq Plateau (Gehlen *et al.*, 2002: 96-97; Riemer & Schönfeld, 2010: 750).

Chufu

Middle Holocene pottery has also been identified in the area of Chufu, located close to the eastern dune trains of the southern Great Sand Sea. Due to its scarcity and highly abraded surfaces, the chronology and cultural affinity of this pottery are difficult to determine. On the basis of analyses of lithic assemblages from another Chufu site, namely 02/15, Riemer (2006) suggested that people who occupied the Dakhleh Oasis during the dry season would arrive at the area of Chufu after rainfalls. Therefore, undecorated pottery from this area can be linked to the similar pottery of the Late Bashendi A or Bashendi B known from the Dakhleh

Oasis. Unique findings are two pots from site Chufu 02/14 with surfaces decorated in the Khartoum style with a packed zigzag pattern. According to Riemer and Jesse, the presence of organic temper in the sherds implies a younger horizon of Khartoum-style traditions dated to the Middle Holocene period (Riemer & Jesse, 2006: 65-67).

5.2.5. The Abu Muhariq Plateau

Djara, Abu Gerara, El Karafish and Farafra Sand Sea

Pottery has been recorded at sites in the Djara area, Abu Gerara, El Karafish and the Farafra Sand Sea. Although the collection features 423 fragments, only 246 sherds from 19 assemblages are dated to the Late and Final Djara B phase, contemporaneous with the Late Bashendi A and Bashendi B of the Dakhleh Oasis. The remaining assemblages are either dated to the Sheikh Muftah unit and the Islamic period, or their chronology is uncertain.

Three fabrics were recorded in Djara B pottery. That labelled fabric 1 by Riemer and Schönfeld (2010) is typical for Middle Holocene assemblages. It is "insignificantly tempered", with a dense matrix and it may also contain some intrusions, namely plant seeds, limestone grit and rounded sand. Moreover, some sherds of the Djara B are made of fabric 2, additionally recorded in younger assemblages of the Sheikh Muftah. A characteristic feature of fabric 2 is the presence of a fine shale temper. Most fabric 2 sherds additionally contain sand and, in a few cases, also plant seeds. The least numerous group of sherds from Abu Muhariq Plateau is made of fabric 3, containing rounded or less-angular quartz grains in amounts greater than in the case of fabric 1.

The external surfaces of fabric 1, 2 and 3 sherds have different tones of brown (brown to brownish yellow, brown to reddish yellow, olive brown) and, less often, red (red to reddish brown). Although sherds have burnished or polished surfaces, rough sherds also occur. While a red coating was recorded on both fabric 1 and fabric 2 sherds, in the opinion of Riemer and Schönfeld (2010), this type of surface treatment is most characteristic for fabric 2. The presence of blackened rims was also confirmed on fragments of fabrics tempered with fine shale.

As regards forms, most vessels are open or closed spherical pots with a height to maximum diameter ratio of 1:1. Jars with nearly vertical walls also occur. Although most vessels have rounded rims, some pointed and flat rims have been found as well. Most fragments came from thin-walled vessels while the average wall thickness of Djara-B-phase sherds ranges from 4.5 to 5 mm. It seems likely that the vessels were rather small, with mouth diameters below 180 mm (Fig. 7:9-19).

The pottery of the Djara B is not decorated. However, some sherds from the sites at Abu Gerara 98/5 and 00/111 bear impressions. According to Riemer and

Schönfeld, a sherd with a cord impression is technologically similar to undecorated pottery found at the site and could be linked to the Djara B phase (Riemer & Schönfeld, 2010: 737).

The distribution of pottery across the Abu Muhariq Plateau is not uniform. Greater amounts of material have been found at sites in the southern part of the plateau, namely in the areas of Abu Gerara and El Karafish. In the area of Djara in the north, sherds were recorded at only two sites of the Late Djara B phase. In other locations in the northern part of the plateau, e.g. on Seton Hill, no pottery traces have been found despite lithics indicating that herders were present here in the period in question. According to K. Kindermann (2010), the lithic assemblages from the northern and southern parts of the Abu Muhariq Plateau are homogenous, with only a small number of differences. Both the northern and the southern part of the plateau were occupied by people with the same cultural background. Despite this, pottery was rarely used by groups occupying the northern part of this region, or was not used by them at all. According to Riemer and Schönfeld, the distribution of pottery in this area was linked to a variable landscape pattern (distribution and density of playa locations) and to the fact that further to the north of the plateau, the distances between potential water sources increased (Riemer & Schönfeld, 2010: 750-753).

Abu Tartur

Abu Tartur sites are also located on the Abu Muhariq Plateau. However, they were not researched directly by archaeologists from the ACACIA project. Pottery from Abu Tartur was collected by Siegbert Eickelkamp at 68 individual sites (50% of all sites recorded). They were located both on the plateau and in playa depressions. The findings were analysed by Riemer and Schönfeld (2006). Pottery was recorded at sites representing Abu Tartur phases B, C and D. The earliest known Abu Tartur pottery was identified at the eight sites of Abu Tartur B. Moreover, a total of 12 medium-walled sherds (6-8 mm) tempered with angular sand have Khartoum-style decorations (packed dotted zigzag motif). C14 dates point to the period of between 6,400 and 6,100 BC for this phase.

Abu Tartur C pottery seems to have been produced locally from two fabrics, namely a thin-walled dense untempered fabric and a fine shale fabric. The surface of the former has colours ranging from reddish brown to pale brown and grey. Sherds made of the latter fabric are brown or yellowish brown. Forms include small open bowls, open bowls with straight walls, hemispherical bowls, and deep restricted vessels. Vessels are thin-walled and sherd wall thicknesses range from 3 to 7 mm. While most pottery is undecorated, two sherds have a rim decoration in the form of incised grooves on the top. Two fragments of one or two small Tasian-like beakers with incised geometric decoration were also recorded. Riemer and

Schönfeld also mentioned black-topped rims and sherds with a rippled surface known from other locations in the Egyptian part of the Sahara and Upper Egypt (Riemer & Schönfeld, 2006: 349).

In terms of fabrics, forms and decoration patterns, the pottery of Abu Tartur shows a large degree of affinity to that of the Late Bashendi A and B from the Dakhleh Oasis. Considering the location of Abu Tartur between the Dakhleh Oasis and the Kharga Oasis, pottery was probably made by groups travelling between the desert and the oases in the Middle Holocene period (Riemer & Schönfeld, 2006).

5.2.6. The Dakhleh Oasis

Although C. Hope suggested that the oldest pottery in the Dakhleh Oasis is known from the sites of the Masara A (or B) cultural unit, in the opinion of A. Warfe, the sherds identified as Early Holocene were produced by later groups (Bashendi and Sheikh Muftah) (Hope, 2002: 40; Warfe, 2006; 2018: 34-36; 75). Thus, their presence at Epipalaeolithic sites is a result of reoccupation or post-deposition processes. However, he also suggested that the Masara people could have been aware of this technology through links with other parts of the Western Desert, especially its southern part (Warfe, 2018: 75). Pottery production was not introduced into the Masara cultural unit probably for a few reasons, including economic or social organisation, way of life or a lack of demand for ceramic containers.

The earliest pottery production in the Dakhleh Oasis is known from Late Bashendi A sites. However, the number of recorded sherds at these sites is very low. The most common fabric is tempered with sand and shale. In the estimation of Warfe, most pottery during the Bashendi A period was made of fabric with fine non-plastic inclusions (Warfe, 2018: 38). Other fabrics containing organic temper are rare (Hope, 2002: 41; Warfe, 2018: 52-54). Surface colours range between brown, red and grey. In the view of Warfe, mostly pottery with compacted, plain surfaces was produced during the Late Bashendi A phase (Warfe, 2018: 36-27). Most sherds probably come from small and medium-sized deep open or slightly restricted bowls, or hemispherical bowls with a wall thickness ranging from 3 to 7 mm (Warfe, 2018: 36). On the basis of pottery uniformity, Warfe suggested that Late Bashendi A potters invested considerable time and effort in pottery production despite its small scale and early stage of pottery making. Most pottery is undecorated. Hope (2002) mentioned a few sherds with black tops and some vessels with oblique short incised lines. However, he also suggested that the rippling visible on some sherds had been caused by erosion. Some sherds with Khartoum-style impressed decoration with distinctive quartz-rich fabric have been recorded at Late Bashendi A sites as well. All decorated pottery is treated by Warfe as non-local (Warfe, 2018: 38).

Although the amount of pottery at Bashendi B sites grew, pottery production was still rather limited (Warfe, 2018: 76). It is better preserved than the older pottery from the oasis. In terms of fabrics, surface treatments and forms, Bashendi B pottery is reminiscent of ceramics known from Late Bashendi A sites. Most fabrics are tempered with sand and shale (fine and coarse) (Warfe, 2018: fig. 14). According to M.A.J. Eccleston, the raw material used for local pottery production came from within the oasis, although its inhabitants could have also sourced it from other clay deposits (Eccleston, 2002: 64; Warfe, 2018: 66-73). Additionally, sherds made of a fabric tempered with gypsum/quartz, quartz/straw and a high amount of quartz were also recorded. In the estimation of Warfe, the continuation of a preference for fabrics with fine to medium inclusions is clearly visible during the Bashendi B phase (Warfe, 2018: 40). All vessels were made of coils by hand. Most sherds came from small and medium-sized deep, open or slightly restricted bowls (Fig. 7:1-7) (Warfe, 2018: figs. 16, 29). Hope (2002) suggests a self-slip on the external surfaces of most of the vessels, resulting in non-uniform surface colouration. According to Warfe, almost half of Bashendi B pottery was plain while approximately 35% had a compacted surface (Warfe, 2018: fig. 15). Coatings were first used at this time, although rarely. Warfe also noticed that vessel colours changed during the Middle Holocene, mostly to reddish-brown (Warfe, 2003: 183). In his opinion, vessels with very thin walls (3.5 to 5 mm) appeared at Bashendi B sites, although vessels with a wall thickness below 3 mm occurred there as well (Warfe, 2018: 28).

Within the pottery of the Bashendi B culture, low-fired vessels appeared. As they are very fragile and easy to break by hand, Warfe suggested that they were used for less rigorous purposes, such as serving food or short-term storage (Warfe, 2018: 76). Moreover, as proposed by Gibbs (2012), the features of Middle Holocene low-fired pottery from the Dakhleh Oasis fit short-life or disposable pottery very well.

A vast majority of pottery is undecorated, while only a few bowl sherds have oblique grooves on rim tops. Other decorations include oblique or vertical incised lines found on some sherds. At site Locality 74 fragments of decorated beakers were found, displaying a typical Tasian motif of incised triangles filled with vertical or horizontal rows of impressed dashes or dots, probably arranged in several rows between incised lines (Hope, 2002: 43, fig. 1: a-f, pl. 53). From the same site comes the only jar known from the Dakhleh Oasis, with incised decoration in its upper part. Although Hope suggests that its form is similar to that of Maadi jars, its origin and chronology are uncertain. Other noteworthy items include fragments with impressed decorations from Locality 212. Hope suggested that the decoration pattern was an imitation of basketry or woven mat, and that the vessel had been made outside the oasis.

To conclude, pottery from both Late Bashendi A and Bashendi B sites may be divided into two groups. The first one includes undecorated thin-walled simple and open vessels made mostly of quartz and shale fabric with smoothed surfaces. The other group features pottery made outside the oasis and introduced by people coming from different directions. The Khartoum-style pottery was the first to arrive and is now believed to reflect influences from the south (Riemer & Jesse, 2006; McDonald, 2016: 190; Warfe, 2018: 61-66). At Bashendi B sites there probably appeared imports from the Nile Valley and from the desert, namely fragments of beakers with incised decorations and blacktopped sherds from the desert.

5.2.7. The Kharga Oasis

According to M. McDonald, the earliest evidence of pottery in the Kharga Oasis appears at sites dated to the 7th millennium BC, similar to those from the Dakhleh Oasis, of the Masara C cultural units (McDonald, 2009: 31-32). It is decorated with Khartoum-style impressions. Parallel pottery has also been recorded by French archaeologists working in the north of the oasis, namely at Epipalaeolithic sites (e.g. KS121) similar to the Masara C sites (Briois & Midant-Reynes, 2010: 46; see also Dachy *et al.*, 2018). In the opinion of McDonald, the sites in the Midauwara area with Masara C materials may have been used by Epipalaeolithic groups who left the Dakhleh Oasis in the middle of the 7th millennium BC (McDonald, 2009: 32). The remains from the Kharga Oasis probably fill in an occupation gap observed in the Dakhleh Oasis between 6,500-5,800 cal. BC.

In the Kharga Oasis, pottery has also been recorded at Baris sites. It is made of a sand and gypsum fabric and its walls are thin and undecorated. Sherds with Khartoum-style decoration made of a coarse sand fabric have been recorded as well (e.g. at the sites MD-18, MD-24, MD-66, MD-69) (McDonald, 2009: 32-34). Archaeological assemblages, including the pottery from Early Baris sites, are reminiscent of those of the Late Bashendi A culture from the Dakhleh Oasis. The amount of pottery at Late Baris sites (e.g. at site MD-22) grew. The recorded fragments mostly come from undecorated thin-walled, open or closed simple bowls. A fabric tempered with sand and shale (in varying quantities) is the most common type, although fabrics with organic temper and coarse shale inclusions have also been recorded. In addition, vessel fragments with rippling, believed to have been linked to the Badarian culture, were found at sites MD-22 and MD-36 (McDonald, 2006: 489).

In terms of forms and fabrics, the pottery of the Early and Late Baris cultures resembles that of the Late Bashendi A and Bashendi B from the Dakhleh Oasis. This situation is associated with cultural links existing between the two oases during the Middle Holocene. However, in the Late Baris period, the connection was gradually weakened, while Khargan sites contain evidence suggesting more intensive contacts with the Nile Valley (McDonald, 2009: 11). Given its short distance from the Nile Valley, towards the end of the Holocene humid phase, the oasis became a place of activity of groups travelling between the river and the oasis. Badarian rippled pottery in the Midauwara area, black-topped pottery and Tasian incised beakers found at site KH043 appeared in the Kharga Oasis probably because of the movement of people between the two regions at the time when settlement activity had begun in the Nile Valley in the 5th millennium BC (Briois & Midant-Reynes, 2010: 49; Briois *et al.*, 2012). The presence of Neolithic pottery from the Nile Valley in the Western Desert not only confirms contacts between groups inhabiting both regions and travelling across the desert but may also point (at least partially) to African roots of the Egyptian Predynastic civilisation (McDonald, 2009: 37; Briois & Midant-Reynes, 2010; Dachy *et al.*, 2018).

5.2.8. The Farafra Oasis

Pottery dated to the Neolithic period has been recorded in two locations in the Farafra Oasis: at site Sheikh el-Obeiyid 99/1 and at site Hidden Valley 2/Area 1. However, it should be pointed out that the overall number of recorded sherds is very small. Only five fragments were analysed in detail, including three from Sheikh el-Obeiyid 99/1 and two (probably coming from the same vessel) from Hidden Valley 2/Area 1. The material used to make Late Neolithic pottery was probably sourced from within the oasis, although its exact place of origin was not identified due to the fact that our knowledge of the oasis is rather limited. M.C. Gatto and I. Muntoni suggest silty sands or clayey sediments of playa deposits as a possible source of raw materials (Muntoni & Gatto, 2014: 456). The vessels were made both of naturally tempered fabric, and of a fabric with additionally added tempers – medium-sized sand or organic tabular remains. The sherd surface colour is greyish black or pale brown. The surface treatment is difficult to identify because the sherds are either completely or partially abraded. Only in the case of a potsherd from the Hidden Valley were traces of smoothing on the external and internal surfaces recognised. The vessels were fired in a semi-controlled oxidizing atmosphere at a maximum temperature of 700°C. Most fragments were thin-walled, except for a fragment from Sheikh el-Obeiyid, probably coming from a jar or a deep bowl (Muntoni & Gatto, 2014).

According to Muntoni and Gatto, the pottery from the Farafra Oasis displays considerable affinity in terms of fabrics to Middle Holocene pottery known from other sites in the Western Desert (Muntoni & Gatto, 2014: 456-457). The lack of shale ware, found in copious amounts in other locations, is explained as a specific technological choice or as a consequence of the absence of shale deposits in the oasis.

5.2.9. Sodmein Cave

Pottery fragments have been recorded at only one site in Sodmein Cave in the Eastern Desert. The greatest number of sherds were recorded in the northern part of the cave, mostly in the A and C1 deposits, associated with feature 111, dated to 6,148±38 BP. Due to vertical scattering of other sherds at the site, it is not possible to link them to any other structures and, consequently, to precisely date them (Vermeersch *et al.*, 2015: 482). According to P. Vermeersch *et al.*, the pottery from the cave should be linked to the presence of ovicaprine herders between 5,400-5,000 cal. BC (horizon C1) (Vermeersch *et al.*, 2015: 499). This assumption is based on the similarities to flint inventories belonging to the bifacial tradition known from the northern part of the Western Desert.

All vessel fragments found in Sodmein Cave were made of coils by hand. On three sherds, turntable traces were identified (Vermeersch *et al.*, 2015: figs. 19: 4-5, 10-11, 18). The fine paste is sandy, usually without temper. In a few cases, small open pores are visible in the paste, although it is unclear whether they are traces left by a burnt organic admixture (Vermeersch *et al.*, 2015: online resources 3; fig. 19: 1-2, 4, 8). In one case, fine, red grit particles were recorded in the paste. Surface colours are yellow, red, grey and black, while surface treatment techniques include burnishing, both on the inside and outside. Slip traces are visible only in one case (Vermeersch *et al.*, 2015: fig. 19: 8). Firing is described as hard, resulting in some degree of sintering of the paste. Most sherds are undiagnostic, while the original vessel forms are beyond identification. Three of the preserved rims suggest the so-called spherical vessels with incurving walls and round rims (Vermeersch *et al.*, 2015: fig. 19: 2-3, 8). One fragment was part of a simple bowl with a rim that was slightly thickened on the outside (Vermeersch *et al.*, 2015: fig. 19: 11).

From among the few sherds found in Sodmein Cave, two are particularly worthy of attention, namely one with a blackened rim similar to those known from other localities on the Western Desert, and the other with engraved herringbone decoration on the outside. Desert black-topped pottery is well known from Middle Holocene sites in the Western Desert (e.g. Abu Gerara, Abu Tartur, the Dakhleh Oasis, Nabta Playa). In addition, the decorated fragment comes from a hole-mouth jar, probably with a diameter of approximately 18 cm. Its inner and outer surface is red and burnished. The fragment consists of a few smaller sherds, one of which is related to feature 10, dated to approximately 5,600 cal. BC (Fig. 7:8). Both may be helpful in determining the cultural identity of the herders who occupied the site.

Since Vermeersch *et al.* have suggested that the pottery from Sodmein Cave can be dated to the period 5,400-5,000 cal. BC, the cave may have been visited by herders moving with their animals across the eastern Sahara in search of water, food, and pastures (Vermeersch *et al.*, 2015: 499). Other pottery features (fabrics and surface treatment techniques) show similarities to pottery typical for groups from the northern part of the Western Desert, belonging to the Bifacial techno-complex. The herringbone pattern is known in Egypt from the site at Merimde

Beni Salame, where it was recorded in layers representing the oldest settlement phase dated to approximately 5,000 BC. In terms of design, the decoration pattern from Sodmein Cave diverges slightly from the Merimde herringbone pattern (Figs. 7:8; 22). It is rougher than that known from specimens found in the Nile Delta. On the other hand, vessel forms and homogenous paste display a high degree of affinity. At the current state of research, it is nevertheless difficult to draw any conclusions on such remote connections. However, the above-mentioned connections no longer appear unlikely assuming that the herders from Sodmein Cave belonged to the Bifacial tradition of the northern part of the Western Desert and could travel over long distances, and additionally assuming (on the basis of the similarity of the lithic assemblages of Middle Holocene sites from the Western Desert and the sites in the Fayum and Merimde Beni Salame) that mobile herders could have visited the Fayum and the Delta margins or even settled there at the beginning of the desiccation of the desert. Undoubtedly, it is yet another issue that calls for more research.

5.2.10. The eastern Saharan pottery tradition - a summary

The pottery that appeared in the Egyptian part of the eastern Sahara during the Holocene humid phase does not form a homogenous group and displays many regional differences. Its roots are definitely local (African). As the desert pottery spread in the Early and Middle Holocene periods, its production underwent changes visible both in technology and vessel forms/decorations. These changes are attributable to many different factors, including the environment and climate, on the one hand, and social, economic and cultural changes in various regions of the eastern Sahara, on the other.

Pottery appeared in southern Egypt in the 9th millennium BC at sites in the Nabta Playa-Bir Kiseiba region. Throughout nearly the entire Holocene humid phase, the southern part of the Western Desert showed strong connections with Sudanese regions, visible in pottery decorations (e.g. at Nabta Playa, Gilf Kebir). During the Early and Middle Holocene, the southern Khartoum tradition spread northwards, reaching the Dakhleh-Abu Tartur-Kharga line in the late 7th/early 6th millenniums BC. Khartoum-style decoration appeared at the sites of Abu Ballas (Mudpans, Eastpans, and Chufu) and in the Dakhleh, Kharga and Farafra oases. Although it was also recorded at the sites at Abu Tartur located in the southern part of the Abu Muhariq Plateau, no sherds with Khartoum-style decoration have so far been recovered in northern locations of the plateau at Abu Gerara, El Karafish, and Djara.

The oldest known evidence of the undecorated pottery tradition comes from the area of the Dakhleh Oasis and, specifically, from Late Bashendi A sites dated to approximately 6,100-5,700 cal. BC. Around 5,600 BC, similar pottery appeared on the Abu Muhariq Plateau in Late and Final Djara B assemblages. Undecorated thin-walled sherds are also known from the Kharga and Farafra oases, a number of locations in the area of Abu Ballas (Chufu, Eastpans) and the eastern margins of the Great Sand Sea. The pottery from Sodmein Cave in the Eastern Desert is also associated with the northern tradition.

It seems likely that the development of the pottery tradition in the area of the Dakhleh and Kharga oases in the Middle Holocene was not accidental. According to McDonald, owing to the bimodal rainfall pattern (winter-summer), the conditions in the oases were more favourable for human occupation and resulted in a certain degree of sedentism (McDonald, 2015: 277). Longer stays in (or more frequent returns to) the same place could promote adaptation of the new technology and its incorporation in the existing system. Despite the fact that the Bashendi B people returned to a mobile lifestyle, they continued to make and use undecorated thin-walled pottery. This has been found at numerous sites dated to the 6th millennium BC and shows a high degree of technological and stylistic convergence.

As the pottery tradition spread northwards, it probably underwent a technological change. Decorated pottery from older Middle Holocene sites (6,600-6,000 cal. BC) is tempered with mineral materials, while Khartoum-style decorated pottery from younger Middle Holocene sites (ca. 5,600-5,000 cal. BC) contained organic temper (e.g. Glass Area 83/20 and 96/12, Chufu 02/14) (Riemer & Jesse, 2006; Riemer *et al.*, 2013). Another novelty observed in the late 7th/early 6th millenniums BC was the fact that decorated pottery was accompanied by undecorated sherds. Kindermann and Riemer suggest that a new undecorated pottery tradition developed in the area of the Dakhleh Oasis in the above-mentioned period, and which they treat as undecorated facies of the Khartoum-style technocomplex (Kindermann & Riemer, in press).

In the estimation of Riemer *et al.* (2013), in the final stage of the Holocene humid phase (6,000-5,300/5,200 cal. BC) two distinct cultural traditions/technocomplexes can be differentiated on the basis of material culture, namely the northern Bifacial tradition and the southern Khartoum-style tradition. While the differences between them are visible, first of all, in lithic assemblages, the pottery of both traditions differs also. The Khartoum-style tradition continued to have many links with Sudanese regions, visible in decoration patterns (packed doted zigzags, incised wavy lines, dotted wavy lines) (e.g. Nabta Playa, Gilf Kebir). However, undecorated, thin-walled pottery is typical for the northern tradition. The current state of research does not indicate any pottery presence north of the Farafra Oasis.

Unquestionably, the low quality and quantity of finds have a bearing on our poor level of knowledge of the pottery tradition of the eastern Sahara in the Early and Middle Holocene. It is unclear why and when people adapted pottery in the southern part of the Western Desert. Little is known about the process of spreading pottery technology and knowledge (Close, 1995; Jesse, 2003; 2010). In some ways, the mobile lifestyle of hunter-gatherers and herders involving frequent relocations over long distances in search of food, water, and animal pastures must have helped promote the idea of pottery production. On the other hand, it should not be forgotten that the transport of clay vessels was rather cumbersome (see Eerkens, 2008). While pottery is present in the Dakhleh and Kharga oases and at nearby sites such as Abu Tartur or Chufu (likely stopover places used by groups that seasonally or occasionally travelled between the oases), the small number of sherds at most of the explored sites may reflect certain limitations in carrying ceramic vessels and/or their limited use.

Archaeological assemblages tell us little about why people chose to add pottery to previously available tools. Unquestionably, pottery was far more difficult to make than lithic tools. Even though raw materials for both technologies were available in the desert, the requirements associated with both production processes were different. Although some know-how was necessary for both technologies, knapping can be done basically anywhere, while pottery making – apart from raw materials – additionally requires water, fire, and fuel to sustain it. Due to the said challenges, groups wishing to make and use pottery had to incorporate its production into their way of life and to secure access to all necessary materials. According to Riemer and Schönfeld, in the case of the northern part of the Abu Muhariq Plateau, long distances between water sources (more than a day's walk) are the reason for the scarcity of pottery in this area (Riemer & Schönfeld, 2010: 752-753).

Vessel functions are an important aspect of the discussion on the adaptation of pottery production in the eastern Sahara. If its functions were attractive enough, hunter-gatherers or herders could have chosen to make pottery regardless of the inconvenience involved. Since pottery emerged simultaneously with domesticated animals and the exploitation of wild plants, its function is usually associated with these new food sources. In periods of intensive plant gathering, pottery could be used for plant processing (Dunne *et al.*, 2016). Similarly, the use of animal secondary products, such as milk and blood, could be linked to ceramic containers. Although traces of the first dairying practices have so far been confirmed only for the 5th millennium BC among pastoral groups in the Libyan Sahara, earlier knowledge of milk processing cannot be excluded at this stage without further studies on materials in other parts of the Sahara. In addition, dairying would have enabled the consumption of milk products by desert herders who were lactose intolerant (Dunne *et al.*, 2012; 2013; 2018).

The size of ceramic assemblages does not grow significantly in the Holocene humid phase. The quantity of sherds recorded at sites is rather small, which can result both from deposition or post-deposition processes, as well as from pottery functions and methods of use. According to both Close and Gatto, the small number of sherds at the oldest sites may denote a special or even symbolic function of pottery (Close, 1995: 28; Gatto, 2002: 77). However, Wendorf and Schild (2001) are of the opinion that the increased quantity of vessels at El Ghorab sites in the Nabta Playa-Bir Kiseiba area may be attributable to their emerging utilitarian function (as containers), although the absolute number of vessel fragments at El Ghorab sites continues to be low. It seems that ceramic vessels were not the only containers used by herders. Already from the beginning of the Holocene, they used bottles made of ostrich eggshells. Indeed, Gatto made an interesting remark on the presence of the same decoration pattern on ostrich eggshell containers dated to the El Adam phase, and on the younger ceramic vessels from the El Ghorab phase (Gatto, 2002: 72). In her opinion, while this similarity may suggest a special or symbolic character of the decoration, it may also indicate that both types of containers were used for similar purposes.

The addition of pottery to the toolkit used by Early and Middle Holocene mobile herders had a number of consequences. On the one hand, it required knowledge, access to raw materials and a series of deliberate pottery-making activities. Due to their structure, the transport of vessels also required certain attention in order to avoid breakage. On the other hand, the use of pottery offered certain benefits. In most cases, ceramic vessels were open or closed spherical vessels with vertical or incurving rims, as well as simple open bowls that could be used for a variety of purposes, such as the storage, processing or even transport of products. In all likelihood, pottery became yet another adaptation tool, helping people survive in the harsh conditions prevailing in the Sahara during the Holocene humid phase.

The end of the 6th millennium BC saw some profound climatic changes in the Sahara. The desert began to desiccate, first expelling people from areas with limited access to water, and then forcing them to leave the desert altogether in the middle of the 5th millennium BC. Initially, people moved with their cultural heritage to or near oases, or even to the Nile Valley. Movements to the north, towards the Fayum or even the Nile Delta, were likely as well. At the same time, an important economic change took place, accompanied by the rise of cattle pastoralism across the eastern Sahara. Nomadic groups travelled with animals over large territories during the annual cycle, searching for water and pastures. Remains of human occupation are known from the Nabta Playa area (Late and Final Neolithic), Gilf Kebir (Gilf C-D) in the south, as well as from the Dakhleh, Kharga and Farafra oases (Bashendi B, Sheikh Muftah, Wadi el-Obeiyid C) in the central part of the Western Desert. In all these locations, pottery was still used, despite the mobile way of life.

The emergence of Badarian societies in the Nile Valley around 4,500 cal. BC coincided with the second dry spell in the eastern Sahara and the final exodus from the desert. People probably moved to the Upper Egyptian Nile Valley and to the south, thus following the monsoonal belt. The movement of people towards northern Egypt was also possible (Qasr el-Sagha, Merimde II) Therefore, researchers have increasingly often suggested the African or desert heritage of the Predynastic Egyptian civilisation (see Wengrow, 2003; Gatto, 2011; Mączyńska, 2018a). Some links between the desert and the valley are visible in pottery production. Fine examples are the so-called Tasian beakers known from Gebel Ramlah, Kharga Oasis (e.g. sites KS043 and KS051), Wadi el-Hol in the middle of the Qena bend, or even from the Wadi Atulla located in the Eastern Desert. Currently, the so-called Tasian culture is often discussed and identified with nomadic people coming from the desert, with cultural links to A-group and Nubian Neolithic (Darnell, 2002; Friedman & Hobbs, 2002; Gatto, 2010; see also Horn, 2017a; 2017b; Dachy *et al.*, 2018). Apart from the issue of the origins of Tasa pottery and Tasian society, links between black-topped pottery known from the Western Desert (Nabta Playa, central oases, Abu Muhariq Plateau) and Predynastic black-topped pottery typical for the Naqada society in Upper Egypt are the subject of discussion. Riemer and Schönfeld suggested that black-topped pottery known in the Nile Valley could have been initiated by the pottery tradition of the Western Desert at the end of the Holocene humid phase (Riemer & Schönfeld, 2010: 754-758). However, the issue of cultural connections between the Western Desert and the Nile Valley still needs more research.

5.3. The southern Levant

The emergence of pottery in the southern Levant is linked to a new stage in the development of farming communities in this area, referred to as the Pottery Neolithic. Pottery-making skills are believed to have appeared after the Pre-Pottery Neolithic and became a hallmark of the Pottery Neolithic. Recent research has shed new light on the transition from the PPN to the Pottery Neolithic. As a result, it is no longer seen as a collapse or a break in the cultural development of this region. This transition involved considerable social and economic changes, even with the continuation of a number of PPNB traits into the Pottery Neolithic. Particularly important in this context are the discoveries from the site of Kfar Ha-Horesh, where ceramic potsherds were found in layers dated to the Early and Late PPNB (Biton *et al.*, 2014). These finds have redefined earlier views on the introduction of ceramic vessels to the southern Levant. However, while the skills of pottery making and use were known before the Pottery Neolithic, ceramic containers began to be commonly used only in the Pottery Neolithic.

5.3.1. The origins of pottery in the southern Levant

Originally researchers were of the opinion that pottery was introduced to the southern Levant from the north. Given that the form and decorations of the early Levantine pottery were not primitive enough as for an initial production stage, its emergence was linked to migrations from other regions, including, first and foremost, the northern Levant (Kenyon, 1957: 82; Amirian, 1965: 243-247; Mellart, 1975). Currently, most researchers agree that early pottery production in the southern Levant originated locally and link it to the production of plaster for architectural and artistic purposes (Goren *et al.*, 1993; Banning, 1998: 206; Garfinkel, 1999; Rice, 1999: 5-6, 45; Gibbs, 2015: 347; Budja, 2016: 78).

Plaster products first appeared in the PPNA or even slightly earlier. Initially, burnt lime was closely connected with residential structures. It was used for the plastering of floors or walls and for the paving of installations. In the PPNB, this began to be used for the plastering of skulls, figurines, beads, as well as for making small vessels, such as bowls and basins referred to as White Ware, a name derived from their light surface colour (Goren *et al.*, 1993: 34). Towards the end of the 7th and during the 6th millenniums BC, such vessels became more common while closed forms began to be used alongside open forms (Garfinkel, 1999: 13-15, figs. 3-5).

It seems that there is a relationship between White Ware production and pottery production. Ceramic vessels are believed to have been a continuation of a tradition that began in the PPN. Remains of both technologies have been found alongside one another at a number of Pottery Neolithic sites (Garfinkel, 1999: 13). Another important point in the discussion on the origins of pottery in the southern Levant and its relations with White Ware is *pyrotechnology*. The term refers to a production process requiring high temperatures, necessary in both cases. In lime production, a high temperature (850°C) triggered decalcination of the raw material (limestone). The resulting quicklime was mixed with water, and the paste obtained in this way was used to form vessels that were subsequently dried. In the case of pottery, pyrotechnology is used at a later stage, in order to harden clay and to finish off the entire process. Although the timing of using high temperatures was different in each process, both of them had to be controlled by people and required specific knowledge and skills (Garfinkel, 1999: 12). The proponents of this hypothesis suggest that people skilled in pyrotechnology were capable of initiating pottery production without any external assistance (Banning, 1998: 206).

Some thoughts linking the origins of pottery with White Ware can also be found in the works of Y. Goren *et al.*, (1993: 37-39; Gopher & Goren, 1998: 224-225). Having analysed PPN materials in detail, these researchers noticed that the use of burnt lime was not as common as it was often believed and that the paste used to form White Ware additionally contained other materials, such as clay, dung, marl or soil. In their view, the use of other raw materials and their mixing with burnt lime could indicate a link between early Pottery Neolithic and Pre-Pottery Neolithic plaster and mud technology. Furthermore, these analyses inspired Y. Goren and A. Gopher to propose a hypothesis on the dichotomy of the origins of decorated and undecorated pottery in the Pottery Neolithic (Gopher & Goren, 1998: 224). Decorated pottery was always made of light-coloured calcareous materials, including marl or even burnt lime, and its sophisticated decorations required a lot of time and effort (see Yarmukian and Lodian pottery). Meanwhile, undecorated pottery was darker and made of mud. Following these observations, Goren and Gopher proposed a new explanation for the beginning of pottery in the southern Levant, including two different origins and development pathways of the new technology (Gopher & Goren, 1998: 224-225). In the case of undecorated pottery, the introduction of the new form of containers was inspired by their utilitarian functions and by the need for improvement in cooking and storage. However, the origins of decorated pottery go beyond a culinary explanation and are linked to rituals and symbolic contexts, in which White Ware was used as well, alongside figurines and other objects not related to architecture made of burnt lime (see also Rice, 1999: 45).

The hypothesis by Goren *et al.* (1993) has a few weak points. First of all, it focuses on a small part of Pottery Neolithic ceramic assemblages. Secondly, the relative share of decorated vessels is not greater than 10-25% of Yarmukian pottery, while most vessels found at sites are plain (75-90%). Furthermore, the latest studies on the functions of Yarmukian pottery suggest that both decorated and undecorated vessels were used for utilitarian purposes (Vieugué *et al.*, 2016: 103).

The other explanation for the introduction of pottery into the southern Levant has been proposed by Garfinkel (2014). He considers this event as a gastronomic revolution that opened up new possibilities in food preparation.

In the light of research conducted to date, southern Levantine pottery seems to be of local origin. Although its emergence is generally associated with technological development, the reason why ceramic containers began to be commonly produced and used continues to be unclear. Given the high popularity of the architecture hypothesis and the culinary hypothesis, it is possible that the new technology had a symbolic and utilitarian function for Pottery Neolithic people.

5.3.2. Yarmukian pottery

Yarmukian pottery was made of local materials sourced from near a given site (Garfinkel, 1999: 16). Most clays were calcareous while tempers identified so far include sand, crushed calcite, chalk, straw, basalt, grog, and flint (Vieugué *et al.*, 2016: 99). In the view of A. Gopher and R. Eyal, analyses of pottery from Nahal

Zehora II imply that paste was prepared in a labour-intensive manner, including, in particular, the mixing of alluvial soils and chalk (Gopher & Eyal, 2012c: 703).

Yarmukian vessels were made of coils or slabs by hand, although traces of moulding and pounding have also been observed. Mat impressions visible on some surfaces suggest that mats were used to form vessels. While vessel surfaces could be smoothed, some vessels still had uneven undulating surfaces (Gopher & Eyal, 2012c: 725). Yarmukian vessels were covered with slip and may have been burnished. Although, according to Garfinkel, red slip was a form of decoration, Gopher and Eyal do not preclude utilitarian reasons for its application (Garfinkel, 1999: 59; Gopher & Eyal, 2012c: 726). At Sha'ar Hagolan only 9% of all recorded sherds and 60.5% of all treated sherds have traces of slip, while in Munhata slip is present on less than 5% of all sherds and on 38.6% of all treated sherds (Garfinkel, 1999: tab. 6). In the assemblage from Nahal Zehora II, slip was recorded on 45% of all treated sherds found in Yarmukian layers.

While some Yarmukian vessels are burnished, such surface treatment may be present over plain, self-slipped or slipped vessels. Plain burnishing is considered to be a purely Yarmukian phenomenon. At Nahal Zehora II, it is present on 12% of all treated sherds. Other characteristic Yarmukian elements include rough surfaces, while in the course of the Yarmukian culture, honeycomb roughening also appeared (Gopher & Eyal, 2012c: 726-727). Moreover, the internal walls of some vessels show traces of wiping and smoothing using grass or straw.

In most cases, vessels were fired in an oxidising atmosphere, probably controlled by potters. However, pottery suggesting a relatively high level of firing atmosphere control is accompanied by fragments displaying a low level of such control (Gopher & Eyal, 2012c: 725).

Garfinkel (1999) presented a sophisticated typology of vessels of this cultural unit based on two features, namely their basic shape (open vs. closed) and size. Open vessels include small and medium-sized truncated bowls, small and big chalices, pots, basins, and pithoi (Fig. 8:2-4, 6). Closed vessels feature jars of various sizes with a spherical body, a long vertical neck and a simple rim with two lug handles (Sha'ar Hagolan jars) (Fig. 8:5, 7, 8), jars with a spherical body, a short vertical neck and a simple rim (Jericho IX jars), hole-mouth jars and large jars with an ovoid body, a wide flat base and an S-shaped profile (Fig. 8:1, 9).

Interesting observations about the frequencies of different vessel types and the functions of Yarmukian vessels from three sites, namely Sha'ar Hagolan, Munhata and Nahal Zippori 3, were made by J. Vieugué *et al.* (2016), who divided Yarmukian pottery into six functional classes, four of which were analysed in detail. The first group includes big pithoi, used for long-term storage. Group 2 consists of vessels used for the storage and transport of liquids, i.e. different types of small and medium-sized jars, mostly with handles, and decorated in some cases. Group 3 is represented by vessels used to serve and consume food, such as bowls of different sizes. Vessels showing signs of use-wear only belong to group 4. They include hole-mouth jars used for cooking, sometimes fitted with handles.

Statistical analyses of three ceramic assemblages showed that the most common group consists of vessels used for serving and consuming food (38%), which is fairly typical for settlement sites. The second largest group are big pithoi used for long-term storage (27%). Given the long-life span of such vessels and their lower replacement rate, their quantity may suggest that food storage played a particularly important role in the Yarmukian culture. As the vessels' capacity ranges from 40 to 100 litres, they could contain supplies for groups inhabiting compounds typical for the period in question. Jars used for the storage and transport of liquids with capacities ranging from 3 to 16 litres (group 3) are also well represented in, and constitute an important element of Yarmukian assemblages (approximately 15%). The fourth group of vessels, although the least numerous (7%), provides additional information on vessel functions. Charred residues in the form of organic impregnation trapped within vessel walls have been identified by Vieugué *et al.*, in all hole-mouth jars. In Vieugué's opinion, they indicate that such vessels were used for cooking. Marks on vessels also indicate that they were placed inside fireplaces and had direct contact with fire. Food inside vessels was boiled rather than fried or grilled, which is contrary to earlier observations on the low thermal shock resistance of Yarmukian pottery that precluded its use in open fire cooking (Gopher & Eyal, 2012c: 719 ; Vieugué *et al.*, 2016: 105). According to Vieugué *et al.*, one hole-mouth jar could hold from 11 to 29 litres of food, which was sufficient to feed the residents of a single compound typical for Yarmukian settlements (Vieugué *et al.*, 2016: 108).

The relative proportions of various vessel types recorded at Nahal Zehora II were somewhat different. The most common group here were variously sized bowls (46.5%). Small and medium-sized jars represent 4.8% of all assemblages, while only 1.4% of the Yarmukian ceramic assemblage from Nahal Zehora II are big pithoi used for long-term storage. Unfortunately, no use marks that would suggest open fire cooking were recorded on kraters (36.3%) and hole-mouth jars (9.1%) (Gopher & Eyal 2012c: 725).

An important feature of Yarmukian pottery is decoration, present on 10 to 25% of all vessels and found both on bowls (conical shapes and deep bowls with a slightly restricted orifice) and on tall handled jars. Vessels were decorated with incised and/or painted patterns. Incised motifs include, first of all, horizontal lines located below the rim or on the neck, zigzag lines and herringbone patterns on the body. All these elements come in a variety of arrangements (Fig. 8:2-3, 8) (Garfinkel, 1999: 64-65). Incised patterns are sometimes accompanied by painted decorations. Paint would be applied all over the non-incised surface or only on a part thereof (Fig. 8:7). Sometimes only a small space adjacent to or around incisions is painted (Garfinkel, 1999: 67). Incised decorations, including herringbone patterns and parallel lines, are present on more than 58% of all decorated sherds (excluding sherds covered with red slip) from Sha'ar Hagolan. At Munhata, these decoration patterns are present on 69% of all decorated sherds (Garfinkel, 1999: 61). Painted decorations in the form of triangles, zigzags, and lines in various arrangements on a beige background have also been recorded on Yarmukian vessels (Garfinkel, 1999: 61; Vieugué *et al.*, 2016). While decorated pottery represents a small portion of Yarmukian ceramic assemblages (10 to 25%), the great variety of decoration patterns has attracted researchers' attention. Gopher and Goren consider decorated pottery to be a continuation of the production of symbolic objects (figurines, beads) using plaster technology (Gopher and Goren, 1998: 224). Consequently, they are of the opinion that its meaning was symbolic. E. Orrelle and A. Gopher (2000) suggest non-utilitarian functions of decorations on Yarmukian pottery. They assert that pottery decoration could be linked to gender roles. In their approach, the triangles, V motifs, and zigzags present among decoration patterns should be seen as a single symbol, associated with vulvae. The red colour (paint or slip) in its vicinity should be interpreted as menstrual blood. The interpretation of Yarmukian pottery decoration presented by Orrelle and Gopher is a follow-up to their interpretation of figurines proposed earlier (Orrelle & Gopher, 2000: 299-300).

In addition, Gibbs (2013) associates decorated Yarmukian pottery with symbolic meanings. He is of the opinion that decorated pottery conveyed a certain symbolic message. Apparently, this pottery was a part of a rigid symbolic system in existence during the Yarmukian period, one which also included pottery. The system was easy to interpret and clear to understand. The complex decoration system of Yarmukian pottery does not give much freedom for interpretation. According to Gibbs, the variability of decorative motifs grew over time, which was accompanied by a shift towards simpler designs. The process is particularly visible in the case of Wadi Rabah pottery. The changes were associated with an increase in the ambiguity of pottery symbolism promoting more flexible interpretations (Gibbs, 2013: 80).

5.3.3. Lodian pottery

In terms of technology, typology, and decoration, Lodian pottery is in many ways similar to that of the Yarmukian culture, which is one of the arguments used by Garfinkel to suggest that both cultures were contemporaneous (Garfinkel, 1999: 101). However, Gopher is of the opinion that the existing differences are strong enough to consider both units as separate cultures.

Local clays and tempers were still used in pottery production. Such a situation was observed at the site of Lod, where vessels were made of marl clay of the Taqiya

Formation, the outcrops of which were located near the settlement, only a few kilometres to the east (Goren, 2004: 53; Paz *et al.*, 2005: 121-122). Local raw materials were also used at Nahal Zehora II. However, the analyses of pottery from the Lodian layers showed that the choice of raw materials evolved over time (Gopher & Eyal, 2012c: 702). Petrographic analyses of pottery indicated the presence of new raw materials used for paste preparation, different from those used by the Yarmukians (Nativ *et al.*, 2012b: 676). Although in the Yarmukian culture alluvial soil and chalk were mixed on site, Lodian pottery was made of terra rosa clay mixed with rendzina available locally. Raw material changes entailed some modifications to the organisation of the pottery production process. While terra rosa was a local material, it was transported to the site over a distance of approximately 10 km. This raw material was much easier to prepare than the raw materials used by Yarmukian potters (particularly as regards their mixing with rendzina). Thus, while transporting the material to the site took more time and effort, preparation of the paste itself was far easier.

A different situation was observed at Yesdot, i.e. another Lodian site (Nativ *et al.*, 2012a). As in Nahal Zehora II, clays used for pottery making were of local origin. Calcareous clay originated partially from the Taqiya Formation, and partially from Bira and Gesher deposits. Alluvial soils were taken from the Soreq River. Over time, the production of marl clay vessels decreased, while those made of alluvial soils became more numerous. According to A. Nativ *et al.*, the change may have been related to a preference for materials available closer to the site (alluvial soils) and to technological improvements (fine-grained calcareous paste was replaced with coarser and more ferruginous clay) (Nativ *et al.*, 2012a: 130). Furthermore, certain changes were also noticed in the choice of tempers. Ground chalk, wadi sand, and grog were added to the paste directly on site. However, in the period of the settlement's operation, the relative share of chalk grew from 40 to 90%. Both raw material and temper changes influenced the overall pottery production process. Unlike at Nahal Zehora II, where, despite the greater raw material transport distance, paste preparation became easier, Yesdot saw a shift to a more complicated procedure of mixing alluvial soil and chalk, which required more time, effort and skill. Such a change is not easy to interpret, one which, in the opinion of A. Nativ *et al.*, may even be linked to some symbolic meaning (Nativ *et al.*, 2012a: 132-133).

In 2016, results of petrographic tests of new materials from Lod were published. The materials included a single sherd made of marl of the Moza Formation, exposed along the Judean-Samarian anticline, at least 20 km east of Lod. It is the only Lodian sherd made of a raw material whose outcrops are located so far away from the production place. Due to its isolated character, any interpretations linking it to the question of contacts and exchange would be mere speculation at the current stage (van den Brink & Commenge, 2016: 21).

The Lodian method of vessel shaping and firing did not differ from the techniques known in Yarmukian assemblages. Pottery was made on mats using coils or slabs, although the former was used less frequently than the latter. On the basis of studies carried out at Lod, E. van den Brink and C. Commenge also suggest that bowls were moulded (van den Brink & Commenge, 2016: 13, 20).

So far, such surface treatment methods as smoothing, slip covering, burnishing, plain burnishing, roughening (including honeycomb roughening) have been identified in Lodian pottery. Garfinkel differentiated two slip colours, namely red and pale (creamy pink), with the latter always being a background for the former (Garfinkel, 1999: 95). Slip-covered surfaces could be burnished (e.g. on Jericho IX jars). At Nahal Zehora II, the relative proportion of slip-covered pottery was greater in Lodian layers than in Yarmukian layers, with more than 50% of treated bodysherds belonging to this group. Simultaneously, the quantity of burnished pottery (and plain burnished in particular) decreased. Surface treatments typical for the Lodian include burnishing over painted elements (Gopher & Eyal, 2012b: 551).

A different situation was observed at Yesodot, where one's attention is drawn to a high quantity of untreated pottery (without any surface treatment or decoration). Its relative proportion grew from 68 to 85% in the course of the site's occupation which was accompanied by a decrease in the quantity of treated pottery (Nativ *et al.*, 2012a: 122-123).

At Lod more than 76% of the pottery was plain (slightly smoothed or left unfinished) (Gopher & Blockman, 2004: 8).

According to Gopher and Eyal, vessels of the Lodian period were fired in a well-controlled low-to-medium temperature (Gopher & Eyal, 2012c: 727). Although most pottery is light in colour (cream, pink, pale brown, orange), according to Gopher and Eyal, the variety of surface colours was reduced compared with that of Yarmukian pottery (Gopher & Eyal, 2012c: 727).

Vessel shapes display continuity between the Yarmukian and the Lodian cultures, although Lodian sites additionally feature new forms (Fig. 9:1, 4-5). The relative shares of each vessel type at Lodian sites did not change much compared with Yarmukian sites. At Nahal Zehora II, bowls, kraters, jars and hole-mouth jars are present in similar quantities in layers corresponding to either culture. At most sites, the prevailing form are open vessels, including, in particular, variously sized bowls and kraters (Lod: 70%; Yesodot: 60 to 67%; Nahal Zehora II: over 86%), as they were commonly used for food serving and consumption. Hole-mouth jars, probably used for cooking, represent less than 10% of vessels found at the Lodian sites mentioned above. The frequencies of storage vessels, including small and medium-sized jars and pithoi, vary from site to site, which may be explained by different storage methods. Jars represent approximately 30% of the ceramic assemblage from Yesdot and around 22% at Lod (with amphoriskoi), as compared with only 2% at Nahal Zehora II. No fragments of large pithoi associated with long-term storage were recorded at Yesdot or Lod. However, at Nahal Zehora II, only 1.3% of the assemblage are large jars. Studies at the Yesodot site additionally showed that Lodian pottery changed over time. A reduction in the relative proportion of bowls from 64 to 40%, accompanied by an increase in kraters from 3 to 20% is clearly visible. Although these changes may reflect changes in culinary behaviours, they did not have any significant effect on the number of open vessels used in the settlement, varying from 60 to 67% of the entire assemblage.

In the Lodian assemblages some new features could also be observed (Fig. 9). According to Garfinkel, shallow and spherical bowls were far more common in this culture than in that of the Yarmukian (Garfinkel, 1999: 75). In Lodian assemblages, the number of jars with vertical or slightly inverted necks decreased, while in Yarmukian assemblages they were one of the most important vessel groups (Fig. 9:1, 3, 5) (Gopher, 2012c: 1588). According to Garfinkel, a characteristic feature of the Lodian ceramic assemblage is the Jericho IX jar, well represented in Jericho's Stratum IX (Garfinkel, 1999: 87). It is a medium-sized vessel with handles and a low neck, either straight or slightly everted outwards. In contrast, Gopher considers the inclined-neck jar with a spherical or oval body and an indentation or ridge between the neck and the shoulder as a typical Lodian jar (Gopher & Blockman, 2004: 10; Gopher & Eyal, 2012a). In the estimation of Gopher and Blockman, the Jericho IX jar is more closely linked to Yarmukian jars, considering it to be archaic rather than typical for the Lodian culture (Gopher & Blockman, 2014: 15). Other characteristic Lodian elements include cylindrical handles known from Jericho (Fig. 9:2, 7) (Garfinkel, 1999: 95).

Not unlike Yarmukian pottery, Lodian vessels were richly decorated. According to Garfinkel, the most characteristic feature of Lodian pottery are painted and burnished narrow or wide red/brown lines applied on a creamy/whitish slip, resembling the incised herringbone decoration of the Yarmukian culture (Garfinkel, 1999: 68). Painted motifs of the Lodian include triangles, lozenges, and zigzags (Fig. 9:1, 4). Some of them are made of thin or wide parallel lines. Another unique design of the Lodian culture is well-burnished and lustrous paint. Although rare, incised motifs do occur at Lodian sites. These include herringbone patterns inside a frame or frames of parallel lines (Fig. 9:6) (Garfinkel, 1999: 95-96; Gopher & Eyal, 2012c: 727-728). Painted decorations are known from cups, deep bowls, hemispherical bowls, as well as necked jars.

5.3.4. Wadi Rabah pottery

Compared with the ceramic assemblages of the Yarmukian and Lodian cultures, the pottery of the Wadi Rabah culture shows considerable differences in terms of raw material choices, shaping techniques, surface treatments, forms, and decoration. In the opinion of Gopher, Wadi Rabah pottery marked the technological peak of pottery production in the Pottery Neolithic (Gopher, 2012c: 1557; Gopher & Eyal 2012c: 723).

Raw materials continued to be of local origin. According to Garfinkel, a preference for carbonatic clay is visible (Garfinkel, 1999: 109). Studies of Nahal Zehora II pottery assemblages showed that pottery was made using rendzina soils, which being abundant in the vicinity of Nahal Zehora II, did not need tempering and could be readily formed in its moist state (Nativ *et al.*, 2012b: 676). It is, therefore, reasonable to conclude that pottery technology was further simplified by reducing the time and effort necessary for transport and preparation of the paste. Tempers added to Wadi Rabah pottery include a variety of materials, the choice of which was most probably determined by their local availability. The following materials have been identified so far: chalk (Munhata); grit (Nahal Zehora II); grog; and organic temper (Tel Te'o) (Goren, 1992; Gopher & Eyal, 2012c: 728; Goren & Halperin, 2001). Wadi Rabah pottery was made by hand using different techniques, namely coiling, slabbing, pinching and drawing. The coiling technique was used to form most of the inventory found in al-Basatin and Tabaqat al-Bûma and was the only method used in Nahal Zehora II (Gibbs, 2008: 267; Gopher & Eyal, 2012c: 728). A possible use of a stone mould was suggested by E. Yannai *et al.* with regard to some bowls from En Assawir (Yannai *et al.*, 2006: 64). Vessels may have also been finished using a tournette in the form of a stone mould or a round reed mat (Streit, 2016: 235). In the Wadi Rabah culture, firing was well controlled, probably in kilns that could create both an oxidizing and reducing atmosphere (Garfinkel, 1999: 10-19; Gopher & Eyal, 2012c: 728).

The quality of surface treatment on the pottery of Wadi Rabah is very high. Slip (red, orange, brown, dark brown, grey and black) and burnishing occur over large parts of the vessel surface or even cover the entire vessel. In Munhata layer 2A, 86.4% of all decorated sherds were covered with slip (red, black or both) (Garfinkel, 1992: 82). At Ein el-Jarba the pottery with burnished slip represents 71% of all decorated sherds. In Nahal Zehora II, in layers related to Wadi Rabah occupations, slip is present on 59% (Stratum II) and 56% (Stratum I) of all treated items (Gopher & Eyal, 2012b: 550). Plain burnishing and honeycomb roughening known from older units are absent from Wadi Rabah assemblages.

Major changes are also visible in vessel shapes produced and used by Wadi Rabah communities. One characteristic feature of this culture is a sharp carination between the neck and the body and/or between the shoulder and the lower part of a vessel, near the base. One's attention is also drawn to carefully formed rims (Fig. 10:4, 8, 11) (Garfinkel, 1999: 109). Typical Wadi Rabah vessels include carinated, S-shaped or V-shaped bowls, pedestaled bowls, mini bowls, jars with bow-rims, flaring rims, or collard jars, tabular stands, pithoi with thumb-impressed ledge handles and hole-mouth jars (Fig. 10:4-11). Churns, spouted bowls and spouted kraters appear for the first time (Garfinkel, 1999: 108-141; Gopher & Eyal, 2012c: 728). Hole-mouth jars are the most numerous group of Wadi Rabah ceramic assemblages from Ein el-Jarba (30.8%), Abu Zureiq (41.5%) and Munhata (38.3%) (Streit, 2016: 225, tab. 6.28). At Nahal Zehora II, they represented only 9% in Stratum II and 13% in Stratum I of all vessels. A large group of vessels at this site are kraters – 37% in Stratum II and 32% in Stratum I. Bowls of various shapes and sizes are plentiful at all sites (nearly 50% in Nahal Zehora; 32% in Munhata 2A; and 47.9% in Ein el-Jarba) (Gopher & Eyal, 2012b: 538, tab. 11.4; Streit, 2016: 225, tab. 6.28). Jars, including bow-rim jars, do not account for more than 10% at any site occupied by the Wadi Rabah people.

Although the pottery of the Wadi Rabah culture is decorated, considerable changes in the number of decorated vessels, as well as in decoration techniques and forms, are visible compared with the Yarmukian and Lodian cultures. Burnished slip, generally considered to be a decorative form on Wadi Rabah pottery, is accompanied by painted, incised and combed decorations. Painted horizontal lines are present on the inside or the outside of the rim or (less frequently) on the body, in the form of horizontal lines, parallel lines, semi-circles, triangles or a net pattern (Garfinkel, 1999: 142; Gopher & Eyal, 2012c: 729; Streit, 2016: 232). Incised motifs on Wadi Rabah pottery include net and herringbone bands (Fig. 10:1-3) (Garfinkel, 1999: 145; Streit, 2016: 232). Although combed decoration takes the form of wavy line motifs, this technique could also be used to form herringbone patterns and zigzags (Garfinkel, 1999: 142, fig. 90). According to Garfinkel, Wadi Rabah pottery also features impressed decorations made using a comb or a round/triangular stylus (Garfinkel, 1999: 145). These take a variety of forms, including dense puncturing, round or triangular impressions, lunar-shaped impressions or roulette impressions. Equally remarkable are plastic decorations in the form of pendants or figural representations (e.g. snakes from Munhata). One of the most noteworthy discoveries is a hole-mouth jar with two applied figurines from Ein el-Jarba. According to Streit (2015b), although the vessel's form is typical for the Wadi Rabah culture, its applied plastic decoration is unique for the southern Levant and shows affinities with plastic decorations from the northern Levant, or even Anatolia and south-eastern Europe.

The relative amounts of various decorative forms (other than burnished slip) vary considerably at Wadi Rabah sites. Although sherds with painted decorations are the least numerous type in Munhata 2A (0.4%), in Ein el-Jarba they account for approximately 17%, in Nahal Zehora II – 20% (Stratum II) and 23% (Stratum I) and in Aby Zureiq – nearly 26%. Incised sherds represent 10% of all decorated sherds from the Wadi Rabah strata in Nahal Zehora II, while they constitute less than 5% of the decorated assemblages at other sites. A similar situation is observed with regard to impressed and combed decorations, which, in addition, are absent from certain sites, such as Nahal Zehora II (Gopher & Eyal, 2012b: fig. 11:9; Streit, 2016: fig. 6:30).

Compared with Yarmukian and Lodian decorations, the assemblages of the Wadi Rabah show an increase in the range of decorative motifs and techniques, while a shift towards simpler decorative motifs is noticeable. According to Gibbs (2013), changes in pottery decoration were linked to changes in the symbolic system of the Wadi Rabah culture. The variability of motifs and their simpler designs may have been associated with the fact that their interpretations were more flexible than in the Yarmukian or Lodian cultures. In turn, this had an effect on the community, its relations with others and the boundaries between them. A more ambiguous symbolic system may have facilitated contacts and positively influenced social relationships.

5.3.5. Nizzanim pottery

Nizzanim pottery has been recorded at three sites, namely Nizzanim, Giv'at Haparsa, and Ziqim. The ceramic assemblage features coarse and crumbly sherds, mostly low fired. Vessel shapes are basic and undecorated for the most part. The prevailing forms include hole-mouth jars (ca. 46% in Nizzanim) and deep bowls (ca. 35% in Nizzanim). Although pithoi represent only ca. 20% of the assemblage, it should be mentioned that a high number of lug handles, possibly coming from pithoi, were found as well. A few sherds covered with red slip, as well as a few sherds with painted and incised decoration were also recorded (Garfinkel, 1999: 99).

5.3.6. Qatifian pottery

Qatifian pottery was made by hand of clay available locally. Petrographic analyses of the pottery from site P14 demonstrate its considerable similarity to pottery known from Qatif. According to Goren, the clay used to make pottery from both locations is of local origin and is typical for coastal environments, such as the Qatif area (Goren, 1988: 133*). Qatifian pottery was usually tempered with copious amounts of straw, although grit, sand, and shells were added as well (Gilead 2007: 43; Abadi-Reiss & Gilead, 2010). Due to the large size of temper particles, vessel surfaces are rough and uneven, sometimes with visible finger pressure marks. Moreover, C. Epstein drew attention to marks left by smoothing the surface by means of a bunch of grass (Epstein, 1984: 212). The pottery was fired at a low temperature, which is evidenced by the presence of a dark core (Epstein, 1984: 212; Goren, 1990: 101*; Abadi-Reiss & Gilead, 2010: 28). According to Epstein, Qatifian pottery was "coarse, heavy, crumbly, crudely fashioned and exhibiting little variety of shape" (Epstein, 1984: 212). Indeed, the latest studies on Qatifian pottery have confirmed its homogeneity in terms of technology (Abadi-Reiss & Gilead, 2010: 28).

The variety of vessel shapes is greatly limited. Most items found at Qatifian sites were, first of all, small and medium-sized bowls and hole-mouth jars. Little intra-type variability has been observed. At site P14, hole-mouth jars represent 23.5% of the entire assemblage, as compared with 42.9% at site D and 30% at site Y3 (Garfinkel, 1999: 191; Adadi-Reiss & Gilead, 2010: 28). Another characteristic feature of the Qatifian are pie-crust rims and loop handles located low on the body. Lug handles and pierced handles have also been recorded in Qatifian pottery.

Although most of the ceramic assemblages of the Qatifian are undecorated, some sherds do bear decoration. Garfinkel differentiated vessels covered with red slip and traces of painted stripes (Garfinkel, 1999: 197). Furthermore, the Qatifian assemblage features impressed and incised decorations. Another characteristic feature of Qatifian pottery is applied plastic rope decoration.

5.3.7. The Pottery Neolithic pottery tradition of the southern Levant – a summary

Although the circumstances in which pottery first appeared in the southern Levant are unclear, no trial stage has been identified in pottery production in this region, one typically associated with the learning of, and experimenting with a new technology. The technological sophistication of the early Pottery Neolithic pottery may be partially explained by its links with plaster technology, on the one hand, and the fact that White Ware requires a similar set of skills, on the other. However, one element is still missing from the above hypothesis, i.e. the reasons why people began to make clay vessels. While researchers link the early pottery with food preparation and storage and, simultaneously, see some symbolic meaning in it, the issue needs to be further researched.

From the very beginning of the Pottery Neolithic, pottery production was fairly advanced in terms of technology, which is demonstrated by the diversity of colours, surface treatments, firing and shapes in Yarmukian pottery. Vessels were made by hand of coils of local raw materials. Their surfaces were smoothed, although rough-surfaced vessels have also been recorded. There was a great diversity of forms, including jars, bowls, cups of different sizes, very often with burnished and decorated surfaces. Decorations, present in less than 25% of all assemblages, feature a variety of motifs and techniques and indicate a high level of pottery-making skills.

Lodian pottery was similarly advanced technologically and had many features in common with Yarmukian ceramic assemblages in terms of the choice of raw materials, vessel forming techniques, surface treatments, firing, vessel forms, or even decoration. The similarities were connected to still not fully explained links between both cultures which are sometimes treated as contemporaneous, and sometimes as consecutive cultural units. However, Lodian pottery has certain distinct features that make it different from earlier ceramic products, most probably resulting from the development of pottery production. Progress is visible in the paste preparation mode. Moreover, new vessel forms appeared and decoration techniques evolved. The most characteristic feature of Lodian pottery is decoration, including painted and burnished narrow or wide red/brown lines applied on top of creamy/whitish slip.

The pottery of the Wadi Rabah, the next Pottery Neolithic culture, stands out clearly from that of the two previous cultural units, i.e. the Yarmukian and Lodian cultures. Progress and innovations in technology, morphology or decoration are much more clearly visible. Potters' skills were significantly improved, which is testified by the choice of raw materials, forming techniques, elaborate burnishing, or control of the firing process to obtain the desired surface colour. In the estimation of Gopher, Wadi Rabah pottery marked the peak of the Pottery Neolithic technology (Gopher, 2012c: 1557; Gopher & Eyal, 2012c: 723). The gradual disappearance of vessel forms known from the Yarmukian and Lodian cultures is accompanied by the emergence of new types of bowls and jars. Decorations changed significantly, in terms of both techniques and patterns. Although a shift towards simple decorations is visible, the number of different motifs used is greater. It is likely that the changes in pottery production that took place during the Wadi Rabah culture were in some way linked to social and economic changes (a shift towards the nuclear family, changes in subsistence activities, the emergence of specialisation). Pottery production may have also been influenced by more intensive interregional contacts of Wadi Rabah communities with other areas, including the exchange of goods and ideas.

The analyses of Pottery Neolithic ceramic assemblages suggest their homogeneity. Moreover, the pottery of each Pottery Neolithic culture has certain common features. Some of these are easy to identify and are used by archaeologists in order to determine cultural identity or chronology (decorations, forms). However, some intra-site variability can be also observed within each culture. Site-to-site differences are visible in the choice of raw materials, surface treatments, shapes and even decorations. They may have resulted from a multitude of environmental, social or even symbolic factors affecting pottery production in a given location. Pottery production was determined by the availability of raw materials, social organisation and structure, subsistence system and demand at the site. In addition, ritual/symbolic behaviours may have influenced what vessels were produced and used locally. As a result, despite characteristic features visible across the entire cultural unit, each site has its own endemic features.

Variability during the Pottery Neolithic is not limited to the Yarmukian, Lodian, and Wadi Rabah cultures. A similar phenomenon can be observed in two smaller cultural units identified in this period, namely the Qatifian and Nizzanim. Although it is difficult to determine their character (culture, local variant, ware, style) and chronological position (the Pottery Neolithic or Chalcolithic period), their ceramic assemblages fit well in the Pottery Neolithic pottery tradition (raw materials, shapes). The existing differences between these two and the other Pottery Neolithic cultures (i.e. considerable amount of straw temper, low firing) may have also resulted from multiple environmental, functional, social or even symbolic factors. However, this question will not be answered without further studies.

Pottery is one of the most common discoveries at sites dated to the Pottery Neolithic. It provides a basis for differentiating archaeological cultures and is commonly used by researchers for the purpose of cultural identification and chronology determination. However, it needs to be remembered that an archaeological culture is an artificial term created to suit the needs of archaeology. It helps systematise archaeological evidence and put it in the framework of time and space. Archaeological cultures have little in common with past societies, while the boundaries marked by their names never really existed. The three main Pottery Neolithic entities identified by archaeologists do not necessarily correspond to actual human groups from the past. Therefore, the development of the pottery tradition in the Pottery Neolithic needs to be seen as a continuous process, without any cultural borders. After its emergence in the southern Levant, pottery production underwent dynamic changes visible in technology, typology, decoration, or even vessel functions. The peak of its development occurred during the Wadi Rabah culture, which constituted a basis for further changes leading to a new level of quality of pottery production in the Chalcolithic period.

In Search of the Origins of Lower Egyptian Pottery:
A New Approach to Old Data
Studies in African Archaeology 16
Poznań Archaeological Museum 2018

Chapter 6
Comparative analyses of the pottery of Lower Egypt, the southern Levant and the eastern Sahara

The purpose of the comparative analyses covering ceramics from Lower Egypt, the southern Levant and the eastern Sahara presented below is to identify the most important similarities and differences between pottery production in the 6th and 5th millenniums BC of these three regions. The results of the analyses will allow verification of two hypotheses concerning the origin of Neolithic Lower Egyptian pottery, linking it with the southern Levant or with the Western Desert.

The scope of the analysis covered pottery from all currently known sites in Lower Egypt dated to the middle of 6th and the 5th millenniums BC (Map 2), namely: Fayumian pottery from the sites on the northern shore of Lake Qarun (Caton-Thompson & Gardner, 1934; Ginter *et al.*, 1980; Ginter & Kozłowski, 1983; Kozłowski & Ginter, 1989); Merimde pottery (Eiwanger, 1984; 1988; 1992); as well as el-Omari pottery (Debono & Mortensen, 1990). The data from the Fayum was supplemented by the results of J. Emmitt's recent analyses of the Fayumian ceramics excavated by G. Caton-Thompson and E. Gardner (2011; 2017; Emmitt *et al.*, 2018). Moreover, the author takes into account the results of her own research on the Neolithic pottery presented in the Appendix (Tables 7abc-9abc).

Lower Egyptian pottery was juxtaposed with undecorated thin-walled pottery that emerged in the Western Desert during the Middle Holocene period (Map 3). The latter is characteristic for the Bifacial technocomplex distinguished in the central and northern parts of the Western Desert in the final part of the Holocene humid phase (Riemer *et al.*, 2013). Pottery from Sodmein Cave in the Eastern Desert, associated with this northern pottery tradition, is also addressed here (Vermeersch *et al.*, 2015).

This analysis also takes into account the Pottery Neolithic ceramic assemblages from the southern Levant, belonging mostly to three main cultures, namely the Yarmukian, the Lodian and the Wadi Rabah, despite the fact that these go beyond the timeframe discussed in this monograph (Map 4). The ceramic assemblages of the Nizzanim and the Qatifian cultures have also been taken into account, although their size and unclear chronological position and cultural identity affect their scientific value in comparative analyses.

Pottery collections from the three regions could not be analysed comparatively on the basis of statistical data. Although the ceramic assemblages studied here are mostly available in the form of scientific publications, there are significant differences in approaches to ceramic assemblages and in the way they are described, not only between regions but also between sites located in the same region. As a result, the available data, including statistics, is not homogeneous. Harmonising such data for the purposes of this research was impossible due to a lack of, or limited access to source materials.

The comparison was made difficult by the nature of ceramic assemblages from Lower Egypt, including, in particular, those from the Fayum, found in the first half of the 20th century. Desert assemblages were challenging too, both for their small size and a limited amount of detailed publications. Southern Levantine pottery seems to be the best understood, as it has been researched in accordance with the latest standards and numerous publication are available. However, comparative and parallel analyses are made difficult by a great diversity among sites, including large differences in the percentages of both vessel forms and surface treatments, existing even between sites of similar chronology in the southern Levant (Gopher & Eyal, 2012a: tables 11.5-6).

The pottery from these three regions is presented in detail in Chapter 5 and the Appendix. However, in order to facilitate the analysis, the basic pottery data has been arranged and presented in a similar way in this chapter. Given the nature of the available data, comparative analyses are carried out taking into account the principal stages in pottery production, as proposed by C. Orton *et al.*, namely procurement and preparation of raw materials (clay, tempers), forming vessels and pre-firing treatments, and firing (Orton *et al.*, 2010: table 10.1; see also Rice, 2005). Moreover, in the analyses two morphological features of pottery, namely forms and decoration, are also addressed.

Additionally, the analyses took into account the factors influencing pottery production defined by D.E. Arnold (1989) as part of ceramic theory. Thus, five of the seven factors outlined have been analysed in detail, namely: raw material resources; weather and climate; possible scheduling conflicts; the degree of sedentariness; and demand. Their analysis will help determine the organisation of pottery production in the regions in question.

6.1. Neolithic pottery production in Lower Egypt

6.1.1. The stages of pottery production

Procurement and preparation of raw materials (clay, tempers)

Locally available clay was used for pottery production during the Lower Egyptian Neolithic. The pottery of the Fayumian culture was mostly made of Nile clay. Thanks to analyses of pottery from sites at Qasr el-Sagha, it was confirmed that Nile silts originating from the Hawara Depression were used to make vessels. Moreover, lake sediments and lake silts were also used for pottery production. On the basis of analyses involving a portable X-ray fluorescence spectrometer, Emmitt identified four different raw materials used in the Fayum, originating from different sources (Emmitt, 2017: 149-150; Emmitt *et al.*, 2018). Although the identification of their exact location was impossible, in Emmit's opinion, the presence of multiple raw material sources indicates movements from outside the Fayum. Although Nile silts were also used for pottery production at Merimde, a number of different clay sources is suggested as well (Emmitt, 2017: 155; Emmitt *et al.*, 2018). The el-Omari pottery was made of two kinds of local calcareous clays present in the region of Wadi Hof.

Among tempers added to the Neolithic pottery sand and straw were recorded, although their relative proportions may differ from site to site. The oldest Merimde pottery was made also of untempered clay. At Sais I, untempered and tempered pottery coexists. In the pottery of Merimde phase II, straw-tempered pottery is well represented, while in phase III it accounts for a half of the entire assemblage.

In the younger ceramic assemblage of this site, Emmitt identified a number of tempers, including gravel, sand, quartz, limestone, and shells (Emmitt, 2017: 219-220). He also suggests that the frequency of using sand and gravel tempers decreased over time. As for el-Omari tempers, sand dominates over straw, which may be associated with the use of other clays, the quality of which differed from that of Nile silts. Moreover, crushed papyrus fibres and ochre were also confirmed inside sherds collected at Wadi Hof as intentional fillers (Debono & Mortensen, 1990: 25; Hamroush & Abu Zied, 1990: 117-127; Holmen, 1990).

The frequent use of chaff temper by Neolithic potters was likely related to the requirements of pottery technology in humid conditions. Chaff added to clay could improve drying and prevent shrinkage of wet vessels before firing.

While conducting analyses of Lower Egyptian Neolithic pottery, the author made some fresh observations. Voids of burnt straw found on the surfaces of vessel from all Neolithic sites are sometimes large and can be up to 2 cm in length. Moreover, impressions of other plant remains (including grains) are also visible. A very coarse organic temper is present even in the paste used for the production of thin-walled vessels, and covered with slip before firing. As a result, this kind of temper causes the slip to crack, peel and damage the vessel surface. The large amount of plant remains added to clay indicates that pottery was produced in households, where the remains of crops or other plants were probably available in large quantities, as they were commonly used (see Appendix).

Forming vessels and pre-firing treatments

Pottery was made by hand of coils joined together and using the pinching and hollowing method. The slab method emerged during phase III at Merimde and is also seen in el-Omari pottery. The inventories from the northern shore of Lake Qarun show both fine vessels with thin walls and pots with thick and uneven walls (Emmitt, 2011: 110). In the group of complete vessels studied by Emmitt, vessel thicknesses ranged from 5 to 12 mm, while their diameters varied from 5 to 50 cm. At Merimde, the wall thickness of Urschicht vessels was between 4 and 18 mm, while the rim diameter, depending on the form, varied from 3 cm to as much as 45 cm. In phase II, the minimum thickness of vessel walls increased slightly to about 5 mm, not exceeding 15 mm (Eiwanger, 1984: 25-26; 1988: 19-20). At el-Omari, wall thicknesses ranged between 5 and 15 mm while the rim diameter of most vessels ranged from 5 to 30 cm, although large vessels with diameters of between 30 and 42 mm were also present (Debono & Mortensen, 1990: tab. 3). Smoothing the inner vessel surfaces by means of a bunch of grass or straw was also used at the stage of vessel formation (Fig. 23). In the opinion of author, the pottery skills of all Neolithic cultures in Lower Egypt were comparable as they used the same methods during forming and shaping. Differences between sites (i.e. tempers, shapes) probably reflect differences in factors affecting pottery production (i.e. resources, subsistence strategies, demand).

The colours of pottery surfaces at all Neolithic sites range from black to various shades of grey, brown and red. It was only in the case of the sherds from Kom W and the Upper K Pits that Emmitt recorded 28 colours, of which red as the dominant colour occurred only on 8.1% of all sherds (Emmitt, 2011: 104-105). At Wadi Hof, ochre was added to the paste to ensure vessels had a red colour. The increase in human skills in controlling the firing atmosphere and obtaining high temperatures had an impact on more uniformly coloured surfaces of vessels during the Neolithic.

Surface treatments recorded on the Neolithic pottery of Lower Egypt included slip, burnishing and smoothing, although vessels with rough surfaces were also present. In the sample from Kom W and the Upper K Pits studied by Emmitt, 68.9% of all sherds were too worn to identify the surface treatment method used (Emmitt, 2011: 100-102). Among sherds with preserved surface treatment, he identified ceramics with slip and burnish (11.5%), as well as ceramics that were only covered with slip (7.4%) or only burnished (2.7%) (Table 2) (see also Emmitt, 2017: 200-201). Apart from red and black slip, orange slip was recorded too. Burnished surfaces prevail over smoothed surfaces at Merimde (62.5%) and Sais (67.25%), although the percentage of burnished ware decreased during phase II (to 53%) and that of smoothed ware grew from 33.7% to 46.7%. In phase III, these proportions remained almost unchanged (Table 2) (Eiwanger, 1992: 19, Abb. 4). Moreover, in the latter part of the Neolithic, the burnishing direction and the quality of this surface treatment changed as well. Although in the el-Omari assemblage the dominance of burnished vessels covered by slip is clearly visible (62%), the burnishing was not done carefully and consistently (Table 2). F. Debono and B. Mortensen point out sherds blackened with fire or soot, found in el-Omari pottery (Debono & Mortensen, 1990: 26). These may have been imitations of black-topped vessels. Alternatively, the surface colour may simply be the result of placing them upside down in ashes during the cooling process in order to prevent them from cracking.

Firing

The uneven surface colouration of most Fayumian vessels suggests a simple open firing process and its incomplete control, with interrupted access to oxygen. The likely firing temperature was approximately 600°C. According to Emmitt, fire-clouds identified on part of the ceramics concerned indicate that vessels were surrounded by fuel during the firing process (Emmitt, 2011: 107-108). He also suggests the use of dung as fuel. Pottery analyses on materials from Qasr el-Sagha also suggest firing at a temperature of approximately 600°C, both in oxidizing and reducing conditions. At the beginning of the Merimde culture, the arrangement of the firing process was similar to that known from the Fayum. The emergence of grey-coloured vessel surfaces in phase II, and additionally black surfaces in phase III, could be interpreted as progress in pottery-firing technology, attributable to improved control of firing conditions and oxygen availability during the process. In case of el-Omari pottery, one's attention is drawn to a relatively high temperature of approximately 800ºC, in an oxidizing environment. Although such high temperatures could be reached in open firing, it called for skills and know-how. The suggested presence of vessels with black tops in the el-Omari culture could have also been linked to a thorough understanding of the firing process and an ability to control oxygen access (Hamroush & Abu Zied, 1990: 122).

Forms

The most plentiful shapes of the Fayumian culture are open vessels, namely hemispherical, spherical or conical bowls. Deep jars with a restricted mouth (hole-mouth jars) also occur. Fairly numerous are rectangular bowls, vessels on a raised base and vessels on 'knobbed feet' (Figs. 1:1-4; 2:1-2; 3:1-5; 4:1-3; 11-15). Emmitt suggests a preference for unrestricted vessels with flaring and straight rims among the Fayumian assemblages. However, in the Upper K Pits, restricted vessels represent 60%, which may be attributable to the site's function as a storage place (Table 3) (Emmitt, 2011: 99-100).

Vessel forms in the oldest phase of Merimde seem to be very similar to those of the Fayumian culture. They include hemispherical, spherical and conical bowls, vessels with vertical walls or deep vessels with a restricted mouth (Figs. 1:5-7; 2:3-4; 3:6-8, 11; 16-20). Open forms prevail in both burnished and smoothed ware (Table 3). However, in Sais I, closed forms prevail over open forms. Additionally, some fragments of broad jars, known from the younger phases of Merimde, are also known from Sais I (Wilson *et al.*, 2014: 118–121, figs. 113–114). During phases II and III of the Merimde settlement, an increase in the number of closed forms could be observed. In the last phases of Merimde, the domination of closed forms over open forms is clearly visible in the group of burnished wares, although open and closed forms were recorded in similar numbers in smoothed ware. Moreover, in the younger phases of the Merimde site, new forms of closed vessels appeared, namely jars with a S-shaped profile or burnished jars with a globular body and a long neck (Figs. 5:7-8; 6:1-2, 4, 7; 16:15-16; 20:1, 3, 6).

At the site of el-Omari, open forms prevail over closed forms. The percentage of vertically walled vessels is also high (Table 3). Among the most numerous shapes, there are fairly deep restricted spherical vessels (some with a S-shaped profiles) and vessels with vertical walls. Conical bowls with flat bases are plentiful as well. Vessels with long necks and rims everted outwards, similar to Merimde III bottles, are also present. Some fragments of pottery with a knobbed base, known from the Fayumian culture, were also recorded (Figs. 1:13-15; 2:9-11; 3:17; 4:9-10, 12; 5:10-14; 6: 3, 5-6, 19; 21).

Decoration

Neolithic pottery is rarely decorated. In the Fayumian culture, knobs constitute the only form of decoration but are also found on pottery at Merimde and el-Omari. The oldest pottery of Merimde and Sais was decorated with an incised herringbone pattern (Fig. 22). This kind of decoration is present on burnished vessels, either under the rim or on the upper part of the vessel. The decorated area is not burnished. The pottery of Merimde II was not decorated, except for knobs identified on a few vessels. In phase III, decorated pottery became more numerous, with a greater variety of techniques (incised, impressed, plastic, painted) and motifs. A range of horizontal, vertical and diagonal lines and oval, or even crescent-shaped indentations, were identified.

6.1.2. The organisation and development of pottery production in Neolithic Lower Egypt

Resources

Determining the exact location of sources of raw materials used for pottery production in Lower Egypt is not always possible. At each known Neolithic site, clays from deposits located at some distance from the site were probably used. Extracting clay from such deposits may have accompanied movements across the area concerned, thus being part of exploiting the abundant resources of the region.

Ethnographic studies investigating the distance between resources and the place of pottery production concentrate primarily on sedentary or semi-sedentary populations. Among these communities, the maximum distance to clay deposits was 50 km, although in most cases the sources of raw materials were located 7 km or less from the production site (Arnold, 1989: 50). However, the logistics of raw materials procurement may have been different in the case of mobile groups, while distances may have been greater than those observed in the case of sedentary or semi-sedentary communities. A 20-30 km round trip is suggested by L.H. Kelley as the upper limit of the distance that mobile hunter-gatherers could walk in a day (Kelley, 1995: 133). Assuming that the Neolithic groups from Lower Egypt were partly mobile and their existence was based on movement and using resources (materials and food) located within an area they occupied and probably knew well, they may have used multiple clay deposits located at distances ensuring their return home before sunset. N. Shirai suggests that the people of the Fayumian culture obtained lithic raw materials from different locations within the area between the lake and the Nile Valley at Gebel el-Rus and Gebel Lahun (between 10 to 30 km to the Neolithic sites) and at Ilwet Hialla and Umm es-Sawan (ca. 14 km north of Kom K) (Shirai, 2010: 278-292). A parallel situation may have taken place in the case of clay. Tempers were probably also sourced from similar locations.

Other materials necessary for pottery making, i.e. water and fuel, were also easily available in the vicinity, as the sites were located in rich ecological niches (Barakat, 1990; Wilson *et al.*, 2014: 149). The presence of water had a positive effect on vegetation including, in particular, trees. Indeed, most charcoal samples from the sites in the Fayum were identified as originating from tamarisk or other typical waterside trees (Marston *et al.*, 2017; Wendrich & Holdaway, 2017). Tamarisk and acacia were also identified among el-Omari charcoals (Barakat, 1990). Emmitt additionally suggests the use of animal dung as firing fuel in the Fayum (Emmitt, 2011: 107-108).

Vessels were made and fired in places used for an extended stay, next to other activities (production of food, production of lithics and baskets). Pottery was made at Kom W as indicated by an unfired clay vessel found on the site, large vessels not suitable for transport and hearths which could have been used for pottery firing (Emmitt, 2017: 243-244). Emmitt suggests that pottery production at Kom W was not routinised and that vessels were made only when necessary (Emmitt, 2011: 131-132). At present, there is no evidence that would clearly indicate the local production of pottery at the Merimde and Sais sites or in Wadi Hof. However, given the presence of a large number of vessels and their widespread use, such production would have had to take place at or near the sites, while the structures recorded at the sites could also have been used for vessel firing.

Weather and climate

Although, according to R. Phillipps *et al.* (2012), the Fayum was located beyond the reach of the ITCZ in the Early and Middle Holocene periods, it was influenced by the southward movement of Mediterranean winter rains (see also Welc, 2016: 276-277). Winter rainfalls and cooler conditions, both being of key importance for crop farming in this region, may have had a negative effect on pottery production in general, and vessel drying and firing in particular. As a result, pottery production may have been confined only to periods when temperature and humidity levels were favourable for pottery making, including first of all warm summers (see also Köhler, 1997 for the Predynastic period). Higher temperatures during summer periods could have limited the migration of people across the area, while the high-water level in the lake associated with the Nile floods, guaranteeing access to water and diverse wildlife (fish, birds, animals) allowed for longer stays in one place, thus favouring pottery production (Table 4).

In the second part of the Neolithic, the negative impact of climate and weather on the pottery production could have also been reduced by stable settlement structures. There was also a great popularity of using chaff as temper, which makes it easier to dry vessels before firing.

Seasonal pottery production may have taken place at sites close to branches of the Nile, namely at Merimde and Sais, and even at Wadi Hof. In addition, H.A. Hamroush and H. Abu Zied suggest that the el-Omari people used the Nile flood plain for crop cultivation after the floods (Hamroush & Abu Zied, 1990: 92). The presence of a small number of vessels made from Nile silt in the el-Omari assemblage may be linked to the presence of the inhabitants of Wadi Hof on the floodplain in connection with the cultivation or use of other river resources available there, including, in particular, fish. A small amount of pottery could have been made during the harvesting and processing of crops, or intensive fishing in the late summer (Table 4).

Degree of sedentariness

For many years, the Neolithic societies of Lower Egypt were considered as fully sedentary. Currently, however, a certain degree of mobility connected with the use of many different resources available in the environment has been implied. Some degree of such mobility has been suggested for the Fayumian culture on the basis of flint and pottery analyses (Holdaway *et al.*, 2010; 2016; 2017; Phillipps *et al.*, 2016ab; Holdaway & Wendrich, 2017; Emmitt, 2011; 2017; Emmitt *et al.*, 2018; contra Shirai, 2017). Moreover, the results of recent wood charcoal analyses from the Fayum show the use of a few ecological zones for wood gathering. This particular observation could also be treated also as an indicator of mobility in this area in the period in question (Marston *et al.*, 2017).

In the estimation of Emmitt, places where pottery was produced had to be occupied long enough for the whole production process to be completed (Emmitt, 2011: 132). Vessels may have been produced at extended stay sites, where lithic items were made, food was cooked and other activities were carried out. However, they could not have been possibly made in transit. When leaving a given location, people would take those vessels that were useful on the way. Other vessels were probably left behind in the form of 'site furniture'. Subsequently, when returning to a given location, people would use both the vessels they carried with them and those constituting the site's 'equipment'. Particularly remarkable among the latter are large vessels, whose dimensions and weight made them perfect 'site furniture'. As they were used for storage, it was their contents that may have made people come back. Storage facilities (including large vessels) located in various locations within the area used by the Fayumians became permanent points in their settlement pattern (Emmitt, 2017: 242-243).

In the light of the most recent research, the Merimdians also travelled across Wadi Gamal and exploited available resources for hunting, food processing and working tools (Rowland, 2015; Rowland & Bertini, 2016). Round structures recorded in phase I of the site, probably constituting part of a camp, have been interpreted in the context of seasonal occupation (Wetterström, 1993). Pottery may have been made within the camp, while the hearths recorded there may have been used for vessel firing. Movement across Wadi Gamal did not necessarily influence pottery production, since if it was practiced in places used for a longer stay (e.g. seasonal camps), it could have been pursued independently of, and simultaneously with other activities, not unlike in the Fayum. In the younger phases of Merimde, when settlement structures became more stable, dense and complex (thus denoting permanent human presence), pottery production could have been practiced within the settlement, inside households or in their vicinity.

A similar situation may have taken place at Wadi Hof, a rich ecological niche exploited by the el-Omari community. With its numerous structures in the younger occupation phases (including a semi-subterranean circular hut), the settlement may have served as a permanently inhabited central place, from where expeditions to other parts of the region were organised. Pottery production may have been located in the vicinity of clay outcrops in one of the places of activity located around the main settlement sites. A small amount of pottery made of Nile silt may indicate that pottery production was also located on the Nile floodplain, a place visited in search of fish and in connection with crop farming (Hamroush & Abu Zied, 1990: 92).

Scheduling conflicts

In the early studies on the Neolithic in Lower Egypt, domesticated plants and animals from the Fayum were treated as an important source of food for humans. However, recent studies have largely changed this view. According to R. Phillips *et al.*, domesticated grains were not extensively used in the Fayum (Phillips *et al.*, 2016b: 12). Moreover, they were adopted rather late, probably in the 5th millennium BC. Although Shirai (2017) has suggested that cereals could have been introduced earlier, in the early or middle 6th millennium BC, due to its experimental character, early cultivation is not well recognised. In both cases, the initially minor role of domesticated crops in the human diet may have helped avoid scheduling conflicts with pottery production. In the Fayum area, crops were sown after summer inundations, probably in lake basins. The growing season coincided with the cold and humid winter (November – April). As this part of the year was unfavourable for pottery production, scheduling conflicts were minimised. Pottery production may have begun after harvesting – not only because of favourable climate conditions but also due to demand for storing grain in ceramic vessels (Table 4).

A similar situation is clearly visible in the case of domesticated animals. Although their bones in the Fayum are dated to the middle of the 6th millennium BC, V. Linseele *et al.* (2014) stress their unclear context. Studies conducted in the Fayum indicate that domesticates were only an addition to wild food (Phillipps *et al.*, 2016b: 12). Faunal analyses indicate the major importance of fish among groups that occupied the northern shores of Lake Qarun (99% of all identified faunal remains). On the basis of the predominance of adult/spawning fish, Linseele *et al.* have suggested that fishing was probably practised in the late summer months, namely August/September or slightly later (Linseele *et al.*, 2014; Phillips *et al.*, 2016b). Compared with fish, other wild animals did not constitute an important source of food for the Fayumians, while the quantity of their bones in the assemblages makes it reasonable to suggest that hunting was an opportunistic activity, practiced all year round (Linseele *et al.*, 2014).

Fishing, hunting and pottery production may have been practiced in the Fayum at the same time, namely in summer (Table 4). Currently, the available evidence is insufficient to determine the existence of a scheduling conflict between them. Since pottery was produced as and when necessary in places of extended stay during dry and warm periods, its simple technology and firing conditions did not necessarily interfere with other activities, including, in particular, those related to food supply (fishing or hunting). A lack of scheduling conflicts between pottery production and other activities (including subsistence strategies) seems also likely in the case of the early occupation at Merimde and Sais. Mobility coupled with rich environmental resources available all year round, as well as the seasonality of various activities, allowed for the flexible organisation of pottery production during the Early Neolithic.

Domesticated plants and animals were also known to the inhabitants of Wadi Hof. However, the diet of the inhabitants of Wadi Hof was primarily based on fish, along with products supplied by domesticated animals. The richness of natural resources in Wadi Hof and in its vicinity, as well as the probably permanent human presence, made it possible to organise pottery production in a manner preventing possible scheduling conflicts with important subsistence strategies. Assuming that crop farming was linked to the Nile floods, it was of a seasonal nature (took place mostly after floods and during winter). In addition, it was at a rather early stage of development. As such, it probably did not create any conflicts with pottery production.

Probably in the 5th millennium BC, the Nile Delta saw a reduction in the mobility of human groups, accompanied by a more stabilised settlement activity. Both processes may have been linked to the growing importance of domesticated plants and animals as food resources. Remains from Merimde show that, during the 5th millennium BC, farming and breeding became important subsistence strategies. Although fish are still present in faunal assemblages, their relative proportions are far lower than those recorded earlier. Pigs begin to appear among domesticated animals, which, according to Linseele *et al.* (2014), is a discernible marker of reduced mobility among Neolithic communities. Such a reduction in mobility may have had a positive effect on the development of pottery production. Pots may have been formed and fired as and when needed in a given household, rather than only in periods of extended stay in one location. Scheduling conflicts with farming, herding, or other activities followed by sedentary groups, may have been resolved by a division of labour. Arnold suggests pottery production could have been easily introduced as an additional activity for women, as they were closely attached to households because of pregnancy, infant care, and other tasks (Arnold, 1989: 100-102).

Demand

In the Fayumian culture, pottery may have served a number of functions, from storage to processing, to cooking and serving, and through to transport. Before the introduction of domesticated grains, ceramic vessels may have been used for processing 'wild' foods. P. Jordan and M. Zvelebil, as well as P. Rice suggest that in non-farming communities pottery introduction and adoption was best suited to aquatic zones owing to the abundance of foods, including both aquatic fauna (fish, water mammals, birds), as well as wild plants (Jordan & Zvelebil, 2010: 58; Rice, 1999: 21). Ceramic vessels made it possible to use these resources efficiently for both storage and processing. The introduction of domesticated plants and the growing importance of domesticated animals surely extended the range of uses and functions of ceramic vessels.

The prevalence of open forms and simple shapes in the early Neolithic promoted using the same vessels for multiple purposes (Table 3) (Mączyńska, 2017). Owing to their reduced permeability, vessels with slip and burnishing may have been additionally used for the storage of liquids. Ceramic containers were in common use and people relied on them, both in transit and during longer stays in a given location. Both portable pots and 'site furniture' were also in use. In places of extended stay, potters manufactured vessels that were immediately necessary, but also due to their breakage. When it comes to large storage vessels, the situation may have been different, as such vessels were not carried from one place to another. Instead, they were used for the storage of grain. The demand for these vessels appeared probably after the harvest when grain had to be properly stored.

The variety of vessel forms known from Merimde and el-Omari settlements, coupled with the lack of detailed data concerning their function, renders it impossible to precisely analyse the effect of demand on pottery production. As in the Fayumian culture, they may have been used for a number of activities (food storage, preparation, serving or transport). Particularly remarkable are the cord marks recorded by Emmitt on Merimde pottery, formed during vessel transport (Emmitt, 2017: 221). Other interesting observations have been provided by the Sais site. While its chronology is similar to that of Merimde, unlike in Merimde I, most burnished ware items recorded in Sais are closed forms. The difference may be linked to the key function of the site, namely a fish-catching station.

The production of clay vessels during the Neolithic period in Lower Egypt changed from a seasonal activity pursued between transits to a permanent activity. In both cases, production was not routinised and output was regulated by demand. People probably made vessels to cater for their own needs. Changes in the organisation of pottery making resulted from the reduction of human mobility and the emergence of permanent settlements, as well as from an increase in the importance of farming and herding. The technological and typological development of pottery also took place at this time. Next to simple shapes known from the Fayum or Merimde, new forms emerged. The number of closed forms used to store a variety of products increased. The dominance of vessels with flat bases, ensuring greater stability on flat surfaces, such as household floors could be observed. A greater variety can also be seen among surface treatments, although their quality in some cases decreases, perhaps due to a declining importance of decorative functions. The ceramic assemblages also indicate an increase in potters' skills during firing. The ability to control oxygen made it possible to obtain a range of different surface colours. In the last phase of the Merimde settlement, pottery decorated with various motifs and techniques appeared. Although it is impossible to understand meaning of decoration in this context, the presence of this new feature of the Neolithic pottery may also indicate its additional non-utilitarian function, which may have emerged during the development of the Neolithic communities (Rice, 2005: 266-272).

6.2. Middle Holocene pottery production of the central and northern part of the Western Desert

6.2.1. The stages of pottery production

Procurement and preparation of raw materials (clay, tempers)

In the Western Desert, pottery was produced using both clay and tempers available locally, although precise data on the location of clay deposits is not available. Only in the case of the Dakhleh or Farafra oases, has detailed research indicated sources located within the given oasis, although the use of other deposits is not excluded either (Eccleston, 2002; Muntoni & Gatto, 2014: 456; Warfe, 2018: 61-73). Local or oasis origin is also suggested for Djara pottery (Riemer & Schönfeld, 2010)

Tempers added intentionally to clay include mostly quartz, shale and organic temper in the form of straw or other plant remains, as well as seeds of different sizes. At the Dakhleh Oasis, gypsum (anhydrite) was recorded and in the Late Djara B sherds, limestone grit. In addition, some vessels were also made of naturally tempered or untempered clay (e.g. Abu Tartur and Farafra Oasis). The surprising lack of shale temper in the pottery from the Farafra Oasis is explained by the absence of shale deposits in the oasis (Muntoni & Gatto, 2014).

Forming vessels and pre-firing treatments

Undecorated thin-walled vessels were made by hand of coils. Vessel walls are narrow, ranging from 3 to 7 mm. Surface colours are dominated by different tones of brown, although vessels with red or gray surfaces have also been found. Vessel surfaces are smoothed, although rough surface vessels are known in this context. Slip and burnishing have been recorded on some sherds too. Differences in surface treatments are visible among various sites. On the Abu Muhariq Plateau, most sherds have burnished surfaces (18 out of 38 sherds). Rough sherds are less numerous (8 out of 28 sherds). Although a red coating has also been recorded, this sherd group is the least numerous (2 out of 38 sherds) and is linked to the Late Djara B and the Bashendi B cultural units (Riemer & Schönfeld, 2010: 731-734; 750; fig. 7c). For the Dakhleh Oasis, A. Warfe suggests that most sherds have plain, compacted surfaces (Warfe, 2018: 54-57). While coating appeared during the Bashendi B period, it was rarely used for vessel surface finishing. Warfe also noted a considerable investment of labour in finishing the Bashendi pottery, visible in the symmetry of vessel forms, straight rims, smooth and even surfaces and uniform wall thickness (Warfe, 2018: 52).

When it comes to Farafra pottery, surface treatment is difficult to identify because sherds are either completely or partially abraded. Only in the case of a single potsherd from the Hidden Valley were traces of smoothing on the external and internal surfaces recognised (Muntoni & Gatto, 2014). It is worth mentioning the presence of blackened rims in a few locations on the Abu Muharque Plateau and in the Dakhleh Oasis.

Firing

Vessels were probably fired in an open fire, as implied by their non-uniform colouration and numerous dark grey or black fire stains on the surface (e.g. the Abu Muhariq Plateau) (Riemer & Schönfeld, 2010: 740). Moreover, the low hardness of some sherds of the Late Djara B culture may indicate low-temperature firing (Riemer & Schönfeld, 2010: 730-731). Some Bashendi B vessels were fired at low temperatures, which made them fragile. Detailed studies on the pottery from the Farafra show that vessels were fired in a semi-controlled oxidizing atmosphere at a maximum temperature of 700°C (Muntoni & Gatto, 2014).

Forms

Given the small number of sherds recorded at the desert sites, vessel reconstruction was possible only in a few cases. Undecorated thin-walled pottery is dominated by simple forms, namely open bowls, open bowls with straight walls, hemispherical bowls, and deep restricted vessels (Fig. 7). Although most vessels have rounded rims, some pointed and flat rims have also been found. Pots have rounded or pointed bases, are rather small, with their rim diameters ranging from 10 to 20 cm. One's attention is drawn to the thin walls of vessels requiring specialised skills from potters during forming and shaping.

Decoration

The pottery of the Bifacial technocomplex is not decorated. However, at some sites dated to the Middle Holocene period, decorated imported pottery was found next to undecorated local vessels (e.g. Mudpans, Eastpans, Dakhleh Oasis). Sherds with a characteristic elaborate decoration are typical for the southern part of the Western Desert for the Khartoum-style technocomplex. In the northern part of the Western Desert, Khartoum-style vessels or sherds are treated as imports which appeared in the region due to the mobile way of life of hunter-gatherers and herders and the mingling of ideas (Warfe, 2018: 75). In the opinion of K. Kindermann and H. Riemer, the undecorated pottery of the northern tradition derives from Khartoum-style pottery (Kindermann & Riemer, in press).

The only exception of probably local decoration is known from the Eastern Desert. An incised herringbone pattern was recorded on one sherd from Sodmein Cave. The decorated fragment belonged to a hole-mouth jar, probably with a diameter of approximately 18 cm. Its inner and outer surfaces are red and burnished (Fig. 7:8).

6.2.2. The organisation and development of pottery production in the central and northern part of the Western Desert

Resources

The exact location of deposits from which clay or tempers for pottery making were sourced cannot be possibly determined. Herders who made and used ceramic vessels probably had a fairly thorough knowledge of the environment within which they operated seasonally. The knowledge of places offering essential raw materials (including those for making tools, such as lithics and pottery) helped them survive in the challenging conditions of a savannah environment. Clay and temper deposits were probably located in the vicinity of vessel-making sites. However, in the eastern Sahara where mobile groups travelled, the distance to raw material sources may have been greater, extending beyond the confines delineated for sedentary groups (Arnold, 1989: 50). In the opinion of Kelley, the maximum distance that hunter-gatherers could walk per day was 20-30 km (Kelley, 1995: 133). Raw material sources were probably located within such distances. Only in the case of the Dakhleh or Farafra oases, have sources located within the oasis been pointed out.

The undecorated thin-walled pottery from the eastern Sahara is not homogeneous in terms of fabric. Although Riemer and Schönfeld (2010) identified three different fabrics for the Late Djara B culture, they noted that most recorded sherds do not fit well into these categories and exhibit a mixture of a few of them. A parallel situation can be observed in the Dakhleh Oasis (Warfe, 2018: 52-54). The variety of recorded fabrics of which the vessels were made may be the result of different pottery production sites and different raw material sources.

Apart from clay and tempers, two other important raw materials were necessary for pottery production, namely water and firing fuel (Arnold, 1989: 53-54). Although the climate in the eastern Sahara in the Middle Holocene was milder than today, access to water sources was not equally simple in all locations. The presence of artesian springs in oases encouraged people to set up production sites in their vicinity. A lack or limited availability of water could render pottery production difficult or simply impossible. In the northern part of the Abu Muhariq Plateau, long distances between water sources (more than a day's walk) were the reason for the scarcity of pottery in the area (Riemer & Schönfeld, 2010: 752-753).

Vessel firing was an important stage in pottery production. The fuel necessary to sustain a high firing temperature was most plentiful in places with a permanent water presence. In the Farafra Oasis in the Hidden Valley, a large palaeobotanical sample with 30 different taxa has been identified. Acacia and tamarisk trees, found there in large quantities, may have been used during firing (Lucarini, 2014).

Weather and climate

In the Middle Holocene period, the southern part of Egypt was under the influence of monsoonal summer rains, while its northern part was dominated by a winter rain regime. It has been commonly accepted that the annual rainfall for the eastern Sahara during the Middle Holocene ranged between 50 and 100 mm (Kuper & Kröplin, 2006). Rainy seasons were separated by dry periods during which people may have faced difficulties in accessing water. Furthermore, average temperatures in the eastern Sahara grew in the Middle Holocene. Although the evaporation rate did not exceed 3 mm annually in winter, in summer it even tripled due to high temperatures (Neumann, 1989; Riemer, 2006).

Although summer monsoons and (to some extent) winter rains were of key importance for a human presence in the desert, rainy weather may have had a negative influence on pottery production. The way production was organised (including, in particular, the timing of vessel shaping, drying, and firing) had to take precipitation and related humidity into account. In dry periods, herders moved to places ensuring permanent access to water. Given the favourable conditions for pottery making offered by oases (including access to the necessary raw materials), it seems that they were the best place for potters in the summer period. Since they were regularly visited by mobile groups, it was in the oases that herders could seasonally make vessels in periods when high temperatures and limited access to water made it difficult to stay elsewhere (Table 4).The negative influences of the summer monsoons could be minimised by high temperatures, which allowed vessels to dry more rapidly (Kindermann & Bubenzer, 2007: 29).

However, it should be emphasised that a lack of water, or difficult access to it, could have been factors to the limiting, or even abandonment of pottery making in areas without access to other resources or favourable climatic conditions.

Degree of sedentariness and scheduling conflicts

Desert groups who made and used pottery were highly mobile, which was a form of adaptation to unstable conditions prevailing in this area in the Holocene humid phase. Mobility made their presence in the savannah possible by offering access to a variety of resources, such as water, wild animals, and plants available in various locations. Movements in search of food, water and various plant and animal resources took place in the winter season when transient reservoirs formed after rainfalls. Lower temperatures also favoured mobility during winter seasons, as people and animals were able to walk greater distances with little or no need for replenishing water. In dry seasons, water sources outside oases and large reservoirs became limited, and vegetation and pasture for herds shrank rapidly. Oases and other places with access to water attracted human groups from various directions (Riemer 2009; Riemer *et al.*, 2013). Dry seasons were the right time for pottery making, as the production technology (e.g. drying before firing) required a prolonged stay in one location (Eerkens, 2001: 7-8; 2008: 309-310). Pottery production organised in this way could be successfully adapted to the mobile way of life and to subsistence strategies followed by desert groups, without causing any scheduling conflicts. The limited scale of pottery making also allowed one to avoid scheduling conflicts (Table 4) (Arnold, 1989).

The emergence of undecorated thin-walled pottery in the area of the central oases in the late 6th and 5th millenniums BC may be linked to the increase in sedentism observed at sites as suggested by M. McDonald for the Late Bashendi A groups who started to use and probably produce ceramic vessels (McDonald, 2009: 26). Conducive conditions and extended stays in one location favoured pottery adaptation (see also Warfe, 2018: 75). Despite the fact that the Bashendi B people had returned to a mobile lifestyle, they continued to make and use undecorated thin-walled pottery. This situation fits well with the observations J. Eerkens made during a study on the relationship between mobility and pottery production (Eerkens, 2008: 319). In his opinion, once pottery had begun to be used by mobile groups, pottery production would have been continued and would no longer have been affected by the mobile way of life.

The presence of low-fired pottery among the Bashendi B assemblages could be also treated as an attempt at minimising the mismatch between pottery production and mobility (Gibbs, 2012). Local potters made vessels that either had a short use-life or were simply disposable, paying far less attention to their durability or longevity. Vessels could be made even during short stays, in cold and humid periods while the production process itself could be short, with little preparation of raw materials and no special tools. Likewise, the drying and firing processes could be reduced to the bare minimum. The outcome would be 'ugly' low-fired pots, discarded after use rather than transported to the next stopover.

Demand

Limited size of assemblages is a particular feature of pottery from the Western Desert. On the basis of research on the ceramic assemblages from the Dakhleh Oasis, taking into account the number of recorded sherds and temporal spans of Dakhleh cultural units, Warfe suggested that, on average, the Bashedni A people made one vessel every 35 years and their descendents – the Bashedni B people – a vessel every 11 years (Warfe, 2018: 52). The quantity of sherds recorded at sites is low, which may result from production limitations or from the fact that vessels were cumbersome to transport. Although the fragility of pottery and the ensuing high breakage rates during movement did not favour vessel transport during seasonal movements, it did not preclude it altogether either. The problem of vessel transport may have been solved by caching pots in regular stopover locations along seasonal movement routes (Eerkens, 2008: 313). Clay vessels may have remained in places where people stayed for longer periods of time or to those which they frequently returned. Unfortunately, no evidence from the Western Desert linked to the Bifacial technocomplex has been found so far in support of the above assumption. The production of short use-life vessels as observed in the Dakhleh Oasis could also have helped avoid problems with pottery transport (Gibbs, 2012; Warfe, 2018: 76).

The number of clay vessels used by desert groups may have also reflected the demand for, and the functions of such vessels. In this part of the eastern Sahara, undecorated thin-walled pottery emerged simultaneously with the introduction of domesticated animals. Its function may have been linked to new food resources. Despite the greater presence of domesticated animals at sites, wild animals continued to be one of the major components of Middle Holocene faunal assemblages in this region. In the opinion of Riemer, herding could have been incorporated in the traditional hunting subsistence strategy, while domesticated animals played a minor role in the 6th millennium BC (Riemer, 2009: 132). Ceramic vessels seem to be well suited for dairy processing, which allowed herders with lactose intolerance to consume milk products. The earliest traces of dairying were recorded in clay vessels used by fully pastoral groups in the Libyan Sahara in ca. 5,200 BC (Dunne *et al.*, 2018). Ceramic containers could also have been used to process dairy products on a small scale at the end of Holocene humid phase in the Western Desert. The limited number of vessels could reflect a minor role played by dairy products in the local diet and subsistence practices. With a limited demand and high production requirements, people may have preferred to use containers made of other materials, as they were simpler to produce and could even be made in transit.

Last but not least, it cannot be precluded that pottery had some sort of symbolic meaning, as suggested by B. Hayden (1995) or Rice (1999). Pottery could have been a prestige technology available to a limited number of users, thus denoting their special social status (Warfe, 2018: 76). Moreover, Warfe has suggested that efforts invested in pottery production in the Bashendi cultural units extended beyond requirements for water containers (Warfe, 2018: 52).

6.3. Pottery Neolithic pottery production in the southern Levant

6.3.1. The stages of pottery production

Procurement and preparation of raw materials (clay, tempers)

All Pottery Neolithic cultures of the southern Levant used locally available raw materials. Clays and tempers were sourced from locations distributed around the sites at various distances, not exceeding 10 km. Differences in the location of clay deposits can be seen, both among the cultures of this period and among sites belonging to the same cultural unit. Most pastes used by the Yarmukians were made of calcareous clays (Vieugué *et al.*, 2016: 99). During the Lodian period, new local raw materials were introduced, probably because of their superior quality and the increase in potters' skills. At Nahal Zehora II, a terra rosa clay was used for the production of vessels, although its deposits were further (about 10 km) from the site than alluvial clays used there during the Yarmukian period. Terra rosa was mixed with locally available rendzina. In addition, Wadi Rabah pottery production was based only on the use of locally occurring rendzina clay, easily accessible and easy to form even without tempers.

During the Pottery Neolithic, a wide range of tempers such as chalk, sand, crushed calcite, straw, basalt, grog and flint chalk, as well as organic temper, were added to the clay. Their choice depended both on the location of their sources and on the preferences of manufacturers and users, which may have changed over time.

Forming vessels and pre-firing treatments

Vessel forming techniques used by the Yarmukian and Lodian cultures do not differ from each other. Vessels were made by hand of coils or slabs, although the former technique was used less frequently than the latter during the Lodian period. At some sites of the Wadi Rabah, coiling was the only technique used to form vessels. In the Yarmukian, Lodian and Wadi Rabah assemblages, traces of using moulds have also been reported. Numerous mat imprints on Yarmukian and Wadi Rabah pottery indicate that mats were also used for vessel forming. Traces of the pinching and drawing method have been recorded so far only on Wadi Rabah pottery. In the context of this culture, the use of a tournette, in the form of a stone mould or a reed mat, has also been suggested. The internal walls of some vessels show traces of wiping and smoothing using grass or straw.

Potters possessed the appropriate knowledge and skills to make vessels of various sizes with different wall thicknesses. Pottery Neolithic assemblages include small diameter thin-walled vessels (both bowls and jars), as well as large storage vessels, ten to twenty times larger than the smallest pots (Garfinkel, 1999: 37). Vessel wall thickness depended on vessel size. Although vessel surface colouration depended on the type of clay used, throughout the entire Pottery Neolithic a preference for light brown/ beige, orange or pink or yellowish white is clearly visible.

On Pottery Neolithic pottery, different surface treatments have been identified, such as smoothing, slip covering, burnishing, plain burnishing and roughening (including honeycomb roughening). Pottery without any surface treatment has also been found. Differences in the relative proportions of the different surface treatments are visible both among cultures and among sites representing the same culture. The first vessels with slip-covered surfaces (red and pale) emerged at the beginning of the Pottery Neolithic. Burnishing is present on slip-covered vessels, as well as on plain or self-slipped vessels. Plain burnishing is considered to be a purely Yarmukian phenomenon. Surface treatments typical for the Lodian culture include burnishing over painted elements. Nizzanim and Qatifian pottery assemblages are of low quality and are coarse, heavy, crumbly, and crudely fashioned. Among all Pottery Neolithic cultures, only the Wadi Rabah stands out for its high burnishing quality. Slip (red, orange, brown, dark brown, grey and black) and burnishing occur over large parts of the vessel surface, or even cover the entire vessel. Vessels with slip and burnishing account for most of the assemblages from a number of sites (Ein el-Jarba – 71%; Nahal Zehora II – 56%; Munhata 2A – 86.4%). Moreover, plain burnishing and honeycomb roughening are absent from Wadi Rabah assemblages.

Firing

Yarmukian and the Lodian vessels were fired in an oxidising atmosphere, with potters probably having been capable of controlling it. However, pottery suggesting a relatively high level of firing atmosphere control is accompanied by fragments displaying a low level of such control. In the Wadi Rabah period, firing was well controlled, probably in kilns that could create both an oxidising and reducing atmosphere.

Forms

The Yarmukian and Lodian ceramic assemblages are characteristic for a large quantity of similar open and closed forms. Open vessels include small and medium-sized truncated bowls, small and large chalices, pots, basins, and pithoi (Figs. 8:2-4, 6; 9:4, 6, 8). Closed vessels feature jars of various sizes with a globular body, a long vertical neck and a simple rim with two lug handles (Sha'ar Hagolan jars), jars with a globular body, a short vertical neck and a simple rim (Jericho IX jars), hole-mouth jars and large jars with an ovoid body, a wide flat base and an S-shaped profile. Despite the typological similarity of these two cultures, some differences can also be discerned in their respective assemblages. The Yarmukian culture is characterised by the so-called Sha'ar Hagolan jar (Fig. 8:5, 7-8). Although their number clearly declines in Lodian assemblages, instead, inclined-neck jars with a globular or oval body and an indentation or ridge between the neck and the shoulder, known as Lodian jars, become more plentiful (Fig. 9:3, 5). Another vessel type, known as the Jericho IX jar, is referred to as a characteristic feature of the Lodian ceramic assemblage. It is a medium-sized vessel with handles and a low neck, either straight or slightly everted outwards. However, according to some researchers, this vessel type should be linked to the Yarmukian culture, as it has a number of archaic features (Gopher & Blockman, 2004: 15). Other characteristic Lodian elements include cylindrical handles.

The relative proportions of particular vessel forms vary from site to site. Vessels used for serving and consuming food, including, in particular, bowls of different sizes and shapes, are the largest group of early Pottery Neolithic assemblages. However, as regards the other vessel forms, differences exist between sites and cultures. At the Yarmukian sites of Sha'ar Hagolan, Munhata and Nahal Zippori 3, the second largest group are large pithoi used for long-term storage. On the other hand, at Nahal Zehora II, in layers dated to the Yarmukian, bowls are followed by kraters and hole-mouth jars. In the Lodian assemblages, open forms, including bowls, continued to dominate, while the second most numerous group consisted of jars used for short-term storage (Nahal Zehora II, Yesdot). Hole-mouth jars constituted about 10% of all forms. In the younger part of the Pottery Neolithic, vessel forms underwent considerable changes. The Wadi Rabah culture is characterised by a sharp carination between the neck and the body and/or between the shoulder and the lower part of vessel, near the base, and a carefully formed rim. Typical vessels include carinated, S-shaped or V-shaped bowls, pedestaled bowls, mini bowls, jars with bow-rims, flaring rims, or collard jars, tabular stands, pithoi with thumb-impressed ledge handles and hole-mouth jars. Churns, spouted bowls, and spouted kraters appeared for the first time. Bowls of various shapes and sizes and hole-mouth jars are the most numerous group of Wadi Rabah ceramic assemblages from most known sites, while jars, including bow-rim jars, do not account for more than 10%. The Pottery Neolithic sites of the Nizzanim variant and the Qatifian culture exhibit little variety of shapes while their ceramic assemblages are dominated by hole-mouth jars and bowls of various shapes and sizes.

Decoration

Richly incised and painted decoration makes the Pottery Neolithic pottery distinguishable. It is present on 10 to 25% of all Yarmukian vessels, both on bowls (conical shapes and deep bowls with a slightly restricted orifice) and on tall handled jars. Incised motifs include, first of all, horizontal lines located below the rim or on the neck, zigzag lines and herringbone patterns on the body in a variety of arrangements (Fig. 8:2-3, 8). They are sometimes accompanied by painted decoration. The paint was applied all over the non-incised surface or only on a part thereof. Sometimes, only a small space adjacent to, or around incisions is painted. Moreover, painted decoration in the form of triangles, zigzags, and lines in various arrangements have also been identified (Fig. 8:7). Rich decoration also covers Lodian pottery. Lodian painted motifs include triangles, lozenges, and zigzags (Fig. 9:1, 4). Some of them are made of thin or wide parallel lines. Painted and burnished narrow or wide red/brown lines were applied on a creamy/whitish slip on cups, deep bowls, hemispherical bowls, as well as necked jars. Another unique design feature of the Lodian culture is well-burnished and lustrous paint. Incised motifs are rarely identified at Lodian sites (herringbone patterns inside a frame or frames of parallel lines) (Fig. 9:6).

Compared with Yarmukian and Lodian pottery decoration, the assemblages of the Wadi Rabah show an increase in the range of decorative motifs and techniques and a shift towards simpler decorative motifs. Burnished slip, generally considered to be a form of decoration on Wadi Rabah pottery, is accompanied by painted, incised and combed patterns. Painted horizontal lines are present on the inside or the outside of the rim or (less frequently) on the body, in the form of horizontal lines, parallel lines, semi-circles, triangles or net patterns. Incised motifs include net and herringbone bands. Although combed decoration takes the form of wavy line motifs, this technique could also be used to form herringbone patterns and zigzags (Fig. 10:1-3). Wadi Rabah pottery also features impressed decoration made using a comb or a round/triangular stylus. They take a variety of forms, including dense puncturing, round or triangular impressions, lunar-shaped impressions or roulette impressions. Equally remarkable is plastic decoration in the form of pendants or figural representations. Moreover, knobs may be considered as a decorative form present on Pottery Neolithic ceramic materials.

6.3.2. The organisation and development of pottery production in the Pottery Neolithic southern Levant

Resources

All Pottery Neolithic cultural units used local resources. Deposits of clays and temper sources were located near the sites, within a radius of approximately 10 km from the production site. The distance to raw material sources may have been one of the important factors taken into account when choosing clay (e.g. at Yesdot). Clay quality may have been another criterion also used in the selection process (e.g. at Nahal Zehora II).

Other raw materials, such as water and fuel, were probably easily available in the vicinity of the sites of the Pottery Neolithic. As they were located in the Mediterranean zone, along the Rift Valley, in the coastal plain, as well as on the edges of major alluvial valleys, all these sites enjoyed convenient access to water, farmland, and pasture.

Weather and climate

The Holocene epoch brought warmer and more humid conditions to the southern Levant. These conditions were treated as factors exerting a major influence on the economic and socio-cultural transformations during the Neolithic period in the southern Levant, namely an increase in sedentism, as well as the emergence and spread of new subsistence strategies that relied on domesticated plants and animals (Borrell *et al.*, 2015; Rosen & Rosen, 2017). The 8.2 kiloyear BP cold event, which apparently caused drier and cooler conditions in the southern Levant, has often been linked to the changes that took place between the Pre-Pottery Neolithic and the Pottery Neolithic. However, warmer and wetter conditions returned to the southern Levant, where Pottery Neolithic communities of a unique nature were formed throughout the 7th and 6th millenniums BC. Favourable climatic conditions prevailing in the Middle Holocene period, in combination with the occupation of the rich Mediterranean zone, caused it to stabilise settlement activity. Permanent settlements with access to water, farmland, and pasture together with numerous raw materials in the vicinity allowed Pottery Neolithic societies to develop.

Although pottery production first appeared in the PPNB, it flourished during the Pottery Neolithic, when clay pots became common utensils typically used in many activities during the period in question. Relatively warm conditions were conducive to pottery production all year round (Table 4). Possible negative impacts of rain and humidity could be minimised by stable settlement patterns and the possibilities offered by it.

Degree of sedentariness

The Pottery Neolithic societies of the southern Levant were sedentary. Settlements may have been inhabited permanently or seasonally, with the differences in their size denoting a kind of hierarchy in the settlement system with small farmsteads, larger villages, and mega sites. Most of the Pottery Neolithic sites are small and transitory. However, some sites (‘Ain Ghazal, Sha’ar Hagolan, Jericho) revealed a much more sophisticated spatial organisation of the settlement. The stable settlement pattern of the Pottery Neolithic communities surely allowed for organising pottery production in a manner addressing all its constituent stages, from raw material procurement over to vessel firing. Unlike farming communities, mobile pastoral groups who occupied the southern desert areas in the Pottery Neolithic did not make ceramic containers.

Scheduling conflicts

Pottery Neolithic groups relied on domesticated grains and pulses, as well as on secondary products of domesticated or tamed sheep, goats, pigs, and cattle.

The importance of hunting decreased during this period, which is clearly visible in the typology and frequencies of projectile points in the Pottery Neolithic assemblages. Moreover, in the later part of the Pottery Neolithic, Wadi Rabah groups reached beyond the basic food products offered by domesticated plants and animals. The production of dairy products and the intensive use of olives are suggested for the second part of the Pottery Neolithic. Since clay pots could be produced all year round, their production could interfere with other activities, particularly those relating to the procurement and production of food, such as farming and breeding (Arnold, 1989: 99-108). Scheduling conflicts between pottery production and subsistence strategies in the Pottery Neolithic could have been avoided due to appropriate social organisation. The mega sites like Sha'ar Hagolan or 'Ain Ghazal are characterised by a sophisticated spatial organisation and are notable for their building complexes incorporating numerous rooms arranged around courtyards. Such compounds may have been inhabited by extended families consisting of several nuclear families (Garfinkel & Ben-Shlomo, 2009: 67-84; Banning, 2010: 73-74; Gibbs & Banning, 2013: 365-357). Moreover, the courtyards connecting households could have been a place of various activities for those living in the compound, including pottery making (Garfinkel & Ben-Shlomo, 2009: 76-77). Extended families inhabiting the compounds had access to large labour forces, allowing for the distribution of various activities among its members (see also Kadowaki, 2012: 19-21). Arnold suggests a gender-based division of labour, consisting of allocating pottery making to one gender (mostly to women) as one of the ways to avoid scheduling conflicts (Arnold, 1989: 100-101). In his opinion, female potters were able to combine pottery production alongside other household activities and with the demands of pregnancy and infant/child care. However, according to J. Peterson, the archaeological evidence does not indicate that Neolithic societies in the southern Levant were organised in terms of gender (Peterson, 2010: 260). Her analyses show that both males and females were engaged in different activities. However, the same researcher admitted that one of the reasons for the emergence of large households in the Pottery Neolithic could be the challenges of the timing and pace of farming activities (Peterson, 2010: 260).

The emergence of specialisation of pottery production could also have reduced scheduling conflicts between subsistence activities and pottery production (Arnold, 1989: 107). According to S. Kerner, the Pottery Neolithic was characterised by household production (Kerner, 2010: 187-189). Vessels were made in households from locally available raw materials, in a simple way, as and when needed. A low level of specialisation in pottery production first appeared during the Wadi Rabah culture (local and non-local raw materials, a more expansive repertoire of vessels, use of tournettes/mats, high burnishing quality). At the same time, the first traces of specialisation appeared in agriculture (dairy production, intensive use of olives), and lithic production. Exchange processes also became intensified. All these changes were part of more complex social and economic processes that took place in the Pottery Neolithic community. Thus, the emergence of specialists in different fields, including pottery production allowed one to avoid scheduling conflicts.

Demand

The pottery of the Pottery Neolithic had a utilitarian character and was used mostly for storing, transporting, cooking and consuming foods. Clay vessels used at sites formed a typical set of kitchen utensils, although its composition differed between sites and cultures. Detailed analyses sometimes show large differences in the relative amounts of particular vessel types in different assemblages. Such sets of kitchen utensils may indicate different dietary habits and practices and may be the reflect differences in demand. At the Yarmukian sites of Sha'ar Hagolan, Munhata and Nahal Zippori 3, large pithoi used for long-term storage are the second largest group of vessels, outnumbered only by bowls. A different situation was recorded at Nahal Zehora II, where vessels of this type represent only 1.4% of all vessels in the Yarmukian layers, indicating a lower importance of long-term storage and thus little demand for such vessels or perhaps other, alternative ways of storage that were not identified among the remains. In addition, differences in the quantities of hole-mouth jars, small and medium jars or kraters at Yarmukian and Lodian sites may be related to other ways of food cooking and storage.

Significant changes in relation to Yarmukian and Lodian pottery are visible in the Wadi Rabah assemblages (technology, surface treatment, shapes, and decoration). In the opinion of Gopher, it was during the Wadi Rabah period that the final stage of the second Neolithic revolution took place, involving adaptation of the full agricultural package (Gopher, 2012c: 1577). New forms could be a response to new demand. Thus, the emergence of churns has been linked to the beginning of dairy production in the period in question (Gopher & Gophna, 1993: 334).

Particularly remarkable among the Pottery Neolithic ceramics is decorated pottery, which constitutes up to 25% of the whole assemblage. For Kerner, decorated Pottery Neolithic ceramics forms a group of special vessels occurring in small quantities and requiring considerable time and effort for production (Kerner, 2010: 188). According to Kerner, the interpretation of decorative vessels goes beyond their utilitarian meaning. The lack of use marks on decorated pottery does not make its interpretation any easier. Gopher and Goren consider decorated pottery to be a continuation of the production of symbolic objects (figurines, beads) using plaster technology (Gopher & Goren, 1998: 224). In addition, E. Orrelle and A. Gopher (2000) suggest non-utilitarian functions for decoration on Yarmukian pottery and link it to gender roles. The elaborate decoration on

Yarmukian and Lodian vessels may be a response to the demand for symbolic behaviours. However, J. Vieugué *et al.* (2016) position decorated pottery among differentiated functional groups and see it also as utilitarian.

Pottery decoration evolved in the Wadi Rabah period. Compared with those of the Yarmukian and Lodian cultures, the assemblages of the Wadi Rabah show an increase in the range of decorative motifs and techniques, and a shift towards simpler decorative motifs is noticeable. According to Gibbs (2013), changes in pottery decoration were a response to changes in the symbolic system of the Wadi Rabah culture. The emergence of new forms of decoration may have been associated with a demand for a more flexible symbolic system, which may have facilitated contacts and positively influenced social relationships.

6.4. A comparative analysis: Lower Egyptian Neolithic pottery vs. Pottery Neolithic pottery of the southern Levant

The similarities between the Lower Egyptian Neolithic pottery assemblages, on the one hand, and the Pottery Neolithic southern Levantine assemblages, on the other, used to be quite generally referred to as arguments in favour of the Levantine origin of Lower Egyptian ceramics. However, more detailed analyses show that, despite some similarities, the inventories of the two regions differ significantly (Table 5).

Although in both cases pottery production was at an early stage, the social and economic context in which vessels were produced and used was different in either region. In Lower Egypt, pottery production was an innovation introduced from outside and adapted to local conditions. In the case of the southern Levant, its emergence was connected with the development of human skills in pyrotechnology.

At first glance, both regions are linked by the use of local raw materials, simple forming methods and a simple firing process. However, these features are characteristic for the early pottery production of each (Rice, 1999). In Lower Egyptian pottery, one can notice a large variability in clays and tempers, probably related to the use of many different deposits of raw materials located in areas explored by partly mobile groups (e.g. the Fayumian and Merimde I cultures) (Emmitt, 2017). Meanwhile, the number and quality of clays used in the Pottery Neolithic is limited, which involved the use of deposits located near permanent settlements or production sites. In Lower Egypt, a similar situation is only visible during the later part of the Neolithic in the area of Wadi Hof, probably because of the stable settlement pattern enabled by the local rich ecological niche, reminiscent of the Pottery Neolithic occupation in the southern Levant.

The organisation of pottery production in both regions was influenced by various social, economic and environmental factors, of which lifestyle, subsistence strategies, and probably weather and climate, deserve special attention. Due to the partly mobile way of life in Lower Egypt, pottery production was possible at extended stay sites ensuring access to water and other resources needed in the production process. Additionally, winter rains and cold and humid conditions occurring in the Middle Holocene period could have limited pottery production and caused it to have a seasonal character (Table 4).

The Pottery Neolithic groups of the southern Levant were sedentary, while pottery production probably took place throughout the year at or near their settlements. The stabilisation of settlement activity in places with access to water and various resources had a positive effect on how pottery production was organised. Vessel production was made easier by the warm climate of the Middle Holocene, while the possible negative impacts of wetter conditions could be minimised by locating pottery production inside extended households, more stable settlement structures, and technological adjustments.

Subsistence strategies also had a significant impact on the organisation of pottery production in the two regions concerned. Although domesticated plants and animals were known in both of them, their role differed. In Lower Egypt, domesticated animals and plants were initially only an addition to 'wild' food available in rich environmental niches. It seems that the flexible organisation of the Neolithic communities, apart from the richness, seasonality, and renewability of wild resources, allowed one to avoid scheduling conflicts between pottery production and subsistence strategies. During the later part of the Neolithic, after the stabilisation of the settlement pattern in Lower Egypt (large permanent settlements at Merimde and Wadi Hof), scheduling conflicts could have been reduced through the division of labour.

From the very beginning of the Pottery Neolithic, the Levantine communities relied on products supplied by agriculture and animal husbandry. Moreover, these subsistence strategies were continuously developing, which lead to the emergence of dairy production and the intensive use of olives at the end of the Pottery Neolithic. From the beginning of this period, the division of labour in large households may have helped avoid scheduling conflicts between pottery production, on the one hand, and farming and breeding, on the other. In some way, the initiation of a process of specialisation towards the end of the Pottery Neolithic could also be attributable to the need to minimise such conflicts.

To conclude, the organisation of pottery production in Lower Egypt and the southern Levant shows more differences than similarities. The differences are more visible at the beginning of the Neolithic period, while the similarities begin to emerge in the later part of the period. During the 6th millennium BC, communities in both regions were at different stages of socio-economic development. Although in Lower Egypt, pottery had been adapted to local conditions, it kept developing during the Neolithic period, which probably accompanied a reduction in mobility, stabilised settlement activity, the introduction of domesticated plant and animal species and their gradually increasing role. During the 5th millennium BC, ceramic vessels became common utensils used for many different activities. Although pottery was still produced in households, progress in forming techniques, surface treatments, vessel shapes, decoration, and firing is noticeable. It is during this period that parallels between Lower Egyptian and southern Levantine pottery production become more visible.

The southern Levantine communities underwent social, economic and symbolic transformation between the Pre-Pottery Neolithic and the Pottery Neolithic. However, their cultural development did not end with the beginning of the Pottery Neolithic. Throughout the period, Pottery Neolithic communities continued to evolve. The technology was being developed, also in the area of pottery production, which had first appeared already at the end of the Pre-Pottery Neolithic. Although the Yarmukian and Lodian cultures are mainly characterised by generalised, unspecialised production, their inventories are notable for the presence of vessels with elaborate decoration, requiring time and skills. Vessels of this type are present alongside simple, rough pottery. Such a dichotomy may indicate a faster technological advancement in the production of certain kinds of pottery, perhaps related to symbolic behaviours (Kerner, 2010: 188-189). The progress in pottery production visible in the Wadi Rabah assemblages (new forms, improvement in surface treatment techniques, the appearance of kilns, changes in decoration patterns, first traces of specialisation) results from the development of Pottery Neolithic communities affecting social, economic and symbolic systems alike.

The comparative analysis also included morphological features of pottery from both regions. Taking into account vessels forms and the set of shapes used on the northern shore of Lake Qarun or at Merimde, phase I is rather modest when compared with the assemblages of the Pottery Neolithic units from the southern Levant. Initially, Lower Egyptian sites (the Fayum, Merimde, phase I) featured a limited number of mostly open, simple forms serving multiple functions. However, younger assemblages show an increase in the variety of shapes and a growing number of closed forms (Merimde, phase II-III, el-Omari). These changes should be seen as a result of the development of pottery production technology, changes in demand and the increased importance of clay vessels as utensils for Neolithic society.

The variety of forms is clearly visible from the beginning of the Pottery Neolithic period. Although open forms continue to prevail (including, in particular, bowls of different sizes), jars already account for a significant percentage of the entire collection (approx. 15% in the Yarmukian culture). Clay vessels were important utensils used in many everyday activities of southern Levantine farmers.

Particular attention is required in the case of hole-mouth jars, an important part of Lower Egyptian and southern Levantine inventories. This type of vessel can be found at all Neolithic sites in Lower Egypt. In phase I of Merimde, they represent 42.3% of all burnished forms and 21.1% of all smoothed forms. However, in the younger phases of the Merimde site, their number gradually decreases. Hole-mouth jars are also present at the sites of all cultures of the Pottery Neolithic in the southern Levant. Their percentages vary and range from 5 to over 33% in the first part of the Pottery Neolithic and from 10 to 40% during the Wadi Rabah culture (Gopher & Eyal, 2012a: table 11.5-6). Although they have been interpreted as cooking pots, traces of fire on these vessels are not always recorded. In both regions, this type includes vessels with smoothed or rough surfaces, used for preparing food, as well as burnished vessels covered with slip, which are likely to have been used for short-term storage. Their simple production method and use for various purposes probably contributed to their popularity, high demand and, consequently, their large quantities in the assemblages from both regions.

Another noteworthy form of clay vessels is seen in large storage jars. Large vessels used for storing grain have been found both in Lower Egypt and in the southern Levant. In Lower Egypt, these vessels are known from Kom W, Kom K and the Upper K Pits in the Fayum, where they had been placed in pits. A few large vessels of unknown shape, probably in pits, have also been recorded at the site of the el-Omari culture (Debono & Mortensen, 1990: 20) In the southern Levant, large pithoi, known from Yarmukian, Lodian and Wadi Rabah sites, were used to store cereals. At sites at Sha'ar Hagolan, Munhata and Nahal Zippori 3, they represent 27% of all vessels in the Yarmukian layers, although at other sites pithoi are less numerous (e.g. 1.4% at the Yarmukian site of Nahal Zehora II). These differences may indicate a different way of storage, or no need for it. It seems that alternative cereal storage techniques were also used in Lower Egypt. In the Fayum, Merimde and Wadi Hof, particularly remarkable are storage pits lined with basketry or with Nile silt (Debono & Mortensen, 1990; Wetterström, 1993: 212-214; Wendrich & Holdaway, 2017).

Parallels between inventories from both regions are also visible in surface treatment techniques. Slipping and burnishing is the dominant surface treatment in the early Lower Egyptian Neolithic. Although the amount of burnished pottery decreases over time, it still accounts for more than a half of the total assemblage. Slipped and burnished surfaces account for a significant proportion of the Yarmukian and Lodian assemblages, and for over a half of the Wadi Rabah assemblage. In both regions, changes in this surface treatment technique can be observed. At Merimde, throughout phases II and III, and at Wadi Hof, a decrease in the quality of burnishing was observed, while during the Wadi Rabah period, burnished surfaces are of very high quality and sometimes cover the entire vessel surface. The decrease in burnishing quality in Lower Egypt during the Neolithic may have been linked to the decrease in its importance as a decorative element. During the Wadi Rabah period, the decorative character of slip and burnishing may have gained importance, especially during the 'birth' of household specialisation.

One of the most frequently mentioned similarities between Neolithic Lower Egyptian pottery and Pottery Neolithic pottery of the southern Levant is the herringbone pattern incised on the earliest Merimde pottery (Fig. 22). This has been linked to Yarmukian, Lodian and Wadi Rabah decoration patterns (Eiwanger, 1984:62; Shirai, 2010: 314; Streit, 2017). At Merimde, decorated pottery represents only a small part of the entire assemblage (2.3%) and stands out for its quality (untempered clay, red slip, and burnishing). The herringbone pattern is incised on the outer surface of closed vessels (hole-mouth jars), in the upper part of the vessel under a straight edge. In the Yarmukian culture, however, the herringbone pattern is part of a more elaborate decoration composed of other elements (Garfinkel, 1999: figs. 25, 41). Most often it is located in a narrow frame of two lines, which could be placed horizontally in the upper part of the vessel or formed a zigzag pattern around the vessel on its body (Fig. 8:2-3, 8). A similar type of decoration is also characteristic for Lodian pottery (Fig. 9:6) (Garfinkel, 1999: figs. 46; 61). A fragment with incised herringbone was also found at Nizzanim (Garfinkel, 1999: fig. 64:12). The herringbone pattern is also a characteristic element of Wadi Rabah decoration. However, the designs in which it appears are already simpler, while the herringbone itself is not placed in a frame and is twice as wide as in the Yarmukian or Lodian cultures (Fig. 10: 1-3; Garfinkel, 1999: fig. 90). The author agrees with the suggestion of Streit (2017) that, in terms of form, the herringbone pattern of Merimde I phase is more similar to Wadi Rabah decoration than to the Yarmoukian or Lodian herringbone pattern.

6.5. A comparative analysis: Lower Egyptian Neolithic pottery vs. undecorated thin-walled pottery

A careful look at pottery production in the Western Desert typical for the final part of the Holocene humid phase and Neolithic pottery production in Lower Egypt reveals a few similarities, attributable, first of all, to the parallel lifestyles and (to some extent) subsistence strategies particularly visible in the second half of the 6th millennium BC (Table 6).

Both in the desert and in Lower Egypt, pottery was made at extended stay sites, in response to the requirements of the production technology, such as access to raw materials and a sufficient amount of time required by the process (from raw material sourcing through to vessel firing). Although in both cases vessels were made of local materials, their diversity suggests reliance on multiple deposits within the group's movement area. Likewise, the diversity of tempers (both in the eastern Sahara and in Lower Egypt) may suggest that they came from different locations. In both cases, such a situation was probably linked to the groups' mobility within a well-known environment and to the use of various resources offered by it.

In the eastern Sahara, oases were the most likely production sites. Nevertheless, it is possible that pottery was also made in other locations ensuring easy access to water. The lack of water could have been a limiting factor in the production of vessels (e.g. in the northern part of the Abu Muhariq Plateau). Difficult access to water could also be the reason for the lack of ceramics in the areas north of the Farafra Oasis, despite the presence of mobile groups in this area during the Middle Holocene period. Given the importance of firing fuel for the production process, oases or locations with permanent water availability and the resulting vegetation provided convenient access to it.

Although the mobility of people in Lower Egypt in the second part of the 6th millennium was probably limited when compared with that of desert groups, Lower Egyptians nevertheless moved around exploring various environmental resources. Unlike desert groups, Neolithic people inhabited rich ecological niches with permanent access to water and its resources. Although pottery production inevitably involved extended presence in the same location, it could nevertheless take place in a few different places, as long as each of them ensured a rich environment and easy access to the necessary raw materials.

Pottery production both in the eastern Sahara and Lower Egypt depended heavily on weather and climate (Table 4). A human presence in the desert was made possible by the northward shift of the ITCZ and summer monsoonal rains. In the Middle Holocene period, the northern part of Egypt was within reach of Mediterranean rainfalls that supplied water to wadis and to areas located at greater distances from water reservoirs. While precipitation had a positive effect on the presence of vegetation and wild animals (thus enabling or facilitating human existence in both areas), it was rather unfavourable for pottery production, as it interfered with every single stage of the process. It seems that both in the desert and Lower Egypt, pottery production was a seasonal activity, practised not only in specific places but also at specific times of the year. In the desert, high temperatures and limited access to water in the summertime forced people to gather in the vicinity of reservoirs or springs (playas, ponds, wadis, oases) with easy access to a wide range of plants and animals. Such locations were favourable for pottery production, which was additionally facilitated by warm and dry weather and reduced mobility due to droughts and high temperatures. However, the production of low-fired vessels was also possible in less favourable weather conditions (e.g. the Dakhleh Oasis). Likewise, the summer (April – September) seems to have been the most convenient time for pottery making in Lower Egypt, allowing potters to avoid the negative impact of winter rains.

The mobility of human groups in the eastern Sahara and Lower Egypt resulted from their adaptation to the local environment. Hunting was the fundamental subsistence strategy of desert groups, supplemented by gathering wild plants and herding domesticated animals. Longer stays in oases or other locations ensuring permanent access to water in hot and dry summers, when humans' and animals' mobility was reduced by the harsh climate, probably made it possible to combine a few different activities, involving both subsistence and tool-making. A similar situation may have been observed in Lower Egypt, where wild resources constituted a very important source of food despite the presence of domesticated animals already in the second part of the 6th millennium BC. Seasonal pottery production in places of extended stay did not necessarily cause any scheduling conflicts with other activities (including subsistence), as the surrounding area offered plentiful, predictable and renewable resources. Even the introduction of domesticated plants in this region at the beginning of the 5th millennium BC or even earlier did not cause a scheduling conflict since farming activities were confined to the cold season of winter rainfalls and the importance of grains of domesticated plants in the Neolithic diet was rather small in this initial period (Table 4).

In the course of the Neolithic, Lower Egypt saw the growing role of domesticated plants and animals, accompanied by the declining mobility of human groups who switched to more permanent settlements. Possible scheduling conflicts between pottery production and subsistence strategies may have been resolved by a division of labour, with some individuals being in charge of pottery making in households (as and when necessary), while others procured and produced food.

The similarities between undecorated thin-walled pottery and Lower Egyptian Neolithic pottery are visible not only in how pottery production was organised but also in the production technology itself (Table 6). A simple technology, involving open firing and vessels that were made by hand of coils could have been applied even when potters' skills and know-how were rather low, as long as access to raw materials and adequate conditions (time, temperature and humidity) were ensured. One's attention is drawn to the striking degree of similarity between vessel forms used by desert herders, on the one hand, and those of the Fayumians and early Merimdians, on the other. While in either case it is not possible to compare relative amounts, assemblage analyses indicate that open vessels prevailed in both regions. The most common forms in both regions were hemispherical, spherical and conical bowls, vessels with vertical walls or deep vessels with a restricted mouth (hole-mouth jars). Most vessels have round rims and bases. The only exceptions are large storage jars from Lower Egypt, linked to growing domesticated plants and used for the storage of grain.

Some common features are also visible in surface treatments, although the poor condition of artefacts makes proper recognition difficult. The presence of slip on vessel surfaces, as well as vessels with burnished or smoothed surfaces, has been confirmed both in the eastern Sahara and at Neolithic sites in Lower Egypt. Burnishing is the dominant form of surface treatment on the Abu Muhariq Plateau

(Riemer & Schönfeld, 2010:731-734). A similar situation is visible in pottery from phase I of Merimde, although in the younger phases of the settlement the quantity of vessels with burnished surfaces decreases gradually, while smoothed surfaces become increasingly common (Mączyńska, 2017: table 2). Moreover, vessels with rough surfaces are also present in both regions. The fact that black-topped vessels have been found in el-Omari assemblages is rather puzzling, as vessels of this kind are known from a few locations in the Western Desert, and from the Eastern Desert. Unfortunately, the available data is too scant to verify whether any relationship exists between black-topped pottery from these two regions (Debono & Mortensen, 1990: 26; Riemer & Schönfeld, 2010: 754-758; Vermeersch *et al.*, 2015: Sodmein Online Resource 3).

The presence of the herringbone pattern on materials from Merimde and Sodmein Cave deserves special attention. In both cases, this form of decoration was found on hole-mouth jars with a surface covered by slip and then burnished. However, the herringbone pattern found in the Eastern Desert is rougher compared with the finely incised decoration from Lower Egypt (Figs. 7:8; 22). The decorated sherd from Sodmein Cave is dated to approximately 5,600 cal. BC, while the Merimde settlement was established just before the 5th millennium BC. Since the current state of research does not provide information that would help link the two decoration patterns, the issue requires further research.

Apart from the above similarities in pottery production in the eastern Sahara and in Lower Egypt, a number of differences have also been identified. Considerable disproportion in the size of ceramic assemblages from both regions is fairly evident and may result either from the state of research, or from a multitude of cultural and environmental factors affecting the presence and use of ceramic vessels. For desert groups, such vessels may have been a tool used for a limited scope of activities. Since they were introduced simultaneously with domesticated animals, their function has often been linked to these new food resources. Given that domesticated animals were merely an addition to food obtained by hunting, the scarcity of vessels may be a reflection of the scarcity of products of animal origin (such as milk or blood) used by these groups. Thus, the limited demand for animal secondary products resulted in a limited demand for ceramic containers.

The number of vessels used may have also resulted from the degrees of difficulty related to pottery production faced by mobile groups. Seasonality, the necessary resources, a lengthy production process and challenging external conditions affected the quantity of vessels produced. Moreover, mobility and transport problems may have limited the number of vessels used. Moreover, desert groups may have also more frequently used containers made of organic materials, such as straw or leather, as they were much simpler to make. Since the production of short use-life vessels found in the Dakhleh Oasis did not require longer stays or elaborate techniques, they could have been a way of overcoming difficulties typically caused by pottery production.

Finally, it is possible that undecorated thin-walled vessels had a certain non-utilitarian function, as suggested by Hayden (1995), Rice (1999) or, recently, Warfe (2018). The limited quantity of vessels may reflect their special, symbolic function, as well as a limited group of users.

Ceramic assemblages from Neolithic sites in Lower Egypt are far more numerous and indicate the common use of vessels in many activities related to food processing, cooking, serving, storage, and transport. Although Lower Egyptian assemblages (the Fayum, Merimde I and II) are initially dominated by simple open forms suitable for many different activities, younger layers show an increase in form diversity and a growing proportion of closed forms. These changes may have resulted from the development of the pottery tradition. They suggest not only an improvement in potters' skills but also the growing role of clay vessels among Neolithic communities. Such vessels gradually became utilitarian utensils used in many activities, while the diversity of forms and surface treatments reflects their various possible functions. The development of the pottery tradition visible in the Neolithic communities of Lower Egypt was probably linked to reduced mobility, a more stable settlement pattern and the growing importance of domesticated animals and plants during the 5th millennium BC.

At the beginning of the Neolithic period, the size of early Lower Egyptian pottery inventories was also influenced by the practice of caching pots, which solved problems caused by transporting vessel faced by mobile groups. The possibility of leaving vessels in frequently visited places in order to use them during the next stay had an effect on the size of the inventory used by a given group. Such a practice may have also contributed to greater production volume and a greater diversity of vessel forms, including vessels too large and too heavy for transport.

6.6. Summary and conclusions

The results of comparative analyses of pottery dated to the Neolithic period from Lower Egypt and the Pottery Neolithic pottery of the southern Levant, as well as Lower Egyptian pottery and undecorated thin-walled pottery from the eastern Sahara, do not allow one to confirm or disprove either the hypothesis promoting the Levantine origins of Lower Egyptian Neolithic pottery or that claiming its desert origins. Parallels with Lower Egyptian pottery production can be seen both in the assemblages from the southern Levant and those from the eastern Sahara (Tables 4-5).

In the Levantine hypothesis, pottery is an element of the Neolithic package, introduced to Lower Egypt together with domesticated plants and animals. While the archaeological evidence found so far does not indicate directly that migrants from the east were present in Lower Egypt, breeding of domesticated animals and farming of domesticated crops of Levantine origin began there in the 6th and 5th millenniums BC, alongside the production of previously unknown clay vessels. The production process was simple and vessels were made using local raw materials. Similarities indicated in the ceramic assemblages by many researchers, in terms of shape, surface treatments and decoration, were apparently supposed to confirm the eastern origin of pottery. Thus, a foreign idea was adapted to local conditions, with clay vessels becoming popular utensils over time and widely used in many activities.

There are many vague aspects of the Levantine hypothesis. It is still rather puzzling how the Neolithic package appeared and was adopted in these regions. So far, migration from the southern Levant to Lower Egypt has been suggested, while some researchers have also proposed a long-term infiltration of the region by drifters and refugees from the East, continuing for approximately 500 years or more (Eiwanger, 1984: 61-63; Hassan, 1984b: 222-223). In addition, the existence of a socio-cultural network linking Egypt with the Levant and enabling a steady flow of ideas has been proposed (Shirai, 2010; 2013a; 2015; 2017). Various Pottery Neolithic cultures have been considered as a source of Egyptian pottery. Undoubtedly, domesticated animals and plants introduced to Egypt originated from the Near East. Domesticates may have reached Lower Egypt with the Levantines, although, currently, no archaeological evidence exists to confirm the presence of such eastern visitors (see Garcea, 2016; Garcea *et al.*, 2016). Despite the fact that some clues are provided by DNA studies, indicating a genetic influx from the Near East into north-eastern Africa dated to the Neolithic, this issue needs further research (Arredi *et al.*, 2004; Kujanová *et al.*, 2009; Smith, 2013b).

Comparative analyses of pottery from Lower Egypt and the southern Levant has allowed the author to identify some similarities and differences both in how pottery production was organised and in pottery technology and typology. In the middle of the 6th millennium BC, pottery production in both regions was organised in significantly different ways, which resulted from different lifestyles and subsistence strategies. In addition, pottery production is likely to have been affected by weather and climate differently in both regions. In the 5th millennium BC in Lower Egypt, declining mobility, a stabilised settlement pattern, and the growing role of domesticated plants and animals all had a significant impact on pottery production, thereby fostering its development. As a result, the organisation of pottery production in the later part of the Egyptian Neolithic period was similar to that known from the Pottery Neolithic in the southern Levant (the use of a limited number of local raw materials, a wide range of open and closed forms, a controlled firing atmosphere, the introduction of decoration).

Comparative analyses have also shown some technological and typological convergences and differences between the pottery of both regions. However, the parallels pointed to in such analyses are sometimes of a rather general nature. Similarities in production methods may, in both cases, result from the fact that pottery production was at an early stage of development. The dominance of open forms is characteristic for all settlement sites due to the widespread use of this type of vessels during food preparation, serving and eating and the short life span of such. The presence of hole-mouth jars may be attributable to their simple method of production and their multiple functions. The high proportion of slip-covered pottery with burnished surfaces in both regions could have been caused by a high demand for short-term storage containers.

The herringbone pattern present on the oldest ceramics at Merimde and Sais may be an important link between the two regions (Fig. 22). The presence of untempered pottery in the same phase of Merimde, reminiscent of Wadi Rabah pottery made of untempered rendzina should also be mentioned. The technique of smoothing the inner walls of the vessels using a bunch of grass, characteristic during the Pottery Neolithic in the southern Levant, and also recorded on some vessels from the Merimde culture, may also be of eastern origin (Fig. 23).

The other hypothesis addressed in this monograph assumes the desert origins of Lower Egyptian Neolithic pottery production. Clay vessels, being part of the desert heritage, supposedly appeared in Lower Egypt together with communities of herders and hunter-gatherers, forced to leave the eastern Sahara when the desert began to desiccate in ca. 5,300 BC. The northern shore of Lake Qarun, or Wadi Gamal at the boundary of the Nile Delta and the desert, may have been places where desert groups settled. These groups probably belonged to the Bifacial technocomplex occupying the central and northern part of the Western Desert. One of their features was the ability to produce and use clay vessels. If the groups who came to, and settled in Lower Egypt possessed pottery making skills, pottery production could have flourished in an environment with an abundance of water, food resources, and raw materials.

Comparative analyses of pottery production in both regions has allowed the author to identify a number of similarities and differences in its organisation. The mobile way of life, the important role of wild resources accompanied by the relative insignificance of domesticated animals and plants, and a dependency on weather and climate all influenced pottery production in both regions, limiting it to periods of longer stays in places ensuring access to water and other necessary resources during dry and warm periods (Table 4). However, the similarities between Lower Egyptian Neolithic groups, on the one hand, and desert groups, on the other, are outnumbered by the differences which appeared during the development of Neolithic communities in Lower Egypt. Declining mobility, a stabilised settlement pattern and the growing role of domesticated plants and animals significantly influenced the organisation of pottery production. Although it still took the form of generalised household production, the progress in potters' skills (new forms of pottery, decoration, firing control) and stabilisation of production is notable.

Parallels and differences between the Lower Egyptian and eastern Saharan assemblages are also visible in terms of technology and typology. In both regions, the raw materials came from the area explored by the local community, although their deposits may have been located far from production sites. Both assemblages are linked by the variability of fabrics, a great similarity of forms, and similar surface treatment. However, the simple way of producing vessels in both regions can also be explained by the fact that pottery production was at an early stage in both cases, not unlike in the Levantine hypothesis. Particularly remarkable is the herringbone pattern known from Lower Egypt and the Eastern Desert, although their relationships need further research.

One of the most important differences is visible in the size of assemblages from both regions. Desert assemblages are small, and their size probably reflects a low demand for pottery and the requirements of the production process, as well as the difficulties commonly encountered by mobile herders and hunter-gatherers. In Lower Egypt, the Neolithic assemblages are much more abundant, as in this region vessels became common utensils, used for many different activities.

The current state of research does not allow one to confirm the presence of desert herders' groups in Lower Egypt. Research on the Western Desert has shown that the activity of Middle Holocene herders and hunter-gatherers also included the northern part of the area, namely the Siwa and Qattara Depressions, or even parts of north-eastern Africa further to the west (Hassan, 1976; 1978; Cziesla, 1989; 1993; Tassie *et al.*, 2008; Lucarini, 2013; Garcea, 2016; Garcea *et al.*, 2016; Barich, 2016). Furthermore, Wendorf and Schild (1984) suggest that the area around Lake Qarun was known to hunter-gatherers and herders as a fishing ground already before the 6th millennium BC. Recent studies in this area have shown a high level of activity on the northern shore of Lake Qarun from the Early Holocene period until 6,000 BP (Wendrich *et al.*, 2010; Holdaway *et al.*, 2016; Holdaway & Wendrich, 2017). Lower Egypt, including the Fayum and the Nile Delta, may have been known to desert groups that moved over long distances across the eastern Sahara in search of water, plants, and animals. These locations could have been part of their annual cycle of migrations. One's attention is drawn to the similarity of Middle Holocene lithic assemblages from sites in the Western Desert, on the one hand, and from the Fayum and Merimde Beni Salame, on the other. Mobile herders may have visited the area in question and settled there at the beginning of the desert desiccation process (see Kindermann & Bubenzer, 2007).

In the author's opinion, both hypotheses addressed here are based on similar assumptions. In both hypotheses, stylistic and technological similarities are an important issue. The state of research on the Lower Egyptian Neolithic does not provide any grounds for disproving either of these hypotheses nor does it allow us to consider one of them more accurate or better than the other. The prevalence of the Levantine hypothesis stems from the long history of research and from the fact that this hypothesis is deeply rooted in Near Eastern archaeology. The hypothesis claiming eastern Saharan origins of the Lower Egyptian Neolithic emerged only after intensive research on the Western Desert and has gained popularity among researchers dealing with the prehistory of north-eastern Africa.

Egypt enjoys a special geographical and cultural position. It is both part of the Near East and the African continent. The lack of any significant geographical barriers between Lower Egypt and the eastern Sahara, or between Lower Egypt and the southern Levant, enabled the movement of people and ideas between these regions. Lower Egyptian pottery was, therefore, not invented in this area but introduced from outside. It seems that the desert groups who settled on the northern shore of Lake Qarun or in Wadi Gamal may have possessed pottery making skills. Once introduced to Lower Egypt, the pottery tradition developed dynamically, and also because of social and economic changes within Neolithic societies. Reduced mobility, stabilised settlement patterns, as well as the greater role of farming and animal breeding, all had an effect on pottery production. Furthermore, its development may have been influenced from another direction. Domesticated plants and partly domesticated animals were introduced to Lower Egypt from the southern Levant in the 6th and 5th millenniums BC. It was then that local pottery production may have been influenced by Levantine newcomers, who knew and used clay vessels (Garcea, 2016; Garcea *et al.*, 2016; Shirai, 2017; Streit, 2017). However, the very process of pottery adaptation is unclear and requires further research

Finally, taking into account the results presented in this monograph, the author is of the opinion that, in the first place, searching for the origin of Lower Egyptian pottery is not actually necessary. What seems more important is conducting intensified studies on the occupation of Egypt in the Early and Middle Holocene periods. Such studies will make it possible to reach beyond the concepts of prehistoric communities developed in the early 20th century and repeated ever since, as well as beyond the boundaries of regions, or even archaeological units. Probably during the Early and Middle Holocene periods, the Western Desert and Lower Egypt were traversed by many groups of people, namely hunter-gatherers and herders. Their destinations depended on a multitude of factors, primarily environmental and economic. They probably knew the local territory and its resources very well. Rich ecological niches such as oases, valleys, wadis or playas could have been visited for centuries. From our present perspective, the end of the Holocene humid phase was a dramatic event influencing human life and forcing human groups to migrate. However, movement from the dry and hot desert to more hospitable areas was part of their annual cycle. Although increased aridity must have influenced migration patterns, people could have come back to places known from previous journeys, where all they need to survive was available. It is us, archaeologists, who systematise all remains and data region by region, affixing archaeological labels to them. In doing so, we tend to forget that, in this way, we build artificial frameworks. Is it really so that the Qarunians, Fayumians and herders of the Bifacial technocomplex were distinct groups with different cultural backgrounds? Perhaps all of them were hunter-gatherers and herders with a very similar cultural background, well adapted to local conditions and skilfully using different resources available in different parts of the north-eastern Africa. In this context, solving the problem of the origin of Lower Egyptian pottery is closely related to studies on the socio-economic development of communities occupying this part of north-eastern Africa.

In Search of the Origins of Lower Egyptian Pottery:
A New Approach to Old Data
Studies in African Archaeology 16
Poznań Archaeological Museum 2018

Chapter 7
The origins of Lower Egyptian Neolithic pottery. A model

The oldest Lower Egyptian pottery was recorded at sites on the northern shore of Lake Qarun, dating back to the middle of the 6th millennium BC. In the light of the latest research, the groups that produced and used it did not resemble typical farming communities known from the Near East area at that time. Although the bones of domesticated animals (sheep, goats, and cattle) are known in Neolithic archaeological assemblages, the role of animal husbandry as one of the subsistence strategies was rather minor. During the 6th millennium BC, domesticated plants were probably not known in Lower Egypt, or were known on a very small, experimental scale, being undistinguishable in the archaeological evidence (see Shirai, 2017). Fayumian groups, thanks to the abundance of natural resources in the vicinity of the lake, relied on food resources offered by the environment, including, in particular, fish available in the lake. The lack of permanent settlement structures in this area is interpreted in the context of a partially mobile way of life. Moving within the Fayum Depression and adjacent desert areas, people were able to use the resources of the natural environment, including raw materials used for tool production.

The origins of the Fayumian groups are not clear. The subsistence strategies and mobile way of life bring them closer to desert groups that occupied central and northern part of the Western Desert in the final part of Holocene humid phase (6,000-5,300 cal. BC). They belonged to the so-called Bifacial technocomplex and were characteristic for their lithic assemblages and the presence of pottery. The northern part of the Western Desert, probably including the Fayum, lay in the zone of migration for hunter-gatherers and herders during the Early and Middle Holocene periods. Traces of their presence have been recorded within the Siwa and Qattara depressions and even further to the northwest. The latest C14 dates indicate that people had already reached the northern shore of Lake Qarun in the Early Holocene period. The rich ecological niche of the Fayum Depression may have been positioned on routes travelled by desert groups, as it offered access to the water, wild plants and animals on which their survival depended.

Approximately in 5,300 BC the process of desiccation in the desert began, forcing hunter-gatherers and herders to look for new habitats. Some people found shelter in oases where water was still available thanks to artesian springs. People moved also to the Nile Valley or southern Egypt and northern Sudan. It has also been suggested that desert groups may also have made their way further north, to Lower Egypt.

The northern shore of Lake Qarun or Wadi Gamal offered the desert people everything they were looking for, namely water and access to many resources, including food and raw materials. It was then that the depth and surface area of Lake Qarun was greater than ever due to the restored connection with the Nile.

In the opinion of the author, the ceramic vessels of the Fayumian culture may have desert roots. Pottery production in both regions is linked by a similar organisation of the pottery production process (taking into account mobility and subsistence strategies), as well as by technological and typological similarities. One of the arguments that has made it difficult to combine Lower Egyptian pottery and undecorated thin-walled pottery is the lack of ceramics in the area north of the Farafra Oasis, despite the presence of other traces of human activity. However, such a situation may be associated with the fact that pottery production was discontinued in the area due to certain limitations (i.e. insufficient access to water and raw materials, climate) and not to the lack of pottery-making skills and knowledge. Under favourable conditions, when access to the necessary raw materials was ensured, pottery may have become needed again.

Thus, ‘refugees’ from the desert came to Lower Egypt with their cultural ‘equipment’. Due to the specific nature of the environment, they settled down and reduced their mobility to some extent. They moved within a well-known environment, relying on its rich resources. Although they owned domesticated animals, their diet was based on fish. They did not set up permanent settlements but stopped for longer stays in places where their needs could be satisfied. Moreover, pottery production was adjusted to local conditions. Among the most important factors influencing it, one should mention mobility, subsistence strategies, as well as weather and climate. The production of vessels in places of prolonged stay, confined to a favourable warm and dry period, along with the practise of caching vessels, were the reason why vessels secured a permanent place among other utensils.

Undoubtedly, their popularity increased there when compared with the Western Desert. The character of pottery production was influenced by the change in demand for ceramic containers. Even before domesticated plants had been introduced and become an important food source in this area, ceramic vessels could have been used in exploring abundant lake resources, mostly fish. Their production in the summer, when fishing was most effective, fits this demand quite well. Indeed, intensive use of water resources may have resulted in the development of pottery production (e.g. at Sais I). It seems, however, that it was the emergence of intensive cereal cultivation during the 5th millennium BC and the intensification of animal husbandry (sheep, goats, pigs, and cattle) that caused changes in pottery production in Lower Egypt. Thus, vessels could have been used in many activities related to processing, consuming or storing domesticated products.

The pottery of the 5th millennium BC is known from two sites located in the western Nile Delta at Merimde and Sais. The exact beginning of the settlement at Merimde is unknown and is currently dated to approximately 5,000 BC. Treated as a daughter site of Merimde, Sais is associated with fishing and is where the refugees from Merimde may have settled after leaving the site in 4,850 BC due to cold and arid conditions. Recent research suggests that groups occupying the site at Merimde Beni Salame at the beginning of the Neolithic resembled groups of the Fayumian culture in terms of subsistence strategies and ways of life. Natural resources played an important role in their diet, whereas domesticated animals and plants were merely an addition to it. The absence of permanent settlements and other traces of activity in the Wadi Gamal area may indicate, at least, a partially mobile way of life and movement within well-known environments. Ceramic vessels are known from the oldest phase of the Merimde site, namely the Urschicht phase and at Sais I. In terms of technology and typology, they resemble Fayumian pottery (a simple mode of household production, open firing, mostly open forms, similar surface treatment), although Sais pottery shows a greater diversity, probably related to the specialisation of the site and the intensive use of fish. Moreover, the organisation of pottery production was probably similar to that known from the Fayum (seasonal production during longer stays, similar function). What distinguishes the oldest ceramics from Merimde and Sais is the presence of the herringbone decoration, which could be linked both to the southern Levant and the Eastern Desert (Fig. 22).

The presence of domesticated plants and animals of Levantine origin at Merimde and Sais, the herringbone pattern, as well as some features of the ceramic assemblages, are most often interpreted as a consequence of the presence of Levantine newcomers who introduced these items into Lower Egypt. Although domesticated animals were known in Lower Egypt in the 6th millennium BC and may have come together with desert groups, it was during the 5th millennium

BC that the second wave of their introduction into Egypt took place, probably directly from the Near East (Linseele *et al.*, 2014; 2016; Garcea, 2016; Garcea *et al.*, 2016). Together with domesticated animals, domesticated grains could also have reached Lower Egypt. The process of introducing and adapting domesticates is not clear, while the available evidence does not allow for any detailed hypotheses. Excessively profound social and economic differences between the communities of Lower Egypt and the southern Levant, as well as the lack of evidence of migration among the archaeological remains, currently excludes a Levantine origin for these Lower Egyptian communities. However, they may have been influenced by the newcomers, with the interactions between resulting in the introduction of some new ideas into existing local traditions. The parallels between local pottery and Levantine pottery may be one of the results of such interactions.

Although the introduction of domesticates was crucial for the development of Lower Egyptian communities, it did not initially reduce the use of the wild resources. Pottery vessels were used in many activities related to the use of natural resources, on the one hand, and domesticated plants and animals, on the other, including processing, serving, consuming and storage. It seems that large jars were directly associated with domesticated plants, as they were used to store cereals. New practical uses increased the demand for vessels, thus triggering the more intensive development of their production.

The Merimde settlement was abandoned in approximately 4,850 BC due to cold and hyper-arid climatic conditions. Thus, the occupation of Sais could be linked to the migration from Merimde. In the middle of the 5th millennium BC, the site was resettled. During this period, the first signs of settlement stabilisation and a gradual increase in the role of domesticated plant and animal species are already visible. Some features of the lithics from phase II indicate possible influences from the Western Desert. Once again more and more inhospitable conditions in the eastern Sahara could have been responsible for the arrival of desert groups to Lower Egypt. Although during phase II pottery was still produced and used, influences from the desert have not been found (contrary to the lithic assemblage). Moreover, the incised herringbone pattern is no longer used to decorate pottery, although these vessels have many features in common with the pottery of the Urschicht phase and Fayumian culture, in terms of organisation production, as well as its technology and typology (see Mączyńska, 2017). New forms, a gradual increase in the number of closed forms, an increase in the diversity of surface treatments (burnishing, smoothing, roughing), and gradually improved control of firing conditions, all indicate the development of pottery production which would continue during the next, third phase of the Merimde culture.

Social and economic changes in the Lower Egyptian Neolithic community, consisting of abandoning the mobile lifestyle, establishing a stabilised settlement pattern, the growing role of domesticated plants and animals accompanied by the intensive use of natural resources, are mostly visible in the remains from the youngest phase of the Merimde culture. As the size of the settlement grew, a variety of stable settlement structures were introduced, including circular huts, clustered to form compounds with family storage facilities. The emergence of crafts and ideology have also been suggested at that time (Tassie, 2014: 212-226). As regards pottery, there was an increase in the diversity of ceramic assemblages and an associated increase in potters' skills. New open and closed vessel forms were emerging, including characteristic bottles with a globular body and a long neck. Burnished and smoothed pieces are present in similar quantities, alongside numerous vessels with rough surfaces, indicating functional differentiation of the assemblage. Improved control of the firing process resulted in more diverse and more uniform surface colours, including red, grey and black. Incised, impressed, plastic and painted decorations appeared on pottery. Similar changes in pottery assemblages are also visible in Wadi Hof, where human groups settled probably around the middle of the 5th millennium BC (4,600 BC). Wadi Hof offered easy access to water and other resources. Its location in the vicinity of the Nile also allowed for the use of resources located in the area between the river and the wadi, as well as in the flood plain and the river. Despite the use of natural resources, the el-Omari community kept domesticated animals and grew cereals on the flood plain. The settlement activity in Wadi Hof was fairly stabilised with a permanent settlement and some activity sites in the area around it. The main settlement area moved within the wadi. The abandoned parts of the settlement served as burial grounds, or as storage areas. Pottery production no longer resembled that of the Fayum and the Urschicht phase of Merimde. Only two kinds of calcareous clays available within the wadi were used for the production of vessels, while the small amount of pottery made of Nile clay may be associated with the seasonal presence of people in the vicinity of the Nile, associated with cereal growing or fishing. Although open forms continued to prevail, the percentage of closed forms, including jars, is high. The range of vessel shapes is much larger than at the beginning of the Neolithic. Most of the inventory consists of ceramics covered by slip and burnished, while smoothed vessels represent 1/3 of the inventory. Also of note is the high firing temperature (800°C), poorer quality of burnishing and the addition of ochre to clay.

At the end of the 5th millennium BC, the sites both in the Fayum and Wadi Hof were abandoned. The northern shore of Lake Qarun was probably deserted because of a lowered water level and the need for adapting earlier subsistence strategies. Groups of Fayumian people could have moved towards the Nile Valley or into the Nile Delta. The reasons for the end of the occupation of Wadi Hof are unknown. The continuation of settlement activity into the 4th millennium BC has been suggested for two sites (Merimde and Sais). Although the end of settlement activity of the Merimde culture is dated to ca. 4,100 BC, traces of the Chalcolithic Lower Egyptian culture have also been confirmed at the site. (Hawass *et al.*, 1988). Moreover, as recent excavations at Sais have shown that the Merimde people occupied the site for a longer period of time, its demise is dated to 3,900 BC.

The emergence of pottery in Lower Egypt in the middle of the 6th millennium BC was, from our contemporary point of view, an important cultural event and involved multiple benefits. It is generally accepted that pottery was introduced to this region as an innovation, rather than as an invention. However, the emergence of clay vessels alone did not guarantee their entry into common use and local production. This process was affected by many factors, both environmental and cultural. The production of clay vessels had to be adapted and integrated into the social and technological system of past societies. It became one of their traditions, constituting a set of technological practices forming the entire production sequence, from collecting raw materials through to firing them into a durable vessel.

From the moment of the introduction of pottery to Lower Egypt, its production developed dynamically throughout the Neolithic period. This was also connected with social and economic changes within Neolithic societies, as well as with external influences from the Western Desert and the southern Levant. Therefore, by the end of the Neolithic period in Lower Egypt, pottery had become one of the most important elements of Lower Egyptian communities.

In Search of the Origins of Lower Egyptian Pottery:
A New Approach to Old Data
Studies in African Archaeology 16
Poznań Archaeological Museum 2018

Chapter 8
Conclusions

The aim of this study was to identify the origins of Lower Egyptian Neolithic pottery which emerged in the middle of the 6th millennium BC in Lower Egypt. The point of departure was determined by two existing hypotheses assuming either a Levantine or Saharan origin of Lower Egyptian Neolithic pottery. Comparative analyses of ceramic assemblages from the three regions concerned (Lower Egypt, central and northern part of the Western Desert and southern Levant) dated to the 6th and 5th millenniums BC were aimed at verifying these hypotheses, and thus at determining the direction from which pottery was introduced to Lower Egypt.

Given the current state of research on pottery production in the three above-mentioned regions, none of those hypotheses can be either disproved or considered more likely than the other. Indeed, the arguments presented in both hypotheses are very much alike. Furthermore, both hypotheses assume that pottery was an innovation introduced from outside by newcomers. In the Levantine hypothesis, pottery was part of the Neolithic package introduced to Lower Egypt together with domesticated plants and animals. However, the desert hypothesis sees pottery production as a technology introduced to the northern part of Egypt by refugees from the eastern Sahara as part of their African heritage. Both hypotheses are based on technological and typological similarities, including vessel forms, surface treatments or decoration patterns. Meanwhile, although detailed analyses confirm the similarities between ceramic assemblages, they also demonstrate that these similarities are highly general. Furthermore, they are accompanied by a number of differences.

The available archaeological and linguistic evidence does not confirm any direct connection between Lower Egypt and the southern Levant or Lower Egypt and the Western Desert, or the presence of migrants from the eastern Sahara or the Near East in the northern part of Egypt. Although DNA studies indicate a possible genetic influx from the Near East dated to the Neolithic period, such evidence is insufficient to link the introduction of pottery with the arrival of Levantine groups to north-eastern Africa.

The origins of Lower Egyptian pottery are clearly not a new research problem, as one which has been raised nearly from the beginning of research on the Neolithic period in Lower Egypt. The coexistence of pottery with domesticated plants and animals was well suited to the model assuming that farming and animal husbandry had spread outside the core area of the Near East. Thus, the Levantine origin of Lower Egyptian pottery became ostensibly obvious, with the publications of many authors sustaining this view for years. Although explorations in the eastern Sahara began in the 1970s, it was only in the 1980/90s that the first hypotheses began to suggest some loose links between the desert occupation and the Neolithic occupation both in the Nile Valley and Delta. Research carried out in both regions has been strikingly divided until today, with only some scholars drawing attention to the cultural links between them. The purpose of combining the Levantine and desert hypotheses in the model presented in this monograph is to go beyond the rigid framework of studies in the desert or the Nile Valley and Delta and to address possible interactions between them. Thus, a broader cultural context of such research may be beneficial for a better understanding of the prehistoric occupation in north-eastern Africa.

The results of analyses discussed in the monograph show that Lower Egyptian Neolithic pottery has both Levantine and desert roots. In the model of the introduction of pottery production into Lower Egypt created on the basis of these analyses, pottery was introduced into Lower Egypt from the Western Desert, although its development was influenced by the Levantines during the course of the Neolithic. This model assumes the presence of visitors from both the desert and the east. It is based not only on the technical and typological similarities of pottery but also takes into account the cultural, as well as environmental factors that influenced the organisation of pottery production, namely lifestyle, subsistence strategies, and the environment they occupied. This model is not just an artificial attempt to reconcile two different views on the origin of Lower Egyptian Neolithic pottery. It is the result of viewing Lower Egyptian Neolithic in a broader context, taking into account not only the Near East but also north-eastern Africa. Key to this model were the results of the latest research conducted in Lower Egypt, specifically, in the Fayum or in Wadi Gamal, which showed Lower Egyptian Neolithic communities in a completely new light and made it possible to go beyond the framework of the Near Eastern model of farming communities imposed on them nearly a century ago. This is particularly evident in the case of the groups that occupied the northern shore of Lake Qarun which, in terms of way of life and subsistence strategies, are more reminiscent of the hunter-gatherers and herders of the eastern Sahara than Levantine farmers. However, in conducting research on the Lower Egyptian Neolithic period, one cannot ignore the links connecting it with the southern Levant, including, in particular, the Near Eastern origin of domesticated plants and animals. Moreover, the Near Eastern elements of the Lower Egyptian Neolithic are very important because their introduction initiated important social and economic processes leading to the formation of complex farming communities that occupied the Nile Valley and Delta in the 4th millennium BC.

Admittedly, the proposed model is not perfect and many of its elements need to be further studied. Indeed, our limited knowledge of both the Neolithic occupation of Lower Egypt and the Middle Holocene occupation of the Western Desert, based on limited archaeological evidence, does not make conducting research any easier. In addition, the southern Levantine Pottery Neolithic requires further studies explaining its cultural diversity.

Finally, the author is aware that new discoveries may have a significant impact on the value of the model proposed here. However, for now, it may serve as a starting point for further works and discussions on the problem of the origin of the Lower Egyptian Neolithic period. Whether it is confirmed or disproved in the course of further studies is, for better or worse, beyond the author's control.

Appendix
Neolithic pottery of Lower Egypt in the collections of museums and other institutions

1. Introduction

In 2014, the author received a financial grant from the National Science Centre Poland for a project entitled *The Development of the Early Neolithic societies in Lower Egypt in the 5th millennium BC and their Interactions with the Southern Levant*. The project's point of departure was a hypothesis presented by the author at the *Egypt at its Origins 5* conference, held in Cairo in 2014. It assumed the existence of a single pottery-making tradition, shared by all known Neolithic cultures in Lower Egypt (see Mączyńska, 2017). The source base for the project included technological and typological descriptions of Egyptian Neolithic pottery, as well as actual pottery from the Egyptian Neolithic sites, deposited and available in the collections of museums or other institutions. Therefore, the author visited five institutions that offered access to part of their collections, thus enabling an analysis of the Lower Egyptian Neolithic ceramic assemblage, namely the Petrie Museum of Egyptian Archaeology in London, the British Museum in London, the Museum of Mediterranean and Near Eastern Antiquities in Stockholm (Medelhavsmuseet), the Institute of Prehistory and Historical Archaeology of the University of Vienna and the Egyptian Museum in Cairo. Since each of these institutions has its own rules regarding access to materials, the size of the analysed collections was different in all cases. The small amount of ceramics analysed in the Egyptian Museum in Cairo resulted from its internal regulations in effect in 2016. Apart from access to ceramics, the author had an opportunity to use an on-line catalogue containing the basic information about artefacts and other remains from the collections.

Only in the Egyptian Museum in Cairo was access to the EMC registry possible exclusively in the museum.

2. The method of pottery analyses

Macroscopic analyses of potter were carried out according to modern ceramological standards (see Rice, 2005; Orton *et al.*, 2010; Wodzińska, 2010). The choice of non-destructive method in this case is dictated by the special character of the material (pottery from the museum/institution collections), on the one hand, and the available funds, on the other.

The analysed pottery was fully documented, including information on measurable features (if any). The pottery analyses were divided into three stages:

1. technological analyses (clay, tempers, shaping method, surface treatment, surface colour, firing conditions)
2. typological analyses (shapes – vessel, base, rim, decoration)
3. pottery documentation – (description, drawings, pictures)

All features were recorded whenever possible. In the case of complete vessels, observation of some features was difficult or unfeasible. The colours were recorded using the Munsell colour chart. Finally, all the analysed ceramics were aggregated in a tabular database (Tables 7abc-9abc). The terms used in the tables are consistent with those proposed for pottery analyses by A. Wodzińska (2010), unless otherwise noted.

3. Fayumian pottery (Tables 7abc)

The author had an opportunity to study the pottery collection of the excavations of G. Caton-Thompson and E. Gardner at Kom W now housed in the Petrie Museum of Egyptian Archaeology, University College London. Courtesy of the British Museum, the author was also offered access to the ceramic assemblage from site E29H2, Trench 2 (part of the Wendorf Collection of the Department of Egypt and Sudan).

The explorations by Caton-Thompson and Gardner in the Fayum Depression in the area north of Lake Qarun between 1924 and 1928 were aimed at an archaeological and geological reconnaissance of this *terra incognita*. The two researchers identified both traces of prehistoric human activity and remains dated to the Pharaonic period. Nevertheless, the Fayum is best known for the remains of the earliest farming communities in Egypt discovered at the sites named Kom K, Kom W and the Upper K Pits, located on the northern shore of Lake Qarun. The exploration of stratified deposits of the sites provided rich archaeological evidence, including pottery. However, the excavation methods of the early 20th century had immense effect not only on the site's exploration, but also on the handling of artefacts recorded during investigations. All materials underwent a selection process.

As far as pottery is concerned, the assemblage only contains complete and almost complete vessels or fragments of diagnostic and typological significance, as well as those that stood out for aesthetic reasons. Artefact collections removed from the sites of Kom K, Kom W and the Upper K Pits were distributed among different institutions/museums around the world.

In 1969, the Fayum area was also investigated by the Combined Prehistoric Expedition headed by F. Wendorf and R. Schild (1976). Their key objective was to conduct a preliminary verification of the site's stratigraphy and chronology, as well as to understand the geomorphology of this area. The excavations were carried out pursuant to contemporary standards and all artefacts were collected.

3.1. The Petrie Museum of Egyptian Archaeology, University College London (Figs. 11-12)

More than 1,800 objects linked the Fayum Neolithic are now housed in the Petrie Museum of Egyptian Archaeology.[1] Most of them are part of the assemblage recorded by Caton-Thompson and Gardner on the northern shore of Lake Qarun. The author analysed in detail 35 ceramic items (vessels and sherds). Most of them come from Kom W. Some of them were recorded in the Upper K Pits. Site T is indicated as a source for one base fragment. In two cases, the location is unknown. All studied sherds are generally dated to the Neolithic period.

3.2. British Museum *(Figs. 13-15)*

In 2001, Professor Fred Wendorf donated his entire collection of artefacts and environmental remains excavated over a period of 40 years to the British Museum.[2] The collection also features pottery from the Fayum, excavated at site E-29-H2 in Trench 2 located just beside the trench of Caton-Thompson and Gardner at Kom W. The collection features 76 sherds (21 Museum ID numbers), 64 of which were analysed. The pottery from the collection was recorded in layers 1 to 10 and on the surface. It is all dated to the Neolithic, parallel to the occupation recorded at Kom W by Caton-Thompson and Gardner (Wendorf & Schild, 1976).

4. Merimde pottery (Tables 8abc)

The author had an opportunity to study part of the collections from the Institute of Prehistory and Historical Archaeology of the University of Vienna and the Museum of Mediterranean and Near Eastern Antiquities in Stockholm (Medelhavsmuseet).

The prehistoric site at Merimde Beni Salame was discovered by H. Junker during a survey of the 'Westdelta Expedition' organised by the Austrian Academy of

[1] http://petriecat.museums.ucl.ac.uk/

[2] http://www.britishmuseum.org/research.aspx

Science in Vienna. Excavations at Merimde Beni Salame were carried out between 1929-1939 pursuant to early 20th century standards. All finds from Merimde Beni Salame were recorded within a 200 × 240 m grid, with numbers along the X-axis and letters along the Y-axis. Depth was expressed in centimetres below the surface. However, due to the lack of excavation records indicating the depth of layers, it is not possible to establish a more detailed chronology on the basis of depth alone. The preserved collection of Merimdian pottery underwent a selection process, not unlike the Fayumian collection. It is housed in institutions/museums around the world.

4.1. The University of Vienna (Figs. 16-17)

The study collection of the Institute of Prehistory and Historical Archaeology at the University of Vienna features 664 artefacts from the site at Merimde Beni Salame, including 515 ceramics, namely vessels, vessel fragments and sherds.[3] A total of 34 ceramics of the collection, including eight complete or almost complete vessels and 26 fragments, were studied by the author. All of them are dated to the Neolithic, but may come from all phases of the settlement.

4.2. Medelhavsmuseet in Stockholm (Figs. 18-20)

Given that from 1931 to 1934 the excavations at Merimde were carried out in cooperation with the Egyptiska Museet of Stockholm, a considerably large part of the artefact collection was sent to Sweden, in return for the participation of Swedish researchers. A huge collection of approximately 6,000 items and other remains from Merimde Beni Salame is now housed in the Medelhavsmuseet in Stockholm. A total of 2,310 ceramics, including complete or almost complete vessels and sherds are part of this collection.[4] The author studied 68 items – 9 vessels and 51 fragments – rims, bases and decorated sherds. Only in 14 cases was the original location of the item not recorded.

5. El-Omari pottery in the Egyptian Museum in Cairo *(Tables 9abc, Fig. 21)*

The author was offered an opportunity to study a small part of ceramic assemblage of the Area A, originally collected by F. Debono during the excavation season of 1943-1944. The collection is housed now in the Egyptian Museum in Cairo.

The Neolithic site on a gravel terrace in Wadi Hof near the rocky spur known as the Ras el-Hof was discovered by Amin el-Omari, a young Egyptian mineralogist, who explored the region of Helwan at the request of the French archaeologist Fr. P. Bovier-Lapierre. The works began in 1924 and were continued after his death in 1925 by Fr. Bovier-Lapierre. In 1936, the site was once again explored by F. Debono,

[3] on the basis of the Unidam database on https://unidam.univie.ac.at

[4] on the basis of http://collections.smvk.se/carlotta-mhm/web

who identified several small separate camps with non-homogenous flint industries. Debono returned to Helwan during the war in order to protect it from damage. In 1943 and 1944, he explored it on behalf of the Egyptian Department of Antiquities. When the war ended, excavations continued in 1948 and 1951. However, the results of the works carried out at the Neolithic settlement were published only in 1990.

The entire site stretched over a surface of 750 x 500 m and was divided into eight areas, named A, B, C, D, E, F, G, and H. The excavations concentrated in Areas A and B, whereas soundings were made in Areas D, E, F, G, and H. The material including the pottery of Areas A and D was sent to the Egyptian Museum in Cairo while that from Area B was sent to Giza.

Due to the regulations of the Egyptian Museum in Cairo, only six complete vessels and three fragments of vessels made available for analysis. All of them came from Area A. Six ceramics, including complete vessels and rim fragments, were found in burials, and two complete vessels and one rim fragment were collected during pit exploration. Pits and burials are dated to different occupation phases of Area A. The el-Omari culture lasted for approximately 200/300 years (4,600-4,400/4,300 BC). The earliest occupation in Wadi Hof was registered in Area BIII. Area A was settled during the next occupation phase. However, human activity in Wadi Hof was not concentrated in one place. People moved around a wider area, consisting of many structures related to habitation, storage or other activities. For this reason, it is difficult to date the studied pottery collection. The oldest item seems to be a vessel fragment JE87546 found in pit A132 dated to the first occupation phase. A small jar JE87541 from burial A35 was found together with its famous wooden stick and is dated to the 4th phase. Other ceramics are associated with the 7th and 8th phases of Area A.

4. Summary

Analyses of pottery from the above collections have confirmed the current state of research on pottery production during the Neolithic in Lower Egypt, as presented in Chapters 5 and 6. Moreover, they have allowed us to take a closer look at some specific features of pottery production. In all three assemblages, the attention of the author was drawn to a large number of organic inclusions added to clay. Voids of burnt straw are sometimes large and can be up to 2 cm in length. On the surface of the vessels there are visible voids formed after other plant remains (including grains) were burnt out. A very coarse organic temper is present even in paste used for the production of thin-walled vessels, covered with slip before firing. As a result, this kind of temper causes the slip to crack, peel and damage the surface of the vessels. A large amount of plant remains added to clay indicates that pottery was produced within households, where remains of crops or other plants were probably available in large quantities, as they were in common use.

Pottery with a rough surface differs considerably from that decorated with the herringbone pattern, known from phase 1 of the Merimde site (Fig. 22). Its non-tempered clay is very compact. The surface of the sherds is additionally covered with red or brown slip and strongly smoothed with a hard object. The decoration pattern was made after the vessel was covered with slip, but before burnishing. Importantly, the herringbone pattern zone was not burnished.

Another interesting feature observed on ceramics are the marks of smoothing the inner surface of vessels by means of a bunch of grass or straw (Fig. 23). Such marks are visible only on a few studied items and it is difficult, therefore, to judge how often this particular method was used.

The opportunity to study the ceramic assemblages of the Fayumian, Merimde and el-Omari cultures consolidated the author's views on the existence of a single, region-wide cultural tradition shared by all Lower Egyptian societies which developed throughout the 6th and 5th millenniums BC. Although the archaeological map of Neolithic Lower Egypt was divided into three independent parts referred to as archaeological cultures, in opinion of the author, all of them represent different stages of the development of single, region-wide cultural tradition. This tradition changed over time and space, probably being transformed through day-to-day living, and influenced by internal and external factors. Consequently, each of the cultures had some common features of the Lower Egyptian cultural tradition, as well as its unique characteristics distinguishing it from the other cultures (for details, see Mączyńska, 2017). Moreover, in the opinion of the author, the pottery production in the Neolithic is closely linked to the pottery tradition in the Chalcolithic of Lower Egypt (for details, see Mączyńska, 2018b). Analyses show that although ceramic assemblages from both periods do differ, they also indicate some common technological features which could be explained as a result of a common cultural background of the societies occupying the region in question from the 6th to 4th millenniums BC. The adaptation to, and the use of local resources, simple pottery-making techniques, a limited number of vessels shapes and a household mode of production can all be observed in both periods. The rough surface of pottery, self-slip and burnishing observed in the studied samples of the Neolithic assemblages are parallel to those observed on Chalcolithic pottery. The studies of the assemblages from old surveys quickly verified the research questions that had to be asked upfront. Their selective nature, the lack of contextual details, as well as the absence of a detailed chronology limit their scientific value. However, it should be stressed that, in most cases, the data contained in the tables include ceramics, in particular, sherds, which have not been published in detail. Together with data from other studies (see Emmitt, 2011; 2017; Emmitt *et al.*, 2018), they may be the subject of detailed research on the Egyptian Neolithic pottery in the future.

Abbreviations for Tables 7abc-9abc

Location – location of collection
PM – the Petri Museum of Egyptian Archaeology
BM – the British Museum
EMC – the Egyptian Museum in Cairo
MS – Medelhavsmuseet in Stockholm
UV – the Institute of Prehistory and Historical Archaeology of the University of Vienna

ID – identification number assigned to every ceramic item – a vessel or a sherd in a database or registry

Item no. – assigned when more than one item have the same ID

Site – archaeological site

Context – archaeological context: area, grid, layer, feature (only if available)

Chronology – chronology, including chronology established by excavator/s

Vessel part
V – complete vessel (with rim and body present)
R – rim sherd
RC – complete or almost complete profile of a vessel
N – neck sherd
B – base sherd
F – sherd
H – handle

Catalogue description – as stated in a registry, database or publication

Vessel shape
O – open
C – closed

Shaping method
HM – handmade
PD – pinching and drawing technique (only if clearly visible)

Rim shape
P – pointed
F – flat
R – rounded
RC – recurved
ST – straight
F – flaring
N – narrowing

Body shape

S – sphere
E – ellipsoid
O – ovaloid
C – cylinder
H – hyperboloid
CN – cone

Base shape

R – round
SF – slightly flat
F – flat
P – pointed
R – ring base
K – knobbed base

RD – rim diameter (mm)

MD – maximum vessel body diameter (mm)

BD – base diameter (mm)

H – height (mm)

WT – wall thickness (mm)

Clay

N - Nile clay
C - calcareous clay

Temper

S – organic
SD – sand
G – grog
C – calcite
F – fibrous organic temper
M – mica (natural) (only if abundant and clearly visible)

Temper size (according to Orton *et al.*, 2010: 240, fig. A.4)

S – small
M – medium
C – coarse
VC – very coarse

Temper % – percentage of tempers in paste (according to Orton *et al.*, 2010: fig. A.4)

Break EXT/M/INT – colours of break section exterior-middle-interior
R – red
DR – dark red
YR – yellowish red
B – brown
LB – light brown
DB – dark brown
RB – reddish brown
BL – black
G – grey

PF – post-firing marks
P – pierced
B – burnt

Ext. surf. colour - external surface colour according to a Munsell colour chart

Int. surf. colour – internal surface colour according to a Munsell colour chart

Slip colour – slip colour according to a Munsell colour chart

Ext. surf. treat. – external surface treatment

Int. surf. treat. – internal surface treatment
S – smoothing
B – burnishing
R – roughening
H – horizontal burnishing
V – vertical burnishing
C – in the upper part horizontal burnishing, in the lower part vertical burnishing
O – oblique burnishing
X – identification not possible

Dec. pattern – decoration pattern
KN – knob
HB – herringbone
L – line
HL – horizontal line
N – nail impression

Dec. technique – technique of decoration
APP – applied
INC – incised
IMP – impressed

Dec. location – location of decoration
- E – exterior
- R – rim
- UR – under rim
- U – upper part of the vessel
- SH – shoulders

Drawing – reference to a drawing

References – reference to original publications (only if possible)

Tables

Table 1. Chronological comparative table of the cultural units of north-eastern Africa and the southern Levant during the Early and Middle Holocene periods

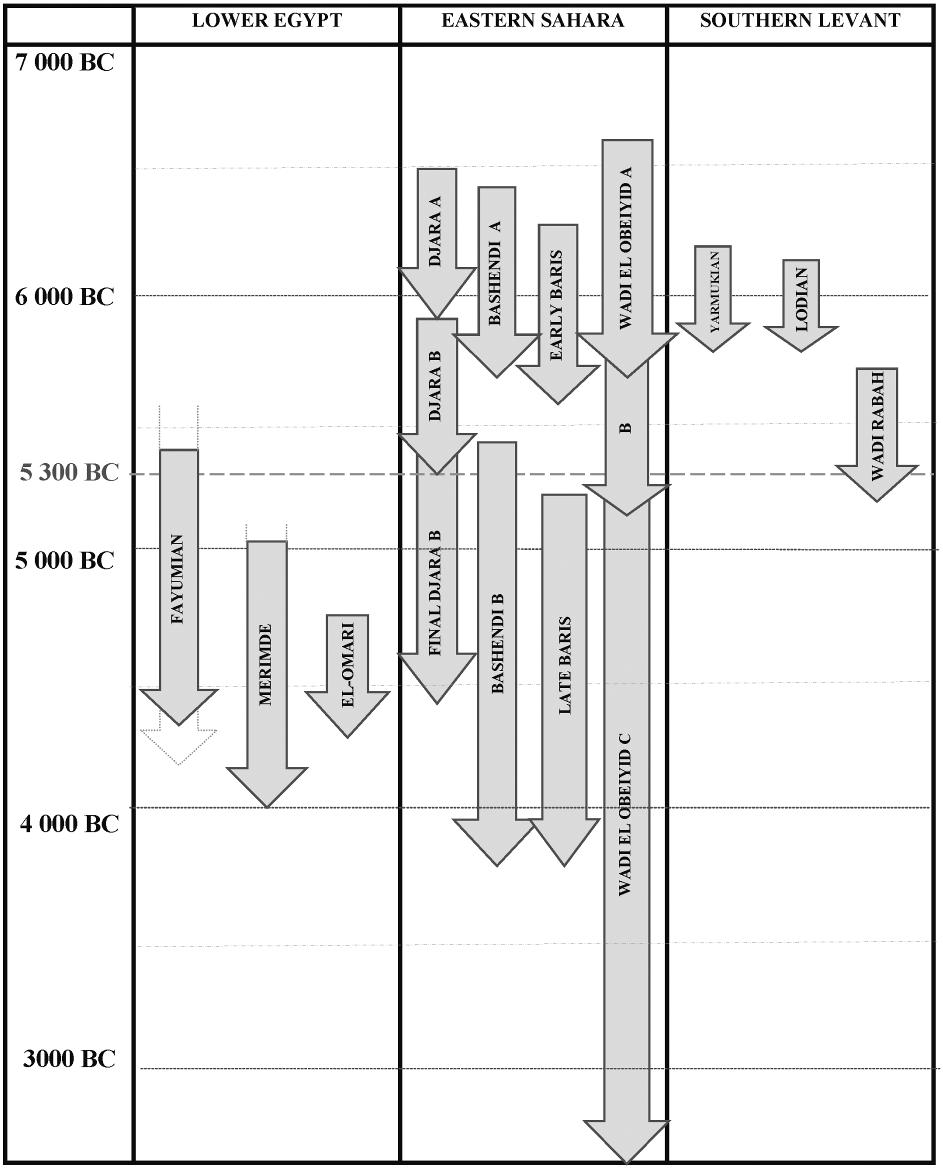


Table 2. Percentages of wares at Neolithic sites in Lower Egypt (Caton-Thompson & Gardner, 1934; Eiwanger, 1984; 1988; 1992; Debono & Mortensen, 1990; Emmitt, 2011)

	Fayumian[1]	Fayumian[2]	Merimde I	Merimde II	Merimde III	el-Omari[3]
Burnished	dominant?	14.2%[4]	62.5 %	53%	53.1%	62% /37%
Smoothed	n/a	n/a	33.7%	46.7%	46.9%	34% / 46%
Rough	n/a	n/a	n/a	n/a	n/a	4% / 17%
Others	n/a	7.4%[5]	3.8%	0.3%	n/a	n/a

1 According to G. Caton-Thompson & E. Gardner (1934) most pottery with rough surfaces originally belonged to red-polished ware.

2 The Kom W and Upper K Pits assemblages analysed by J. Emmitt (2011: table 5.14).

3 Only site A; all bodysherds/without unit 113.

4 Including "slip and burnished" and "only burnished"

5 The surface treatment has worn off 68.9% of the studied assemblages; on 9.5% of studied assemblages no traces of any surface treatment were identified.

Table 3. Percentages of vessel forms at Neolithic sites in Lower Egypt (Caton-Thompson & Gardner, 1934; Eiwanger, 1984; 1988; 1992; Debono & Mortensen, 1990; Emmitt, 2011)

	Fayumian[1]	Fayumian[2]	Merimde I		Merimde II		Merimde III	el-Omari
			B	S	B	S		
Open	dominant	15%	43.9%	53.3%	38.6%	51.8%	decrease	41%
Closed	n/a	13%	42.3%	21.1%	46.15%	31.4%	increase	29%
Vertical	n/a	9%	7%	13.3%	10.59%	12.5%	decrease	30%
Others	n/a	n/a	6.8%	12.3%	4.66%	4.3%	n/a	n/a

1 G. Caton-Thompson & E. Gardner (1934).

2 On the basis of rim orientations and types in the assemblage from the Kom W and the Upper K Pits studied by J. Emmitt (2011: table 5.12). In case of 63% of the assemblages an identification was not possible

Table 4. Annual ecological cycle and possible schedule of subsistence strategies and pottery production in north-eastern Africa and the southern Levant (Hassan, 1984a: fig. 3; Köhler, 1997: fig. 3; Midant-Reynes, 2003: fig. 4; Abbo *et al.*, 2003; Wengrow, 2006 : 17 ; Kindermann & Bubenzer, 2007: fig. 10; Emmitt, 2011; Kadowaki, 2012: fig. 3; Linseele *et al.*, 2016)

REGION / MONTH	1	2	3	4	5	6	7	8	9	10	11	12
WESTERN DESERT	WINTER RAINS					SUMMER MONSOONS					WINTER RAINS	
	BASE CAMPS ALONG POOLS			SHORT-TERM CAMPS							BASE CAMPS ALONG POOLS	
	MICRO MOVES			MICRO AND MACRO MOVES		MIGRATION TO PERMANENT WATER SOURCES					MICRO MOVES	
	GATHERING AND HUNTING											
	HERDING											
				POTTERY PRODUCTION								
LOWER EGYPT	WINTER RAINS										WINTER RAINS	
	POST-FLOOD PERIOD					FLOOD AND POST-FLOOD PERIOD						
	MICRO AND MACRO MOVES WITH LONGER STOPOVERS											
	CROPS			HARVEST								CROPS
								FISHING				
	FORAGING											
				POTTERY PRODUCTION								
SOUTHERN LEVANT	WINTER RAINS										WINTER RAINS	
	PERMANENT OCCUPATION											
	CROPS			HARVEST AND PROCESS							CROPS	
	HERDING											
	POTTERY PRODUCTION											

Table 5. A comparative table of the Neolithic pottery of Lower Egypt and the Pottery Neolithic ceramics of the southern Levant

	Southern Levant			Lower Egypt		
	Yarmukian	**Lodian**	**Wadi Rabah**	**Fayum**	**Merimde**	**el-Omari**
	Procurement and preparation of raw materials					
clay	local; calcareous clays	local; calcareous, alluvial or ferruginous clays; 'terra rosa'	local; rendzina	local; Nile silts, different deposits	local; Nile silts, different deposits	local; Wadi Hof, Nile silts
tempers	local; sand, crushed calcite, straw, basalt, grog, and flint	chalk, wadi sand, and grog	chalk, grit, grog and organic temper	local; sand, straw,	untempered pottery in phase 1; local; sand, straw, gravel, quartz, limestone, shells	local; sand, straw, papyrus, ochre
water	in the vicinity of settlements			lake	river	springs, wadi, river
fuel	in the vicinity of settlements			local; tamarisk, acacia	local	local; tamarisk, acacia
	Forming vessels					
method	hand-made; slabs; coils; moulds	hand-made; slabs; coils; moulds	hand-made; slabs; coils; moulds	hand-made; coils, pinching and drawing; wall thickness approx. 5-12 mm	hand-made; coils; wall thickness approx. 5-15 mm	hand-made; coils; wall thickness approx. 5-15 mm
forms[1]	truncated bowls, chalices, pots, basins, and pithoi, jars of various sizes with a spherical body, a long vertical neck and a simple rim with two lug handles (Sha'ar Hagolan jars), jars with a spherical body, a short vertical neck and a simple rim (Jericho IX jars), hole-mouth jars and jars with an ovoid body, a wide flat base and an S-shaped profile	variety of open and closed vessels known in the Yarmukian assemblages; inclined-neck jars with a globular or oval body and an indentation or ridge between the neck and the shoulder (Lodian jars)	carinated, S-shaped or V-shaped bowls, pedestaled bowls, mini bowls, jars with bow-rims, flaring rims, or collard jars, tabular stands, pithoi with thumb-impressed ledge handles, hole-mouth jars, churns, spouted bowls, spouted kraters	open bowls, bowls with straight walls, hemispherical bowls and deep restricted vessels; round rims, round and flat bases	open bowls, open bowls with straight walls, hemispherical bowls and deep restricted vessels; round rims, round and flat bases[2]	open bowls, open bowls with straight walls, hemispherical bowls and deep restricted vessels; round rims, round and flat bases

Table 5. *(continued)* A comparative table of the Neolithic pottery of Lower Egypt and the Pottery Neolithic ceramics of the southern Levant

	Southern Levant			Lower Egypt		
	Yarmukian	**Lodian**	**Wadi Rabah**	**Fayum**	**Merimde**	**el-Omari**
			Pre-firing treatments			
surface treatment	burnishing, roughing slip coating	smoothing, burnishing, plain burnishing, roughening, slip covering,	burnishing, slip coating	burnishing, smoothing, roughing, slip coating	burnishing, smoothing, roughing, slip coating	burnishing, smoothing, roughing, slip coating
decoration	burnishing; variety of incised and painted patterns: zigzag, herringbone, parallel lines;	burnishing; variety of painted patterns: triangles, lozenges, and zigzags; incised patterns zigzag, herringbone, parallel lines;	burnishing; variety of painted, incised and combed patterns: zigzag, herringbone, parallel lines, wavy lines, round, triangular, lunar-shaped impressions, plastic decoration	knobs	herringbone pattern[3]; knobs; various decoration patterns in phase 3	knobs
			Firing			
method and temperature	open firing	open firing	open firing; kilns	open firing; 600°C	open firing; 600°C	open firing; 800°C

1 Only the most common forms.

2 Phases 1 and 2.

3 Only for phase 1.

Table 6. A comparative table of the Neolithic pottery of Lower Egypt and the undecorated thin-walled pottery of the eastern Sahara

	Eastern Sahara	Lower Egypt		
		Fayum	**Merimde**	**el-Omari**
Procurement and preparation of raw materials				
clay	local; clay deposits in oases	local; Nile silts, different deposits	local; Nile silts, different deposits	local; Wadi Hof, Nile silts
tempers	local; quartz, shale, limestone, gypsum; organic temper	local; sand, straw,	untempered pottery in phase 1; local – sand, straw, gravel, quartz, limestone, shells	local; sand, straw, papyrus, ochre
water	pans, playas, springs, oasis	lake	river	springs, wadi, river
fuel	local; tamarisk, acacia	local; tamarisk, acacia	local	local; tamarisk, acacia
Forming vessels				
method	hand-made; coils, wall thickness app. 3-7 mm	hand-made; coils, pinching and drawing; wall thickness approx. 5-12 mm	hand-made; coils; wall thickness approx. 5-15 mm	hand-made; coils; wall thickness approx. 5-15 mm
forms[1]	open bowls, open bowls with straight walls, hemispherical bowls and deep restricted vessels, round rims, round or pointed bases	open bowls, open bowls with straight walls, hemispherical bowls and deep restricted vessels; round rims, round and flat bases	open bowls, open bowls with straight walls, hemispherical bowls and deep restricted vessels; round rims, round and flat bases[2]	open bowls, open bowls with straight walls, hemispherical bowls and deep restricted vessels; round rims, round and flat bases
Pre-firing treatments				
surface treatment	burnishing, smoothing, roughing, slip coating	burnishing, smoothing, roughing, slip coating	burnishing, smoothing, roughing, slip coating	burnishing, smoothing, roughing, slip coating
decoration	no	knobs	herringbone pattern[3]; knobs; various decoration patterns in phase 3	knobs
Firing				
method and temperature	open firing; 700°C	open firing; 600°C	open firing; 600°C	open firing; 800°C

1 Only the most common forms.

2 Phases 1 and 2.

3 Only for phase 1.

Table 7a. Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
1	BM	EA76775	1	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	Group of 18 sherds from different hand-made pottery vessels with sand and/or vegetal tempered fabrics. Most surfaces are abraded.
2	BM	EA76775	2	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
3	BM	EA76775	3	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
4	BM	EA76775	4	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
5	BM	EA76775	5	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
6	BM	EA76775	6	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
7	BM	EA76775	7	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
8	BM	EA76775	8	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
9	BM	EA76775	9	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
10	BM	EA76775	10	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
11	BM	EA76775	11	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
12	BM	EA76775	12	Fayum E29H2 Trench 2	surface	NEOLITHIC	F	see EA76775(1)
13	BM	EA76775	13	Fayum E29H2 Trench 2	surface	NEOLITHIC	R	see EA76775(1)
14	BM	EA76775	14	Fayum E29H2 Trench 2	surface	NEOLITHIC	R	see EA76775(1)
15	BM	EA76775	15	Fayum E29H2 Trench 2	surface	NEOLITHIC	R	see EA76775(1)
16	BM	EA76775	16	Fayum E29H2 Trench 2	surface	NEOLITHIC	R	see EA76775(1)
17	BM	EA76775	17	Fayum E29H2 Trench 2	surface	NEOLITHIC	R	see EA76775(1)

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
18	BM	EA76776	1	Fayum E29H2 Trench 2	surface	NEOLITHIC	R	Rim sherd, rounded to pointed in shape, belonging to a hand-made, simple contour unrestricted pottery bowl. Surfaces are reddish brown in colour and partially abraded. The fabric is vegetal tempered.
19	BM	EA76778	1	Fayum E29H2 Trench 2	sub-surface	NEOLITHIC	R	Rim sherd, rounded in shape, belonging to a hand-made, unrestricted simple contour, thick pottery bowl. It is dark brown coated on the ouside and red inside. Surfaces are poorly preserved. The fabric is vegetal tempered.
20	BM	EA76779	1	Fayum E29H2 Trench 2	sub-surface	NEOLITHIC	R	Rim sherd, rounded in shape, belonging to a hand-made, unrestricted simple contour, pottery bowl. It is brown coated with red spots. Surfaces are poorly preserved. The fabric is sand tempered. Many salt encrustations recorded.
21	BM	EA76780	1	Fayum E29H2 Trench 2	layer 10	NEOLITHIC	F	Group of two sherds from different hand-made pottery vessels with sand or vegetal tempered fabrics. Surfaces are abraded.
22	BM	EA76780	2	Fayum E29H2 Trench 2	layer 10	NEOLITHIC	F	see EA76780(1)

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
23	BM	EA76781	1	Fayum E29H2 Trench 2	layer 10	NEOLITHIC	R	Rim sherd, rounded in shape, belonging to a hand-made pottery bowl. Surfaces are abraded, but probably they were coated. The fabric has sand and vegetal inclusions.
24	BM	EA76782	1	Fayum E29H2 Trench 2	layer 9	NEOLITHIC	F	Group of 4 sherds from hand-made pottery vessels made of fine vegetal tempered fabric. Surfaces are abraded.
25	BM	EA76782	2	Fayum E29H2 Trench 2	layer 9	NEOLITHIC	F	see EA76782(1)
26	BM	EA76782	3	Fayum E29H2 Trench 2	layer 9	NEOLITHIC	R	see EA76782(1)
27	BM	EA76783	1	Fayum E29H2 Trench 2	layer 9	NEOLITHIC	RC	Sherd, including a section of rim and base, belonging to a hand-made, unrestricted simple contour, pottery bowl. Surfaces are partially encrusted, probably the inside was dark brown and the outside brown smoothed. The fabric is sand tempered.
28	BM	EA76784	1	Fayum E29H2 Trench 2	layer 8	NEOLITHIC	F	Group of 15 sherds from different hand-made pottery vessels with sand and/or vegetal tempered fabrics. Surfaces abraded.

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
29	BM	EA76784	2	Fayum E29H2 Trench 2	layer 8	NEOLITHIC	F	see EA76784(1)
30	BM	EA76784	3	Fayum E29H2 Trench 2	layer 8	NEOLITHIC	F	see EA76784(1)
31	BM	EA76784	4	Fayum E29H2 Trench 2	layer 8	NEOLITHIC	F	see EA76784(1)
32	BM	EA76784	5	Fayum E29H2 Trench 2	layer 8	NEOLITHIC	R	see EA76784(1)
33	BM	EA76785	1	Fayum E29H2 Trench 2	layer 8	NEOLITHIC	F/B	Basal sherd from a hand-made pottery vessel, rounded in shape and red-brown in colour. The fabric is sand tempered.
34	BM	EA76786	1	Fayum E29H2 Trench 2	layer 8	NEOLITHIC	B	Flat basal sherd with a rounded edge from a hand-made pottery vessel, yellowish-red inside and violet-red outside. The fabric is vegetal tempered.
35	BM	EA76787	1	Fayum E29H2 Trench 2	layer 7	NEOLITHIC	F	Group of 3 sherds from different hand-made pottery vessels made of sand and/or vegetal tempered fabrics. Surfaces are abraded.
36	BM	EA76787	2	Fayum E29H2 Trench 2	layer 7	NEOLITHIC	F	see EA76787(1)
37	BM	EA76787	3	Fayum E29H2 Trench 2	layer 7	NEOLITHIC	R	see EA76787(1)

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
38	BM	EA76788	1	Fayum E29H2 Trench 2	layer 6	NEOLITHIC	F	Group of 2 sherds from different hand-made pottery vessels made of sand and/or vegetal tempered fabrics. Surfaces are abraded.
39	BM	EA76788	2	Fayum E29H2 Trench 2	layer 6	NEOLITHIC	R	see EA76788(1)
40	BM	EA76789	1	Fayum E29H2 Trench 2	layer 5	NEOLITHIC	F	Group of 3 sherds from different hand-made pottery vessels made of sand and sand and vegetal tempered fabrics. Surfaces are abraded.
41	BM	EA76789	2	Fayum E29H2 Trench 2	layer 5	NEOLITHIC	F	see EA76789(1)
42	BM	EA76789	3	Fayum E29H2 Trench 2	layer 5	NEOLITHIC	R	see EA76789(1)
43	BM	EA76790	1	Fayum E29H2 Trench 2	layer 4	NEOLITHIC	F	Group of 5 sherds from different hand-made pottery vessels made of sand and sand and vegetal tempered fabrics. Surfaces are abraded.
44	BM	EA76790	2	Fayum E29H2 Trench 2	layer 4	NEOLITHIC	F	see EA76790(1)
45	BM	EA76790	3	Fayum E29H2 Trench 2	layer 4	NEOLITHIC	F	see EA76790(1)
46	BM	EA76790	4	Fayum E29H2 Trench 2	layer 4	NEOLITHIC	F	see EA76790(1)
47	BM	EA76790	5	Fayum E29H2 Trench 2	layer 4	NEOLITHIC	F	see EA76790(1)

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
48	BM	EA76791	1	Fayum E29H2 Trench 2	layer 4	NEOLITHIC	R	Rim sherd, rounded in shape, belonging to a hand-made, unrestricted simple contour, pottery bowl. Surfaces abraded but once red polished. The fabric is sand tempered.
49	BM	EA76792	1	Fayum E29H2 Trench 2	layer 3	NEOLITHIC	F	Group of 5 pottery sherds from different hand-made vessels with sand and/or vegetal tempered fabrics. Surfaces are abraded.
50	BM	EA76792	2	Fayum E29H2 Trench 2	layer 3	NEOLITHIC	F	see EA76792(1)
51	BM	EA76792	3	Fayum E29H2 Trench 2	layer 3	NEOLITHIC	F	see EA76792(1)
52	BM	EA76792	4	Fayum E29H2 Trench 2	layer 3	NEOLITHIC	F	see EA76792(1)
53	BM	EA76792	5	Fayum E29H2 Trench 2	layer 3	NEOLITHIC	F	see EA76792(1)
54	BM	EA76793	1	Fayum E29H2 Trench 2	layer 2	NEOLITHIC	F	Group of 4 sherds from different hand-made pottery vessels with sand and vegetal tempered fabrics. Surfaces are abraded.
55	BM	EA76793	2	Fayum E29H2 Trench 2	layer 2	NEOLITHIC	F	see EA76793(1)
56	BM	EA76793	3	Fayum E29H2 Trench 2	layer 2	NEOLITHIC	R	see EA76793(1)
57	BM	EA76793	4	Fayum E29H2 Trench 2	layer 2	NEOLITHIC	R	see EA76793(1)

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
58	BM	EA76794	1	Fayum E29H2 Trench 2	layer 2	NEOLITHIC	R	Rim sherd, flat in shape, probably belonging to a hand-made, unrestricted deep pottery bowl. Both surfaces are partially eroded but interior and rim top still black and exterior red polished. The fabric has sand and vegetal inclusions.
59	BM	EA76795	1	Fayum E29H2 Trench 2	layer 1	NEOLITHIC	F	Group of 5 pottery sherds from different hand-made vessels with sand and vegetal tempered fabrics. Surfaces abraded.
60	BM	EA76795	2	Fayum E29H2 Trench 2	layer 1	NEOLITHIC	F	see EA76795(1)
61	BM	EA76795	3	Fayum E29H2 Trench 2	layer 1	NEOLITHIC	F	see EA76795(1)
62	BM	EA76795	4	Fayum E29H2 Trench 2	layer 1	NEOLITHIC	F	see EA76795(1)
63	BM	EA76795	5	Fayum E29H2 Trench 2	layer 1	NEOLITHIC	R	see EA76795(1)
64	BM	EA76796	1	Fayum E29H2 Trench 2	layer 1	NEOLITHIC	R	Rim sherd, flat in shape, belonging to a hand-made pottery bowl. Surfaces are abraded but still red in colour. The fabric is sand tempered.
65	PM	UC2500	1	Fayum Kom W	strip Q at latitude/longitude 79/4	NEOLITHIC	V	Pottery bowl; rough; brown grey.

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
66	PM	UC2501	1	Fayum Kom W	N/A	NEOLITHIC	RC	Pottery cup; rough, red; fragment, restored.
67	PM	UC2502	1	Fayum Kom W	strip F at latitude/ longitude 154/12	NEOLITHIC	F	Pottery cup; red with convex sides.
68	PM	UC2503	1	Fayum Kom W	N/A	NEOLITHIC	RC	Pottery cup; rough; pinky buff; fragment restored.
69	PM	UC2504	1	Fayum Kom W	strip R at latitude/ longitude 45/8 (register pencilled R ?35/8)	NEOLITHIC	V	Pottery cup; rough; mottled.
70	PM	UC2505	1	Fayum Kom W	strip P at latitude/lon-gitude 100/1	NEOLITHIC	RC	Pottery cup; rough; brown; restored.
71	PM	UC2506	1	Fayum Kom W	N/A	NEOLITHIC	V	Pottery cup; rough; brown; hole in base mended. From Kom W, precise location not identified.
72	PM	UC2507	1	Fayum Kom W	strip J at latitude/lon-gitude 100/2	NEOLITHIC	B	Pottery pedestalled cup; rough; red brown; fragment.

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
73	PM	UC2508	1	Fayum Kom W	strip P at latitude/ longitude 141/14	NEOLITHIC	B	Pottery pedestalled cup; rough; red brown; fragment.
74	PM	UC2509	1	site T near Qasr el-Sagha	N/A	NEOLITHIC	B	Pottery pedestalled cup; rough; red brown; fragment.
75	PM	UC2510	1	Fayum Kom W	strip Q at latitude/lon-gitude 79/11	NEOLITHIC	B	Pottery fragment of base; rough brown.
76	PM	UC2511	1	Fayum Kom W	strip H at latitude/lon-gitude 100/5	NEOLITHIC	R	Pottery fragment of red polished rim; rivet hole.
77	PM	UC2512	1	Fayum Kom W	strip K at latitude/ longitude 108/10	NEOLITHIC	R	Pottery fragment of rim, rough red, large base.
78	PM	UC2513	1	Fayum Kom W	N/A	NEOLITHIC	R	Pottery fragment of rim, unpolished grey with four studs. From Fayum Kom W.
79	PM	UC2514	1	Fayum Kom W	N/A	NEOLITHIC	B	Pottery fragment of base with four knobbed feet.
80	PM	UC2515	1	Fayum Kom W	strip L at latitude/ longitude 100/10	NEOLITHIC	R	Pottery fragment of rim with protruding, rounded edge.

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
81	PM	UC2516	1	Fayum Kom W	strip L at latitude/longitude 66/1	NEOLITHIC	R	Pottery fragment of rim; rough; brown grey.
82	PM	UC2517	1	Fayum	N/A	NEOLITHIC	F	Pottery fragment; polished red outside.
83	PM	UC2518	1	Fayum	N/A	NEOLITHIC	F	Pottery fragment; polished black.
84	PM	UC2520	1	Fayum Site N	in the ancient lake-bed	NEOLITHIC	RC	Pottery rectangular dish.
85	PM	UC2521	1	Fayum	N/A	NEOLITHIC	F	Pottery sherds, from a cooking pot.
86	PM	UC2522	1	Fayum	N/A	NEOLITHIC	V	Pottery cooking pot; rough; mottled red; rim crumbled.
87	PM	UC2523	1	Fayum Kom W	strip R at latitude/longitude 98/1	NEOLITHIC	V	Pottery cooking pot; polished red; keeled; rim crumbled.
88	PM	UC2803	1	Fayum Kom W	strip I, site longitude/latitude 80/17	NEOLITHIC	R	Pottery sherd, rim; red polished; mended.
89	PM	UC2804	1	Fayum Kom W	N/A	NEOLITHIC	F	Pottery sherd; red polished.
90	PM	UC2805	1	Fayum Kom W	N/A	NEOLITHIC	R	Pottery sherd rim; red polished.

Table 7a. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION
91	PM	UC2806	1	Fayum Kom W	strip N, site longitude/ latitude 90/19	NEOLITHIC	R	Pottery sherd, rim; red polished.
92	PM	UC2807	1	Fayum Kom W	N/A	NEOLITHIC	R	Pottery sherd rim and fragments; red polished, peaked.
93	PM	UC2809	1	Fayum Kom W	N/A	NEOLITHIC	R	Pottery sherd, rim; smoothed.
94	PM	UC2810	1	Fayum Kom W	N/A	NEOLITHIC	F	Pottery sherd; dark grey polished.
95	PM	UC2811	1	Fayum Kom W	N/A	NEOLITHIC	R	Pottery sherd, rim; red polished; black at rim.
96	PM	UC2948	1	Fayum	granary pit K7	NEOLITHIC	RC	Pottery bowl; fragments rejoined in modern times; conical; rough.
97	PM	UC2949	1	Fayum	granary pit K47	NEOLITHIC	RC	Pottery bowl; fragments rejoined; coni-cal; rough.
98	PM	UC2950	1	Fayum	granary pit K65	NEOLITHIC	RC	Pottery bowl; fragment; red polished; no rim.
99	PM	UC2951	1	Fayum	N/A	NEOLITHIC	V	Pottery bowl; red brown, smoke-black-ened externally, part of rim missing.

Table 7b. Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (shape and fabric)

NO.	ID	VESSEL SHAPE	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
1	EA76775(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13	N	S/SD	C/M	20-5	B
2	EA76775(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20-22	N	S/SD	M/M	15-15	B/BL/B
3	EA76775(3)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14	N	S/SD	C/M	20-10	BL/B
4	EA76775(4)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12	N	S/SD/C	C/M	20-5-5	B
5	EA76775(5)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17	N	S/SD	C/M	10-10	DR
6	EA76775(6)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13-14	N	S/SD	F/M	10-15	YR
7	EA76775(7)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8	N	S/SD	C/F	15-10	YR/BL/YR
8	EA76775(8)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7-9	N	S/SD	F/M	15-10	R
9	EA76775(9)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14	N	S/SD	M/M	15-10	R
10	EA76775(10)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11	N	S/SD	M/M	10-15	G/B
11	EA76775(11)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11	N	S/SD	M/M	10-15	DB
12	EA76775(12)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12	N	S/SD	M/M	10-10	DB
13	EA76775(13)	O	HM	RS	N/A	N/A	250	N/A	N/A	N/A	9	N	S/SD	M/M	10-15	BL
14	EA76775(14)	O	HM	RF	N/A	N/A	250	N/A	N/A	N/A	9-11	N	S/SD	M/M	15-5	B
15	EA76775(15)	C	HM	RN	N/A	N/A	250	N/A	N/A	N/A	8	N	S/SD	M/M	10-10	YB
16	EA76775(16)	O	HM	FF	N/A	N/A	250	N/A	N/A	N/A	10	N	S/SD	M/M	10-10	B/BL/B
17	EA76775(17)	O	HM	RF	N/A	N/A	70	N/A	N/A	N/A	7	N	S/SD	M/M	10-5	R
18	EA76776	O	HM	RF	N/A	N/A	150	N/A	N/A	N/A	6-7	N	S/DF	C/M	15-10	R/BL/R
19	EA76778	O	HM	RF	N/A	N/A	N/A	N/A	N/A	N/A	16-20	N	S/SD	C/M	20-20	B
20	EA76779	O	HM	RF	N/A	N/A	250	N/A	N/A	N/A	9-10	N	S/SD	C/M	15-10	B/BL/B

Table 7b. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (shape and fabric)

NO.	ID	VESSEL SHAPE	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
21	EA76780(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17-18	N	S/SD	VC/C	20-10	DR/BL/DR
22	EA76780(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11-13	N	S/SD	F/M	3-10	R
23	EA76781	O	HM	RS	N/A	N/A	150	N/A	N/A	N/A	6-9	N	S/SD	M/M	15-5	R
24	EA76782(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8	N	S/SD	M/M	10-5	YR/G/YR
25	EA76782(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8-9	N	S/SD	M/M	10-5	R
26	EA76782(3)	O	HM	PF	N/A	N/A	210	N/A	N/A	N/A	10-11	N	S/SD	M/M	10-10	R
27	EA76783	O	HM	PF	C	F	N/A	N/A	N/A	60	7-13	N	S/SD	C/M	15-15	B
28	EA76784(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17-16	N	S/SD	M/F	10-10	DB
29	EA76784(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13-17	N	S/SD	M/F	10-10	DB
30	EA76784(3)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	13-14	N	S/SD	M/M	5-10	R/DG/R
31	EA76784(4)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10-11	N	S/SD	M/M	15-5	R
32	EA76784(5)	O	HM	PF	N/A	N/A	250	N/A	N/A	N/A	8-11	N	S/SD	M/M	5-3	R
33	EA76785	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12-25	N	S/SD	F/M	5-10	B
34	EA76786	N/A	HM	N/A	N/A	F	N/A	N/A	N/A	N/A	14-18	N	S/SD/M	C/M/F	20-3-3	B
35	EA76787(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9	N	S/SD	M/F	10-10	DB
36	EA76787(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17-18	N	S/SD	M/M	5-15	RB/BL/RB
37	EA76787(3)	O	HM	RF	N/A	N/A	N/A	N/A	N/A	N/A	8	N	S/SD	C/M	15-5	B/BL/B
38	EA76788(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16-18	N	S/SD	M/M	10-15	B/BL
39	EA76788(2)	O	HM	PF	N/A	N/A	N/A	N/A	N/A	N/A	6-8	N	S/SD	M/F	10-10	R
40	EA76789(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10-11	N	S/SD	F/M	3-10	B

Table 7b. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (shape and fabric)

NO.	ID	VESSEL SHAPE	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
41	EA76789(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	N	S/SD	F-M/M	10-5	B
42	EA76789(3)	O	HM	PF	N/A	N/A	250	N/A	N/A	N/A	7	N	S/SD/M	M/M/F	10-5-3	B
43	EA76790(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7	N	S/SD	M/F	10-3	LB/BL/LB
44	EA76790(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12-13	N	S/SD	M/M	10-5	B
45	EA76790(3)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12	N	SD	F-M	15	B
46	EA76790(4)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7	N	S/SD	M/F	5-5	LB/BL/LB
47	EA76790(5)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15	N	S/SD	C/M	15-10	B/BL/B
48	EA76791	O	HM	PF	N/A	N/A	200	N/A	N/A	N/A	8	N	S/SD	F/F	5-5	R/BL/R
49	EA76792(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6-8	N	S/SD	C/M	15-5	RB/BL/RB
50	EA76792(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12-14	N	S/SD	M/M	5-10	R
51	EA76792(3)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7	N	S/SD	C/M	10-10	B/BL/B
52	EA76792(4)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12-13	N	S/SD	M/F	5-5	B/BL/B
53	EA76792(5)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16-21	N	S/SD	C/M	15-10	RB/BL/RB
54	EA76793(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10-13	N	S/SD	F/F	5-10	R/B
55	EA76793(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20-26	N	S/SD	C/M	20-5	B
56	EA76793(3)	O	HM	RF	N/A	N/A	N/A	N/A	N/A	N/A	6-8	N	S/SD	M/M	10-10	B
57	EA76793(4)	O	HM	PF	N/A	N/A	170	N/A	N/A	N/A	8-10	N	S/SD/M	M/M/F	5-5-3	B
58	EA76794	C	HM	FN	N/A	N/A	220	N/A	N/A	N/A	8-7	N	S/SD	M/F	5-5	R/BL/R
59	EA76795(1)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12-13	N	S/SD	M/F	10-20	B/BL/B
60	EA76795(2)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	17	N	S/SD	C/M	15-10	B

Table 7b. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (shape and fabric)

NO.	ID	VESSEL SHAPE	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
61	EA76795(3)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8	N	S/SD	M/F	15-5	BL/B
62	EA76795(4)	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9	N	S/SD	M/F	15-5	B/BL/B
63	EA76795(5)	O	HM	RF	N/A	N/A	250	N/A	N/A	N/A	10	N	S/SD	C/M	20-5	B
64	EA76796	C	HM	FN	N/A	N/A	190	N/A	N/A	N/A	12	N	S/SD	C/M	10-5	B
65	UC2500	O	HM	PS	S	F	165	165	80	85	8-13	N	S/SD	M-C/M-C	15-2/15-20	?
66	UC2501	O	HM	RS	O	F	120	112	68	112	6-10	N	S/SD	M/M	15-20/10	YB
67	UC2502	C	HM	N/A	O	F	N/A	104	70	111	7-8-12	N	S/SD	M/M	20-10	DR
68	UC2503	C	HM	PN	O	F	100	118	80	110	6-9	N	S/SD	M-C/C	15-5	N/A
69	UC2504	O	HM PD	PS	O	R	70	73		73	7	N	SD/M	F/F	10-3	YB?
70	UC2505	C	HM	RN	O	F	50	60	23	62	6	N	S/SD	M/M	10-15	N/A
71	UC2506	C	HM PD	RN	O	F	45	58	47	51	5	N	S/SD/C	M/F/F	5-5-3	LYB
72	UC2507	N/A	HM	N/A	N/A	RB	N/A	N/A	80	N/A	10	N	S/SD/C	F/VF/F-C	5-5-3	B
73	UC2508	N/A	HM	N/A	N/A	RB	N/A	N/A	80	N/A	8-18/24	N	S/SD/M	M/M/F	15-5-3	RB
74	UC2509	N/A	HM	N/A	N/A	RB	N/A	N/A	40	N/A	5-7	N	S/SD/M	M-C/F/F	20-5-3	B/BL/B
75	UC2510	N/A	HM	N/A	C	F	N/A	N/A	110	N/A	6-7	N	S/SD/M	M-VC/ VF/F	30-3-3	DB
76	UC2511	C	HM	RN	S	N/A	140	N/A	N/A	N/A	7-8	N	S/SD	M/F	10-3	R
77	UC2512	C	HM	RN	S	N/A	130	N/A	N/A	N/A	9	N	S/SD	F/F	5-5	RY/BL/RY
78	UC2513	O	HM	RS	N/A	N/A	60	N/A	N/A	N/A	6	N	SD/M	F/F	5-9	B/BL/B

Table 7b. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (shape and fabric)

NO.	ID	VESSEL SHAPE	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
79	UC2514	N/A	HM	N/A	N/A	K	N/A	N/A	50	63x61	8	N	SD/M	M-C	10	R
80	UC2515	C	HM	RN	N/A	N/A	180	N/A	N/A	N/A	11	N	S/SD	F/F	5-10	RY/BL/RY
81	UC2516	O	HM	PS	S	N/A	260	N/A	N/A	N/A	6-11	N	S/SD/M	M/F/F	15-5-3	YB/BL/B
82	UC2517	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6-7	N	S/SD	F/F	5-3	DR/V/DR
83	UC2518	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	N	S/SD/M	F/F/F	5-3-3	BL
84	UC2520	O	HM	RF	S	F	260X300	N/A	N/A	108	10	N	S/SD/G	M-C/M-C/C	15-5-10	RB/BL/RB
85	UC2521	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	22 X 30	9	N	S/SD	M/M	5-5	DB
86	UC2522	C	HM	N/A	N/A	N/A	250	250	N/A	N/A	N/A	N	S/SD	M/F-M	15-5	RB/BL/RB
87	UC2523	C	HM	N/A	N/A	N/A	N/A	320	N/A	N/A	N/A	N	S/SD	M/F	10-5	R
88	UC2803	O	HM	RF	CN	N/A	280	N/A	N/A	N/A	9	N	S/SD	M/M	10-3	RB/BL/RB
89	UC2804	N/A	HM	N/A	N/A	N/A	C	N/A	N/A	N/A	7-10	N	S/SD/C	M/M/M	5-5-5	RB
90	UC2805	O	HM	RF	CN	N/A	160	N/A	N/A	N/A	7-8	N	S/SD	M/F	10-5	B/BL/BR
91	UC2806	C	HM	FN	S	N/A	100	N/A	N/A	N/A	8	N	S/SD	M-F	5-5	RB/BL/RB
92	UC2807	O	HM	RF	CN	N/A	250	N/A	N/A	N/A	10-15	N	S/SD	M-F	10-5	DR/BL/DR
93	UC2809	C	HM	FN	S	N/A	80	N/A	N/A	N/A	7	N	S/SD	F/F-M	3-3	RY/BL/RY
94	UC2810	N/A	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7	N	SD/C	M-C/M	5-5	BL

Table 7b. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (shape and fabric)

NO.	ID	VESSEL SHAPE	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
95	UC2811	O	HM	PF	CN	N/A	13	N/A	N/A	N/A	4	N	SD	VF	3	YR
96	UC2948	O	HM	RF	CN	F	225	225	70	142	11-12	N	S/SD	VC/F	30-5	B/BL/B
97	UC2949	O	HM	PS	S	F	140	140	77	109	8	N	SD/M	F-C/F	15-3	BL-DB
98	UC2950	C	HM	N/A	O	F	N/A	180	80	190	9-10	N	S	C/M	30	RB/BL
99	UC2951	C	HM	FN	O	F	N/A	180	72	230	N/A	N	S	M-C	10	N/A

Table 7c. Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
1	EA76775(1)	N/A	7.5YR5/3	7.5YR5/3	N/A	R	R	N/A	N/A	N/A	N/A	N/A
2	EA76775(2)	N/A	7.5YR5/6	7.5YR5/6	N/A	S	S	N/A	N/A	N/A	N/A	N/A
3	EA76775(3)	N/A	7.5YR4/6	7.5YR4/6	N/A	S	S	N/A	N/A	N/A	N/A	N/A
4	EA76775(4)	N/A	7.5YR5/8	7.5YR5/8	N/A	N/A	S	N/A	N/A	N/A	N/A	N/A
5	EA76775(5)	N/A	2.5YR4/8	2.5YR4/8	N/A	S	S	N/A	N/A	N/A	N/A	N/A
6	EA76775(6)	N/A	5YR5/8; 2.5YR5/1	5YR5/8; 2.5YR5/1	N/A	S	S	N/A	N/A	N/A	N/A	N/A
7	EA76775(7)	N/A	5YR5/6	5YR5/6	N/A	R	R	N/A	N/A	N/A	N/A	N/A
8	EA76775(8)	N/A	2.5YR5/4	2.5YR5/4	N/A	S	S	N/A	N/A	N/A	N/A	N/A
9	EA76775(9)	N/A	7.5YR6/6	7.5YR6/6	N/A	R	R	N/A	N/A	N/A	N/A	N/A
10	EA76775(10)	N/A	10YR3/1	7.5YR6/4	N/A	S	S	N/A	N/A	N/A	N/A	N/A
11	EA76775(11)	N/A	7.5YR5/8	7.5YR5/8	N/A	S	S	N/A	N/A	N/A	N/A	N/A
12	EA76775(12)	N/A	7.5YR3/3; 7.5YR2.5/3	7.5YR3/3; 7.5YR2.5/3	N/A	S	S	N/A	N/A	N/A	N/A	N/A
13	EA76775(13)	N/A	7.5YR6/4	2.5YR3/1	N/A	S	S	N/A	N/A	N/A	Fig. 13:5	N/A
14	EA76775(14)	N/A	10YR5/3	10YR5/3	N/A	R	R	N/A	N/A	N/A	Fig. 15:4	N/A
15	EA76775(15)	N/A	10YR5/6	10YR5/6	N/A	R	R	N/A	N/A	N/A	Fig. 13:2	N/A
16	EA76775(16)	N/A	10YR6/8	10YR6/8	N/A	R	R	N/A	N/A	N/A	Fig. 15:2	N/A
17	EA76775(17)	N/A	5YR5/6	5YR5/6	N/A	S	S	N/A	N/A	N/A	Fig. 14:1	N/A

Table 7c. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
18	EA76776	N/A	2.5YR5/8; 2.5YR4/1;	2.5YR 5/6	N/A	N/A	S	N/A	N/A	N/A	Fig. 14:2	N/A
19	EA76778	N/A	2.5YR5/6	7.5YR4/2	N/A	S	S	N/A	N/A	N/A	Fig. 13:4	N/A
20	EA76779	N/A	7.5YR5/6	7.5YR5/6	N/A	S	S	N/A	N/A	N/A	Fig. 15:7	N/A
21	EA76780(1)	N/A	2.5YR4/6	2.5YR4/6	N/A	R	R	N/A	N/A	N/A	N/A	N/A
22	EA76780(2)	N/A	2.5YR5/6	2.5YR5/6	7.5YR7/4	R	S	N/A	N/A	N/A	N/A	N/A
23	EA76781	N/A	2.5YR5/6	2.5YR5/6	7.5YR7/4	S	X	N/A	N/A	N/A	Fig. 14:3	N/A
24	EA76782(1)	N/A	5YR5/8	5YR5/8	EXT. 7.5YR4/4; INT. 2.5YR4/8	S	S	N/A	N/A	N/A	N/A	N/A
25	EA76782(2)	N/A	5YR5/8	5YR5/8	7.5YR7/4	S	S	N/A	N/A	N/A	N/A	N/A
26	EA76782(3)	N/A	5YR6/6	5YR6/6 R	N/A	S	S	N/A	N/A	N/A	Fig. 15:3	N/A
27	EA76783	N/A	7.5YR6/6; 7.5YR2.5/1	7.5YR3/4	N/A	S	S	N/A	N/A	N/A	Fig. 13:6	N/A
28	EA76784(1)	N/A	7.5YR4/2	7.5YR4/2	N/A	S	S	N/A	N/A	N/A	N/A	N/A
29	EA76784(2)	N/A	7.5YR4/3	7.5YR4/3	N/A	S	S	N/A	N/A	N/A	N/A	N/A
30	EA76784(3)	N/A	5YR6/6	2.5YR6/8	N/A	S	X	N/A	N/A	N/A	N/A	N/A
31	EA76784(4)	N/A	2.5YR5/8	2.5YR5/6	N/A	R	S	N/A	N/A	N/A	N/A	N/A
32	EA76784(5)	N/A	7.5YR6/6	7.5YR6/6	7.5YR7/4	S	S	N/A	N/A	N/A	Fig. 15:6	N/A
33	EA76785	N/A	7.5YR5/8	7.5YR5/8	N/A	S	S	N/A	N/A	N/A	N/A	N/A

Table 7c. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
34	EA76786	N/A	7.5YR5/3	7.5YR5/8	N/A	S	S	N/A	N/A	N/A	N/A	N/A
35	EA76787(1)	N/A	7.5YR5/4	7.5YR5/4	N/A	S	R	N/A	N/A	N/A	N/A	N/A
36	EA76787(2)	N/A	7.5YR6/6	7.5YR6/6	N/A	S	R	N/A	N/A	N/A	N/A	N/A
37	EA76787(3)	N/A	7.5YR6/4	7.5YR6/4	N/A	R	R	N/A	N/A	N/A	Fig. 14:6	N/A
38	EA76788(1)	N/A	10YR5/3	10YR4/2	N/A	S	S	N/A	N/A	N/A	N/A	N/A
39	EA76788(2)	N/A	2.5YR5/4	2.5YR5/4	N/A	S	S	N/A	N/A	N/A	Fig. 14:4	N/A
40	EA76789(1)	N/A	10YR5/3	10YR7/6	N/A	S	S	N/A	N/A	N/A	N/A	N/A
41	EA76789(2)	N/A	5YR6/3	5YR5/3	N/A	S	S	N/A	N/A	N/A	N/A	N/A
42	EA76789(3)	N/A	10YR4/3	10YR5/3	N/A	R	R	N/A	N/A	N/A	Fig. 14:8	N/A
43	EA76790(1)	N/A	7.5YR6/6	7.5YR6/6	N/A	R	R	N/A	N/A	N/A	N/A	N/A
44	EA76790(2)	N/A	7.5YR5/3	7.5YR5/4	7.5YR7/4	R	R	N/A	N/A	N/A	N/A	N/A
45	EA76790(3)	N/A	2.5YR5/6	10YR5/4	N/A	R	S	N/A	N/A	N/A	N/A	N/A
46	EA76790(4)	N/A	7.5YR6/4	7.5YR6/4	N/A	R	R	N/A	N/A	N/A	N/A	N/A
47	EA76790(5)	N/A	10YR7/4	10YR7/4	N/A	S	R	N/A	N/A	N/A	N/A	N/A
48	EA76791	N/A	5YR5/6;	2.5YR4/8	N/A	S	S	N/A	N/A	N/A	Fig. 15:1	N/A
49	EA76792(1)	N/A	5YR5/6	2.5YR4/8	N/A	R	R	N/A	N/A	N/A	N/A	N/A
50	EA76792(2)	N/A	2.5YR5/6	2.5YR5/6	N/A	S	S	N/A	N/A	N/A	N/A	N/A
51	EA76792(3)	N/A	7.5YR6/6	7.5YR6/4	N/A	S	S	N/A	N/A	N/A	N/A	N/A
52	EA76792(4)	N/A	7.5YR6/6	7.5YR5/4	N/A	S	S	N/A	N/A	N/A	N/A	N/A
53	EA76792(5)	N/A	5YR5/6	5YR5/6	N/A	R	R	N/A	N/A	N/A	N/A	N/A

Table 7c. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
54	EA76793(1)	N/A	7.5YR5/4	7.5YR6/6	N/A	R	R	N/A	N/A	N/A	N/A	N/A
55	EA76793(2)	N/A	7.5YR5/4	7.5YR5/4	7.5YR7/4	R	R	N/A	N/A	N/A	N/A	N/A
56	EA76793(3)	N/A	7.5YR5/4	7.5YR5/4	N/A	S	S	N/A	N/A	N/A	Fig. 14:5	N/A
57	EA76793(4)	N/A	2.5YR5/6	2.5YR5/6	7.5YR6/6	X	S	N/A	N/A	N/A	Fig. 14:7	N/A
58	EA76794	N/A	2.5YR6/6	5YR3/1	10YR4/6	BH	S	N/A	N/A	N/A	Fig. 13:3	N/A
59	EA76795(1)	N/A	5YR4/3; 5YR5/6	7.5YR5/4	N/A	R	R	N/A	N/A	N/A	N/A	N/A
60	EA76795(2)	N/A	5YR4/3; 5YR5/6	7.5YR5/4	N/A	R	R	N/A	N/A	N/A	N/A	N/A
61	EA76795(3)	N/A	10YR4/2	5YR5/6	N/A	N/A	S	N/A	N/A	N/A	N/A	N/A
62	EA76795(4)	N/A	7.5YR5/3	7.5YR5/3	N/A	R	R	N/A	N/A	N/A	N/A	N/A
63	EA76795(5)	N/A	7.5YR6/3	7.5YR4/2	N/A	S	N/A	N/A	N/A	N/A	Fig. 15:5	N/A
64	EA76796	N/A	7.5YR5/4	2.5YR5/8	N/A	R	R	N/A	N/A	N/A	Fig. 13:1	N/A
65	UC2500	N/A	5YR5/6; 5YR2.5/1; 10YR3/2	5YR5/6; 5YR2.5/1; 10YR3/2	N/A	R?	R?	N/A	N/A	N/A	Fig. 11:6	Caton-Thompson & Gardner, 1934: pl. XVIII, 6; Emmitt, 2011: fig. A10
66	UC2501	N/A	10YR4/4; 10YR2/2	10YR4/4	N/A	S	S	N/A	N/A	N/A	Fig. 12:11	N/A

Table 7c. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
67	UC2502	N/A	2.5YR4/6; 2.5YR2.5/2; 2.5YR2.5/1	2.5YR 3/3	N/A	R	R	N/A	N/A	N/A	Fig. 12:10	Caton-Thompson & Gardner, 1934: pl. XVI: 1; Emmitt, 2011: fig. A11
68	UC2503	N/A	5YR3/1; 5YR4/2; 5YR5/6; 2.5YR4/8	2.5YR2.5/1; 2.5YR5/4; 2.5YR3/3	N/A	S	S	N/A	N/A	N/A	Fig. 12:9	Emmitt, 2011: fig. A12
69	UC2504	N/A	10YR5/6; 10YR3/1	10YR5/6; 10YR3/1	N/A	S	S	N/A	N/A	N/A	Fig. 12:2	Emmitt, 2011: fig. A13
70	UC2505	N/A	10YR5/6; 10YR3/2	10YR5/6	N/A	R/S	R/S	N/A	N/A	N/A	Fig. 12:1	Emmitt, 2011: fig. A14
71	UC2506	N/A	10YR5/6; 10YR3/1	10YR5/6; 10YR3/1	N/A	S	S	N/A	N/A	N/A	Fig. 12:3	Emmitt, 2011: fig. A15
72	UC2507	N/A	7.5YR5/4	7.5YR5/4	N/A	S	S	N/A	N/A	N/A	Fig. 11:9	Caton-Thompson & Gardner, 1934: pl. XX: 48
73	UC2508	N/A	7.5YR6/8; 7.5YR4/4; 5YR6/6	7.5YR4/3	N/A	S	S	N/A	N/A	N/A	Fig. 11:8	Emmitt, 2011: fig. A16
74	UC2509	N/A	7.5YR5/6	7.5YR5/6	N/A	R	R	N/A	N/A	N/A	Fig. 11:10	N/A

Table 7c. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
75	UC2510	N/A	2.5YR3/3	2.5YR3/3	N/A	R	R	N/A	N/A	N/A	Fig. 11:4	N/A
76	UC2511	P	2.5YR5/6 RED	2.5YR5/6	2.5YR4/4	BH	S	N/A	N/A	N/A	N/A	Caton-Thompson & Gardner, 1934: pl.XVII: 12
77	UC2512	N/A	7.5YR6/6	7.5YR6/6	5YR5/8	S	S	KB	APP	EUR	Fig. 12:8	Caton-Thompson & Gardner, 1934: pl. XVII: 10
78	UC2513	N/A	10YR4/4	10YR5/4	N/A	S	S	KBS	APP	EUR	Fig. 12:4	Caton-Thompson & Gardner, 1934: pl.XVII: 24
79	UC2514	N/A	5YR5/6	5YR5/6	N/A	R	R	N/A	N/A	N/A	Fig. 11:7	Caton-Thompson & Gardner, 1934: 35 class 4.
80	UC2515	N/A	10YR4/2	5YR5/8	N/A	S	S	N/A	N/A	N/A	Fig. 12:12	N/A
81	UC2516	N/A	RIM 7.5YR6/8; BODY 2/5Y3/1	10YR6/8	N/A	R/S	R/S	HL	INC	EUR	Fig. 12:13	N/A
82	UC2517	N/A	N/A	N/A	2.5YR3/6	BH	S	N/A	N/A	N/A	N/A	N/A
83	UC2518	N/A	N/A	N/A	N/A	BH	BH	N/A	N/A	N/A	N/A	N/A

Table 7c. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
84	UC2520	N/A	5YR5/6; 5YR5/8; 5YR4/4	10YR6/6	N/A	R	R	N/A	N/A	N/A	Fig. 11:13	N/A
85	UC2521	N/A	10YR5/4	10YR5/4	N/A	R	R	N/A	N/A	N/A	N/A	N/A
86	UC2522	N/A	5YR4/4; 5YR2.5/2	5YR4/4; 5YR2.5/2	N/A	R	R	N/A	N/A	N/A	N/A	N/A
87	UC2523	N/A	10YR 4/8	10YR 4/8	10YR3/6	BH/O	BH/O	N/A	N/A	N/A	N/A	N/A
88	UC2803	N/A	7.5YR5/8	7.5YR5/8	2.5YR3/4; 2.5YR 2.5/1; 2.5YR4/8	BH	N/A	N/A	N/A	N/A	Fig. 11:11	Caton-Thompson & Gardner, 1934: 35
89	UC2804	N/A	N/A	N/A	EXT. 2.5YR3/4; INT. 2.5YR3/6	BH?	BH?	N/A	N/A	N/A	N/A	Caton-Thompson & Gardner, 1934: 35
90	UC2805	N/A	N/A	N/A	2.5YR3/6; 7.5YR5/8	BH	BH	N/A	N/A	N/A	Fig. 11:3	Caton-Thompson & Gardner, 1934: pl. XVII: 19
91	UC2806	N/A	7.5YR5/6	7.5YR5/6	2.5YR4/6	BH/O	S	N/A	N/A	N/A	Fig. 12:5	Caton-Thompson & Gardner, 1934: 35
92	UC2807	N/A	N/A	N/A	EXT. 2.5YR4/4; INT. 2.5YR3/6	S	BH	N/A	N/A	N/A	Fig. 11:1	Caton-Thompson & Gardner, 1934: 35

Table 7c. *(continued)* Fayumian pottery collections of the British Museum and the Petrie Museum of Egyptian Archaeology, University College London (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
93	UC2809	N/A	7.5YR6/5; 7.5YR7/4; 5YR6/6	7.5YR7/6	N/A	S	S	N/A	N/A	N/A	Fig. 12:7	Caton-Thompson & Gardner, 1934: pl. XVII: 21
94	UC2810	N/A	N/A	N/A	EXT. 7.5YR2.5/1; INT. 5Y2.5/1	S	S	N/A	N/A	N/A	N/A	Caton-Thompson & Gardner, 1934: 36
95	UC2811	N/A	5YR5/6; 5YR2.5/1	5YR5/6; 5YR2.5/1	N/A	S	S	N/A	N/A	N/A	Fig. 11:2	Caton-Thompson & Gardner, 1934: 36
96	UC2948	N/A	N/A	N/A	7.5YR4/3; 7.5YR2.5/2; 5YR2.5/1	BC	BH	N/A	N/A	N/A	Fig. 11:12	Emmitt, 2011: fig. A19
97	UC2949	N/A	N/A	N/A	7.5YR3/2; 5YR3/4; 5YR2.5/1; 5YR2.5/2; 5YR4/6	B	B	N/A	N/A	N/A	Fig. 11:5	Emmitt, 2011: fig. A20
98	UC2950	B	N/A	N/A	2.5YR4/6; 2.5YR2.5/3	BH	S	N/A	N/A	N/A	Fig. 12:14	N/A
99	UC2951	B	N/A	N/A	7.5YR4/3; 7.5YR2.5/1	BC(BH-O)	BC (BH-O)	N/A	N/A	N/A	N/A	Emmitt, 2011: fig. A21

Table 8a. Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
1	UV	25056	1	Merimde Beni Salame	N/A	NEOLITHIC	RC	Aus mehreren Fragmenten und Gips unvollständig zusammengestetztes kleines, ovales Gefäß aus vegetabilien gemagertem Ton. Gerade Standfläche; konisch ausbieg-ender Gefäßunterteil; tief sitzender Bauch-Schulterumbruch; konisch einziehender Schulterbereich; glatter, leicht einziehender Rand.	C
2	UV	25057	1	Merimde Beni Salame	N/A	NEOLITHIC	RC	Nicht näher zuordenbares Wandfragment aus 4 bis 5 kleinen, vegetabilien gemagerten Fragmenten, mit viel Gips ergänzt.	C
3	UV	25059	1	Merimde Beni Salame	Hutte I; W15; E Nr.7	NEOLITHIC	RC	Mit Gips zum Ganzgefäß ergänztes Ge-samtprofil eines vegetabiliengemagerten Topfes. Gerade Standfläche, leicht konisch ausbiegender Gefäßunterteil, leicht einzie-hender Rand.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
4	UV	25060	1	Merimde Beni Salame	S8 in 110cm Tiefe	NEOLITHIC	RC	Mit Gips zum Ganzgefäß ergänztes Boden-Wandfragment eines vegetabiliengemagerten Topfes. Gerader Boden, stark konisch ausbiegende gerade Wand.	O
5	UV	25066	1	Merimde Beni Salame	B16 Oberste Schicht	NEOLITHIC	R	Rand-Wandfragment aus vegetabiliengemagertem Ton. Schmauchspuren. Ein Lochungsansatz (Dm 4 mm). Inventarbuch: “Randstück eines Gefässes aus braunem Ton mit einem Reparaturloch / B16 Oberste Schicht”.	O
6	UV	25068	1	Merimde Beni Salame	A19 Oberflache	NEOLITHIC	R	Rand-Wandfragment aus vegetabiliengemagertem Ton, 2 mal unterhalb des Randes gelocht (Dm 4 mm). Inventarbuch: “Randstück eines wenig sorgfältig geglätteten Gefässes aus rotbraunem Ton mit zwei Reparaturlöchern / A19 Oberfläche”.	O

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
7	UV	25069	1	Merimde Beni Salame	O16 Oberflache	NEOLITHIC	R	Rand-Wandfragment aus vegetabiliengemagertem Ton, Lochung (Dm 9-4 mm). Inventarbuch: “Randstück eines wenig sorgfältig geglätteten Gefässes aus rotbraunem Ton mit einem Reparaturloch / O16 Oberfläche”.	O
8	UV	25074	1	Merimde Beni Salame	E6 Oberschicht	NEOLITHIC	R	Rand-Wandfragment aus vegetabiliengemagertem Ton, schwarz verbrannt. Inventarbuch: “Randstück eines Topfes aus grau-braunem stark verrustem Ton, mit 3 Knubben unter dem Rand / E16 Oberschicht.	C
9	UV	25075	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment aus vegetabiliengemagertem Ton, eine Knubbe unter dem Rand. Inventarbuch: “Randstück eines Topfes aus braunem Ton mit schlecht geglätteter Oberfläche mit 1 Knubbe unter dem Rand”.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
10	UV	25079	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Schwarzpoliertes Rand-Wandfragment aus vegetabiliengemagertem Ton. Inventarbuch: "Randstück eines graffitierten und geglätten Gefässes aus dunklem Ton (die Glättung u. Graffitierung ist beiderseitig und bildet einen Überzug)".	O
11	UV	25082	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabiliengemagerten Gefäßes; geschlickerte Oberfäche, leicht ausbiegender kurzer Hals, gerader Rand.	C
12	UV	25083	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabiliengemagerten Gefäßes; zweiphasig gebrannt, leicht einziehender Gefäßoberteil, gerader Rand.	C
13	UV	25086	1	Merimde Beni Salame	N/A	NEOLITHIC	F	Wandfragment eines vegetabilien gemagerten Gefäßes; rotpolierte Oberfläche.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
14	UV	25088	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabilien gemagerten Gefäßes. Schulter einziehend; steiler, kurzer Hals; glatter Rand.	C
15	UV	25096	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabilien gemagerten Gefäßes; außen rot, innen schwarz. Leicht einziehende Schulter, leicht ausbiegender, sehr dünnwandiger Rand.	C
16	UV	25103	1	Merimde Beni Salame	N/A	NEOLITHIC	RC	Gesamtprofil. Magerung: Steinchen, aber auch vegetabil. Leicht ausbiegende Wand, gerader Rand, Grifflappen am Rand,.	O
17	UV	25110	1	Merimde Beni Salame	Objekt D7	NEOLITHIC	R	Rand-Wandfragment eines vegetabil gemagerten, mehrphasig gebrannten Gefäßes.	O
18	UV	25114	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabil gemagerten Großgefäßes. Verziert.	O

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
19	UV	25142	1	Merimde Beni Salame	Objekt O	NEOLITHIC	R	Rand-Wandfragment eines vegeta-biliengemagerten Gefäßes. Einziehender Gefäßoberteil. Polierte Oberfläche.	C
20	UV	25146	1	Merimde Beni Salame	Objekt W 14, II	NEOLITHIC	RC	Gesamtprofil einer vegetabiliengemagerten Schale; gerader Boden, gerade ausbiegende Wand; polierte Oberfläche.	O
21	UV	25152	1	Merimde Beni Salame	N/A	NEOLITHIC	RC	Aus 5 Fragmenten zusammengesetztes Gesamtprofil einer steinchengemagerten Schale mit steiler Wand.	O
22	UV	25175	1	Merimde Beni Salame	N/A	NEOLITHIC	RC	Umlaufend erhaltenes Wandfragment eines vegetabiliengemagerten Gefäßes; insgesamt 4 Knubben, jeweils 2 pro Seite; kugeliger Bauch, runder Schulter-Halsübergang, steiler Halsanstatz.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
23	UV	25178	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabilien- und steinchengemagerten Gefäßes; "Black-topped Redware" polierte Oberfläche.	O
24	UV	25155_42	1	Merimde Beni Salame	N/A	NEOLITHIC	F	Wandfragment eines steinchengemagerten Gefäßes.	N/A
25	UV	25157_26	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Aus 2 Fragmenten zusammengeklebtes Rand-Wandfragment eines vegetabiliengemagerten Gefäßes; rotpolierte Oberfläche.	O
26	UV	25157_33	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabiliengemagerten Gefäßes; Rand großteils ausgebrochen.	O
27	UV	25157_51	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabiliengemagerten Gefäßes; rotpolierte Oberfläche.	O
28	UV	25159	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabiliengemagerten Gefäßes; glatte Oberfläche.	O

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
29	UV	25159_19	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabilienge-magerten kugeligen Gefäßes.	C
30	UV	25159_22	1	Merimde Beni Salame	Objekt A 16 O	NEOLITHIC	R	Rand-Wandfragment eines vegetabilienge-magerten Gefäßes; glatte Oberfläche,	O
31	UV	25159_23	1	Merimde Beni Salame	Objekt Xi 18 11	NEOLITHIC	R	Rand-Wandfragment eines vegetabilienge-magerten Gefäßes; glatte Oberfläche.	O
32	UV	25159_31	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabilienge-magerten Gefäßes; glatte Oberfläche.	O
33	UV	25162_19	1	Merimde Beni Salame	Objekt D17/O	NEOLITHIC	R	Rand-Wandfragment eines bauchigen, vegetabiliengemagerten Gefäßes.	C
34	UV	25162_32	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rand-Wandfragment eines vegetabilienge-magerten Gefäßes.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
35	MS	MM12797	1	Merimde Beni Salame	square and depth not extant	NEOLITHIC	RC	A bowl with a convex profile and oval mouth. Rounded base and direct rim. Yellow brown ware, smoothed.	O
36	MS	MM16002	1	Merimde Beni Salame	Merimde 1931:1914, discovered in square T6, depth:180 cm	NEOLITHIC	F	Sherd with a herring bone pattern void of a centre line. Well fired ware, reddish brown core. Pattern originally deep, now heavily eroded. Once part of a large bodied vessel.	N/A
37	MS	MM16003	1	Merimde Beni Salame	Square R5, depth 240 cm	NEOLITHIC	R	Rim sherd of a large bodied pot, vessel with horizontally running herring bone pattern 7 cm below rim. Well fired red-brown core. Interior, exterior red polished. Incised with deep forceful lines. Tapering to a rounded rim.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
38	MS	MM16004	1	Merimde Beni Salame	Square T5, depth200 cm	NEOLITHIC	F	Sherd with herring bone pattern. Well fired, red brown core. The interior has clear traces of scraping marks. Exterior red brown, faded around decoration, otherwise polished. Diagonal incised lines.	C
39	MS	MM16005	1	Merimde Beni Salame	Square Q5, depth 180 cm	NEOLITHIC	F	Sherd with a herring bone pattern, with a centre line. Surface eroded. Well fired, reddish brown core. Incised with deep lines.	C
40	MS	MM16009	1	Merimde Beni Salame	Square G19, grave 28, depth 170 cm	NEOLITHIC	F	Sherd of a large bodied pot, vessel.Herring bone pattern with a deeply incised centre line. Well fired, reddish core. Coarse interior. Exterior leather brown.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
41	MS	MM16010	1	Merimde Beni Salame	Square F19, 00/13	NEOLITHIC	F	Sherd of a large bodied pot, vessel. Herring bone pattern with centre line. Well fired, reddish core. Interior has scraping marks. Exterior dark slip, polished apart from decoration. Incision lines tightly juxta-posed.	C
42	MS	MM16034		Merimde Beni Salame	N/A	NEOLITHIC	R	Rim sherd of a bulging pot, vessel with an introverted rounded rim. Interior red brown, exterior grey black infiltrated with soot. Exterior decoration: wedge shaped depressions around the rim.	C
42	MS	MM16205	1	Merimde Beni Salame	Square F19, depth 80-100 cm	NEOLITHIC	R	Rim sherd of a large bodied pot, vessel. Red brown exterior, burnished vertically, red brown interior, porous, orginally burnihsed around the rim. Red brown core, round rim.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
44	MS	MM16245	1	Merimde Beni Salame	Square C17, depth 100 cm	NEOLITHIC	R	Rim sherd of a pot, vessel. Deep red exterior, burnished. Grey brown interior, smoothed. Red black core, direct rim, slightly flaring.	C
45	MS	MM16292	1	Merimde Beni Salame	Square G19, depth 20-40 cm	NEOLITHIC	R	Rim sherd of a large bodied pot, vessel, with a short neck and a flaring rim. Red exterior, originally polished. Red interior, well smoothed. Red core, round rim.	C
46	MS	MM16303	1	Merimde Beni Salame	Square SO1, depth not extant	NEOLITHIC	R	Rim sherd of a pot,vessel. Red exterior and interior, polished. Red core, round rim.	O
47	MS	MM16369	1	Merimde Beni Salame	Square SO3, depth not known	NEOLITHIC	R	Rim sherd of a pot, vessel. Black exterior, polished. Black interior, smoothed. Black core, rounded, somewhat flaring rim.	C
48	MS	MM16515b	1	Merimde Beni Salame	Square E19, depth 100-120 cm	NEOLITHIC	R	Rim sherd of a pot, vessel. Black exterior, burnished horizontally.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
49	MS	MM16516	1	Merimde Beni Salame	Square G19, depth 80-100cm	NEOLITHIC	R	Rim sherd of a pot, vessel. Brown black exterior, polished. Yellow brown interior, polished. Black core, rounded rim.	C
50	MS	MM16535	1	Merimde Beni Salame	Square C17, depth 50cm	NEOLITHIC	R	Rim sherd of a bulging pot, vessel. Black to red brown exterior, polished. Red brown to grey interior, smoothed. Red black core, rounded rim.	C
51	MS	MM16538	1	Merimde Beni Salame	N/A	NEOLITHIC	B	Sherd of a pot, vessel. Black exterior and interior. Black core.	N/A
52	MS	MM16540	1	Merimde Beni Salame	Square Y1 17, depth 40cm	NEOLITHIC	B	Foot with a flat base of a coarse round bowl. Base, exterior and interior, black and burnished. Black and porous, core.	N/A
53	MS	MM16542	1	Merimde Beni Salame	Square Y1 18, depth 50cm	NEOLITHIC	N	Rim sherd of a bulging pot, vessel. Black exterior, polished. Grey interior, smoothed. Grey brown core, rounded rim.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
54	MS	MM16740	1	Merimde Beni Salame	Square C18, depth 100cm	NEOLITHIC	R	Rim sherd of a poorly fired pot, vessel with a flaring wall. Black exterior, smoothed. Black interior, smoothed.Black core, rounded rim. One repair hole adjacent to a fracture / so close to it that it may be a hole made for suspension.	O
55	MS	MM16746	1	Merimde Beni Salame	Square D18, depth 0-20cm	NEOLITHIC	R	Rim sherd of a bulging pot,vessel with a slightly flaring rim. Brown and yellow exterior, burnished. Dark brown interior. Smoothed and with clear traces of manu-facture. Brown core, rounded rim.	C
56	MS	MM16754	1	Merimde Beni Salame	Square F19, depth 120-140cm	NEOLITHIC	R	Rim sherd of a well fired pot,vessel. Leather brown exterior, burnished. Leather brown interior, burnished by the rim, otherwise smoothed with traces of tool marks. Red core, pointed rim.	O

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
57	MS	MM16761	1	Merimde Beni Salame	Square C18, depth 0-20cm	NEOLITHIC	R	Rim sherd of a pot, vessel with a somewhat flaring wall. Red exterior, burnished. Red interior, burnished. Red and black core . Rounded rim.	O
58	MS	MM16884	1	Merimde Beni Salame	Square S6, depth 200cm	NEOLITHIC	B	Base sherd of a large, bulging pot,vessel with a round base. Red brown exterior, polished. Grey interior, smoothed with rich traces of comb-like tools. Black core.	N/A
59	MS	MM16903	1	Merimde Beni Salame	Squre A18, depth 90cm	NEOLITHIC	RC	Piece of a pot, vessel, dish with a flaring profile and a flat base. Grey brown exterior and interior, smoothed. Brownish core, sand inclusions.	O
60	MS	MM16966	1	Merimde Beni Salame	Square F20, depth 120-130cm	NEOLITHIC	B	Base sherd of a coarse pot,vessel wit a rounded base and flaring wall. Originally reddish exterior and burnished. Light brown interior, raw. Light brown to black core, very porous.	N/A

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
61	MS	MM16969	1	Merimde Beni Salame	Square C19, depth 40-50cm	NEOLITHIC	R	Rim sherd of a well fired pot, vessel. Red brown exterior with a black spot, burnished. Red interior, polished. Dense black core, rounded rim.	O
62	MS	MM16975	1	Merimde Beni Salame	Square E19, depth 100-130cm	NEOLITHIC	R	Rim sherd of a large, coarse pot, vessel / deep bowl? /. Red brown exterior, lightly polished. Red brown interior towards the rim, the remaining parts, black, poorly polished. Black core, rounded rim.	O
63	MS	MM17032	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rim sherd of a coarse, porous, pot, vessel. Red brown exterior and interior, smoothed. Red and black core, rounded rim.	O
64	MS	MM17170		Merimde Beni Salame	Square, depth not extant; marked B17. B1	NEOLITHIC	F	Sherd of a well fired pot, vessel. Grey greenish complexion, well smoothed. Grey to greenish, dense core.	N/A

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
65	MS	MM17177	1	Merimde Beni Salame	Square B17, depth 100cm	NEOLITHIC	R	Rim sherd of a large pot, vessel with a flaring wall. Red brown exterior and interior, burnished. Red and black core, rounded rim.	O
66	MS	MM17181	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rim sherd of a very large pot, vessel. Red brown exterior and interior, well smoothed. Red and black core, rounded rim.	C
67	MS	MM17224	1	Merimde Beni Salame	Square A18, depth not extant; marked B1	NEOLITHIC	RC	Piece of a coarse pot, vessel with a flat base and convex flaring wall. Widest at the rim. Exterior originally black, smoothed, straw tempered. Black interior, eroded, originally smoothed. Black to brownish core, rounded rim.	O
68	MS	MM17276	1	Merimde Beni Salame	Square W1 16, surface find	NEOLITHIC	R	Rim sherd of a pot, vessel. Black exterior, smoothed. Black interior, eroded, originally smoothed. Black core. Rim rounded from within.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
69	MS	MM17344	1	Merimde Beni Salame	Square A17, depth 110cm	NEOLITHIC	R	Rim sherd of a pot, vessel. Red exterior, blackened top, lightly polished. Black interior, a little eroded, lightly polished. Black core, rounded rim.	O
70	MS	MM17359	1	Merimde Beni Salame	markings destroyed	NEOLITHIC	B	Base sherd of a pot, vessel with a flat base and flaring wall. Red exterior, lightly burnished. Red interior, smoothed. Red core. The interior and interior base form an even curve.	N/A
71	MS	MM17431	1	Merimde Beni Salame	Square G19, depth 20-40cm	NEOLITHIC	R	Rim sherd of a pot, vessel, slightly converging wall. Brown surfaces, interior eroded, smoothed. Brown and black core. Rounded rim.	C
72	MS	MM17436	1	Merimde Beni Salame	Square D19, depth 20-40cm	NEOLITHIC	R	Rim sherd of a pot, vessel with flaring wall. Dark red, red brown exterior with black spots, smoothed. Red brown interior, smoothed. Red brown and black core. Rounded rim.	O

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
73	MS	MM17441		Merimde Beni Salame	Square G19, depth 80-100cm	NEOLITHIC	R	Rim sherd of a pot, vessel. Brown red exterior, smoothed. Light brown interior, straw tempered, smoothed. Brown core, rounded rim.	O
74	MS	MM17443	1	Merimde Beni Salame	Square C19, depth 40-50cm	NEOLITHIC	R	Rim sherd of a pot, sherd with a bulging body and slightly flaring rim. Light brown exterior and interior rim, otherwise black, smoothed, but eroded. Brown and black core. Rounded rim.	C
75	MS	MM17445	1	Merimde Beni Salame	Square D19, depth 30-40cm	NEOLITHIC	B	Base sherd of a pot, vessel or small cup with round base. Brown exterior, partly black-ened. Black interior, crude. Black core.	N/A
76	MS	MM17450	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rim sherd of a pot, vessel with flaring wall. Black and streaky brown exterior, bur-nished. Lighter interior, burnished. Light brown core, dense. On top of the rim there is a furrow.	O

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
77	MS	MM17467	1	Merimde Beni Salame	Square Y1 17, depth 50cm	NEOLITHIC	R	Neck sherd of a bottle with a slightly flaring rim. Exterior originally black, burnished. Red brown interior, lightly burnished. Red core, thinly rounded rim.	C
78	MS	MM17485	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rim sherd of a pot, vessel, tapering rim. Red brown exterior, smoothed. Brown interior, smoothed. Red core, porous, rounded rim.	C
79	MS	MM17489	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rim sherd of a pot, vessel with flaring wall. Red exterior, lightly burnished but eroded. Red interior ,burnished. Black core, dense. Rounded rim.	O
80	MS	MM17496		Merimde Beni Salame	Square C18, depth 80cm	NEOLITHIC	R	Rim sherd of a pot, vessel. Red brown exterior and interior, smoothed. Red brown core, dense. Tapering to the rounded rim.	O

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
81	MS	MM17540	1	Merimde Beni Salame	Square A17, depth 20-50cm	NEOLITHIC	V	Piece of a small vessel with a converging profile, tapering at the rim and a flat base. Grey black exterior and interior, smoothed. Brown core.	O
82	MS	MM17564	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rim sherd of a large pot, vessel with a flaring wall. Brown exterior, burnished. Black interior, burnished. Black core, partly completely red. Rounded rim. One repair hole adjacent to a fracture.	O
83	MS	MM17565	1	Merimde Beni Salame	N/A	NEOLITHIC	R	Rim sherd of a large pot, vessel with a bulging body. Red exterior, smoothed to lightly burnished. Brown interior, smoothed. Red core. Rim rounded from within.	C
84	MS	MM17579	1	Merimde Beni Salame	Square W1 16, surface find	NEOLITHIC	R	Piece of a large, crude open pot, vessel with a flat base. Red brown exterior and interior, crude. Black and red core, rounded rim.	O

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
85	MS	MM17584	1	Merimde Beni Salame	Square G20, depth 20cm	NEOLITHIC	R	Rim sherd of a restricted pot, vessel with a bulging body. Black exterior, lightly polished. Brown interior, burnished rim, smoothed lower body. Red core. Rim rounded from within.	C
86	MS	MM17603	1	Merimde Beni Salame	Square R4, depth 40cm; marked 1331	NEOLITHIC	R	Rim sherd of a small open, shallow cup, pot, vessel. Grey brown exterior and interior, smoothed. Light brown core, dense. Rounded rim.	C
87	MS	MM17623	1	Merimde Beni Salame	Square G19, depth 100cm	NEOLITHIC	B	Part of ring base. Red brown exterior. smoothed. Red grey interior smoothed. Red and black core.	N/A
88	MS	MM17624	1	Merimde Beni Salame	Square G20, depth 20-40cm	NEOLITHIC	B	Piece, fragment of a stand for a pot, vessel. Red, black exterior, smoothed. Red interior, smoothed. Red and black core.	N/A

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
89	MS	MM17662	1	Merimde Beni Salame	Square Z1 17, depth 80cm	NEOLITHIC	F	jar sealing of potsherd, irregularly shaped. Grey brown exterior, smoothed. Red interior, smoothed. Red and black core.	N/A
90	MS	MM17843	1	Merimde Beni Salame	Square F19, depth 40cm	NEOLITHIC	H/L	Part of the handle and ladle of a clay spoon. Broken off at both ends. Tapering brown and black handle, smoothed. Lightly burnished spoon.	N/A
91	MS	MM17861	1	Merimde Beni Salame	markings not extant	NEOLITHIC	B	Base sherd of an open pot, vessel with a tall and flat base and rounded interior. Red exterior, originally smoothed. Brown interior, eroded. Red black core.	N/A
92	MS	MM17863		Merimde Beni Salame	Square T4, depth 60cml; marked, 1334	NEOLITHIC	B	Base sherd of a pot. Red brown sides, smoothed. Red and black core.	N/A

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
93	MS	MM17864	1	Merimde Beni Salame	markings not extant	NEOLITHIC	B	Ring base of a pot, vessel. Brown exterior, lightly burnished. Black rounded interior, polished, a little eroded. Black core.	N/A
94	MS	MM17865	1	Merimde Beni Salame	Square T5, depth 120cm; marked 1333	NEOLITHIC	B	Ring base of a pot, vessel. Flat base, brown sides, burnished. Black and red core.	N/A
95	MS	MM17962	1	Merimde Beni Salame	Square and depth not extant	NEOLITHIC	RC	A vessel with a convex profile, oval mouth, flat base and rounded rim. Grey ware, crude.	O
96	MS	MM31792	1	Merimde Beni Salame	Square F19, depth 20-30 cm	NEOLITHIC	R	Rim sherd from a tall and narrow vessel. Both interior and exterior dark brown, the exterior well polished, however cracked. Medium grained clay.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
97	MS	MM31796	1	Merimde Beni Salame	Square F19	NEOLITHIC	R	Rim sherd, coarse porous ware. Greyish brown and black interior and exterior with plenty of large inclusions. On the exterior, two protruding lumps close to the rim.	C
98	MS	MM31799	1	Merimde Beni Salame	Square A18, depth 90 cm	NEOLITHIC	B	Base sherd from narrow cup. Coarse ware with plenty of small stones as inclusions. Grey clay, the exterior blackened by fire. One protruding lump on the exterior.	N/A
99	MS	MM32917	1	Merimde Beni Salame	Square W17 1, depth 40cm	NEOLITHIC	RC	A bowl with an ovoid body, slightly tapering to an oval mouth, a direct rim and a flat base. Dark brown surface, rough and chaff tempered. The vessel has 4 drilled holes around the body and one not fully extant hole adjacent to a break.	C

Table 8a. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
100	MS	MM32920	1	Merimde Beni Salame	Square D16, surface find	NEOLITHIC	RC	Part of an open, deep bowl with a flaring profile, round mouth, direct rim, and a flat base. Drab surface, poorly fired and chaff tempered.	O
101	MS	MM32921	1	Merimde Beni Salame	Square E 17 8, depth 44cm	NEOLITHIC	RC	An open, deep bowl with a flaring profile, direct rim and tapering to a flat base. Rough buff surface, poorly fired and chaff tempered.	O
102	MS	MM33608	1	Merimde Beni Salame	Square W1 17 (6)	NEOLITHIC	RC	A large broad vessel with a straight profile, direct rim and tapering to a flat base. One section, the upper body and rim are miss-ing. Buff surface. Rough ware and poorly fired.	C

Table 8b. Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (shape and fabric)

NO.	ID	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
1	25056	HM	RN	O	SF	60	72	30	73	6	N	S	VC	15	B/BL/B
2	25057	HM	FN	S	F	80	95	60	8,9	6	N	S	VC	20	N/A
3	25059	HM	PN	O	F	130	140	90	103	9	N	S/SD	C/C	10-1	B
4	25060	HM	PF	CN	F	190	190	95	N/A	12	N	S/SD	VC/M	20-1	B
5	25066	HM	FS	O	F	190	193	N/A	N/A	11	N	S/SD	C/M	15-5	N/A
6	25068	HM	PF	CN	N/A	230	N/A	N/A	N/A	7	N	S/SD/C	VC/M/M	15-3-5	N/A
7	25069	HM	FS	CN	N/A	200	N/A	N/A	N/A	9	N	S	VC	20	R/BL/R
8	25074	HM	FN	S	N/A	110	N/A	N/A	N/A	8	N	S/SD	VC/C	20-3	BL
9	25075	HM	RN	S	N/A	N/A	N/A	N/A	N/A	13	N	S/SD	VC/C	15-3	R
10	25079	HM	PF	CN	N/A	300	N/A	N/A	N/A	12	N	S/SD	VC/C	20-3	B
11	25082	HM	FF	H	N/A	90	N/A	N/A	N/A	8	N	S/SD	C/F	3-3	B/G/B
12	25083	HM	PN	S	N/A	130	N/A	N/A	N/A	8	N	S/SD	VC/F	10-1	R/BL/R
13	25086	HM	N/A	N/A	N/A		N/A	N/A	N/A	6	N	S/SD/C	VC/F/M	20-1-5	DR
14	25088	HM	RF	S	N/A	70	N/A	N/A	N/A	5	N	S/M	C/C	3-1	BL
15	25096	HM	PF	O	N/A	50	N/A	N/A	N/A	7	N	S/SD/C	C/F/F	3-3-1	YB/BL
16	25103	HM	RF	CN	F	270	270	250	55	12	N	S/SD/C	C/C/C	10-20-1	NON HO-MOGENIUS; STAINS
17	25110	HM	PF	CN	N/A	260	N/A	N/A	N/A	17	N	S/SD/C	VC/F/M	20-5-10	DB/BL/DB
18	25114	HM	RS	O	N/A	550	N/A	N/A	N/A	32	N	S/SD	VC/M	25-3	N/A

Table 8b. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (shape and fabric)

NO.	ID	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
19	25142	HM	PN	O	N/A	120	N/A	N/A	N/A	10	N	S/SD	C/C	15-1	YR
20	25146	HM	FF	CN	F	290	290	130	103	17	N	S/SD	VC/M	20-3	N/A
21	25152	HM	RF	S	F	350	350	320	30	14	N	S/SD/C	M/C/M	10-20-1	LB
22	25175	HM	N/A	S	N/A	N/A	153	N/A	108	10	N	SD/C/G	C/M/M	10-10-10	DR
23	25178	HM	FS	O	N/A	130	N/A	N/A	N/A	12	N	S/C	C/M	10-1	BL/R
24	25155_42	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9	?	C/SD	M/M	20-5	N/A
25	25157_26	HM	FF	CN	N/A	180	N/A	N/A	N/A	8	N	S	C	15	N/A
26	25157_33	HM	PS	O	N/A	189	N/A	N/A	N/A	9	N	S	C	10	N/A
27	25157_51	HM	RS	O	N/A	180	N/A	N/A	N/A	9	N	S	M	20	N/A
28	25159	HM	MF	S	N/A	280	N/A	N/A	N/A	13	N	SD/G	M/C/M	10-10	N/A
29	25159_19	HM	PN	S	N/A	100	N/A	N/A	N/A	7	N	SD	M	10	N/A
30	25159_22	HM	RF	CN	N/A	280	N/A	N/A	N/A	11	N	S/SD	M/M	20-20	N/A
31	25159_23	HM	RF	CN	N/A	270	N/A	N/A	N/A	12	N	S/SD	M/M	20-20	BL
32	25159_31	HM	PF	CN	N/A	260	N/A	N/A	N/A	12	N	S	C	20	N/A
33	25162_19	HM	RN	S	N/A	150	N/A	N/A	N/A	23	N	S	VC	20	BL
34	25162_32	HM	RN	S	N/A	85	N/A	N/A	N/A	9	N	SD	C	15	N/A
35	MM12797	HM	PF	S	R	119	N/A	N/A	90	1,2	N	S/SD	C/M	20-5	N/A
36	MM16002	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9	N	S/SD	M-C/F	10-5	B
37	MM16003	HM	RN	S	N/A	180	N/A	N/A	N/A	8	N	S/SD/M	M-C/F/F	10-5-5	R
38	MM16004	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7	N	SD	VF	3	DR

Table 8b. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (shape and fabric)

NO.	ID	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
39	MM16005	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	N	S/SD/M	M/F-M-F	3-3-1	RB
40	MM16009	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9	N	S/SD/M	F/F/F	3-5-5	RB
41	MM16010	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	N	S/SD/M	F-M/F/F	3-1-1	B
42	MM16034	HM	PN	O	N/A	80	N/A	N/A	N/A	12	N	S/SD/M	M-C/M/F	10-5-1	B
42	MM16205	HM	RN	O	N/A	150	N/A	N/A	N/A	10	N	S/SD	VC/M	30-5	N/A
44	MM16245	HM	FN	S	N/A	150	N/A	N/A	N/A	10	N	S/SD/M	VF-M/F/F	10/20/1	R/BL/R
45	MM16292	HM	PF	S	N/A	80	N/A	N/A	N/A	6	N	S	M-C	20	R
46	MM16303	HM	PF	CN	N/A	220	N/A	N/A	N/A	9	N	S/SD	C/F	10-3	RB
47	MM16369	HM	RN	S	N/A	90	N/A	N/A	N/A	7	N	S/SD	M/M	5-5	BL
48	MM16515b	HM	RN	S	N/A	110	N/A	N/A	N/A	9	N	S/SD	F/VC	3-5	B
49	MM16516	HM	FN	S	N/A	150	N/A	N/A	N/A	12	N	S/SD	F/VC	3-10	BL
50	MM16535	HM	RN	O	N/A	70	N/A	N/A	N/A	4	N	S/SD	VF/M	3-5	N/A
51	MM16538	HM	N/A	N/A	F	N/A	N/A	120	N/A	8	N	S/SD/C	M/F/M	1-5-1	B
52	MM16540	HM	N/A	N/A	RB	N/A	N/A	74	N/A	1,2	N	S/SD/C	C/M/F	10-10-3	B
53	MM16542	HM	RS	S	N/A	90	N/A	N/A	N/A	6	N	S/SD	F/C	3-10	B/BL/B
54	MM16740	HM	PF	CN	N/A	120	N/A	N/A	N/A	6	N	S/SD	M/M	5-10	BL
55	MM16746	HM	PN	S	N/A	100	N/A	N/A	N/A	10	N	S/SD	VC/M	25-5	B
56	MM16754	HM	PF	CN	N/A	150	N/A	N/A	N/A	6	N	S/SD	F/M	3-5	R
57	MM16761	HM	PF	CN	N/A	140	N/A	N/A	N/A	10	N	S/SD	C/F-M	10-5	R/BL/R
58	MM16884	HM	N/A	N/A	R	N/A	N/A	N/A	N/A	10	N	S/SD	C/M	10-5	R/B/R

Table 8b. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (shape and fabric)

NO.	ID	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
59	MM16903	HM	RF	CN	F	250	250	84	90	12	N	S/SD	M/F-M-F	10-10	B
60	MM16966	HM	N/A	N/A	R	N/A	N/A	N/A	N/A	5-16	N	S/SD	VC/M	30-5	N/A
61	MM16969	HM	RS	S	N/A	90	N/A	N/A	N/A	6	N	SD	VF	5	R/BL/R
62	MM16975	HM	RS	S	N/A	250	N/A	N/A	N/A	8	N	S/SD/F?	VFC/F/VF	30-5-10	R/BL
63	MM17032	HM	RS	S	F	340	340	292	92	24	N	S/SD	VC/C	30-15	R
64	MM17170	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	N	SD	F	10	B
65	MM17177	HM	RF	CN	N/A	280	N/A	N/A	N/A	18	N	S/SD	F/C	5-20	RB
66	MM17181	HM	FN	O	N/A	310	N/A	N/A	N/A	21	N	S/SD	VC/F	20-5	B/BL/B
67	MM17224	HM	RF	O	SF	80	82	19	62	8	N	S/SD	M/VC	5-15	RB/BL/RB/BL
68	MM17276	HM	PN	S	N/A	8	N/A	N/A	N/A	9	N	S/SD	C/F	10-3	BL
69	MM17344	HM	RF	CN	N/A	190	N/A	N/A	N/A	10	N	S/SD/C	C/F/M	10-5-1	BL/R
70	MM17359	HM	N/A	N/A	N/A	N/A	N/A	130	N/A	7	N	S/SD	F-M/F	5-10	R/G/R
71	MM17431	HM	RN	S	N/A	160	N/A	N/A	N/A	10	N	S/SD/M	VC/F-M/F	15-10-5	B/BL/B
72	MM17436	HM	FF	CN	N/A	250	N/A	N/A	N/A	8	N	S/SD	VC/VC	20-20	R
73	MM17441	HM	FF	S	N/A	?	N/A	N/A	N/A	11	N	S/SD	VC/M	15-50	R
74	MM17443	HM	FN	O	N/A	150	N/A	N/A	N/A	12	N	S/SD	VC/M	20-5	B/BL/B
75	MM17445	HM	N/A	N/A	R	N/A	N/A	N/A	N/A	10	N	S/SD/M	VC/VC/F	20-10-1	B/BL/B
76	MM17450	HM	RF	CN	N/A	250	N/A	N/A	N/A	12	N	S/SD	F/C	5-20	RB
77	MM17467	HM	PF	H	N/A	90	N/A	N/A	N/A	7	N	S/SD	C/F	15-5	RB
78	MM17485	HM	RN	O	N/A	130	N/A	N/A	N/A	10	N	S/SD	C/M	40-3	R/BL/B

Table 8b. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (shape and fabric)

NO.	ID	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
79	MM17489	HM	FF	CN	N/A	230	N/A	N/A	N/A	10	N	S/SD	M/M	1-15	BL
80	MM17496	HM	PS	S	N/A	210	N/A	N/A	N/A	10	N	S/SD/M	M/F/F	5-5-3	RB
81	MM17540	HM	PS	O	F	50	60	N/A	67	6	N	SD/C	F/F	10-3	B
82	MM17564	HM	RF	CN	F	280	N/A	N/A	N/A	9-12	N	S/SD	C/M	10-3	B/BL/B
83	MM17565	HM	FN	S	N/A	150	N/A	N/A	N/A	10	N	S/SD	VC/F	15-5	DR
84	MM17579	HM	RF	CN	F	320	320	175	170	20	N	S/SD/G	VC/M/C	30-5-1	N/A
85	MM17584	HM	PN	O	N/A	60	N/A	N/A	N/A	6	N	S/SD	M-C/F	3-10	B
86	MM17603	HM	RN	S	N/A	80	N/A	N/A	N/A	6	N	SD	VF	10	B
87	MM17623	HM	N/A	N/A	N/A	N/A	N/A	N/A	5	15	N	S/SD	M-C/M/F	10-5	N/A
88	MM17624	HM	N/A	N/A	N/A	N/A	N/A	N/A	3	N/A	N	S/SD	M-C/F	15-5	N/A
89	MM17662	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14	N	S/SD	VC/M	10-5	R
90	MM17843	HM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5-11	N	S/SD	M-C/F	10-5	R/B
91	MM17861	HM	N/A	N/A	RB	N/A	N/A	70	N/A	10-37	N	S/SD	C/M	20-5	DR/BL/DR
92	MM17863	HM	N/A	N/A	RB	N/A	N/A	70	N/A	13	N	S/SD	F-M/C	10-10	B/BL/B
93	MM17864	HM	N/A	N/A	RB	N/A	N/A	50	N/A	9	N	S/SD	M/F	10-10	B/B
94	MM17865	HM	N/A	N/A	RB	N/A	N/A	70	N/A	11	N	S/SD	C-VC/M	20-5	B/BL/B
95	MM17962	HM	RS	S	F	136	N/A	N/A	70	10	N	S/SD	M-C/F	20-5	N/A
96	MM31792	HM	RN	O	N/A	80	N/A	N/A	N/A	6	N	S/SD	M/F	5-5	RB/BL/RB
97	MM31796	HM	PN	S	N/A	160	N/A	N/A	N/A	7	N	S/SD/C	VC/M/M	20-5-3	B
98	MM31799	HM	N/A	N/A	F	N/A	N/A	48	N/A	15	N	S/SD/G	C/M/C	10-5-1	B

Table 8b. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (shape and fabric)

NO.	ID	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
99	MM32917	HM	N/A	O	N/A	80	N/A	N/A	90	N/A	N	S/SD	M-C/F-M	10-5	B
100	MM32920	HM	PF	CN	F	178	N/A	N/A	125	N/A	N	S/SD	VC/F	20-3	N/A
101	MM32921	HM	PF	CN	F	170	N/A	67	109	N/A	N	SD	F-M	15	B
102	MM33608	HM	PN	O	F	220	290	N/A	225	N/A	N	S/SD	VC/M	20-5	N/A

Table 8c. Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
1	25056	N/A	10YR3/3	10YR3/3	N/A	S	S	N/A	N/A	N/A	Fig. 16:9	N/A
2	25057	N/A	7.5YR5/4	7.5YR5/4	N/A	S	S	N/A	N/A	N/A	Fig. 16:7	N/A
3	25059	N/A	7.5YR4/4	7.5YR4/4	N/A	S	S	N/A	N/A	N/A	N/A	N/A
4	25060	N/A	7.5YR 4/1	7.5YR 4/1	N/A	S	S	N/A	N/A	N/A	N/A	N/A
5	25066	P	7.5YR 6/6	7.5YR 6/4	N/A	S	S	N/A	N/A	N/A	Fig. 16:12	Rowland & Tassie, 2017
6	25068	P X 2	10YR4/6	10YR4/6	N/A	S	S	N/A	N/A	N/A	Fig. 17:7	Rowland & Tassie, 2017
7	25069	P	2.5YR4/6	2.5YR4/6	N/A	BH	BH	N/A	N/A	N/A	Fig. 17:4	Rowland & Tassie, 2017
8	25074	B	7.5YR4/6	7.5YR4/6	N/A	S	S	KN X 3	APP	EUR	Fig. 16:5	Rowland & Tassie, 2017
9	25075	B	7.5YR4/6	7.5YR4/6	N/A	R	R	KN X 1	APP	EUR	Fig. 16:4	Rowland & Tassie, 2017
10	25079	N/A	1GLEY2.5/N	N/A	N/A	BH	BH	N/A	N/A	N/A	Fig. 17:1	N/A
11	25082	N/A	7.5YR3/4	5YR5/8	N/A	SC	SH	N/A	N/A	N/A	Fig. 16:15	N/A
12	25083	N/A	2.5YR3/5	2.5YR3/5	N/A	BH	BH	N/A	N/A	N/A	N/A	N/A
13	25086	N/A	10R3/3	10R3/3	N/A	X	R	N/A	N/A	N/A	N/A	N/A

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
14	25088	B	N/A	N/A	N/A	BH	X	N/A	N/A	N/A	Fig. 16:13	N/A
15	25096	N/A	10YR5/4	10YR5/4	N/A	S	R	N/A	N/A	N/A	Fig. 16:14	Rowland & Tassie, 2017
16	25103	N/A	7.5YR5/6; 7.5YR2.5/2	7.5YR5/4	N/A	S	S	N/A	N/A	N/A	Fig. 16:2	Rowland & Tassie, 2017
17	25110	N/A	N/A	N/A	N/A	BH	BH	N/A	N/A	N/A	Fig. 17:8	N/A
18	25114	N/A	5YR5/8	5YR5/8	5YR4/6 - SELF SLIP	S	S	N/A	N/A	N/A	N/A	Rowland & Tassie, 2017
19	25142	N/A	5YR5/6	5YR5/6	N/A	BC	S	N/A	N/A	N/A	Fig. 16:16	N/A
20	25146	N/A	10YR3/4	10YR3/4	N/A	S	S	N/A	N/A	N/A	Fig. 17:9	N/A
21	25152	N/A	7.5YR6/4	7.5YR6/4	N/A	S	S	N/A	N/A	N/A	Fig. 16:1	Rowland & Tassie, 2017
22	25175	N/A	7.5R2.5/1	7.5R2.5/1	N/A	S	S	KN X 4	APP	SH	N/A	Rowland & Tassie, 2017
23	25178	N/A	2.5YR4/8; 5YR2.5/2	2.5YR4/8	N/A	BC	S	N/A	N/A	N/A	Fig. 16:10	Rowland & Tassie, 2017
24	25155_42	N/A	10YR5/6	10YR5/6	N/A	S	S	N/A	N/A	N/A	N/A	N/A
25	25157_26	N/A	N/A	N/A	10R4/6	BC	BH	N/A	N/A	N/A	Fig. 17:2	N/A

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
26	25157_33	N/A	N/A	N/A	10YR3/6	BH	BH	N/A	N/A	N/A	N/A	N/A
27	25157_51	N/A	N/A	N/A	2.5YR4/6	BC	BH	N/A	N/A	N/A	Fig. 17:6	N/A
28	25159	N/A	N/A	N/A	N/A	S	S	N/A	N/A	N/A	Fig. 16:3	N/A
29	25159_19	N/A	N/A	N/A	N/A	S	S	N/A	N/A	N/A	Fig. 16:8	N/A
30	25159_22	N/A	N/A	N/A	N/A	BH	BH	N/A	N/A	N/A	Fig. 17:5	N/A
31	25159_23	N/A	N/A	N/A	N/A	BH	BH	N/A	N/A	N/A	Fig. 17:3	N/A
32	25159_31	N/A	N/A	N/A	N/A	BH	BH	N/A	N/A	N/A	N/A	N/A
33	25162_19	B	10YR5/5	10YR5/5	N/A	S	S	N/A	N/A	N/A	Fig. 16:11	N/A
34	25162_32	N/A	7.5YR2.5/3; 7.5YR4/4	7.5YR2.5/3; 7.5YR4/4	N/A	S	S	N/A	N/A	N/A	Fig. 16:6	N/A
35	MM12797	N/A	7.5YR5/6	7.5YR5/6	N/A	R	R	N/A	N/A	N/A	N/A	Larsen, 1963: 28, pl. X; Rowland & Tassie, 2017
36	MM16002	N/A	10YR5/6	10YR5/6	N/A	R	R	HB	INC	EU	Fig. 22:1	Rowland & Tassie, 2017
37	MM16003	N/A	N/A	N/A	2.5YR5/6	BH	S	HB	INC	EU	Fig. 18:10	Larsen, 1963: 60; Rowland & Tassie, 2017

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
38	MM16004	N/A	2.5YR3/6	2.5YR3/6	N/A	BH	S	HB	INC	E	N/A	Larsen, 1959: 9, fig. 2; Rowland & Tassie, 2017
39	MM16005	N/A	N/A	N/A	10YR6/3	S	S	HB	INC	E	Fig. 22:2	Larsen, 1959: 9, fig. 2; Rowland & Tassie, 2017
40	MM16009	N/A	N/A	N/A	2.5YR3/6	BH	S	HB	INC	E	Fig. 22:3	Larsen, 1959: 9, fig. 2; Rowland & Tassie, 2017
41	MM16010	N/A	5YR5/4	5YR5/4	2.5YR43/6	X	S	HB	INC	E	Fig. 22:4	Larsen, 1959: 9, fig. 2; Rowland & Tassie, 2017
42	MM16034	N/A	10YR3/2; 10YR4/4	10YR5/8	N/A	R	R	N	IMP	R	N/A	Larsen, 1959: 18, fig. 5; Rowland & Tassie, 2017
42	MM16205	N/A	5YR5/6	7,5YR5/6	N/A	BC	BX	N/A	N/A	N/A	Fig. 18:8	N/A
44	MM16245	N/A	N/A	N/A	2.5YR4/6	BO	S	N/A	N/A	N/A	Fig. 18:3	N/A
45	MM16292	N/A	N/A	N/A	N/A	BH	S	N/A	N/A	N/A	Fig. 20:1	Rowland & Tassie, 2017

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
46	MM16303	N/A	N/A	N/A	N/A	BH	BH	N/A	N/A	N/A	Fig. 19:4	N/A
47	MM16369	B	N/A	N/A	10YR2/1	BH/O	X	N/A	N/A	N/A	Fig. 20:4	N/A
48	MM16515b	N/A	10YR3/4	10YR3/3	N/A	BH	S	N/A	N/A	N/A	Fig. 18:2	N/A
49	MM16516	N/A	5Y2.5	2.5Y3/2	N/A	BO	S	N/A	N/A	N/A	Fig. 18:7	N/A
50	MM16535	N/A	N/A	N/A	5Y2.5/1; 2.5YR5/6	BX	S	N/A	N/A	N/A	Fig. 20:8	N/A
51	MM16538	N/A	N/A	N/A	7.5YR3/1	BH	BH	N/A	N/A	N/A	N/A	Larsen, 1963: 57
52	MM16540	N/A	N/A	N/A	7.5YR4/1	S	S	N/A	N/A	N/A	Fig. 2:17	Larsen, 1963: 34, 47, pl.VII: 9; Rowland & Tassie, 2017
53	MM16542	N/A	N/A	N/A	10YR3/4; 10YR3/1; 2.5Y1/1	BV	S	N/A	N/A	N/A	Fig. 20:6	N/A
54	MM16740	N/A	N/A	N/A	2.5Y2.5/1; ONLY RIM 10YR5/8	S	S	N/A	N/A	N/A	Fig. 19:3	N/A
55	MM16746	N/A	N/A	N/A	10YR3/4	BC	X	N/A	N/A	N/A	Figs. 20:5; 23:2	N/A

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
56	MM16754	N/A	N/A	N/A	2.5YR4/6; 7.5YR6/6	S	S	N/A	N/A	N/A	Fig. 19:5	N/A
57	MM16761	N/A	2.5YR5/6	2.5YR5/6	N/A	S	S	N/A	N/A	N/A	Fig. 19:1	N/A
58	MM16884	N/A	N/A	N/A	10R3/6; 2.5YR2.5/1	BO	S	N/A	N/A	N/A	Fig. 23:1	N/A
59	MM16903	N/A	10YR5/8	10YR5/8	N/A	S	S	N/A	N/A	N/A	Fig. 19:9	Larsen, 1963: 36, pl. IV; Rowland & Tassie, 2017
60	MM16966	N/A	N/A	7.5YR6/6	2.5YR4/6	S	R	N/A	N/A	N/A	N/A	N/A
61	MM16969	N/A	N/A	N/A	N/A	BH	BH	N/A	N/A	N/A	Fig. 20:2	N/A
62	MM16975	N/A	2.5YR3/6	2.5YR3/6	N/A	R	B	N/A	N/A	N/A	Fig. 19:10	N/A
63	MM17032	N/A	5YR4/6	5YR4/6	N/A	R	R	N/A	N/A	N/A	Fig. 20:20	N/A
64	MM17170	N/A	N/A	N/A	10YR3/3	X	X	N/A	N/A	N/A	N/A	N/A
65	MM17177	N/A	N/A	N/A	5YR5/8; 7.5YR5/4	BH	BH	N/A	N/A	N/A	N/A	N/A
66	MM17181	N/A	5YR5/8; 5YR5/6; 5YR4/4	5YR5/8; 5YR5/6; 5YR4/4	N/A	R	R	N/A	N/A	N/A	Fig. 18:13	N/A
67	MM17224	B INT.	5YR3/3	5YR2.5/1	N/A	R	R	N/A	N/A	N/A	Fig. 20:12	N/A

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
68	MM17276	N/A	N/A	N/A	10YR2/2	S	S	N/A	N/A	N/A	N/A	N/A
69	MM17344	N/A	N/A	N/A	5YR4/6	BH	BH	N/A	N/A	N/A	Fig. 18:9	N/A
70	MM17359	N/A	2.5YR4/8	2.5YR4/8	5YR5/6	BH	S	N/A	N/A	N/A	N/A	N/A
71	MM17431	N/A	10YR5/4	10YR5/4	N/A	S	S/R	N/A	N/A	N/A	Fig. 18:11	N/A
72	MM17436	N/A	2.5YR3/6	5YR6/8	N/A	R	R	N/A	N/A	N/A	Fig. 19:7	N/A
73	MM17441	N/A	5.YR4/6	10YR5/8	N/A	R	R	N/A	N/A	N/A	Fig. 19:8	N/A
74	MM17443	N/A	2.5YR4/4; 7.5YR2.5/3	2.5YR4/4; 7.5YR2.5/3	N/A	R	R	N/A	N/A	N/A	Fig. 18:4	N/A
75	MM17445	N/A	5YR5/8	5YR2.5/1	N/A	R	R	N/A	N/A	N/A	Fig. 20:11	N/A
76	MM17450	N/A	5YR4/6	7.5YR5/4	N/A	BH	BH	L	INC	R	N/A	Larsen, 1963: 38, 46, pl. XIII: 8; Rowland & Tassie, 2017
77	MM17467	N/A	5YR5/4	5YR5/6	N/A	S	S	N/A	N/A	N/A	Fig. 20:3	Larsen, 1963: 61; Rowland & Tassie, 2017
78	MM17485	N/A	N/A	N/A	5YR4/6	S	S	N/A	N/A	N/A	Fig. 18:6	N/A
79	MM17489	N/A	N/A	N/A	2.5YR4/6	S	S	N/A	N/A	N/A	Fig. 19:6	N/A
80	MM17496	N/A	N/A	N/A	5YR4/6	S	S	N/A	N/A	N/A	Fig. 19:12	N/A

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
81	MM17540	N/A	2.5Y4/4	2.5Y4/4	N/A	S	S	N/A	N/A	N/A	N/A	Larsen, 1963: 39, pl. VI; Rowland & Tassie, 2017
82	MM17564	P	N/A	N/A	EXT. 7.5YR5/8; INT. 7.5YR5/8; 7.5YR3/3	BH	BH	N/A	N/A	N/A	Fig. 19:11	N/A
83	MM17565	N/A	N/A	N/A	2.5YR4/8	S	S	N/A	N/A	N/A	Fig. 18:12	N/A
84	MM17579	N/A	5YR5/8	5YR5/8	N/A	R	R	N/A	N/A	N/A	Fig. 19:13	Rowland & Tassie, 2017
85	MM17584	N/A	N/A	N/A	7.5YR2.5/3	BH	S	N/A	N/A	N/A	Fig. 20:7	N/A
86	MM17603	N/A	10YR5/8	10YR5/8	N/A	S	S	N/A	N/A	N/A	Fig. 20:10	N/A
87	MM17623	N/A	N/A	N/A	N/A	R/S	R/S	N/A	N/A	N/A	Fig. 20:15	Rowland & Tassie, 2017
88	MM17624	N/A	N/A	N/A	N/A	R	R	N/A	N/A	N/A	Fig. 20:13	N/A
89	MM17662	N/A	N/A	N/A	7.5YR7/6	S	S	N/A	N/A	N/A	N/A	N/A

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
90	MM17843	N/A	5YR5/8; 7.5YR5/4; 7.5YR2.5/1	5YR5/8; 7.5YR5/4; 7.5YR2.5/1	N/A	R/S	R/S	N/A	N/A	N/A	Fig. 19:2	Larsen, 1963: 40
91	MM17861	N/A	2.5YR4/8	N/A	N/A	S	X	N/A	N/A	N/A	Fig. 20:19	N/A
92	MM17863	N/A	7.5YR5/6	N/A	N/A	S	X	N/A	N/A	N/A	Fig. 20:18	Rowland & Tassie, 2017
93	MM17864	N/A	7.5YR5/6	N/A	N/A	S	X	N/A	N/A	N/A	Fig. 20:14	N/A
94	MM17865	N/A	N/A	N/A	10YR4/6	BC	X	N/A	N/A	N/A	Fig. 20:16	N/A
95	MM17962	N/A	N/A	N/A	10YR4/6	R	R	N/A	N/A	N/A	N/A	Larsen, 1963: 43, pl. XI
96	MM31792	N/A	N/A	N/A	5YR3/3	BO	S	N/A	N/A	N/A	Fig. 18:1	N/A
97	MM31796	B	10YR5/6; 10YR2/2; 10YR 3/3	10YR5/6; 10YR2/2; 10YR 3/3	N/A	R	R	KN X 2	APP	EUR	Fig. 18:5	N/A
98	MM31799	N/A	10YR2/2	10YR2/2	N/A	S	S	KN	APP	B	Fig. 20:9	N/A

Table 8c. *(continued)* Merimde pottery collections of the Institute of Prehistory and Historical Archaeology, the University of Vienna, and Medelhavsmuseet, Stockholm (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT.	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
99	MM32917	P X 6	N/A	N/A	EXT. 10YR3/2; 10YR5/6; INT. 10YR4/3	BC	S	N/A	N/A	N/A	N/A	Rowland & Tassie, 2017
100	MM32920	P X 2	N/A	N/A	EXT. 5YR5/8; 5YR4/4; INT. 5YR2.5/2	BO	BH	N/A	N/A	N/A	N/A	Rowland & Tassie, 2017
101	MM32921	N/A	N/A	N/A	10YR5/4	S	S	N/A	N/A	N/A	N/A	N/A
102	MM33608	N/A	7.5YR6/6	7.5YR6/6	7.5YR5/4	BO	BO	N/A	N/A	N/A	N/A	Rowland & Tassie, 2017

Table 9a. El-Omari pottery collection of the Egyptian Museum in Cairo (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
1	EMC	JE87537	1	el-Omari, Area A	pit A69	NEOLITHIC, phase 8	V	Type I.1; red - red brown polished slip, smoothed inside.	C
2	EMC	JE87538	1	el-Omari, Area A	burial A30	NEOLITHIC, phase 7	V	Type IVd; light brown, reddish brown with a black spot, wet-smoothed polished, smoothed inside.	O
3	EMC	JE87540	1	el-Omari, Area A	burial A140	NEOLITHIC, phase 7	V	Type IVd; red polished slip? wet-smoothed inside.	C
4	EMC	JE87541	1	el-Omari, Area A	burial A35 (a wooden stick)	NEOLITHIC, phase 4	V	Type IVd; ducky red - red brown polished slip, inside wet-smoothed.	C
5	EMC	JE87542	1	el-Omari, Area A	burial A136	NEOLITHIC, phase 7	V	Type IVd; brown wet-smoothed, smoothed inside.	C
6	EMC	JE87543	1	el-Omari, Area A	pit A91	NEOLITHIC	V	N/A	O

Table 9a. *(continued)* El-Omari pottery collection of the Egyptian Museum in Cairo (general data)

NO.	LOCATION	ID	ITEM NO.	SITE	CONTEXT	CHRONOLOGY	VESSEL PART	CATALOGUE DESCRIPTION	VESSEL SHAPE
7	EMC	JE87544	1	el-Omari, Area A	burial A150	NEOLITHIC, phase 8	R	Group VIII; clear red polished slip, smoothed inside.	O
8	EMC	JE87545	1	el-Omari, Area A	burial A113	NEOLITHIC, phase 8	R	Type II.1b; dark brown polished slip od the same clay; wet-smoothed inside.	C
9	EMC	JE87546	1	el-Omari, Area A	pit A132	NEOLITHIC, phase 1	R	Type II.2; red brown - brown polished slip, smoothed inside. Black soot on the surface.	C

Table 9b. El-Omari pottery collection of the Egyptian Museum in Cairo (shape and fabric)

NO.	ID	SHAPING METHOD	RIM SHAPE	BODY SHAPE	BASE SHAPE	RD	MD	BD	H	WT	CLAY	TEMPER	TEMPER SIZE	TEMPER %	BREAK EXT/M/INT
1	JE87537	HM	PF	S	SF	56	98	33	85	4	C	S/SD	VC/M	20-5	DR
2	JE87538	HM	RS	O	F	75	77	43	93	6	C	S/SD	M/VC	20-10	RB
3	JE87540	HM	RF	O	F	60	77	46	85	5	C	S/SD	VC/M	30-15	RB
4	JE87541	HM	RF	O	F	50	48	30	78	5	C	S/SD	F/VC	5-15	RB
5	JE87542	HM	RS	O	F	40	47	32	58	8	C	S/SD	F/C	5-20	URB?
6	JE87543	HM	RF	S	K	85-50	50	N/A	47	6	C	S/SD	F/C	5-15	LB/BL/LB
7	JE87544	HM	RF	O	N/A	140	N/A	N/A	97	8-10	C	S/SD	M/F	10-3	RB
8	JE87545	HM	RF	S/O?	N/A	90	N/A	N/A	N/A	5-7	C	S/SD	M-C/F	10-5	BL
9	JE87546	HM	RF	S/O?	N/A	8	N/A	N/A	N/A	6-7	C	S/SD	M/F	10-5	RB

Table 9c. El-Omari pottery collection of the Egyptian Museum in Cairo (surface treatment and decoration)

NO.	ID	PF	EXT. SURF. COLOUR	INT. SURF. COLOUR	SLIP COLOUR	EXT. SURF. TREAT	INT. SURF. TREAT.	DEC. PATTERN	DEC. TECHNIQUE	DEC. LOCATION	DRAWING	REFERENCES
1	JE87537	N/A	2.5YR4/6	2.5YR4/6	10YR4/6	BC	S	N/A	N/A	N/A	Fig. 21:4	Debono & Mortensen, 1990: pls.1:1; 37:1; 46:1
2	JE87538	N/A	5YR5/6	5YR5/6	N/A	S	S	N/A	N/A	N/A	Fig. 21:8	Debono & Mortensen, 1990: 67; pl.4:2
3	JE87540	N/A	7.5YR6/4	7.5YR6/4	2.5YR4/8	S	S	N/A	N/A	N/A	Fig. 21:3	Debono & Mortensen, 1990: 69; pls. 4:6; 43:3-4
4	JE87541	N/A	5YR4/4	5YR4/4	10YR4/6	BX	S	N/A	N/A	N/A	Fig. 21:1	Debono & Mortensen, 1990: 67; pls. 4:3; 43:1-2; 46:3
5	JE87542	N/A	7.5YR5/4; 7.5YR3/1; 10YR3/2	7.5YR5/4; 7.5YR3/1; 10YR3/2	N/A	S	S	N/A	N/A	N/A	Fig. 21:2	Debono & Mortensen, 1990: 68; pls. 4:5; 47:1
6	JE87543	N/A	10YR6/4; 10YR3/1	10YR6/4; 10YR3/1	N/A	S	S	N/A	N/A	N/A	Fig. 21:7	Debono & Mortensen, 1990: 35; pl. 47:1
7	JE87544	N/A	2.5YR4/8	2.5YR4/8	N/A	BV	S	N/A	N/A	N/A	Fig. 21:9	Debono & Mortensen, 1990: pl. 7:20
8	JE87545	N/A	2.5YR3/3	2.5YR3/3	N/A	BC	S	N/A	N/A	N/A	Fig. 21:6	Debono & Mortensen, 1990: 68; pl. 1:21
9	JE87546	N/A	2.5YR3/6	2.5YR3/6	N/A	BC	S	N/A	N/A	N/A	Fig. 21:5	Debono & Mortensen, 1990: pl. 2:12

Figures

Figure 1. Lower Egyptian Neolithic pottery: 1-4 – Fayum; 5-7 – Merimde I; 8-10 – Merimde II; 11-12 – Merimde III; 13-15 – el-Omari (Caton-Thompson & Gardner, 1934; Eiwanger, 1984; 1988; 1992; Debono & Mortensen, 1990; prepared by A. Mączyńska and drawn by J. Kędelska)

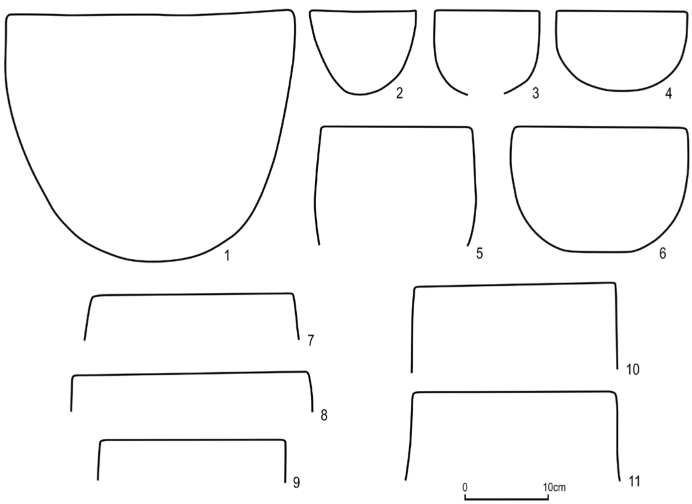


Figure 2. Lower Egyptian Neolithic pottery: 1-2 – Fayum; 3-4 – Merimde I; 5-6 – Merimde II; 7-8 – Merimde III; 9-11 – el-Omari (Caton-Thompson & Gardner, 1934; Eiwanger, 1984; 1988; 1992; Debono & Mortensen, 1990; prepared by A. Mączyńska and drawn by J. Kędelska)

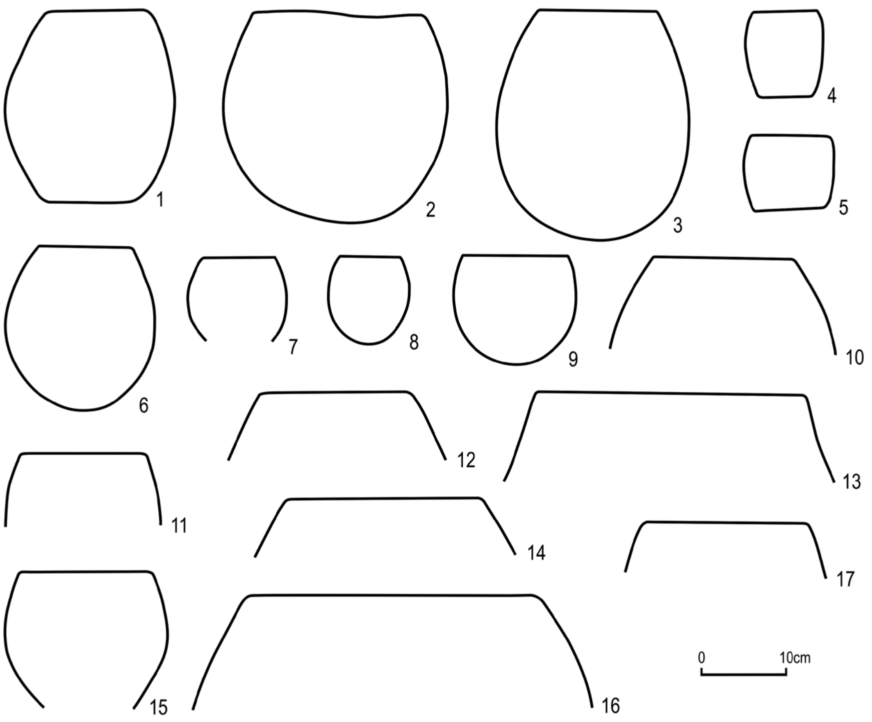


Figure 3. Lower Egyptian Neolithic pottery: 1-5 – Fayum; 6-8, 11 – Merimde I;
9-10, 12-14 - Merimde II; 15-16 – Merimde III; 17 – el-Omari (Caton-Thompson & Gardner, 1934; Eiwanger, 1984; 1988; 1992; Debono & Mortensen, 1990; prepared by A. Mączyńska and drawn by J. Kędelska)

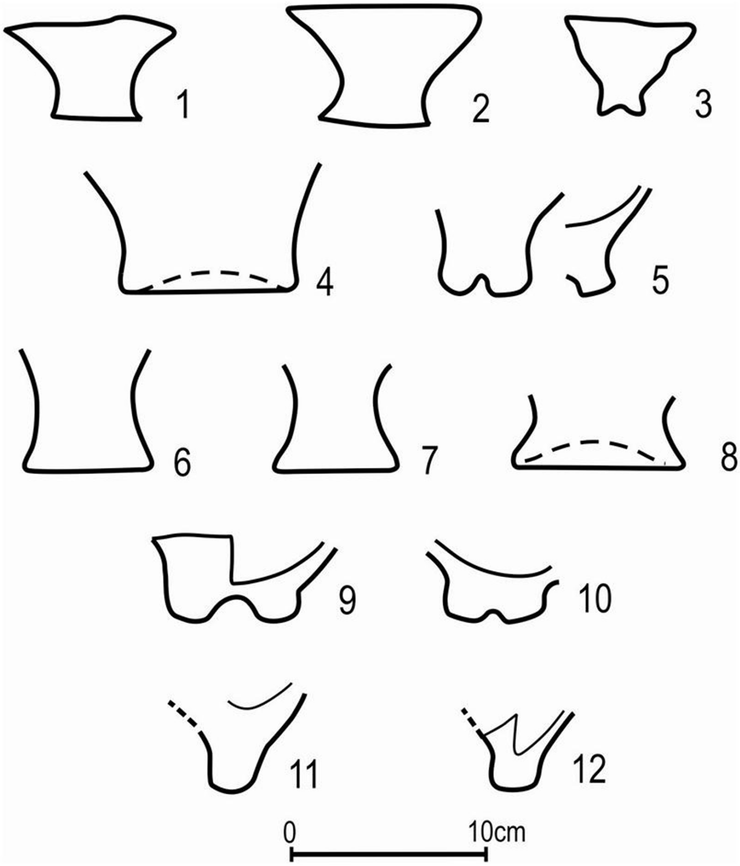


Figure 4. Lower Egyptian Neolithic pottery: 1-3 – Fayum; 4-5 – Merimde II; 6-8, 11 – Merimde III; 9-10, 12 – el-Omari (Caton-Thompson & Gardner, 1934; Eiwanger, 1984; 1988; 1992; Debono & Mortensen, 1990; prepared by A. Mączyńska and drawn by J. Kędelska).

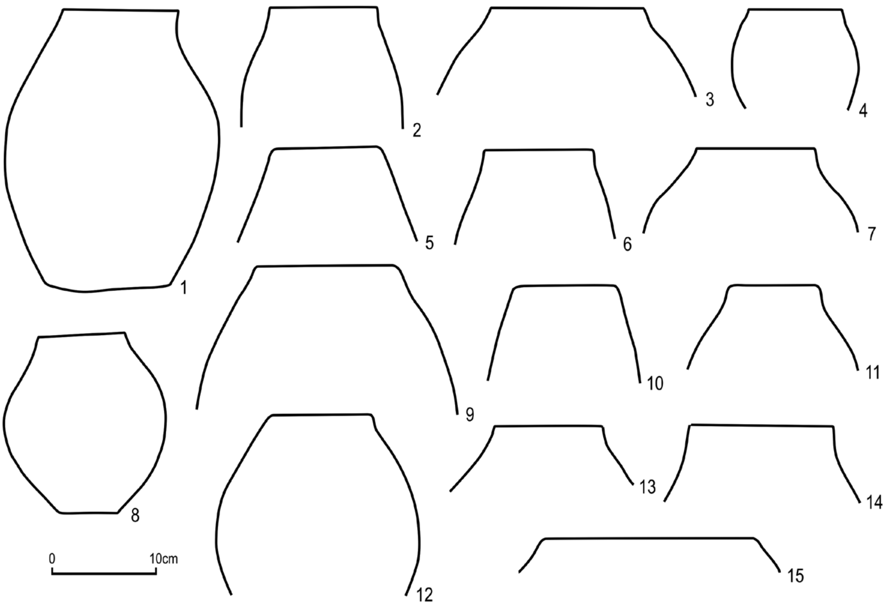


Figure 5. Lower Egyptian Neolithic pottery: 1 – Fayum; 2, 4-5 – Merimde II; 3, 6-9 – Merimde III; 10-14 – el-Omari; 15 – Qasr el-Sagha (Caton-Thompson & Gardner, 1934; Ginter & Kozłowski, 1983; Eiwanger, 1984; 1988; 1992; Debono & Mortensen, 1990; prepared by A. Mączyńska and drawn by J. Kędelska).

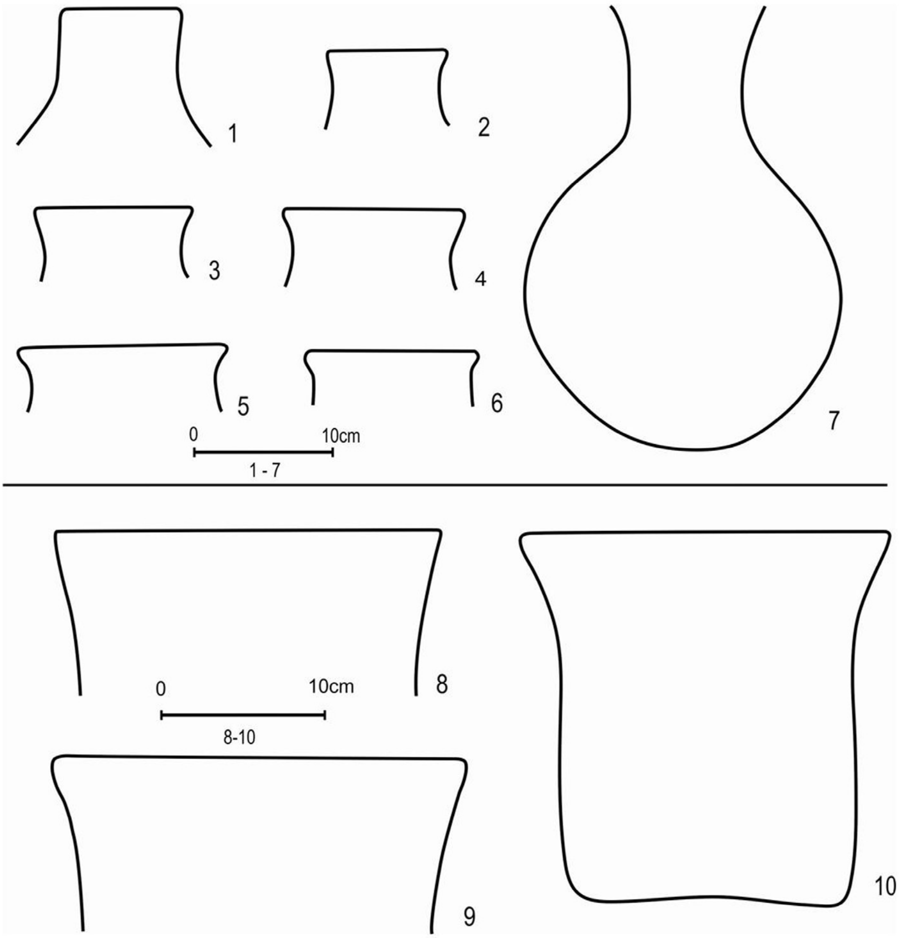


Figure 6. Lower Egyptian Neolithic pottery: 8-9 – Merimde II; 1-2, 4 – Merimde III; 3, 5-6, 19 – el-Omari (Caton-Thompson & Gardner, 1934; Eiwanger, 1984; 1988; 1992; Debono & Mortensen, 1990; prepared by A. Mączyńska and drawn by J. Kędelska)

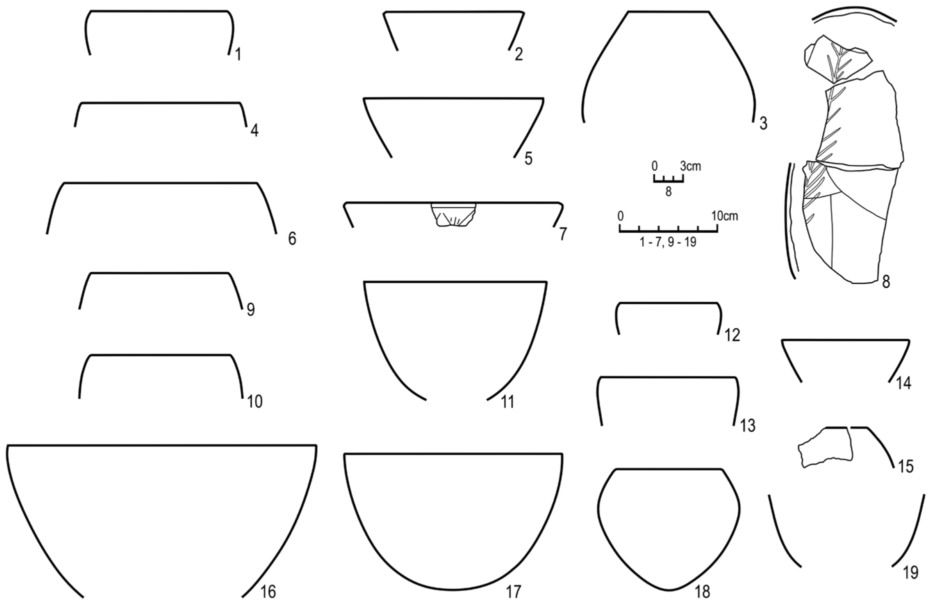


Figure 7. Undecorated thin-walled pottery of the eastern Sahara: 1-7 – Bashendi B, Dakhleh Oasis; 8 – Sodmein Cave; 9-19 – Djara B (Hope, 2002: figs. 1, 3; Riemer & Schönfeld, 2010: figs. 16-19; Vermeersch *et al.*, 2015: fig. 19:1; prepared and drawn by J. Kędelska)

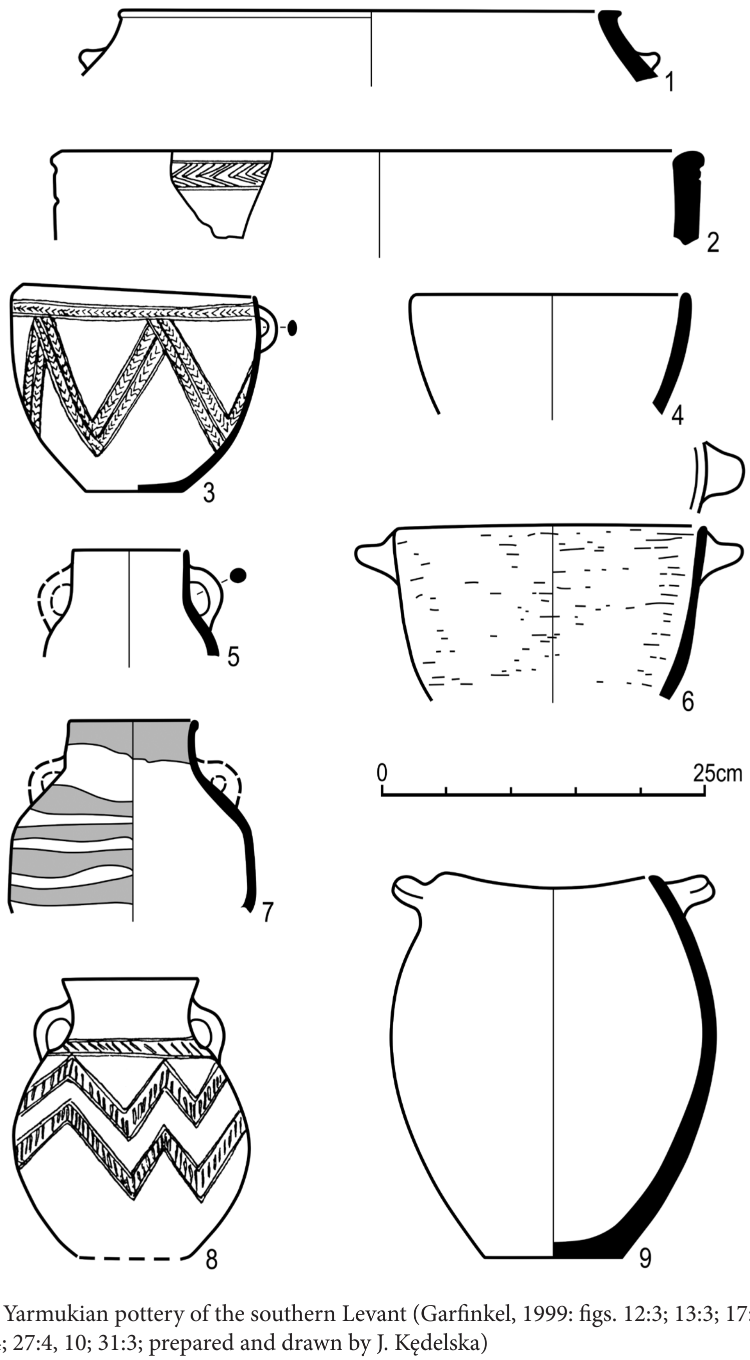


Figure 8. Yarmukian pottery of the southern Levant (Garfinkel, 1999: figs. 12:3; 13:3; 17:1; 22:2; 23:6; 26:4; 27:4, 10; 31:3; prepared and drawn by J. Kędelska)

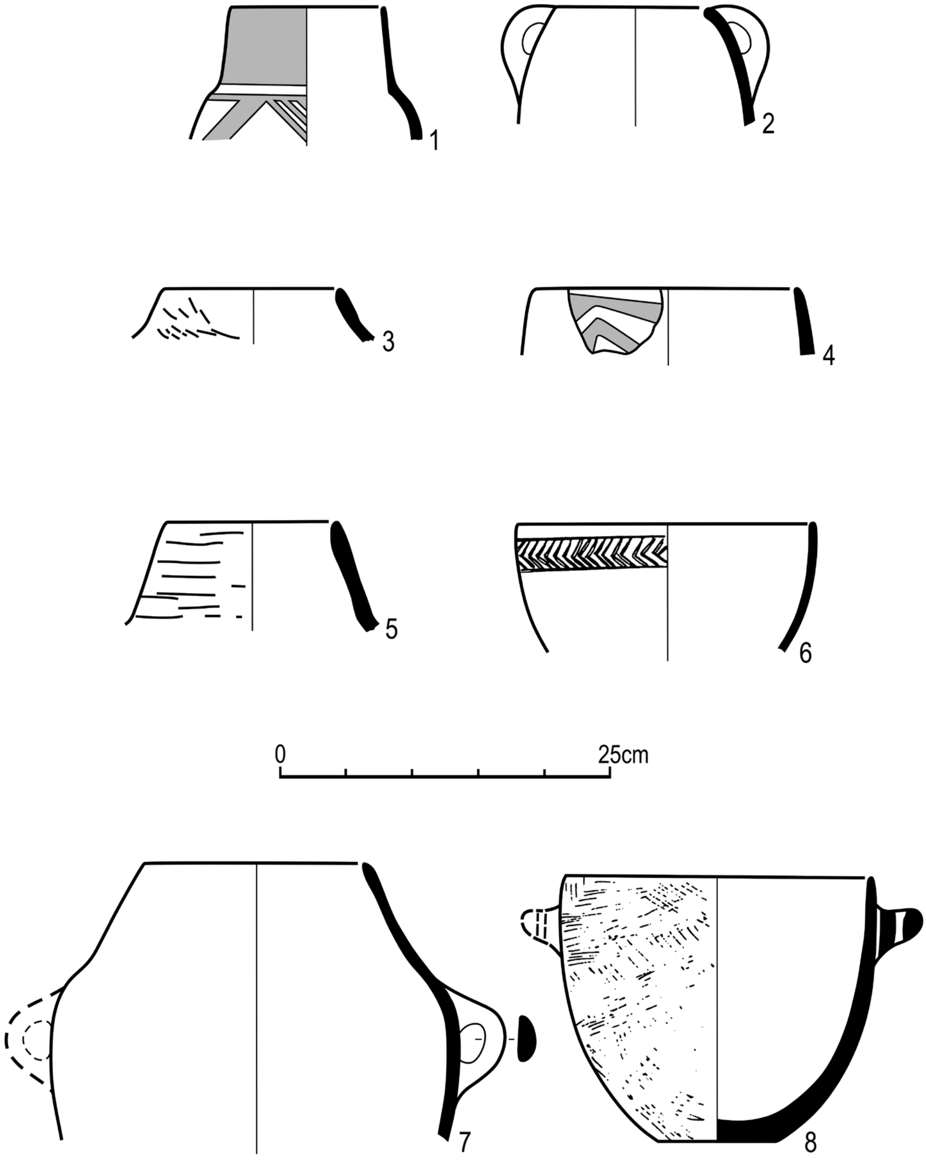


Figure 9. Lodian pottery of the southern Levant (Garfinkel, 1999: figs. 46:149:3, 6; 50:2; 55:4; 60:6; Gopher & Eyal, 2012a: figs. 10.9:19; 10.11:6; prepared and drawn by J. Kędelska)

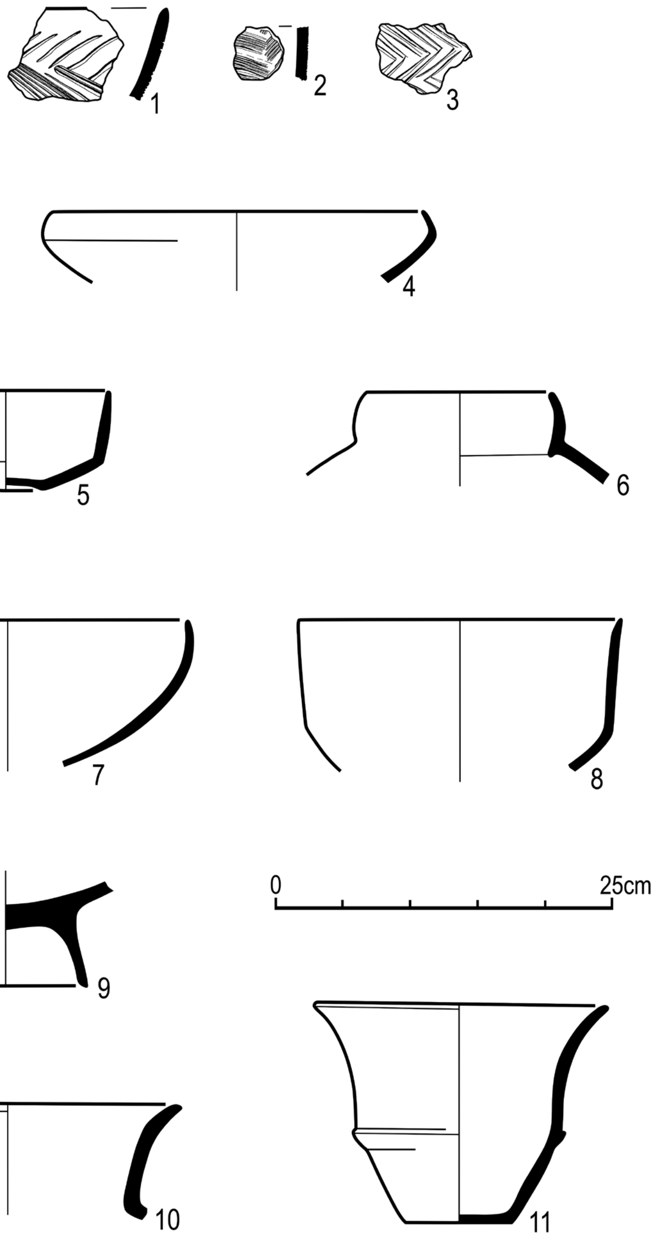


Figure 10. Wadi Rabah pottery of the southern Levant (Garfinkel, 1999: figs. 67:7; 69:5; 70:10; 72:5; 73:4; 77:5; 84:5; 85:5; Gopher & Eyal, 2012a: figs. 10.63:11; 10.71:1; prepared and drawn by J. Kędelska)

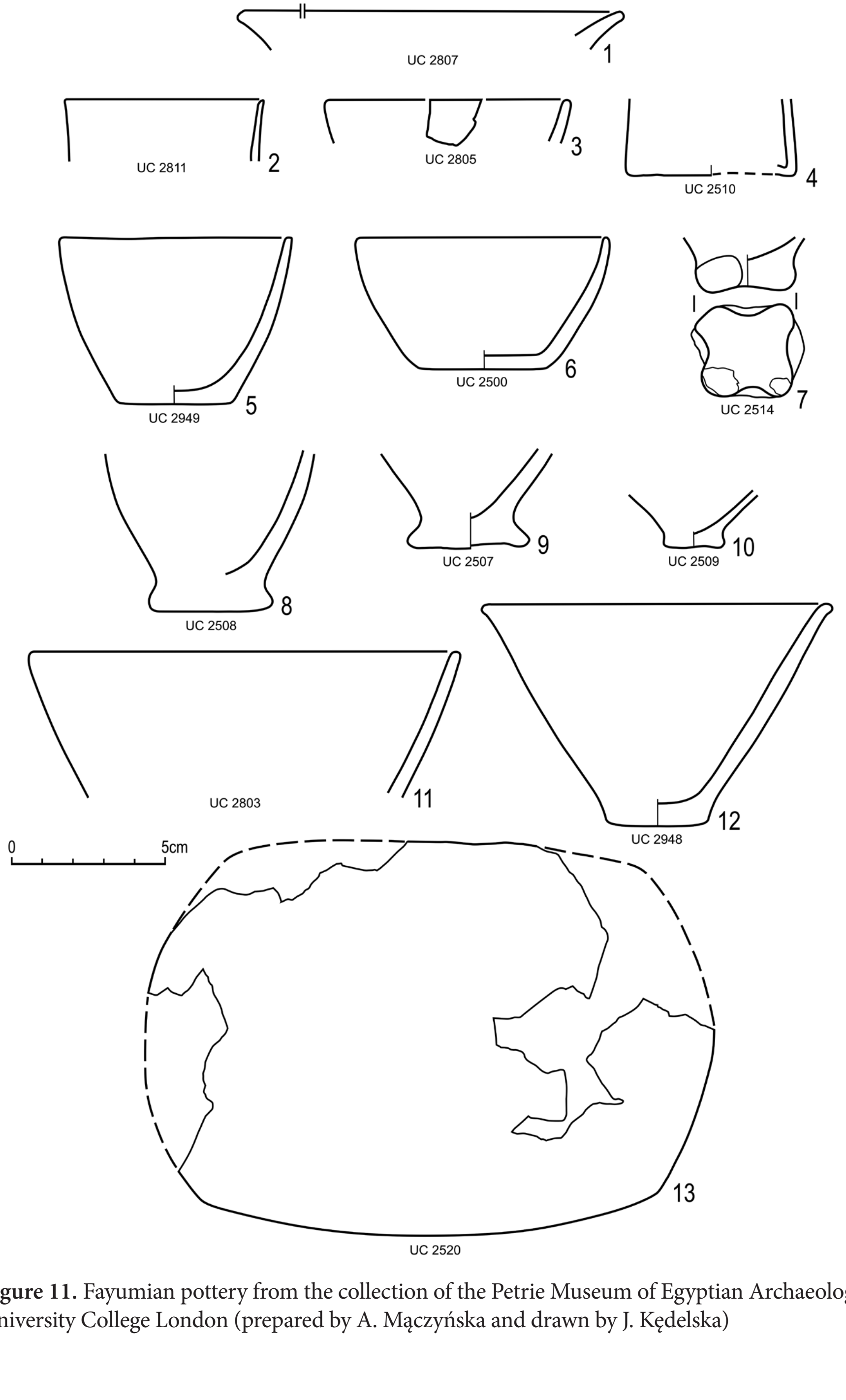


Figure 11. Fayumian pottery from the collection of the Petrie Museum of Egyptian Archaeology, University College London (prepared by A. Mączyńska and drawn by J. Kędelska)

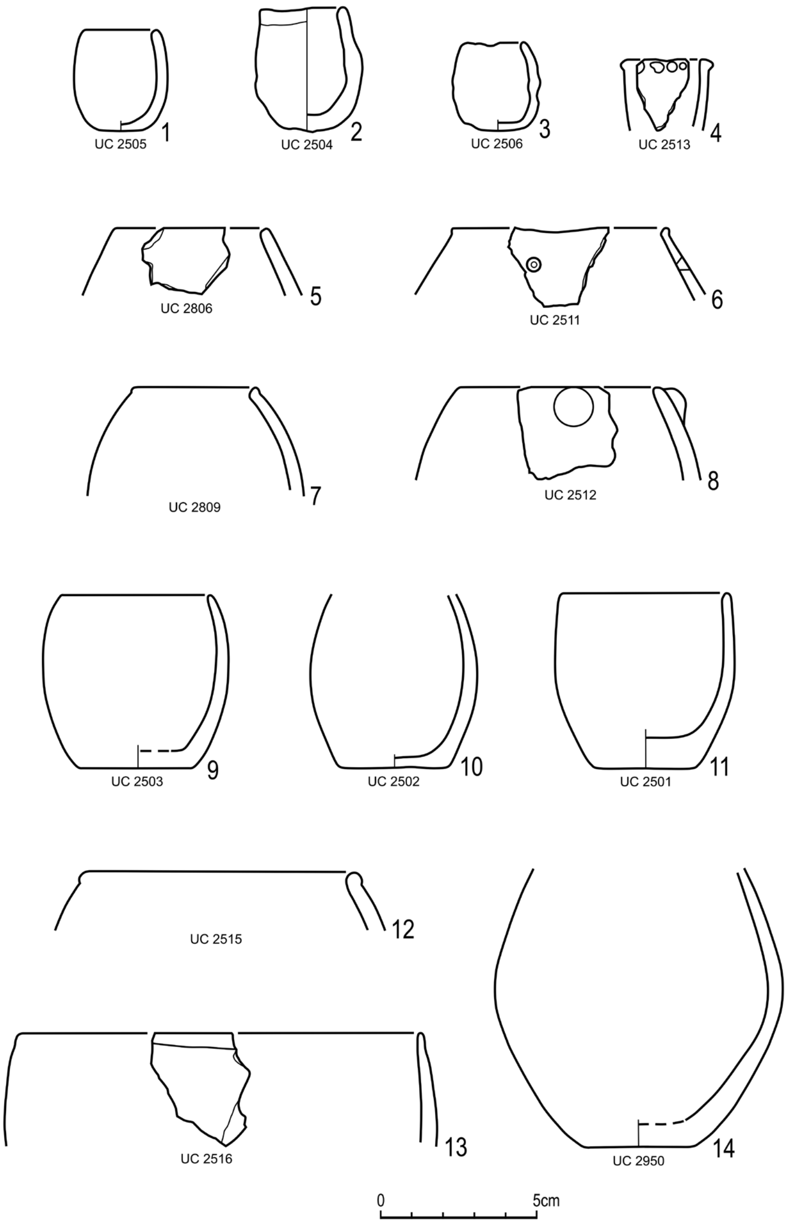


Figure 12. Fayumian pottery from the collection of the Petrie Museum of Egyptian Archaeology, University College London (prepared by A. Mączyńska and drawn by J. Kędelska)

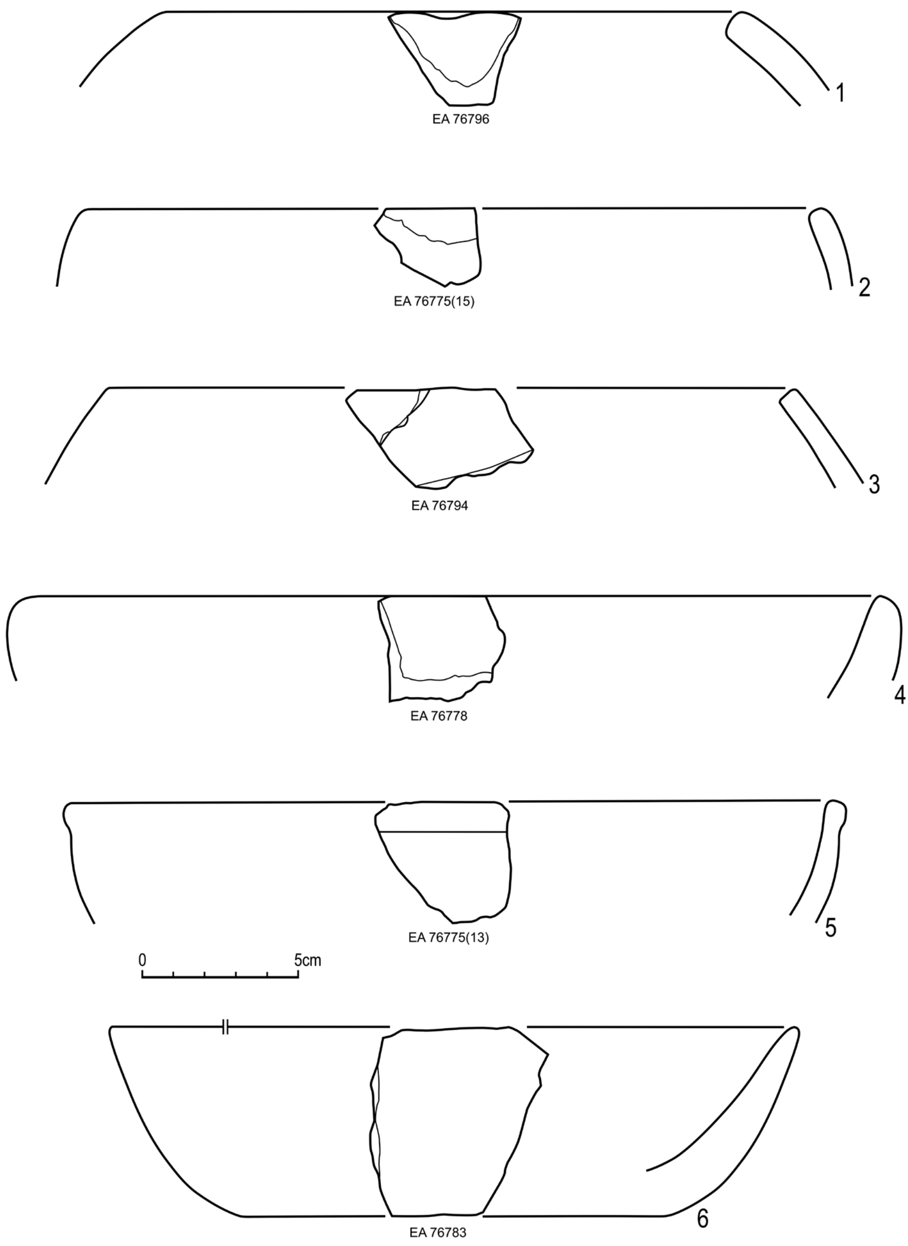


Figure 13. Fayumian pottery from the Fred Wendorf collection, the British Museum (prepared by A. Mączyńska and drawn by J. Kędelska)

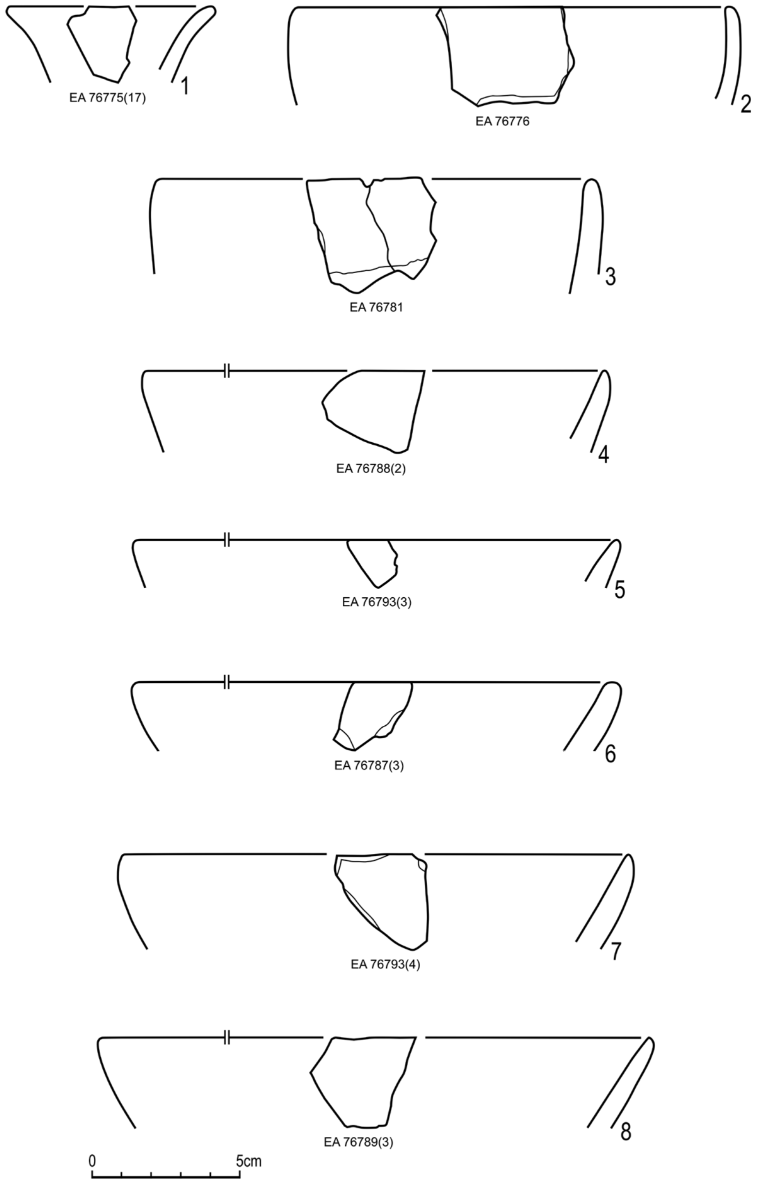


Figure 14. Fayumian pottery from the Fred Wendorf collection, the British Museum (prepared by A. Mączyńska and drawn by J. Kędelska)

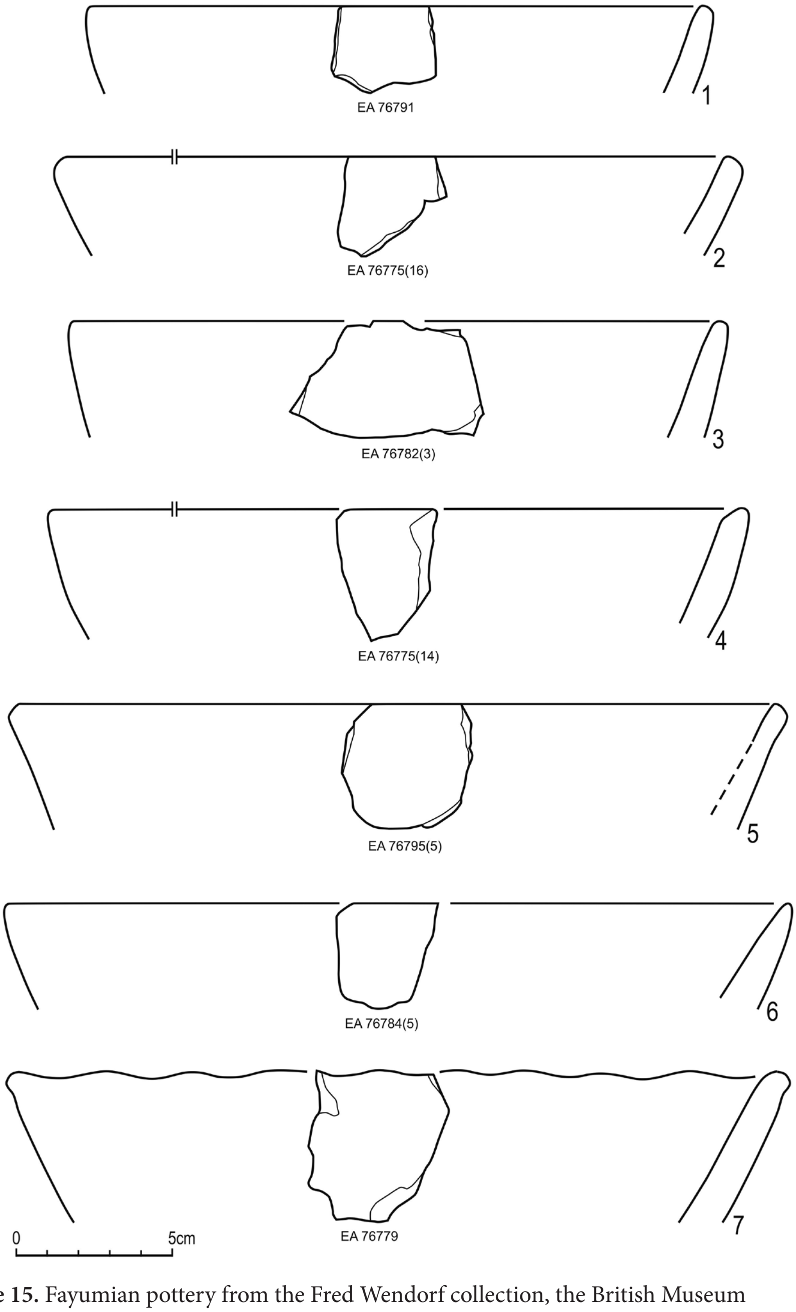


Figure 15. Fayumian pottery from the Fred Wendorf collection, the British Museum (prepared by A. Mączyńska and drawn by J. Kędelska)

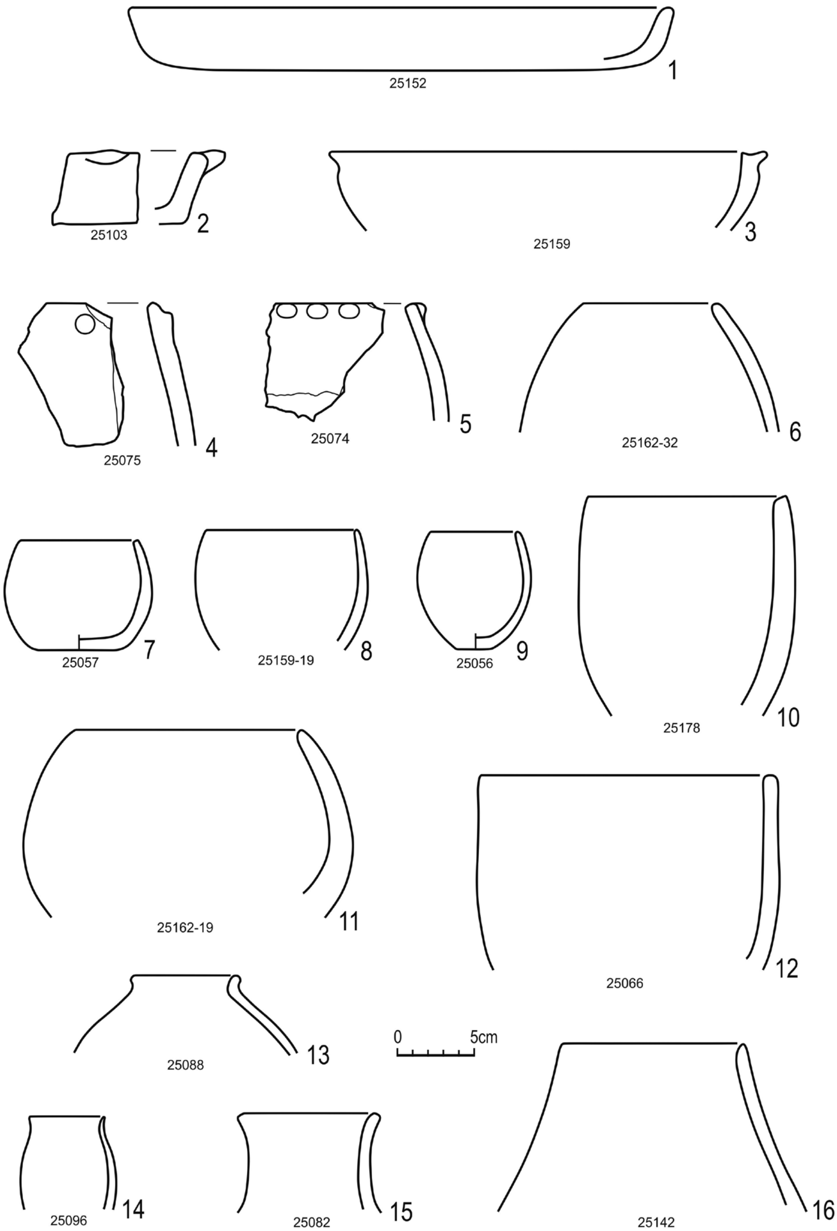


Figure 16. Merimde pottery from the study collection of the Institute of Prehistory and Historical Archaeology, the University of Vienna (prepared by A. Mączyńska and drawn by J. Kędelska)

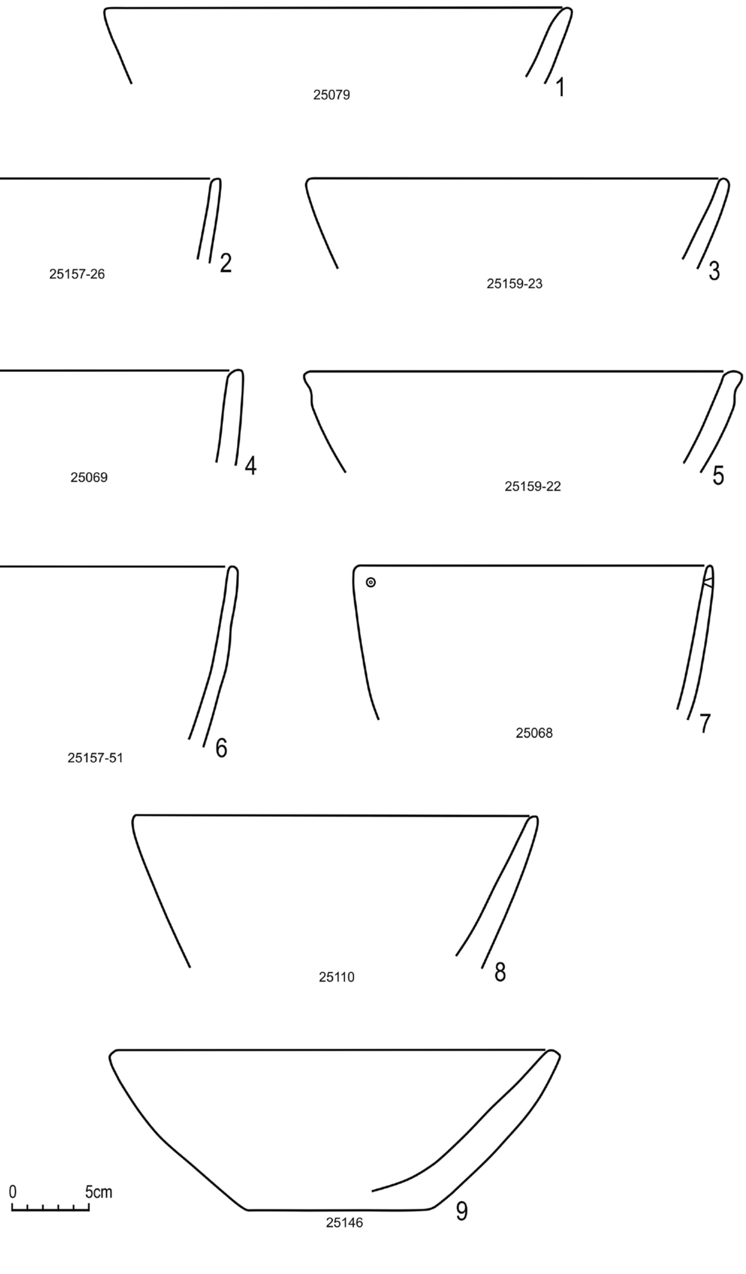


Figure 17. Merimde pottery from the study collection of the Institute of Prehistory and Historical Archaeology, the University of Vienna (prepared by A. Mączyńska and drawn by J. Kędelska)

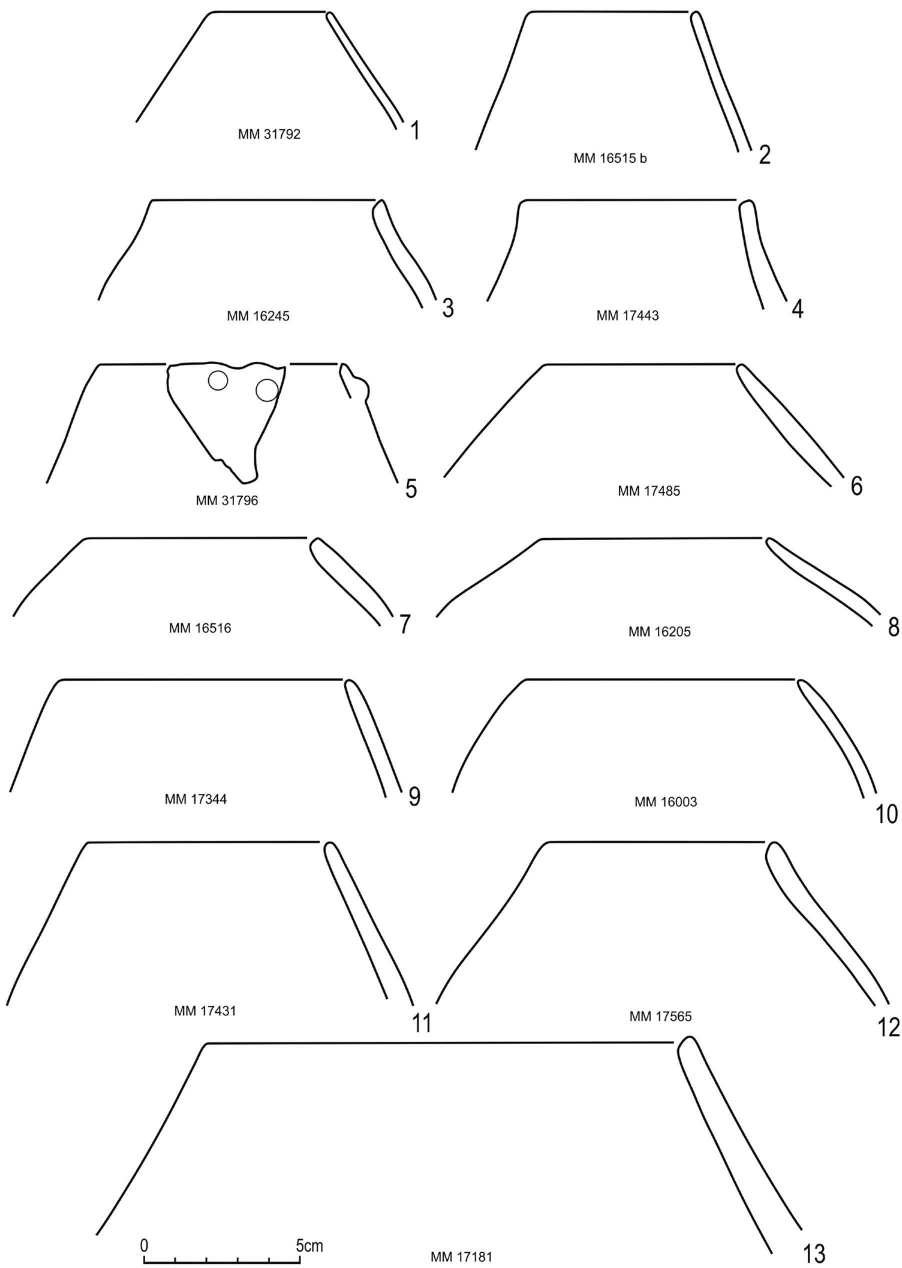


Figure 18. Merimde pottery from the collection of Medelhavsmuseet, Stockholm (prepared by A. Mączyńska and drawn by J. Kędelska)

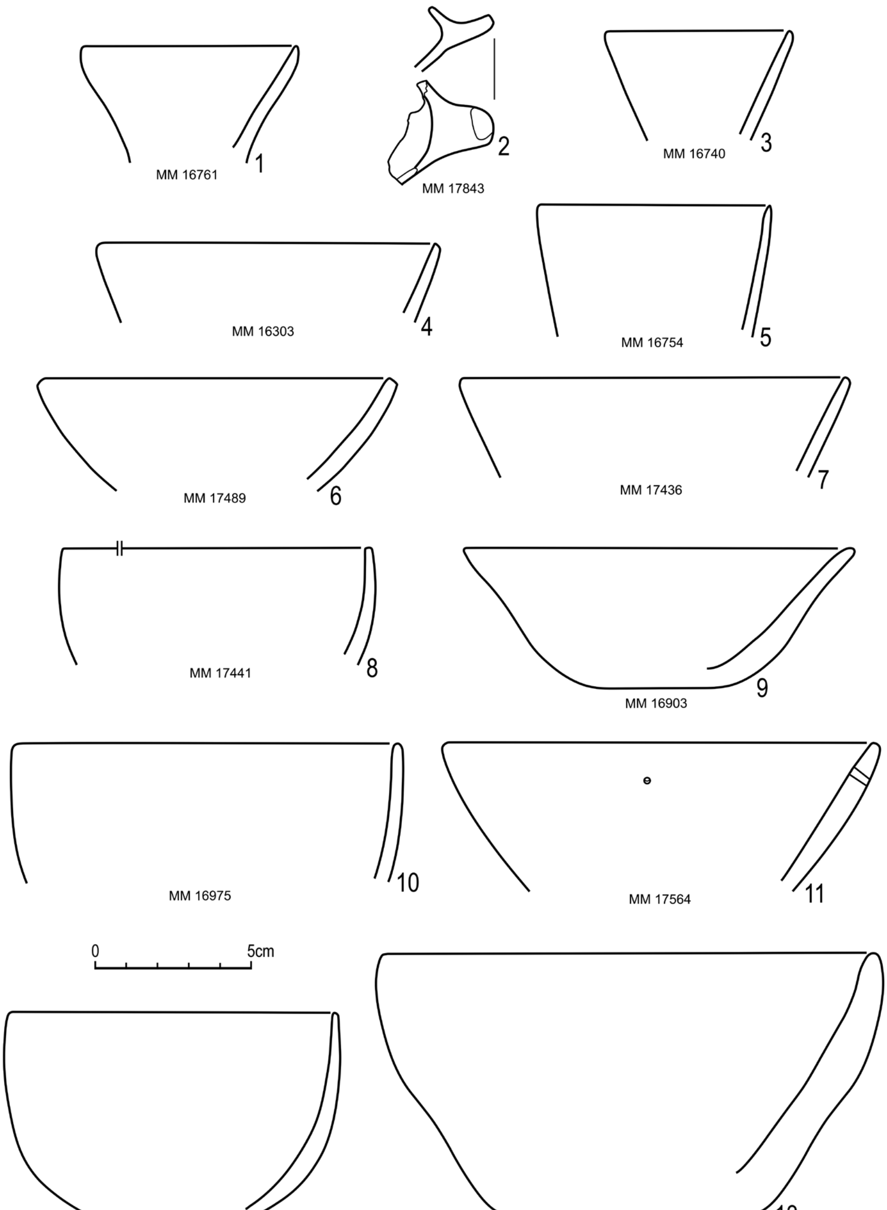


Figure 19. Merimde pottery from the collection of Medelhavsmuseet, Stockholm (prepared by A. Mączyńska and drawn by J. Kędelska)

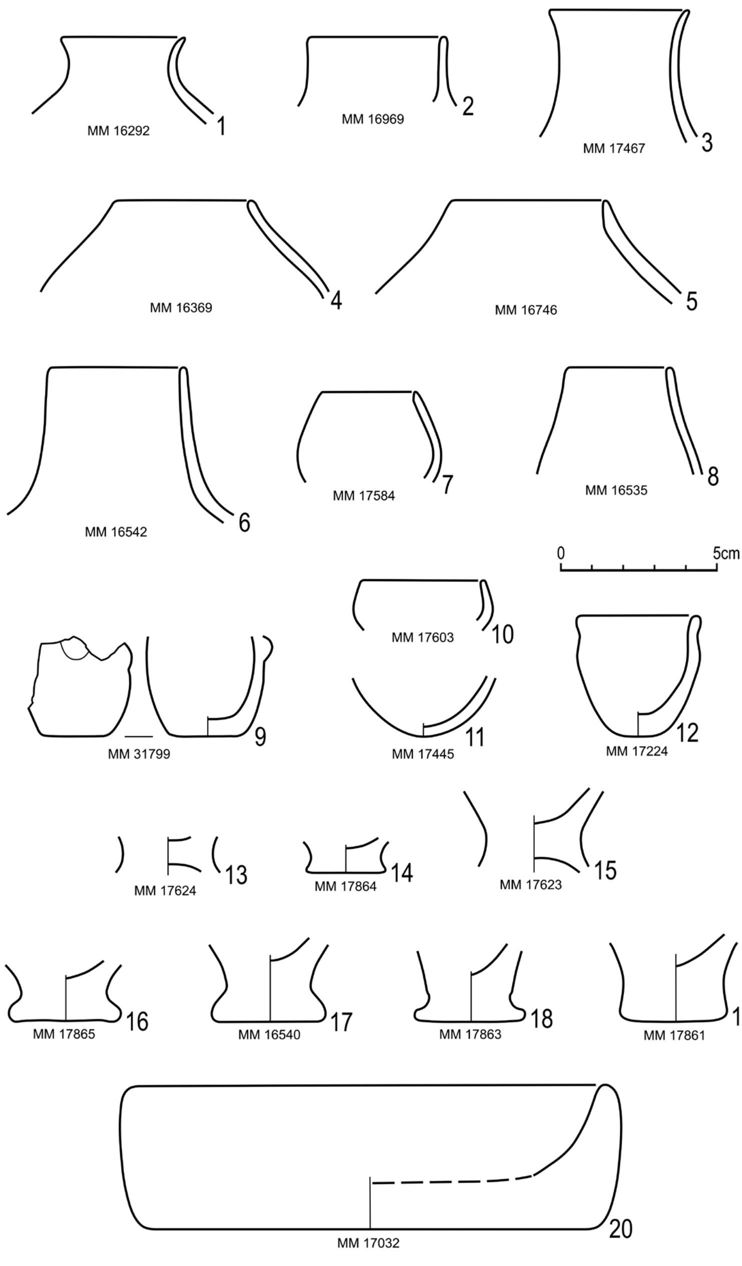


Figure 20. Merimde pottery from the collection of Medelhavsmuseet, Stockholm (prepared by A. Mączyńska and drawn by J. Kędelska)

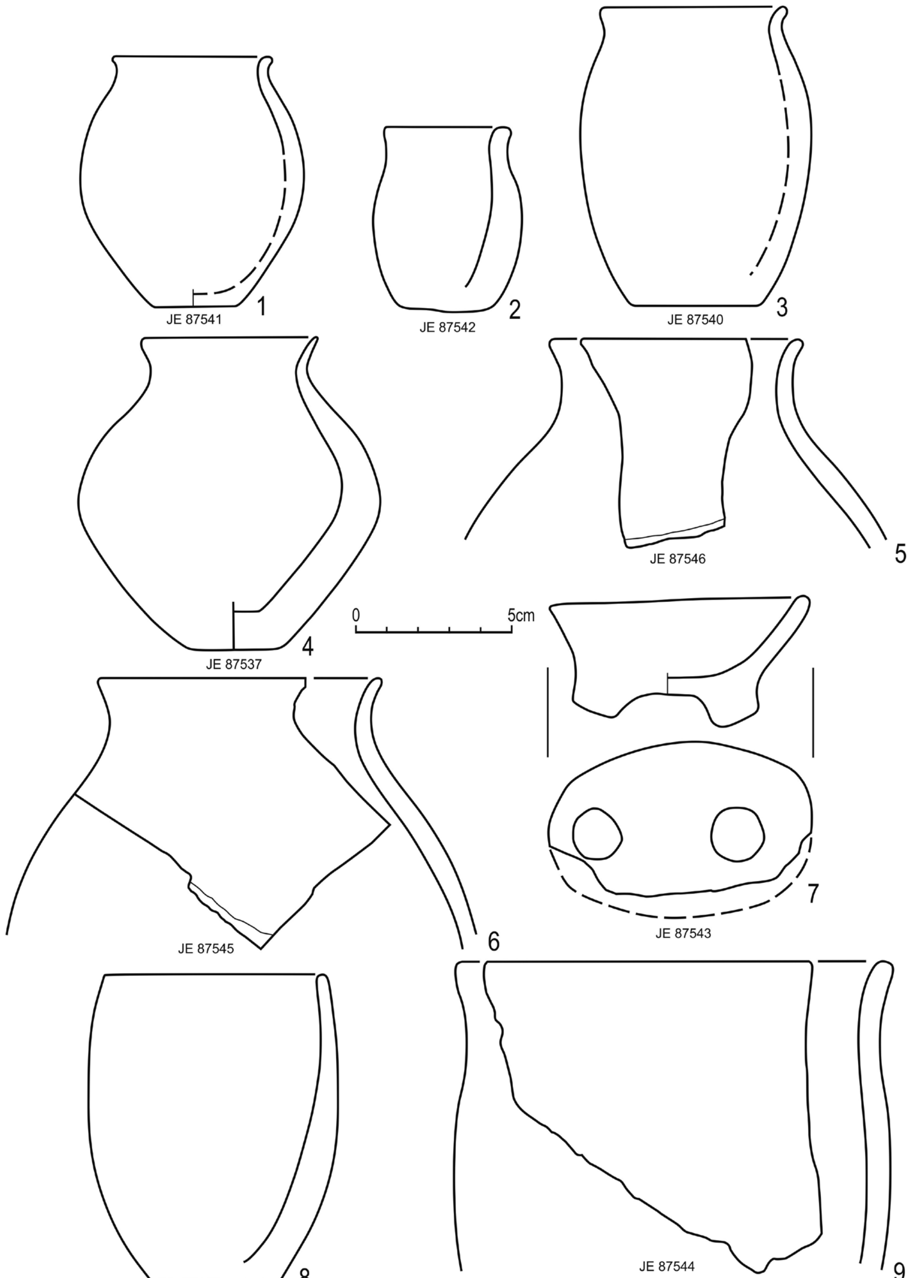


Figure 21. El-Omari pottery from the collection of the Egyptian Museum in Cairo (prepared by A. Mączyńska and drawn by J. Kędelska)

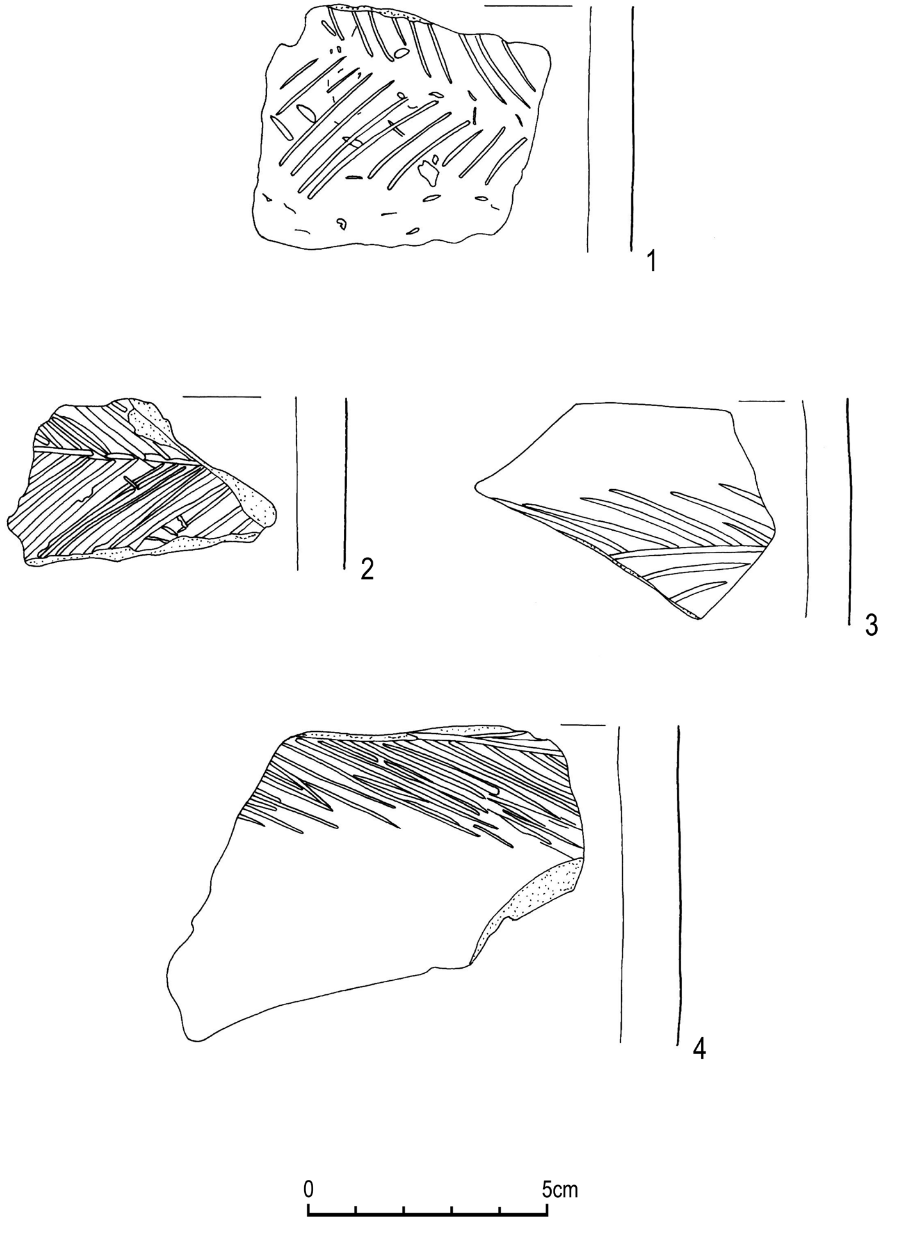


Figure 22. Herringbone decoration pattern, Merimde Beni Salame (Medelhavsmuseet, Stockholm): 1 - MM16002; 2 – MM16005; 3 – MM16009; 4 – MM16010 (prepared by A. Mączyńska and drawn by J. Kędelska)

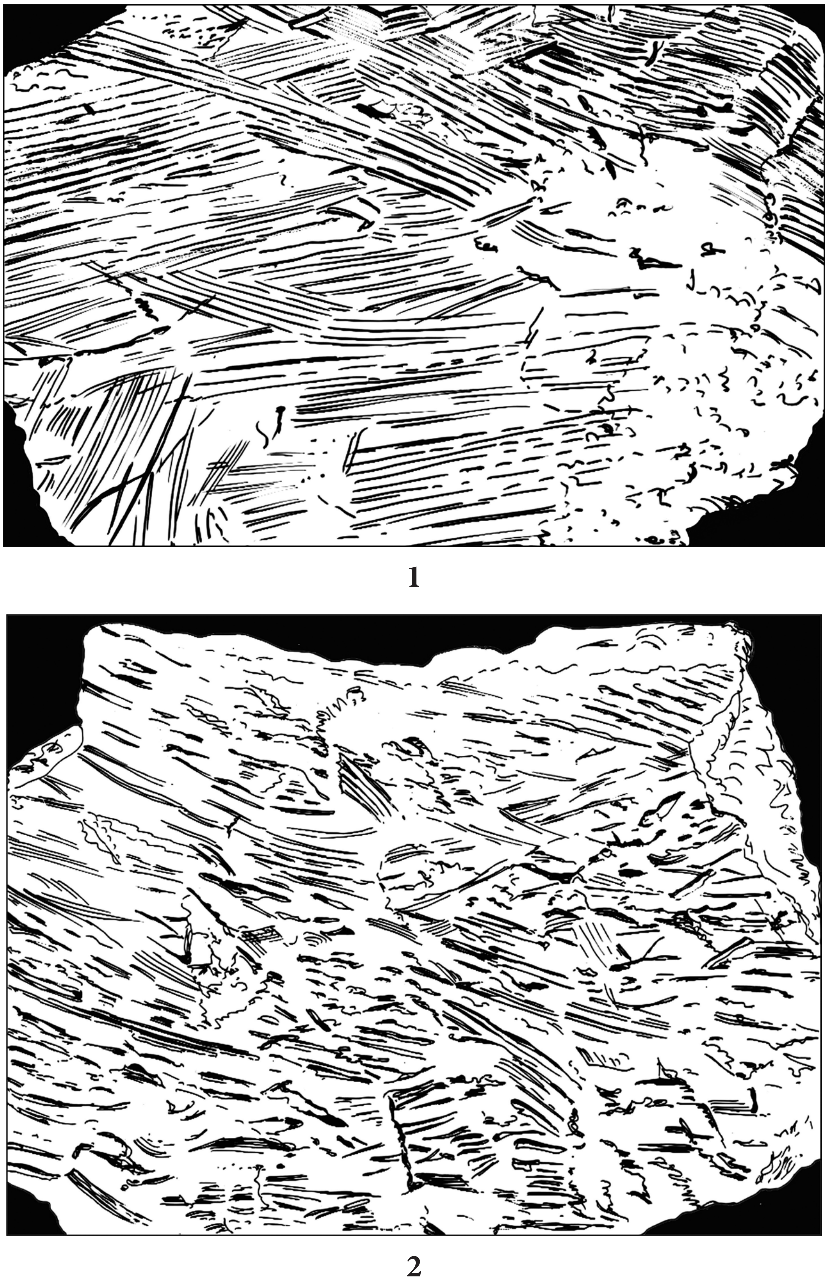


Figure 23. Internal walls of Merimde sherds with traces of wiping and smoothing using grass or straw (Medelhavsmuseet, Stockholm): 1 – MM16884; 2 – MM16746 (drawn by B. Bednarczyk)

Bibliography

ABADI-REISS, Y. & GILEAD, I., 2010. The transition of Neolithic–Chalcolithic in the southern Levant: recent research of cultural assemblages from the site of Qatif. In: Matthiae, P., Pinnock, F., Nigro, L. & Marchetti, M. (eds.), *Proceedings of the 6th International Congress of the Archaeology of the Ancient Near East*, Volume II. Wiesbaden: 27-38.

AMIRAN, R., 1965. The Beginning of Pottery-Making in the Near East. In: Marson, F.R. (ed.), *Ceramic and Man*. Chicago: 240-247.

ARKELL, A.J., 1975. *The Prehistory of the Nile Valley*. Leiden.

ARKELL, A.J. & UCKO, P.J., 1965. Review of Predynastic Development in the Nile Valley. *Current Anthropology* 6(2): 145-166.

ARNOLD, D.E., 1989. *Ceramic theory and cultural process*. Cambridge.

ARREDI, B., POLONI, E.S., PARACCHINI, S., ZERJAL, T., FATHALLAH, D.M., MAKRELOUF, M., PASCALI, V.L., NOVELLETTO, A. & TYLER-SMITH, C., 2004. A Predominantly Neolithic Origin for Y-Chromosomal DNA Variation in North Africa. *American Journal of Human Genetics* 75: 338-45.

ARZ, H.W., LAMY, F., PÄTZOLD, J., MÜLLER, P.J. & PRINS, M., 2003. Mediterranean Moisture Source for an Early-Holocene Humid Period in the Northern Red Sea. *Science* 300: 118–21.

BANNING, E.B., 1998. The Neolithic Period: Triumphs of Architecture, Agriculture, and Art. *Near Eastern Archaeology* 61(4): 188-237.

BANNING, E.B., 2007. Wadi Rabah and Related Assemblages in the Southern Levant: Interpreting the Radiocarbon Evidence. *Paléorient* 33(1): 77-101.

BANNING E.B., 2010. Houses, Households, and Changing Society in the Late Neolithic and Chalcolithic of the Southern Levant. *Paléorient* 36(1): 49-87.

BANNING, E.B., 2012. The Southern Levant. In: Potts, D.T. (ed.), *A Companion to the Archaeology of the Ancient Near East*. Oxford: 397-414.

BARAKAT, H., 1990. Plant remains from El Omari. In: Debono, F. & Mortensen, B., El Omari. *A Neolithic settlement and other sites in the vicinity of Wadi Hof, Helwan* (= Archäologische Veröffentlichungen 82). Mainz am Rhein: 109-114.

BARICH, B., 2014a. Early to mid Holocene archaeology of the Egyptian Western Desert. In: Barich, G., Lucarini, G., Hamdan, M.A. & Hassan. F.A. (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 39-53.

BARICH, B., 2014b. The El-Bahr/Wadi el Obeiyid playa: its general setting and the main archaeological features. In: Barich, G., Lucarini, G., Hamdan, M.A. & Hassan. F.A. (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 101-128.

BARICH, B., 2014c. Hidden Valley: a 7000 year-old village in Wadi el Obeiyid. In: Barich, G., Lucarini, G., Hamdan, M.A. & Hassan. F.A. (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 167-207.

BARICH, B., 2016. The introduction of Neolithic resources to North Africa: A discussion in light of the Holocene research between Egypt and Libya. *Quaternary International* 410A: 198-216.

BARICH, B. & LUCARINI, G., 2014. Social dynamics in northern Farafra from the Middle to Late Holocene: changing life under uncertainty. In: Barich, B., Lucarini, G., Hamdan, M.A. & Hassan, F.A. (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 467-484.

BARICH, B., LUCARINI, G., GALLINARO, M. & HAMDAN, M., 2012. Sheikh/Bir El Obeiyid: Evidence of Sedentism in the Northern Farafra Depression (Western Desert, Egypt). In: Kabaciński, J., Chłodnicki, M. & Kobusiewicz, M. (eds.), Prehistory of Northeastern Africa. New Ideas and Discoveries (= Studies in African Archaeology 11). Poznań: 255-278.

BARNETT, W.K., 1990. Small-Scale Transport of Early Neolithic Pottery in the West Mediterranean. *Antiquity* 64(245): 859-865.

BARNETT, W.K. & HOOPES, J.W., 1995. *The Emergence of Pottery. Technology and Innovation in Ancient Societies*. Washington & London.

BÁRTA, M. & & BRŮNA, V., 2013. The re-emergence of the El-Hayez Oasis. In: Dospěl, M. & Suková, L. (eds.), *Bahriya Oasis. Recent Research into the Past of an Egyptian Oasis*. Prague: 19-34.

BAR-YOSEF, O., 1987. Pleistocene connection between Africa and Southwest Asia: an archaeological perspective. *African Archaeological Review* 5(1): 29-38.

BAR-YOSEF, O., 2009. The Collapse of the Levantine PPNB and its Aftermath. In: Burdukiewicz, J.M, Cyrtek, K., Dyczek, P & Szymczak, K. (eds.), *Understanding the Past. Papers offered to S.K. Kozłowski*. Warsaw: 29-35.

BAR-YOSEF, O., 2013. Nile Valley-Levant interactions: An eclectic view. In: Shirai, N. (ed.), *Neolithisation of Northeastern Africa*. Berlin: 237-247.

BAR-YOSEF, O. & BELFER-COHEN, A., 2002. Facing environmental crisis. Societal and cultural changes at the transition from the Younger Dryas to the Holocene in the Levant. In: Cappers, R.T.J. & Botteman, S. (eds.), *The Dawn of Farming in the Near East*. Berlin: 55-66.

BAR-YOSEF, O. & GARFINKEL, Y., 2008. *The prehistory of Israel. Human cultures before writing*. Jerusalem.

BAUMGARTEL, E.J., 1955. *The Culture of Prehistoric Egypt* I. London.

BITON, R., GOREN, Y. & GORING-MORRIS, A.N., 2014. Ceramics in the Levantine Pre-Pottery Neolithic B: evidence from Kfar HaHoresh, Israel. *Journal of Archaeological Science* 41: 740-748.

BORRELL, F., JUNNO, A. & BARCELÓ, J.A., 2015. *Synchronous Environmental and Cultural Change in the Emergence of Agricultural Economies 10,000 Years Ago in the Levant*. PLoS ONE 10/8: e0134810. doi.org/10.1371/journal.pone.0134810; accessed on 22.04.2018.

BOURKE, S.J., 2007. The Late Neolithic/Early Chalcolithic Transition at Teleilat Ghassul: Context, Chronology and Culture. *Paléorient* 33(1): 15-32.

BOVIER-LAPIERRE, P., 1926a. Station préhistorique des environs du Caire. In: *Compte rendu du Congrès international de Géographie (Le Caire, 1925)* 4. Le Caire: 298-308.

BOVIER-LAPIERRE, P., 1926b. Une nouvelle Station Néolithique au Nord d'Hélouan (Égypte). In: *Compte rendu du Congrès international de Géographie (Le Caire, 1925)* 4. Le Caire: 268-282.

BRASS, M., 2018. Early North African Cattle Domestication and Its Ecological Setting: A Reassessment. *Journal of World Prehistory* 31(1): 81-115. https://doi.org/10.1007/s10963-017-9112-9 ; accessed 11.08.2018.

BREWER, D.J., 1989. *Fishermen, Hunters, and Herders: Zooarchaeology in the Fayum, Egypt (c. 8200-5000 bp)* (= BAR IS 478). Oxford.

BRIOIS, F. & MIDANT-REYNES, M., 2010. L'oasis de Kharga dans la Préhistoire: aux origines des cultures prédynastiques. *Archéo-Nil* 20: 43-50.

BRIOIS, F., MIDANT-REYNES, B., MARCHAND, S., TRISTANT, Y., WUTTMANN, M., DE DAPPER, M., LESUR, J. & NEWTON, C., 2012. Neolithic occupation of an artesian spring: KS043 in the Kharga Oasis, Egypt. *Journal of Field Archaeology* 37: 178-191.

BROOKFIELD, M., 2010. The Desertification of the Egyptian Sahara during the Holocene (the Last 10,000 Years) and Its Influence on the Rise of Egyptian

Civilization. In: Martini, I.P. & Chesworth, W. (eds.), *Landscape and Societies. Selected cases*. Dordrecht, Heidelberg, London, New York: 91-108.

BROWN, J.A., 1989. The beginnings of pottery as an economic process. In: van der Leeuw, S.E. & Torrence, R. (eds.), *What's New? A Closer Look at the Process of Innovation*. London: 203-224.

BUBENZER, O. & RIEMER, H., 2007. Holocene Climatic Change and Human Settlement between the Central Sahara and the Nile Valley: Archaeological and Geomorphological Results. *Geoarchaeology: An International Journal* 22(6): 607-620.

BUDJA, M., 2016. Ceramics among Eurasian hunter-gatherers. 32 000 years of ceramic technology use and the perception of containment. *Documenta Praehistorica* XLIII: 61-86.

BUTZER, K.W., 1976. *Early Hydraulic Civilization in Egypt: a study in cultural ecology*. Chicago.

CANEVA, I. (ed.), 1983. *Pottery-using gatherers and hunters at Saggai (Sudan): preconditions for food production*. Rome.

CAPPERS, R.T.J., 2013. Modelling cereal selection in Neolithic Egypt: An evaluation of economic criteria. In: Shirai, N. (ed.), *Neolithisation of Northeastern Africa*. Berlin: 109-119.

CARTER, T., BATIST, Z., CAMPEAU, K., GARFINKEL, Y. & STREIT, K., 2017. Investigating Pottery Neolithic Socio-Economic "Regression" in the Southern Levant. Characterising Obsidian Consumption at Sha'ar Hagolan (N. Israel). *Journal of Archaeological Science: Reports* 15: 305-317.

CASINI, M., 1984. Neolithic and Predynastic in the Fayum. In: Krzyżaniak, L. & Kobusiewicz, M. (eds.), *Origin and early development of food-producing cultures in north-eastern Africa* (= Studies in African Archaeology 1). Poznań: 199-204.

CATON-THOMPSON, G., 1952. *Kharga Oasis in Prehistory*. London.

CATON-THOMPSON, G. & GARDNER, E.W., 1934. *The Desert Fayum*. London.

CHILDE, V.G., 1925. *The Dawn of European Civilisation*. London.

CHILDE, V.G., 1928. *The Most Ancient East. The Oriental Prelude to European Prehistory*. London.

CHILDE, V.G., 1935. *New Light on the Most Ancient East*. London.

CHILDE, V.G., 1936. *Man Makes Himself*. London.

CIAŁOWICZ, K.M., 1999. P*oczątki cywilizacji egipskiej*. Warszawa & Kraków.

CIAŁOWICZ, K.M., 2001. *La naissance d'un royaume. L'Égypte dès la période prédynastic à la fin de la Ière dynastie*. Kraków.

ÇILINGIROĞL, Ç., 2005. The concept of "Neolithic package": considering its meaning and applicability. *Documenta Praehistorica* XXXII: 1-13.

CLOSE, A., 1995. Few and Far Between. Early ceramics in North Africa. In: Barnett, W.K. & Hoops, J.W. (eds.), *The Emergence of Pottery. Technology and Innovation in Ancient Societies*. Washington & London: 23-37.

CRISTIANI, E., 2014. Ostrich eggshell products from Hidden Valley village, Farafra Oasis. Contributions from technological analyses. In: Barich, G., Lucarini, G., Hamdan, M.A. & Hassan. F.A. (eds), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 301-306.

CZEKAJ-ZASTAWNY, A. & KABACIŃSKI, J., 2015. New Final Neolithic cemetery E-09-4, Gebel Ramlah Playa, Western Desert of Egypt. In: Kabaciński, J., Chłodnicki, M. & Kobusiewicz, M. (eds.), *Hunter-Gatherers and Early Food Producing Societies in Northeastern Africa* (= Studies in African Archaeology 14). Poznań: 277-385.

CZEKAJ-ZASTAWNY, A., GOSLAR, T., IRISH, J.D. & KABACIŃSKI, J., 2018. Gebel Ramlah – a Unique Newborns' Cemetery of the Neolithic Sahara. *African Archaeological Review*. https://doi.org/10.1007/s10437-018-9307-1; Accessed on 23.07.2018.

CZIESLA, E., 1989. Sitra and related sites at the western border of Egypt. In: Krzyżaniak, L. & Kobusiewicz, M. (eds.), *Late Prehistory of the Nile Basin and the Sahara* (= Studies in African Archaeology 2). Poznań: 205-214.

CZIESLA, E., 1993. Investigations into the archaeology of the Sitra-Hatiyet, Northwestern Egypt. In: Krzyżaniak, L., Kobusiewicz, M. & Alexander, J. (eds.), Environmental Change and Human Culture in the Nile Basin and Northern Africa until the Second Millennium B.C. (= Studies in African Archaeology 4). Poznań: 185-197.

DACHY, T., BRIOIS, F., MARCHAND, S., MINOTTI, M., LESUR, J. & WUTTMANN, M., 2018. Living in an Egyptian Oasis: Reconstruction of the Holocene Archaeological Sequence in Kharga. *African Archaeological Review*. https://doi.org/10.1007/s10437-018-9306-2; accessed on 19.09.2018.

DARNELL, D., 2002. Gravel of the Desert and Broken Pots in the Road: Ceramic Evidence from the Routes between the Nile and Kharga Oasis. In: Friedman, R.F. (ed.), *Egypt and Nubia. Gifts of the Desert*. London: 156-177.

DEBONO, F. & MORTENSEN, B., 1990. *El Omari. A Neolithic settlement and other sites in the vicinity of Wadi Hof, Helwan* (= Archäologische Veröffentlichungen 82). Mainz am Rhein.

DE VAUX, R., 1966. *Palestine during the Neolithic and Chalcolithic period*. Cambridge.

DOSPĚL, M. & SUKOVÁ, L., 2013. Exploration of the El-Hayz Oasis: Issues, approaches, challenges. In: Dospěl, M. & Suková, L. (eds.), *Bahriya Oasis. Recent Research into the Past of an Egyptian Oasis*. Prague: 3-18.

DUNNE, J., DI LERNIA, S., CHŁODNICKI, M., KHERBOUCHE, F. & EVERSHED, R.P., 2018. Timing and pace of dairing inception and animal husbandry practices across Holocene North Africa. *Quaternary International* 471A: 147-159.

DUNNE, J., EVERSHED, R.P., SALQUE, M., CRAMP, L.,BRUNI, S., RYAN, K., BIAGETTI, S., & DI LERNIA, S., 2012. First dairying in green Saharan Africa in the fifth millennium BC. *Nature* 486: 390-394.

DUNNE, J., EVERSHED, R.P., CRAMP, L., BRUNI, S., BIAGETTI, S. & DI LERNIA, S., 2013. The beginnings of dairying as practised by pastoralists in 'green' Saharan Africa in the 5th millennium BC. *Documenta Praehistorica* XL: 119-130.

DUNNE, J., MERCURI, A.M., EVERSHED, R.P, BRUNI, S. & DI LERNIA, S., 2016. Earliest direct evidence of plant processing in prehistoric Saharan pottery. *Nature Plants* 3(16194): 1-6.

ECCLESTON, M.A.J., 2002. Early and Mid-Holocene ceramics from the Dakhleh Oasis: macroscopic, petrographic and technological descriptions. In: Friedman, R.F. (ed.), *Egypt and Nubia. Gifts of the Desert*. London: 62-109.

EDWARDS, C.J., MCHUGH, D.E., DOBNEY, K.M., MARTIN, L., RUSSELL, N., HORWITZ, L.K. *et al.*, 2004. Ancient DNA analysis of 101 cattle remains: Limits and prospects. *Journal of Archaeological Sciences* 31(6): 695-710.

EERKENS, J.W., 2001. *The Origins of Pottery among Late Prehistoric Hunter-Gatherers in California and the Western Great Basin*. Unpublished Ph. D. Thesis. University of California, Santa Barbara.

EERKENS, J.W., 2008. Nomadic potters: relationships between ceramic technologies and mobility strategies. In: Barnard, H. & Wendrich, W. (eds.), *The Archaeology of Mobility: Old World and New World Nomadism*. Los Angeles: 307-326.

EIWANGER, J., 1984. *Merimde-Benisalâme I. Die Funde der Urschicht* (= Archäologische Veröffentlichungen 47). Mainz am Rhein.

EIWANGER, J., 1988. *Merimde-Benisalâme II. Die Funde der mittleren Merimdekultur* (= Archäologische Veröffentlichungen 51). Mainz am Rhein.

EIWANGER, J., 1992. *Merimde-Benisalâme III. Die Funde der jüngeren Merimdekultur* (= Archäologische Veröffentlichungen 59). Mainz am Rhein.

EMBABI, N.S., 2004. *The Geomorphology of Egypt. Landforms and Evolution*. Volume I. *The Nile Valley and the Western Desert*. Cairo.

EMMITT, J.J., 2011. *Investigating ceramics from the Neolithic occupation of Kom W, Fayum, Egypt*. Unpublished M.A. Thesis. The University of Auckland.

EMMITT, J.J., 2017. *The Neolithic pottery of Egypt. Investigating settlement pattern in middle Holocene northeast Africa with ceramics*. Unpublished Ph. D. Thesis. The University of Auckland.

EMMITT, J.J., MCALISTER, A.,J, PHILLIPPS, R.S. & HOLDAWAY, S., 2018. Sourcing without sources: Measuring ceramic variability with pXRF. *Journal of Archaeological Science*: *Reports* 17: 422-432.

EPSTEIN, C., 1984. A Pottery Neolithic site near Tel Qatif. *Israel Exploration Journal* 34(4): 209-219.

FAHMY, A.G., 2014. Plant food resources at Hidden Valley, Farafra Oasis. In: Barich, G., Lucarini, G., Hamdan, M.A. & Hassan. F.A. (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 333-344.

FAKHRY, A., 1973. *The Oases of Egypt*, Vol. 1: *Siwa Oasis*. Cairo.

FLOHR, P., FLEITMANN, D., MATTHEWS, R., MATTHEWS, W. & BLACK. S., 2015. Evidence of resilience to past climate change in Southwest Asia: Early farming communities and the 9.2 and 8.2 ka events. *Quaternary Science Reviews* 136: 23-39.

FORDE-JOHNSTON, J.L., 1959. *Neolithic Cultures of North Africa. Aspects of one phase in the development of the African Stone Age Cultures*. Liverpool.

FRIEDMAN R.F. & HOBBS J.J., 2002. A ,Tasian' Tomb in Egypt's Eastern Desert. In: Friedman R.F. (ed.), *Egypt and Nubia. Gifts of the Desert*. London: 178-191.

GARCEA, E.A.A., 2004. An Alternative Way towards Food Production: The Perspective from the Libyan Sahara. *Journal of World Prehistory* 18(2): 107-154.

GARCEA, E.A.A. 2016. Multi-stage dispersal of Southwest Asian domestic livestock and the path of pastoralism in the Middle Valley. *Quaternary International* 412: 54-64.

GARCEA, E.A.A., KARUL, N. & D'ERCOLE, G., 2016. Southwest Asian domestic animals and plants in Africa: Routes, timing and cultural implications. *Quaternary International* 412: 1-10.

GARFINKEL, Y., 1992. *The Pottery Assemblages of the Sha'ar Hagolan and Rabah Stages of Munhata (Israel)* (= Les Cahiers des Missions Archéologiques Françaises en Israël 6). Paris.

GARFINKEL, Y., 1993. The Yarmukian Culture in Israel. *Paléorient* 19(1): 115-134.

GARFINKEL, Y., 1999. *Neolithic and Chalcolithic Pottery of the Southern Levant* (= Qedem 39). Jerusalem.

GARFINKEL, Y., 2014. The Levant in the Pottery Neolithic and Chalcolithic Periods. In: Renfrew, C. & Bann, P. (eds.), *Cambridge World Prehistory*, Vol. 3: *West and Central Asia and Europe*. Cambridge: 1439-1461.

GARFINKEL, Y. & BEN-SHLOMO, D., 2002. Yarmukian Architecture and Village Planning at Sha'ar Hagolan. In: Garfinkel, Y. & Miller, M.A. (eds.), *Sha'ar Hagolan 1: Neolithic Art in Context*. Oxford: 55-70.

GARFINKEL, Y. & BEN-SHLOMO, D., 2009. *Sha'ar Hagolan 2: The Rise of Urban Concepts in the Ancient Near East*. Jerusalem.

GARFINKEL, Y., DAG, D., KOLSKA HORWITZ, L. & LERNAU, O., 2002a. Ziqim, a Pottery Neolithic Site in the Southern Coastal Plain of Israel: A Final Report. *Journal of the Israel Prehistoric Societ*y 32: 73-145.

GARFINKEL, Y., KORN, N. & MILLER, M.A., 2002b. Art from Sha'ar Hagolan: Visions of a Neolithic Village in the Levant. In: Garfinkel, Y. & Miller, M.A. (eds.), *Sha'ar Hagolan Volume 1: Neolithic Art in Context*. Oxford: 188-208.

GARFINKEL, Y., KORN, N. & BEN-SHLOMO, B., 2010. Sha'ar Hagolan 3. Symbolic Dimensions of Yarmukian Culture. Oxford.

GARSTANG, J., BEN-DOR, I. & FITZGERALD, G. M., 1936. Jericho: City and Necropolis: Report of the Sixth and Concluding Season. *Annals of Archaeology and Anthropology* 23: 67-90.

GARSTANG, J., DROOP, J.P. & CRAWFOOT, J., 1935. Jericho: City and Necropolis: Fifth Report. *Liverpool Annals of Archaeology and Anthropology* 22: 143-73.

GATTO M.C., 2002. Early Neolithic pottery of the Nabta-Kiseiba area: stylistic attributes and regional relationships. In: Nelson, K., Gatto, M.C., Jesse, F. & Zedeño, M.N. (eds.), *Holocene Settlement of the Egyptian Sahara.* Volume II. *The Pottery of Nabta Play*a. New York: 65-79.

GATTO, M.C., 2010. Pottery from Gebel Ramlah. In: Kobusiewicz, M., Kabaciński, J., Schild, R., Irish, J., Gatto, M.C. & Wendorf, F. (eds.), *Gebel Ramlah. Final Neolithic Cemeteries from the Western Desert of Egypt*. Poznań: 125-167.

GATTO, M.C., 2011. The Nubian Pastoral Culture as Link between Egypt and Africa: A View from the Archaeological Record. In: Exell, K. (ed.), *Egypt in its African Context. Proceedings of the conference held at The Manchester Museum, University of Manchester, 2-4 October 2009* (= BAR IS 2204). Oxford: 21-29.

GATTO, M.C., 2013. Beyond the shale: Pottery and cultures in the Prehistory of the Egyptian Western. Desert. In: Bagnall, R.S., Davoli, P. & Hope, C.A. (eds.), *The Oasis Papers 6. Pro- ceedings of the Sixth International Conference of the Dakhleh Oasis Project*. Oxford: 61-72.

GAUTIER, A., 1984. Archaeozoology of the Bir Kiseiba region, Eastern Sahara. In: Close, A.E. (ed.), *Cattle-keepers of the Eastern Sahara: the Neolithic of Bir Kiseiba*. Dallas: 49-72.

GAUTIER, A., 2014. Animal remains from the Hidden Valley Neolithic site, Farafra Oasis. In: Barich, G., Lucarini, G., Hamdan, M.A. & Hassan. F.A. (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 369-374.

GEHLEN, B., KINDERMANN, K., LINSTÄDTER, J. & RIEMER, H., 2002. The Holocene Occupation of the Eastern Sahara: Regional Chronologies and Supra-regional Developments in four Areas of the Absolute Desert. In: Jennerstrasse 8 (eds.), *Tides of the Desert: Contributions to the Archaeology and Environmental History of Africa in Honour of Rudolf Kuper*. Köln: 85-116.

GIBBS, K., 2008. *Understanding Community: A Comparison of Three Late Neolithic Pottery Assemblage from Wadi Ziqlam, Jordan*. Unpublished Ph. D. thesis. University of Toronto.

GIBBS, K., 2012. Not meant to last: mobility and disposable pottery. *Documenta Praehistorica* XXXIX: 83-93.

GIBBS, K., 2013. The Late Neolithic pottery and ambiguous symbols in the southern Levant. *Paléorient* 39(2): 69-84.

GIBBS, K., 2015. Pottery Invention and Innovation in East Asia and the Near East. *Cambridge Archaeological Journal* 25(1): 339-351.

GIBBS, K. & BANNING, E.B., 2013. Late Neolithic society and village life: the view from the southern Levant. In: Nieuwenhuyse, O., Akkermans, P., Bernbeck, R. & Rogasch, J. (eds.), *Interpreting the Late Neolithic of Upper Mesopotamia*. Turnhout: 354-366.

GIBBS, K. & JORDAN, P., 2013. Bridging the Boreal Forest Siberian Archaeology and the Emergence of Pottery among Prehistoric Hunter-Gatherers of Northern Eurasia. *Sibirica* 12(1): 1-38.

GIBBS, K. & JORDAN, P., 2016. A comparative perspective on the 'western' and 'eastern' Neolithics of Eurasia: ceramics, agriculture and sedentism. *Quaternary International* 419: 27-35.

GIFFORD-GONZALEZ D. & HANOTTE, O., 2011. Domesticating Animals in Africa: Implications of Genetic and Archaeological Findings. *Journal of World Prehistory* 24(1): 1-23.

GILEAD, I., 1990. The Neolithic-Chalcolithic transition and the Qatifian of the northern Negev and Sinai. *Levant* 22: 47-63.

GILEAD, I., 2007. The Besorian: A Pre-Ghassulian Cultural Entity. *Paléorient* 33(1): 33-49.

GILEAD, I., 2009. The Neolithic-Chalcolithic Transition in the Southern Levant: Late Sixth-Fifth Millennium Culture History. In: Shea, J.J. & Lieberman, D.E. (eds.), *Transitions in Prehistory: Essays in Honor of Ofer Bar-Yosef*. Oxford: 335-355.

GILEAD, I., & ALON, D., 1988. Excavations of Protohistoric Sites in the Nahal Besor and the Late Neolithic of the Northern Negev. Mitekufat Haeven. *Journal of the Israel Prehistoric Society* 21: 109*-130*.

GINTER, B., HEFLIK, W., KOZŁOWSKI, J.K. & ŚLIWA, J., 1980. Excavations in the region of Qasr el-Sagha, 1979: Contribution to the Holocene Geology, the Predynastic and Dynastic settlement in the northern Fayum desert. *Mitteilungen des Deutschen Archäologischen Instituts Kairo* 36: 105-169.

GINTER, B. & KOZŁOWSKI, J.K., 1983. Investigation on Neolithic settlement. In: Kozłowski, J.K. (ed.), *Qasr el Sagha 1980. Contributions to the Holocene*

Geology, the Predynastic and Dynastic settlements in the northern Fayum Desert. Kraków: 37-71.

GOLDEN, J.M., 2016. *Dawn of the Metal Age: Technology and Society during the Levantine Chalcolithic*. London & New York.

GOPHER, A., 1995. Early Pottery-Bearing Groups in Israel – The Pottery Neolithic Period. In: Levy, T.E. (ed.), *The Archaeology of Society in the Holy Land*. London: 205-225.

GOPHER, A., 2012a. Chapter 6. Architecture at the PN Nahal Zehora Sites. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 252-291.

GOPHER, A., 2012b. Chapter 24. Groundstone Tools at the Nahal Zehora Sites. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 1035-1100.

GOPHER, A., 2012c. Chapter 41. The Pottery Neolithic in the southern Levant – A second Neolithic Revolution. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 1525-1611.

GOPHER, A. & BARKAI, R., 2012. Chapter 26. The Lithic Assembalge at the Nahal Zehora Sites: a Summary. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 1110-1132.

GOPHER, A. & BLOCKMAN, N., 2004. Excavations at Lod (Neve Yaraq) and the Lodian Culture of the Pottery Neolithic Period. *ʿAtiqot* 47: 1-50.

GOPHER, A. & ESHED, V., 2012. Chapter 36. Burials and Human Remains from Nahal Zehora II in PN Perspective. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 1389-1412.

GOPHER, A. & EYAL, R., 2012a. Chapter 10. Nahal Zehora Pottery Assemblages: Typology. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 359-523.

GOPHER, A. & EYAL, R., 2012b. Chapter 11. Pottery Variability and Change over Time: a Simple Count. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 524-554.

GOPHER, A. & EYAL, R., 2012c. Chapter 17. The Pottery Assemblages at The Nahal Zehora Sites: a Summary. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 691-747.

GOPHER, A. & EYAL, R., 2012d. Chapter 29 Clay and Stone Imagery Items of Nahal Zehora II. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 1170-1244.

GOPHER, A. & GOPHNA, R., 1993. Cultures of the Eighth and Seventh Millennia BP in the Southern Levant: A Review from the 1990s. *Journal of World Prehistory* 7(3): 297-353.

GOPHER, A. & GOREN, Y., 1998. The Beginning of Pottery. In: Levy T.E. (ed.), *The Archaeology of Society in the Holy Land*. London: 224-225.

GOPHER, A. & ORRELLE, E., 1996. An Alternative Interpretation for the Material Imagery of the Yarmukian, a Neolithic Culture of the Sixth Millennium BC in the Southern Levant. *Cambridge Archaeological Journal* 6(2): 255-279.

GOREN, Y., 1988. A Petrographic Analysis of Pottery from Sites P14 and DII. Mitekufat Haeven. *Journal of the Israel Prehistoric Society* 21: 131*-137*.

GOREN, Y., 1990. The "Qatifian Culture" in Southern Israel and Transjordan: Additional Aspects for its Definition. Mitekufat Haeven. *Journal of the Israel Prehistoric Society* 23: 100*-112*.

GOREN, Y., 1992. Petrographic Study of the Pottery Assemblage from Munhata. In: Garfinkel, Y. (ed.), *The Pottery Assemblages of the Sha'ar Hagolan and Rabah Stages of Munhata (Israel)* (= Les Cahiers des Missions Archéologiques Françaises en Israël 6). Paris: 329-342.

GOREN, Y., 2004. Technological study of the ceramic assemblage from Nevé Yaraq, Lod. *'Atiqot* 47: 51-55.

GOREN, Y., GOPHER, A. & GOLDBERG, P., 1993. The Beginnings of Pottery Production. In the Southern Levant: a Model. In: Biran, A. & Aviram, J. (eds.), *Biblical Archaeology Today. Proceedings of the Second International Congress on Biblical Archaeology*. Jerusalem: 33-40.

GOREN, Y. & HALPERIN, N., 2001. Chapter 11: Pottery Technology. In: Eisenberg, E., Gopher, A. & Greenberg, R. (eds.), *Tel Te'o: A Neolithic, Chalcolithic, and Early Bronze Age Site in the Hula Valley* (= IAA Reports 13). Jerusalem: 157-62.

GORING-MORRIS, A.N., 1993. From foraging to herding in the Negev and Sinai. The Early to Late Neolithic transition. *Paléorient* 19(1): 65-89.

GORING-MORRIS, A.N. & BELFER-COHEN, A., 2014. The southern Levant (Cisjordan) during the Neolithic period. In: Steiner, M.L. & Killebrew, A.E. (eds.), *The Oxford Handbook of the Archaeology of the Levant c.8000-332 BCE*. Oxford: 147-169.

GORING-MORRIS, A.N., HOVERS, E. & BELFER-COHEN, A., 2009. The dynamics of Pleistocene and early Holocene settlement patterns and human adaptations in the Levant: An overview. In: Shea, J.J. & Lieberman, D.E. (eds.), *Transitions in Prehistory. Essays in Honor of Ofer Bar-Yosef*. Oxford: 185-236.

GRONENBORN, D., 2010. Transregional Culture Contacts and the Neolithization Process in Northern Central Europe. In: Jordan, P. & Zvelebil, M. (eds.), *Ceramics before Farming. The Dispersal of Pottery among Prehistoric Eurasian Hunter-Gatherers*. Walnut Creek: 527-550.

HAALAND, R., 2007. Porridge and Pot, Bread and Oven: Food Ways and Symbolism in Africa and the Near East from the Neolithic to the Present. *Cambridge Archaeological Journal* 17(2): 167-183.

HAMROUSH, H.A. & ABU ZIED, H., 1990. Petrological and Chemical Analyses of Some Neolithic Ceramics from el Omari, Egypt. In: Debono, F. & Mortensen, B., 1990. *El Omari. A Neolithic settlement and other sites in the vicinity of Wadi Hof, Helwan* (= Archäologische Veröffentlichungen 82). Mainz: 117-128.

HAMZA, W., 2009. The Nile Delta. In: Dumont, H.J. (ed.), *The Nile. Origin, Environments, Limnology and Human Use* (= Monographiae Biologicae 89). Dordrecht: 75-94.

HANOTTE, O., BRADLEY, D.G., OCHIENG, J.W., VERIJEE, Y., HILL, E.W., & REGE, J.E.O., 2002. African pastoralism: Genetic imprints of origins and migrations. *Science* 296: 336-339.

HASSAN, F.A., 1976. Prehistoric Studies of the Siwa Oasis region, Northwestern Egypt. *Nyame Akuna* 9: 18-36.

HASSAN, F.A., 1978. Archaeological Explorations of the Siwa Oasis Region, Egypt. *Current Anthropology* 19(1): 146-148.

HASSAN, F.A., 1979. Archaeological Exploration at Baharia Oasis and the West Delta, Egypt. *Current Anthropology* 20(4): 806.

HASSAN, F. A., 1981. *The Predynastic of Egypt: subsistence-settlement studies in the Nagada-Kattara region. Final Report to the National Science Foundation*. Washington.

HASSAN, F.A., 1984a. Environment and Subsistence in Predynastic Egypt. In: Clark, J.D. & Brandt, S.A. (eds.), *From Hunters to Farmers: The Causes and Consequences of Food Production in Africa*. Berkeley: 57-64.

HASSAN, F.A., 1984b. Towards a model of agricultural development in predynastic Egypt. In: Krzyżaniak, L. & Kobusiewicz, M. (eds.), *Origin and Early Development of Food-Producting Cultures in north-eastern Africa* (= Studies in African Archaeology 1). Poznań: 222-230.

HASSAN, F.A., 1985. A radiocarbon chronology of Neolithic and Predynastic sites in Upper Egypt and the Delta. *African Archaeological Review* 3: 95-116.

HASSAN, F.A., 1986. Desert environment and origins of agriculture in Egypt. *Norwegian Archaeological Review* 19: 63-76.

HASSAN, F.A., 1988. The Predynastic of Egypt. *Journal of World Prehistory* 2(2): 135-186.

HASSAN, F.A., 1995. Egypt in the Prehistory of Northeast Africa. In: Sasson J.M. (ed.), *Civilizations of the Ancient Near East*. Vol. II. New York: 665-678.

HASSAN, F.A., 1997. Holocene Palaeoclimates of Africa. *African Archaeological Review* 14(4): 213-230.

HASSAN, F.A., 1998. Holocene climatic change and rivierine dynamics in the Nile Valley. In: di Lernia, S. & Manzi, G. (eds.), *Before Food Production in North Africa. Questions and tools dealing with resources exploitations and population dynamics at 1200-7000 bp*. Forli: 43-51.

HASSAN, F.A., 2002a. Conclusion: Ecological Changes and Food Security in the Later Prehistory of North Africa: Looking Forward. In: Hassan, F.A. (ed.), *Droughts, Food and Culture*. Boston: 321-334.

HASSAN, F.A., 2002b. Palaeoclimate, Food and Culture Change in Africa: An Overview. In: Hassan, F.A. (ed.), *Droughts, Food and Culture*. Boston: 11-26.

HASSAN, F.A., & GROSS, G.T., 1987. Resources and subsistence during the early Holocene at Siwa Oasis, northern Egypt. In: Close, A. (ed.), *The Prehistory of Arid North Africa. Essays in Honour of Fred Wendorf*. Dallas: 85-103.

HASSAN, F.A., HAMDAN, M., FLOWER, R. & TASSIE, G., 2011. Holocene geoarchaeology and water history of the Fayum, Egypt. In: Pirelli, R. (ed.), *Natural and Cultural Landscapes in the Faiyum*. Cairo: 116-133.

HAYDEN, B., 1995. The Emergence of Prestige Technologies and Pottery. In: Barnett, W.K. & Hoops, J.W. (eds.), *The Emergence of Pottery. Technology and Innovation in Ancient Societies*. Washington & London: 257-265.

HAYES, W.C., 1965. *Most ancient Egypt*. Chicago.

HAWASS, Z., HASSAN, F.A. & GAUTIER, A., 1988. Chronology, sediments, and subsistence at Merimda Beni Salama. *Journal of Egyptian Archaeology* 74: 31-38.

HENDRICKX, S., 1999. Le chronologie de la préhitoire tardive et des débuts de l'histoire de l'Egypte. *Archéo-Nil* 9: 13-81.

HENDRICKX, S. & VERMEERSCH, P., 2000. Prehistory. From the Paleolithic to the Badarian culture. In: Shaw, I. (ed.), *The Oxford History of Ancient Egypt*. Oxford: 17-43.

HENDRICKX, S., & HUYGE, D., 2014. Neolithic and Predynastic Egypt. In: Renfrew, C. & Bahn, P. (eds.), *The Cambridge World Prehistory*. Cambridge: 240-258; doi:10.1017/CHO9781139017831.017

HOFFMAN, M.A., 1979. *Egypt before the Pharaohs*. New York.

HOLDAWAY, S. & PHILLIPPS, R., 2017. Human Environmental Interrelationships and the Origins of Agriculture in Egypt and Sudan. In: *Oxford Research Encyclopedia of Environmental Science*. http://dx.doi.org/10.1093/acrefore/9780199389414.013.177; accessed on 8.03.2018.

HOLDAWAY, S., PHILLIPPS, R., EMMITT, J. & WENDRICH, W., 2016. The Fayum revisited: Reconsidering the role of the Neolithic package, Fayum north shore, Egypt. *Quaternary International* 410A: 173-180.

HOLDAWAY, S. & WENDRICH, W. (eds.), 2017. *The Desert Fayum Reinvestigated*. Los Angeles.

HOLDAWAY, S., WENDRICH, W. & PHILLIPPS, R., 2010. Identifying low-level food producers: detecting mobility from lithics. *Antiquity* 84(323): 185-194.

HOLDAWAY, S., WENDRICH, W. & PHILLIPPS, R., 2017. The Desert Fayum Reinvestigated. The Evidence Considered. In: Holdaway, S. & Wendrich, W. (eds.), *The Desert Fayum Reinvestigated*. Los Angeles: 213-231.

HOLMEN, K., 1990. Identification of some plant remains in the El Omari pottery. In: Debono, F. & Mortensen, B., *El Omari. A Neolithic settlement and other sites in the vicinity of Wadi Hof, Helwan* (= Archäologische Veröffentlichungen 82). Mainz: 129-130.

HOLMES, J. & HOELZMANN, P., 2017. *The Late Pleistocene-Holocene African Humid Period as Evident in Lakes. Climate of Africa*. doi: 10.1093/acrefore/9780190228620.013.531; accessed on 19.04.2018.

HOPE, C.A., 2002. Early and Mid-Holocene ceramics from the Dakhleh Oasis: traditions and influences. In: Friedman, R.F. (ed.), *Egypt and Nubia. Gifts of the Desert*. London: 39-61.

HORN, M., 2017a. Late Neolithic Superimposed Burials in the Qua-Matmar Region: The Final Nail in the Tasian Coffin. In: Beck, S., Backes, B. & Verbovsek, A. (eds.), *Interkulturalität Beiträge des sechsten Berliner Arbeitskreises Junge Aegyptologie (BAJA 6) 13.11.-15.11.2015*. Wiesbaden: 73-91.

HORN, M., 2017b. Re-appraising the Tasian-Badarian divide in the Qua-Matmar Region. In: Midant-Reynes, B. & Tristant, Y. (eds.), *Egypt at its Origins 5. Proceedings of the Fifth International Conference "Origin of the State. Predynastic and Early Dynastic Egypt", Cairo, 13th – 18th April 2014* (= Orientalia Lovaniensia Analecta 260). Leuven: 335-377.

HUYSECOM, E., RASSE, M., LESPEZ, L., NEUMANN, K., FAHMY, A., BALLOUCHE, A., OZAINNE, M. MAGGETTI, S., TRIBOLO, C. & SORIANO, S., 2009. The Emergence of Pottery in Africa during the Tenth Millennium Cal BC: New Evidence from Ounjougou (Mali). *Antiquity* 83(322): 905-917.

IKRAM, S., 2009a. Drawing the World: Petroglyphs from Kharga Oasis. *Archéo-Nil* 19: 67-82.

IKRAM, S., 2009b. A desert zoo: An exploration of meaning and reality of animals in the rock art of Kharga Oasis. In: Riemer, H., Förster, F., Herb, M. & Polläth, N. (eds.), *The Desert Animals in the Eastern Sahara: Status, economic significance, and cultural reflection in antiquity*. Köln: 263-291.

IKRAM, S., 2018. *Fat Ladies, Thin Men, Blobby People, and Body Parts: An Exploration of Human Representations in the Rock Art of the North Kharga Basin*. https://www.researchgate.net/publication/325653762_Fat_Ladies_Thin_Men_Blobby_People_and_Body_Parts_An_Exploration_of_Human_Representations_in_the_Rock_Art_of_the_North_Kharga_Basin; accessed on 11.07.2018.

JESSE, F., 2003. Early ceramics in the Sahara and the Nile Valley. In: Krzyżaniak, L., Kroeper, K. & Kobusiewicz, M. (eds), *Cultural Markers in the Later Prehistory of Northeastern Africa and Recent Research* (= Studies in African Archaeology 8). Poznań: 35-50.

JESSE, F., 2010. Early Pottery in Northern Africa – An Overview. *Journal of African Archaeology* 8(2): 219-238.

JORDAN, P., GIBBS, P., HOMMEL, P., PIEZONKA, H., SILVA, F. & STEELE, J., 2016. Modelling the diffusion of pottery technologies across Afro-Eurasia: emerging insights and future research. *Antiquity* 90(351): 590-603.

JORDAN, P. & ZVELEBIL, M., 2010. Ex Oriente Lux. The Prehistory of Hunter-Gatherer Ceramic Dispersals. In: Jordan, P. & Zvelebil, M. (eds.), *Ceramics before Farming. The Dispersal of Pottery among Prehistoric Eurasian Hunter-Gatherers*. Walnut Creek: 33-89.

JÓRDECZKA, M., KRÓLIK, H., MASOJĆ, M. & SCHILD, R., 2011. Early Holocene Pottery in the Western Desert of Egypt: New Data from Nabta Playa. *Antiquity* 85(327): 99-115.

JÓRDECZKA, M., KRÓLIK, H., MASOJĆ, M. & SCHILD, R., 2013. Hunter–Gatherer Cattle-Keepers of Early Neolithic El Adam Type from Nabta Playa: Latest Discoveries from Site E–06–1. *African Archaeological Review* 30(3): 253-284.

JÓRDECZKA, M., KRÓLIK, H., MASOJĆ, M. & SCHILD, R., 2015. Here comes the rain again… The early Holocene El Adam occupation of the Western Desert, Nabta Playa, Egypt: Site E-08-2. *Azania: Archaeological Research in Africa* 50(1): 1-24.

JUNKER, H., 1929-1940. *Merimde I-VI. Vorläufiger Bericht über die Grabungen der Akademie der Wissenschaften in Wien auf der neolithischen siedlung von Merimde-Benisalame*. Wien.

KADOWAKI, S., 2012. A Household Perspective towards the Pre-Pottery Neolithic to Late Neolithic Cultural Transformation in the Southern Levant. *Orient* XLVII: 3-28.

KAISER, W., 1985. Zur Südausdehnung der vorgeschichtlichen Deltakulturen und zur frühen Entwicklung Oberägyptens. *Mitteilungen des Deutschen Archäologischen Instituts, Abteilung Kairo* 41: 61-87.

KANTOR, H. J., 1942. The Early Relations of Egypt with Asia. *Journal of Near Eastern Studies* 1: 174-213.

KAPLAN, J., 1959. The Connection of the Palestine Chalcolithic Culture with Prehistoric Egypt. *Israel Exploration Journal* 9: 134-36.

KELLEY, L.H., 1995. Protoagricultural practices among hunter-gatherers. In: Price, T.D. & Gebauer, A.B. (eds.), *Last Hunters, First Farmers: New perspectives on the prehistoric transition to agriculture*. Santa Fe: 243-272.

KENYON, K.M., 1957. *Digging Up Jericho*. London.

KENYON, K.M., 1970. The Origins of the Neolithic. *The Advancement of Science* 26: 144-160.

KERNER, S., 2010. Craft Specialisation and its Relation with Social Organisation in the Late 6th to Early 4th mill BCE of the Southern Levant. *Paléorient* 36(1): 179-198.

KINDERMANN, K., 2003. Djara: Prehistoric links between the Desert and the Nile. In: Hawass, Z. & Pich Brock, L. (eds.), *Egyptology at the Dawn of the Twenty-First Century. Proceedings of the Eighth International Congress of Egyptologists*. Cairo & New York: 272-279.

KINDERMANN, K., 2004. Djara: Excavations and surveys of the 1998–2002 seasons. *Archéo-Nil* 14: 31-50.

KINDERMANN, K., 2010. *Djara. Zur mittelholozänen Besiedlungsgeschichte zwischen Niltal und Oasen (Abu-Muharik-Plateau, Ägypten)*, 2 Teile (= Africa Praehistorica 23). Köln.

KINDERMANN, K. & BUBENZER, O., 2007. Djara – Humans and their environment on the Egyptian limestone plateau around 8,000 years ago. In: Bubenzer, O., Bolten, A. & Darius, F. (eds.), *Atlas of Cultural and Environmental Change in Arid Africa* (= Africa Praehistorica 21): 26-29.

KINDERMANN, K. & RIEMER, H., in press. From Complex Hunter-gatherers in the Eastern Sahara to the Early Nile Neolithic. In: Rowland, J. Tassie, G.J., Lucarini, G. (eds.), *Proceedings of the Revolutions Workshop. The Neolithisation of the Mediterranean Basin: The Transition to Food-Producing Economies in North Africa, Southern Europe and the Levant*. Berlin.

KLEES, F., 1989. Lobo: a contribution to the prehistory of the eastern Sand Sea and the Egyptian oases. In: Krzyzaniak, L., Kroeper, K. & Kobusiewicz, M. (eds.), *Recent Research into the Stone Age of Northeastern Africa* (= Studies in African Archaeology 7). Poznań: 223-231.

KLEINDIENST, M.R., MCDONALD, M.M.A., WISEMAN, M.F., HAWKINS, A.L., SMITH, J.R., KIENIEWICZ, J.M. & ADELSBERGER, K.A., 2006. *Walking* *in the footsteps of Gertrude Caton-Thompson and Elinor W. Gardner: surveys by Kharga Oasis Prehistory Project (KOPP)*. SAfA 2006 Proceedings.

KOBUSIEWICZ, M., KABACIŃSKI, J., SCHILD, R., IRISH, J., GATTO, M.C. & WENDORF, F., 2010. *Gebel Ramlah. Final Neolithic Cemeteries from the Western Desert of Egypt*. Poznań.

KOBUSIEWICZ, M. & KUCIEWICZ, E., 2015. Last Research of Petroglyph Unit in Dakleh Oasis. Western Desert of Egypt. In: Kabacinski, J., Chłodnicki, M., Kobusiewicz, M. (eds.), *Hunter-Gatherers and Early Food Producing Societies in Northeastern Africa* (= Studies in African Archaeology 14). Poznań: 287-296.

KÖHLER, E.C., 1997. Socio-economic aspects of early pottery production in the Nile Delta. *The Bulletin of the Australian Centre for Egyptology* 8: 81-89.

KÖHLER, E.C., 2010. Prehistory. In: Lloyd, A.B. (ed.), *A Companion to Ancient Egypt*. Chichester: 25-47.

KÖHLER, E.C., 2011. Neolithic in the Valley (Fayum A, Merimde, el-Omari, Badarian). *Archéo-Nil* 21: 17-20.

KOZŁOWSKI, J. K., & GINTER, B., 1989. The Fayum Neolithic in light of new discoveries. In: Krzyżaniak, L. & Kobusiewicz, M. (eds.), *Late Prehistory of the Nile Basin and the Sahara* (= Studies in African Archaeology 2). Poznań: 157-179.

KRZYŻANIAK, L., 1977. *Early Farming Cultures on the Lower Nile. The Predynastic Period in Egypt*. Warsaw.

KUIJT, I., 2000. People and space in early agricultural villages: exploring daily lives, community size, and architecture in the Late Pre-Pottery Neolithic. *Journal of Anthropological Archaeology* 19: 75-102.

KUJIT, I. & CHESSON, M.S., 2002. Excavations at 'Ain Waida', Jordan: New Insights into pottery Neolithic Lifeways in the Southern Levant. *Paléorient* 28(2): 109-122.

KUJANOVÁ, M., PEREIRA, L., FERNANDES, V., PEREIRA, J.B. & ČERNÝ, V., 2009. Near Eastern Neolithic genetic input in a small oasis of the Egyptian Western Desert. *American Journal of Physical Anthropology* 140: 336-346.

KUPER, R., 1993. Sahel in Egypt: Environmental change and cultural development in the Abu Ballas Area, Libyan Desert. In: Krzyżaniak, L., Kobusiewicz, M. & Alexander, J. (eds.), *Environmental Change and Human Culture in the Nile Basin and Northern Africa until the Second Millennium B.C.* (= Studies in African Archaeology 4). Poznań: 213-223.

KUPER, R., 1996. Between the oases and the Nile: Rohlfs' Cave in the Western Desert. In: Krzyżaniak, L., Kroeper, K. & Kobusiewicz, M. (eds.), *Interregional contacts in the Later Prehistory of Northeastern Africa* (= Studies in African Archaeology 5). Poznań: 81-91.

KUPER, R., 2002. Routes and Roots in Egypt's Western Desert: The Early Holocene Resettlement of the Eastern Sahara. In: Friedman, R.F. (ed.), *Egypt and Nubia. Gifts of the Desert*. London: 1-12.

KUPER, R., 2006. An attempt at Structuring the Holocene Occupation of the Eastern Sahara. In: Kroeper, K., Chłodnicki, M. & Kobusiewicz, M. (eds.) *Archaeology of Early Northeastern Africa. In Memory of Lech Krzyżaniak* (= Studies in African Archaeology 9). Poznań: 261-272.

KUPER, R. & KRÖPLIN, S., 2006. Climate-controlled Holocene occupation in the Sahara: motor of Africa's evolution. *Science* 313: 803-807.

KUPER, R. & RIEMER, H., 2013. Herders before Pastoralism: Prehistoric Prelude in the eastern Sahara. In: Bollig, M., Schnegg, M. & Wotzka, H.-P. (eds.), *Pastoralism in Africa. Past Present and Future*. Oxford: 31-65.

LARSEN, H., 1957. Eine eigenartige Tongefäss-Scherbe aus Merimde. *Orientalia Suecana* 6: 3-8.

LARSEN, H., 1958. Ein eigenartiger Tongefäßscherben aus Merimde-Beni Salame in der ägyptischen. Abteilung des Mittelmeermuseums in Stockholm. *Orientalia Suecana* 7: 3-53.

LARSEN, H., 1959. Ein neolithisches Steingefass aus Merimde in der agyptischen Abteilung des M ittelmeer- museums. *Orientalia Suecana* 8: 69-72.

LARSEN, H., 1960. Knochengerate aus Merimde in der agyptischen Abteilung des Mittelmeermuseums, Stockholm. *Orientalia Suecana* 9: 28-53.

LARSEN, H., 1962. Die Merimdekeramikim Mittelmeermuseum Stockholms. *Orientalia Suecana* 11: 3-88.

LINSEELE, V., MARINOVA, E. VAN NEER W. & VERMEERSCH, P.M., 2010. Sites with Holocene dung deposits in the Eastern Desert of Egypt. Visited by herders? *Quaternary Research* 74: 818-828.

LINSEELE, V., VAN NEER, W., THYS, S.; PHILLIPPS, R., CAPPERS, R., WENDRICH, W. & HOLDAWAY, S., 2014. *New Archaeozoological Data from the Fayum "Neolithic" with a Critical Assessment of the Evidence for Early Stock Keeping in Egypt*. PLoS One, vol. 9(10):e108517; accessed on 19.04.2018.

LINSEELE, V., HOLDAWAY, S.J. & WENDRICH, W., 2016. The earliest phase of introduction of Southwest Asian domesticated animals into Africa. New evidence from the Fayum Oasis in Egypt and its implications. *Quaternary International* 412B: 11-21.

LINSTÄDTER, J., 1999. Leben auf der Düne. Der mittelneolithische Fundplatz Wadi Bakht 82/21 im Gilf Kebir (Südwest-Ägypten). *Archäologische Informationen* 22/1: 115-124.

LINSTÄDTER, J., 2003. Systems of prehistoric land use in the Gilf Kebir. In: Hawass, Z. & Pinch Brock, L. (eds.), *Egyptology at the Dawn of the 21st Century. Proceedings of the Eighth International Congress of Egyptologists, Cairo*. Cairo: 381-389.

LINSTÄDTER, J., 2007. Rocky islands within oceans of sand – Archaeology of the Jebel Ouenat / Gilf Kebir region, Eastern Sahara. In: Bubenzer, O., Bolten, A. & F. Darius (eds.), *Atlas of environmental and cultural change in arid Africa* (= Africa Praehistorica 21): 34-37.

LINSTÄDTER, J. & KRÖPELIN, S., 2004. Wadi Bakht revisited: Holocene climate change and prehistoric occupation in the Gilf Kebir region of the Eastern Sahara, SW Egypt. *Geoarchaeology* 19: 753-778.

LUCARINI, G., 2013. Was a transition to food production homogeneous along the circum-Mediterranean littoral? A perspective on Neolithisation research from the Libyan Coast. In: Shirai, N. (ed.), *Neolithisation of Northeastern Africa*. Berlin: 149-173.

LUCARINI, G., 2014. Exploitation and management of wild grasses at Hidden Valley, Farafra Oasis [in:] Barich, G, Lucarini, G., Hamdan, M.A. & Hassan. F.A. (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 345-367.

MĄCZYŃSKA, A., 2008. Some remarks on Egyptian-Southern Levantine Interrelations in the first half of 4th Millennium B.C. In: Midant-Reynes, B. & Tristant, Y. (eds), Rowland, J. & Hendrickx, S. (ass.), *Egypt at its Origins 2. Proceedings of the International Conference "Origin of the State. Predynastic and Early Dynastic Egypt", Toulouse (France), 5th-8th September 2005* (= Orientalia Lovaniensia Analecta 172). Leuven: 763-781.

MĄCZYŃSKA, A., 2013. *Lower Egyptian communities and their interactions with Southern Levant in the 4th millennium BC* (= Studies in African Archaeology 12). Poznań.

MĄCZYŃSKA, A., 2017. The pottery of the Neolithic Lower Egyptian societies: a single regionwide tradition or multiple local traditions? In: Midant-Reynes, B. & Tristant, Y. (eds), *Egypt at its Origins 5. Proceedings of the Fifth International Conference "Origin of the State. Predynastic and Early Dynastic Egypt", Cairo, 13th – 18th April 2014* (= Orientalia Lovaniensia Analecta 260). Leuven: 657-688.

MĄCZYŃSKA, A., 2018a. Is There a Place for Prehistoric Egypt in Near Eastern Archaeology? Some Remarks on Early Relations between Egypt and its Neighbours. In: Horejs, B. & Schwall, Ch. (eds.), *Proceedings of the 10th International Congress on the Archaeology of the Ancient Near East*. Volume 1. *Transformation & Migration*. Wiesbaden: 45-56.

MĄCZYŃSKA, A., 2018b. On the transition between the Neolithic and Chalcolithic in Lower Egypt and the origins of the Lower Egyptian Culture: a pottery study. In: Kabaciński, J., Chłodnicki, Kobusiewicz, M. & Kabacińska-Winiarska, M. (eds.), *Desert and the Nile. Prehistory of the Nile Basin and the Sahara. Papers in honour of Fred Wendorf* (= Studies in African Archaeology 15). Poznań: 261-287.

MAHER, L., BANNING, E. & CHAZAN, M., 2011. Oasis or Mirage? Assessing the Role of Abrupt Climate Change in the Prehistory of the Southern Levant. *Cambridge Archaeological Journal* 21(1): 1-30.

MANDEL, R.D. & SIMMONS, A.H., 2001. Prehistoric occupation of Late Quaternary landscapes near Kharga Oasis, Western Desert of Egypt. *Geoarchaeology* 16: 95-117.

MARINOVA, E., LINSEELE, V. & VERMEERSCH, P., 2008. Holocene environment and subsistence patterns near the Tree Shelter, Red Sea Mountains, Egypt. *Quaternary Research* 70: 392-397.

MARKS, L., SALEM, A., WELC, F., NITYCHORUK, J., CHEN, Z., ZALAT, A., MAJECKA, A., CHODYKA, M., SZYMANEK, M. & TOŁOCZKO-PASEK, A., 2016. Preliminary report on unique laminatem Holocene Sedimentd from the Qarun Lake in Egypt. *Studia Quaternaria* 33(1): 35-46.

MARKS, L., SALEM, A., WELC, F., NITYCHORUK, J., CHEN, Z., BLAAUW, M., ZALAT, A., MAJECKA, A., SZYMANEK, M., CHODYKA, M., TOŁOCZKO-PASEK, A., SUN, Q., ZHAO, X. & JIANG, J., 2017. Holocene lake sediments from the Faiyum Oasis in Egypt: a record of environmental and climate change. *Boreas* 47 : 62-79. doi: 10.1111/bor.12251; accesed on 12.07.2018.

MARSHALL, F., & HILDEBRAND, E., 2002. Cattle before Crops: The Beginnings of Food Production in Africa. *Journal of World Prehistory* 16(2): 99-143.

MARSTON, J.M., HOLDAWAY, S. & WENDRICH, W., 2017. Early- and middle Holocene wood exploitation in the Fayum basin, Egypt. *The Holocene* 27(12): 1812-1824.

MCBURNEY, C.B.M., 1967. *The Haua Fteah in Cyrenaica and the Stone Age of the South-East Mediterranean*. Cambridge.

MCDONALD, M.M.A., 1991. Technological organization and sedentism in the Epipalaeolithic of Dakhleh Oasis, Egypt. *African Archaeological Review* 9: 81-109.

MCDONALD, M.M.A., 1993. Cultural adaptations in Dakhleh Oasis, Egypt, in the Early to Mid-Holocene. In: Krzyżaniak, L., Kobusiewicz, M. & Alexander, J. (eds.), *Environmental Change and Human Culture in the Nile Basin and Northern Africa until the Second Millennium B.C.* (= Studies in African Archaeology 4). Poznań: 199-209.

MCDONALD, M.M.A., 2003. The early Holocene Masara A and Masara C cultural subunits of Dakhleh Oasis, within a wider cultural setting. In: Bowen, G.E. & Hope, C.A. (eds.), *The Oasis Papers 3: Proceedings of the Third International Conference of the Dakhleh Oasis Project*. Oxford: 43-69.

MCDONALD, M.M.A., 2006. Holocene Prehistory of the Wadi el Midauwara above the Kharga Oasis, Egypt. In: Kroeper, K., Chłodnicki, M. & Kobusiewicz, M. (eds.), *Archaeology of Early Northeastern Africa. In Memory of Lech Krzyżaniak* (= Studies in African Archaeology 9). Poznań: 479-492.

MCDONALD, M.M.A., 2009. Increased Sedentism in the Central Oases of the Egyptian Western Desert in the Early to Mid-Holocene: Evidence from the Peripheries. *African Archaeological Review* 26(1): 3-43.

MCDONALD, M.M.A., 2013. Whence the Neolithic of Northeastern Africa? Evidence from the Central Western desert of Egypt. In: Shirai, N. (ed.), *Neolithisation of Northeastern Africa*. Berlin: 175-192.

MCDONALD, M.M.A., 2015. Sedentism and the advent of food production in and around Dakleh Oasis in the Western Desert of Egypt: a distinctively African Phenomenon. In: Kabacinski, J., Chłodnicki, M. & Kobusiewicz, M. (eds.), *Hunter-Gatherers and Early Food Producing Societies in Northeastern Africa* (= Studies in African Archaeology 14). Poznań: 273-285.

MCDONALD, M.M.A., 2016. The pattern of Neolithization in Dakhleh Oasis in the Eastern Sahara. *Quaternary International* 410A: 181-197.

MCKIM MALVILLE, J., SCHILD, R., WENDORF, F. & BRENME, R., 2008. Astronomy of Nabta Playa. In: Holbrook, J., Medupe, R.T. & Urama, J.O. (eds.), *African Cultural Astronomy – Current Archaeoastronomy and Ethnoastronomy Research in Africa*. Dodrecht: 131-143.

MELLART, J., 1975. *The Neolithic of the Near East*. New York.

MENGHIN, O.F.A., 1961/63. Zur Chronologie des Neolithikum in Aegypten. *Acta Praehistorica* V/VII: 128-147.

MIDANT-REYNES, B., 1992. *Préhistoire de l'Egypte, des premiers Hommes aux premiers Pharaons*. Paris.

MIDANT-REYNES, B., 2000. *The Prehistory of Egypt. From the First Egyptians to the First Pharaohs*. Oxford.

MIDANT-REYNES, B., 2003. *Aux origines de l'Égypte. Du Néolithique à l'émergence de l'État*. Paris.

MOORE, A.M.T., 1973. The Late Neolithic in Palestine. *Levant* 5: 36-68.

MORALES, J., PEREZ JORD, G., PENA-CHOCARRO, L., BOKBOT, Y. VERA, J.C., MARTÍNEZ SANCHEZ, R.M. & LINSTÄDTER J., 2016. The introduction of South-Western Asian domesticated plants in North-Western Africa: An archaeobotanical contribution from Neolithic Morocco. *Quaternary International* 412B: 96-109.

MORGAN, H.L., 1877 (1964). *Ancient Society*, reprinted 1964. Cambridge.

de MORGAN, J., 1896. *Recherches sur les origines de l'Egypte. I. L'age de la pierre et des métaux*. Paris.

MORTENSEN, B., 1992. Carbon-14 Dates from El Omari. In: Friedman, R. & Adams, B. (eds.), *The Followers of Horus. Studies Dedicated to M. A. Hoffman*. Oxford: 173-174.

MUIGAI, A.W.T. & HANOTTE, O., 2013. The Origin of African Sheep : Archaeological and Genetic Perspectives. *African Archaeological Review* 30: 39-50.

MUNTONI, I.M. & GATTO, M.C., 2014. Archaeological and archaeometric data on the Farafra pottery. In: Barich, G., Lucarini, G., Hamdan, M.A. & Hassan. F.A. (eds.), *From Lake to Sand. The Archaeology of Farafra Oasis Western Desert, Egypt*. Florence: 445-463.

NAJJAR, M., ABU DAYYA, A., SULEIMAN, E., WEISGERBER, G. & HAUPTMANN, A., 1990. Tell Wadi Feinan: The First Pottery Neolithic Tell in the South of Jordan. *Annual of the Department of Antiquities of Jordan* 34: 27-56.

NATIV, A., ISERLIS, M. & PAZ, Y., 2012a. Transformations of Lodian pottery assemblages as recorded at the site of Yesodot, Israel. *Journal of the Israel Prehistoric Society* 42: 115-135.

NATIV, A., GOPHER, A. & GOREN, Y., 2012b. Chapter 16. Pottery production at Nahal Zehora II. In: Gopher, A. (ed.), *Village Communities of the Pottery Neolithic Period in the Menashe Hills, Israel: Archaeological Investigations at the Sites of Nahal Zehora* (= Monograph Series 29). Tel Aviv: 657-696.

NELSON, K., 2001. The Pottery of Nabta Playa: A Summary. In: Wendorf, F & Schild, R. (eds.), *Holocene Settlement of the Egyptian Sahara*. Volume I. *The Archaeology of Nabta Playa*. New York: 534-543.

NELSON, K., 2002. Ceramic assemblages of the Nabta-Kiseiba area. In: Nelson, K., Gatto, M.C., Jesse, F. & Zedeño, M.N. (eds.), *Holocene settlement of the Egyptian Sahara. Volume* II. *The pottery of Nabta Playa*, New York: 21-51.

NELSON, K. & KHALIFA, E., 2010. Nabta Playa Black-topped pottery: Technological innovation and social change. *British Museum Studies in Ancient Egypt and Sudan* 16: 133-48.

NEUMANN, K., 1989. Holocene vegetation of the eastern Sahara: charcoals from prehistoric sites. *African Archaeological Review* 7(1): 97-116.

OLAMI, Y., BURIAN, F. & FRIEDMAN, E., 1977. Giv'at Haparsa: A Neolithic Site in the Costal Region. *Eretz Israel* 13: 34-47.

ORRELLE, E. & GOPHER, A., 2000. The Pottery Neolithic Period: Questions about Pottery Decoration, Symbolism, and Meaning. In: Kuijt, I. (ed.), *Life in Neolithic Farming Communities: Social Organisation, Identity and Differentiation*. New York: 295-308.

ORTON, C., TYERS, P. & VINCE, A., 2010. *Pottery in Archaeology*. Cambridge.

PAZ, Y., ROSENBERG, D. & NATIV, A., 2005. Excavations at Lod: Neolithic and Chalcolithic remains and an Egyptian presence in the Early Bronze Age. *Salvage Excavation Reports* 2: 114-158.

PERROT, J., 1968. *La Prehistoire Palestinienne* (= Supplement au Dictionnaire de la Bible 8). Paris: 286-446.

PETERSON, J., 2010. Domesticating gender: Neolithic patterns from the southern Levant. *Journal of Anthropological Archaeology* 29(3): 249-264.

PETRIE, W.M.F., 1901. *Diospolis Parva, the cemeteries of Abadiyeh and Hu, 1898-9*. London.

PHILLIPPS, R., 2012. *Documenting socio-economic variability in the Egyptian Neolithic through stone artifact analysis*. Unpublished Ph. D. Thesis. The University of Auckland.

PHILLIPPS, R. & HOLDAWAY, S., 2016. Estimating Core Number in Assemblages: Core Movement and Mobility During the Holocene of the Fayum, Egypt. *Journal of Archaeological Method and Theory* 23: 520-540.

PHILLIPPS, R., HOLDAWAY, S., EMMITT, J. & WENDRICH, W., 2016a. Variability in the Neolithic Patterns of the Egyptian Nile Valley. *African Archaeological Review* 33(3): 277-295.

PHILLIPPS, R., HOLDAWAY, S., RAMSAY, R., EMMITT, J., WENDRICH, W. & LINSEELE, V., 2016b. Lake Level Changes, Lake Edge Basins and the Paleoenvironment of the Fayum North Shore, Egypt, during the Early to Mid-Holocene. *Open Quaternary* 2(2): 1-12.

PHILLIPPS, R., HOLDAWAY, S., WENDRICH, W. & CAPPERS, R., 2012. Mid-Holocene occupation of Egypt and global climatic change. *Quaternary International* 251: 64-76.

POLKOWSKI, P.L., 2016. *Krajobraz i sztuka naskalna. W palimpseście egipskiej Oazy Dachla* (= Bibliotheca Fontes Archaeologici Posnanienses 16). Poznań.

POLKOWSKI, P.L., 2018. Working on Rok Art in the Dakhleh oasis: Some Thoughts on Treats to Petroglyphs and Possibilities of research in the Westeren Desert, Egypt. *African Archaeological Journal*. https://doi.org/10.1007/s10437-018-9295-1; accessed on 11.07.2018.

PUGLISI, S. M., 1967. Missione per Ricerche Preistoriche in Egitto. *Origini* 1: 301-312.

RICE, P., 1999. On the origin of pottery. *Journal of Archaeological Method and Theory* 6/1: 1-54.

RICE, P., 2005. *Pottery Analysis: A Sourcebook*. Chicago and London.

RIEMER, H., 2000. Regenfeld 96/1 – Great Sand Sea and the question of human settlement on whale back dunes. In: Krzyżaniak, L., Kroeper, K. & Kobusiewicz, M. (eds.), *Recent Research into the Stone Age of Northeastern Africa* (= Studies in African Archaeology 7). Poznań: 21-31.

RIEMER, H., 2003. Abu Gerara: Mid-Holocene sites between Djara and Dakhla Oasis (Egypt). In: Krzyżaniak, L., Kroeper, K. & Kobusiewicz, M. (eds.), *Cultural markers in the Later Prehistory of Northeastern Africa and Recent Research* (= Studies in African Archaeology 8). Poznań: 73-93.

RIEMER, H., 2006. Out of Dakhla: Cultural diversity and mobility between the Egyptian oases and the Great Sand Sea during the Holocene humid phase. In: Kroeper, K, Chłodnicki, M. & Kobusiewicz, M. (eds.), *Archaeology of early Northeastern Africa. In Memory of Lech Krzyżaniak* (= Studies in African Archaeology 9). Poznań: 493-526.

RIEMER, H., 2007. When hunters started herding: Pastro-foragers and the complexity of Holocene economic change in the Western Desert of Egypt. In: Bollig, M., Bubenzer, O., Vogelsang, R. & Wotzka, H.-P. (eds.), *Aridity, Change and Conflict in Africa Proceedings of anInternational ACACIA Conference held at Königswinter, Germany, October 1–3, 2003*. Köln: 105-144.

RIEMER, H., 2009. Risks and Resources in an Arid Landscape: An Archaeological Case Study from the Great Sand Sea, Egypt. In: Bollig, M. & Bubenzer. O (eds.), *African Landscapes. Interdisciplinary Approaches* (= Studies in Human Ecology and Adaptation 4). New York: 119–158.

RIEMER, H., 2011. *El Karafish. The archaeology of Sheikh Muftah pastoral nomads in the desert around Dakhla Oasis (Egypt)* (= Africa Praehistorica 25). Köln.

RIEMER, H., 2013. Dating the rock art of Wadi Sura. In: Kuper, R. (ed.), *Wadi Sura—the Cave of Beasts. A rock art site in the Gilf Kebir (SW-Egypt)* (= Africa Praehistorica 26). Köln: 38-41.

RIEMER, H. & JESSE, F., 2006. When decoration made its way: the northern extent of Khartoum-style pottery in the eastern Sahara. In: Caneva, I. & Roccati, A. (eds.), *Acta Nubica. Proceedings of the X International Congress of Nubian Studies, Rome 9-14 September 2002*. Roma: 63-72.

RIEMER, H. & KINDERMANN K., 2008. Contacts between the oasis and the Nile: A résumé of the Abu Muhariq Survey 1995-2002. In: Midant-Reynes, B. & Tristant, Y. (eds), Rowland, J. & Hendrickx, S. (ass.), *Egypt at its Origins 2. Proceedings of the International Conference "Origin of the State. Predynastic and Early Dynastic Egypt", Toulouse (France), 5th-8th September 2005* (= Orientalia Lovaniensia Analecta 172). Leuven: 609-633.

RIEMER, H., KRÖPELIN, S. & ZBORAY, A., 2017. Climate, styles and archaeology: An integral approach towards an absolute chronology of the rock art in the Libyan Desert (Eastern Sahara). *Antiquity* 91(355): 7-23.

RIEMER, H., LANGE, M. & KINDERMANN, K., 2013. When the Desert Dried up. Late Prehistoric cultures and Contacts in Egypt and Northern Sudan. In: Raue, D., Seidlmayer, S.J. & Speiser, P. (eds.), *The First Cataract of the Nile. One Region – Diverse Perspectives. DAI Kairo Sonderschrift*. Kairo: 157-183.

RIEMER, H. & SCHÖNFELD, P., 2006. The prehistoric pottery of Abu Tartur, Western Desert of Egypt. In: Chłodnicki, M., Kroeper, K. & Kobusiewicz, M. (eds.), *Archaeology of the Earliest Northeastern Africa* (= Studies in African Archaeology 9). Poznań: 335-374.

RIEMER, H. & SCHÖNFELD, P., 2010. The prehistoric pottery of the Abu Muhariq Plateau. In: Kindermann, K. (ed.), *Djara. Zur mittelholozänen Besiedlungsgeschichte zwischen Niltal und Oasen (Abu Muharik-Plateau, Ägypten)*. Teil 2 (= Africa Praehistorica 23). Köln: 715-764.

ROFFET-SALQUE, M., MARCINIAK, A., VALDES, P.J., PAWŁOWSKA, K., PYZEL, J., CZERNIAK, L., KRÜGER, M., ROBERTS, C.N., PITTER, S. & EVERSHED, R.P., 2018. Evidence for the impact of the 8.2-kyBP climate event on Near Eastern early farmers. *Proceedings of the National Academy of Sciences* 115(35): 8705-8709. doi:10.1073/pnas.1803607115

ROLLEFSON, G.O., 1997. Changes in Architecture and Social Organization at ʿAin Ghazal. In: Gebel, H.G.K., Kafafi, Z. & Rollefson G.O. (eds.), *The Prehistory of Jordan II: Perspectives from 1997*. Berlin: 287-308.

ROLLEFSON G.O., 2000. Ritual and social structure at Neolithic ʿAin Ghazal. In: Kuijt, I. (ed.), *Life in Neolithic farming communities: social organization, identity, and differentiation*. New York: 162-190.

ROLLEFSON, G.O., SIMMONS, A.H. & KAFAFI, Z., 1992. Neolithic cultures at ʿAin Ghazal, Jordan. *Journal of Field Archaeology* 19(4): 443-470.

ROSEN, A.M. & RIVERA-COLLAZO, I., 2012. Climate change, adaptive cycles, and the persistence of foraging economies during the late Pleistocene/Holocene transition in the Levant. *Proceedings of the National Academy of Sciences* 109 (10): 3640-3645.

ROSEN, A. & ROSEN, S., 2017. Environmental Change and Society in Holocene Prehistory. In : Enzel, Y. & Bar-Yosef, O. (eds.), *Quaternary of the Levant: Environments, Climate Change, and Humans*. Cambridge: 761-766. doi:10.1017/9781316106754.085; accessed on 11.07.2018.

ROSENBERG, D., GETZOV, N., & ASSAF, A., 2010. New Light on Long-Distance Ties in the Late Neolithic/Early Chalcolithic Near East: The Chlorite Vessels from Hagoshrim, Northern Israel. *Current Anthropology* 51: 281-93.

ROSSIGNOL-STRICK, M., 1995. Sea-land Correlation of Pollen Records in the Eastern Mediterranean for the Glacial-Interglacial Transition: Biostratigraphy versus Radiometric Time-Scale. *Quaternary Science Reviews* 14: 893-915.

ROSSIGNOL-STRICK, M., 2002. Holocene Climatic Changes in the Eastern Mediterranean and the Spread of Food Production from Southwest Asia to Egypt. In: Hassan, F.A. (ed.), *Droughts, Food and Culture: Ecological Change and Food Security in Africa's Later Prehistory*. New York: 157-170.

ROWAN, Y.M. & GOLDEN, J., 2009. The Chalcolithic Period of the Southern Levant: A Synthetic Review. *Journal of World Prehistory* 22(1): 1-92.

ROWLAND, J.M., 2015. Prehistoric groups along the western Nile Delta. *Egyptian Archaeology* 42: 31-33.

ROWLAND, J.M. & BERTINI, L.C., 2016. The Neolithic within the context of northern Egypt: New results and perspectives from Merimde Beni Salama. *Quaternary International* 410A: 160-172.

ROWLAND, J.M. & TASSIE, G.J., 2014. Prehistoric Sites along the Edge of the Western Nile Delta: Report on the Results of the Imbaba Prehistoric Survey, 2013–14. *Journal of Egyptian Archaeology* 100: 49-66.

ROWLAND, J. & TASSIE, G., 2017. *The Neolithic in the Nile Delta, Edition Topoi*, DOI: 10.17171/1-9-1324; http://repository.edition-topoi.org/collection/MRMD/overview; accessed on 5.11.2018.

SCHILD, R. & WENDORF F., 2002. Forty years of the Combined Prehistoric Expedition. *Archeologia Polona* 40: 5-22.

SCHILD, R. & WENDORF F., 2013. Early and Middle Holocene Paleoclimates in the south Western Desert of Egypt – the World before Unification. *Studia Quaternaria* 30(2): 125-133.

SCHÖN, W., 1996. Ausgrabungen im Wadi el Akhdar, Gilf Kebir. *Africa Praehistorica* 8: 11-138.

SHIRAI, N., 2005. Walking with Herdsmen: In Search of the Material Evidence for the Diffusion of Agriculture from the Levant to Egypt. *Neo-Lithics* 1/05: 12-17.

SHIRAI, N., 2006. Supra-Regional Concepts in Near Eastern Neolithisation From a Viewpoint of Egyptian Neolithic Research. *Paléorient* 32(2):7-21.

SHIRAI, N., 2010. *The Archaeology of the First Farmer-herders in Egypt. New insights into the Fayum Epipalaeolithic and Neolithic*. Leiden.

SHIRAI, N., 2013a. Was Neolithisation a struggle for existence and the survival of the fittest, or merely the survival of the luckiest? A case study of socio-economic and cultural changes in Egypt in the Early-Middle Holocene. In: Shirai, N. (ed.), *Neolithisation of Northeastern Africa*. Berlin: 213-235.

SHIRAI, N., 2013b. What makes the Neolithic in northeastern Africa? A new debate over and old issue for eliminating neighbourly ignorance. In: Shirai, N. (ed.), *Neolithisation of Northeastern Africa*. Berlin: 1-3.

SHIRAI, N., 2015. Filling the gap between the Fayum Epipalaeolithic and Neolithic. In: Kabacinski, J., Chłodnicki, M. & Kobusiewicz, M. (eds.), *Hunter-Gatherers and Early Food Producing Societies in Northeastern Africa* (= Studies in African Archaeology 14). Poznań: 221-238.

SHIRAI, N., 2016a. Establishing a Neolithic farming life in Egypt: A view from the lithic study at Fayum Neolithic sites. *Quaternary International* 412B: 22-35.

SHIRAI, N., 2016b. The Desert Fayum at 80: revisiting a Neolithic farming community in Egypt." *Antiquity* 90(353): 1181-1195.

SHIRAI, N., 2017. Teething problems in cereal cultivation in prehistoric Egypt: a restudy of Fayum Neolithic sisckle blades. *Azania: Archaeological Research in Africa*. http://dx.doi.org/10.1080/0067270X.2017.1328209; accessed on 13.07.2018.

SILVA, F. & STEELE, J., 2014. New methods for reconstructing geographical effects on dispersal rates and routes from large-scale radiocarbon databases. *Journal of Archaeological Science* 52: 609-620.

SIMMONS, A.H., 2007. *The Neolithic Revolution in the Near East*. Tucson.

SKIBO, J.M & SCHIFFER, M.B., 2008. *People and Things. A Behavioral Approach to Material Culture*. New York.

SMITH, A., 1989. The Near Eastern Connection: Early to Mid-Holocene Relations between North Africa and the Levant. In: Krzyżaniak, L. & Kobusiewicz, M. (eds.), *Late Prehistory of the Nile Basin and the Sahara* (= Studies in African Archaeology 2). Poznań: 69-77.

SMITH, A.B., 2013a. An appraisal of the terms 'Neolithic" and 'Neolithisation' for use in North Africa in the 21st century. In: Shirai, N. (ed.), *Neolithisation of Northeastern Africa*. Berlin: 5-22.

SMITH, A.C., 2013b. Unraveling the prehistoric ancestry of the present-day inhabitants of Northeastern Africa: An archaeogenetic approach to Neolithisation. In: Shirai, N. (ed.), *Neolithisation of Northeastern Africa*. Berlin: 121-147.

STEKELIS, M., 1951. A New Neolithic Industry: The Yarmukian of Palestine. *Israel Exploration Journal* 1: 1-19.

STEKELIS, M., 1972. *The Yarmukian Culture of the Neolithic Period*. Jerusalem.

STREIT, K., 2015a. Exploring the Wadi Rabah Culture of the 6th millennium cal BC: Renewed Excavations at Ein el-Jarba in the Jezreel Valley, Israel (2013-2015). *Strata. Bulletin of the Anglo-Israel Archaeological Society* 33: 13-36.

STREIT, K., 2015b. Interregional Contacts in the 6th millennium BC: Tracing Foreign Influences in the Holemouth Jar from Ein el-Jarba, Israel. *Levant* 47: 255-266.

STREIT, K., 2016. *The Near East before Borders: Cultural Interaction between Mesopotamia, the Levant and Lower Egypt at 5800-5200 BC*. Unpublished Ph. D. Thesis. The Hebrew University of Jerusalem.

STREIT, K., 2017. Transregional interactions between Egypt and the Southern Levant in the 6th millennium cal. BC. *Ägypten und Levante* 27: 403-429.

STREIT, K., 2018. Beyond the Image. Composite Female Figurines and Gender Relations of the Near East in the Mid-Sixth Mill. Cal. B.C.E. *Zeitschrift des Deutschen Palästina-Vereins.* 134(1): 1-27.

STREIT, K. & GARFINKEL, Y., 2015. Tel Tsaf and the Impact of the Ubaid Culture on the Southern Levant: Interpreting the Radiocarbon Evidence. *Radiocarbon* 57: 865-880.

SVOBODA, J., 2013. Prehistory of Southern Bahriya: A case study in Northeast African settlement archaeology. In: Dospěl, M. & Suková, L. (eds.), *Bahriya Oasis. Recent Research into the Past of an Egyptian Oasis*. Prague: 35-62.

TASSIE, G.J., 2014. *Prehistoric Egypt. Socioeconomic Transformations in North-East Africa from the Last Glacial Maximum to the Neolithic, 24,000 to 6,000 cal BP*. London.

TASSIE, G.J., VAN WETERING, J. & CAROLL, I., 2008. Repatriating prehistoric artefacts to Egypt: Fekri Hassan's Naqada and Siwa study collection. *Archaeology International* 12: 52-57.

THOMAS, J., 1999. *Understanding the Neolithic*. London.

TRISTANT, Y., 2005. Le delta du Nil avant les pharaons. Entre originalités locales et influences étrangères. *Archéo-Nil* 15: 75-102.

TWISS, K., 2007. The Neolithic of the Southern Levant. *Evolutionary Anthropology* 16: 24-35.

van DEN BRINK, E.C.M. & COMMENGE, C., 2016. Lod (Newe Yaraq): A Late Roman Pottery Kiln and Pottery Neolithic A (JerichoIX/Lodian) Remains. *ʿAtiqot* 85: 1-36.

VERHOEVEN, M., 2002. Transformations of Society: the Changing Role of Ritual and Symbolism. *Paléorient* 28(1): 5-14.

VERHOEVEN, M., 2004. Beyond Boundaries: Nature, Culture and a Holistic Approach to Domestication in the Levant. *Journal of World Prehistory* 18(3): 179-282.

VERHOEVEN, M., 2011. The Birth of a Concept and the Origins of the Neolithic: A History of Prehistoric Farmers in the Near East. *Paléorient* 37(1): 75-87.

VERMEERSCH, P.M., LINSEELE, V., MARINOVA, E., VAN NEER, W., MOEYERSONS, J. & RETHEMEYER, J., 2015. Early and Middle Holocene Human Occupation of the Egyptian Eastern Desert: Sodmein Cave. *African Archaeological Review* 32(3): 465-503.

VIEUGUÉ, J., GARFINKEL, Y., BARZILAI, O. & VAN DEN BRINK, E.C.M., 2016. Pottery function and culinary practices of Yarmukian societies in the late 7th millennium cal. BC: First results. *Paléorient* 42(2): 97-115.

WARFE, A., 2003. Cultural Origins of the Egyptian Neolithic and Predynastic: An Evaluation of the evidence from the Dakhleh oasis (South Central Egypt). *African Archaeological Review* 20(4): 175-202.

WARFE, A., 2006. Reconsidering the argument for an early Holocene pottery tradition in Dakhleh Oasis, central Western Desert, Egypt. *Sahara* 17: 19-28.

WARFE, A., 2018. *Prehistoric Pottery from Dakhleh Oasis, Egypt* (= Dakhleh Oasis Project Monograph 18). Oxford & Philadelphia.

WASYLIKOWA, K., BARAKAT, H.N. & LITYŃSKA-ZAJĄC, M., 2001. Part IV: Nabta Playa Sites E-5-8, E-91-1, E-92-7, E-94-1, E-94-2, and El Gebel El Beid Playa Site E-77-7: Seeds and fruits. In: Wendorf, F. & Schild R. (eds.), *Holocene settlement of the Egyptian Sahara.* Volume 1. *The archaeology of Nabta Playa*. New York: 544-591.

WELC, F., 2016. *Holoceńskie zmiany klimatu w dorzeczu dolnego Nilu w świetle danych geoarcheologicznych z Oazy Fajum (Egipt)*. Warszawa.

WENDORF, F., AND SCHILD, R., 1976. *Prehistory of the Nile Valley*. New York and London.

WENDORF, F. AND SCHILD, R., 1980. *Prehistory of the Eastern Sahara*. New York.

WENDORF, F. & SCHILD, R., 1984. Conclusion. In: Wendorf, F., Schild, R. & Close, A.E., (eds.), *Cattle-keepers of the Eastern Sahara: the Neolithic of Bir Kiseiba*. Dallas: 404-428.

WENDORF, F. & SCHILD, R., 1998. Nabta Playa and Its Role in Northeastern African Prehistory. *Journal of Anthropological Archaeology* 17: 97-123.

WENDORF, F. & SCHILD, R., 2001. Conclusions. In: Wendorf, F & Schild, R. (eds.). *Holocene Settlement of the Egyptian Sahara*. Volume I. *The Archaeology of Nabta Playa*. New York: 648-675.

WENDORF, F. & SCHILD, R., 2006. The Emergence of Village Settlements during the Early Neolithic in the Western Desert of Egypt. *Adumatu* 14: 7-22.

WENDRICH, W. & CAPPERS, R.T.J., 2005. Egypt's earliest granaries: evidence from the Fayum. *Egyptian Archaeology* 27: 12–15.

WENDRICH, W. & HOLDAWAY, S., 2017. Basket use, raw materials and arguments on early and Middle Holocene mobility in the Fayum, Egypt. *Quaternary International* 468B: 240-249.

WENDRICH, W., TAYLOR, R.E. & SOUTHON, J., 2010. Dating stratified settlement sites at Kom K and Kom W: Fifth millennium BCE radiocarbon ages for the Fayum Neolithic. *Nuclear Instruments and Methods in Physics Research* B 268: 999-1002.

WENGROW, D., 2003. Landscape of Knowledge, Idioms of Power: The African Foundation of Ancient Egyptian Civilization Reconsidered. In: O'Connor D. & Reid A. (eds.), *Ancient Egypt in Africa*. London: 121-135.

WENGROW, D., 2006. *The Archaeology of Early Egypt: Social Transformation in North-East Africa, 10,000 to 2650 BC*. Cambridge.

WENKE, R.J., BUCK, P., HANLEY, J.R., LANE, M.E., LONG, J. & REDDING, R.R., 1983. The Fayum archaeological Project: Preliminary Report of the 1981 Season. *ARCE Newsletter* 122: 25-40.

WENKE, R.J. & CASINI, M., 1989. The Epipalaeolithic-Neolithic transition in Egypt's Fayum Depression. In: Krzyżaniak, L. & Kobusiewicz, M. (eds.), *Late Prehistory of the Nile Basin and the Sahara* (= Studies in African Archaeology 2). Poznań: 139-155.

WENKE, R.J., LONG, J.E. & BUCK, P.E., 1988. The Epipaleolithic and Neolithic Subsistence and Settlement in the Fayum Oasis of Egypt. *Journal of Egyptian Archaeology* 15: 29-51.

WETTERSTRÖM, W., 1993. Foraging and farming in Egypt: The transition from hunting and gathering to horticulture in the Nile Valley. In: Shaw, T., Andah, B., Sinclair, P. & Okpoko, A. (eds.), *The archaeology of Africa. Food, metals and towns*. London: 165-226.

WHITTLE, A.W.R., 1996. *Europe in the Neolithic: The Creation of New Worlds*. Cambridge.

WILLIAMS, M.A.J., 2009. Late Pleistocene and Holocene Environments in the Nile Basin. *Global and Planetary Change* 69: 1-15.

WILSON, P.; GILBERT, G. & TASSIE, G., 2014. *Sais II: The Prehistoric Period at Sa el-Hagar* (= EES Excavation Memoir 107). London.

WINKLER, H.A., 1938. *Rock-drawings of Southern Upper Egypt: Sir Robert Mond Desert Expedition 1: Season 1937-1938. Preliminary report*. London.

WINKLER, H.A., 1939. *Rock-drawings of Southern Upper Egypt: Sir Robert Mond Desert Expedition 2: Season 1936-1937. Preliminary report*. London.

WODZIŃSKA, A., 2010. *A Manual of Egyptian Pottery*. Volume 1: *Fayum A- Lower Egyptian Culture*. Revised First Edition. Boston.

YANNAI, E., LAZAR-SHORER, D. & GROSINGER, Z., 2006. Chapter 4: The Pottery Assemblages. In: Yannai, E. (ed.), *'En Esur ('Ein Asawir) I: Excavations at a Protohistoric Site in the Coastal Plain of Israel* (= IAA Reports 31). Jerusalem: 63-210.

YEIVIN, E. & OLAMI, Y., 1979. Nizzanim: A Neolithic Site in Nahal Evtah: Excavations of 1968-1970. *Tel Aviv* 6: 99-135.

ZALAT, A., MARKS, L., WELC, F., SALEM, A., NITYCHORUK, J., CHEN, Z., MAJECKA, A., SZYMANEK, M., CHODYKA, M., TOŁOCZKO-PASEK, A., SUN, Q., ZHAO, X. & JIANG, J., 2017. Diatom stratigraphy of FA-1 core, Qarun Lake, records of Holocene environmental and climatic change in Faiyum Oasis, Egypt. *Studia Quaternaria* 34(1): 61-69. doi:10.1515/squa-017-0005; accessed on 11.07.2018.

ZEDEÑO, N., 2002. Neolithic ceramic production in the Eastern Sahara of Egypt. In: Nelson, K., Gatto, M.C., Jesse, F. & Zedeño, M.N. (eds.), *Holocene settlement of the Egyptian Sahara.* Volume II: *The pottery of Nabta Playa*. New York: 51-64.

ZEDER, M., 2017. Out of the Fertile Crescent: The dispersal of domestic livestock through Europe and Africa. In : Boivin, N., Crassard, R. & Petraglia, M. (eds.), *Human Dispersal and Species Movement: From Prehistory to the Present*. Cambridge: 261-303.

PREVIOUSLY RELEASED VOLUMES IN SERIES „STUDIES IN AFRICAN ARCHAEOLOGY"

vol. 1. Lech Krzyżaniak and Michał Kobusiewicz (eds.), *Origin and Early Development of Food-Producing Cultures in North-Eastern Africa*. Poznań 1984.

vol. 2. Lech Krzyżaniak and Michał Kobusiewicz (eds.), *Late Prehistory of the Nile Basin and the Sahara*. Poznań 1989.

vol. 3. Lech Krzyżaniak, *Late Prehistory of the Central Sudan* (in Polish, with English summary). Poznań 1992.

vol. 4. Lech Krzyżaniak, Michał Kobusiewicz and John Alexander (eds.), *Environmental Change and Human Culture in the Nile Basin and Northern Africa until the Second Millenium BC*. Poznań 1993.

vol. 5. Lech Krzyżaniak, Karla Kroeper and Michał Kobusiewicz (eds.), *Interregional Contacts in the Later Prehistory of Northeastern Africa*. Poznań 1996.

vol. 6. Marek Chłodnicki, *Pottery in the Neolithic Societies of the Central Sudan* (in preparation).

vol. 7. Lech Krzyżaniak, Karla Kroeper and Michał Kobusiewicz (eds.), *Recent Research into the Stone Age of Northeastern Africa*. Poznań 2000.

vol. 8. Lech Krzyżaniak, Karla Kroeper and Michał Kobusiewicz (eds.), *Cultural Markers in the Later Prehistory of Northeastern Africa and Recent Research*. Poznań 2003.

vol. 9. Karla Kroeper, Marek Chłodnicki and Michał Kobusiewicz (eds.), *Archaeology of the Earliest Northeastern Africa. In Memory of Lech Krzyżaniak*. Poznań 2006.

vol. 10. Marek Chłodnicki, Michał Kobusiewicz and Karla Kroeper (eds.), *Kadero: the Lech Krzyżaniak excavations in the Sudan*. Poznań 2011.

vol. 11. Jacek Kabaciński, Marek Chłodnicki and Michał Kobusiewicz (eds.), *Prehistory of Northeastern Africa. New Ideas and Discoveries*. Poznań 2012.

vol. 12. Agnieszka Mączyńska, *Lower Egyptian communities and their interactions with Southern Levant in the 4th millennium BC*. Poznań 2013.

vol. 13. Agnieszka Mączyńska (ed.), *The Nile Delta as a centre of cultural interactions between Upper Egypt and the Southern Levant in the 4th millennium BC*. Poznań 2014.

vol. 14. Jacek Kabaciński, Marek Chłodnicki and Michał Kobusiewicz (eds.), *Hunter-Gatherers and Early Food Producing Societies in Northeastern Africa*. Poznań 2015.

vol. 15. Jacek Kabaciński, Marek Chłodnicki, Michał Kobusiewicz and Małgorzata Winiarska-Kabacińska (eds.), *Desert and the Nile. Prehistory of the Nile Basin and the Sahara. Papers in honour of Fred Wendorf*. Poznań 2018.

PL ISSN 0866-9244
ISBN 978-83-60109-61-8