ARCHAEOZOOLOGY OF THE NEAR EAST VI

Proceedings of the sixth international symposium on the archaeozoology of southwestern Asia and adjacent areas

edited by

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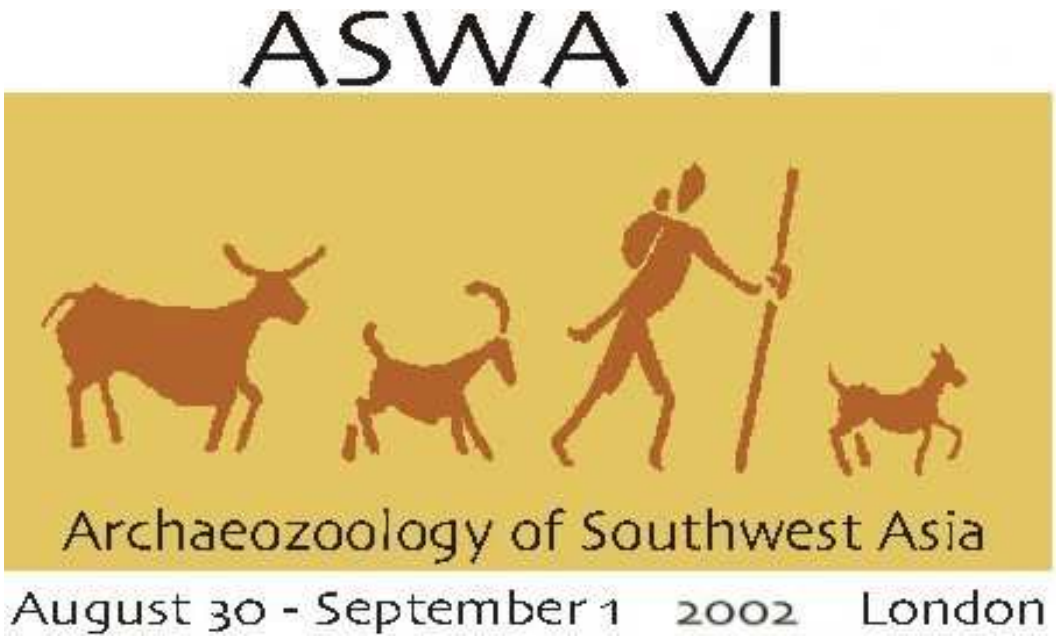


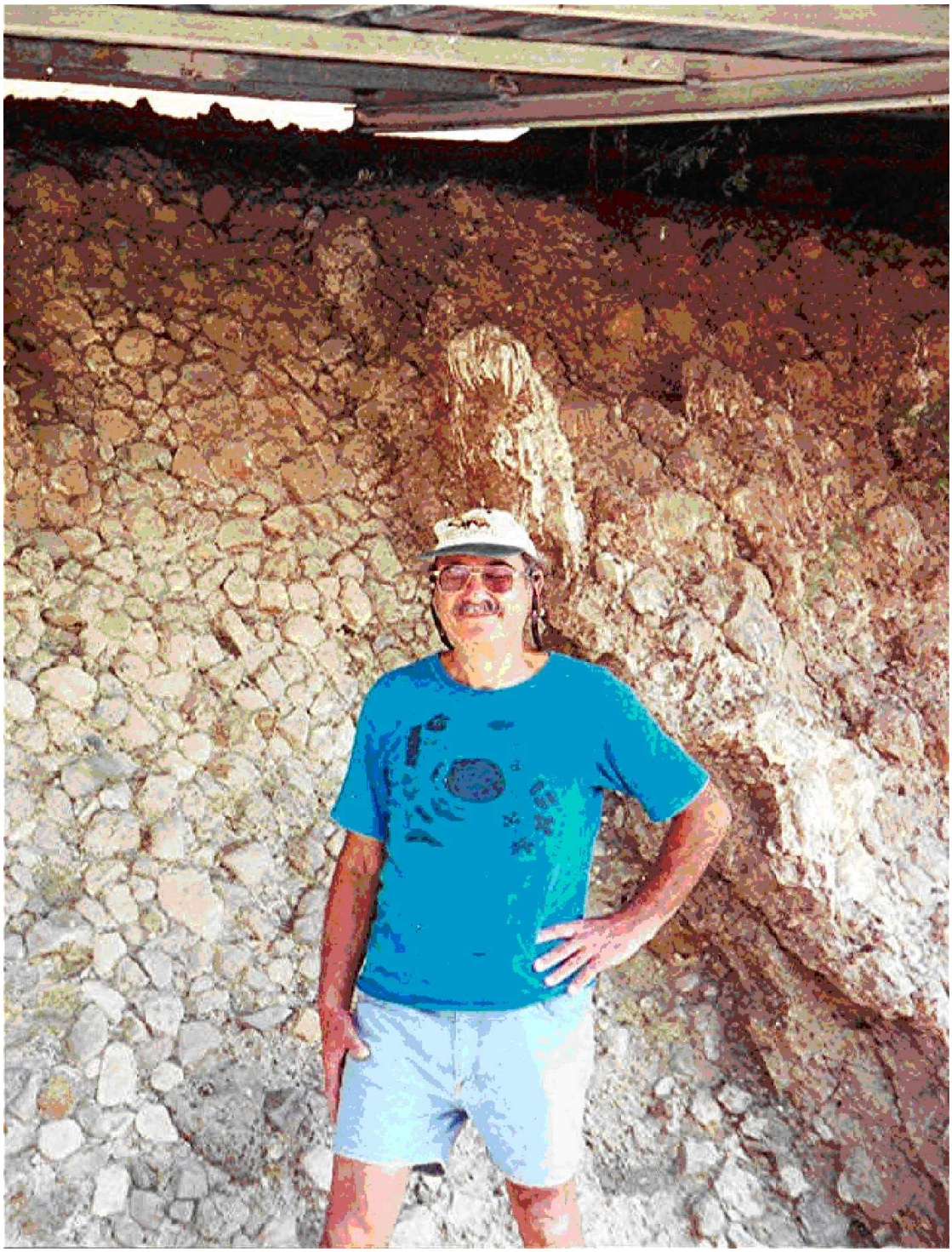
ARC-Publicaties 123
Groningen, The Netherlands, 2005

Cover illustration by Chris Mosseri-Marlio

This publication is sponsored by: ARC-bv and Vledderhuizen Beheer bv

Information and sales: ARC-bv, Koningsweg 48, Postbus 41018, 9701CA Groningen, The Netherlands, Tel: +31 (0)50 3687100, fax: +31 (0)50 3687 199, email: info@arcbv.nl, internet: www.arcbv.nl

ISBN 90-77170-02-2



Prof.Dr. Eitan Tchernov

This volume is dedicated to the memory of Prof. Dr. Eitan Tchernov, in fond memory of his enthusiasm and support to many in the field of archaeozoology.

Preface

The ASWA VI meeting was held at the Institute of Archaeology, University College London, from 30th August-1st September 2002, timetabled to follow on the heels of the ICAZ meeting in Durham, UK. Over 55 participants attended the meeting, travelling from 13 countries, bringing the latest research results from our field. As usual, it was a pleasure to see so many doctoral students presenting their research – a sign for a very healthy future for zooarchaeology in south west Asia. It is still unfortunate, however, that colleagues from some Middle Eastern countries were unable to attend due to financial and political constraints.

Presentations were organized into the following six themes, which highlight the scope of the ASWA membership: Animals in Palaeolithic and Epipalaeolithic Levant; Neolithic Patterns of Animal Use; Animals in Neolithic Anatolia; Animals in the Chalcolithic and Bronze Ages; Iron Age, Nabatean and Roman Patterns of Animal Use; Animals in Ancient Egypt. There was also a poster session, and contributors were invited to submit papers to this volume.

As always with the ASWA forum, the meeting served to welcome new scholars to the group, but was also very much a reunion of old friends and colleagues who have been sharing new information and discussing issues of joint interest for many years now. In this vein, it is a great sadness that ASWA VI was the last international meeting attended by Prof. Eitan Tchernov, an original founder of the group and mentor and inspiration to so many. For many of us, it was the last time we saw Eitan, and experienced his usual incisive comment, unstoppable enthusiasm for the subject, and warm friendship. He will be greatly missed.

ASWA VI was supported by the Institute of Archaeology, UCL, who provided facilities and financial and administrative help. In particular, the organizing team was aided greatly by the administrative assistance of Jo Dullaghan at the Institute. ARC bv (Archaeological Research and Consultancy, Groningen, The Netherlands) once again shouldered the finances of the publication of the proceedings, and we are extremely grateful for their continuing support. Many thanks are also due to the postgraduate student helpers from the Institute of Archaeology who made the meeting run so smoothly: Banu Aydinoğlugil, Jenny Bredenberg, Chiori Kitagawa, Peter Popkin, and Chris Mosseri-Marlio (who also produced the logo reproduced on the frontispiece of this volume).

Many thanks to all the participants for making the meeting such a success!

Louise Martin
London 2005

Participants of the 6th ASWA Conference, held at the Institute of Archaeology, University College London.

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Preface

PRELIMINARY REPORT ON THE VERTEBRATE FAUNA FROM SITE H3, SABIYAH: AN ARABIAN NEOLITHIC/'UBAID SITE IN KUWAIT

Mark Beech[1] and Mohsen al-Husaini[2]

Abstract

This paper summarises the preliminary results of an analysis of the mammalian, bird and fish vertebrate fauna from site H3 at Sabiyah in Kuwait. The site is a settlement located on the northern shore of Kuwait Bay. Radiocarbon dating, as well as distinctive pottery found at the site, confirms that the settlement dates to the late 6th/early 5th millennium BC. Domestic livestock exploited include sheep/goat and cattle. Hunting was carried out for gazelle, fox and marine turtle. Birds so far identified include cormorants. The numerous fish remains include requiem sharks, sawfish, sea catfish, groupers, jacks/-trevallies, emperors, seabream and tuna. Most fishing was probably carried out in shallow waters adjacent to the site, although some larger jacks and groupers, and particularly the tuna, must have been caught in deeper offshore waters. A large number of sea catfish otoliths were recovered from the site. These are currently being studied by the authors in the Fish Ageing Laboratory of the Mariculture and Fisheries Department, Kuwait Institute for Scientific Research. Preliminary data suggest that the sea catfish were caught during both summer and winter months. Interestingly, some of their otoliths had been utilised as blanks for the manufacture of beads.

Resumé

Cet article résume les résultats préliminaires d'une analyse de restes mammaliens, d'avifaune et d'ichtyofaune du site H3 à Sabiyah à Kuwait. Le site est un établissement situé sur les rivages septentrionaux de la baie de Kuweit. Les datations radiométriques ainsi qu'un style de poterie distinctif confirme une occupation du site datant de la fin du 6em début du 5em millénaires BC. Les animaux domestiques exploités sont le mouton et la chèvre ainsi que le bœuf. La chasse était pratiquée pour capturer des gazelles, renard et tortues marines. Les oiseaux jusqu'ici identifiés comprennent le cormoran. Les nombreux poissons comprennent le requin requiem, le poisson scie, le mâchoiron, le mérou, le carange, l'empereurs, le pagre et le thon. La majeur partie de la pêche se déroulait probablement dans les eaux peu profondes, proche du sites, même quelques plus gros caranges et mérous et particulièrement le thon était certainement pêchés dans les eaux plus profondes du large. Un grand nombre d'otolithes de mâchoiron a été retrouvé sur le site. Ils sont actuellement entrain d'être étudiés par les auteurs au Laboratoire d'estimation d'âge des poissons de la Department de la pisciculture de l'Institut de la recherche scientifique de Kuweit. Les premières données suggèrent que le mâchoiron était capturés aussi bien durant les mois d'été que d'hiver et il est à noter que quelques uns de leur otolithes étaient utilisés dans la manufacture de perles.

Keywords: site H3, Sabiyah, Kuwait, late 6th/early 5th mill. BC, Arabian Neolithic, 'Ubaid, mammals, birds, fishes, sea catfish, otoliths, seasonality

Mots Clés: Site H3, Sabiyah, Kuweit**,** fin du 6em /début du 5em millénaires BC, Néolithique de la Péninsule arabique. 'Ubaid, Mammifères, oiseaux, poissons, otolithes, saisonnalité

Introduction

This paper presents the preliminary results of the analysis of a vertebrate faunal assemblage from the site of H3 which is located on the north-east shore of Kuwait Bay in the northern Arabian Gulf (Fig. 1). Archaeological excavations undertaken at the site by a joint British-Kuwaiti team between 1999 and 2002 have recovered more than 52 kg of animal bones. The excavations were co-directed by Dr. Harriet Crawford and Dr. Rob Carter from the Institute of Archaeology, University College London, together with Sultan al Duwish and a team from the National Museum of Kuwait.

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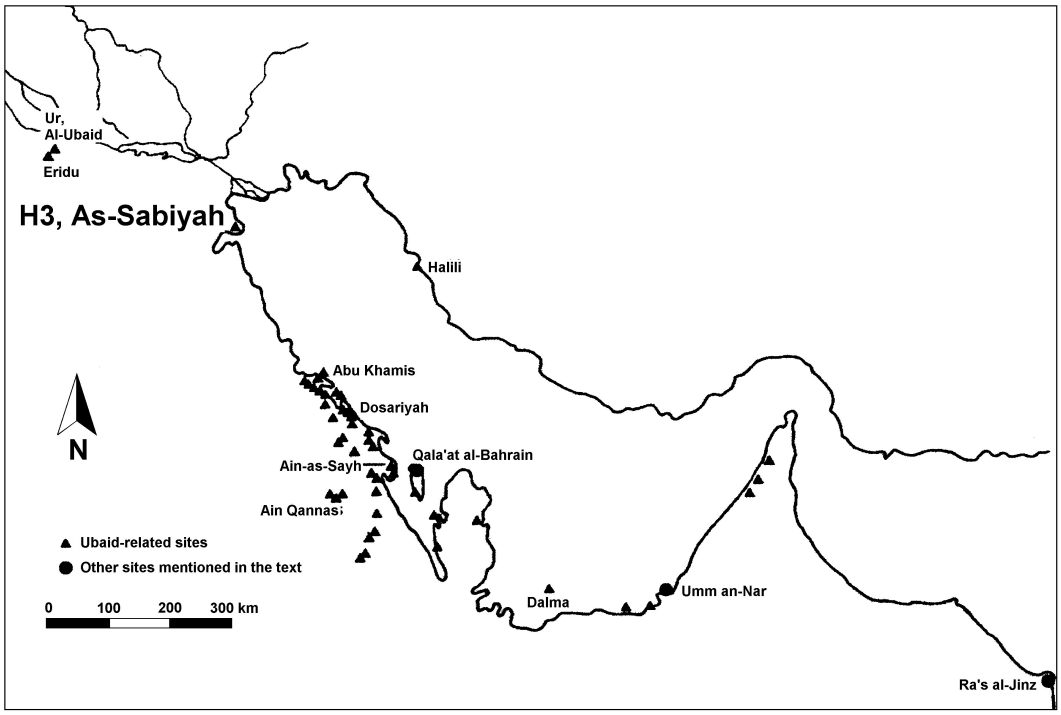

Fig. 1. Map of the Arabian Gulf showing the location of H3 and other Ubaid-related sites, as well as other sites mentioned in the text (after Carter 2002, Fig. 1).

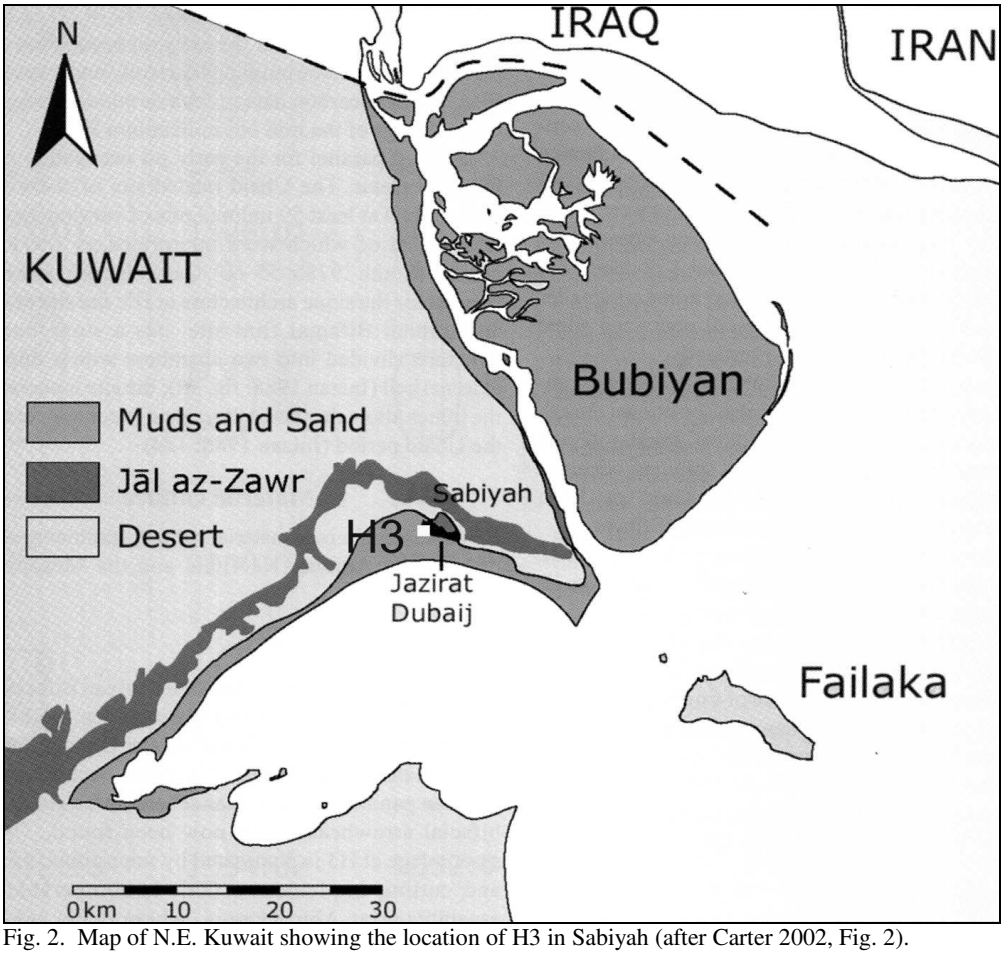

Fig. 2. Map of N.E. Kuwait showing the location of H3 in Sabiyah (after Carter 2002, Fig. 2).

Location and site discovery

H3 is located on a low peninsula known as Jazirat Dubaij which extends into mud flats on the north side of Kuwait Bay (Fig. 2). This peninsula directly bordered the sea to its south in antiquity, and the area around the northern edge of the peninsula probably formed the edge of a shallow lagoon lying between the peninsula and the ridge of the Jal al-Zawr escarpment (Carter *et al* 1999).

At the present day, the site consists of a low mound towards the western end of the peninsula, which rises about 2.5 metres above the muds and sands along the northern edge of Kuwait Bay. This mound is densely covered in shell, lithics and pottery, a large scatter being spread over an area approximately 90 metres from north-west to south-east and 80 metres from north-east to south-west.

The site was first discovered by Dr. Fahad Al Wohaibi, former director of the National Museum in Kuwait, in the mid 1990's. He then invited Dr. Harriet Crawford to visit the site in Kuwait and to carry out an initial survey of the site and its surroundings in 1998. Archaeological excavations then began in 1999, and continued in 2001 and 2002.

Site chronology

The site of H3 dates to the late 6th to early 5th millennium BC. This is confirmed by a series of radiocarbon dates taken on ashy material excavated through the stratigraphic profile of the site. A radiocarbon sample taken on ash collected from a fire-pit in the early part of the H3 sequence gave a value of 6480 ± 45 BP radiocarbon years (sample AA-42171/GU-9301). Using the decadal atmospheric curve and the University of Washington Quaternary Isotope Laboratory Radiocarbon Dating Program CALIB 4.3, this gives a calibrated date range of 5511-5324 BC at 2 sigma.

The distinctive 'Ubaid pottery found at the site is comparable to material of Ubaid 2/3 period. About two thirds of the assemblage consisted of pale greenish, buff and pale brown wares with a fine fabric and, where present, distinctive black or brown-painted stripes. These were usually bowls which have close parallels with material found at Ra's al Amiyah and Choga Mami. Comparisons can also be made with pottery from Ubaid 2 and 3 levels at Eridu, al-Ubaid, Oueili, Hajji Mohammed and other sites. Fine greenish ware in the form of delicate beakers comprised 13% of the assemblage. Coarse Ubaid wares used to make large vats and jars accounted for 2% of the pottery. Finally, a crude red or brown ware with coarse vegetal temper comprised around 20% of the pottery assemblage (Carter 2002). Petrographic and compositional analyses suggest that this was not made in Mesopotamia, like all the aforementioned types of pottery, but that this red ware may have been produced locally in the central Gulf region, as kiln wasters have been found from Dosariyah on the Saudi Arabian Gulf coast (Oates *et al* 1977: 224). The fact that these two types of pottery (Mesopotamian and Gulf region) are present at the site is of some interest. It demonstrates that the inhabitants of H3 were at an important location for interactions between both Mesopotamian and Arabian spheres.

The site and its finds

Excavations revealed that there was over a metre of depth of archaeological deposits at the centre of the mound. The earliest occupation level appeared to consist of fire-pits cut into a natural beach deposit. Subsequently a shell midden partly covered these layers. A series of stone-built cellular buildings were then constructed at the site, directly on top of the earlier layers (Fig. 3). The western building (chamber 15) has been interpreted as a workshop area with an associated storage facility (chamber 9). Large numbers of microlithic drills as well as unfinished shell artefacts were discovered here. The central cellular building (chambers 1, 3, 17 and 18) may have performed a number of functions. There was some evidence of rooms having been used for storage (e.g. the shelving in chamber 3), and activities such as spinning may also have been carried out (e.g. the concentration of spindle whorls in chamber 18). The two easternmost chambers had some special, as yet unknown, purpose. Whilst one was carefully paved with close-fitting stone slabs (chamber 11), the other contained a thick black fill of uncertain origin (chamber 7).

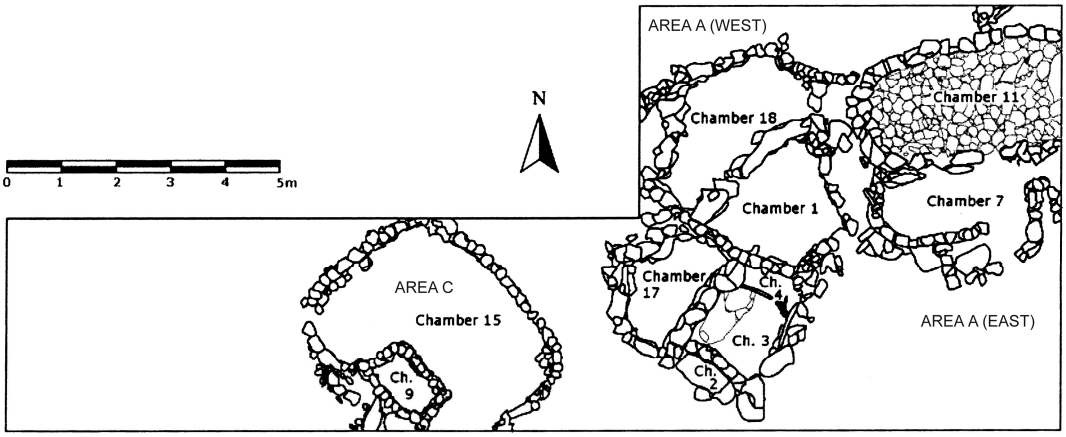

Fig. 3. Plan of the main excavation trench at H3 showing the stone structures following the 2001 season (after Carter 2002, Fig. 3).

The other finds from H3, besides the pottery, suggest that the site's inhabitants had a mixed material culture including elements of both the Arabian Neolithic and Mesopotamian 'Ubaid. Whilst the lithics largely belong to the so-called Arabian Bifacial group, as exemplified by the presence of several bifacial foliates and a dozen bifacial arrowheads, several polished axes were also found. Similar axes have been found in the southern Gulf in Ras Al-Khaimah in the United Arab Emirates (Kallweit 2001). The lithics assemblage, however, was dominated by microlithic drills, which indicates that shell jewellery was being manufactured on a large scale. Several pieces of worked obsidian were recovered from H3 and it has been suggested that these may have been used to make jewellery (Kallweit 2002). The obsidian is believed to have been imported from Yemen (Carter 2002).

Other important finds from the site included a complete model ceramic boat, a drilled pearl, thousands of shell beads, evidence for the manufacture of pearl oyster buttons, sequins and pendants, and body ornaments which have been interpreted as being labrets, or lip plugs, and ear stoppers (Carter 2002).

Methods

Only a small part of the vertebrate assemblage was excavated and removed by hand. It has long been established that hand recovery biases the faunal assemblage towards larger and more identifiable fragments (Payne 1975). A sensible strategy was therefore put into place on the excavation to ensure that the faunal remains being collected were a representative sample. The policy on the excavation was that all excavated sediment wherever possible was dry sieved using 4mm mesh screen. Every 10th bucket of spoil excavated from excavated layers was dry sieved using 2mm mesh screen. This acted as a monitor on the general recovery of bones and other finds. Bulk sediment samples were then taken of all important archaeological layers. These were usually around 40 litres in size. These sediment samples were then processed using flotation equipment. Anything which floated was caught in a 500 micron mesh sieve, whilst the non-floating residues remaining were then wet sieved using a 1mm mesh.

Analysis of the vertebrate faunal assemblage from H3 was carried out partly in the field in Kuwait, but predominantly in the Department of Archaeology at the University of York using the first author's own personal osteological reference collection of Arabian fishes and mammals.

An integrated database for the fish, reptile, bird and mammal bones has now been established. The database currently holds 1493 records, but only covers the 1998-2000 material in detail. This database is now archived within the projects archive in London, as well as a backup copy, being left on CD with Shihab A.H. Shihab, Director of the Department of Museums and Antiquities Department, in Kuwait.

The faunal remains

The list of taxa represented at H3 is presented in Table 3. Most of the bones by weight originated from area C, with moderate quantities from area A-East and Area A-West (Table 1). Only the material from the 1998-2000 seasons has been studied so far in detail. Two thirds of these bones by weight belong to fish, the rest to mammals with very small amounts of reptile, bird and crab (Table 2).

A preliminary evaluation has been carried out of the bone present in important archaeological contexts at H3. This was based on a list of contexts provided to the author by Dr. Rob Carter during the 2002 field season. Three types of contexts were examined: midden deposits, pit fills and chamber fills.

An attempt was made to examine bone concentrations across the site by comparing the weight of bone (in grams) retrieved against the total volume of sediment (in litres) excavated from that particular context. The bone weight/litre ratio varied between different contexts from a minimum of 0.01 g per litre to a maximum of 12.34 g per litre. Whilst midden contexts had an average of 0.56 g per litre, chamber fills had 1.26 g per litre and pit fills had 2.02 g per litre.

Table 1. Weight of all animal bones at H3 (1998-2002 seasons).

AREA	WEIGHT (kg)
A - West	8.87
A - East	12.15
B	0.11
C	24.12
D	2.07
F	4.69
G	0.87
Fenceposts	0.03
TOTAL	**52.90**

Table 2. Type of faunal material represented at H3 (1998-2000 seasons only) (NISP = number of identified specimens).

TYPE	NISP	WEIGHT (g)
bird bone	32	8.9
crab	3	2.3
fish bone (diagnostic)	1465	657.5
fish bone (non-diagnostic)	6730	1576.9
mammal bone (diagnostic)	290	298.1
mammal bone (non-diagnostic)	2383	958.3
reptile bone	3	25.5
TOTAL	**10906**	**3527.5**

Middens included a range of fish and mammalian remains. Pit fills were amongst the richest contexts for bone debris at H3. Notable concentrations were observed in area A-east (contexts 1504 and 1520) and area F (contexts 55, 57-9, 70-71). The richest deposits amongst the chamber fills were in area A-West, chamber 1 (contexts 1019, 1029 and 1052), chamber 17 (context 1043), and chamber 18 (context 1049); area A-East, chamber 7 (context 1525) and chamber 11 (contexts 1520 and 1575); and area C, chamber 15 (contexts 3030 and 3034).

A broad range of taxa is represented even from the earliest stratigraphic levels at the site within area F. No obvious chronological or spatial changes could be seen between different areas or types of deposit, although this will of course await the completion of the recording in detail of the remainder of the data from the 2001-2 seasons.

The results of the analysis of the 1998-2000 bone material are now summarised.

Domestic mammals

Three bone specimens can be positively identified as being from cattle. These were as follows: a distal tibia and distal metatarsal shaft fragment from area A (context 1577) and a proximal metatarsal fragment from area B (context 2005). These were all probably from adult animals, judging from their relative size, as well as the fact that the distal tibia fragment appeared to be fused. The general size of these elements suggested that smallish sized cattle were present.

It is difficult to separate the bones of sheep and goats. Nevertheless, several fragments could positively be attributed to sheep. These included such elements as third and fourth deciduous premolars and a number of carpal and tarsal bones. The presence of milk teeth from young sheep indicates that animals were probably reared on or near the site. Unfortunately, as the assemblage is highly fragmented it was only possible to attribute many bone fragments to “sheep or goat” or even to “sheep or goat or gazelle”.

Table 3. List of taxa represented at H3 (1998-2000 seasons only).

CRUSTACEA	**COMMON NAME**	**NISP**	**Weight (g)**
Portunidae: *Portunus* spp.	Swimming crab	2	1.0
Unknown crab	Unknown crab	1	1.3
MARINE FISH	**COMMON NAME**	**NISP**	**Weight (g)**
Pristidae, indet.	Sawfish, indeterminate	35	14.6
Carcharhinidae: *Carcharhinus* spp.	Requiem shark	153	209.4
Myliobatidae, indet.	Eagleray, indeterminate	12	2.9
Chondrichthyes, indet.	Shark/Ray/Skate, indeterminate	163	17.9
Ariidae: *Arius* spp.	Sea Catfish	222	167.8
Platycephalidae: *Platycephalus* spp.	Flathead	5	1.1
Serranidae: *Epinephelus* spp.	Grouper	43	16.9
Serranidae, indet.	Grouper, indeterminate	149	75.2
Carangidae: *Carangoides* spp.	Jack	14	6.0
Carangidae: *Decapterus* spp.	Scad	21	1.7
Carangidae: *Gnathadon speciosus* (Forsskal, 1775)	Golden trevally	1	1.7
Carangidae: *Scomberoides* spp.	Queenfish	3	0.4
Carangidae, indet.	Jack/Trevally, indeterminate	125	31.8
Lethrinidae: *Lethrinus* spp.	Emperor	15	10.0
Sparidae: *Acanthopagrus* spp.	Seabream	5	4.2
Sparidae: *Argyrops spinifer* (Forsskal, 1775)	King Soldierbream	21	14.0
Sparidae: *Rhabdosargus* spp.	Gold-lined/Haffara Seabream	32	8.7
Sparidae, indet.	Seabream, indeterminate	408	63.3
Scombridae (Thunninae), indet.	Tuna, indeterminate	25	9.7
Soleidae, indet.	Sole, indeterminate	13	0.2
Pisces, indet.	Unknown fish	6730	1576.9
REPTILES	**COMMON NAME**	**NISP**	**Weight (g)**
Chelonidae, indet.	Marine Turtle, indeterminate	3	25.5
BIRDS	**COMMON NAME**	**NISP**	**Weight (g)**
Aves, indet.	Bird, indeterminate	32	8.9
HUNTED TERRESTRIAL MAMMALS	**COMMON NAME**	**NISP**	**Weight (g)**
Gazella spp.	Gazelle	18	42.5
Vulpes spp.	Fox	7	5.0
DOMESTIC FOOD ANIMALS	**COMMON NAME**	**NISP**	**Weight (g)**
Bos primigenius f. *taurus*	Cattle	3	50.9
Ovis ammon f. *aries*	Sheep	5	4.6
Ovis ammon f. *aries* / *Capra aegagrus* f. *hircus*	Sheep/Goat	22	66.5
Ovis ammon f. *aries* / *Capra aegagrus* f. *hircus* / *Gazella* spp.	Sheep/Goat/Gazelle	235	128.6
Large mammal	Cattle-sized fragments	133	227.0
Medium mammal 1	Sheep/Goat/Gazelle-sized fragments	1830	646.6
Medium mammal 2	Dog/Fox-sized fragments	34	6.0
Unknown mammal	Unknown mammal	386	78.7
TOTAL		**10906**	**3527.3**

Non-diagnostic mammal bone fragments could often be assigned to general size categories based on the cortical thickness of the bone fragment. This confirmed that some large cattle-sized animals were present at H3, but that the majority of the highly broken up mammal bone fragments came from sheep, goat or gazelle-sized animals.

Wild mammals

A range of skeletal elements of gazelle were represented at the site including fragments of bones from the skull, forelimb and hindlimb. Gazelle were probably hunted and then the whole carcasses were brought to H3 for butchery. Two gazelle bones had traces of cut marks consistent with primary butchery and dismemberment activities. These were: an astragalus from area F (context 58) which had small oblique cuts to its lateral and medial sides, as well as a first phalanx from the same area (context 55) which had a small oblique cut mark on its proximal posterior medial margin (Fig. 4).

Fig. 4. Gazelle bones with cut marks from H3.
Left - astragalus from area F, context 58, with small oblique cut to its lateral side; Right – first phalanx from area F, context 55, with small oblique cut on its proximal posterior medial margin (Photograph by Mark Beech).

A number of bones from fox were also recorded. These included a mandible fragment from an adult individual from area F (context 55), as well as a distal tibia from area A-West (context 1017). The latter specimen appeared to have been burnt, suggesting that this animal may have been occasionally eaten by the inhabitants of H3. The general size of these bones seem more similar to those of the Arabian race of the common red fox (*Vulpes vulpes arabica*) rather than to the much smaller, and much rarer, Rueppell's fox or sandfox (*Vulpes rueppelli*).

Fishes

The majority of the fish at H3 were probably caught in shallow waters adjacent to the site. Fishes represented include requiem shark, sawfish, eagleray, sea catfish, flathead, grouper, jack, scad, golden trevally, queenfish, emperor, seabream, king soldierbream, gold-lined/haffara seabream, tuna and sole. There is some evidence to suggest that fishing occasionally extended into much deeper waters, judging from the presence of some large specimens of requiem shark, grouper, jack and tuna. A notable feature of the fish bone assemblage was the presence of hundreds of otoliths. These will be discussed in further detail below.

Birds

The bird bones have not yet been examined in detail. These are to be analysed at a future date by Dr. John Stewart (UCL, London). A preliminary inspection of the bird bones, however, has revealed the presence of *Podiceps cristatus*, great crested grebe (Dr John Stewart, pers.comm.). This bird is a partial migrant, its winter range including the North African coastline, Turkey, south to Egypt and central Red Sea, east to Iran and the Arabian Gulf. It occurs in open areas of freshwater throughout the year,

and in coastal areas in winter. It generally nests in water anchored to suitable vegetation. This indicates that the inhabitants of H3 were actively exploiting such areas in the vicinity of the site.

Reptiles

There is some evidence for the exploitation of reptiles. A proximal femur fragment from a marine turtle was identified from area A-West, context 1019 (Fig. 5). Several other bones from turtles, mainly consisting of metapodial fragments, were also noted. It is clear that the inhabitants of H3 occasionally hunted for turtles. The precise identification of which turtle species is represented remains unclear. Five species are reported from the Arabian Gulf at the present time, although only two, the green (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*), are common and nest there (Carpenter *et al* 1997). Green turtles were once very common on Kuwait's sandy beaches but are now only found on the offshore islands (Clayton and Wells 1994). It is reported that a green turtle specimen was caught by the Fisheries Department research vessel in the early 1990's (Ross and Barwani 1995: 379). This is the species which is most likely to be seen in Kuwaiti waters.

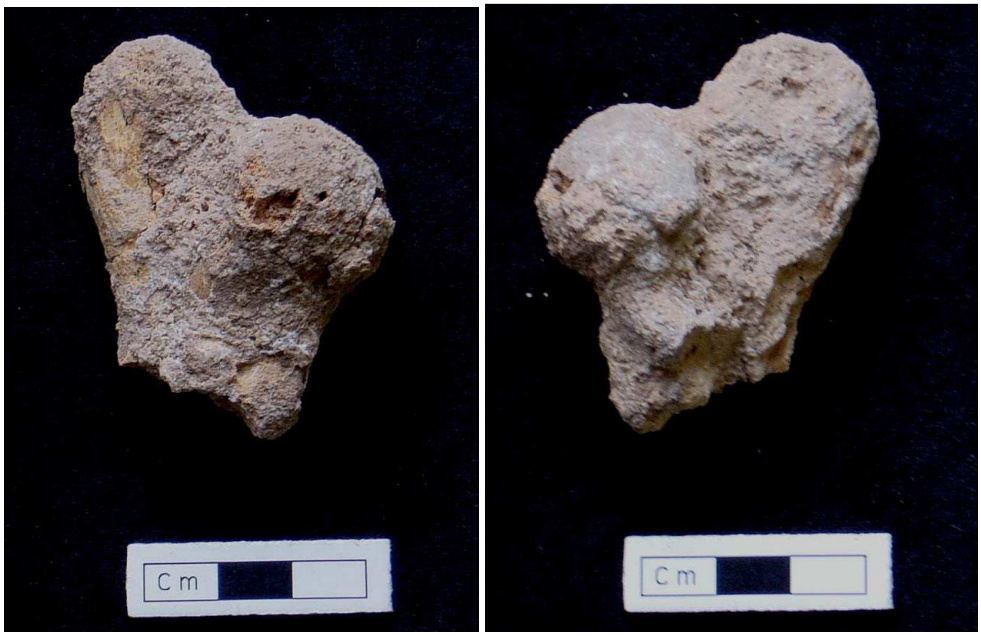

Fig. 5. Turtle proximal femur from area A-West, context 1019.
Left – anterior view; Right – posterior view (Photograph by Mark Beech).

Other environmental finds

The crab remains are currently under study by Dr. Peter Hogarth (Department of Biology, University of York, U.K). Some of the chelae fragments certainly come from swimming crabs (Portunidae). Other taxa may be represented which may shed some light on the structure and type of inter-tidal habitats represented adjacent to H3.

The molluscan remains are currently being studied by Emily Glover (Research Fellow, Natural History Museum, London). The predominant edible species was the turban shell (*Lunella coronata*). This is a rock dwelling gastropod which is typically found in intertidal rock pools. Another common shell species at the site was the pearl oyster (*Pinctada* spp.). This may have been collected by diving from boats in shallow subtidal water since intertidal pearl oyster is relatively uncommon. Pearl oyster, in particular, seems to have been important raw material at H3 for working into various artefacts like beads and pendants.

Three heavily mineralised date stones were recovered during the 2001-2 excavation seasons at Sabiyah (Beech 2003: 23). It is not possible to say whether these represent wild or domesticated date palms. Date stones have also been recently discovered at another Ubaid site in the Arabian Gulf, on Dalma Island in the United Arab Emirates (Beech and Shepherd 2001).

The marine catfish otolith project (with Dr. Mohsen al-Husaini)

One of the important questions concerning the settlement at H3 is whether it was occupied on a year round or seasonal basis. It is fortunate that at the site we have found large numbers of fish otoliths (Fig. 6). These mostly come from what appeared at first examination to be one species, the marine catfish, a member of the Ariidae family. A collaborative study on the fish otoliths from H3 was therefore established together with Dr. Mohsen al-Husaini (Fish Ageing Laboratory, Mariculture and Fisheries Department, Kuwait Institute for Scientific Research - KISR).

In actual fact, four species of sea catfish are inhabiting Kuwait waters. There are two dominant species, *Arius tenuispinis* and *A. bilineatus*, and two minor species, *A. thalassinus* and *A. dussumieri*. However, their otolith morphology and macrostructures are very similar and it is difficult at this stage to identify the excavated archaeological otoliths to species level. Attempts are currently under way to compare external and internal measurements of modern otoliths with their archaeological counterparts, as well as with the morphological characteristics of the sea catfish species inhabiting Kuwait's waters. Sea catfish are being sampled from fish markets and during KISR departmental sea surveys in Kuwaiti waters in order to investigate the otoliths' internal macrostructures. Once the length of the fish has been recorded the otoliths are removed and then processed as follows:

Sea catfish otoliths were embedded in Araldite 2020/A resin, using Araldite 2020/B as a hardener. This was carried out using the standard preparation alphanumeric moulds used in the Fish Ageing Laboratory in the Kuwait Institute for Scientific Research. This ensures that the otolith is correctly orientated and aligned within the resin block, and the grid marked on the preparation moulds assists with the later cutting of the otolith through its nucleus. A Buehler Isomet low speed diamond cutting saw was then used to cut the resin blocks containing the embedded otoliths. The blocks were initially cut into two halves using speed 6 or 7. One of the blocks was then taken and a slice about 0.68-0.7

Fig. 6. Sea catfish (*Arius* sp.) otoliths from area F, context 55 at H3 (Photograph by Mark Beech).

mm thick was then cut through the nucleus of the otolith. These slices were then mounted on a glass microscope slide, ground and polished down so that the incremental rings could eventually be clearly seen. Periodic visual checking was made by inspecting the slide through a microscope. A Buehler variable speed polisher was utilised to polish the slides using Ecomet 3 Polish – Gamma 0.05, Alpha 0.3, Alumina C - 1C, Alumina A - Z, and Aluminium Oxide powder. The polishing continued until a satisfactory microscopic inspection of the slide was achieved (i.e. clear defined rings with no cloudiness, the light being able to pass through the slide effectively).

Determination of the timing of the formation of annual (opaque zones under transmitted light) marks using marginal increment analysis for modern otoliths of sea catfish is crucial to estimate the timing of annuli formation in the historical otoliths. Estimating the timing of capture of these fish assumes that changes in environmental and biological factors that governed otolith formation were minimal over the last 7000 years. The method being used will allow validation of the annual nature of the formation of these marks, proving its formation regardless of spawning events.

By early March 2002, a total of 82 archaeological sea catfish (*Arius* spp.) otoliths, as well as eight archaeological otoliths from groupers (*Epinephelus* spp.), had been sectioned and prepared. Otolith sections were then recorded using an image analysis system within the KISR Fish Ageing Laboratory. All recorded images have been stored as high resolution colour tif files, as well as compressed colour jpg files.

Several interesting points have started to emerge from this work (Figs. 7-8):

a. It was easier to read the annuli on the younger smaller sea catfish otoliths than on their older larger counterparts. In the case of the latter, the annuli became very close together and were difficult to separate, especially near the edge of the otolith.
b. Some of the otoliths were burnt, especially in the edge area, and this led to a darkening of some parts of the sections, which obscured the reading of some or all of the growth rings.
c. Some of the otoliths were extremely brittle and shattered upon being sectioned.
d. Although only a small number of modern sea catfish otoliths have so far been sectioned and examined as comparative material for this study, some clear patterns are beginning to emerge. The annual mark seems to form in sea catfish sometime between April-May.
e. Comparing some of the archaeological sea catfish otoliths with modern examples of known capture date suggested that the inhabitants of H3 were fishing during the summer, late-summer, and autumn/early winter months. There does not appear to be clear unequivocal evidence that the site was only occupied during a single short season.

Dr. Mohsen Al-Husaini will start a research project on 2nd April 2005 for two years to study both modern and 7000 year old archaeological sea catfish from the H3 site. The research grant (KD 65,980, equivalent to about 227,100 US dollars) is supported by the Kuwait Institute for Scientific Research (KISR), the Kuwait Fund for Advancement of Science (KFAS), and the National Council for Culture, Arts and Letters (NCCAL). The specific objectives of this study are:

a. To study the fisheries biology of the four species of sea catfish inhabiting Kuwait's waters using annuli in otoliths, and to study the sea catfish otoliths retrieved from the archaeological excavations at site H3, Sabiyah.
b. To compare data on modern otoliths with that on the excavated otoliths to determine the species and sizes of fish caught, fishing seasons, and past patterns of human occupation in the Sabiyah region.
c. To use stable isotopes of oxygen in otoliths to estimate the history of temperature regime of the area and to estimate the seasonal timing of fishing in the past.

A Kuwaiti national, Mrs. Khlood Al-Enezi from the National Museum, is already working part-time in Dr. Husaini's laboratory continuing the sectioning of more examples of the archaeological sea catfish otoliths.

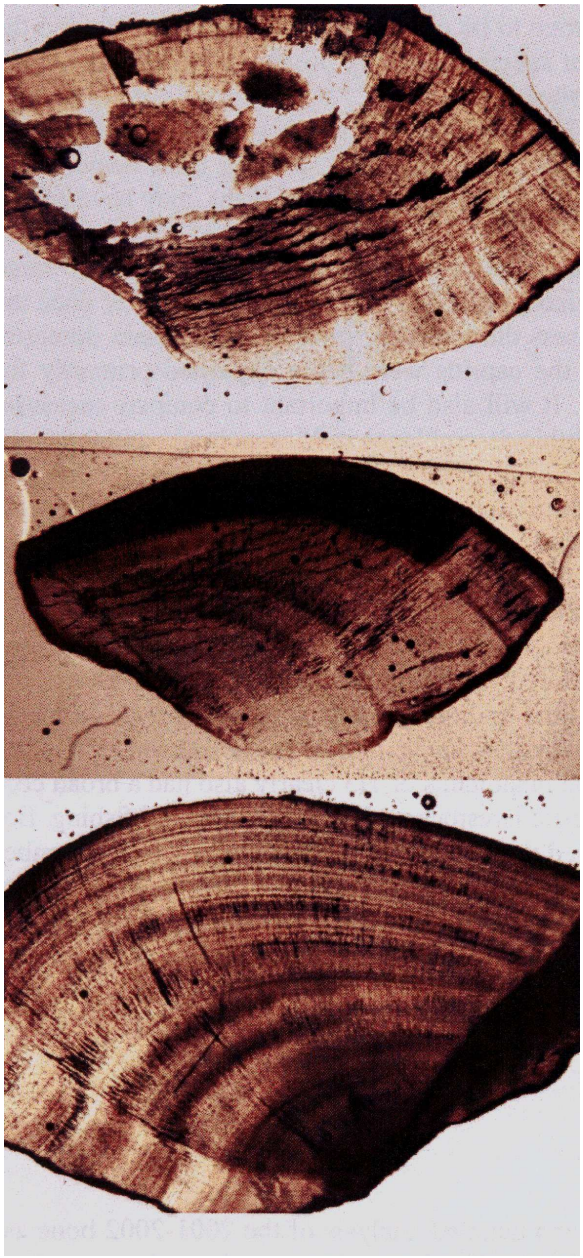

Fig. 7. Typical problems interpreting the sectioned sea catfish otoliths. Top – cracked otolith; Middle – burnt otolith; Bottom – otolith from mature individual. (Photographs by Mark Beech and Mohsen al-Husaini).

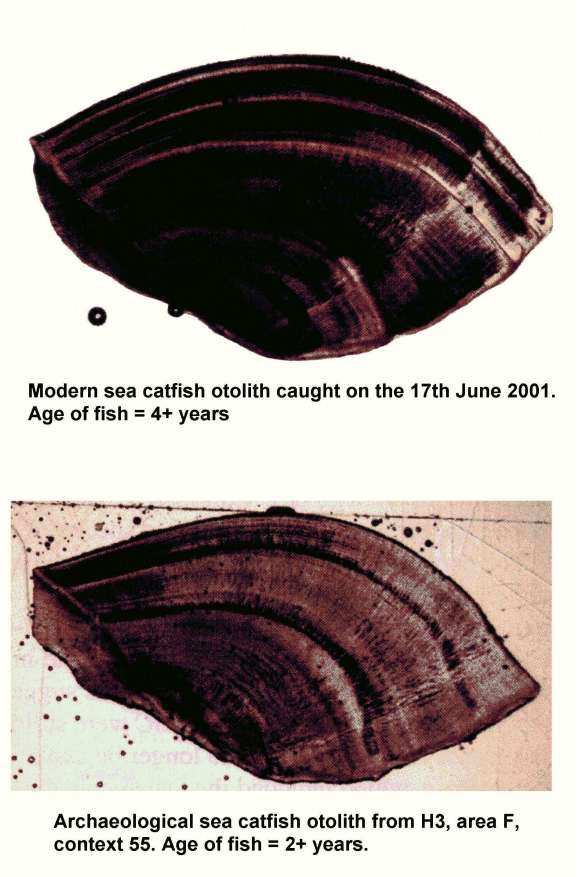

Fig. 8. Section of modern sea catfish otolith of known capture date, compared with an archaeological example from H3. (Photographs by Mark Beech and Mohsen al-Husaini).

Discussion

Although this paper only presents some preliminary results from our work on the bone assemblage from site H3, a number of points of interest can be raised. Most of the fishes represented are shallow water species which inhabit sandy or sandy-muddy bottom habitats. Many of these could have been caught in 'hadra' barrier traps or gill/seine nets, as they still are at the present day in Kuwait. Some of the larger fish, caught in deeper waters, are more likely to have been caught by hook and line or with basket traps. The presence of tuna in the assemblage is of some note. These have not been caught in Kuwait Bay in recent times, and are usually only caught in the southern waters of Kuwait at the present day. This probably reflects the changing environment of Kuwait Bay during the course of the past few thousand years, with mud and silt, as well as more recent modern contaminants, disturbing the marine ecology of the bay.

The recording of bones from marine turtle, probably green turtle, at H3 is of some interest. Turtles may have been hunted in the open seas, or their nesting beaches may have been deliberately targeted. Although they are usually only seen on or near some of the offshore islands along the Kuwaiti coast, they may have been much more common in the past when a greater abundance of unsettled sandy coastline may have provided them with suitable habitats. Bones from turtle were noted in the Dilmun and Hellenistic levels on the island of Failaka in Kuwait (Desse and Desse-Berset 1990). Turtle remains were also recorded at Abu Khamis in Saudi Arabia (Zeder 1974) and Dalma in the U.A.E. (Beech 2000b).

Precise identification of the bird remains may yet prove to be of some interest. Bearing in mind the annual timing of the occurrence of the two cormorant species, this may provide additional data concerning the season when the site may have been inhabited.

Clearly the environment within the hinterland of H3 supported the hunting of a number of wild mammals such as gazelle and fox. The flint arrowheads and cutting and scraping tools demonstrate that hunting, as well as dismembering and processing of animal carcasses and skins, may have been a regular activities taking place within the settlement.

Domestic mammals played an important role in the economy of the site, judging from the large number of bone fragments from sheep/goat/gazelle-sized animals. Further work is required, once the whole assemblage has been recorded in detail, to assess the mortality profiles of the main domestic species represented. This may help to determine if the caprids were being exploited primarily for meat, milk or, more likely, for a combined strategy. It will also be important to compare measurements from the H3 bones with those from other Neolithic assemblages in Mesopotamia and the Gulf. This will help determine if the size of the animals is similar to those from broadly contemporary and later sites in the region. Unfortunately the majority of the caprine bones are highly fragmented, so few bones fragments can be identified to species or measured.

The occurrence of cattle at H3 is worth noting. Small quantities of cattle bones from medium-sized animals have also been found at the broadly contemporary sites of Ain Qannas and Dosariyah in Saudi Arabia (Zeder 1974), and at Umm al-Qaiwain (Phillips 2002; Chris Mosseri-Marlio pers. comm.) and al-Buhais 18 in Sharjah emirate in the United Arab Emirates (Uerpmann and Uerpmann 2000; Uerpmann *et al* 2000). These sites suggest that the traditional assumption that people living in Arabia during the 5th millennium BC were still largely hunters and gatherers in the interior, or lived as fishermen on the coast, can no longer be assumed. The inhabitants of H3 clearly also had a broad economic base, which included the management of domestic livestock as well as hunting and fishing. Being strategically located in Sabiyah would have allowed the inhabitants to be in contact with a number of spheres of influence to both the north and south. H3 can now be added to a growing list of coastal sites in the Arabian Gulf which have Ubaid pottery and domestic animals, as well as evidence of hunting and fishing. These include Abu Khamis, Ain Qannas and Dosariyah in Saudi Arabia (Zeder 1974), Al Markh in Bahrain (Roaf 1976; von den Driesch and Manhart 2000), as well as Dalma (Beech 2000b, 2001b, 2002, 2004; Beech and Elders 1999) and Umm al-Qaiwain (Phillips 2002) in the U.A.E.

Future work

Funds are currently being sought to finance the full and detailed analysis of the 2001-2002 bone assemblage. Further detailed analysis of the marine catfish otoliths from H3 is also planned.

The author has already completed a study of the fish bone assemblage from the site of Dosariyah in Saudi Arabia, following a research visit to the Smithsonian Institution in Washington DC in October 1998 as part of his DPhil thesis (Beech 2001b). The important assemblage from Abu Khamis stored in the same archive, where fish bones formed 85 per cent of the total bones by weight (Zeder 1974), has yet to be examined. It would provide a valuable comparison with the H3 assemblage, as well as with already published assemblages throughout the Gulf (Beech 2002, 2004).

The settlement at H3 in Kuwait is quite a remarkable archaeological site. A number of interesting questions arise in relation to its form and function. Was the site really inhabited all year round or just seasonally? Initial indications from the marine catfish otoliths suggest that some people may have stayed there in the summer as well as the winter, and that the site did not appear to have just been oc-

Fig. 9. Sea catfish otoliths from H3 which have signs of human modification (Photographs by Mark Beech).

cupied for simply one short season each year. Craft specialisation such as the production of shell beads was a regular activity at H3, and it is fascinating that its inhabitants apparently deliberately collected marine catfish otoliths some 7000 years ago as blanks for making beads (Fig. 9).

Once the comprehensive analysis of the bone assemblage from H3 has been completed it will undoubtedly present a rich insight into life in the northern Gulf during the late 6th to early 5th millennium BC.

Acknowledgements

Major sponsors of the work at H3 are Shell Kuwait Ltd. and thanks go to Ken Taylor, General Manager of Kuwait Shell Limited, for his interest, general support and hospitality during our fieldwork. Other major sponsors are the National Museum of Kuwait, National Council for Culture, Arts and Letters, the Department of Antiquities and Museums in Kuwait. Support was also provided by the British School of Archaeology in Iraq, and the Institute of Archaeology (UCL). The following organisations also provided sponsorship: the New English School, Kuwait, the Central Research Fund of the University of London, the Society of Arabian Studies and the Charlotte Bonham-Carter Charitable Trust. Other help and support in Kuwait was provided by the British Embassy, British Council and the British Business Forum. Logistical support has been provided by Burhan and Otis.

This work would not have been possible without the encouragement of Shihab A.H. – Shihab, Director of the Department of Museums and Antiquities, National Council for Culture, Arts and Letters, Kuwait, who kindly granted permission for the temporary export of bones to the U.K. for academic study. Other valuable assistance during the fieldwork was provided by his Kuwaiti colleagues, Sultan

Al Duwish (field director), Ahmed Al Shemari, Hamed M. Al Mutairy, Mohammed Al Ghanim, Khalid Al Ali, Mohamed Al Azmi, and Hadi Al Ameer.

Thanks go to Dr. Harriet Crawford and Dr. Robert Carter (both of the Institute of Archaeology, UCL) for inviting us to study the interesting vertebrate assemblage from H3, and for providing relevant archaeological information.

Dr. Suleiman Almatar, Department Manager of the Mariculture and Fisheries Division of the Kuwait Institute for Scientific Research (KISR), kindly permitted MB to work together with Dr. Mohsen al-Husainy in KISR's Fish Ageing Laboratory during February 2000 and 2002.

Valuable assistance during MB's field seasons in Kuwait in 2001 and 2002 was provided by Dr. William Davies (Department of Archaeology, University of Southampton, U.K.) and Dr. Heiko Kallweit (University of Freiburg, Germany). John Martin (Carlisle, UK) was a tower of strength during the 2002 season and assisted with the processing of environmental samples by flotation and wet sieving, as well as with the weighing, recording and packing of all the archaeological bone and shell material.

Thanks also go to Dr Peter Hogarth (Department of Biology, University of York) and Emily Glover (Natural History Museum, London) for kindly sharing information about their ongoing work on the crabs and shell material from H3.

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