

Sea-birds from coastal and non-coastal, archaeological and “natural” Pleistocene deposits or not all unexpected deposition is of human origin

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Abstract. This paper explores the reasons behind some unexpected occurrences of sea-birds on Palaeolithic and non-archaeological Pleistocene coastal and inland sites in Europe. Such unexpected occurrences are of the kind often interpreted by archaeologists as being of human origin. No universal explanation is offered, as each case should be considered separately. Some, such as the finds of Little Auk *Alle alle*, are probably present due to inland “wrecking” while others may represent scavenged or predated birds moved inland, and due to the distances involved, the predators or scavengers were probably mostly birds. However, modern records show that obligate marine birds are regularly found as inland vagrants and are therefore perhaps not such unusual finds. This paper, therefore, illustrates that unexpected finds are not solely due to anthropogenic processes and that a sound knowledge of natural history is required before special interpretations of animal remains are made.

Key word: Sea birds, archaeological deposits, human agency, Pleistocene.

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I. INTRODUCTION

There is an overriding problem in archaeology that when finds are unearthed on an “archaeological site” they are invariably believed to have arrived there by human agency. This problem is perhaps greater on more recent Holocene than Pleistocene sites but as some of the examples that follow will illustrate it persists throughout archaeology inclusive of the Palaeolithic. Associated with this problem is the fact that unusual or unexpected finds are often interpreted as the result of human agency. The existence of various theoretical perspectives in archaeology has tended to lend support to such explanations (DAVIES 2000). This paper examines a number of examples where marine bird remains have been found on sites dated to the Pleistocene. Some of these examples include sites at some distance from the sea, while others are adjacent to the sea. These sites include both archaeo-

logical and as non-archaeological examples emphasising the “natural” existence of unexpected deposition.

The study of the Palaeolithic includes one particular preoccupation, that is the distance from which any object found on a site may have been transported by humans. The two types of material generally discussed in this context are marine shells transported inland during the Upper Palaeolithic for use as decorative objects and lithic raw materials which may be transported in various states of manufacture from their geological source (MELLARS 1996). The reason for the interest in the transport of such materials is either to infer the home ranges of a group of hominids or to suggest that movements of objects over great distances (hundreds of kilometres) may imply trade or at least some kind of communication network between subpopulations. The general conclusion is that Palaeolithic modern humans had larger home ranges and/or were more likely to be communicating over greater distances than earlier hominids such as Neanderthals and that this may be positively correlated with population density.

Sea-birds form a regular and sometimes significant constituent of avian bone assemblages on archaeological sites (e.g. BROTHWELL et al. 1981; SERJEANTSON 1988). In some instances sea-bird remains occur at a relatively large distance from the coast (O’CONNOR 1989a; BRAMWELL 1974; PARKER 1988) and this would seem to imply that at times they were highly valued by people of the past (O’CONNOR 1989a,b). However, these examples are historical and little attention has been paid to sea-bird occurrences on Palaeolithic sites. This paper therefore seeks to redress this by examining case studies where sea-birds have been found in deposits at a variety of Palaeolithic and non-archaeological Pleistocene sites and to explore the reasons for these occurrences.

Table I lists all the Pleistocene records of sea-birds from both inland and coastal sites from TYRBERG (1998). This illustrates that the most common sea-bird occurring inland is the Little Auk *Alle alle* followed by the Kittiwake *Rissa tridactyla*. Single and double records exist for various tubenose taxa such as the Sooty Shearwater *Puffinus griseus*, Cory’s Shearwater *Calonectris diomedea* and Leach’s Petrel *Oceanodroma leucorhoa* as well as for the Shag *Phalacrocorax aristotelis* and the Puffin *Fratercula arctica*. Of these records the Shag and its relative the Great Cormorant *P. carbo* together with the Little Auk are discussed here in some detail. Also of relevance are the occurrences of Great Auk *Pinguinus impennis* at Boxgrove and the shelduck *Tadorna* spp. assemblage from Tornewton Cave in Devon.

It is also of interest that certain taxa are unexpectedly missing from inland Pleistocene sites. In particular the gull species such as the Black-Headed Gull *Larus ridibundus* and the Herring Gull *L. argentatus* are generally absent in the Pleistocene fossil record of Europe as a whole let alone from inland sites. Today, both these species are commonly found inland as scavengers. The lack of Pleistocene gulls appears to be a genuine phenomenon because they were also absent as late as the Medieval period (O’CONNOR 1993). It is possible that this phenomenon is related to the disappearance from much of North-Western Europe of inland, urban scavengers such as the Raven *Corvus corax* and the Red Kite *Milvus milvus*. Although it should perhaps be mentioned that gulls have very fragile bones due to their greater degree of pneumatization than many other taxa and could be underrepresented in the record as a consequence (pers. obs.). The large number of Kittiwake fossils, as gull species, would seem to contradict this however.

In addition to the inland records of seabirds a coastal site with Great Auk, Gruta da Figueira Brava, is also discussed as it has been used to infer human predation and southern European breeding for the species. The Great Cormorant, whose occurrence inland has recently been re-established, is also described as confusion over their habitat could lead to misinterpretations of the fossil record.

A c k n o w l e d g e m e n t s. I would like to thank Roger JACOBI for discussions regarding the significance of Little Auks in inland sites. I also thank Chris HAWKES of the University of Bristol Spelaeological Society Museum for allowing access to the bones from Merlin’s Cave.

I am also grateful to Rachel MASSEY who proofread an early draft of this manuscript and Simon PARFITT and Alexis WILLETT provided critical comment. Tabitha STEWART STACEY was never far from my thoughts. I would also like to thank Cecile MOURER-CHAUVIRÉ and Tommy TYRBERG for

Table I

Occurrences of sea-birds in European Pleistocene deposits (modified from TYRBERG 1998)

Species		Coastal Records	Inland Records
<i>Fulmarus glacialis</i> (LINNAEUS, 1761)	Fulmar	2	0
<i>Calonectris diomedea</i> (SCOPOLI, 1769)	Cory's Shearwater	11	2
<i>Puffinus gravis</i> (O'REILLY, 1818)	Great Shearwater	1	0
<i>Puffinus griseus</i> (J. F. GMELIN, 1789)	Sooty Shearwater	5	1
<i>Puffinus puffinus</i> (BRÜNNICH, 1764)	Manx Shearwater	10	0
<i>Puffinus yelkouan</i> (ACERBI, 1827)	Mediterranean Shearwater	7	0
<i>Puffinus holeae</i> WALKER, WRAGG & HARRISON, 1990	Extinct Shearwater	2	0
<i>Puffinus nestori</i> ALCOVER, 1989	Extinct Shearwater	1	0
<i>Puffinus</i> sp.	Shearwater sp.	1	0
<i>Hydrobates pelagicus</i> (LINNAEUS, 1758)	Storm Petrel	5	0
<i>Oceanodroma leucorhoa</i> (VIEILLOT, 1818)	Leach's Petrel	0	1
<i>Morus bassanus</i> (LINNAEUS, 1758)	Gannet	8	0
<i>Phalacrocorax aristotelis</i> (LINNAEUS, 17761)	Shag	18	1
<i>Catharacta skua</i> BRÜNNICH, 1764	Great Skua	1	0
<i>Rissa tridactyla</i> (LINNAEUS, 1758)	Kittiwake	6	4
<i>Larus canus</i> LINNAEUS, 1758	Common Gull	0	1
<i>Pagophila eburnea</i> (PHIPPS, 1774)	Ivory Gull	1	0
<i>Uria aalge</i> (PONTOPPIDAN, 1763)	Guillemot	13	0
<i>Uria lomvia</i> (LINNAEUS, 1758)	Brünnichs Guillemot	2	0
<i>Uria</i> sp.	Guillemot sp.	3	0
<i>Alca torda</i> LINNAEUS, 1758	Razorbill	9	0
<i>Pinguinus impennis</i> LINNAEUS, 1758	Great Auk	15	0
<i>Cephus grille</i> (LINNAEUS, 1758)	Black Guillemot	3	0
<i>Alle alle</i> (LINNAEUS, 1758)	Little Auk	6	10
<i>Fratercula arctica</i> (LINNAEUS, 1758)	Atlantic Puffin	7	1

their remarks as referees of the paper. I would like to add that I regret any disagreement with some authors regarding the interpretation of sea-birds on archaeological sites. The purpose of this paper was mostly to critique post-modern over-interpretative archaeologists by using examples of where the “natural” cannot be ignored. Tommy TYRBERG is also thanked for making me aware of the former link that had been made between botulism and *Presbyornis*. Nicky MILNER also read the manuscript and suggested the relevance of the subject at hand to seasonality studies in the European Mesolithic.

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II. CASE STUDIES

Great Auk from Boxgrove and the Gruta da Figueira Brava

The Lower Palaeolithic site of Boxgrove in Sussex has yielded a single find of the extinct flightless Great Auk *Pinguinus impennis* (STEWART 1997; HARRISON and STEWART 1999). The position of the Great Auk bone in the stratigraphical sequence at Boxgrove is significant because it comes from a deposit that is terrestrial and completely devoid of marine influence. While the site includes marine and littoral deposits it also has deposits that formed inland at some distance from the contemporary coastline. That is to say that the sea was not at a very great distance but it signifies that the deposition of the bone could not have taken place by the action of seawater (ROBERTS et al. 1997). Furthermore, as a flightless bird, it is unlikely that the individual made its way inland while alive. This therefore implies that another agent is likely to have deposited the bone at this distance from the sea. The wealth of evidence for humans at the site, including both artefacts and skeletal remains (ROBERTS et al. 1994), have driven the popular media to suggest that it was the hominids of the time who were to blame for the bird's death and transport (ANON 1994). However, the lack of evidence in the form of cut marks made by flint implements do not allow this assertion to be confirmed. It is likely that a predator of some kind, possibly scavenging a beached carcass, brought the bone to where it was eventually found. However, it is not possible to say for certain whether that predator was human, another mammal or a bird.

Other instances where Pleistocene Great Auk finds have been blamed on human predation, albeit on a coastal site, are two humeri from the Gruta da Figueira Brava in Portugal (MOURER-CHAUVIRÉ and ANTUNES 1991, 2000). In this case, the reasoning was that the remains most assuredly represented those of the Neanderthal's diet, and because Great Auks would be too difficult to catch at sea their capture must have occurred on land. Included in this argument is the fact that little evidence for carnivores exist at the site (ANTUNES 2000). Furthermore, MOURER-CHAUVIRÉ and ANTUNES (2000) reasoned that a Great Auk would only come to land to breed and therefore Great Auks must have been breeding on the Atlantic coast of Portugal approximately thirty thousand years ago. MOURER-CHAUVIRÉ (1999) has expanded this argument recently to suggest that a change in breeding distribution occurred in the Great Auk where the lower latitude locations were lost due to human predation pressure rather than because of climate change at the end of the Pleistocene. Holocene finds of Great Auk on archaeological sites at similar low latitudes to those of the Gruta da Figueira Brava have been used to support this argument. MOURER-CHAUVIRÉ invokes the logic that the Great Auk could only be caught on land and that they only came to land to breed to suggest that breeding distribution was at low latitudes in the Holocene as well. The latest find at low latitudes is that from the Spanish Late Roman site of the Plaza del Marques in Gijon (Asturias) where the Great Auk was associated with domestic fowl (HERNANDEZ CARRASQUILLA 1994). The other line of evidence used by MOURER-CHAUVIRÉ (1999) for low latitude breeding of the Great Auk are the taxa that often accompany them such as Guillemot *Uria aalge*, Razorbill *Alca torda*, and other sea-birds. The suggestion being that they were breeding together in mixed species colonies in the South during the Pleistocene near the Gruta da Figueira Brava [and elsewhere during the Holocene? (SERJEANTSON 2001)]. This would be analogous to the way in which the Great Auk lived to the north towards the end of their existence. The argument of MOURER-CHAUVIRÉ (1999) being that colonies in the north and the south were regularly exploited by man causing a gradual extinction starting in the south and ending in the north.

It may be that the birds such as the auks described above had breeding colonies that were distributed further to the south than today during the Pleistocene, and even the Holocene, and that the finds of significant numbers of these taxa in archaeological sites might be evidence thereof. However, it is not necessarily the case that the finds of either the Great Auk or the other sea-birds constitute the results of human predation. Unless cut-marks are found on the remains of such finds it is equally possible that the remains were collected by an avian or mammalian predator or scavenger who removed a dead or live stranded bird from the shore or from a possible breeding colony.

As stated above it may be that sea-birds, including the Great Auk, were breeding to the south of their present range in areas such as Portugal during the last glaciation and the south of England near

Boxgrove during the late Cromerian, however the flightlessness of the Great Auk cannot be used to substantiate this. The very fact that other flying auks are often found in these assemblages would indicate that whatever the mechanism that led to these birds being deposited together it was not dependent on the flightlessness of the birds. The only evidence for southern breeding would therefore be the cut marks on the immature Great Auk bones from Herriko Barra a Holocene site in the Basque country (MARRIEZKURRENA and ALTUNA 1995). The latter may be good evidence, but since Razorbill chicks today take to sea with the male parent 21 to 23 days after hatching and only fly some 40 days later this may be questioned (GASTON and JONES 1998). It may therefore be that the immature bone at Herriko Barra is simply evidence that the Great Auk went to sea before their bones were fully formed and may have reached great distances from their breeding grounds before their bones matured.

Little Auks from European inland sites

As long ago as 1924 E.T. NEWTON identified the remains of Little Auk, a small northern pelagic sea-bird, from the inland site of Merlin’s Cave in the Wye Valley in England (NEWTON 1924). This cave is 20km from the river Severn and further still from today’s coastline, and in the last glacial period the coast would have been at a much greater distance. It is interesting therefore that NEWTON made no comments regarding this occurrence. The Little Auk remains from Merlin’s Cave were thought to be lost, together with the other bird finds from the cave, in a bombing raid during WWII (HARRISON 1987). However, the Little Auk remains, a right tarsometatarsus, together with at least part of the rest of the Merlin’s Cave collection are preserved in the University of Bristol Speleological Society Museum (pers. obs.). The occurrence of this species at Merlin’s Cave is not as unusual as it may seem because the recently published catalogue of Pleistocene birds of the Palaearctic (TYRBERG 1998) gives a further ten European examples of Little Auk finds from inland sites.

Although the occurrence of such little pelagic birds in terrestrial contexts would at first seem odd the explanation is probably quite straightforward. Little Auks are well known today to be subject to “wrecking” (FISHER and LOCKLEY 1954). “Wrecking” is the phenomenon whereby numbers of sea-birds, usually Little Auks, but also other auk species, are blown inland by storms. Sometimes Little Auks are found inland in their thousands in a physically distressed state. Such “wrecks” are well documented and FISHER and LOCKLEY (1954) record instances where the birds have been found “on reservoirs, lakes, ponds, duck-ponds, rivers, sewage-farms, flooded gutters; in greenhouses, down chimneys, in porches, back yards, pigsties, gardens, roads, turnip-fields; and are caught by foxes, cats, dogs, opossums, raccoons, gulls, ravens, crows and small boys”. An amusing instance is also recorded when a doctor met a Little Auk entering his surgery door, snapping at anyone trying to catch it! Wrecking therefore would provide a reasonable explanation for the occurrence of Little Auk in such diverse localities, far from the contemporary coast, such as the Wye Valley (Merlin’s Cave) and Noailles (La Fage, France) (Table II and Figure 1) (TYRBERG 1998).

Other sea-bird species are also known to be subject to wrecking and this might be the explanation for the alcid fossils in Pin Hole Cave, Derbyshire (BRAMWELL 1984). These finds consist of a Puffin *Fratercula arctica* and a Black Guillemot *Cepphus grylle*. The present author has only managed to track down a single alcid fossil, a distal right coracoid, from Pin Hole that appears to have been identified by BRAMWELL as a possible Black Guillemot (note on its container) and subsequently by HARRISON as a Puffin (unpublished note with fossil). Together with other finds of sea-birds such as the various records discussed by TYRBERG (1998) (Table I) the find(s) from Pin Hole Cave may be a wreck or merely a vagrant such as regularly reported in bird watching magazines. Not mentioned by TYRBERG was the record of Common Gull *Larus canus* from Pin Hole Cave (BRAMWELL 1984) whose identification should perhaps be checked in order to eliminate a large wader whose post-cranial skeletal morphology is similar.

Similarly, TYRBERG (1998) explains the second commonest sea-bird recorded in Europe, the Kittiwake, by the fact that they regularly traverse land when migrating. Therefore, modern ornithological studies give us plenty of reason to suppose that such finds of sea-birds in terrestrial contexts are not as surprising as might be supposed. Certainly there is no evidence for human involvement in their occurrence.

Table II

Pleistocene occurrences of Little Auks and their dates. Sources: TYRBERG (1998), NEWTON (1924). Note: Dates are estimates unless a standard error is given in which case they are ^{14}C dates. *: Two records in different aged deposits

Site	Age	Date
France		
La Fage (Noailles, Corrèze)	“Rissian”	ca. 300-150 ka.
Baume de Gigny (Jura)	Last Glaciation	ca. 40-45 ka.
Bois du Cantet (Haute-Pyrénées)	Last Glaciation	10,920±160 BP
Roc de Combe (Lot)	Last Glaciation	24,500±400 BP
Germany		
Gaiskirche im Püttlachtal (Bayern)	Last Glaciation	15-10 ka.
Ireland		
Coffey Cave (Co. Sligo)	Last Glaciation ?	15-10 ka. ?
Norway		
Skjonghelleren (Sunnmøre)*	Last Glaciation	10,360±170 - 11,510±190 and 27,900-32,800 BP
Poland		
Oblazowa 1 (Nowy Sącz)	Last Glaciation	15-10 ka.
Iberia		
Cueva de Laminak II (Vizcaya)	Last Glaciation	15-10 ka.
El Castillo (Santander)	Last Glaciation	34,300±1000 BP
Gorham’s Cave (Gibraltar)	Last Glaciation	30 ka.
UK		
Merlin’s Cave (Gloucestershire)	Last Glaciation	10,020±120 BP
Chelm’s Combe (Somerset)	Last Glaciation	10,190±130 - 10,91±110
Chudleigh Cave (Devonshire)	Last Glaciation or Holocene	?
Creag nan Uamh cave (Sutherland)	Last Glaciation	10,080±70 BP

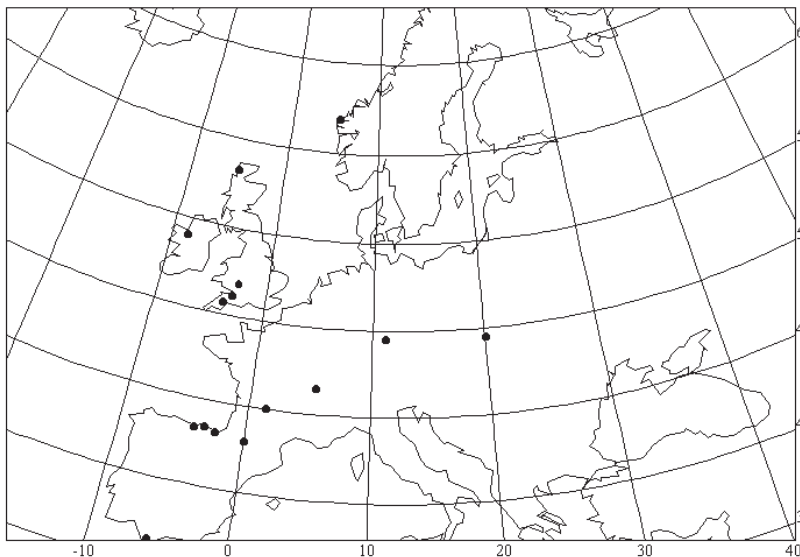


Fig. 1. European distribution of Pleistocene Little Auk finds.

Great Cormorants and Shags

Until relatively recently the Great Cormorant *Phalacrocorax carbo* in Britain was almost exclusively confined to coastal habitats. This situation was altered in 1981 when the Wildlife and Countryside Act (HMSO 1981) banned the culling of the species, which was widely practised in freshwater environments. Since that time the numbers of Great Cormorants breeding in freshwater habitats have risen dramatically causing a conflict between fishermen and fish-farmers on the one hand and conservationists on the other (ANON 1996). The pro-culling lobby has argued that the Great Cormorant is not a freshwater bird and has only begun to occupy such environments due to the depletion of marine fish resulting from over-fishing at sea by man. We know this to be incorrect, however, because fossil records including immature birds are known from freshwater habitats at sites such as Swanscombe (HARRISON and WALKER 1977; PARRY 1996) and Glastonbury (pers. obs.). Clearly the confusion concerning the Great Cormorant's preferred habitat would cause problems when the significance of their remains on sites is considered (STEWART 2001). This confusion, regarding the Great Cormorant's preferred habitat, is not due to variations in the habitats of the two subspecies of Great Cormorant present in Europe today. The two subspecies can be distinguished in the fossil record on the basis of size (ERICSON and HERNANDEZ CARRASQUILLA 1997) and the larger of the two *Phalacrocorax carbo carbo* is often thought to be the marine subspecies while the smaller *P. c. sinensis* dominates freshwater habitats today. It seems possible that *P. c. sinensis* has displaced *P. c. carbo* in freshwater (and even some marine) habitats in many areas. Many fossil and sub-fossil Great Cormorants that the author has examined from localities indicative of freshwater appear to be large and hence more consistent with *P. c. carbo* than *P. c. sinensis*. These include examples from the peat deposits in Denmark as well as from Ulrome in Yorkshire (see Figure 2). The latter confirms the results of ERICSON and HERNANDEZ CARRASQUILLA (1997) who showed that the Baltic subspecies during the breeding season in the past was *P. c. carbo* rather than *P. c. sinensis* found there now. Other birds persecuted by man such as the White-tailed Sea Eagle *Haliaeetus albicilla*, the Red Kite *Milvus milvus* and the Raven *Corvus corax*, which have all been pushed into mar-

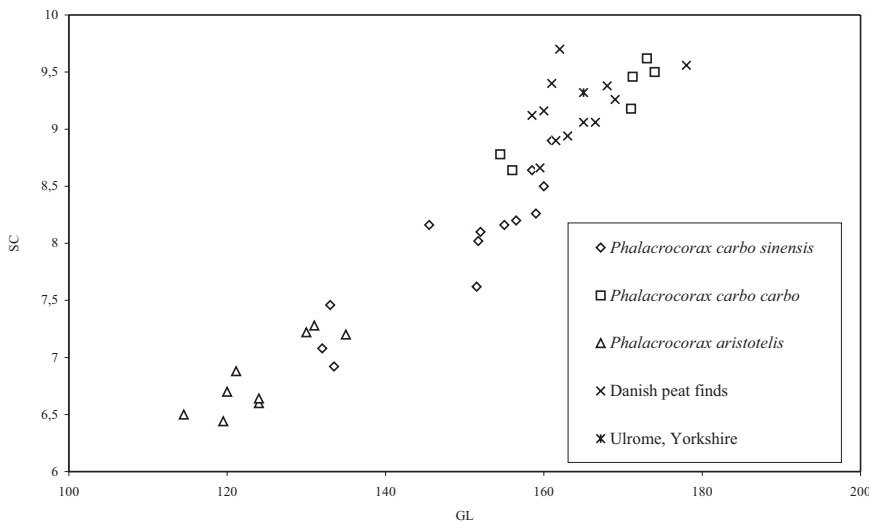


Fig. 2. Scattergram showing humerus greatest length (GL) plotted against shaft width (SC) of European *Phalacrocorax* taxa (the Shag *P. aristotelis* and the two subspecies of Great Cormorant *P. carbo carbo* and *P. c. sinensis*). Sub-fossils from Holocene sites in Denmark and England are compared with the modern comparative material to show that they are likely to belong to *P. c. carbo*.

ginal habitats in historical times have caused a similar situations of apparent habitat change (O'CONNOR 1993).

In contrast to the Great Cormorant the Shag *Phalacrocorax aristotelis*, a close relative, is an obligate sea-bird and has a single inland Pleistocene record in Europe at Cueva Negra in Spain. This record has, however, led to an extraordinary explanation. EASTHAM (1989) speculated that the hominids of Cueva Negra, presumably Neanderthals because the industry is Mousterian, might have used the birds to catch fish for them much in the same way that Great Cormorants have been used in the Far East for centuries (FISHER and LOCKLEY 1954). This imaginative explanation lacks any support and cannot be considered a parsimonious explanation for this single shag bone in an inland site. If it were true it would constitute the earliest example of animal taming (rather than true domestication) in human history and the first by any species of human other than *Homo sapiens*. While human exploitation cannot be completely ruled out neither can the explanation that the bone represents the dietary remains of another predator or scavenger. The distance from the cave to sea makes an avian predator more likely than a mammalian one.

S h e l d u c k i n T o r n e w t o n C a v e

Common Shelduck are not sea-birds in the strict sense but they are clearly adapted to feeding on intertidal mudflats and as such are included in this review. The example discussed here is an unusually large number of bones of what are probably mostly Common Shelduck found in Tornewton Cave in Devon (HARRISON 1980; STEWART 1996, in prep.). This assemblage may originally be derived from one sedimentary unit, the oldest unit called the Otter Stratum, but shelduck bones appear to have been subsequently re-deposited in later layers in the cave. The cave was originally excavated by Tony SUTCLIFFE of the Natural History Museum between 1944 and the early 1960's and later between 1989 and 1992 by a joint team from both the Natural History Museum and the British Museum led by Alison ROBERTS and Andrew CURRANT (SUTCLIFFE and ZEUNER 1962; ROBERTS 1996).

A variety of different explanations have been suggested for the Otter Stratum avian assemblage that is totally dominated by large anseriformes. (The minimum number of individual birds is 32. The figure represents the 32 distal left anseriforme humeri recovered by the SUTCLIFFE excavation from various deposits. All shelduck-sized anseriforme bones were counted as a large number could not be confidently determined to genus and if omitted would not reflect the situation accurately. Only one specimen could be firmly identified as belonging to shelduck *Tadorna* sp. although it is tempting to assume all or most of the remains represent Common Shelduck *T. tadorna*). HARRISON's original explanation for this unusual assemblage was that the bones represented the dietary remains of a large bird of prey such as a White-tailed Sea Eagle (*Haliaeetus albicilla*) and that shelduck were available as a source of prey for a considerable amount of time because they were present in later strata.

The first question that arises is whether the large anseriformes were present relatively close by throughout almost the whole of the time represented by the Tornewton Cave sediments. An alternative explanation would be that the remains that post-date the Otter Stratum might have been re-worked into younger deposits. This is important as it affects the interpretation of the means by which they arrived in the cave. Assuming the remains to be those of Common Shelduck their presence throughout the sequence is questionable. This is because the large number of shelduck presumably came from the habitat where they are found in greatest numbers in north-western Europe, which are intertidal mudflats. Also of importance is that sea-levels and hence the distance between the site and the mudflats would have changed throughout the time represented by the different strata. This might make it unlikely that the shelduck were being predated through an interglacial, such as that represented by the Otter Stratum, as well as during the glacial, represented by the Glutton Stratum, and being transported by a predator to the same cave. Their presence in other relatively temperate deposits such as the Bear Stratum (Oxygen Isotope Stage 5e) or Hyaena Stratum (O.I.S. 5c) (age assignments from CURRANT 1996) while not questionable on these grounds such constancy

in itself gives cause for concern. Ultimately, the problem is impossible to resolve without absolute dates on the actual duck bones. However, further evidence for reworking may be presented by the remains in the Otter Stratum of a single otter *Cyrtosonyx* sp. fossil that is surely reworked from the Otter Stratum. Any suggestion that the shelduck originated as a single assemblage would allow some of the more spectacular explanations for the deposit to be correct as catastrophic events are less likely to reoccur in the same place in different climatic cycles.

A suggestion that the shelduck were breeding in the cave was possibly alluded to by HARRISON (1980). Shelduck regularly nest in suitable animal burrows and other holes today (CRAMP and SIMMONS 1977) and it is just possible that the cave was used in a similar way. However, the absence of eggshell remains in the Otter Stratum sieved sediment residues from the latest excavation seems to negate that possible explanation (pers. obs.). It is also interesting to note that none of the anatids appear to be immature let alone juvenile. A nest site death assemblage is more likely to include juveniles than large numbers of adults. This said, it could be argued that the juveniles would not have survived as they are rarely preserved as Pleistocene fossils (pers. obs.).

Nigela HILDEGARTH (pers. comm.) has suggested that due to the numbers of individuals involved that the birds had succumbed to avian botulism and were either brought to the cave by predators or were washed in. This attractive hypothesis is not simply plucked from the air as thousands of migratory ducks and other waterfowl die regularly in North America when feeding on lakes whose water levels have fallen initiating avian botulism (FRIEND et al. 1996). However, if Common Shelduck are involved the theory falters as they generally feed on intertidal mudflats that are unlikely to give rise to such events. If the remains are Ruddy Shelduck, however, the theory is more viable as they are more usually found in freshwater situations. Interestingly, however, the theory may explain the thousands of bones belonging to the Eocene ancestral anatid *Presbyornis*, in the Green River Formation of the United States (FEDUCCIA 1980). The Green River Formation is a fresh water lake deposit that may well have been prone to the kind of eutrophic event evoked by HILDEGARTH (LEGGIT 1996).

It is possible that the presence of the carnivores found in the Otter Stratum hold a clue to the formation of the assemblage. In particular the clawless otter's occurrence is interesting as it is extinct signifying that we have little knowledge of its diet and habits. It is possible that these otters represent the predator responsible for the assemblage and account for the fragmentation of the shelduck bones. Unfortunately the sediment which makes up the Otter Stratum is coarse and showed signs of movement which may account for the extremely fragmented nature of the duck assemblage. The fragmentation of the anseriformes is mirrored in the other vertebrate remains in the deposit possibly further confirming that post-depositional processes and not carnivore action caused it. A small number of bones showed possible signs of carnivore tooth puncture marks, although the nature of the sediment, showing evidence of post depositional movement, puts this into question. The marks may merely be the result of movement within the sediment causing bone on bone damage.

The unusual nature of the assemblage may mean that a spectacular explanation is required, although the botulism hypothesis does not stand up to criticism. In addition the fragmentation of the bones seriously hinders interpretation, probably masking any original qualitative or quantitative patterns that may have been present. As already mentioned the environmental indications given by the shelduck are mainly those of the intertidal coastal zones where mudflats are periodically exposed by the tide. It is therefore very plausible and seductive to believe that an individual pair, or a succession of generations of pairs, of large predatory birds such as the White-tailed Eagle specialised in the hunting of shelduck on intertidal mudflats. It may also be that the clawless-otters *Cyrtosonyx antiqua* in the Otter Stratum also formed part of the large predatory bird's prey. This explanation however relies on the correct referral of all the anatid bones to the Common Shelduck. It has been pointed out, however, that the White-tailed Eagle is not known to do this today (TYRBERG, pers. comm.) and that although Peregrines *Falco peregrinus* are known to do this the Common Shelduck exceeds their maximum prey size.

III. DISCUSSION AND CONCLUSION

The case studies above illustrate that unusual associations of fossils, in this case sea-birds in terrestrial and other settings, can only be adequately explained when details of the species' natural history are taken into account. This has implications for the study of bones from archaeological sites because it is often assumed that enigmatic finds should automatically be given anthropogenic explanation (e.g. DRIVER 1999). The Great Auk remains from the Gruta da Figueira Brava and Boxgrove are likely to have reached both sites due to predatory or scavenging behaviour by animals that need not include humans. The interpretation of the Shag bone from Cueva Negra in Spain by Anne EASTHAM meanwhile illustrates that caution should be exercised when interpreting unexpected finds. The possible import of the bone to the site by Neanderthals is not necessarily questionable but the speculation that this may be evidence for the use of this cormorant taxon for fishing, as done in eastern Asia in historic times is not parsimonious. The Great Cormorant is an example where confusion over habitat preferences today could cause interpretative problems for the past. The Great Cormorant has always been a freshwater as well as a marine bird but had been pushed out of freshwaters in Britain by persecution leading to the mistaken belief that they had only recently come into such environments due to over-fishing at sea. The case of the Common Shelduck from the Otter Stratum of Tornewton Cave demonstrates that despite the exceptionally strange association of taxa and because no archaeological finds are associated with the shelduck that humans were not involved. Finally, the Little Auk remains, distributed widely across mainland Europe, are almost certainly the result of wrecking that takes place under extreme weather conditions.

This paper deals in the main with occurrences of sea-birds on Palaeolithic sites at some distance from their contemporary coastlines although the caution expressed is also relevant to younger sites, and in particular those from the Mesolithic. In such circumstances the remains of sea-birds are often used to imply seasons of occupation of sites (MILNER 1999). Reliance on these remains in any such argument presumes that the birds were predated by the humans occupying the site and that these humans subsequently disposed of them on their middens. These middens are often, large, open air accumulations of marine shells located near the coast. It is therefore quite possible for bird remains to be deposited by other predators and scavengers at these sites during the seasons unoccupied by the humans giving a wrong season of occupation for this site. Inferences taken from sea-birds about the season at which a site was occupied should be made with great care. If the midden were buried in a pit or the like the argument might be safer, as long as the bones were not residual (STEWART, in press).

Therefore, the author would like to appeal to certain sectors of the archaeological community who regard all explanations of associations in the ground as equally valid to be more cautious in the mode of DAVIS (2000). Complex depositional circumstances are not the sole domain of humans.

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