The bones

The excavation at what is called the "hieroglyphic archive" at Petras produced a small assemblage of animal remains which consists of 219 specimens. Among those eleven belong to marine molluscs, three to land snails, three to fish and four to birds. The rest are mammalian remains, of which 138 are non-identifiable (see methodology section). Most of these remains have been carefully hand collected during the excavation but several originate from dry-sieved deposits[1] (*e.g.* **B19**, **B25**). The assemblage is homogenous chronologically and largely belongs to the context of the archive. The possibility that a few of the remains may have a different origin is discussed below. In this report an effort has been made to examine the animal remains in relation to their position in space and association to other types of finds.

Methodology

The animal remains from the archive have been identified on several levels of precision, depending on preservation and adequacy of the reference collection. Wherever possible, exact identifications on the level of species have been made. Where this was not possible, animal remains have been attributed to larger taxonomic groups, such as Ovicaprids (*Ovis* sp./*Capra* sp.), Muricidae, etc., or even broader categories such as "medium-size mammals", "land snails" and so on. Identifications of remains are based on reference specimens[2] and relative atlases.[3]

The sheep/goat distinction is based on Boessneck and on Payne.[4] The recording is limited to the limb bones, pelvis, mandibles, maxillae, teeth and horn cores. All other anatomical elements are considered non-identifiable and are recorded in a generalised way (Table 1).[5] Determination of sex has been possible only for goat and it is based on a single pelvis.[6] Some indications on the animals' age at slaughter have been obtained, based on dental eruption and wear.[7] Epiphyseal fusion data[8] have not been used, due to the small size of the sample and because the generally poor preservation of the bones lead to a

[1] Sieve mesh: 0.3 cm.
[2] These are housed at the Laboratory for Geophysical-Satellite Remote Sensing and Archaeo-environment at the Institute for Mediterranean Studies (FORTH) in Rethymnon, Crete.
[3] Schmid 1972; D'Angelo & Gargiullo 1991; Cohen & Serjeantson 1996.
[4] Boessneck 1969; Payne 1985.
[5] These data have only been selectively used in this report.
[6] Schmid 1972; Boessneck 1969.
[7] Payne 1973 for ovicaprids; Bull & Payne 1982 for pig.
[8] Silver 1969.

Context	Number of bones	Elements	Fragment size	Animal size	Burning	Cut marks	Comments
B1	2	2 long bone fragments	0–3 cm	MD			
B2	2	2 long bone fragments	0–5 cm	LG			
B4	9	2 long bone fragments	0–5 cm	MD			severely eroded
B8	67	24 ribs, 15 vertebrae, 28 long bone fragments	0–5 cm	MD	on spots	5	2 knife marks across MD ribs, 2 knife marks on MD long bone splinters, 1 LG long bone splinter chopped across, mostly MD lumbar vertebrae
B10	15	6 vertebrae, 9 long bone fragments	0–5 cm	MD			3 unfused vertebrae, brittle
B11	10	10 flat bones	0–5 cm	MD			
B14	-	-	-	-			
B15	6	4 long bone fragments, 2 vertebrae	0–5 cm	MD			
B17	5	5 vertebrae	0–5 cm	MD		5	knife marks across the caudal vertebrae
B19	33	4 ribs, 29 various indeterminate	0–1 cm	MD	on spots		uniform light brown burning; all brittle
B21	5	4 ribs, 1 long bone fragment	0–5 cm	MD		1	cut mark on a flat bone fragment, probably a pelvis
B24	8	8 long bone fragments	5–10 cm	LG		2	perpendicular knife marks on long bone splinters
B25	9	1 rib, 2 vertebrae	0–2 cm	MD			unfused vertebrae
B26	-	-	-				

*MD: medium-size mammals (pig/sheep/goat/fallow deer); LG: large size mammals (cattle/horse/red deer)

Table 1. Non-identifiable bones by context.

Table 2. Animal bones preservation by context.

Context	Burning	Erosion
B1	1	3
B8	16	15
B10	2	4
B19	39	39 (brittle)
B25	2	1

Based on number of remains (NR)

heavy under-representation of the younger age groups (which have more fragile bones). Quantification is kept minimal and elaborate statistical treatment of the animal remains is avoided, due to the small size of the assemblage and its bad preservation (see taphonomy section). Most figures are expressed either as number of remains (NR) or as numbers of identifiable specimens (NISP). Wherever appropriate, they are expressed as percentages.

Taphonomy

The assemblage of animal remains from the archive is very fragmented. Of the non-identifiable fragments 16 out of the 17 samples are dominated by bone splinters smaller than 5 cm in length (Table 1). Among those, several are considerably smaller. The assemblage appears to have been altered by two main factors, namely burning and erosion. Burning altered the bones pre-depositionally. Five out of 28 identifiable mammalian remains and some that are non-identifiable, exhibit traces of burning (Table 2). In most cases this is localised on several spots on the bones' surfaces. Such traces are produced when the bones are exposed to contact with burning charcoal rather than the heat of a blazing fire. An exception to this pattern is **B19** (Table 2). The bones from this context appear to be burned uniformly light brown. Furthermore, they are very brittle. The implications of this observation are discussed below. It is interesting that no animal gnawing marks have been observed in the assemblage. This fact probably indicates that the animal remains from the archive had not been exposed to scavengers (*e.g.* dogs, rodents) prior deposition.

The assemblage also appears to have been heavily affected by post-depositional erosion, perhaps due to the soil acidity[9]. Ten out of the 28 identifiable mammal remains are heavily eroded as well as the majority of the non-identifiable fragments of two more samples (Table 2). It is interesting that this type of erosion has mostly affected bones from **B1**, **B4**, **B8**, **B10** and **B19** on the eastern side of the room and **B25** on the western side (Fig. 78).

[9] For a relevant discussion see Lyman 1994, 422.

Taxa	Hieroglyphic archive		Other contexts	
	NR	%	NR	%
Cattle (*Bos taurus*)	-	-	8	1.1
Pig (*Sus scrofa*)	2	4.2	44	5.9
Ovicaprids	19	39.5	173	23.4
Sheep (*Ovis aries*)	4	8.3	11	1.5
Goat (*Capra hircus*)	2	4.2	20	2.7
Ovicaprids total	(25)	(52.1)	(208)	(28.1)
Birds	4	8.3	3	0.4
Fish	3	6.3	4	0.5
Land snails indeterminate	3	6.3	138	18.6
Limpet (Patellidae)	3	6.3	64	8.6
Murex shell (Muricidae)	7	17.6	241	32.6
Mussel (Mytilidae)	1	2.1	10	1.3
Marine molluscs indeterminate	-	-	18	2.4
TOTAL identifiable	48	100	738	100
Unidentifiable	171		803	
TOTAL remains	219		1541	

Table 3. Taxonomic representation in the archive and other contexts on site.

★ Based on number of remains (NR).

Taxonomic representation (Table 3)

The assemblage of animal remains from the archive is clearly dominated by ovicaprid bones. Out of twenty seven identifiable mammal bones twenty five (52.1%) belong to either sheep (*Ovis aries*) or goat (*Capra hircus*). Pig (*Sus scrofa* dom.) is represented by two bones only (4.2 %). The assemblage includes remains of birds (8.3%) namely a partridge (*Alectoris* sp.) and a member of the pigeons family (Columbidae) and also of fish (6.3%), namely sea-bream (Sparidae). It also includes the shells of several land and marine molluscs. The marine molluscs are purple shells (Muricidae, 17.6%), limpets (Patellidae, 6.3%) and mussel (Mytilidae, 2.1%). The land snails (6.3%) have not been identified.

Sheep and goats

Sheep and goats are the most common animals in the archive assemblage. Sheep appear to be twice as frequent as goats. Only one pelvic bone can be sexed, and that belongs to a female animal. The age at slaughter for these ovicaprids can only be judged in a very generalised manner on the basis of some loose teeth. All age determining teeth belong to young mature animals (2–4 years of age). In the bone assemblage from the archive ovicaprids are represented by a variety of anatomical parts. The small size of the sample obscures

Table 4. Taxonomic representation in the archive and other contexts on site.

	Pig	Ovi-caprids	Sheep	Goat mammals	MD	LG
Humerus		3	1	1		
Pelvis		1		1		
Femur		2				
Tibia		4				
Ulna		1				
Metapodial		1				
Calcaneus			1			
Astragalus			1			
Phalanx I			1			
Phalanx II	1					
Mandibular hinge		2				
Mandible		1				
Maxilla	1					
Mandibular teeth		2				
Maxillary teeth		2				
Vertebrae indeterminate					30	
Ribs					33	
Long bones indeterminate					105	3
TOTAL bones	2	19	4	2	168	3

*MD: medium-size mammals (pig/sheep/goat/fallow deer); LG: large size mammals (cattle/horse/red deer)

the existence of any possible trend in the anatomical part representation. Perhaps the most distinct feature of the ovicaprid bone assemblage is the abundance of vertebrae and ribs (Table 4). Considering that the vast majority of the identifiable animal bones from the assemblage belong to ovicaprids, we can safely assume that almost all the non-identifiable remains of medium-size mammals also belong to ovicaprids. Several of those (as well as some of the long bone splinters) bear cut marks. They are usually knife marks placed perpendicularly to the long axis of the bone. This, in the case of the vertebrae, shows an effort to disarticulate the vertebral column into small sections. In the case of ribs, it also indicates an effort to cut the rib case into small pieces. These cut marks could be viewed as the result of the preparation of meat in order to be cooked.

Pig

The two pig bones from the archive assemblage are a second phalanx and a maxilla fragment (Table 4). Their number is too small to permit any further comment.

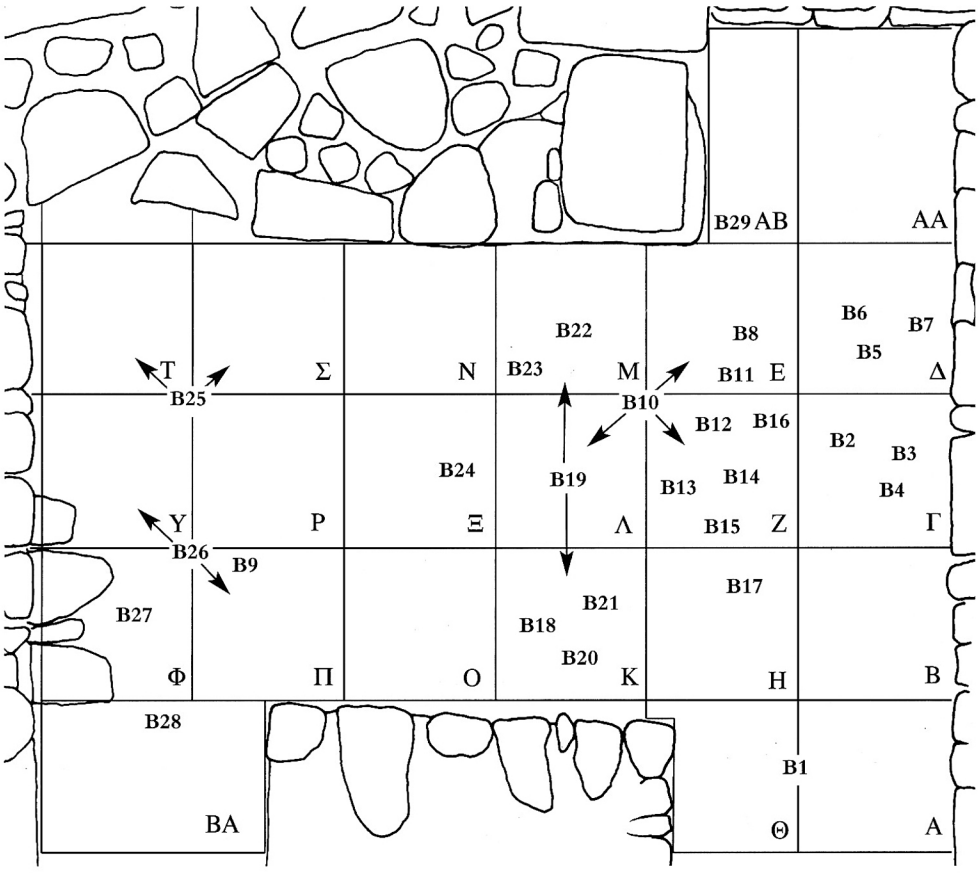

Fig. 78. Spatial distribution of bone contexts in the archive. From general cleanings came **B30–31**.

Birds

Four bird bones have been identified in the archive assemblage (Table 3). Three of them, a tibiotarsus, a synsacrum and a sternum (**B8**) belong to a partridge (*Alectoris* sp.). Although no exact identification has been possible on osteological grounds, it could be suggested that the chukar partridge (*Alectoris chukar*) is a more likely candidate than the rock partridge (*Alectoris graeca*) or other varieties, because the chukar is a species which favours lowland, dry and rocky areas, similar to those found in eastern Crete.[10] Partridge remains have also been found at other Bronze Age sites on Crete.[11] The fourth bone, a tarsometatarsus (**B24**), is from a smaller bird, of the Columbidae family (pigeons). Secure identification has not been possible in this case either. Several instances of the presence of birds of this family have however, been recorded on Crete.[12]

The partridge remains have all been collected from one spot within the archive (**B8**, Fig. 78). Anatomically they are both from the body's trunk and the leg (Fig. 79). They could be the remains of a single individual, entering the room in the form of a cooked piece of bird meat.

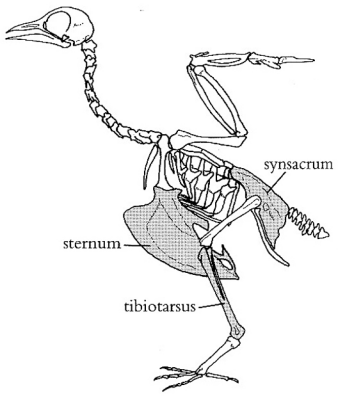

Fig. 79. Skeleton of a bird (after Young 1950). The *Alectoris* sp. elements found in the archive are shaded grey.

[10] Papageorgiou 1990, 277–80.
[11] Reese 1995, 200 and references therein.
[12] Reese 1995, 258–61 and references therein.

Fish

The assemblage of fish remains from the archive consists of three fish bones. One, a caudal vertebra (**B8**), belongs to a medium size fish of the Sparidae family (sea breams). The other two (**B25**) are unidentifiable elements of medium-size fish (<30 cm in length). They may all belong to the same fish. Sparidae is a very common fish family in the Aegean, and is represented by several species. All of them are inshore, and a number of them can be caught very near the shore. Sparidae are among the most common fish in Bronze Age fish assemblages on Crete.[13]

Molluscs

The molluscan assemblage from the archive consists of seven fragments of purple shells, three limpets, one mussel and three small land snails. Most of the purple shell fragments belong to the *Murex brandaris* species, which inhabits rocky or sandy shores and is common in the area of Crete and the Aegean in general. Limpets also inhabit rocky environments, but unlike the purple shells, which live submerged, limpets are found on the wave line. Both these taxa are particularly common in Bronze Age sites, being either food remains and/or serving secondary uses as construction material, decorative objects and so on[14]. The single mussel shell (*Mytillus* sp.), forms an unusual find, as mussels are quite rare on Crete both at present and in the Bronze Age. Isolated finds of single shells have been found in LM IIIA:2 strata at Kommos[15] and at inland Tylisos of an MM-LM II date[16]. Its presence at Petras might indicate the existence of a favourable, nutrient rich micro-environment.

The land snails have not been identified, but as mentioned above, it is quite possible that they are intrusive.

Spatial distribution and origin of remains (Table 5 and Fig. 78)

The spatial distribution of animal remains is partly consistent with that of the other finds. The majority of the animal remains originate from the eastern part of the room, the area "where transactions with the outside world took place".[17] Apart from the animal remains, this area of the room produced finds which are believed to be part of a process of entering documents into

[13] Rose 1994; Mylona 2003.
[14] For a review of purple shell and limpet occurrence in Bronze Age sites on Crete and elsewhere see Reese 1995, 252 and 258–61; Reese 1987. For a discussion of the primary and secondary uses of purple shell see Ruscillo 2006, 802–3 and 807–16.
[15] Reese 1995, 243 (240–73).
[16] Hazzidakis 1912, 233.
[17] Cf. below, 239.

	B1	B2	B4	B8	B10	B11	B14	B15	B17	B19	B21	B24	B25	B26	TOTAL NR	%
Pig (*Sus scrofa* dom.)											1		1		2	4.2
Ovicaprids	4	1		2	2	2			1		1		6		19	39.5
Sheep (*Ovis aries*)	1				3										4	8.3
Goat (*Capra hircus*)				2											2	4.2
Ovicaprids total	(5)	(1)		(4)	(5)	(2)			(1)		(1)		(6)		(25)	(52.1)
Partridge (*Alectoris* sp.)				3											3	6.2
Pigeon (Columbidae)												1			1	2.1
Sparidae				1											1	2.1
Fish indeterminate													2		2	4.2
Land snails indeterm.				3											3	6.2
Limpet (Patellidae)									1	2					3	6.2
Purple shell (Muricidae)	1			1			1			4				1	7	14.5
Mussel (Mytilidae)		1													1	2.1
Total identifiable	6	2	-	12	5	2	1	-	2	6	2	1	8	1	48	100
Unidentifiable	2	2	9	67	15	10	-	6	5	33	5	8	9	-	171	
TOTAL	8	4	9	79	20	12	1	6	7	39	7	9	17	1	219	

*Based on number of remains (NR).

Table 5. Taxonomic representation by context.

the archive such as half-inscribed *noduli*, lumps of clay prepared for use etc. It also produced a number of vessels, such as an amphora, a wide-mouthed jar and several cups and bowls, which according to the excavator[18] "may have provided drinks and 'snacks' for the employees as well as the 'customers'".

Most of the animal bones found in this area could, well be food remains. The carcass parts that these bones represent (*i.e.* some leg portions and mostly portions of the vertebral column and rib case of sheep and goats) along with the cut marks on them, which apparently divided the carcass into manageable pieces, lead towards this direction. The same is implied by the concentration of partridge bones in one find spot (B8). Those could represent remnants of one cooked bird (see discussion above). The burning pattern on several bones, points towards boiling/stewing rather than roasting on the spit, as a possible cooking process.[19] Of interest, from this point of view, is the case of B19 (Tables 5 and 2). The lightly burned, brittle, ovicaprid bones of this context are unlike all the other bones in the assemblage. One could perhaps suggest, that these particular bones, were the contents of a vessel, which were indirect-

[18] Cf. below, 239.

[19] Experiments have shown that cooking on the spit produces distinctive burning patterns (Lyman 1994, 384–92 and references therein) which have not been observed in this particular assemblage.

ly exposed to heat and then, during the collapse of the archive floor, fell on the floor.

Considering the origins of the animal remains one could perhaps suggest that some of them could have been incorporated in the mud-brick walls.[20] The fact that the animal bones have not been exposed to scavengers such as dogs or rodents, suggests that they were incorporated into the sediment fairly rapidly. This would be consistent with the scenario presented by the excavator,[21] for a sudden and hurried abandonment of the archive by its occupants and for its subsequent destruction.

The assemblage does not offer any clues regarding the use of the animal remains for purposes other than food, such as clay polishing tools or writing instruments. However, if bones or shells (*e.g.* limpets) were used for such purposes occasionally and not as specially fashioned tools, then the short period of their use might not leave any visible traces on the bone/shell.

It is perhaps instructive to compare the taxonomic richness of the archive assemblage with that of a sample of animal remains from the rest of the site[22] (Table 3). What becomes immediately evident is that the archive assemblage is quite different from that of the rest of the site. A major difference lies in the fact that it contains far fewer molluscs than the rest of the assemblage. A preliminary examination of the molluscan assemblage from the rest of the site revealed that the majority of these are land snails of various types. None of them bear any burning or working traces therefore we cannot be certain whether they are anthropogenic or intrusive.[23] The next most common categories of molluscs which are the purple shells and limpets, could also be partly intrusive, incorporated in the sediments by natural processes. However, the assemblage includes several purple shell specimens, which are exceptionally large, and bear a hole, which appears to be man-made, probably intended to facilitate the removal of the flesh.[24] These examples point towards a deliberate presence of these shells on site. The difference observed in the frequency of molluscs between the archive and the rest of the site, cannot be evaluated at present.

If we isolate the animal bones from the rest of the animal remains (Table 6), some very interesting trends emerge. Perhaps the most remarkable difference between the two assemblages (from the archive and from the rest of the site) lies in the fact that the archive assemblage is dominated by ovicaprids. Very few pig bones have been found and no cattle. These two animals are present in the rest of the site, although the frequency of pig remains is consistently low. The second remarkable difference, namely the relatively high presence of birds and fish in the archive assemblage, is probably artificial, and relates to the

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[20] Cf. below, 235.

[21] Cf. above, 46–47.

[22] A sample of animal remains from several localities throughout the site have been randomly selected and analysed.

[23] Snails tend to seek refuge in the soil during the dry months. Archaeological deposits often offer a favourable environment, as the sediments are generally soft and easily penetrable.

[24] For the function of the deliberate drilling on purple shells see Ruscillo 2006, pl. 4.57, 1222.

Taxa	Archive NR	%	Other contexts NR	%
Cattle (*Bos taurus*)	-	-	8	3
Pig (*Sus scrofa*)	2	6.25	44	16.4
Ovicaprids	19	59.3	173	64.7
Sheep (*Ovis aries*)	4	12.5	11	4.1
Goat (*Capra hircus*)	2	6.25	20	7.4
Ovicaprids total	(25)	(78.1)	(208)	(77.9)
Birds	4	12.5	3	1.1
Fish	3	9.3	4	1.5
TOTAL bones	32	100	267	100

Table 6. Taxonomic representation in the archive and other contexts on site.

* Based on number of remains (NR).

collection method applied. Fish and bird remains, especially around the Aegean, are usually of a very small size.[25] A reliable retrieval of these would require the application of specific collection methods, such as water flotation or water sieving.[26] In the case of the archive, no water flotation has been applied, but the excavation and find collection were particularly detailed and careful due to the special nature of this context. Aditionally a fraction of the deposit had been dry sieved, thus increasing the number of finds of small size (bones and shells included) in comparison to the rest of the site. Therefore, the highest frequency of fish and bird remains from the archive cannot securely be interpreted as significant in terms of human choices in the past.

Concluding remarks

The excavation and publication of a hieroglyphic archive within the confines of a Bronze Age palatial centre offers unique challenges. The analysis of the animal remains in such a context offers a double challenge. Not only does it contribute to a limited body of data concerning animal-human relationships in Bronze Age Crete, but it also offers a chance to investigate ordinary activities (such as eating) in formal (or usually thought of as so) contexts. This particular assemblage is very small, thus creating problems in the interpretation of the observable trends. However, it still offers some insights into the daily life in the bureaucratic quarters of Petras.

It appears that meat of sheep and goats was frequently consumed. This is a common feature in other parts of Crete at that time. In the vast MM storage facilities at Monastiraki in Rethymno[27] for example, which also produced a

[25] Rose 1994; Mylona 2003.
[26] Payne, 1972; Mylona 2003.
[27] Kanta 2001, 94–5.

high number of sealings,[28] the animal bone assemblage is also dominated by ovicaprids.[29] Inshore fish, wild birds and possibly seafood, were also common elements of the Cretan Bronze Age diet. The few published animal bone reports from Crete (of various phases in the Bronze Age), refer to the presence of such remains on several sites.[30] The particular assemblage probably does not reflect the complete range of possible animal food sources, or the importance of each kind of animal in the diet. It is probably just a "snapshot" of what people might have been eating during a day, at work, and not on a regular basis at home.

[28] Kanta & Tzigounaki 2000.
[29] Mylona, unpublished annual report.
[30] For fish, see Mylona 2003; for birds and sea shells, see Reese 1995 and Ruscillo 2006.