Quaternary International xxx (2016) 1–11

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

The earliest phase of introduction of Southwest Asian domesticated animals into Africa. New evidence from the Fayum Oasis in Egypt and its implications

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Egypt
Holocene
Archaeozoology
Livestock
Fish
Preservation

ABSTRACT

The oldest records for Southwest Asian domesticated livestock species in Egypt date to the late 7th but mainly the 6th millennium cal BC and are among the earliest known evidence from the African continent as a whole. The records were obtained from Egypt's Eastern and Western Desert, where only cattle and caprines are present, and are not associated with evidence for cultivated crops. It takes until the 5th millennium cal BC before significant numbers of sites, with significant numbers of bones of domesticated species appear. In the Fayum Oasis, the sites of Kom K and Kom W date to this period and these have generally received most attention in the context of early stock keeping. However, older evidence for domesticated stock has also been found in the Fayum. We describe new faunal data from the early and middle Holocene, at and around the E29H1 locality, including the oldest remains of domesticated caprines recorded from the Fayum up to now (ca. 5600 cal BC). Based on the new finds, we emphasise the need to also investigate surface sites. We argue that much of the earliest history of stock keeping in Egypt is skewed by a lack of evidence. The remaining fauna from E29H1 shows the importance of fish. This is a common feature of all prehistoric sites of the Fayum and indicates adaptations to the local environment.

1. Introduction

The Fayum Oasis in northern Egypt (Fig. 1) is a natural depression separated from the Nile Valley by a ridge known as the Nile-Fayum divide (Sandford and Arkell, 1929). In the course of the Holocene, Nile floodwaters are thought to have repeatedly reached the height of the channel cut in this divide, and transformed the depression into a series of lakes (Said, 1993), of which the present Lake Qarun is a remnant. In 2008, salvage archaeology work was carried out at locality E29H1at the northern edge of Fayum (Fig. 2), in the concession of the **U**niversity of California, Los Angeles, USA, the **R**ijksuniversiteit Groningen, the Netherlands, and the **U**niversity of Auckland, New Zealand (URU). In 2012 the wider area around E29H1 was also investigated. The investigations were undertaken in the framework of large scale archaeological work in the north of the Fayum Oasis, in order to understand prehistoric land use and occupation (Holdaway and Wendrich, submitted for publication). Faunal remains collected were studied by the first author as part of a postdoctoral research project on the transition to food production in northeastern Africa. Unexpectedly, at E29H1 evidence from the earliest phase of appearance of Southwest Asian domesticated animals in Egypt was found. This evidence and more importantly its implications for the study of early stock keeping in Egypt are presented below.

1.1. Current state of evidence for early stock keeping in Egypt

The area within the borders of modern Egypt is very important for the reconstruction of the spread of stock keeping over Africa as a

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http://dx.doi.org/10.1016/j.quaint.2015.12.028
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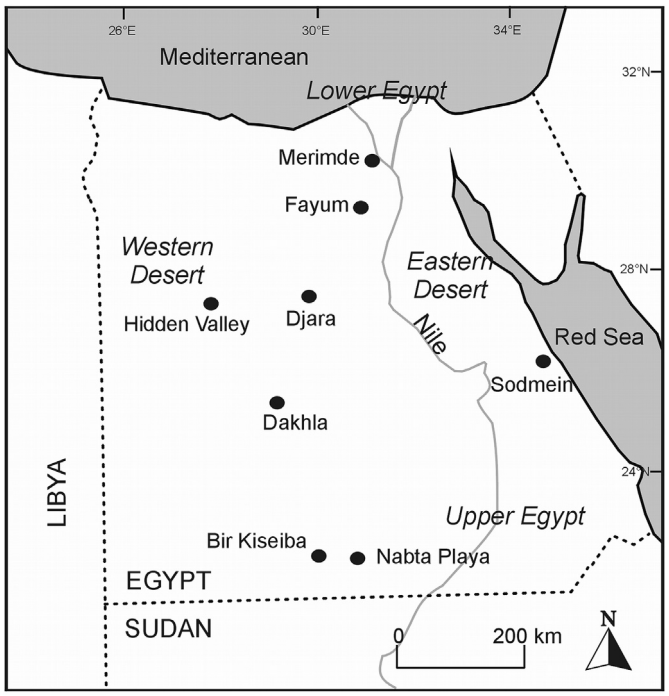

Fig. 1. Map of Egypt with indication of sites and regions mentioned in the text and tables. See Fig. 2 for the location of sites inside of the Fayum.

whole. There is a general consensus that this area served as an overland corridor through which domesticates from Southwest Asia passed before they reached other parts of the continent (Blench and MacDonald, 2000). However, recent archaeological data suggest that in coastal areas of northern Africa, the expansion of agricultural economies was accomplished through several waves of seafaring, as in other parts of the Mediterranean (Zeder, 2008; Barich, 2014). The current evidence also suggests that farming and stock keeping reached the west of North Africa (Morocco) at the same time or earlier than the eastern parts of North Africa (modern day Egypt), pointing to independent routes of dispersal (Barich, 2014).

In order to understand the significance and meaning of newly excavated and studied, large animal bone assemblages from the Fayum "Neolithic" sites Kom K and Kom W (ca. 4500 cal BC), we have recently made a critical assessment of the available archaeozoological evidence for early stock keeping in Egypt (Linseele et al., 2014) (Table 1). These data suggest that there were two phases in the appearance of animal domesticates in Egypt. In the late 7th, but mainly in the 6th millennium cal BC, undisputable evidence for domesticated animals first appears. The numbers of bones recorded for this phase are very limited and all come from the Egyptian deserts, where people with apparently mobile lifestyles had caprines (*Ovis aries* and *Capra hircus*) and some cattle (*Bos taurus*). Key sites and areas include Nabta Playa/Bir Kiseiba (Gautier, 2001) and Hidden Valley Site in the Farafra Oasis (Gautier, 2014) for the Western Desert, and Sodmein for the Eastern Desert (Vermeersch et al., 2015) (Fig. 1). At this stage, there is no evidence for the cultivation of crops. Not all sites in the Western Desert dating to the 6th millennium cal BC have evidence for domestic stock (Pöllath, 2009). However, from the 5th millennium cal BC, numbers of Egyptian sites with domestic animals significantly increase and these also appear in the Nile Valley. The pig (*Sus domesticus*) is added to the list of domesticated species found. Cultivated crops from Southwest Asia are from then onwards also present in the Egyptian archaeological record. Before the appearance of Southwest Asian domesticates, there was a phase with possible management of local wild species in northern Africa. This is proposed for aurochs/wild cattle (*Bos primigenius)* at Nabta Playa/Bir Kiseiba (late 9th/8th millennium cal BC) and this has resulted in the hypothesis that cattle were also locally domesticated (Gautier, 1984, 2002), although this remains highly controversial. In the Acacus in Libya, management of Barbary sheep (*Ammotragus lervia*) at ca. 6000 cal BC is hypothesised (Di Lernia, 2001). This is less controversial than for the African aurochs because the Barbary sheep was never domesticated. In Southwest Asia the major livestock species were domesticated from about the middle of 9th millennium cal BC (Vigne, 2011) and by the 5th millennium cal BC, farming economies reached the western borders of continental Europe (Crombé and Robinson, 2014). Considering its proximity to Southwest Asia, domesticates from this region appear comparatively late in Egypt and this remains one of the key issues in the archaeology of Holocene northern Africa.

Table 1
Egyptian sites dating to the 6th millennium cal BC with numbers of bones of domesticated animals recorded. X = present but numbers not reported. For a summary of the context and more details of these finds see Linseele et al. (2014).

Site	Approximate date (cal BC)	Cattle	Sheep/goat	of which sheep	of which goat	References
QS XI/81 (Fayum)	5400	–	5	1	–	von den Driesch, 1986
QS IX/81 (Fayum)	5350	10	46	7	1	von den Driesch, 1986
Hidden Valley	6200–5500	–	15	min. 1	min. 4	Gautier, 2014
Djara	6500–5900 + 4900	–	1? + 1	1?	–	Kindermann et al., 2006
Dakhla Oasis	6500–5600/5400	x	x			McDonald, 1998, 2013; Churcher et al., 2008
Nabta Playa/Bir Kiseiba	6100–5400	35	120	Mainly sheep		Gautier, 2001
Sodmein	6200–3700	–	10	–	1	Vermeersch et al., 2015

1.2. E29H1 and the archaeology of the northern shore of Lake Qarun in the Fayum Oasis

Apart from the two famous sites Kom K and Kom W, prehistoric traces on the north shore of Lake Qarun generally occur as surface artefact scatters and form a continuous cultural landscape within which there are areas with different types and quantities of features. Despite the shallow nature of deposits, preservation of material is remarkable. The earliest Holocene traces date to ca. 7400 cal BC. Previously, the prehistory of the Fayum was subdivided into an Epipalaeolithic, also described as Fayum B or Qarunian, and a Neolithic phase, Fayum A, in which farming and herding appeared, separated by a gap in the first half of the 6th

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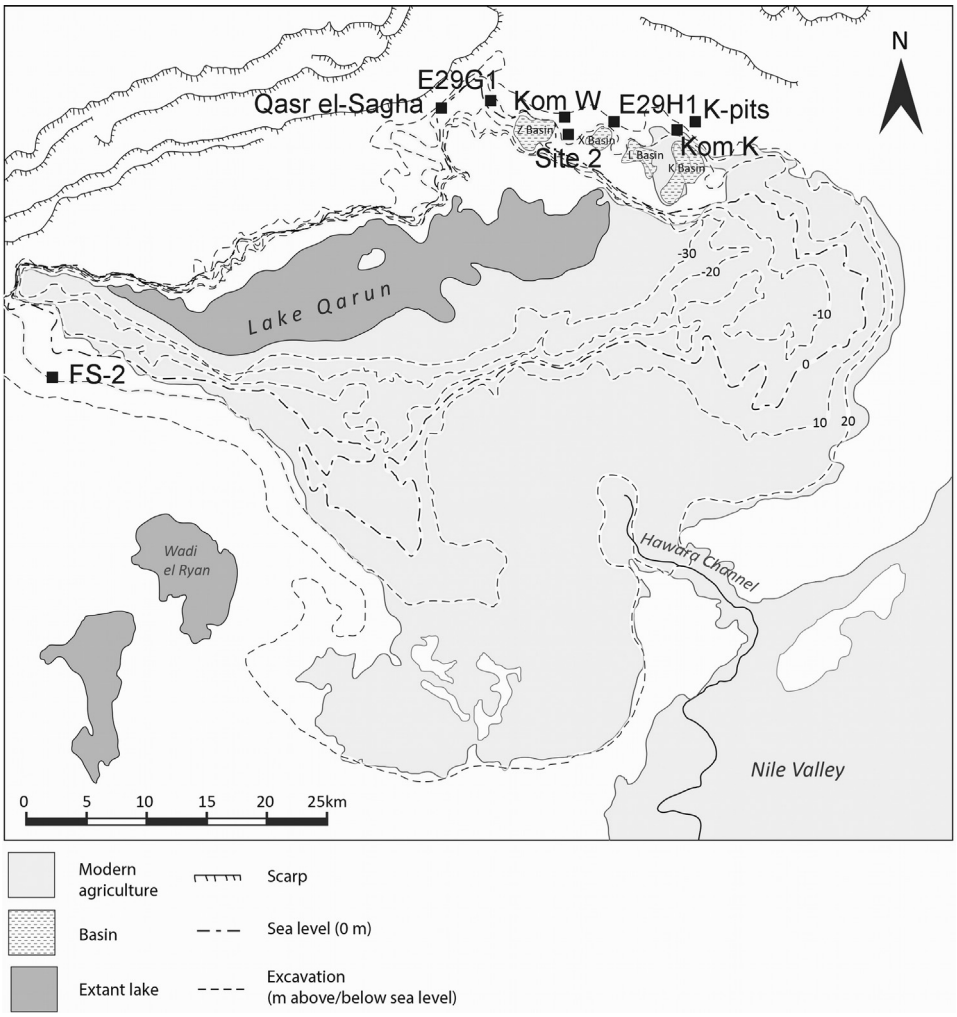

Fig. 2. Map of the Fayum Oasis (from Phillips, 2013, p. 36) with indication of the early and middle Holocene sites mentioned in the text and tables.

millennium cal BC. Domestic stock, cattle, sheep, goat and pigs, are attested mainly at Kom K and Kom W, at ca. 4500 cal BC (Linseele et al., 2014). Cultivated crops from the K pits near Kom K date from approximately the same period (Wendrich and Cappers, 2005; Holdaway and Wendrich, submitted for publication).

Lake Qarun is today about 40 km long in an east-west direction, and 7 km at its widest point, with conditions that are nearly as saline as seawater (Fathi and Flower, 2005). During the early and middle Holocene, Lake Qarun was a much larger, freshwater lake. Its size oscillated through time but there is no evidence for high lake levels after the early Holocene (Koopman et al., 2016). The early and middle Holocene archaeological remains are nowadays in the middle of a desert landscape, but they occur concentrated in a band of several hundred meters from what have been in the past interpreted as ancient lake shores. There is no reason to assume that people occupied the immediate shores of the lake or the lake basins that Caton Thompson and Gardner (1934) identified (Koopman et al., 2016).

In the 1920's, a dense surface scatter with many hearths was first noted on the edge of one of a series of lake basins identified by Caton-Thompson and Gardner (1934), the so-called X-basin. Compared to the other basins, the X-basin is large and shallow. In the 1960s, Wendorf and Schild (1976, p. 182) labelled the locality E29H1 and described it as a spatially extensive distribution of stone artefacts, faunal material and hearths, attributed to the "Epipalaeolithic" occupation of the Fayum. Of all "Epipalaeolithic" traces, Z1 or E29G1, situated at the western edge of the Fayum north shore, is similar in extent and finds (Caton-Thompson and Gardner, 1934, p. 79; Wendorf and Schild, 1976, p. 162). It seems that Site 2 of Brewer (1989, p. 49) is also similar. Neither Caton-Thompson and Gardner (1934) nor Wendorf and Schild (1976) make any reference to the cultural assemblage, but Shirai (2010, 43) thinks it may the most southern part of Caton Thompson's site V. Site 2 is situated about 7 km east of Qasr el-Sagha and thus not so far west of E29H1 (Fig. 2). In November 2008, URU team members discovered that a large-scale agricultural development was being prepared in the area of E29H1. The work planned for that season was therefore halted and over six weeks all efforts were directed towards investigating E29H1. The results of recent archaeological work at E29H1 and the area immediately to the east, referred to as the L-Basin, as well as further east around K-Basin are reported on in detail in Holdaway and Wendrich (submitted for publication).

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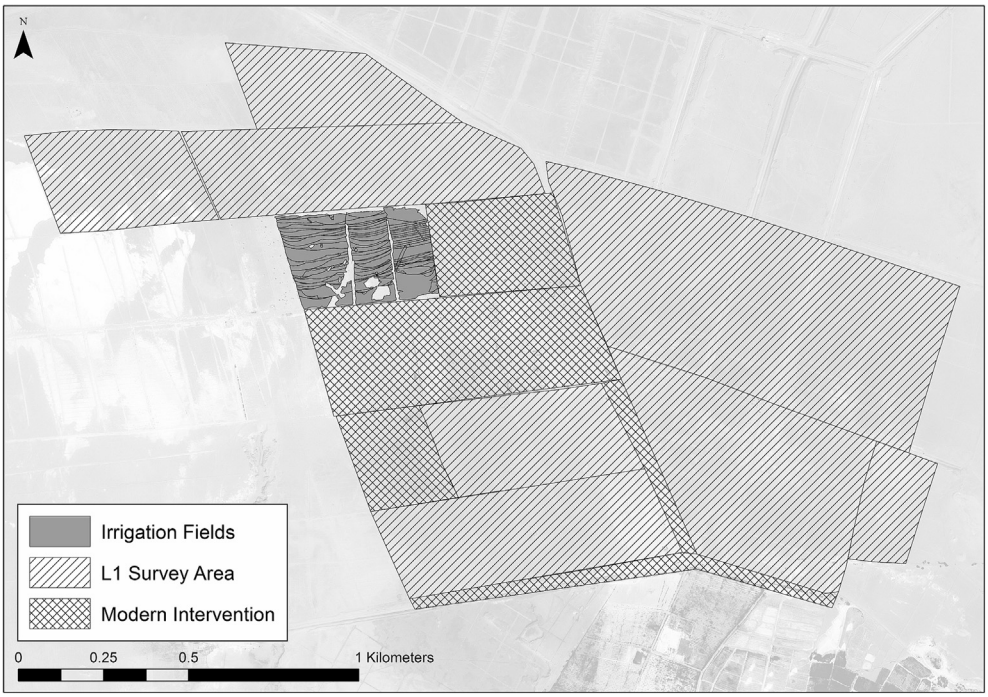

Fig. 3. E29H1 and adjacent areas. The irrigated fields were investigated in 2008, the other parts in 2012. Note the lines in the irrigated fields that represent the PVC irrigation pipes which delimited research units.

2. Material and methods

As mentioned earlier, prehistoric traces in the Fayum Oasis mainly occur as shallow deposits and this includes E29H1. The only features are isolated hearths and otherwise the archaeological traces consist mainly of numerous stone artefacts, ceramics and animal bones. In November 2008, the entire area at E29H1 under preparation for farming activities, comprising three fields totalling ca. 10 ha, was investigated (Fig. 3). Use was made of spatial units defined by PVC irrigation pipes that had been placed by the farmer. Stone, ceramic, bone and shell objects (>20 mm) were located in 3D space with a total station and the underlying surface recorded and described by a geoarchaeologist (Koopman et al., 2016). Lithic artefacts were identified according to class and material, and coded directly as such into the total station. Ceramics and grinding stones were also described. All 38 hearths were excavated in order to determine their structure and more importantly to obtain charcoal for radiocarbon dating. In a number of areas detailed morphological variables were recorded for stone artefacts. In addition to the animal bones logged individually to provide a measure of density, in selected areas animal remains were excavated and collected for further analyses. In five areas with concentrations, Trench 202, 204, 205, 206 and 207 (Fig. 4), the surface was swept in 3 by 3 m squares, and then the collected sediment sieved through 2 mm meshes. In this way, relatively small faunal remains were recovered. In 2012, the larger area around, and mainly east of E29H1, named after another lake basin, the "L-Basin", was surveyed (Fig. 3). A permit to remove samples for radiocarbon determinations was obtained from the Supreme Council of Antiquities in collaboration with the Egyptian Mining Resources Authority (EMRA) (see Holdaway and Wendrich, submitted for publication for more details on methods used for radiocarbon dating). Radiocarbon ages were converted into calibrated (calendar) dates using OxCal 4.1.7 (Bronk Ramsey, 2001, 2009) which incorporates the IntCal13 atmospheric curve (Reimer et al., 2013).

The animal remains collected at E29H1 in 2008 were studied by Veerle Linseele and Sofie Thys at the excavation house or in the store room of the URU project, using a locally built reference collection, in combination with identification keys and reference skeletons, mostly of fish, brought from the Royal Belgian Institute of Natural Sciences (Brussels). Standard records included identified taxon, element, part, colour as compared to the Munsell soil colour chart, number, state of fusion of long bones for the mammals, measurements, Standard Length (SL) estimations for the fish and any visible traces, such as those related to butchery and burning. All observations were made without the use of optical magnification devices. Data were entered directly in an Excel database that could be linked to the other databases of the project. The bones of all squares from Trench 204 were analyzed, while from the other trenches fauna of part of the squares was studied. In addition, faunal remains from excavated hearths were analyzed. In total about 15,000 animal bone remains from E29H1 have been analyzed. It is estimated that about 10,000 bones remain unstudied. Shells have also been collected and studied and are reported in Holdaway and Wendrich (submitted for publication).

3. Results

3.1. Find densities and artefact analyses

At the end of the fieldwork, approximately 80,000 stone artefacts and 14,000 bones had been located and logged. A total of 6292 stone artefacts from a variety of locations across E29H1 were analyzed using a suite of technological variables. The lithics mainly consist of flakes and cores with few retouched tools. Flint is not local to the Fayum and the sources of flint cobbles used during the

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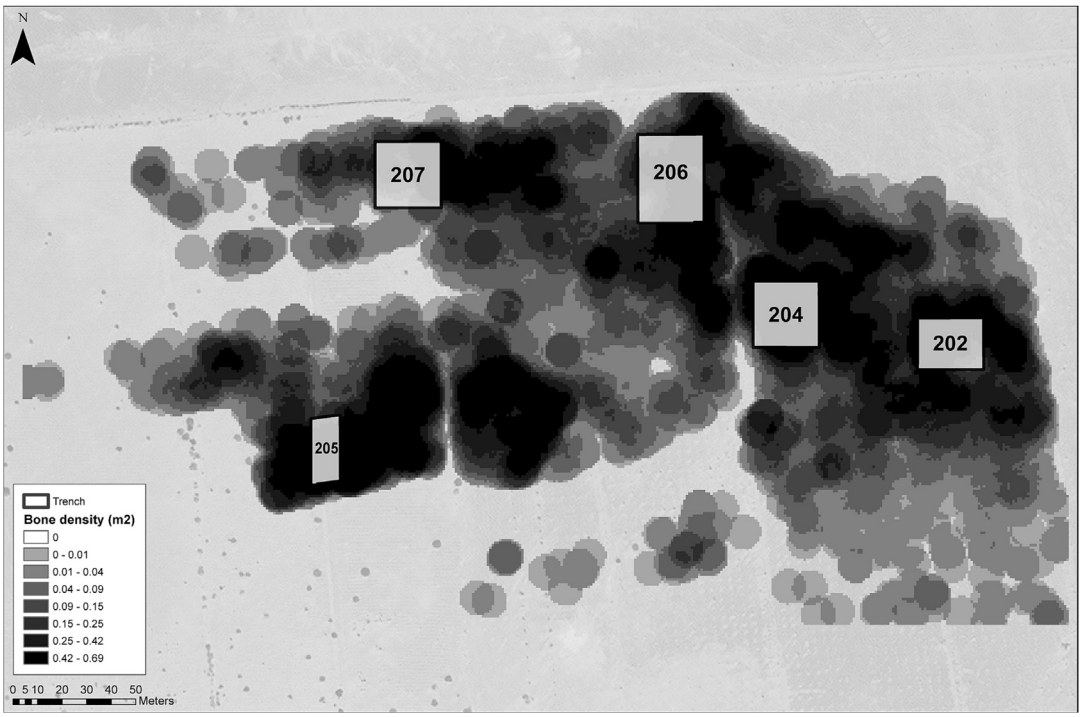

Fig. 4. Bone densities recorded in the area at E29H1 investigated in 2008, with indication of the trenches where bones were collected for detailed analyses. Numbers are trench numbers as mentioned in the text.

early and middle Holocene are still unknown but probably were not constant through time. The new lithic analyses have shown that substantial quantities of flakes from E29H1 were taken elsewhere (Phillipps and Holdaway, 2015). The logged material shows that there is some variation in densities of finds across the surface of E29H1.

3.2. Dates from the hearths

The ages obtained from around 10 hearths in both the E29H1 and L-Basin area to the east, range between ca. 7200 and 4700 cal BC (see Holdaway and Wendrich, submitted for publication for more details). From these dates, it seems that the Fayum has known prehistoric occupation during more of the Holocene than previously thought. Though limited by where suitable hearths for dating were available, the dates suggest that any given location was used for a relatively short period of time, and relatively little overprinting of early dates by later ones occurred. There is no evidence for any significant mixture with later period activity at the E29H1 location. Only a handful of historic items (likely Roman period pottery and Islamic coins) were found, deposited with the thousands of stone artefacts and animal remains.

Fig. 5. Unfused distal sheep radius from Trench 6 at E29H1 submitted for radiocarbon dating.

3.3. Fauna

Tables 2 and 3 summarize the animal taxa identified from the newly collected faunal remains at E29H1. Compared to previous reports from E29H1 and E29G1 (Table 4), the new faunal dataset is very large. This reflects the scale of the 2008 investigations at E29H1. Although not all collected faunal remains were studied, it is clear that samples are of sufficient size for reliable interpretations. Apart from E29H1 and E29G1, two other "Epipalaeolithic" localities in the Fayum with published faunal records are FS-2, on the western shores of Lake Qarun, and Site 2 on the northern shores (Table 4). While only a small number of remains was collected and studied from the former, over 4000 animal bones were identified from the latter. They were collected from the surface in multiple 2 × 2 m collection units and one large 8 × 22 m grid. Only a small fraction of the new faunal remains from E29H1 comes from hearths. These show an impoverished, but similar spectrum to that collected from the surface and the results presented below therefore mainly concern the surface trenches.

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Table 2
Animal taxa identified from the surface trenches at E29H1 investigated in 2008 (numbers of identified specimens).

Trench	202	204	205	206	207	All
Number of 3 × 3 m squares analysed	24	102	36	37	36	235
Fish						
Mullets (Mugilidae)	2	1	–	–	–	3
Elephant-snout fishes (Mormyridae)	1	1	–	–	–	2
Barbel family (Cyprinidae)	3	8	–	1	1	13
Alestes/Brycinus	–	1	–	–	–	1
Catfish 1 (*Clarias* sp.)	–	–	–	1	–	1
Clariid catfish (Clariidae)	168	874	201	416	185	1844
Catfish 2, Bagrid catfish (*Bagrus* sp.)	–	22	1	3	1	27
Catfish 3 (*Synodontis schall*)	–	2	–	2	–	4
Synodontis sp.	23	185	1	25	4	238
Nile perch (*Lates niloticus)*	60	254	7	40	55	416
tilapia (Tilapiini)	354	335	4	88	59	840
Pufferfish (*Tetraodon lineatus*)	9	37	83	28	18	175
Identified fish	620	1720	297	604	323	3564
unidentified fish	1190	1856	88	590	486	4210
Amphibians						
Toad (Bufonidae)	30	7	–	5	1	43
Frog or toad (Batrachia)	25	26	–	4	5	60
Reptiles						
Softshell turtle (*Trionyx triunguis*)	–	20	20	16	27	83
Small lizard	1	–	–	–	–	1
Snake (Serpentes)	–	1	–	–	–	1
Birds						
Great crested grebe (*Podiceps cristatus*)	1	2	–	–	–	3
Stork (Ciconiidae)	–	–	–	1	–	1
Duck (Anatidae)	10	22	1	2	2	37
cf. Duck (Anatidae)	–	–	–	1	1	2
Goose (size *Alopochen aegyptiaca*)	–	1	–	–	–	1
Goose (size *Anser anser*)	1	–	–	–	–	1
Coot (*Fulica atra*)	2	8	–	2	2	14
Common raven (*Corvus corax*)	–	1	–	–	–	1
Rail (Rallidae)	–	–	–	1	–	1
Small Passeriformes	1	–	–	–	–	1
Identified birds	15	34	1	7	5	62
Unidentified birds	64	114	6	28	52	264
Ostrich (*Struthio camelus*) eggshell	–	1	2	–	–	3
Bird (not ostrich) eggshell	–	–	–	48	–	48
Wild mammals						
Bats (Chiroptera)	4	1	–	–	–	5
Small rodent	6	4	–	–	–	10
Hare (*Lepus capensis*)	1	–	–	1	1	3
Hippopotamus (*Hippotamus amphibius*)	–	–	3	–	–	3
Dorcas gazelle (*Gazella dorcas*)	1	3	2	2	1	9
Hartebeest (*Alcelaphus buselaphus*)	2	2	–	–	–	4
cf. Hartebeest	–	–	5	–	–	5
Domesticated mammals						
Sheep (*Ovis aries*)	–	–	–	1	–	1
Goat (*Capra hircus*)	–	2	–	–	–	2
Sheep or goat	1	1	–	–	–	2
Wild or domesticated mammals						
Dog sized canid (*Canis* sp.)	1	4	–	–	–	5
Unidentified carnivore	1	1	–	–	1	3
Small bovid (teeth)	11	11	120	14	7	163
Small bovid (other)	1	14	1	11	1	28
Cattle or aurochs (*Bos* sp.)	–	–	3	–	–	3
Large bovid	2	17	118	3	7	147
Bovid	–	–	–	6	1	7
Very large mammal	–	–	1	–	–	1
Identified mammals	31	60	253	38	19	401
Unidentified mammals	258	266	1382	156	98	2160
Unidentified vertebrates	284	1346	918	86	269	2903
Grand Total	2518	5453	2968	2307	1285	14,531
% identified	28.7	33.2	18.6	28.1	27.0	27.6

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Table 3
Animal taxa identified from hearths excavated at E29H1 in 2008 (numbers of identified specimens).

Hearth number	104	110	111	112	114	115	116	119	121	122	123	124	126	129	130	131	132	133	135	137	140	141	142	143	145	147	148	149	Sum
Catfish 1, clariid catfish (Clariidae)	–	–	–	2	2	8	4	2	–	–	–	–	1	–	1	1	1	1	–	1	–	1	1	2	–	–	1	15	44
Catfish 2 (*Bagrus* sp.)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1
Catfish 3 (*Synodontis schall*)	-	-	-	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
Nile perch (*Lates niloticus*)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	–	–	1	–	–	–	–	3
tilapia (Tilapiini)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	1	3
Pufferfish (*Tetraodon lineatus*)	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	1	–	–	–	–	4
Unidentified fish	2	2	1	5	–	1	–	1	–	1	–	–	1	–	2	1	–	1	–	–	–	6	3	–	1	18	16	33	90
Softshell turtle (*Trionyx triunguis*)	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	3
Unidentified birds	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	3
Small bovid	–	–	–	–	–	1	–	–	1	–	1	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	8
Large bovid	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	–	2
Unidentified mammals	–	–	–	–	–	7	4	8	1	1	8	–	–	3	8	5	–	1	–	2	–	1	–	–	–	–	1	–	51
Unidentified vertebrates	2	–	–	5	7	14	2	1	3	2	5	4	19	–	8	4	5	3	1	3	7	–	7	7	3	–	6	–	116
Grand total	4	2	1	15	9	31	12	13	5	4	14	4	21	3	19	19	6	8	1	6	8	9	11	13	4	18	25	50	328

Table 4
Animal taxa previously identified at Fayum "Epipalaeolithic" sites (numbers of identified remains unless otherwise indicated). Note that fish remains of E29G1 and E29H1 were collected separately and were never published apart from the odd bones that were present in the remaining faunal samples. For a similar table of "Neolithic" remains see Linseele et al. (2014).

Site	E29G1	E29H1	Site 2	FS2
Reference	1	1	2	3
Surface (S) or excavated (E) material	S&E	S&E	S	E
Fish				
Tiger fish (*Hydrocynus* sp.)	–	–	–	6
Barbel (*Barbus* sp.)	–	–	1	–
Catfish 1, clariid catfish (Clariidae)	–	–	3563	16
Catfish 2, Bagrid catfish (*Bagrus* sp.)	–	–	6	–
Catfish 3 (*Synodontis* sp.)	–	–	225	–
Catfish 4 (*Chrysichthys auratus*)	–	–	2	–
Nile perch (*Lates niloticus*)	–	–	267	1
Tilapia (Tilapiini)	–	–	63	3
Pufferfish (*Tetraodon lineatus*)	–	–	44	56
Identified fish	0	0	107	59
Unidentified fish	5	–	–	1112.5 g
Reptiles				
Softshell turtle (*Trionyx triunguis*)	–	–	132	8
Lizard	–	–	–	2
Snake (Serpentes)	–	–	–	7
Birds				
Great crested grebe (*Podiceps cristatus*)	–	–	15	–
Little bittern (*Ixobrynchus minutus*)	–	–	1	–
Shelduck (*Tadorna tadorna*)	–	–	1	–
Teal (*Anas crecca*)	–	–	2	–
Duck (Anatidae)	–	–	1	–
Common moorhen (*Gallinula chloropus*)	–	–	1	–
Swamphen (*Porphyrio porphyrio)*	–	–	1	–
Coot (*Fulica atra*)	–	–	11	–
Identified birds	0	0	33	0
Unidentified birds	4	–	–	71
Ostrich (*Struthio camelus*) eggshell	–	–	20	–
Bird (not ostrich) eggshell	–	–	–	1
Wild mammals				
Hare (*Lepus capensis*)	–	–	4	–
Dorcas gazelle (*Gazella dorcas*)	22	7	10	1
Hartebeest (*Alcelaphus buselaphus*)	26	25	1	4
Wild or domesticated mammals				
Dog sized canid (*Canis* sp.)	1	–	9	1
Canidae	–	–	1	–
Cattle or aurochs (*Bos* sp.)	4	7	4	1
Small bovid	–	–	6	–
Bovidae	–	–	27	–
Identified mammals	53	39	62	7
Unidentified mammals	No data	No data	4560	566.9 g

References: 1: Gautier, 1976; 2: Brewer, 1989; 3: Wenke et al., 1988.

The bones collected from the selected trenches at E29H1 usually have either a grey to white, a pink or a (dark) red colour. It is assumed that the greyish, and especially the white bones, rested directly on the surface where their colour was formed as a consequence of weathering due the exposure to the sun and wind. In contrast, the reddish bones were probably more protected, hence their relatively fresh appearance. Some bones were white on one side and reddish on the other. Most of the grey to white bones are from Trench 204, suggesting longer surface exposure. In Trench 205, the majority of the bones are pink, a colour which has not been attested in any of the other sites. On average 28% of the faunal remains was identifiable, meaning that the skeletal element was determined and the specimen was attributable to an animal taxon below class level. Trench 204 has the highest identification rate (33%) and Trench 205 the lowest (19%). The rates are much higher than expected for surface deposits and are indicative for the exceptionally good preservation of the material, probably thanks to the hyper-arid conditions at the northern edge of the Fayum. Identification rates are generally determined by the degree

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of preservation and fragmentation of the material, but also by the animal taxa present.

Assemblages from Trenches 202, 204, 206 and 207 have a similar faunal composition, with 86–94% of the identifiable remains belonging to fish. The high numbers of fish are similar to those observed at Site 2 and FS-2, while details of the fish from E29G1 and previous studies at E29H1 have not been published. The predominant fish taxa in the new fauna from E29H1 are clariid catfish, tilapia, Nile perch and *Synodontis* catfish. This is very similar to the species spectrum at Site 2. Clariid catfish were mainly 60–80 cm Standard Length, Tilapia 20–40 cm, Nile perch 30–50 cm and *Synodontis* 20–30 cm. The predominance of clariid catfish is probably exaggerated by the fact that bones of these fish preserve well and are also easy to recognize. This is particularly true for neurocranial roof fragments. Tilapia, on the other hand, has smaller, more fragile bones that are therefore more easily destroyed. Trench 202 is the only one where tilapia bones are more common than clariids. The species composition at E29H1 indicates the presence of both shallow (clariid catfish, tilapia) and open fresh water habitats (Nile perch, *Synodontis*) (Van Neer, 2004). The fish fauna from E29H1 includes some mullet remains. Mullets have also been identified at prehistoric localities near Qasr el-Sagha and are actually sea fish that, when water levels of the Nile are high, seasonally move inland (von den Driesch, 1986). Their presence thus proves a connection between the lake in the Fayum and the sea via the Nile.

Remains of amphibians are relatively common in Trenches 202, 204, 206 and 207, whereas just one small lizard bone and one snake bone were recorded in the total sample studied. Apart from Trench 202, all trenches yielded some pieces of the carapace or plastron of the soft-shell turtle. They are proportionally the most common in Trench 207 and have previously been identified in large numbers at Site 2. Soft-shell turtle bones seem to preserve particularly well when exposed to various weathering processes at the surface (Linseele et al., 2014). Bird bones are not common compared to those of fish and contain many unidentified remains. Nevertheless, at least ten species are present, most of which are water birds.

Mammal bones are not common among the animal remains collected at E29H1. The wild species identified include hare, dorcas gazelle and hartebeest. By comparison, more gazelle and hartebeest bones were identified in the previously studied sample from E29H1 as well as E29G1. Five of the new bones from E29H1 were attributed to domestic caprines (Table 5), one of those more precisely to sheep (Trench 206) (Fig. 5), two others to goat (Trench 202 and Trench 204). The sheep bone was submitted for radiocarbon dating. The sample returned a radiocarbon determination of 6684 ± 43 bp (on apetite, RICH-21270, 5673–5520 cal BC, 95% confidence interval). The age is closest to the hearth dates, ca. 5400–4800 cal BC, obtained further to the east of E29H1 and may relate to activities there. In any case, the date shows that the domesticates are not intrusive as initially assumed as no domesticated animal species have been found associated with the other Fayum "Epipalaeolithic" sites. More bones of domesticated caprines may be present among the undiagnostic small bovid remains found at E29H1. Domesticated dog or cattle have not been attested, although there is a chance that these species are present among bones that could not be identified more precisely than dog sized canid or carnivore and large bovid respectively. No suid bones have been recorded.

Table 5
Caprine remains identified from E29H1.

Trench	Taxon	Element	Measurements (cf. von den Driesch, 1976)	Remarks
202	Sheep/goat	Tibia	Bd: 21.3	Distal end, articulation not fused.
204	Sheep/goat	Phalanx 1		
204	Goat	Phalanx 2	GLPe: 22.8, Bp: 12.5, SD: 10.6, Bd: -	
204	Goat	Phalanx 2	GLPe: 22.4, Bp: 11.9, SD: 10.4, Bd: 9.7	
206	Sheep	Radius	Bd: 28.2	Distal end, articulation not fused. Radiocarbon dated

The fauna from Trench 205 is different to the faunal assemblages from the other trenches. The bones usually have a pink colour as noted above. Most bones are too fragmented and too weathered to allow for species identification but where this is possible, mammal bone predominates. Species identified include hippo, dorcas gazelle, and a larger antelope, most likely hartebeest. In addition, wild or domesticated cattle were identified among the remains. The trench yielded a lot of remains identified as small or large bovid. About 75% of these are teeth fragments. Fish are also present and consist mainly of pieces of the skull roof of clariid catfish and jaws of pufferfish. Trench 205 is the only sampling unit where frogs or toads are entirely missing. Bird bones are very rare in this part of E29H1, but the trench yielded ostrich egg shell fragments. No sheep or goat bones are present. Trench 205 is closest to the oldest E29H1 hearths. This raises the possibility that the faunal remains in Trench 205 are older than those in the other trenches, a possibility that would also explain their poorer state of preservation. Preservation conditions certainly influenced species composition but it is doubtful whether this can explain all differences in species composition.

Traces related to butchery or food preparation were not recorded on any of the E29H1 bones. Some fine traces may have been missed because observations were done with the naked eye. No clear traces of burning were identified, although some of the grey-white colouring on the bones may be due to the burning rather than to surface weathering.

4. Discussion

4.1. Taphonomy at E29H1

The fauna contains remains of some small vertebrate taxa which presumably lived and died at the site around the time of the human occupation but otherwise have no link to human activities, the so-called pene-contemporaneous intrusives (Gautier, 1987). These include amphibians, small lizard, snake, small birds and small rodents. A poor association between densities of bone and stone artefacts raises the possibility that some of the other bones represent natural death assemblages connected with (reworked) lake deposits (Koopman et al., 2016). However, the lack of at least partially articulating skeletons as observed elsewhere in the Fayum desert, the similar faunal composition in the hearths and surface trenches as well as the similarities with the fauna from Kom K and Kom W (Linseele et al., 2014) make a deposition by humans likely. The

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majority of the faunal remains are considered as food refuse. The absence of any obvious traces related to food preparation is not inconsistent with the use of the identified taxa as food. In our experience, in prehistoric contexts, such traces are often not very clear due to the techniques and tools used during food preparation, as well to the impact of post-depositional processes. Fish bones in particular often seem to retain no or few traces of food preparation, as was also the case at Kom K and Kom W (Linseele et al., 2014).

Although the fauna from E29H1 is exceptionally well preserved for surface material, it has nevertheless suffered from differential preservation. Underrepresented in shallow contexts are taxa with more fragile bones, like amphibians or birds in general, and tilapia among the fish. Species with hard, compact bones preserve particularly well at the surface and include clariid catfish and softshell turtle. Differences in species composition between the trenches at E29H1 are likely to be in part due to preservation conditions, and in some places bones were presumably entirely destroyed. Trench 202 seems to have offered the best protection for taxa with fragile skeletal remains. The fauna collected at Site 2 by Brewer (1989) has a higher proportion of bones resistant to weathering compared to most trenches at E29H1, in particular bones of clariid catfish and of softshell turtle. Another issue with surface material is the risk of contamination with material from a more recent date. All results indicate that this happened to a very limited extent at E29H1 (see also 3.2.).

4.2. Early domesticated animals in the Fayum

Prior to the caprines identified at E29H1, the earliest bone finds of domesticated animal species from the Fayum were from deposits at QS XI/81 near Qasr el-Sagha dated to ca. 5400 cal BC (6480 ± 170 bp; Gd-2021, 5721–5056 cal BC, 95% confidence interval), where five caprine bones were found (von den Driesch, 1986). A slightly younger site in the same area, QSIX/81 dated ca. 5350 cal BC (6380 ± 60 bp, Gd-1499, 5476–5227 cal BC, 95% confidence interval) yielded a larger sample of caprine bones as well as some cattle remains. The domesticated status of these animals is clear from their size, which is in the range of the smallest cattle from Merimde (ca. 4900–4100 cal BC) (von den Driesch, 1986). Together with Middle Neolithic cattle from Nabta Playa/Bir Kiseiba, these cattle are the only ones published for the 6th millennium cal BC in Egypt. Fauna at QSIX/81 and QS XI/81 was mainly collected in or around hearths. Both sites are often overlooked in current overviews of early domesticates or models of the spread of livestock to Egypt (e.g. Close, 2002; Barich, 2014). Together with the new evidence for domesticated caprines from E29H1, they put the Fayum on the map as one of few the areas of Egypt with domesticated animals prior to the 5th millennium cal BC, and thus older than any evidence from the Nile Valley proper. The earliest cultivated crops found so far for the Fayum date to ca. 4500 cal BC (Wendrich and Cappers, 2005; Holdaway and Wendrich, submitted for publication). Domesticated pigs have not been documented at any sites older than this (Linseele et al., 2014).

4.3. Domesticated animals in Egypt before the 5th millennium cal BC. Evidence for absence or absence of evidence?

As mentioned in the introduction, the relatively late appearance of domesticated animals in Egypt is interesting. However, with the oldest domesticates dated to ca. 6200 cal BC, this evidence is contemporaneous with southeastern Europe, where the appearance of farming and stock keeping around that time was connected with a period of rapid climatic change (Weninger et al., 2014). It is rather the poor evidence for domesticated animals and their patchy spread until well into the 5th millennium cal BC, and the lack of evidence for cultivated crops until that time, which make Egypt stand out. The poor indications for food production in Egypt prior to the 5th millennium cal BC may be due to problems of visibility of archaeological remains. Part of the problem can be connected to the Nile and the possible burial of early and middle Holocene sites underneath alluvial deposits, as some exceptional finds show (Vermeersch et al., 1992). However, the data from Fayum suggest that it may also be a question of looking at the wrong types of "sites". Outside of the Nile Valley, human occupation before the 5th millennium cal BC is not found in stratified sites, but rather in shallow, though sometimes spatially extensive deposits. Perhaps up to know we have been looking for early domesticates in the wrong places by concentrating only on the relatively sparse stratified deposits.

While domesticated animals were certainly present in Egypt by the 6th millennium cal BC, the data are insufficient to explain the patterns seen. Were domesticated animals indeed present earlier in the Western Desert and Eastern Desert than in the Nile Delta and the Fayum? Certainly, we are very reluctant to reconstruct routes of dispersal of livestock over Egypt based on the current state of knowledge. Did pigs and farming indeed appear only in a second stage, or is this an artefact of the evidence that has been found and published? Dating the earliest evidence for the appearance of domesticated animals (and plants), actually means dating the earliest evidence for these species that is both present and preserved, not necessarily, and probably unlikely their first use. In other words, even though we do not find domesticated animals at a certain place and time, they may still have been there.

4.4. Early food production at a higher resolution

We should not only look at what kind of species were spread, from where and when, but also whether or not domesticates were adopted and, if they were adopted, how they were used in a new environment. The emphasis given to the appearance of domesticates in the Holocene of northern Africa obscures much of the local and chronological variation, including the continued importance of wild resources in some cases. We have as yet a very incomplete and a very punctual image of a period of more than 1000 years for the presence of domestic animals in the Fayum, between ca. 5600 and 4500 cal BC. The archaeological record of the early and middle Holocene in the Fayum is probably a palimpsest of occupations which represent only part of the life ways of the individuals responsible for their formation (Holdaway and Wendrich, submitted for publication). Local conditions inevitably had some impact on the shape lifeways took, and the lake in the Fayum obviously offered ample opportunity for fishing. For the entire prehistory of the area, fish predominate in the archaeological bone assemblages. The available evidence certainly does not sustain the idea of a period when domesticated livestock became the most prominent resource of animal protein. To understand events on a local scale, the local impact of climatic change also needs to be known (Phillipps et al., 2012). Environmental changes are thought ultimately to have led to the abandonment of the northern part of the Fayum after ca. 4200 cal BC. The exact impact of such changes on farming and stock keeping are not clear – sheep and goat are the most flexible livestock species, while cattle and pig are more tied to specific conditions. However, considering the importance of fish in the Fayum, what if rather the consequences of environmental change for fishing activities were decisive (Holdaway et al., in press)?

5. Summary and conclusions

Although surface collections may have problems, analyses of fauna collected from the surface in and around E29H1 at the

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northern shores of Lake Fayum have proven that such collections can be well preserved and coherent. In fact, we must study them in order to document all types of prehistoric land use and their associated subsistence strategies. In this case they have yielded the oldest evidence recorded so far in the Fayum for domesticated caprines, dated to ca. 5600 cal BC. When combined with previous evidence from the Fayum, it is clear that early domesticates, caprines and cattle, predate the 5th millennium cal BC in this area. We have very few records for Southwest Asian domesticated livestock in Egypt in the final 7th–6th millennium cal BC. However, this may reflect absence of evidence, rather than evidence for absence. The new data from the Fayum indicate the primary role of fishing, which also needs to be considered while trying to explain periods of use and abandonment of the area.

Acknowledgements

Veerle Linseele is a postdoctoral research fellow of the FWO-Flanders. The work presented here is part of a cooperative project initiated by the University of California, Los Angeles, the Rijksuniversiteit Groningen and the University of Auckland (URU Fayum Project). The URU project works under the aegis of the Egyptian Ministry of Antiquities and Heritage (MSH, formerly the Supreme Council of Antiquities). We especially thank the Minister of Antiquities, Dr. Mamdouh el-Damaty and the Chief Inspector of the Fayum, Mr. Ahmed Abd el-Aal, as well as the Director of the central administration of middle Egypt, Dr. Mansour Boraik. The URU Fayum project in Egypt has been supported by the Regents of the University of California, the Cotsen Institute of Archaeology, the Apache Oil Company, the University of Auckland, The Royal Society of New Zealand Marsden Fund and several private donors among whom we would like to thank especially Deborah Arnold and Harris Bass. Josh Emmitt (University of Auckland) was so kind to assist with Figs. 3 and 4.

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