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10. THE LATE PLEISTOCENE AVIAN ASSEMBLAGES FROM SECTORS 8 AND 10

10.1 INTRODUCTION

Modern Morocco boasts an extremely rich avifauna, thanks to its complex topography, Mediterranean and Atlantic coastlines, wide diversity of habitats and also its location on a major bottleneck on the Europe-Africa migration route. Some 452 bird species have been recorded, of which 209 (46 %) breed regularly as either residents (140 species) or summer migrants (69 species), with 15 further occasional breeding species. The present avifauna includes a small number of full species endemic to the Maghreb region and also nearly 20 subspecies endemic to Morocco. During the 20th century, 13 regular breeding species have become extinct in Morocco, with a further 21 species currently threatened at country level (Thévenot/Vernon/Bergier 2003). 15 species are regarded as Globally Threatened by the IUCN, five of which are considered Critically Endangered or Endangered (BirdLife International 2016).

The biogeographic affinities of the Moroccan avifauna are complex. Considered part of the West Palearctic region, the majority of species now present are of Holarctic or Mediterranean origin, with a minority of Saharan species. However, a significant number of tropical species with origins in sub-Saharan Africa also occur, more so than in other countries of the Maghreb.

Thanks to its diverse avian communities, Morocco has attracted the interest of ornithologists from the mid-1800s onwards. Consequently, the recent ornithological history of the country is now well documented (see Thévenot/Vernon/Bergier 2003). By contrast, relatively little is known about the ancient avian communities of Morocco, or indeed of the Maghreb in general. Only five Moroccan sites were listed in the comprehensive Palearctic Pleistocene catalogue of Tyrberg (1998) with only a further two added in the online revision of 2008 (Tyrberg 2008). Between these sites, which span from Middle to Late Pleistocene, only four avian taxa have been identified, dominated by Ostrich *Struthio* sp. recorded from all seven (Tyrberg 1993; 2008). The Pleistocene and Holocene avifauna of further Moroccan cave sites, including El Harhoura 2 and Guenfouda are presently under review (cf. Aouraghe et al. 2010; Steele 2012).

The fossil avifaunas from the Grotte des Pigeons therefore represent the first Late Pleistocene specimens available for eastern Morocco and are also the most diverse Pleistocene or Holocene Moroccan fossil bird assemblages yet documented.

10.2 MATERIALS AND METHODS

The Grotte des Pigeons is located at approximately 720 m above sea level in the mountains of the Beni Snassen region of eastern Morocco. The Beni Snassen range reaches a maximum elevation of some 1530 m and forms part of a mountainous boundary complex lying between lowland plains to the north reaching the coast some 40 km distant and arid high plateaux to the south. At present, the slopes of the Beni Snassen

are characterised by thermo-Mediterranean scrub and woodland, with a further characteristic of the region near the Grotte des Pigeons being deep, often verdant gorges. Although the region is now recognised as a SIBE (*site d'intérêt biologique et écologique*) preserving a wide range of native species, there has been significant human ecological alteration of the area in recent centuries, which more recently has included dedicated efforts to restore floral and faunal communities (see **Chapter 1** for a regional review).

The assemblages examined here originate from the series of excavations from 2005-2010, for which comprehensive analysis of the avifaunal finds has been completed, including individual finds recorded *in situ*, remains isolated during sieving in the field and remains recovered during post-excavation fine picking of bulk sediment samples.

Most of the assemblages were kindly made available for analysis in the UK, enabling the majority of specimens to be identified by direct comparison with the recent avian osteological collection of the Natural History Museum, held at Tring. A number of the larger finds were examined and identified in the field or at INSAP, Rabat, using reference photographs as necessary. The entire collection is now deposited at INSAP.

All specimens not from the Order Passeriformes were identified as precisely as possible, as was material from larger Passeriformes such as Family Corvidae (crows). Due to the high degree of conservatism in their osteological morphology, detailed taxonomic identification of remains from smaller passerines was restricted to humeri and occasional cranial or mandibular elements, which are more diagnostic. As these elements are comparatively robust and survive well, this approach is a useful method of establishing the diversity of a small passerine assemblage (cf. Cooper 1999; 2012a; 2012b).

The taxonomic treatment used here follows Thévenot/Vernon/Bergier (2003).

10.3 RESULTS

A total of 161 avian remains were recovered from the LSA levels in Sectors 8 and 10 respectively, including 107 non-passerine and 54 passerine remains. Between these two Sectors, a total of 16 distinct taxa were recovered. It should be noted that a significant quantity of avian material was also recovered from MSA levels at the site, which will be described separately in due course.

Sector 8

Sector 8 yielded the less numerous avian assemblage, with 46 remains recovered, of which only five were identifiable to genus or species level (**tab. 10.1**). Despite the low number of avian finds, the identifications are informative.

Taxon	Common name	Current status	NISP	MNI
Alectoris barbara	Barbary Partridge	RB	3	1
Upupa epops	Hoopoe	PM, BM, OW	1	1
cf. *Pyrrhocorax*	probable Chough	RB	1	1
Passeriformes indet.	Passerine	-	20	-
Aves indeterminate	Bird	-	21	-

Tab. 10.1 A summary of avian remains from Sector 8 (abbreviations indicating present status in Morocco are: RB = resident breeder; FB = former breeder; BM = breeding migrant; PM = passage migrant; OW = overwinters; WV = winter vagrant; AV = accidental visitor).

Taxon	Common name	Current status	NISP	MNI	Modified
Struthio sp.	Ostrich species	FB	1	1	1
Aquila sp.	Eagle species	RB, AV, FB	1	1	1
Alectoris barbara	Barbary Partridge	RB	18	2	
cf. *Alectoris*	probable partridge		2	1	
Otis tarda	Great Bustard	RB	24	4	9
Columba cf. *livia*	Pigeon, probable Rock Dove	RB	1	1	
Columba livia/oenas	Rock/Stock Dove	RB, WV	3	1	
cf. *Columba*	probable pigeon		1	1	
Columbidae	Pigeon family		1	1	
Strix aluco	Tawny Owl	RB	1	1	
Apus sp.	Swift species	RB, PM, BM, OW	1	1	
Pyrrhocorax pyrrhocorax	Red-billed Chough	RB	1	1	1
Aves indeterminate	Bird (non-passerine)	-	42	-	
Passeriformes indet.	Passerine	-	17	-	

Tab. 10.2 A summary of avian remains from Sector 10 (abbreviations as in **tab. 10.1**).

The most noteworthy find was the proximal carpometacarpus of Hoopoe *Upupa epops*, from Unit Y2, the only record of this taxon from the site.

Sector 10

The LSA deposits of Sector 10 yielded the most remarkable avian finds yet discovered at the site. Overall 114 bird remains were identified, in 14 distinct taxa (**tab. 10.2**). Similarly to other areas of the cave, the assemblage from this sector includes low numbers of identifiable remains from a reasonably wide range of small taxa. However, this Sector's signature is the presence of a significant number of remains from very large taxa, including a damaged distal phalanx of Ostrich *Struthio* sp., a fragmentary proximal scapula from an eagle *Aquila* sp. but, most importantly, over twenty remains of Great Bustard *Otis tarda*. Also notably abundant in this sector was Barbary Partridge *Alectoris barbara*, with 18 remains recovered, representing two or more individuals.

Amongst the less common taxa, several stand out as being of interest. A distal tibiotarsus of Tawny Owl *Strix aluco* adds a significant predator to the assemblage.

Remarkably, the most abundant taxon present, both in terms of number of identified remains and minimum numbers of individuals (MNI) was Great Bustard *Otis tarda*, represented by 24 remains, including at least four individuals (three adults and one juvenile) but probably more. In terms of skeletal element representation, the assemblage is dominated by elements from the trunk including coracoid, furcula, sternum and synsacrum (**tab. 10.3**). Additionally, although a limb bone, the femur also forms part of the core body mass, being embedded within the significant muscle complex at the hip. Also well represented, indeed forming the basis for the adult MNI, were distal humeri, three each of left and right. A damaged humerus shaft was also found. Other parts included two bill fragments, a damaged juvenile ulna and a damaged tarsometatarsus.

The osteology of Family Otididae is distinctive, making initial identification of bustard relatively straightforward and the large size of the Taforalt remains considerably narrowed the field for candidate taxa. Bustards are believed to have evolved on the African continent, and it remains the centre of their diversity, though the history of the distribution and evolution of the modern taxa remains relatively poorly known (Collar 1996). At present, several large species occur south of the Sahara, including the very large Kori Bustard

Element	Entire	Proximal	Distal	Other
Cranium				
Premaxilla			1	
Mandible				1 fragmentary
Vertebrae	2			
Sternum	1			2 fragments
Furcula	1			
Coracoid	1			
Scapula				
Synsacrum				2 fragmentary
Humerus			6	1 shaft
Ulna	1			
Radius				
Carpometacarpus				
Manus phalanges				
Femur			2	
Tibiotarsus				
Tarsometatarsus				1 shaft
Pedal phalanges				

Tab. 10.3 Great Bustard *Otis tarda* skeletal element representation in Sector 10.

Ardeotis kori (adult males up to 19 kg; all masses from Collar 1996) and somewhat smaller Denham's Bustard *Neotis denhami* (adult males up to 10 kg). The substantial Arabian Bustard *Ardeotis arabs* (adult males up to 10 kg) now has a Sahelian range immediately south of the Sahara, with a probably extinct subspecies *A. arabs lynesi* formerly present in North Africa, including Morocco where it was last recorded in the 1990s (Hume/Walters 2012).

Great Bustard (adult males up to 18 kg) is primarily a Eurasian species but a small population occurs at present in Morocco, marking the southernmost limited of its global range.

Notably, modern ranges of the largest bustards do not overlap; where more than one species of bustard occurs, they appear to be generally organised in size guilds. Nevertheless, there remains the possibility that palaeogeographic ranges may have shifted due to climatic and habitat alterations, replacing one large bustard with another over time. Identification of the larger bustards may also potentially be complicated by their great sexual dimorphism, with males up to 50 % larger than females, which can result in significant overlapping of size ranges. The bustard remains from Grotte des Pigeons were directly compared to skeletal specimens of *Otis tarda*, *Ardeotis kori* and to skins and x-rays of *Ardeotis arabs lynesi* held at the NHM, Tring. A range of comparative measurements of Great Bustard was also obtained from the avian osteological collection held at the Naturhistoriches Museum, Vienna (NHMW).

The Grotte des Pigeons assemblage was identified as Great Bustard on the basis of morphology and measurements. Morphologically, finds of a premaxilla, a fragmentary mandible and a damaged tarsus are particularly noteworthy. Great Bustard has a proportionately short bill and short tarsus, whereas the large southern African species share the features of a long bill and long tarsus; although damaged, the Taforalt finds are clearly proportionately short. In terms of morphometrics, *A. a. lynesi* could additionally be ruled out on the basis of size, being significantly smaller than Great Bustard overall. It was immediately apparent that the size range of the Grotte des Pigeons assemblage exceeded the range of the limited number of comparative specimens available at Tring, but that a number of specimens nevertheless fell into two distinct groups of larger and smaller individuals. Measurements of the extended comparative sample at NHMW both clarified the separation of male and female sizes and expanded the modern size range. From this, a number of the

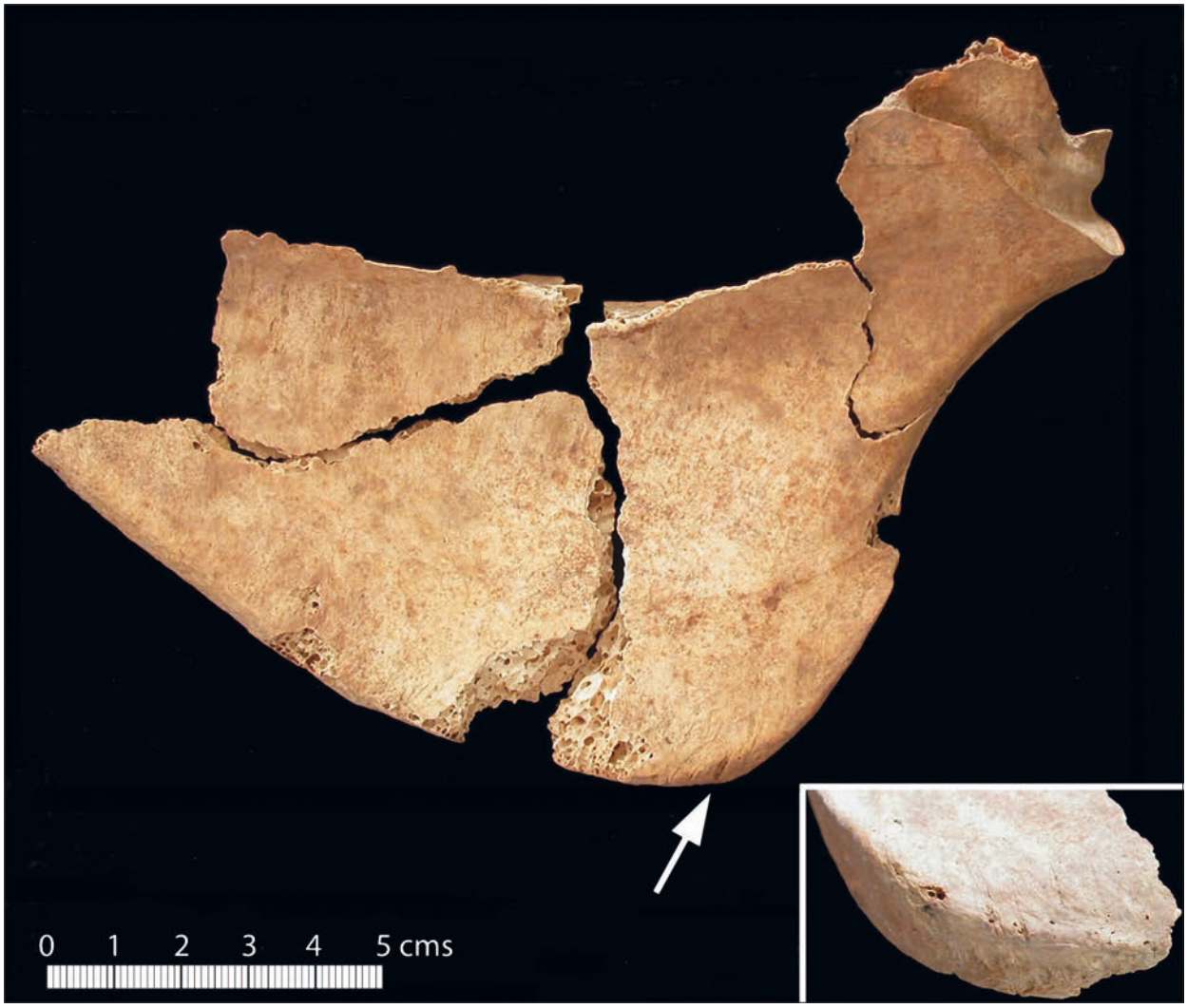

Fig. 10.1 Great Bustard *Otis tarda* fragmented sternum <11389>; inset: cut-marks to keel. – (Photo J. H. Cooper).

present finds can be confidently sexed, confirming that adult male and female individuals are present, with remains of at least one juvenile also preserved. However, the largest of both male and female remains also exceeded the maximum size range of the Vienna collection. Nevertheless, the largest supposed female fossil finds were still below the size of the smallest modern males.

Great Bustard remains were found across the excavated area of Sector 10 and throughout the burial stacks but, due to the complex cross-cutting of the burials, it is difficult to determine clear associations between bustard finds and individual burials. No articulated remains were found but at least two individual bustards, represented by fragmented sterna, were definitely associated with Burial 14 (see below), recovered during the first season of excavation of this individual burial. The most complete of these sterna <11389> is a very large male (**fig. 10.1**). Further sterna fragments <11315-11316> are probably also associated with this burial, but cannot be confirmed as representing additional individual bustards, though this is certainly possible. A damaged tarsometatarsus was unearthed within Burial 5, adjacent to one forearm. However, this may represent disturbance of a previous burial when Individual 5 was deposited. One distal humerus <11348> was found in the midst of Individual 13, but is likely to represent intrusive disturbance. The remaining finds were found throughout the Sector, including in the 'blue stone' burials area and main burial stacks (cf. **Chapter 15**), but with no clear associations to any other individuals.

Fig. 10.2 Ostrich *Struthio* sp. terminal phalanx <4054>, with modern comparative specimen. – (Photo J. H. Cooper).

10.4 MODIFICATIONS

Cut-marks were recorded on numerous bird bones from Sector 10 (**tab. 10.2**). In addition to appearing on many of the Great Bustard bones, discussed in more detail below, cut-marks were also discovered on the eagle scapula fragment <11360> and on the isolated premaxilla of a Red-billed Chough *Pyrrhocorax pyrrhocorax* <11358>. These latter marks may show sawing, being particularly deep with evidence of multiple strokes into the bone (**fig. 10.3**). Unfortunately, though recovered from the area between Individuals 13 and 14, neither eagle nor chough find showed a clear association with a specific burial.

Evidence of further potential modification comes from the single ostrich phalanx, recovered with general finds from the burial stack of Individuals 1-4. This has significant damage to its proximal part (**fig. 10.2**). This is a relatively small but extremely robust element, which might be considered resistant to most natural damage. Additionally, in life, the phalanx would be sheathed by a very strong toenail almost hoof-like in form, with the rest of the digit covered in an extremely tough scaly skin. To penetrate these defences to inflict the damage observed would appear to have required some determination. It seems reasonable to suggest that this damage may have been deliberate.

Within the Great Bustard assemblage, cut-marks are present on nine of the remains, including on the large sternum <11389> and humerus <11853> in Burial 14 and all six distal humeri recovered from the site.

On the sternum, a small group of near vertical fine cuts is apparent on the apex of the keel, passing across its right margin and onto its right side (**fig. 10.1**). On a complete carcass, this is the deepest part of the

Fig. 10.3 Red-billed Chough *Pyrrhocorax pyrrhocorax* cut-marked premaxilla <11358>, with comparative skin specimen. – (Photo J. H. Cooper).

chest, with the maximum depth of breast muscles lying to either side of the keel. Based on personal practical experience of preparing large modern comparative osteological specimens, including Great Bustard, it is worth noting that the edge of the keel itself is not buried very deep in tissue and its apex can make a useful starting point for filleting away the breast muscles from the keel.

The most abundant Great Bustard elements, distal humeri, and also the entire humerus, are also the most cut-marked. All seven displayed cut-marks to a greater or lesser extent, primarily small groups of fine, largely parallel cut-marks on the dorsal and/or caudal surfaces and some isolated cuts to the distal articulation. The extent of the surviving shaft also shows a strong degree of consistency, with several specimens retaining approximately one-third of the original overall length of the humerus.

No charring was observed on the recovered Great Bustard remains.

10.5 DISCUSSION

Origins of the Assemblage

The accumulation of the avian assemblage at Grotte des Pigeons can be attributed to a combination of natural and human agencies. Remains deposited by the latter, all associated with the activities of Sector 10, are considered in more detail below. These include the bustards, ostrich, eagle, some Red-billed Chough and possibly some partridge.

While human use of the cave has changed considerably over time, natural processes of accumulation are still very much in evidence. Observations made during several excavation seasons of birds and their behaviour, in and around the site, provide useful indications of likely past use of the cave. Indeed, many of the same species still occur at the site or in the local area (personal observations).

The simplest, most direct source of birds is death on site. Several species presently use the cave or cliffs for nesting; including Rock Doves and Pallid Swifts *Apus pallidus*. Various other species forage in the cave, particularly for insects and their larvae, or around its entrance. Any of these may potentially die on site and be incorporated. Modern remains of a Rock Dove found towards the entrance of the cave may represent this route. It is striking that in Sector 10, once the species clearly linked with human activities are excluded from the assemblage, the remaining taxa are almost all known occupants of the cave, strongly suggesting the incorporation of the occasional inhabitant.

However, this does not provide a satisfactory explanation for the entire assemblage, given the presence of non-cave dwellers, including woodland and matorral species. Again, the modern cave may provide the answer. Towards the rear of the site, remains of recent birds were being accumulated very effectively at the base of a well-used owl roost on a small, raised pillar-like rock. Feathers and droppings indicated its recent use and also identified the predator as a Tawny Owl *Strix aluco*. Beneath the roost was a significant accumulation of small bird and mammal remains, having apparently been incorporated into the cave sediment as regurgitated pellets decomposed. A full analysis has yet to be completed but the bird remains included numerous small passerines, amongst them significant numbers of hirundines. One find of Tawny Owl was recovered from Sector 10, confirming its presence in the local LSA palaeocommunity.

Tawny Owl is a medium-sized owl, but with a wide prey range for its size, capable of taking birds from the tiny Goldcrest *Regulus regulus* up to adult Mallard *Anas platyrhynchos*. Both Rock Dove (both Sectors) and Woodcock (Sector 8) are known prey, whilst Hoopoe (Sector 8) and Barbary Partridge (both Sectors) are within the prey size range; the additional presence of small but unidentified passerines is also worth noting. Although not described in detail here, it is notable that many of the taxa identified in the site's MSA avian assemblage are also known prey of this owl. Altogether, based on the modern evidence of its activity on site and the taxon's prey profile, it seems reasonable to suggest that Tawny Owl was probably also a key contributor to the fossil avian assemblage.

Overall, the natural sources of birds appear to have provided a sampling of the avifauna of the cave and its local environs. Based on modern home ranges (i. e. the hunting range) of Tawny Owl, this might suggest a sampling area of less than 1 km^2 for possible owl contributions (Mikkola 1983).

Archaeological Significance

Only four taxa provide clear evidence of human activity, all from Sector 10; a large eagle, Red-billed Chough, Ostrich and Great Bustard. Each of these exploited taxa has its own distinct archaeological signature and is considered below. Other taxa may potentially have been utilised, but as yet this cannot be confirmed as no further cut-marks or other modifications have been identified to date. In the case of Barbary Partridge, with 18 (possibly 20) confirmed remains, it is second only in abundance in Sector 10 to Great Bustard. This abundance, which is well in excess of any inhabitant or possible Tawny Owl prey species, combined with its status as a non-cave dweller, may well indicate that its presence is also connected with human activity. The skeletal element distribution of Barbary Partridge (**tab. 10.4**), includes elements from the trunk, legs and proximal wings, but distal wing elements are absent. While a proportional absence of wing elements has been used to suggest human involvement in accumulation (cf. Ericson 1987), it should be noted that some owl species detach wings at the humerus before consuming their prey, which could result in a similar bias (cf. Stronach/Cooper 2010). Considering the present evidence, human activity may be suspected then, but not confirmed. Barbary Partridge is likely to have been abundant locally, then as now, and if it was hunted by humans could have been obtained using ground-based traps or snares made from twigs, sticks and plant-fibre twines (cf. Wadley 2010).

Element	Entire	Proximal	Distal	Other
Cranium				
Premaxilla				
Mandible				
Vertebrae				
Sternum				1 fragment
Furcula				
Coracoid		3		
Scapula	3			
Synsacrum				1 fragment
Humerus	1		1	
Ulna				
Radius				
Carpometacarpus				
Manus phalanges				
Femur	1	2		
Tibiotarsus			2	
Tarsometatarsus	1		1	

Tab. 10.4 Barbary Partridge *Alectoris barbara* skeletal element representation in Sector 10.

Ostrich *Struthio* sp.

For the skilled hunter-gatherer, ostriches should potentially represent a unique resource, providing not only substantial quantities of food, in terms of meat, fat and eggs, but also additional raw materials of feathers, leather, sinews, eggshell and bone. However, while ostrich eggshell is widely recorded in North African Palaeolithic sites, finds of ostrich bone remain extremely limited (cf. Tyrberg 1998; Merzoug 2011). It is possible that the large bones, particularly if heavily damaged by processing, may be going unrecognised in sites. The rarity of ostrich bone in archaeological sites has also been attributed to an inability to hunt adult birds successfully. While this may indeed be true in some areas, a wide range of traditional hunting techniques recorded in the mid-19th to 20th centuries across Africa suggests that ostriches are not as invulnerable as might be supposed (de Mosenthal/Harting 1879; Davies 2002). Even without using arrows, ostrich may be ambushed at the nest or near waterholes; stalked by hunters wearing gazelle or ostrich skins; lassoed; trapped in pits; driven into ambushes; rounded up and killed in a co-operative circle hunt. However, as adult ostrich are large, wary, fast, potentially aggressive and prefer extremely open habitats, they are noted as difficult quarry; indeed in some cultures, success in ostrich hunting carried considerable prestige (de Mosenthal/Harting 1879).

Based on comparisons with 19th century accounts, it seems possible that ancient ostrich kills may have been largely processed in the field for ease of transport and that only a small proportion of the carcasses was returned to hunters' dwellings. One traditional method of field dressing removed the prized skin as a first step, followed by rendering the fat (which may approach 20 litres) into bags made from the intact skin of the thighs tied off at the lower end (de Mosenthal/Harting 1879). The meat may then be divided amongst the hunters. The main meat mass on an ostrich is carried around the thighs and upper shin; it is possible that, as with the anatomically similar moa of New Zealand, relatively little of the rest of the carcass was exploited for meat and was discarded (cf. Berentson 2012). Consequently, even where ostriches might have been exploited, relatively little evidence of the actual birds may have survived to be preserved on sites, having been converted in the field into perishable products.

Currently, only one find of Ostrich bone has been confirmed at the Grotte des Pigeons, a substantial distal phalanx <4054>, heavily damaged at its proximal end (**fig. 10.2**), which unfortunately cannot be associated with a specific burial. Ostriches have only two digits, a reduced outer toe and a large inner toe carrying an extremely robust, almost hoof-like claw. This is triangular in section and gently curved along its length, which may be over 100 mm. Depending on wear, the tip may be blunt or somewhat pointed. It is these heavy claws that make the ostrich's defensive attack of kicking a highly effective and indeed dangerous deterrent.

Bird claws have been, and indeed still are, used very widely across human cultures as objects of cultural significance (Serjeantson 2009). It seems highly likely that this ostrich claw was an ornament of some kind, possibly hung as a pendant by binding the proximal end of the claw. Given the apparent cultural and ritual significance to the people of the Grotte des Pigeons of large animals, including at least one species of bird, the probably highly valuable practical and perhaps also cultural status of ostrich and the likely difficulty of obtaining a claw like this, it seems reasonable to suggest this was some form of trophy, perhaps conferring status upon its owner.

Ostrich Eggshell

Robust and readily recognised, ostrich eggshell (OES) fragments are widespread in North African archaeological sites, frequently noted where other bird remains have not been described (Tyrberg 1998; Steele 2012). In Morocco OES has been recovered from the MSA at Rhafas, Dar-es Soltan 1, Irhoud and El Harhoura 1 and 2 (Steele 2012), and also at the mid-Holocene Bizmoune Cave (Fernandez/Bouzouggar/Collina-Girard/Coulon 2015).

At the Grotte des Pigeons, OES fragments have been recovered throughout Sectors 8 and 10, with 39 and 22 fragments recovered up to 2010 from each sector respectively. Roche (1963) reported 994 OES fragments across the majority of his levels, with the highest number (733) recovered in the outer cave. However, more fragments may not equate to more eggshell but simply more breakage, for example from trampling, as might be expected in the outer cave.

Ostrich eggs are the largest of any modern bird, averaging about 159 × 131 mm in overall size, weighing (with contents) about 1500 g with eggshell thickness approximately 2 mm (Folch 1992). It is worth noting that with a surface area of some 5800 mm^2 (cf. Paganelli/Olszowka/Ar 1974; Muir/Friedman 2011), a single egg can potentially be shattered into a surprisingly large number of fragments. For example, even a generous fragment size of 40 mm^2, similar dimensions to the fragment figured by Roche (1963, fig. 25), would result in a total of 145 fragments. A more detailed analysis of the total area of recovered eggshell could provide a more refined estimate of the potential number of eggs present, but it would seem that the complete Grotte des Pigeons OES assemblage, as recovered (that is, not allowing for any collection bias in the early excavations or for any other taphonomic effects), could represent less than ten eggs.

This may at first appear to be a high figure, however it must be considered that, unlike the adult birds, eggs can be obtained relatively easily. Ostrich lay large communal clutches, which often number over 25 eggs (an example of over 70 in a single nest has been recorded) (Folch 1992). Brooding adults may spend periods away from the nest, allowing eggs to be collected with relative ease (Folch 1992; Davies 2002). Potentially only a very few encounters with ostrich nests would have been necessary to obtain the quantity of eggs apparently present at the site.

Ostrich eggs are likely to have been desirable objects for the people of the Grotte des Pigeons, being not only nutritionally valuable, yielding the equivalent volume of some 28 hens' eggs, but also having a further

practical value as containers, which could be drilled, stoppered and used for water. Ostrich eggshell may also be broken down and manufactured into flat, often disc-shaped, beads, leaving characteristic waste (Serjeantson 2012). Roche (1963, 57 and fig. 25) recorded one scratched fragment and one perforated OES fragment which he interpreted as a broken, unfinished bead. However, this perforation might have been the hole in an egg drilled as a container. As yet no further evidence of other modification has been confirmed at Grotte des Pigeons. With further detailed analysis to examine possible refitting to reconstruct broken flasks or modifications to edges or surfaces that might indicate drilling or decoration, it may eventually be possible to determine precisely how ostrich eggshells were being utilised, or even curated, at this site.

Eagle, Golden/Imperial/Steppe Group *Aquila* sp.

Respected and feared for their hunting prowess, powerful flight, keen eyesight and fierce appearance, eagles carry great symbolic importance across many cultures, both geographically and temporally. Consequently, human use of eagle parts, especially feathers, is common and often carries magical significance, seen as imbuing the user with some of the eagle's power and skill (Serjeantson 2009).

Only one fragment from this taxon, similar in size to Golden Eagle *Aquila chrysaetos*, was recovered, a robust proximal right scapula <11360>, carrying cut-marks. In life, the proximal scapula is enclosed deep within the muscle mass of the shoulder, in articulation with the coracoid, furcula and humerus. Damage to the articular surface of the scapula may be associated with disarticulation, possibly suggesting removal of the wing, though in this case the association is not definitive.

Neanderthal exploitation of raptor and also corvid wing feathers has been suggested at several Gibraltar cave sites (Finlayson et al. 2012; Blasco et al. 2016). Clear evidence of systematic processing of *Aquila* eagle corpses for wing removal has been demonstrated at the Epipalaeolithic site of Wadi Jilat 22 in eastern Jordan, with a peak period between c. 14,700-16,600 BP (Martin/Edwards/Garrard 2013), while the burial of an elderly Natufian lady in the Levant included part of an articulated eagle wing (Grosman/Munro/Belfer-Cohen 2008).

In the absence of any further eagle material from the Grotte des Pigeons at present, it is not possible to say whether or not similar processing or curating of eagle parts was definitely being carried out here. However, given the evidence of systematic exploitation on site of at least one other large bird species for ritual purposes, it seems plausible that eagle remains – wings, feathers and possibly more – may also have been symbolically significant, but perhaps utilised less frequently and in a different manner.

Red-Billed Chough *Pyrrhocorax pyrrhocorax*

The smallest of the archaeologically significant species, Red-billed Chough, is represented by two remains, including a cut-marked premaxilla <11358>. An inhabitant of cliffs and crags in open country, Red-billed Chough was probably a familiar sight in the Grotte des Pigeons region during the Last Glacial Maximum and is still common in the Beni Snassen hills today (Thévenot/Vernon/Bergier 2003). It is a striking bird with all black plumage and bright crimson legs and strong, downward curved beak (**fig. 10.4**). In the Taforalt find, the deep cuts, which show multiple parallel strokes, are located above the nostrils on the dorsal surface, just at the point where in a complete specimen there is a visible junction between the feathers and the ramphotheca (**fig. 10.3**). While this may have been where an attempt was made to detach the beak, the actual break occurred along the relatively weak pre-frontal hinge between the premaxilla and the cranium, possibly

Fig. 10.4 Red-billed Chough *Pyrrhocorax pyrrhocorax* in flight. – (Photo © Mark Adams).

due to the pressure exerted during cutting. Given the location of the cut-marks, detachment of the beak from, rather than removing the beak as part of, a skin seems to have been the objective; with the latter, no damage to this part of the beak would be necessary as the beak could have been detached from the skull from within the skin, i. e. from the cranium side of the pre-frontal hinge.

Along with feet and claws, beaks are also highly prized across many cultures in time and space, widely used as ornaments, amulets or included in artefacts such as medicine bundles or rattles (Serjeantson 2009). Frequently, the species of bird used has symbolic significance. One strong reason why this chough beak was removed is likely to be its original deep crimson colour in life. Along with black and white, red is one of the most important colours in human cultural history, with use of red iron ochre dating back to about 160 ka BP in Africa and about 200 ka BP in Europe (Roebroeks et al. 2011). Symbolically, in prehistoric cultures red appears to be frequently associated with blood and life, and red pigments have a strong association with burials, including finds of ochre at the Grotte des Pigeons (cf. **Chapter 14**). The bright red beak of the Red-billed Chough against its black plumage may have made it a significant species for the people of Grotte des

Pigeons, with this beak removed and curated for some purpose. The shape of the beak would have lent itself well to use as a toggle or perhaps more likely as a striking ornament, for example through an earlobe, septum or other piercing.

Great Bustard *Otis tarda*

The most remarkable component of the avian archaeological assemblage is the collection of remains from Great Bustard, overall 24 finds representing a minimum of four individuals, at least three adults, male and female, and one juvenile. One further piece was found in Sector 2, recovered within the fill of a recent porcupine burrow; however, given the known bone collecting behaviour of Crested Porcupine *Hystrix cristata* (cf. Kibii 2009), at present this specimen is best considered intrusive. This is a highly significant collection, both in terms of its evidence for ancient human use of the species but also for its biogeographic implications for the history of the taxon in North Africa, which will be discussed in more detail below.

Great Bustard is a very large bird of primarily terrestrial habits, strongly associated with open steppe and plains habitats. It exhibits pronounced sexual dimorphism, with adult females standing approximately 0.8 m tall, with a wingspan of up 1.9 m and reaching a weight of between 3.3-5.3 kg, while adult males stand over 1 m tall, have a wingspan of some 2.5 m and may reach a weight of 5.8-18 kg, placing them amongst the world's heaviest flying birds (Collar 1996). There are some suggestions of historic records of even heavier birds, reaching in excess of 24 kg (Collar 1996). Despite their great size, they are capable of strong flight, though very large males may struggle to take off, particularly in spring when at their peak weight prior to the breeding season. Great Bustards have a lekking mating system, where males perform a spectacular display to advertise their presence to females. At the height of his display, puffed up and with wings inverted and fanned to expose their white undersides, a normally well-camouflaged male may be visible for several kilometres (Collar 1996). The taxon has a very broad distribution across Eurasia, though is declining steadily across its range and is ranked as a globally vulnerable species. There is a very small, rapidly declining population in Morocco, with only some 50 individuals remaining (Alonso et al. 2016). The present population is restricted to the northwest of the country, on the Tangier peninsula and adjacent floodplains (Thévenot et al. 2003; Alonso et al. 2016). Given the strong preference of Great Bustard for steppe or plains habitats, it seems likely that the hunters of Taforalt probably obtained them on the open plains lying to the north and south of the Beni Snassen range, possibly in a dedicated hunt. Precisely how the Grotte des Pigeons bustards were secured cannot be determined but ethnographic evidence from modern and historic hunter gatherers proves that, although large bustards are an extremely wary quarry, they are nevertheless vulnerable to a range of traditional hunting techniques, including trapping, stalking and ambush, not dissimilar to those used on ostrich (see above and cf. Collar 1996; Ziembicki 2010). It is possible that the hunting parties may have taken advantage of the birds' gregarious habit of forming droves, hence the presence of multiple individuals within one burial. While the methods of hunting them must remain speculation, the assemblage does provide considerable information about the butchery and subsequent use of the birds.

The preservation on-site of both trunk and some distal extremities, in the form of beak parts and a tarsometatarsus, suggests that some birds at least were returned largely whole to the cave for butchery, with some heads and feet removed on site. Further carcass dismemberment is evident from the six distal humeri, which appear to represent systematic detachment of wings. From the consistency of the surviving portion of the bones, this often appears to have been done at roughly the point where the meaty muscles of the upper wing taper off to thinner slips inserted on the distal epiphyses. This would leave the proximal humerus *in situ* and the meat of the shoulder and breast intact on the substantial butchered carcass.

The core carcass of an adult male Great Bustard measures approximately 300 mm long, 200 mm wide and 200 mm deep, carrying the massive main muscle mass of the breast on the sternum (itself potentially over 100 mm deep) and, if retaining proximal humeri and femora, also the muscle masses of the shoulders and upper legs. It would represent one of the largest and heaviest bird carcasses available to the hunters of Grotte des Pigeons. Remains of trunks from at least three adult Great Bustard were recovered within the site, one from near the 'blue stone' burials area and at least two from the burial of Individual 14. These latter finds provide clear and exceptional evidence of the use of Great Bustards as part of the funerary rituals of the Grotte des Pigeons human population.

Excavation of the burial of Individual 14 commenced in 2010, revealing an extremely complex assemblage of human and faunal remains and artefacts, the excavation of which continued over subsequent seasons. This discussion only considers the Great Bustard remains from that first season; full analysis of the entire burial is still in progress so a full description of the complete Great Bustard assemblage is not yet feasible.

In 2010, Great Bustard remains were found both undisturbed in the base of the Individual 14 burial and also in extremely close association with the burial. The key undisturbed find was the fragmented, cut-marked sternum of an extremely large adult male bustard <11389>, amongst which was discovered a fragment from a second sternum. Further fragments, which may have derived from either of these sterna were unearthed nearby. Additionally, the burial yielded an intact furcula close to the main sternum.

The sternum with associated breast muscles would comprise a portion very similar to the 'crown' joint now popular for the modern western Christmas domestic turkey *Meleagris gallopavo* (another very large, ritually important bird species). Arguably the choicest part of the prepared carcass and being from an extremely large bird, the deposition of such a portion is likely to have represented a significant offering, certainly of high value and perhaps reflecting a high status for the buried individual. This suggestion of linking Great Bustard with high status is also supported by the overall complexity of this burial, which comprises numerous other faunal remains and artefacts (cf. **Chapters 9, 12** and **15**). It may also be significant that the key Great Bustard find in the burial derives from a very large male bird and that Individual 14 was a young adult male of clearly high standing. However, it is difficult to be certain how intact this offering was at deposition and whether the bustard remains with Individual 14 are the leftovers of a funerary feast. Cut-marks across the margin of the preserved keel and up onto its side strongly suggest that at least part of the breast meat was removed prior to deposition. Additionally, the placement at the feet of the human burial seems considered and deliberate. The initial assessment of the bustard assemblage from the burial therefore gives the strong impression of a careful selection of the best part of the bustard, rather than a general collection of waste parts. The cut-marks over the keel may indicate that a part of this prime offering was divided between the living and the dead, perhaps for significant living members of the community to share a final meal with the deceased.

In Sector 10 overall, there seems to be a general absence of other meaty parts of bustard, with large, robust elements such as femora, proximal humeri and tibiotarsi relatively scarce. It may be that these lesser portions contributed to a wider funeral feast and were mostly disposed of in a different part of the cave, perhaps including being removed altogether from the site.

Even with the interpretation of the Great Bustard assemblage at a relatively early stage, it is clear that this taxon was ritually important to the people of Grotte des Pigeons. Large bustards worldwide have not only a long history of being exploited (in many cases, over-exploited) as desirable game species, but have also become the focus of complex cultural beliefs, laws and traditions. In Botswana, the Kori Bustard *Ardeotis kori*, similar in size to Great Bustard, is depicted in the rock art and dances of the San, suggesting a ritual relationship of considerable antiquity in addition to its practical value as quarry. Kori Bustard meat may be subject to strict taboo and is associated with the male initiation rites of the |Gui dialect group (Tanaka/Sugawara

1993). Beyond Africa, the large Australian Bustard *Ardeotis australis* is also both prized game and a highly important cultural and spiritual animal for many Aboriginal groups, again the subject of much mythology and complex systems of totem and taboo laws (Ziembicki 2010).
The presence of other modified remains from apparently valued bird species, including ostrich, Red-billed Chough and eagle, appears to suggest that, while Great Bustards may have been especially important, the people of the Grotte des Pigeons had a cultural relationship with a diverse range of taxa, some aspects of which may have been shared widely across the Mediterranean region over an extended period of time.

Environmental Significance

Most of the taxa identified within the fossil assemblage still occur in the local area or in the wider Beni Snassen region, at present, even some of the scarcer modern Moroccan species, such as Hoopoe (which the author personally observed at Tafoughalt village). Additional species, including Ostrich and Great Bustard, remain part of the wider Moroccan avifauna, albeit in very limited numbers. In general, though, the fossil assemblage provides a solid signal for open woodland habitats and mattoral, not dissimilar to the present day local habitats. However, at the risk of stating the obvious, flighted birds are highly mobile and would definitely have an altitudinal response to moderate environmental shifts in this altered local terrain, probably without much time lag, making them less sensitive indicators in the present context. Ostrich and Great Bustard are indicative of open plains environments, and, as both species have a clearly anthropogenic presence at the cave, probably represent habitats some distance from the site, most likely to be plains beyond the mountains to the north or south.

Biogeographic Significance

European fossil Mediterranean avifaunas have been well-studied and their biogeographic implications discussed on both local and regional scales (e. g. Covas/Blondel 1998; Holm/Svenning 2014). Of particular research interest have been the occurrence of northern irruptive species and the presence of refugia areas. However, while North Africa has been identified as a refugium region, its Pleistocene fossil record seems to have been largely ignored in Mediterranean syntheses, possibly having been regarded as too sparse to be helpful, with the assemblage of the Haua Fteah, Libya, an exception. Although it is only one relatively small site with a fairly limited avifaunal assemblage, the Grotte des Pigeons has yielded the most diverse late Pleistocene avifauna yet described from Morocco, therefore adding valuable data to the North African fossil record, and providing a number of important biogeographic insights.
In general, with its overall similarities to the modern Moroccan avifauna, particularly that of the Beni Snassen region, the fossil avifauna of the Grotte des Pigeons appears to demonstrate a certain persistence, or indeed resilience, in the region's core avian communities, despite significant environmental changes over time. However, it is the impact of humans on the biogeography of the region's avifauna that is highlighted most clearly by the Grotte des Pigeons fossil assemblage. In particular, with the preservation of remains of Great Bustard and Ostrich, the assemblage records a formerly widespread ancient terrestrial avian megafauna that has now largely been eradicated from the Maghreb region, with the probably extinct Moroccan subspecies of Arabian Bustard *Ardeotis arabs lynesi* another member of this lost avian megafaunal community.
Evidence of Ostrich is common and widespread across numerous Holocene and Late Pleistocene Maghreb sites, particularly in Algeria and Tunisia (cf. Tyrberg 1993; also Merzoug 2011). Physical remains largely

consist of eggshell fragments, with bones relatively rare, but depictions of ostrich are also well documented in Neolithic and Capsian rock art (Rahmani/Lubell 2005). However, while the ancient presence of *Struthio* is well-attested and the causes of its extinction in the region are well understood (e. g. Kinzelbach 2003), much remains to be discovered about the dynamics of the taxon's origin and subsequent development across North Africa.

Ostrich is now extinct as a breeding species in Morocco but occurred historically in the Saharan regions of the country, including on the high plateaux and Saharan Atlas regions directly south of the Beni Snassen and Monts d'Oujda ranges, where it persisted into the early 20th century. Ancient records of ostrich at Taforalt, Rhafas and various other archaeological finds in Morocco, e. g. from 1950s excavations at the Neolithic site of Kheneg Kenadsa, also in northeastern Morocco (Merzoug 2011), clearly demonstrate its wider, more northerly ancient distribution across the region. Ostrich still remained abundant in southern Morocco into the 1950s, but the population continued to decline steeply until it disappeared as a breeding species in the 1970s. Only occasional vagrants have subsequently been recorded, though an attempt is underway to reintroduce the species to reserves in southern Morocco. A similar pattern has occurred across the wider region of northern Africa, with formerly abundant populations reduced to limited, critically endangered remnants. The primary cause of these catastrophic declines is human over-exploitation, for meat, eggs and feathers, with the latter a particular focus for hunting in the mid-19th century until ostrich farming became established in southern Africa (Folch 1992; Kinzelbach 2003).

While ostrich has effectively been eradicated as an established part of Morocco's avifauna, Great Bustard continues to cling on as a critically endangered species, with a population of only around 50 individuals in northwest Morocco (Alonso et al. 2016). Bustards as a family have an uneasy relationship with humans. Collar (1996, 259) goes as far as to comment that "bustards and human beings are largely incompatible" and, indeed, almost all bustard species are presently in decline, largely due to human activities. In Morocco, the crucial modern threat to Great Bustard is now collision of flying birds with power-lines, replacing hunting as the primary major threat during the last decade (Alonso et al. 2016). Recent molecular studies have shown the Moroccan Great Bustard population to be genetically distinctive from the Iberian population (Horrero et al. 2014). Although there is clearly some gene flow into Morocco from Iberian vagrant birds, the genetic diversity of the Morocco population is overall highly restricted, partly due to the species' decline on both sides of the Strait increasing the isolation of the Morocco population. The genetic diversity of the Moroccan birds has been interpreted to suggest an historical colonisation from Iberia "thousands of years ago" (Alonso et al. 2009, 387). Based on radiocarbon dates available for human and animal bones in Sector 10, the Great Bustard remains at the Grotte des Pigeons corroborate the DNA evidence and demonstrate that the species was clearly well established in Morocco by at least 15,000 years ago (Humphrey et al. 2014). Additionally, the Taforalt finds are more than 300 km distant from the modern population, now confined to a small region in the Tangier Peninsula, indicating a considerably more extensive ancient range. Remains of large bustards have also been recovered from the Neolithic levels of the Haua Fteah, and also in Egypt and Algeria (MacDonald 1997); identifications have favoured *Ardeotis* species but reviews of these finds could reveal an even wider former distribution for Great Bustard. Overall, it seems highly likely that Great Bustard undertook a southerly range shift in response to environmental changes during the last glaciation, taking advantage of a reduced crossing of the Strait of Gibraltar and colonising the expanded arid steppe habitats available in the Maghreb during this period (cf. Barton et al. 2005).

10.6 CONCLUSIONS

The Late Pleistocene archaeological and palaeontological sites of Morocco are currently the focus of unprecedented levels of research interest based around developments in prehistoric human culture and palaeoenvironmental change. However, while mammalian remains are being reported upon, avian faunal analyses which could also make a significant contribution to these and other lines of enquiry, are unfortunately under-represented at present. This absence is likely to be due in part to the need for potential avian researchers to build up experience with modern comparative specimen collections, which may not be readily available. Although describing an assemblage of relatively modest scale, it is hoped that the present report may demonstrate some of the potential of Morocco's Pleistocene avifaunas to encourage further research across additional sites.

The present LSA avifauna from the Grotte des Pigeons represents the first stage in documenting the most diverse avian assemblage yet recorded from the Pleistocene of Morocco. Comprising 161 remains representing at least sixteen distinct taxa, eight of them first recorded fossil occurrences for Morocco, the LSA avian assemblage provides biogeographic, ecological and archaeological evidence, relevant not only to understanding ancient environments and their human inhabitants but also valuable to modern ornithological science and conservation.

The Grotte des Pigeons assemblage is dominated by taxa strongly associated with cliffs and rocky scrub habitats, typified by Barbary Partridge, Red-billed Chough, probable Rock Dove, a swift and an eagle. Two further taxa, Tawny Owl and Hoopoe contribute an indication of local open woodland habitats. Most of these taxa may be observed locally at the present time, which on the one hand may suggest long-term stability but may equally suggest resilience in these avian communities to environmental change and potentially be indicative of positive results of the restoration efforts in the Beni Snassen region. In either case, the modern occurrence of a suite of taxa that has been occupying the region (albeit with possible interruptions) for in excess of 15,000 years, may well strengthen a case for elevating its reserve status.

Reflecting habitats outwith the immediate area but accessible to LSA human inhabitants, Great Bustard and Ostrich represent the terrestrial faunal communities of the arid plains beyond the mountains, brought to the Grotte des Pigeons by human hands. It is telling that both of these taxa are, by human agency rather than environmental change, either recently extinct or critically endangered as breeding species of Morocco; the history of interaction between these birds and humans is demonstrably ancient.

It is the evidence of this interaction that forms the basis for the most striking avian discoveries at the Grotte des Pigeons thus far, with exploitation of a range of species demonstrating not only resourceful hunting practices but also complex cultural values, with birds utilised for both food and creating objects. Of the archaeological assemblage, it is the Great Bustard remains that are of outstanding importance and the key signature avian discovery from this site.

The Great Bustard assemblage of 24 remains from at least four individuals, male, female and immature, suggests that the taxon was widespread and apparently relatively abundant in Morocco by at least 15,000 years ago. Amongst the archaeological avian assemblage, the finds uniquely demonstrate unequivocal use of a bird for ritual purposes, primarily feasting and offerings associated with the human burials of Sector 10, and establish a record of human exploitation that appears to have continued to at least 2005 in the form of trophy hunting adult male bustards (Alonso et al. 2005).

Unfortunately, both hunting pressure and habitat changes have contributed to the rapid disappearance of the Great Bustard in Morocco, to the point that, at current rates of decline, the extinction of this genetically distinctive population is predicted within 20 years (Palacín et al. 2016). It is therefore to be keenly hoped that the proof of Great Bustard's ancient origin in the country and also its importance to the LSA

people of the Grotte des Pigeons may raise the profile of this species and give it a new cultural significance that will help inspire modern Moroccans to back conservation efforts to secure the species' future in North Africa.