An Offprint of

Dakhleh Oasis Project: Monograph 15

THE OASIS PAPERS 6

Proceedings of the Sixth International Conference
of the Dakhleh Oasis Project

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Proceedings of the Sixth International Conference of the Dakhleh Oasis Project

Edited by

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Editors' Preface

This volume contains the proceedings of the Sixth International Conference of the Dakhleh Oasis Project held in Lecce in 2009 plus one paper that was to have appeared in the proceedings of the previous conference held in Cairo, which is still being prepared for publication. The organization was principally undertaken by Paola Davoli with some assistance from Roger Bagnall and Colin Hope; in this respect we would like to acknowledge the assistance of Professor Mario Capasso, Director of the Centro di Studi Papirologici of the University of Salento. The conference was hosted by the University of Salento at Lecce, which was pleased to undertake this task coinciding as it did almost with the 30th anniversary of the first major field season of the Dakhleh Oasis Project in 1978. The normal geographical range of papers accepted for presentation at the conference, the entire Western Desert of Egypt, was extended on this occasion to include also the Fayyum in light of the University of Salento's activity there since 1993, first at Bakchias and then Soknopaiou Nesos.

We would like to extend our thanks to the Provost of the University of Salento, Professor Domenico Laforgia, who was an enthusiastic supporter of this event from the outset and whose good offices persuaded Monte dei Paschi di Siena generously to sponsor the conference. Monte dei Paschi di Siena is one of the most important Italian banks, founded in 1472; it is considered the oldest bank in the world. Through their respective institutions, the Institute for the Study of the Ancient World of New York University, and the Centre for Archaeology and Ancient History of Monash University, Melbourne, also contributed significantly to the financial effort. Of the latter institution, our gratitude is extended to the Vice-Chancellor, Professor Ed Byrne, and the Dean of the Faculty of Arts, Professor Rae Frances, for their support.

The excellent work of the undergraduate and graduate students of the University of Salento, who volunteered to undertake a variety of tasks throughout the conference, is gratefully acknowledged. For assistance in the preliminary stages of formatting the volume we would like to thank Nate Nagy, while the final result is due to the careful and professional work of Bruce Parr.

On a technical note, the volume includes a programme of the papers presented at Lecce, not all of which are published in this volume; those presented here have been grouped into broad chronological periods. As a wide variety of spellings has been used by the contributing authors for place names in the Western Desert, not only resulting from local linguistic differences, but also conventions employed in the languages of the contributing scholars, and the use of writings that have become accepted both over time and through regularity of use within one language, it was thought necessary to introduce some degree of standardisation. This has been done with the advice of Professor Fred Leemhuis, Emeritus Professor of Islamic Studies, University of Groningen, and Director of the Qasr Dakhleh Project. Thus, where authors prefer to use a particular conventional spelling that varies notably from what Arabists might use as a formal transcription of Standard Arabic, then the latter is provided in parentheses when the popular spelling is first used. In some cases the formal transcription has been adopted throughout when variations in spelling have resulted from an incorrect rendering of the Arabic, or when authors have agreed to the formal transcription.

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Contents

Pharaonic

Ptolemaic

Roman

Christian

Conference Programme

THE SIXTH INTERNATIONAL CONFERENCE OF THE DAKHLEH OASIS PROJECT

New Perspectives on the Western Desert of Egypt

20–24 September 2009
Università del Salento, Lecce

Sunday, 20 September 2009

Opening Ceremony

Dr Paolo Perrone, Mayor of Lecce
Professor Domenico Laforgia, Provost, Università del Salento
Professor Anthony J. Mills, Dakhleh Oasis Project
Associate Professor Colin A. Hope, Monash University
Professor Paola Davoli, Università del Salento
Professor Mario Capasso, Università del Salento

Monday, 21 September 2009

Surveys and Environmental Topics Chairperson: Anthony J. Mills

Sayed Yamani: *Cultural Heritage Management of the Archaeological Resources of the Eastern Sahara.*
Michel Wuttmann: *La prospection de l'oasis de Kharga.*
Salima Ikram: *Exploration of the Darb 'Ain Amur.*
Barbara E. Barich, Mattia Crespi, Ulisse Fabiani and Giulio Lucarini: *Geomatics Resources for Archaeological Survey in Desert Areas – Some Prospects from Farafra Oasis.*
Rudolph Kuper and Heiko Riemer: *The Gilf Kebir National Park: Challenge and Chance for Archaeology.*
Gaëlle Tallet: *The Survey Project at el-Deir, Kharga Oasis: First Results, New Hypotheses.*
Ursula Thanheiser: *Times of Change: Subsistence Strategies in the Early and Middle Holocene in Dakhleh Oasis.*

The Oases in Pharaonic and Ptolemaic Periods Chairperson: Olaf E. Kaper

Anthony J. Mills: *Recent Fieldwork at 'Ain el-Gazzareen.*
Amy J. Pettman: *The Date of 'Ain el-Gazzareen as determined by an Examination of the Ceramic Material.*
Ellen Morris: *Activities at Amheida from Prehistory until the First Intermediate Period.*
Maher Bashendi: *The Necropoleis of the Dakhleh Oasis.*
Laure Pantalacci: *Animals and Meat Consumption in Ancient Balat at the end of the Old Kingdom.*
Colin A. Hope: *Recent Excavations at Mut al-Kharab, Dakhleh Oasis.*
James C. R. Gill: *A Study of Ptolemaic Period Ceramics from Mut al-Kharab, Dakhleh Oasis.*

Tuesday, 22 September 2009

Prehistory Chairperson: Colin A. Hope

Mary M. A. McDonald: *Dakhleh and Kharga Oases in Late Prehistory.*
Barbara E. Barich: *The Culture of the Oases: Late Neolithic Herders in Farafra – a Matter of Identity.*
Giulio Lucarini: *Early Craftsmen of the Desert. Clues of Predynastic Lithic Technology in the Late Neolithic of Farafra.*
Giuseppina Mutri: *Stratigraphic Evidence for MSA Finds at Sheikh el Obeiyid, Northern Farafra Depression.*
Maria C. Gatto: *Beyond the Shale: Pottery and Cultures in the Prehistory of the Egyptian Western Desert.*
Marcia F. Wiseman: *The Khargan Industry Revisited.*
Maxine R. Kleindienst: *Results of Survey for Pleistocene Cultural Evidence from Dakhleh Oasis, 1978–1979 to 2008–2009 Field Seasons: Summary of Evidence and New Geoarchaeological Interpretations.*

Rock Art Chairperson: Mary M. A. McDonald

Andras Zboray: *Rock Art at Jebel Uweinat.*
Daniel James: *Stepping from Winkler's Shadow: an Analysis of Rock-Art Classification at Dakhleh Oasis.*
Daniela Zampetti: *Iconography and Techniques in the Rock Art of the Tadrart Acacus and Messak Settafet (Libyan Sahara).*

Recent Research in the Kharga Oasis Chairperson: Salima Ikram

Bahgat Ahmed Ibrahim: *Archaeological Sites in the Kharga Oasis.*
Françoise Dunand, Jean-Louis Heim and Roger Lichtenberg: *Les Nécropoles d'el-Deir (Oasis de Kharga).*
Deborah Darnell: *Pottery of Ghueita (MK-2IP-NK).*
John C. Darnell: *Cedar of the West, Products of Bahriyya, and Divine Offerings for Thebes: The Trade Relations of Gebel Ghueita in Kharga Oasis*.

Papyrology and Archaeology in el-Fayyum Chairperson: Paola Davoli

Mario Capasso: *La cultura letteraria greca nel Fayyum di età ellenistica e romana.*
Natascia Pellé: *Tra scuola e filologia: la ricezione delle* Historiae *tucididee nel Fayyum.*
Wlodzimierz Godlewski: *The Earliest Hermitages in the Fayyum*.
Fabian Reiter: *New Ostraca from Tebtynis.*
Giuseppina Azzarello: *New Texts from the Archive of Epagathos*.
Ashraf Senussi: *Making Pottery in Fayyum: an Ethnoarchaeological Study.*

Wednesday, 23 September 2009

Egyptian Temples and Religion Chairperson: John C. Darnell

Olaf E. Kaper: *The Recontruction of the Temple of Thoth at Amheida*.
David Klotz: *Yale University Nadura Temple Project, 2009 Season.*
Adam Zielinski: *Archaeological Exploration and Conservation Measures at 'Ain Birbiyeh Site, Dakhleh Oasis.*

Textual Finds Chairperson: Fred Leemhuis

Roger S. Bagnall and Raffaella Cribiore: *Christianity on Thoth's Hill at Amheida.*
Iain Gardner: *The Coptic Ostraca from Qasr al-Dakhleh (2007–20009).*
Günter Vittmann: *New Texts in Demotic and Abnormal Hieratic from Mut al-Kharab, Dakhleh Oasis.*

Christianity and Christian Sites in the Oases Chairperson: Roger S. Bagnall

Nicola Aravecchia: *The Church Complex of 'Ain el-Gedida, Dakhleh Oasis.*
Delphine Dixneuf: *'Ain el-Gedida (Oasis de Dakhleh). La céramique du IV^e siècle.*
Gillian E. Bowen: *The Church of Dayr Abu Matta and its Associated Structures: a Preliminary Report.*
Magali Coudert and Fleur Letellier-Willemin: *The Christian Necropolis of el-Deir in the North of Kharga Oasis.*

Thursday, 24 September 2009

Roman Presence and Late Antique Sites Chairperson: Françoise Dunand

Paola Davoli: *Amheida 2007–2009. New Results from the Excavations.*
Paul Kucera: *al-Qasr: the Roman* castrum *of Dakhleh Oasis.*
Rosanne Livingstone: *The Textiles from Kellis.*
Tosha L. Dupras and Sandra M. Wheeler: *Children and Childhood in Kellis: a Bioarchaeological Approach.*
Helen Whitehouse: *Vine and Acanthus: Decorative Themes in the Dakhleh Oasis and Beyond.*
Evelyne Ferron: *Roman Adaptation to the Environmental Particularities of the Integrated Regions to its Empire: the Example of the Oases of Kharga and Dakhleh.*
Corinna Rossi: *The Distribution of Late-Roman 'Forts' in Northern Kharga Oasis.*

Islamic Period Chairperson: Wlodzimierz Godlewski

Ahmed Salem: *S. C. A. Excavations at al-Qasr.*
Fred Leemhuis: *Letters from al-Qasr. Glimpses into the Life of the Qurashi Family in the 19th and the Early 20th Century.*
Anetta Lyzwa-Piber: *Progress in the Study of the Pottery from al-Qasr*.

Conservation and Technologies Chairperson: Michel Wuttmann

Constance S. Silver: *Mural Painting and Plaster Conservation in the Dakhleh Oasis: a Summary of Conservation Problems and the Status of Conservation Treatments.*
Nicholas Warner: *Amheida: Architectural Conservation and Presentation Works 2006–2009*.
Bruno Bazzani: *A New Database for Recording Excavation Data.*

Posters

Mauro Cremaschi, Simone Occhi and Chiara Pizzi: *The Graeco-Roman Palaeo-Oasis of Dime: Origin, Apogee and Decline.*
Rudolph Kuper, F. Förster and Heiko Riemer: *From Dakhleh down to Yam? New Light on Abu Ballas Trail.*
Conni Lord: *A Histological Investigation of Two Individuals from the Kellis Cemetery*.
Roger Montgomerie: *A Histological Examination of Preserved Lung Tissues from Dakhleh Oasis Mummies.*
Fabrizio Pavia and Silvia Maggioni: *Topographical and Tri-Dimensional Modeling of Amheida, Dakhleh Oasis.*
Maria E. Peroschi: *Wadi Abd el-Malik: Highlights from our Explorations.*
Anna-Katharina Rieger, Thomas Vetter and H. Möller: *Man and Landscape in Ancient Marmarica (Northern Libyan Desert).*
Malgorzata Winiarska-Kabacinska: *Function of Chipped Stone Tools from Old Kingdom Site at 'Ain el-Gazzareen, Dakhleh Oasis.*

Provisions for the Journey: Food Production in the 'bakery' area of 'Ain el-Gazzareen, Dakhleh Oasis

Amy J. Pettman, Ursula Thanheiser and Charles S. Churcher

'Ain el-Gazzareen is an extensive site located on the western fringe of the Dakhleh Oasis. In this area, the natural water supply has been more reliable than in other parts of the oasis, and the groundwater table has been close to the surface resulting in damp soil conditions, thereby supporting a comparatively varied flora. The site has been excavated by Anthony J. Mills since 1995. It is dominated by a rectangular mud-brick enclosure measuring approximately 125m by 55m (Mills and Kaper 2003, 125) (Figure 1). The site dates to the Old Kingdom; analysis of the ceramic material shows that the occupation encompassed at least Dynasties V–VI, with the initial establishment perhaps even as early as Dynasty IV (Pettman, this volume). In the first few years of excavation, the area within this enclosure known as H13/I13 was excavated (Mills 1995) (Figure 2). This area lies close to the original short eastern wall of the enclosure and was probably constructed during the initial development of the site. These excavation squares cover an area of approximately 10 x 15 m (Mills 1997–1998, 17).

Twenty-one rooms or spaces are included within this area, though of those only seven are located entirely within H13/I13 and only five are completely contained by mud-brick walls. Several of these rooms preserved a packed mud-brick floor, though this feature was not discernible in all rooms, and Room V demonstrated two different floor levels, one above the other.

Mills (1995, 64) identified H13/I13 as a bakery area. This identification was based on several factors: a significant number of heavy, straw-tempered bread moulds of typical Old Kingdom form (Mills 1995, 64; Mills 2002, 76); a large quantity of ash (Mills 1995, 62); a high occurrence of grains and rachises of barley (*Hordeum vulgare*) and grains and spikelet forks of emmer wheat (*Triticum dicoccum*) (Mills 2002, 76); and a circular structure in Room I which appears to have served as a silo (Mills 1995, 64). Three very large ceramic vessels were also discovered at the western end of Room II (Figure 2), which Mills (1995, 64) suggested functioned as permanent fixtures for storage of foodstuffs.

Following the initial examination of this material shortly after its excavation, little detailed analysis occurred and no further investigation into the function of this area was undertaken until recently (Pettman 2008; 2011). A large variety of botanical and faunal remains was recovered from the excavations which has the potential to yield a great deal of information regarding the nature of activity, both within the area of H13/I13 and at 'Ain el-Gazzareen as a whole. An extensive ceramic assemblage was recovered from the excavation of this area.

The aim of this article is, therefore, to present the archaeobotanical, archaeozoological and ceramic material from H13/I13 in order to examine the rationale for the initial identification of this area as a bakery, and to show that some revision of this is now necessary. It will also provide key data regarding the subsistence strategies of the Egyptian residents of the oasis during the Old Kingdom, allowing a better understanding of how the new 'colonists' of this region used the resources at their disposal. The determination of the function of this area will contribute much to our understanding of the role of 'Ain el-Gazzareen in light of the Old Kingdom occupation of Dakhleh Oasis; this article will thus attempt to show that the evidence from H13/I13 suggests that the function of this site must be connected to trade and travel passing through Dakhleh Oasis from the Nile Valley, and perhaps also Farafra Oasis, further into the Western Desert.

The Archaeobotanical Evidence

Egyptians from the Nile Valley first permanently settled in Dakhleh Oasis during the Old Kingdom, possibly from Dynasty IV onwards (Hope and Pettman, this volume). They did not adopt the hunting and herding way of life of the indigenous Sheikh Muftah people (Thanheiser 2008, 151) but brought with them a subsistence strategy hitherto unknown in the area: agriculture. However, the oasis environment with its lack of annual Nile floods was challenging. The climate had more-or-less reached its present state of hyperaridity, and very little rain fell at irregular intervals, thus rendering rain-fed agriculture impossible. The surrounding area had already lost most

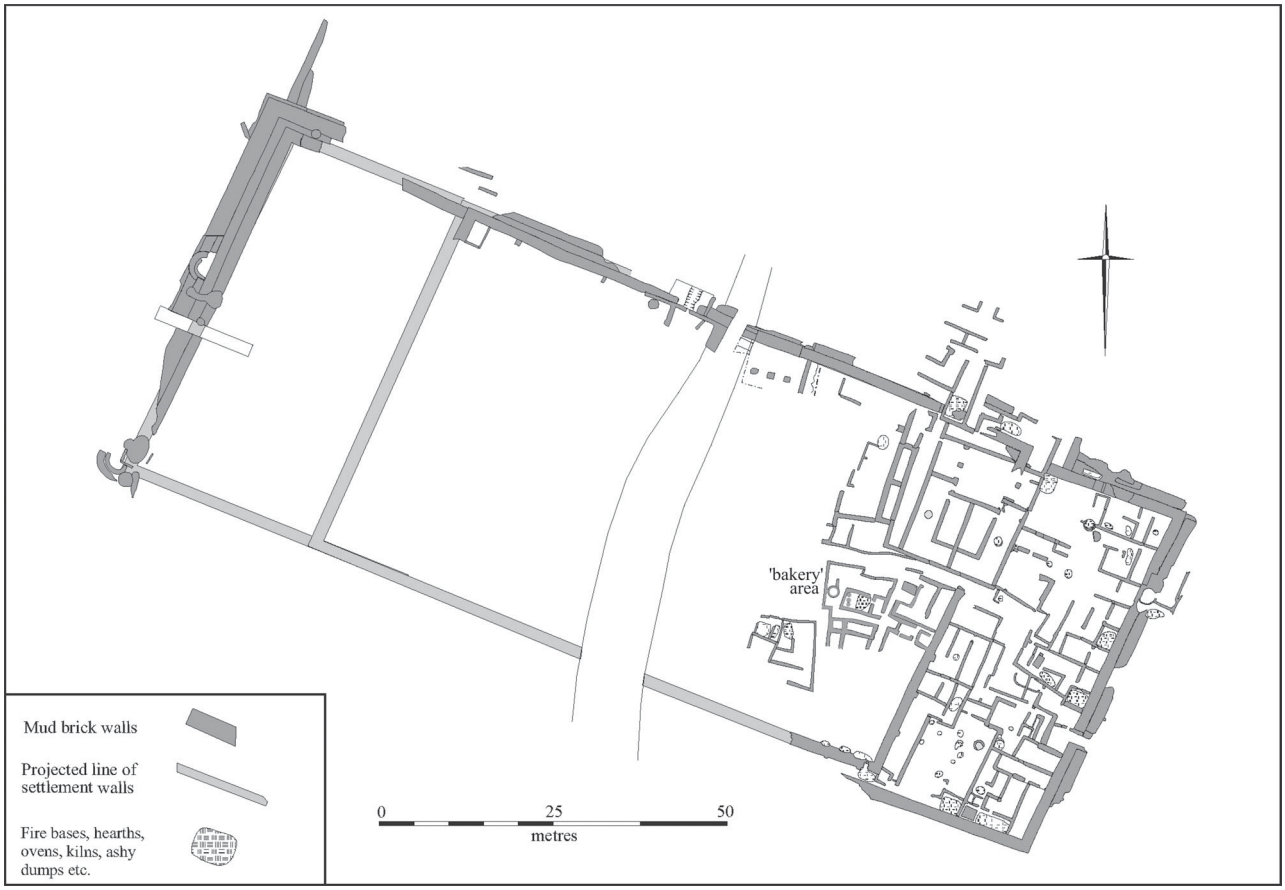


Figure 1 Plan of 'Ain el-Gazzareen; area H13/I13 ('bakery') occurs in the south-eastern corner, just west of the original (inner) eastern wall (courtesy of A. J. Mills).

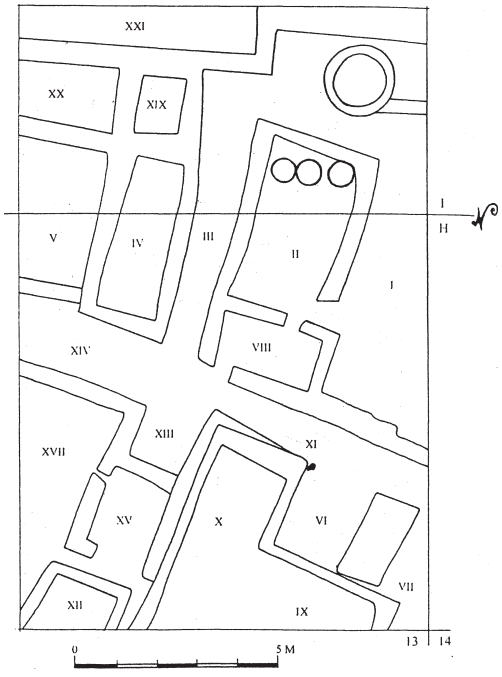


Figure 2 Plan of the area H13/I13; the location of Rooms XVI and XVIII are not marked on this plan and are unknown (after Mills 1995, 63).

of its plant cover and feeding livestock by grazing outside the oasis was no longer possible. All life therefore depended on groundwater reaching the surface along natural vents or as springs. At the time, no effective water-lifting devices were available and therefore wells only served to meet the personal needs of the inhabitants and eventually to water small garden plots. Agriculture depended entirely on careful management of springs. The easiest way to provide sufficient amounts of water for irrigation would have been to build dams around spring eyes in a collective effort in order to raise the point of discharge and create the necessary gradient for gravity propelled irrigation. This 'Egyptian' subsistence strategy, i.e., irrigation-based agriculture, was applied successfully in the oasis and from the very beginning of the Egyptian occupation all crops known in the Nile Valley were also present in Dakhleh. In an environment where plant growth is dependent to a large extent on artificial water supply, field crops serve a dual purpose, as they have to feed humans and beast alike.

Material and Methods

Several parts in the area yielded large, ashy deposits; 30 random matrix samples, varying in volume from 3.7 to 13.5 litres, were taken. According to their position in relation to floors these samples can be grouped as follows: 5 samples from floors or above (BAK-A), 7 samples from below floors (BAK-B), 18 samples from areas where no floor was present (BAK-N).

The biological remains were extracted from the soil by electrostatic means by which the matrix was split into 'predominantly organic' and 'inorganic' fractions (Thanheiser 1995); the smallest mesh diameter was 0.5 mm. From the organic fraction, the plant remains were then isolated manually using a dissecting microscope and identified using the writer's personal reference collection. Scientific nomenclature for wild plants follows the *Flora of Egypt* (Boulos 1999–2005). For cultivated plants the terms known in archaeology are used. Very rich organic fractions were divided with a riffle box and only a part of the sample (usually half or a quarter) was analysed. The figures given in the tables referred to below thus represent calculated numbers. Each item was counted as one piece irrespective of its actual completeness. Only the number of spikelet forks represents calculated whole items. The inorganic fraction was screened for possible escapes.

Only charred plant remains are present. This mode of preservation is the result of a burning event by which the organic material was reduced to almost pure carbon. Charred plant remains in domestic contexts can usually be linked to food preparation, the use of plants as fuel or the accidental burning of structures. Although the density of plant remains in the bakery is much higher than in other areas of 'Ain el-Gazzareen, the number of recovered taxa is rather low. This is a well-known phenomenon at sites with exclusively charred plant remains and is a direct result of the burning event: mainly dense, compact items survive the heat in charred form. In addition, charring and subsequent taphonomic processes often cause distortion of propagules and a loss of the seed or fruit coat (testa or pericarp) with its diagnostic features. Therefore charred plant remains often cannot be identified to species level. In contrast to other (later) sites in the Dakhleh Oasis, desiccated plant remains are not present in `Ain el-Gazzareen, reflecting the damp conditions at the site.

A calculated total of 55,125 identifiable macro remains was recovered. In addition, 4.5% of the botanical remains are unidentifiable material, comprising mainly minute vegetative items such as fragments of twigs, stems and leaves which do not appear in the lists. The identified macro remains can be grouped into three categories: food plants, wild herbaceous

Table 1 Plant macro remains.

Context		**BAK-A**	**BAK-B**	**BAK-N**
Number of Samples		**5**	**7**	**18**
Amoumt of Soil (litre)		**43,9**	**62,7**	**150,3**
Number of Macro remains		**5937**	**11496**	**37692**
Density (Items per Litre)		**135,2**	**183,3**	**250,8**
Food plants				
Hordeum vulgare	rachis	3064	4339	20052
Hordeum vulgare	grain	195	284	622
Triticum dicoccum	spikelet fork	725	700	1280
Triticum dicoccum	grain	15	61	28
Triticum durum	rachis	13		5
Triticum aestivum s.l./durum	grain		4	6
Triticum sp.	rachis	8		
Triticum sp.	grain	27	12	10
Cerealia	rachis	8	21	106
Cerealia	grain	505	1075	3279
Vitis vinifera ssp. vinifera	seed	1		
Wild herbaceous plants				
Caryophyllaceae	seed		16	
Chenopodium murale	seed	1	54	91
Suaeda aegyptiaca	seed	2		
Suaeda monoica	seed	2		
Brassicaceae	seed	8	8	24
Alhagi graecorum	seed	1		1
Astragalus Type	seed	8	6	24
Trifolieae	seed	135	181	529
Fabaceae	flower	8	110	560
Fabaceae	seed		20	93
Cucurbitaceae	seed		2	
Hyoscyamus sp.	seed		4	
Calendula arvensis	seed	17	87	255
Asteraceae	seed	4		
Asphodelus tenuifolius	seed	34	39	253
Avena cf. fatua	seed	21	11	10
Phalaris minor	seed	157	230	609
Poaceae	node	31	11	176
Poaceae	rachis			13
Poaceae	seed	44	14	235
Bolboschoenus glaucus	seed	135	70	163
Schoenoplectus cf. litoralis	seed	18		96
Cyperaceae	seed	34	64	40
Wild woody plants				
Acacia nilotica	fruit	21	70	1016
Acacia nilotica	seed	4		50
Acacia nilotica Type	leaf	81	147	2025
Acacia nilotica Type	seed	249	589	3104
Acacia Type	vegetative	112	260	501
Acacia Type	inflorescense	48	203	1167
Acacia Type	flower	32	225	736
Tamarix aphylla	vegetative		49	9
Tamarix cf. nilotica	vegetative	137	2458	492
Tamarix sp.	inflorescense	32	2	1
Tamarix sp.	flower		70	31

Table 2 Charcoal.

Number of samples	30
Chenopodiaceae	2
Acacia nilotica	153
Acacia tortilis ssp. raddiana Type	2
Acacia sp.	95
Faidherbia albida	21
Tamarix sp.	512
Calotropis procera	54
Leptadenia pyrotechnica	3
Indet. root	1
Indet. twig	1
Indet.	486
Total	1330

plants and wild woody plants (Table 1). Furthemore, 1330 pieces of charcoal were identified (Table 2).

Food Plants

Two species of cereals are present, emmer wheat, *Triticum dicoccum*, and barley, *Hordeum vulgare*. Both are represented by chaff and grains. Identification of emmer wheat is based on the very characteristic rachis segments, the spikelet forks. The grains are slim in dorsal view, rounded at the distal end and pointed at the embryo end; the ventral side is slightly concave or flat; in lateral view they are slightly humped. Some well-preserved grains have longitudinal furrows representing impressions of the glumes. In addition, a few rachis segments and grains representing hard wheat, *Triticum durum*, are present. Emmer wheat was the principal wheat crop in Egypt since the introduction of agriculture, and the current view is that it maintained this status throughout the Pharaonic period, but was gradually replaced by hard wheat from Ptolemaic times onwards (e.g., Cappers 2006, 130; van der Veen 2011, 141). Occasional finds of remains of free-threshing wheat have been reported in Egypt from contexts dating back to the Predynastic Period (de Vartavan and Asensi Amoros 1997), but are considered to represent weeds in emmer crops.

The grains of barley are spindle-shaped both in dorsal and lateral view. Ridges on the surface represent the remains of glumes. No asymmetrical grains are present. The rachis segments are straight and taper outwards at the top. Pedicels and glumes are not present. Although there is no convincing archaeobotanical evidence, it is likely that the barley remains represent six-row hulled barley, the principal barley crop in Egypt since Predynastic times. In ‘Ain el-Gazzareen barley is by far the dominant cereal plant. It needs less water than emmer wheat, has lower demands concerning soil quality and can also grow on slightly saline soil. It is therefore often the crop of choice on land newly reclaimed for agriculture.

Emmer wheat and barley are hulled and the grains are not released from the glumes by threshing. These glumes are unsuitable for human consumption but offer a good protection of the grain against mould. Therefore removal of the glumes by wetting and subsequent pounding is often carried out on a day-to-day basis. The by-products of this step in the cereal processing sequence such as chaff (rachises, glumes and awns) and weeds not extracted in previous crop processing stages are often used as fodder or fuel, and therefore have a high chance of being incorporated in the charred plant assemblage.

With the exception of one grape pip, *Vitis vinifera ssp. vinifera*, from a floor sample, no other cultivated plants are present in the bakery. Other areas of the site, however, also yielded lentil (*Lens culinaris*) and flax (*Linum usitatissimum*).

Wild Herbaceous Plants

This group is dominated by Fabaceae (most notably Trifolieae and other small seeded legumes), Poaceae (mainly *Phalaris minor*), and by Cyperaceae (*Bolboschoenus glaucus* and *Schoenoplectus cf. litoralis*). Other important components of the assemblage are *Calendula arvensis*, *Asphodelus tenuifolius* and *Chenopodium murale*. Together they represent 8–11% of the recovered plant assemblage and almost 100 percent of the wild herbaceous plants.

The tribe Trifolieae comprises several genera which are widely distributed in northeast Africa: *Medicago*, *Melilotus*, *Ononis*, *Trifolium*, *Trigonella*. They are annual or perennial herbs, rarely shrubs. They grow on marshy and moist ground, on alluvial and sandy soils, in silty depressions, in sandy and stony deserts, in coastal sands, and on cultivated land and waste ground. Among others, *Medicago lupulina*, *M. polymorpha*, *Melilotus indicus* and *M. serratifolius* are valued fodder crops which also grow on moist ground and at the edges of cultivation in the oasis today (Boulos 1999, 267 ff.). Their seeds are usually small and often reniform, subrectangular or cylindrical in shape. In modern reference material the hilum and a knob formed by the curved radicula are visible. Identification is mainly based on the size and shape of seeds as well as the position of the radicle tip plus surface micromorphology (Butler 1995). There is a high degree of morphological overlap between taxa, which is compounded in subfossil material by changes in size and shape and sometimes also the loss of the testa due to charring and subsequent taphonomic processes. Identification to genus level was therefore not attempted. Among the Poaceae, *Phalaris minor* is the most common taxon. Today it is a common weed in cereal fields but also grows along irrigation canals as well as in depressions in the desert (Cope and Hosni 1991, 20 ff.; Boulos 2005, 168 ff.). Irrigation canals, saline or brackish marshes, ponds and moist places support the growth of Cyperaceae such as *Bolboschoenus glaucus*, a perennial with leafy

stems and underground tubers, and *Schoenoplectus litoralis*, a perennial with pithy stems (Hooper 1985, 372). *Calendula arvensis* is an annual herb of Mediterranean distribution. In Egypt it is a typical field weed of non-saline depressions, especially in barley cultivations. It is a common plant in sandy habitats and prefers sand plains with deep soil, rich water supply and protection from wind (Zahran and Willis 1992, 30, 42). In Dakhleh it occurs on the edges of fields and on fallow land. *Asphodelus tenuifolius* is an annual herb growing in valleys, salt marshes and on arable land, especially in sandy and loamy fields (Zahran and Willis 1992, 88 ff.; Boulos 2005, 36). Today it is a very common segetal weed of winter cereal crops. *Chenopodium murale* is an annual herb up to 1m high. It is a cosmopolitan weed of cultivation and waste ground but also grows in sandy deserts (Boulos 1999, 96) and is well adapted to saline environments. It has anthropogenic tendencies and is spread by man.

Wild Woody Plants

This group is represented by charcoal as well as macro remains. The charcoal assemblage is dominated by four taxa: *Tamarix sp.*, *Acacia nilotica*, *Acacia sp.* and *Calotropis procera*. Together they represent approximately 61% of the entire assemblage. Of *Tamarix*, today the most common species in Dakhleh is *T. nilotica*. It grows on the edges of salt marshes and in wadis, where it forms coppice dunes. With deep, penetrating roots, it is able to reach water not accessible to other plants. According to the *Flora of Egypt* (Boulos 2000, 126 ff.) all other five *Tamarix* species recorded for Egypt should also be present in the oases of the Western Desert but only *T. aphylla* was found and is today very rare and restricted to the better watered western part. Its presence in Dakhleh during the Old Kingdom can be inferred from the small number of tiny twig fragments among the macro remains. On the basis of wood anatomy, the species are not distinguishable. *Acacia nilotica* grows on canal banks and on moist ground and needs a sustained water supply (El Amin 1990, 160; Maydell 1990, 125; Boulos 1999, 368). When the water supply fails the trees die within a few years. Like *Tamarix*, *Acacia nilotica* also has deeply penetrating roots. *Calotropis procera* is a shrub or small tree growing on sandy desert plains and on alluvial soils close to cultivation (El Amin 1990, 377 f.; Boulos 2000, 220 ff.). The plant is unpalatable to livestock and its presence often indicates overgrazing (Ghazanfar 1994, 31). In Dakhleh, *C. procera* occurs in waste and fallow areas close to settlements, as well as along irrigation canals. It seems to be a good colonizer, developing quickly on neglected land with sufficient water supply. Correspondingly it is more common in the western part of the oasis due to the better water supply there. Less common taxa in the assemblage are Chenopodiaceae, *Acacia tortilis* ssp. *raddiana* Type, *Faidherbia albida*, and *Leptadenia pyrotechnica*. The presence of these

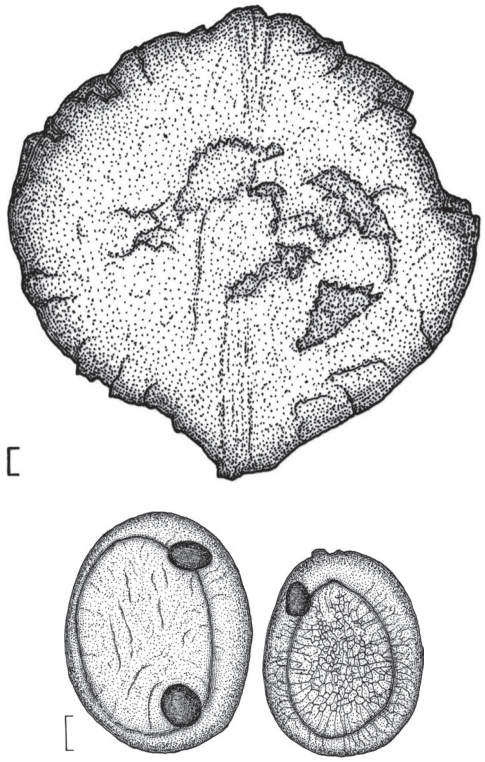


Figure 3 Acacia nilotica; *top, fragment of the pod, and bottom, seeds; bar 1 mm (drawings by J. Walter).*

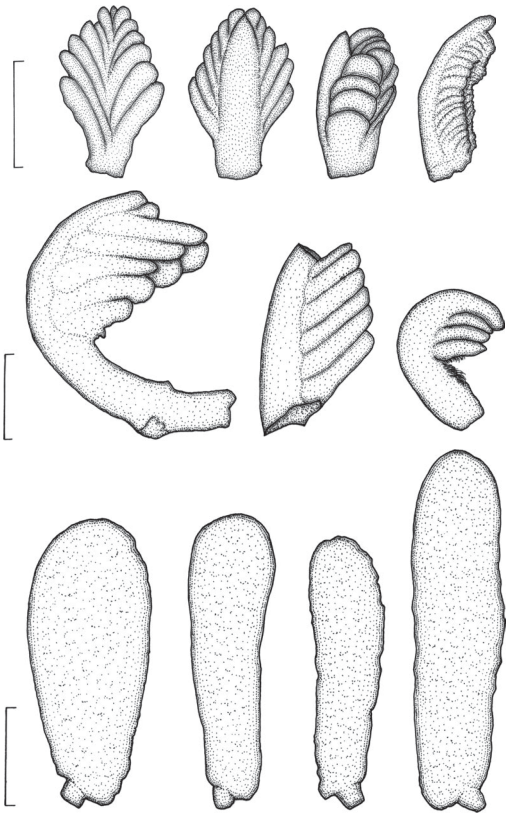
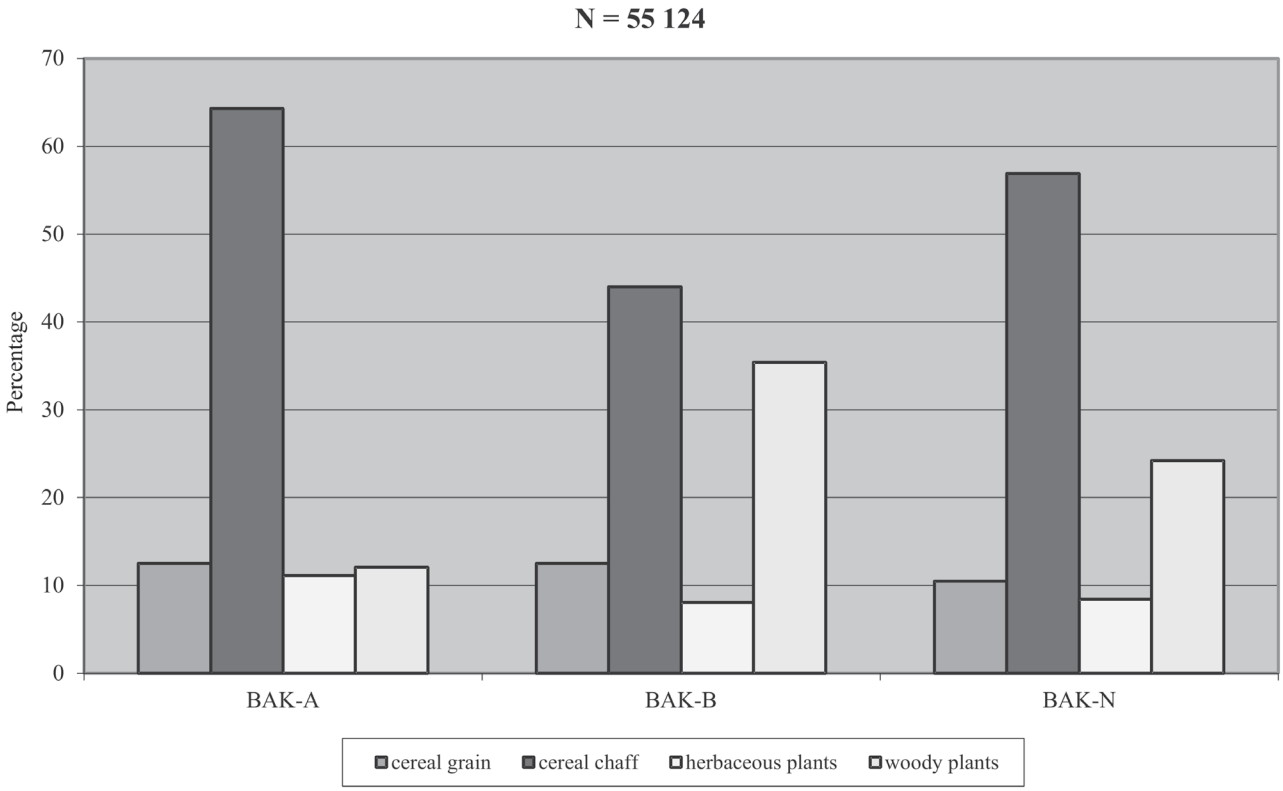
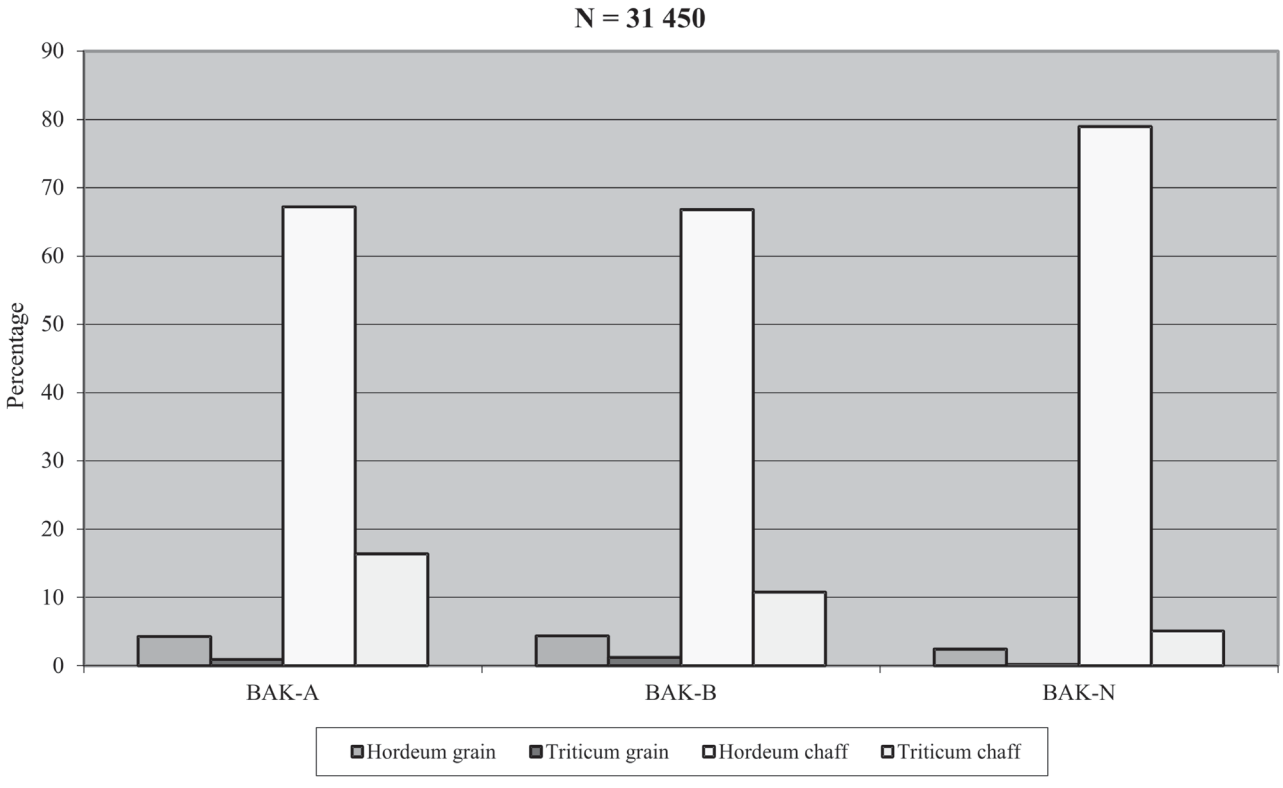


Figure 4 Acacia nilotica: *top, juvenile leaves, and bottom, leaflets, bar 1 mm (drawings by J. Walter).*



Graph 1 Macro remains – sample composition.



Graph 2 Distribution of cereal grains and chaff, excluding unidentified items.

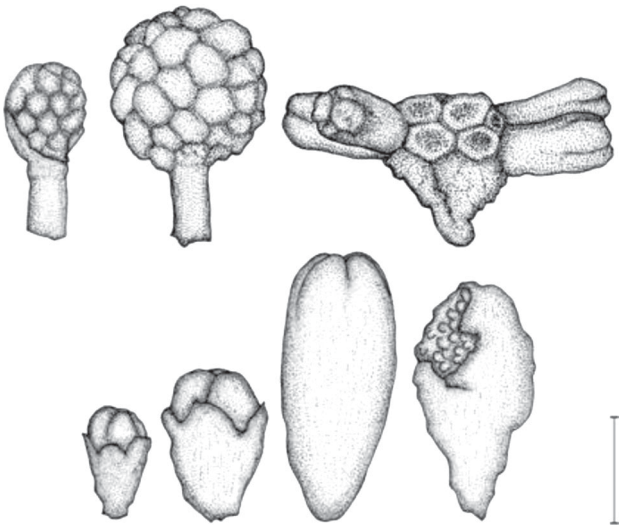


Figure 5 Acacia nilotica: (top) *flower heads and (bottom) flowers. Bar 1 mm (drawings by J. Walter).*

woody plants indicates that the groundwater table was much closer to the surface than it is today or, alternatively, that the necessary water supply was provided via irrigation of field plots.

Acacias are also represented by an abundance of segments of the pod and seeds (Figure 3), of juvenile leaves and mature leaflets (Figure 4), and by flower heads at an early stage of development as well as flowers (Figure 5). Small *Acacia* twigs are often fed to domestic stock and are frequently browsed by goats. However, it seems unlikely that the delicate flowers would have survived digestion. Their presence in the assemblage thus indicates that green wood was used as fuel. Another source of fuel was tamarisk, both *Tamarix* cf. *nilotica* as well as *T. aphylla*.

Discussion

The overall sample composition from H13/I13 (Graph 1) in all three types of deposit, i.e., from floors or above, from below floors, and from areas where no floors are present, is very similar, and the marked difference in pottery assemblages from above and below floors (see below) is not mirrored in the archaeobotanical results. The botanical assemblages are always dominated by chaff, with barley remains far outnumbering emmer wheat (Graph 2). The assemblages do, however, differ in certain aspects. In areas where no floor was present emmer wheat is less well represented than in the other areas, and a strong emphasis on woody plants is visible in the assemblage from below floors.

The plant remains indicate that the area was indeed one where cereals, mainly barley, were processed, quite possibly to make bread. The occurrence of grinding querns as well as an abundance of the typical bread moulds corroborates the assumption that grinding of cereals and baking took place here. However, analysis of bread remains dating to the Dynastic Period indicates that the main ingredient was generally emmer wheat (Samuel 2000, 558). Most data, however, come from the New Kingdom. Conversely, if bread is defined as baked dough made from a starchy ingredient, every other cereal becomes a possible raw material. Other food preparations might have taken place here as well, and an obvious possibility would have been brewing, an assumption entirely based on the prevalence of barley, the cereal most widely used in beer production.

The wild herbaceous and woody plants represent the fuel. Chaff may have been incorporated in the assemblage either directly, when the by-products of cereal processing were disposed of in the fire, or via animal dung, when they were fed to domestic stock. That dung was used in addition to wood is attested by charred dung fragments, some of them with incorporated rachis segments and nutlets of sedges. Although the sturdy, pointed leaves of sedges seem unfit for animal feed, cattle in the oasis graze on them today. (UT)

Faunal Evidence

A large sample of bone, tooth and mollusc shell specimens has been recovered from the 'bakery' area (squares H13/I13) at 'Ain el-Gazzareen. The vertebrate fauna comprises 14 mammals, six birds, and two fish (Table 3). Shells of five molluscs are also represented. The most numerous mammals are domestic cattle (*Bos taurus*) and goat (*Capra hircus*), and wild Dorcas gazelle (*Gazella dorcas*). The faunal spectrum fits within the fauna recovered from other areas of the site and differs from that recovered from the Roman Period settlement of Kellis (Ismant al-Kharab) in lacking some domesticates. The faunal evidence was recovered from a sandy-clayey matrix in which dewatering and loading structures are evident, indicating damper conditions than at present.

The vertebrate and molluscan fauna represented in the bakery area was recovered from the 21 Rooms (I–XXI) within this area (Mills 1995), and 11 samples of unspecified location on the site.

Materials

Most faunal remains (partial bones, shells etc.) derived from depths of 0–60 cm below the surface, though specimens came from as deep as >100 cm in Rooms I and II. Samples were also obtained from surface debris. Table 4 lists the distribution of taxa and specimens by room, space, or loci and levels. All taxa are equally likely to occur above or below floors (Table 5), though the specimens are more numerous above the general floor level.

Bone fragments or teeth of the domestic goat (*Capra hircus*) are the most numerous, being identified in all 21 features and absent only from levels 0–20 cm in Rooms VII and XIV (19/21) and 20–40 cm in Rooms VI and XIX (19/21); otherwise *Capra* is well represented in levels

Table 3 Faunal List from the Bakery Area, 'Ain el-Gazzareen, Dakhleh Oasis.

Mammalia

Homo sapiens – man
Canis ?familiaris – domestic dog
Fennecus zerda – desert fox
Sus scrofa – domestic pig, intrusive
Bos taurus – domestic cattle
Capra hircus – domestic goat
Equus caballus no loc. Surficial, intrusive
Asinus asinus – donkey or domestic ass
Gazella dorcas – Dorcas gazelle
Alcelaphus buselaphus – bubal hartebeest
Oryctolagus cuniculus – domestic rabbit
Lepus capensis – Cape hare
Mus mus or *Acomys cahiranus* – Egyptian house mouse or spiny mouse
Gerbillus pyramidium – greater jird

Aves

Columba livia – rock dove or pigeon
Gallus gallus – domestic chicken, intrusive
Anas platyrhynchos – domestic or mallard duck
Anser anser – domestic goose
Struthio camelus – ostrich
indet., small birds – variable, some small wading birds

Pisces

Clarias anguillaris – Nile catfish
(*Scapanorhynchus rapax* – Cretaceous fossil shark tooth – intrusive by human agency)

Mollusca

Etheria elliptica – Nile oyster
Melanoides tuberculata – freshwater turret snail
Pila ovata – freshwater apple snail – ? intrusive
cowrie – marine, unidentified
clam – marine (?cf. *Pecten* sp.)

Table 4 Faunal samples from the Bakery Area (Squares H13 and I13), 'Ain el-Gazzareen, Dakhleh Oasis.

Samples listed by features and levels.
All specimens are skeletal elements, or fragments when unspecified, or another structure, e.g., ostrich egg or snail shell. For English common names, see Table 3. Loci are within H13 or I13 are combined, with rooms, spaces or features identified by Roman numerals. Depths below grade in centimetres. Floor levels given when known.
Abbreviations: g = grams; > = deeper than level given.
Samples of questionable provenance are omitted.

Locus No.	Depth cm	Taxa (**MNI**), specimens, bone wts (g). Waste (grams) in brackets, e.g., [250g].
I	Surface	*Bos* 45g, *Capra* 20g [40g]
	10–20	*Bos* 260g, *Capra* 45g, *Gazella* vertebra, *Melanoides* shell, *Etheria* shell fragment. Awl, *Capra*. [100g]
	10–30	*Bos* **1**+ 215g, ?*Capra* 410g, *Gazella* 15g, ?*Anas* shaft fragment, cowrie shell. [150g]
	Floor below 30 cm:	
	30 1st Floor	*Gazella* - metapodial bone bead. 2 Awls, *Capra* metapodia.
	30–50	*Bos* **2** 305g, *Capra* **3** 50g., *Melanoides* shell, *Pila* shell.
	Room 4I	*Capra* **1** juv. 25g.
	50–70	*Bos*, horncore 755g, *Capra* **2,** horncore 170g, ?*Canis* small, lumbar vertebra, *Oryctolagus* tibia, ?*Anas* dorsal vertebra. Awl, *Capra*. [150g]
	>200 (test pit)	?*Bos* 15g, *Capra* **1**, horncore, fragment, *Lepus* lumbar vertebra, ?*Anas* fragment. [105g]
	Test pit ?>200	*Bos 25g, Capra* **4** 300g, *Oryctolagus* vertebrae, calcar, ribs, *Mus* jaw, tibia, *Anser* humeral fragment, Aves *indet*. small. [75g] Awl, *Capra*.
	Below floor and test pit.	*Bos* 155g, *Capra* 35g, Aves *indet*., small, longbone, *Etheria* shell fragment. [20g]. ?Mixed sample.
I Silo (originally named 'Oven')	No level	*Bos* **2** 265g, *Capra* **5** 365g, *Gazella* **1** 20g. [330g]
	Silo, in pot.	*Bos*, ?*Anas*.
	Silo, brick floor.	*Gazella* 5g.
	1–40 Silo	*Mus* femur and humerus.
	30–40 Silo	*Bos* 30g, *Capra*.
II	Surface	*Bos, Capra* 20g, *Gazella*, *Melanoides* shell. [45g] 2 Awls, *Capra*.
	10–20	*Bos* 15g, *Capra* 30g. [5+g]
	10–30	*Bos* **5** 1145g, *Capra* **13+**, horncore 925g, *Gazella* **5** 125g, *Oryctolagus*, ?*Mus* or *Acomys*, *Anas* **1** 10g, Aves *indet*. shaft and shell fragments (?*Gallus* fragments, intrusive), *Melanoides* 2 shells, *Etheria* 4 valves and fragments. 2 Awls. [280g]
	20–40	*Bos* **3**? 830g, *Capra* **13–17**+, 2 horncores 1320g, *Gazella* 5g, *Lepus,* thoracic, 2 lumbar vertebrae, *Melanoides* shell, *Etheria* shell fragments, Aves *indet*., small, long legged, tarsometatarsus. 3 Awls, 1 *Bos* and 2 *Capra*. [5250g].

Table 4 continued

Locus No.	Depth cm	Taxa (**MNI**), specimens, bone wts (g). Waste (grams) in brackets, e.g., [250g].
	65–80	*Bos* **1** 110g, *Capra* **3** 300g, *Oryctolagus*, *Anas* **1**, *Columba*, *Clarias*. 3 Awls, *Capra*. [150g, mainly *Capra*]
	80–Floor	*Bos* **1** 100, *Capra* ?**5** 125g, *Gazella* **1** 20g, *Oryctolagus*, *Gerbillus* innominate, *Mus /Acomys* pelvis, femur, tibia, *Struthio* eggshell fragments. 3Awls. [45g]
	Floor at ± 90 cm	
	90–115	*Bos* 140g, *Capra* **4**, 1 juvenile 430g, *Oryctolagus*, *Struthio* eggshell fragments, Aves *indet*. small, *Etheria* valve fragments 20g. Awl. [100]
	115–140	*Bos* **1** 100g, *Capra* **3**, 1 juvenile 455g, *Gazella* **1** 35g, rodent bones, *Struthio* egg shell fragments 100g. Awl. [100]
	140–165	*Capra* **4** 425g, *Asinus* **1** 25g, *Oryctolagus*, *Columba* **2**, *Anser* **2**, *Struthio* egg shell fragments.
	165–190	*Capra* **1** 5g.
	Test pit	*Capra* 20g.
	Floor below bench	*Bos* **1** 75g, *Capra* **4+**, horncore 230g, Gazella], *Struthio* eggshell fragments, ?*Anas*. [80g]
	Pot 1	2 Awls, *Capra*.
	Pot 2	*Gazella* **2**, 3 horncores 40g, *Etheria* valve and fragments. 2 Awls, *Capra*, right tibia, 3 long bone rings.
	Pot/Jar 3	*Bos*, Capra **1**, horncore 70g, *Gazella* **1** 25g, Aves *indet.*, *Etheria* valve flake, small shell. [25g]
	Pot 4/Jar 4	*Bos* **2** 260g, *Capra* ?**1** 35g, ?*Sus* ulna fragment, (? Intrusive). [25g]
	Pot 5	*Capra*, Aves *indet.* [10g]
	Pot 6	*Capra*.
III	10–20	*Bos* 85g, *Capra* **2** 135g, *Oryctolagus* (ribs), ?*Anas* or *Anser*. Awl, *Capra*.
	10–30	*Bos* 10g, ?*Capra* 90g, *Gazella* **1** 20g, *Equus*, phalanx II, ?*Anas* and other small bird bone fragments. [10g]
	20–40	*Bos* 35g, *Capra*, horncore 330g, *Oryctolagus* calcaneum, ?*Anser* humeral shaft fragments, *Clarias* pectoral spine, *Melanoides*. [75g]
	40–>50	*Bos* and juvenile 75g, *Capra* **2,** horncore 210g, *Gazella* 5g, ?*Fennecus* ulna, *Struthio* egg shell fragments, *Melanoides* shell, 'clam' shell fragment. [85g].
	70–100	*Bos* 60g, *Capra* **5+**, horncore 145g, *Gerbillus* femur, *Struthio* eggshell fragments.
	Sample 1	*Capra* **2** 30g.
	Sample 2	*Bos*, *Capra* 100g, ?*Anas*, *Gerbillus* tibia. Awl, *Capra*, plaster pre-bead.
	Sample 4	*Bos* **1** 280g, *Capra* ?**5** 325g, *Gazella* **1** 40g, *Oryctolagus*, *Mus/Acomys*, *Struthio* egg shell fragments, ?*Anas*, *Melanoides*. 3 Awls, 2 *Gazella* metatarsals, 1 *Capra* indet. [50g]
	Floor at unknown depth.	
IV	Floor	*Bos* fragment, *Capra* 100g, including scrap.
	10–40	*Bos* 50g, *Capra*, horncore 50g, *Alcelaphus* molar, *Melanoides* shell. [10g]
	10–30	*Bos* **1** 45g, *Capra* 170g, *Oryctolagus*, canid caudal, *Struthio* eggshell fragments. [35g]
	20–40	*Bos*, skull fragments 310g, *Capra* **2**, horncore 200g. [80g, 50:50 *Bos* and *Capra*]. Awl, *Capra*.
	30–50	*Bos* 10g, ?*Capra* 55g, ?avian bone fragment. [45g]
V	10–20	*Bos* 55g, *Capra* 55g, *Gazella* 35g, *Scapanorhynchus* tooth. [35g]
	10–30	*Bos* **2** 260g, *Capra* **7+** 195g, *Gazella* **1**, horncore 20g, *Lepus* or *Oryctolagus* tibia and ulna, *Struthio* egg shell fragments, Aves *indet*. small shaft fragments and phalanx. 2 Awls, *Capra*. [165, some fire scorched]
	20–40	*Bos* 50g, *Capra* 55g, *Etheria* shell fragments. [10g]
	Upper floor >40; lower floor unknown.	
	between floors >40	*Bos* 20g, *Capra* fragment, ?*Anser* fragment, *Struthio* egg shell fragment.
	below floor 2 ?>60	*Bos* 75g, *Capra* **2** 140g, *Gazella* 15 g, *Oryctolagus*, 2 lumbar verts, ?*Anas* fragment, ?*Etheria* shell flakes. [60g]
	30 1st Floor	*Bos* **1** 450g, *Capra* **4+** 375g, *Gazella* **1** 20g, *Oryctolagus* humerus, Aves indet., small. Awl. [270g]

Table 4 continued

Locus No.	Depth cm	Taxa (**MNI**), specimens, bone wts (g). Waste (grams) in brackets, e.g., [250g].
VI	10–20	*Bos* 85g, *Capra* 30g, *Melanoides*. [20+]
	40–60	*Bos* fragments, *Capra* fragments and juvenile, *Struthio* egg shell fragments. *Melanoides*. [60g] Awl, *Capra*.
VII	20–40	*Bos* 25g, *Capra* **2**, horncore. [25g]
VIII	10–20	*Bos* 140g, *Capra* juvenile 85g, *Oryctolagus* metacarpal and femur. [45g]
	20–40	*Bos* 730g, *Capra* **2**, horncore 380g, *Oryctolagus* (various elements, some rodent gnawed), *Struthio* egg shell fragments, ?*Anas* longbone fragments. [200g] 2 Awls, *Capra* 1 radius.
	Above Floor, >40	*Capra,* horncore 60g, ?*Anas* shaft fragments. Awl, *Capra* radius.
	Floor at 40 cm	
	60–80	*Bos* 50g, *Capra* **3** 125g, avian fragments. Awl, *Capra* or *Gazella* juvenile metacarpal.
	Pot	'mouse mummy', *Mus*, not *Acomys*. **Depth 20–30, as was rabbit scapula in NW corner**.
IX	10–20	*Bos*, *Capra* 60g, Aves *indet*. longbone shaft, *Melanoides* shell. Awl, *Capra*.
IX–X	40–60	*Capra* 105g, *Gazella*, *Gerbillus* tibia, *Struthio* egg shell fragment, Aves *indet*., small humerus, *Melanoides* 2 shells, *Etheria* shell fragment. [125g]
X	10–20	*Bos*, *Capra* 10g, ?*Mus* humerus and tibia.
XI	10–20	*Bos* 60g, *Capra* 160g, ?*Anas* longbone fragments, *Struthio* egg shell fragments, *Oryctolagus* or Aves *indet*. fragments, *Melanoides*. [scrap]
	20–40	*Bos* **1** juv. 45g, Capra, horncore 85g (scrap), *Gerbillus* femur, *Etheria* shell fragment. Awl, *Capra* radius.
	40–60	*Bos* fragments, *Capra* 110g, *Oryctolagus*, lumbar vertabra, *Melanoides* shell. [50g].
XII	10–20	*Bos* 30g, *Capra*, horncore 20g, *Gerbillus* os innominatum. [15g]
	>40	*Capra* fragment. 55g, *Struthio* egg shell fragment. [70g]
XIII	10–20	*Bos* 30g, *Capra*, jaws and fragments 55g, *Columba* wingbone. [35g]
	20–40	*Bos* 245g, *Capra* **5**, horncore 225g (scrap), Aves *indet.*, small, humeral shaft. [50g]
XIII+XIV	Wall between squares.	*Capra* [10g].
XIV	20–40	*Bos* fragment, *Capra* **2/3**, horncore 310g, *Gazella* fragments, *Struthio* egg shell fragments. 30g.
XV	10–20	*Bos* 40g, *Capra* **3**+, horncore 225g, *Oryctolagus* humerus, Aves *indet*. small, many fragments. [55g]
	20–40	*Bos* 55g, *Capra* ?**4** 225g, ?*Fennecus* dentary and radius, *Gerbillus* hind limbbones, ?*Anas* coracoid, *Struthio* egg shell fragments 5g, *Etheria* shell fragment. Awl, *Capra*. [50g].
	40–60	*Bos*, *Capra* **3,** horncore 100g, *Struthio* egg shell fragments 20g, *Melanoides,* shell, cowrie shell. Awl, *Capra*.
XVI	Dep. 2	*Bos* 325g, *Capra* 25g. [65g]
	10–20	*Bos* 170g, *Capra* 80g, *Gazella*, *Fennecus* canine, ?*Anser* longbone shaft, *Melanoides* 2 shells, *Etheria* shell fragment. [70g]
	20–40	*Bos* 45g, *Capra* **3** 180g, *Oryctolagus* tooth, jaw and femur, *Struthio* egg shell fragments, *Etheria* shell fragment. 3 Awls, *Capra* metapodia.
XVII	10–20	*Bos* 60g, *Capra* 90g, *Anser* shaft fragment, *Melanoides* shell. [15g]
	20–40	*Bos* 170g, *Capra* ?**2**, horncore 175g, *Homo* R supraorbital fragment, *Struthio* egg shell fragment, Aves *indet.* small longbones. Awl, *Capra*. [80g]
	>50	*Bos* 360g, *Capra* **2** 125g, *Gazella* 5g, *Oryctolagus* **2** metatarsals, ?*Anas* fragments, *Melanoides* shell. 2 Awls, *Capra*. [60g]

Table 4 continued

Locus No.	Depth cm	Taxa (**MNI**), specimens, bone wts (g). Waste (grams) in brackets, e.g., [250g].
XVIII	10–20	*Bos*, *Capra* 35g, *Struthio* egg shell fragments, *Melanoides*. 2 Awls, 1 pointed, 1 blunt *Capra,* metapodia.
		Floor at 27 cm.
		Under 1st Floor *Bos* 85g, *Capra* 10g, *Oryctolagus* scapula. [35g]
XIX	10–30	*Capra* 40g, *Struthio* egg shell fragments.
	30–100	*Bos* **1** 80g, *Capra* ?**5** 190g, *Gazella* **1** 10g. [50g]
		Floor at unknown depth.
XX	10–30	*Bos* **1** 260g, ?*Capra* 100g, *Oryctolagus* innominate, ?*Anas* humeral end and longbone shaft. Awl, point only *Capra*. [50g]
XXI	10–40	*Bos* **1** 110g, *Capra* **2+**, horncore 235g, *Gazella* 10g, *Struthio* egg shell fragments.
		Floor at ± 40 cm.
	50–80	*Capra* 190g, *Fennecus* right maxillary fragment, *Gerbillus* maxilla. Awl, *Capra*.
	80–100	*Capra* ?**4+** 110g, *Gazella*, ?*Anas*
No square and no feature: only significant finds listed.		
	Surface	*Capra*, horncore, *Vulpes* ulnar olecranon, *Pila* shell and fragment (?aeolian intrusive). 2 Awls, *Capra*
	5–10	*Equus* tooth (? *Asinus* - modern intrusive), *Pila* shell (?aeolian intrusive). 2 Awls.

Table 5 Distribution of Cattle, Goat and Dorcas Gazelle in Bakers' Squares H13 and I13 by Feature (Room or Space) and Level.

*Roman numerals indicate features (Rooms, Passages, etc.; see Figure 2). The three most common animals indicated by 'B': cattle (*Bos taurus*), 'C': goat (*Capra hircus*) and 'G': Dorcas gazelle (*Gazella dorcas*).*
Two cattle records '[B]' are located between H13 and I13 and from levels 60–80 and 80–100; one goat 'C' record is from between IX and X from level 20–40; a cattle, goat and gazelle record 'BCG' is from XIX from combined level 40–100.
Daggers '†' indicate levels from which bone awls have been obtained.
Levels or Depths from Surface are in centimetres.

cm	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI		?
Surface	BC	BCG†																					BC†
0–20	BCG†	BCG†	BCG†	BC	BCG†	BC		BC	BC	BC	BC	BC	BC	BG	BC	BCG	BC	BC†	C	BC†	BCG		BCG†
20–40	BCG†	BCG†	BC	BC†	BC†		BC	BC†	C		BC†	C	BC	C	BC†	BCG†	BCG†	BCG		BC	BCG		BC
40–60	BC†		BCG	BC	BCG	BC†					BC				BC†		BC†				C		
60–80	BC	BC†	C		BC			BC†											BCG		C†	[B]	C
80–100		BCG†																				[B]	
100–120	BCG†																						
120–140	C†																						
140–160	C																						
160–180	C																						
> 200	BC†																						

40–60 cm (9/21) and 60–80 cm (7/21). Fragments of domestic cattle (*Bos taurus*) are next most numerous, being present in all features, but are absent only from levels 0–20 cm in Rooms VII and XIX (19/21) and 20–40 cm in Rooms VI, IX, X, XII, XIV and XIX (15/21). The next most widely distributed taxon is the wild Dorcas gazelle (*Gazella dorcas*) which is present in 9 features (levels 0–20 cm 6/21 and 20–40 cm 7/21). Both *Bos* and *Gazella* are found to a depth of 100 cm in Room I. Distributional analyses by feature and excavation levels show that the three main mammalian taxa and their elements are distributed evenly through the upper levels of the site (Table 5). The less common taxa are distributed randomly, with none of their occurrences being sufficiently concentrated in one feature or level to suggest a changed cultural or environmental circumstance. The fauna recovered from the Bakery therefore reveals no introduction of a new animal, nor of a change in living circumstances.

Bird bones are poorly represented and fragmentary. They confirm the presence of domestic duck (*Anas platyrhynchos*) and goose (*Anser anser*) and of commensal pigeon (*Columbia livia*) (Table 3). Elements from small birds, probably passerines, are sparsely scattered through the samples. No skeletal fragments of ostrich (*Struthio camelus*) are present, despite the presence of many fragments of ostrich egg shell.

Fish is represented only by spines of a Nile catfish (*?Clarias anguillaris*), though its vertebrae are also recorded from elsewhere in ‘Ain el-Gazzareen (Churcher 2000).

Fragments of molluscan shells are sparsely present, with only fragments of the valves of the Nile oyster (*Etheria elliptica*) being conclusively integral within the site. Pulmonate snail shells may be intrusive from more recent times. The turret snail (*Melanoides tuberculata*) is recovered from levels above 60cm, and usually above 40 cm, which may indicate that it was endemic at the time of the site’s occupation: it is present in the area today and was also in Romano-Egyptian times. The apple snail (*Pila ovata*) was recovered only thrice, and may be intrusive. Shells of both snails may have been wind derived from later Roman-Egyptian deposits and redeposited.

Observations on Taxa and Comments

General

Table 3 lists the vertebrates (Mammalia, Aves and Pisces) and molluscs (Mollusca) that were identified from the Bakery Area. All taxa listed here are also present in the fauna identified in the Roman Period settlement of Kellis (Churcher 2002a), in the east of the central oasis, but ‘Ain el-Gazzareen lacks the later domesticates – pig (*Sus scrofa*), camel (*Camelus dromedarius*), chicken (*Gallus gallus*) and sheep (*Ovis aries*; Churcher 2000). Horse (*Equus caballus*) is represented by a single tooth (unlocated 5–10 cm) and is considered intrusive. Donkey (*Equus asinus*) (found in Room II at 140–165 cm) probably represents an early domestic pack animal: it has also been recovered from the surface (0–25 cm) and at that level is probably recently intrusive. Rabbit (*Oryctolagus cuniculus*) is common but not plentiful and shows it to have been a staple food item, though its bones suffer much taphonomic destruction.

Representation of the wild Saharan fauna (Churcher *et alii* 2008; Hollett and Churcher 1999) is sparse, except for Dorcas gazelle (*Gazella dorcas*), as only a single lower molar from a Bubal hartebeest (*Alcelaphus buselaphus*), an ulna and a tibia of the Cape hare (*Lepus capensis*) or a rabbit may show the local presence of the African hare, a jaw fragment and a possible ulna (Room III 40–50+ cm) of a fennec fox (*Fennecus zerda*), and fragments of egg shell, but no bone, of ostrich (*Struthio camelus*) have been recovered. No wild large birds such as waterfowl or Houbara bustards (*Chlamydotis undulata*) are recorded, but remnants of domestic mallard ducks (*Anas platyrhynchos*), domestic geese (*Anser anser*), and pigeon (*Columba livia*), and small commensal birds are scattered throughout the samples. The widely distributed gazelle remains and less common Cape hare (*Lepus capensis*) elements imply a maintained hunting or snaring effort for these small herbivores, with the hartebeest’s tooth suggesting that larger antelopes were taken if the opportunity arose, but were either not hunted regularly or had been so reduced locally that the efforts were seldom successful.

Mammals

Most of the larger mammalian elements show ancient green breaks into marrow cavities by mauling for the extraction of marrow fat by boiling. Some bones are burnt, charred or calcined, but these conditions are probably from chance inclusion in a fire and not from roasting or grilling, as the articular ends are not preferentially burnt. The presence of scavenging dogs, jackals or foxes (*Canis familiaris*, *C. mesomelas* or *Vulpes vulpes*) and striped hyaenas (*Hyaena striata*) (Churcher 2000; 2002b) probably resulted in many smaller and more easily consumed or swallowed items disappearing from the record when left lying exposed. Thus large cattle bones or numerous goat elements resulted in the preservation of reasonable samples. While gazelle remained reasonably represented, its sample size may have been considerably reduced from the actual numbers obtained by hunting. Rarer or more fragile animals’ bones, such as those of rabbits or hares, were scavenged by any carnivores that were present. Note that no remains of domestic cat (*Felis catus*) were recovered.

Birds

The domesticated birds were probably free ranging and scavenging, as they are in the villages of the oasis today. Pigeons are effectively commensal, and live in columbaria or dovecots. Ostrich bones are absent from the sample so far obtained from ‘Ain el-Gazzareen and only egg shell fragments have been recovered. It is unclear whether the

eggs were gathered for food or whether only shell fragments were collected.

Fish

Fish remains are not expected from local sources, and isolated spines of a Nile catfish (*Clarias anguillaris*) probably indicate traded dried fish from the Nile Valley. No vertebrae, fins or heads were found in the bakery area, though vertebral centra and a pectoral girdle element were recovered from elsewhere in 'Ain el-Gazzareen (Churcher 2000), attesting that the fish were filleted before drying.

A single tooth of the Cretaceous shark *Scapanorhynchus rapax* was recovered (Room V 10–20 cm). It is intrusive as there are no nearby Cretaceous bedrock outcrops, and the shallow level for the recovery of the shark's tooth (10–20 cm) means it is likely intrusive but militates against it being derived from some Cretaceous bedrock that lies below. This well-preserved specimen was probably brought in as a curiosity: this may have happened during 'Ain el-Gazzareen's occupation or subsequently.

Molluscs

The freshwater turret snail (*Melanoides tuberculata*) is a modern denizen of vegetation in the irrigation ditches in the oasis and is found in Roman hydraulic works (Churcher *et alii* 2008). It is present in 16 samples from depths to 50 cm and probably favoured the moist environment that was present during the Old Kingdom occupation, as evinced by the plastic clayey soil. The freshwater apple snail's (*Pila ovata*) shells are common in Roman hydraulic works, especially in dredged well-eyes, but it is apparently extinct in the oasis today as it was not found during Hollett and Churcher's (1999) survey. It is present here in only three samples, one in Room II at 30–50 cm, and two without location, one at 5–10 cm and one surficial, so it could be intrusive by aeolian intervention from a Roman site or, less likely, naturally occurring. If naturally present in the oasis during Old Kingdom times, it would probably have found the moist environment of the 'Ain el-Gazzareen locality too dry. Nile oyster (*Etheria elliptica*) valves or shell fragments occur in 13 samples. This bivalve occurs only in the Nile River, and its valves had to have been traded into Dakhleh Oasis for use as scrapers or spoons. Unfortunately the valves delaminate or spall only to leave small flakes when left in damp ground, as was much of the 'Ain el-Gazzareen site, but whole valves, when showing wear use, have ground or worn edges from scraping inside pots or on dishes, or even sharp edges suitable for use as knives.

Two marine cowrie shells from Room I (10–30 cm) and Room XV (40–60 cm) represent shells traded probably from the Red Sea. Both are whole, and possibly were intended for conversion into decorative beads. The shells are discoloured by the damp soil and are unidentified to taxon. A small fragment of a thick-shelled clam (?cf. 'Pecten' sp.) was recovered from Room III at >40 cm depth. This also has to have been traded from a coastal locale.

Horncores

The vertebrate materials included many horncores. Goat (*Capra*) is represented by 44 (male) horncores; cattle (*Bos*) by a single horncore and Dorcas gazelle (*Gazella*) by a pair of male horncores. No female gazelle horncores were recovered. It is noteworthy that no horncores of sheep were found and, in the presence of the large sample of goat horncores, this absence is considered evidence for their absence during Old Kingdom times in Dakhleh Oasis: sheep were apparently also absent from Dakhleh during the Roman Period (Churcher 2002a).

Modified Bones and Shells

The inhabitants of 'Ain el-Gazzareen made robust awls or fids from mammal long bones; 62 of these have been recovered from the bakery area. Unfortunately the identities of the awls' skeletal units and species were not recorded during the early seasons and thus the consideration below is incomplete. It was not possible to see and record all the awls that were recovered from the bakery area as some were recognized during excavation at the site and catalogued as artefacts.

Awl Tally:
Capra – 52 (recognized elements are 1 tibia, 2 radii, 5 metatarsals: 44 unidentified)
Bos – 1 (element unidentified)
Gazella – 1 (element unidentified)
Capra or *Gazella* – 1 (metacarpal).

Eleven awls were recovered from surface debris, in samples from unrecorded levels, or from within pots or vessels. Four awls have no location data. Goat longbones and cannon bones or metapodials were the preferred elements for adaptation. Awls were made by cutting the bones obliquely longitudinally to remove the posterior face and one articulation, thus retaining the stronger anterior wall of the shaft, and then grinding the broken surfaces smooth and into tapered and bluntly conical spikes. The remaining articular facet served as a pommel that fits the palm of the hand. One awl had a flattened blunt point (Room XVIII 10–20 cm), and may have been used for smoothing or decorating pottery, though at present no evidence for pottery production at 'Ain el-Gazzareen is known. Only one broken awl (tip, Room XX 10–30 cm) was recovered.

Awls are scattered throughout the bakery area (and the site) and are present in all excavated levels (Table 5). They concentrate in two discrete zones, one in Rooms I, II, and VIII and the other in Rooms XV, XVI, XVII and XVIII: the former yielded 21 awls and the latter 10. Thus this consideration is based on a partial sample from the bakery area and does not relate to the whole of 'Ain el-Gazzareen (see 'Awl Tally' above). Rooms I, II and VIII are adjacent and share a common entrance way (Figure 2). No awls were recovered from within the silo which, if it was a grain silo, is reasonable. Rooms XV, XVI, XVII and XVIII

are less orderly. Rooms XV and XVII are conjoining but XVI and XVIII are unlocated in Figure 2.

Sections of goat and gazelle longbone shafts were detached (Room II Pot 2). These are rough edged rings suitable for later finishing as beads or other objects.

Birds: The ostrich egg-shell fragments show no signs of preparatory work for bead manufacture nor of exposure to fire, though such partially finished and completed beads are evident elsewhere at the site. Blown eggs could have been used as water flasks or the eggs could have been broken and the contents transferred to pottery containers for cooking. No indication of such uses, nor of the eggs being baked in whole or in partial shells, is present. As noted above, no indication of the shell fragments being collected as whole eggs rather than as post-hatching fragments is available.

Molluscs: Two cowrie shells (marine snails) were recovered. These have lost their natural shiny and patterned outer surfaces and no attempts to identify them were made as they were unlikely to be successful. Both were whole, without any bored holes or other modification. Possibly they were intended as ornamental beads.

Nile Oysters: Due to the delamination of the valves, no worn edges were observed and thus no determination of possible use could be confirmed.

Turret and Apple Snail shells: Some of these shells are fragmentary and show evidences of aeolian sand blasting. This supports the likelihood of aeolian transportation.

Summary

The vertebrate and molluscan fauna from the bakery area in the Old Kingdom settlement of ʻAin el-Gazzareen reflects in taxa those obtained from the wider excavated areas (Churcher 2000). It also resembles that obtained from Kellis (Ismant al-Kharab) in the eastern limits of the central area of Dakhleh Oasis but differs in lacking later domesticates (e.g., pig, camel, horse, cat, chicken) (Churcher 2002a).

The major protein sources were cattle and goats, whose bones and teeth constitute the major osseous sample, with those of the wild Dorcas gazelle the third most numerous. Rabbit is present throughout the sample, but sparsely, as is the wild Cape hare. Dog and donkey are present but not numerous; it is possible that the use of donkeys for transport was still developing within the Old Kingdom desert economy (Jousse and Escarguel 2006). Duck and goose are present, but again not numerous, and together with pigeon, probably scavenged and gleaned in the settlement and its surrounds.

These limited vertebrate resources show that, with the exception of Dorcas gazelle and Cape hare, little use was made of the wide range of savannah species (Pöllath 2009) and the meat economy depended on domestic animals. Only a single tooth of a hartebeeste was identified, attesting that, if they were taken for meat, they were not a major source, a statement supported by their complete absence from ʻAin Aseel to date (Pantalacci and Lesur-Gebremariam 2010, 248). Wild birds are absent from the faunal sample with the exception of the ostrich, represented only by egg shell fragments. There is thus no information as to whether the eggs were collected from nests for food or only shell fragments were collected for other uses. No beads or shell preforms for beads were noted.

Only the freshwater turret snail is considered to have inhabited the irrigation ditches during the Old Kingdom occupation of Dakhleh Oasis. The apple snail present in the Roman time irrigation and hydraulic excavated spoil is considered to be a wind-borne intrusive present only in the upper layers of ʻAin el-Gazzareen. Valves of the Nile oyster are present in the site's matrix but these are delaminated and partial. They show importation from the Nile Valley and a probable use as spoons, scrapers or small dishes, but their uses cannot be determined because of their disintegrating conditions which destroy any worn edges or pigment stains.

The animal information from the bakery area reinforces that obtained from the other excavated areas of ʻAin el-Gazzareen, and shows that the animal economy of Dakhleh Oasis did not significantly change in 2,000 years, despite the introduction of new animals into the economy. (CSC)

Ceramic Evidence

The 'bakery' area of ʻAin el-Gazzareen yielded a very large assemblage of ceramic material during the course of the excavations. A wide variety of vessel forms was recovered, though the assemblage in general was dominated by large jars, large bowls, Meidum bowls, and bread moulds (Pettman, this volume, figure 5). Such a large collection of ceramic material from a small area makes this assemblage ideal for close study, particularly in relation to the issue of food production at ʻAin el-Gazzareen, where the ceramic evidence can also be corroborated by archaeobotanical and archaeozoological evidence.

In this section I will address several key aspects of the ceramic assemblage from the 'bakery' area at ʻAin el-Gazzareen:

1. Is the proposed function of this area as a bakery borne out by a detailed study of the ceramic assemblage?

2. The scale of food production in this area;

3. Evidence for other types of food production in this area not related to the baking of bread;

4. What the ceramic evidence indicates of the identity of the users of the site and the origins of their food-production techniques.

Evidence for Baking Activity in H13/I13

As stated above, previous publications referring to H13/I13 at ʻAin el-Gazzareen have identified this area as a bakery (Mills 1995, 64; this volume). The main reason for this identification was the dominant presence of bread mould fragments amongst the ceramic assemblage, along with the presence of ash from fires and grinding querns, and a brick silo in Room I. While this seems a reasonable assumption upon a preliminary examination of the evidence, a more in-

depth examination of this material was necessary to determine if it supported the original suggestion of the function of this area. Furthermore, little analysis of the material excavated from below the floor levels has been undertaken, and thus it is hoped that this assessment will indicate if the initial development of H13/I13 was as a bakery, or whether it had another function and was later converted to a bakery.

The use of ceramic assemblages to infer the function of an area or site is a well-known archaeological technique. The methods employed are discussed elsewhere (Pettman, forthcoming with references) and will therefore be only briefly outlined here. The theory that underpins using ceramics to determine site function is that specific objects were created to perform specific tasks (Hodder 1986, 126–7), and their presence in an area or site can imply the activities undertaken there through their function. This theory, therefore, relies on the ability to determine accurately the function of particular objects. With regard specifically to ceramic vessels, four main types of evidence can be used to achieve this aim:

- Pictorial evidence depicting particular vessels being used to perform certain tasks (Paice 1989; Rice 1987, 210; see also Hawass and Senussi 2008)
- Contextual evidence from other sites where independent evidence indicates site function (Rice 1987, 211; see also Jacquet-Gordon 1981)
- Vessels which are found with their contents intact
- Morphological evidence from the vessel itself (i.e., presence of a spout would indicate that a vessel was used to hold liquid).

Once the function for individual vessel types has been determined, the types of activity which took place in an area or at a site can be inferred according to the function of the objects found there; the greater the number of objects with the same function, the stronger is the evidence for that activity being undertaken.

The ceramic assemblage within H13/I13 at 'Ain el-Gazzareen includes a variety of forms. Conical-shaped bread moulds in a rough, heavily straw-tempered iron-rich fabric (fabric A4)[1] are dominant in the assemblage. Large bowls in iron-rich A1 or A2 fabrics, with or without surface treatment, are also common and often occur with a rim diameter of over 30 cm; other bowls with smaller rim diameters in the same fabrics are also well-represented in this area. The most common surface treatment for bowls is a red slip, occasionally polished, though cream slips also occur. Jars occur in a variety of forms and fabrics; the most common forms are slender, necked types with direct or modelled rims in A4 fabric. Jars are also represented in finer fabrics, often with a red slip which is also occasionally polished; handled jars are present but rare. The ubiquitous Meidum bowl, in endless variations of wall height, carination angle and aperture index, is also present, and is always shown with an orange, red or plum coloured polished slip. Pot stands are not common and generally occur in fine, iron-rich A2 fabric and often with a red slip.[2]

A variety of corroborative evidence is available which can imply the use which these vessel types served. The function of the conical bread moulds discovered in such abundance in this area is supported by Jacquet-Gordon's (1981) study of bread mould types, as well as the same identification given to virtually identical vessels from the Giza cemetery (Reisner 1955, 88) and el-Hawawish (Hope 2006, 34), and the reliefs from the tomb of Ti which show these vessels being used to bake bread (Steindorff 1913, plates 83–86). At el-Hawawish, jars were generally constructed of porous fabric as they were not intended for the long-term storage of fluids (Hope 2006, 34); however, many of the jars found within H13/I13 are of A2 fabric, often also with evidence of compaction, indicating their suitability to hold liquids for greater periods of time. Thus, they may have been used to store water, and perhaps also flour, to create the bread dough. Large bowls were certainly present in significant numbers above the floor, and these may have been utilised for mixing bread dough, as suggested for similar vessels by Förster (2007, 4). Certainly from a morphological perspective, their large size and large aperture make them ideal for mixing significant quantities of bread dough. Hendrickx *et alii* (2002, 278) suggest that Meidum bowls were also used for the preparation of bread dough. A further suggestion is that they were also 'used directly in eating' (Hendrickx *et alii* 2002, 277), which is supported by their abundance both at 'Ain el-Gazzareen, and the so-called 'watch post' sites in the east of Dakhleh Oasis, where little evidence of food production is to be found (Kaper and Willems 2002, 89). Reliefs from the tomb of Niankhkhnum and Khnumhotep at Saqqara (Moussa and Altenmüller 1977, figure 10) also show Meidum bowls being used in this way. Thus, all vessel types present in H13/I13 have a function which is easily connected to bread production, as well as the consumption of food or similar domestic activity, thereby supporting Mills' original proposal that this area was used to bake bread.

However, a simple analysis of the function of vessel types is insufficient here to determine whether H13/I13 was used as a bakery throughout its history. As mentioned previously, prior to this analysis little work had been undertaken on the material from below the floor levels; thus, further quantitative analysis was undertaken to determine whether there was sufficient evidence from the levels below the floor to indicate the baking of bread as there is above the floor. To this end, a ratio of bread moulds to non-bread moulds for the material from above and below the floor in each room was calculated. This was achieved by calculating the number of whole vessels of each main group (bread moulds, bowls, Meidum bowls, jars and pot stands) in each context, by adding together those rim

[1] All fabric designations are those of the Dakhleh Oasis Project typology (Hope 2004).

[2] See Pettman (this volume, figure 5) for a representative sample of vessel types common in the 'bakery' area of 'Ain el-Gazzareen.

Table 6 Numbers of whole vessels calculated for contexts in H13/I13.

Room	Below Floor					Above Floor				
	Bread Moulds	Meidum	Bowls	Jars	R/Stands	Bread Moulds	Meidum	Bowls	Jars	R/Stands
I	33	22	18	14	3	181	108	139	35	8
I silo	24	15	17	5	3	57	8	13	0	1
II	36	54	16	9	0	153	118	190	72	3
III	31	10	14	5	0	60	7	5	1	0
IV	-	-	-	-	-	69	9	23	10	0
V	between floors: 4	0	3	0	0	43	24	33	30	3
	below floor 2: 16	5	2	7	1					
VI	-	-	-	-	-	30	6	4	2	0
VII	-	-	-	-	-	15	9	0	4	0
VIII	-	-	-	-	-	62	12	1	9	0
IX/X	-	-	-	-	-	18	12	11	14	0
XI	-	-	-	-	-	35	16	9	7	0
XII	-	-	-	-	-	32	15	10	4	2
XIII	-	-	-	-	-	27	4	2	6	0
XIV	-	-	-	-	-	29	11	9	4	0
XV	-	-	-	-	-	60	28	42	23	2
XVI	-	-	-	-	-	32	12	13	7	0
XVII	-	-	-	-	-	73	45	26	20	7
XVIII	13	14	14	7	0	-	-	-	-	-
XIX	1	0	2	0	1	26	10	22	7	3
XX	-	-	-	-	-	12	7	2	5	0
XXI	30	5	20	6	0	34	21	25	7	4

Table 7 Percentages and ratios of bread moulds in comparison to other vessel types from H13/I13 contexts. Note that ratios given here are in terms of one bread mould to equivalent number of other vessels.

Room	Below Floor		Above Floor	
	% Bread Moulds	Ratio	% Bread Moulds	Ratio
I	36.67	1:1.73	38.43	1:1.60
I silo	37.50	1:1.67	72.16	1:0.39
II	31.30	1:2.19	28.54	1:2.50
III	51.67	1:0.94	82.19	1:0.22
IV	-	-	54.05	1:0.61
V between floors:	57.14	1:0.75	32.33	1:2.09
below floor 2:	51.61	1:0.93		
VI	-	-	71.43	1:0.4
VII	-	-	53.57	1:0.87
VIII	-	-	73.81	1:0.35
IX/X	-	-	32.73	1:2.06
XI	-	-	52.24	1:0.91
XII	-	-	52.46	1:0.97
XIII	-	-	69.23	1:0.44
XIV	-	-	54.72	1:0.83
XV	-	-	38.71	1:1.58
XVI	-	-	50.00	1:1
XVII	-	-	42.69	1:1.34
XVIII	27.08	1:2.69	-	-
XIX	25.00	1:3	38.24	1:1.62
XX	-	-	46.15	1:1.17
XXI	49.18	1:1.03	37.36	1:1.68

fragments of the same type with the same fabric, surface treatment and rim diameter. These results are included in Table 6. Those rooms without a discernible floor level were considered alongside the above-floor material. A ratio of bread moulds to other vessels was also calculated, as well as the percentage of the ceramic vessels consisting of bread moulds for each context, found in Table 7.

A similar high ratio of bread moulds to non-bread moulds in both contexts would indicate that this area likely did function as a bakery throughout its use: a different ratio between the above- and below-floor material would necessitate the consideration of other possibilities for the function of that context. The actual numbers of each vessel type present in each context were also considered: while a similar ratio of vessels above and below the floors might indicate a similar function, the numbers of whole vessels should give a good indication of the scale of that activity also.

Both the ratio of bread moulds to other vessels, and numbers of whole vessels of each type, indicate a clear dominance of the above-floor material by bread moulds. In all but one context, bread moulds are the most numerous vessel type: in some cases, they account for over half the number of vessels in that room and may be present in numbers many times that of other vessel types. Rooms I and II also show a large number of bowls, perhaps showing that the creation of bread dough occurred there. Pot stands are rare in general, as are spouted vessels (included in this case amongst the jars), while jars account for a significant proportion of the assemblage in most rooms and may have been used to store ingredients for the bread, such as ground flour or water. Meidum bowl numbers vary greatly between rooms, though it is interesting to note that in Rooms I and II, where the largest collection of vessels were discovered, they account for a significant proportion of the whole assemblage. The Meidum bowls may either show that meals were taken by, or prepared for, the inhabitants in these rooms, or that dough mixing was also performed in small batches, or both.

Other archaeological evidence from above the floor supports the suggestion that this area was utilised as a bakery. Twenty-nine grinding querns and five handstones were also uncovered amongst this material, which were probably used to grind grain (Mills 1995, 64): the discovery of a silo in Room I supports this view. Copious deposits of ash found throughout many of the rooms in this area are probably representative of the open fires used to bake bread in the Old Kingdom (Mills 1995, 64). Early work on the botanical remains indicated that emmer wheat and barley were well-represented in H13/I13 (Mills 2002, 76), both well known to have been staple ingredients of the ancient Egyptian diet, a statement corroborated by Thanheiser's more extensive analysis above.

The material below the floor, however, is far less indicative of a bakery. First, the raw number of whole vessels in each room is far less than that for the material above the floor: the greatest number of bread moulds in any room is thirty-six, and no room shows over one hundred vessels in total. Furthermore, the ratio of bread moulds to other vessels in many rooms is more in favour of other vessel types. Also, Meidum bowls constitute a much higher portion of the number of vessels in each room. This different ratio of vessel types may show that the occupational levels below the floor are not those of a large-scale bakery as those above the floor are.

Scale of the Food Production Activity in H13/I13

It would appear that bread production during the occupation of the above-floor levels was on a large scale; if the rooms with no floor level are included in the analysis, the number of bread moulds from the above-floor contexts is over one thousand. This large number of bread moulds is probably indicative of food production for a great number of people in this area during the later stages of its use. While exact numbers of inhabitants cannot be extrapolated from the present data, it is here suggested that the presence of several hundred bread moulds in the above-floor material might indicate production for more than simply the inhabitants of the site. It is interesting that this function seems to be a later development than the occupation of the site. It is difficult to suggest whether the processing of meat (see below) was also on a greater scale than necessary for the site's inhabitants, though this possibility cannot be excluded on the current evidence.

The contexts from below the floor levels demonstrate a different situation. Some bread baking must have taken place during the earliest period of occupation in H13/I13, as bread moulds and other vessels associated with that activity are present. However, given that the bread moulds in particular occur in far smaller numbers, and do not dominate the ceramic assemblage as they do in the above-floor contexts, it is likely that the focus of activity in this area was not bread baking. It is perhaps possible that 'Ain el-Gazzareen, in the phase of occupation represented by the material discovered in these below-floor contexts, did not yet have the need for an area able to produce large quantities of food and thus may have had a different function. The total number of bread moulds from below-floor contexts is less than one hundred and fifty vessels, significantly less than the later strata. However, the silo which is evident in Room I also extends below the floor, indicating that grain was stored in this area during the earlier strata and therefore supporting the suggestion that bread baking did occur, albeit at a lesser scale.

Further research into the length of use of an Old Kingdom bread mould needs to be undertaken before any more can be said about the scale of food production in H13/I13. While 1,000 bread moulds seems considerable, it is not yet known how many times a bread mould could be used prior to breaking given their exposure during the baking process to a hot, open fire (Mills 1995, 64). Therefore, the possibility must not be discounted that the above-floor contexts from this area may instead represent a much smaller scale of activity than is suggested here, perhaps of only a few years' duration.

Evidence for Other Forms of Food Production

Despite the abundant evidence for bread baking in this area, other evidence was discovered which does not indicate activity generally connected with a bakery. Room XVI showed a collection of chert flakes and blades, with arrowheads and other flint tools found throughout the strata in this area (Mills 2002, 76). Furthermore, H13/I13 also yielded a significant collection of animal bone fragments, including domesticated species such as cattle and goat, and wild Dorcas gazelle (Mills 2002, 76; see above). Reliefs from the tomb of Sekhemka at Saqqara show Meidum bowls being used during the butchering of a cow (Murray 1905, plate VII), and perhaps some of the large collection of these vessels found at 'Ain el-Gazzareen were used for the same purpose. Pantalacci and Lesure-Gebremariam (2009, 249) suggest that lists of game found at 'Ayn Asil likely record live animals which were captured and then brought back to the site to be butchered, and so it seems logical to suggest that a similar practice was carried out at 'Ain el-Gazzareen also, with the butchering taking place in H13/I13. On the basis of this evidence, the 'bakery' area should probably instead be referred to as a 'kitchen' or similarly generalised food preparation area.

Identity of the Users of H13/I13

In all aspects observed, the ceramic assemblage from H13/I13 parallels closely ceramic forms used in the Nile Valley. While Nile Valley fabrics were clearly not available to the potters living in Dakhleh Oasis, it seems that a conscious effort was made to choose local clays which resembled the Nile Valley silts and marls as closely as possible. The shape of the vessels also shows obvious attempts to reproduce forms known and used in the Nile Valley during the Old Kingdom (Hope 1999a, 215).

Several of the vessel forms were also discovered to have pot marks, which were incised on the vessel either prior to, or after, firing. It is not certain whether these marks were intended to denote the contents of the vessel, its maker or owner, a problem which is common to many studies of pot marks (Hope 1999b; Soukiassian *et alii* 2002; Aston 2009); nevertheless, their presence at 'Ain el-Gazzareen contributes valuable data with regards to the identity of the inhabitants of this site, and the users of H13/I13. The predominant marks are single or multiple lines or crosses, though geometric and possibly animal shapes also occur (Pettman 2008, Appendix 3). Many of these pot marks show a close resemblance to potmarks from the settlement of 'Ain Aseel (Minault-Gout and Deleuze 1992; Soukiassian *et alii* 1990; Soukiassian *et alii* 2002), which can be shown through other evidence to have been at least partially inhabited by Egyptians from the Nile Valley (Giddy 1987).

It is known that the indigenous Sheikh Muftah people were still resident in Dakhleh Oasis alongside the Egyptians during the Old Kingdom (McDonald 2002, figure 3). The ceramic material from H13/I13 does include a small quantity of forms which appear to be from this ceramic tradition, and the Sheikh Muftah site Locality 404 is only a short distance from 'Ain el-Gazzareen itself. Contact and influence between the two groups at this location is therefore possible. However, the great majority of the material from H13/I13 - and indeed, from 'Ain el-Gazzareen in its entirety - is clearly in forms from the Egyptian Nile Valley ceramic tradition, indicating a deliberate desire to mimic those traditions, even at such a great remove from the Nile Valley. While archaeological debate continues regarding the connection between ethnic groups and material culture (in particular, see Jones 1997), and the possibility for other scenarios should be entertained, in this case the mostly likely explanation is that 'Ain el-Gazzareen was inhabited solely or mostly by Egyptians from the Nile Valley or their descendants who chose to deliberately transport their material culture with them to Dakhleh Oasis. (AJP)

Summary

The combination of archaeobotanical, archaeozoological and ceramic evidence discussed here suggests several conclusions regarding the activities undertaken both within the 'bakery' area, and at the site of 'Ain el-Gazzareen in general.

The botanical evidence indicates that the inhabitants of 'Ain el-Gazzareen, rather than relying on the gathering of local wild plant species, as the Sheikh Muftah people did, preferred to cultivate domesticated Nile Valley grains as a major part of their diet, particularly emmer wheat and barley. These species are known to have been cultivated as crops in the Nile Valley during the Old Kingdom and it is logical to suggest that their cultivation was a technique introduced by the Egyptian settlers or colonists of 'Ain el-Gazzareen as elsewhere in the oasis. The people who lived at 'Ain el-Gazzareen deliberately and consciously chose to use new subsistence strategies that were hitherto unknown in Dakhleh Oasis.

The abundant archaeozoological evidence clearly indicates that the original function suggested for H13/I13 must be widened from 'bakery' to 'kitchen'. The butchering and cooking of both domesticated and hunted, wild animals shows that varied food production activities were undertaken in this area, and the corroborative ceramic evidence strengthens this argument. There seems to have been a greater reliance upon the domesticated species than wild hunted animals at this site, a situation which contrasts with the textual evidence from 'Ain Aseel that indicates regular hunting forays into the desert for game (Pantalacci and Lesur-Gebremariam 2009, 254).

Ceramic evidence indicates a strong desire to continue Nile Valley ceramic traditions. This complements the archaeobotanical and archaeozoological evidence for the use of Nile Valley techniques for processing grain into bread and the butchering of animals. Furthermore, at least the baking of bread was undertaken on a greatly increased

scale in the later levels, which have been dated to Dynasty VI (Pettman, this volume). The fact that vessel types which were in widespread use in the Nile Valley during the Old Kingdom were also being used at 'Ain el-Gazzareen, shows a desire to maintain all aspects of food production within the customary Egyptian culinary traditions.

It was briefly mentioned, when discussing the ceramic data, that bread production in the above-floor levels may have been greater than necessary to supply the inhabitants of the site. This possible evidence for the production of large batches of bread within H13/I13 during Dynasty VI, the date assigned to the above-floor levels, is connected to the provisioning function of 'Ain el-Gazzareen and perhaps even more widespread events that occurred at this time. 'Ain el-Gazzareen lies in a strategic position on a low rise, affording a good view of the surrounding land. Two different roads leading out of Dakhleh Oasis toward Farafra Oasis pass close to, and are visible from, the site, and traffic along these roads could easily have been monitored and controlled from there. This resembles the siting of 'Ain Aseel at the eastern end of Dakhleh Oasis, and from which the Darb el-Arba'in and the Darb el-Tawil are visible. The location of both these sites can hardly be accidental, and so part of their function may have been related to traffic passing along these roads (Giddy 1987, 169, 208; Pettman 2008, 112; Redford 1976, 8).

During Dynasty VI, there is ample evidence that the Dakhleh Oasis formed part of a trade route which passed through the Western Desert to regions to the south and west. In the biography of Harkhuf it is recorded that his third journey to Yam was along the oasis road. While the debate regarding the location of Yam continues, recent suggestions are that Harkhuf's route passed through Dakhleh Oasis (Giddy 1987, 211; O'Connor 1986; Pettman 2008, 113; Smith and Giddy 1985, 325). The Abu Ballas Trail, leading from Dakhleh Oasis 350 km to the south-west perhaps to the Gilf el-Kebir (Förster 2007, 1), may also have formed part of Harkhuf's route to Yam. Ceramics along this route indicate that traffic to and from Egypt passed along the Abu Ballas Trail in the late Old Kingdom and early First Intermediate Period (Förster 2007). Hope (2007, 408) has also suggested that another starting point for this trail was located at 'Ain el-Gazzareen. It is further possible that traffic from the Nile Valley may have reached this western part of Dakhleh Oasis by way of Farafra Oasis, though it should be noted that at present any evidence for the use of any roads through Farafra Oasis has not been noted. If Harkhuf's account of his journey through the desert is indicative of other such trading missions undertaken by Dynasty VI officials, Dakhleh Oasis may well have witnessed the passage of many trade caravans making the journey from the Nile Valley to regions to the west and south, and their return journeys laden with goods.

Such trading missions, however, faced the problem of food provisions in a harsh environment; 'small groups of desert travellers could hardly have carried more than the provision in water and food they and their animals would need for the journey' (Förster 2007, 2–3). If such travellers intended to carry trade goods with them on the return journey, some method of regularly re-stocking their provisions was necessary. In order to alleviate this problem, and perhaps also to increase the number of trade goods able to be brought back to the Nile Valley, it was important for those embarking on trade expeditions taking this route through the desert to have well-known, and regularly spaced, stops for them to obtain provisions. Förster (2007) has shown convincingly that way stations along the Abu Ballas Trail served this function and must have been periodically restocked with essential provisions such as water and grain. Thus it would be essential and convenient to establish provisioning bases in productive oasis locations and to resupply way stations with food and water from there. Sites in Dakhleh Oasis, particularly 'Ain el-Gazzareen, are ideally located for such a function.

'Ain el-Gazzareen's function as a provisioning stop in its own right is shown by both its geographic location and the evidence from the 'kitchen' area discussed here. While the strategic position of 'Ain el-Gazzareen allowed the inhabitants to easily observe traffic along some oasis roads, this would also have allowed travellers to obtain provisions without a significant detour from their route. It is therefore probable that at least a portion of the bread that was baked in 'Ain el-Gazzareen's 'kitchen area' was intended not for the site's inhabitants, but instead for travellers who stopped there on a much longer journey from the Nile Valley into the desert. Other provisions may also have been taken out to the Abu Ballas Trail way stations to restock them. While it is difficult to determine the scale of meat production which was undertaken, the possibility of meat products also being prepared as provisions for these travellers must be entertained. Indeed, the presence of fish bones indicates that dried fish from the Nile Valley was carried to Dakhleh, and does suggest that travellers with provisions specifically designed for long journeys regularly passed through the oasis.

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