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Subsistence in the Rub' al-Khali during the Umm an-Nar Period. A zooarchaeological study on the archaeological site at Al-Ashoosh (Dubai, UAE)

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Abstract
Twenty years ago, Magee (1996, p. 211) [6] challenged archaeologists to determine how and why prehistoric humans used the interior desert regions of the Arabian Peninsula. Inland deserts play a pivotal role in our understanding of settlement patterns, land use and environmental reconstruction during the Late Bronze Age (Herrmann, 2012, p. 98). Thanks to a collaborative project between the Sanisera Archaeology Institute and Dubai Culture, the excavation at Al-Ashoosh was undertaken (Contreras, 2016, p. 1) [3]. Presented here is the study of the 2015-2016 excavation of Al-Ashoosh, one of the few examples of a seasonal occupation in the Rub' al Khali, or the Empty Quarter, during the Umm an-Nar Period. This analysis provides critical insight into the occupants' habitat, diet and economy, thereby helping researchers understand how the people of Al-Ashoosh exploited this region during the third millennium BC.

Keywords: Third millennium BC, Al-Ashoosh, zooarchaeology, domestication, Rub´al-Khali, Arabian Peninsula, Umm an-Nar, big game haunting in the inland dessert, prehistoric diet, nomadic pastoralism

Introduction

An enclave of the third millennium: configuration and elements of the site

Al-Ashoosh was originally found in 2002-2003 by His Highness Sheikh Mohammed bin Rashid Al Maktoum, Rule of Dubai and Prime Minister of the United Arab Emirates. It is located next to and named after the historic well, Tawi Al-Ashoosh, approximately 70 kilometers south of Dubai City (Figure 1). A total of thirty-three archaeological sites spanning from the prehistoric (6.000-300 BC) period to the Islamic period (600-1.500 AD) were found. Of these sites, Al-Ashoosh was the only one belonging to the third millennium BC. Given the positive results of these surveys, it was decided to continue the studies, and from 2006 to 2007, paleoenvironmental research, subsurface teledetection, excavation and material analysis were carried out in the Al-Ashoosh area. The aim was to shed light on the desert settlements of Dubai (Casana *et al*., 2009, pp. 31-32) [2].

The site currently covers 1.3 hectares, divided in two areas (Figure 2); however, recent surveys suggest that the site may be larger. Surface survey revealed twenty-one archaeological hearths and a central elevation, identified as a midden. Excavations yielded faunal remains, one steatite seal (Figure 3), large quantities of fire-cracked flints (Figure 4) and heavy ash deposits along with pottery (Figure 5), soft stone (Figure 6), lithic tools, debitage and beads. Six mudbrick-lined hearths, or tannours (Figure 7), and one post-hole have been excavated. The seal and pottery determined the site to be dated between 2500 and 2000 BC, but more specifically, carbon-14 analysis of charcoal found in Area A (Square F5, Context 169) provided a date with a 68.2% probability between 2134 and 2016 Cal BC.

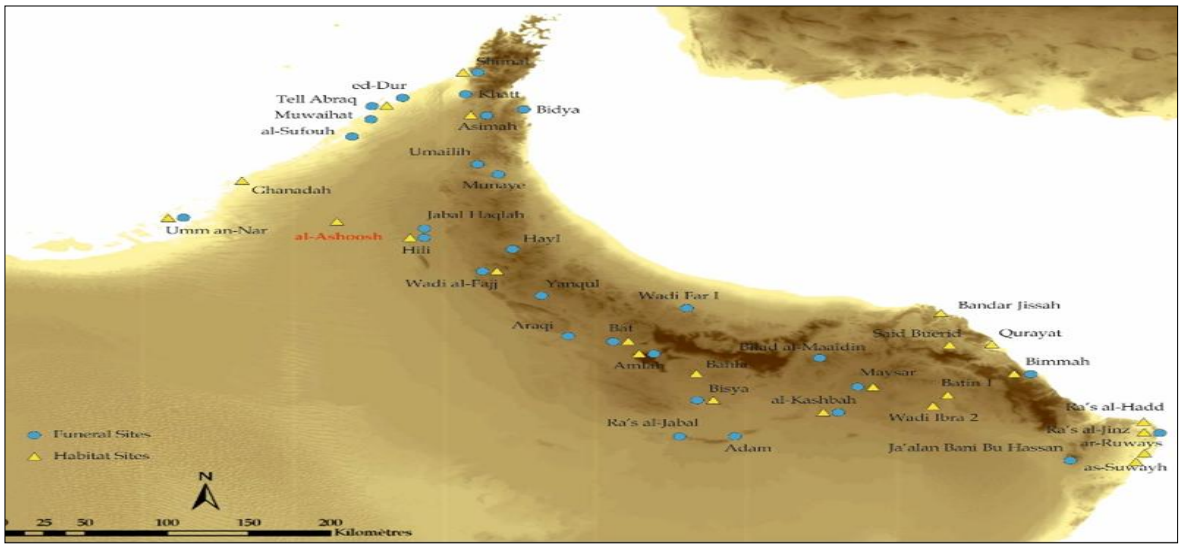

Fig 1: Distribution of Umm an-Nar period sites. Reference source: Riguetti, S. (2015) [10], Les cultures du Wadi Suq et de Shimal dan la péninsule omanaise au deuxième millénaire avant notre ère. Évolution des sociétés du Bronze moyen et du Bronze recent, p. 16, vol. II, Sorbonne Université (Paris)

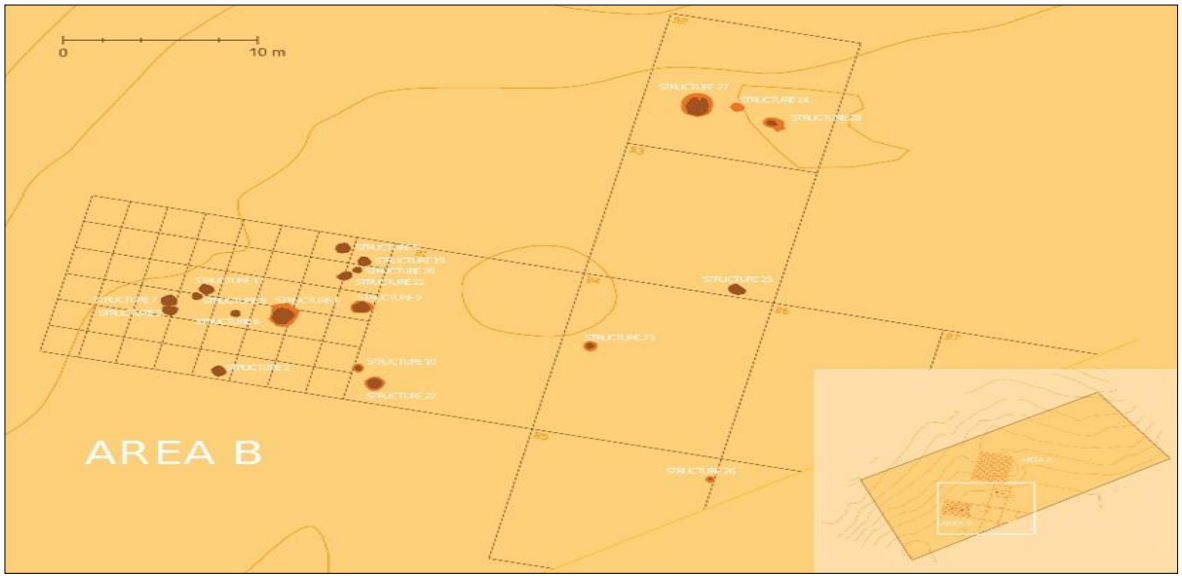

Fig 2: Map of areas A and B of Al-Ashoosh. ©Dubai Culture/Sanisera Archaeology Institute, 2016

The excavated area was divided into two zones: Area A and Area B. Area A, the main zone, covers an approximate area of 350 m² and is located in a central area, where a high concentration of faunal remains, lithic artefacts, stones, charcoal and, to a lesser extent, pottery were found. It is an area with a single period of occupation that would have served as a rubbish dump. Area B has almost no presence of faunal remains, less stones and a higher number of potsherds than area A and clay fragments. This area is located 50 metres southwest of the main area, where eight complete combustion structures, two features identified as post holes, a clay circle and concentrations of charcoal were found. The composition of these structures is based on an irregular clay circle that keeps the walls compact and marks the perimetres of the structures. In some cases, it is possible to see fingerprints on the clay ring. Area B would constitute the production area at the site, as it is located in the lower part of the site and very close to the bedrock, making it an ideal area for building combustion structures.

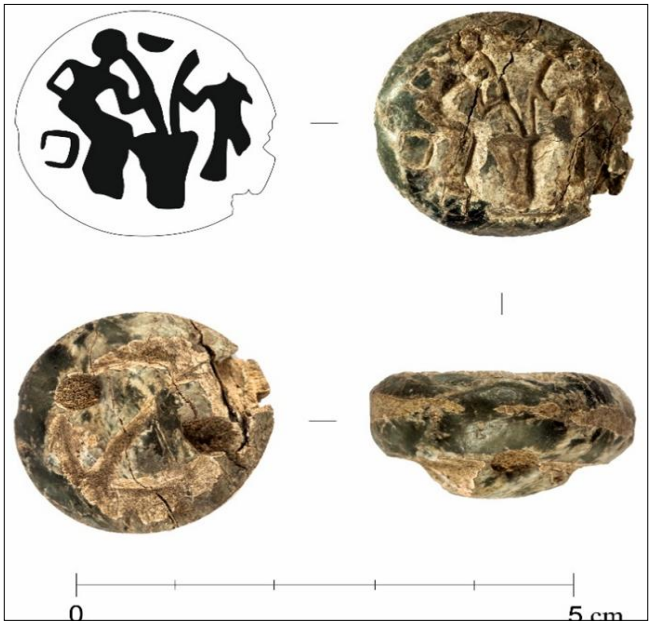

Fig 3: Seal found in Area A of Al-Ashoosh. ©Dubai Culture/Sanisera Archaeology Institute, 2016

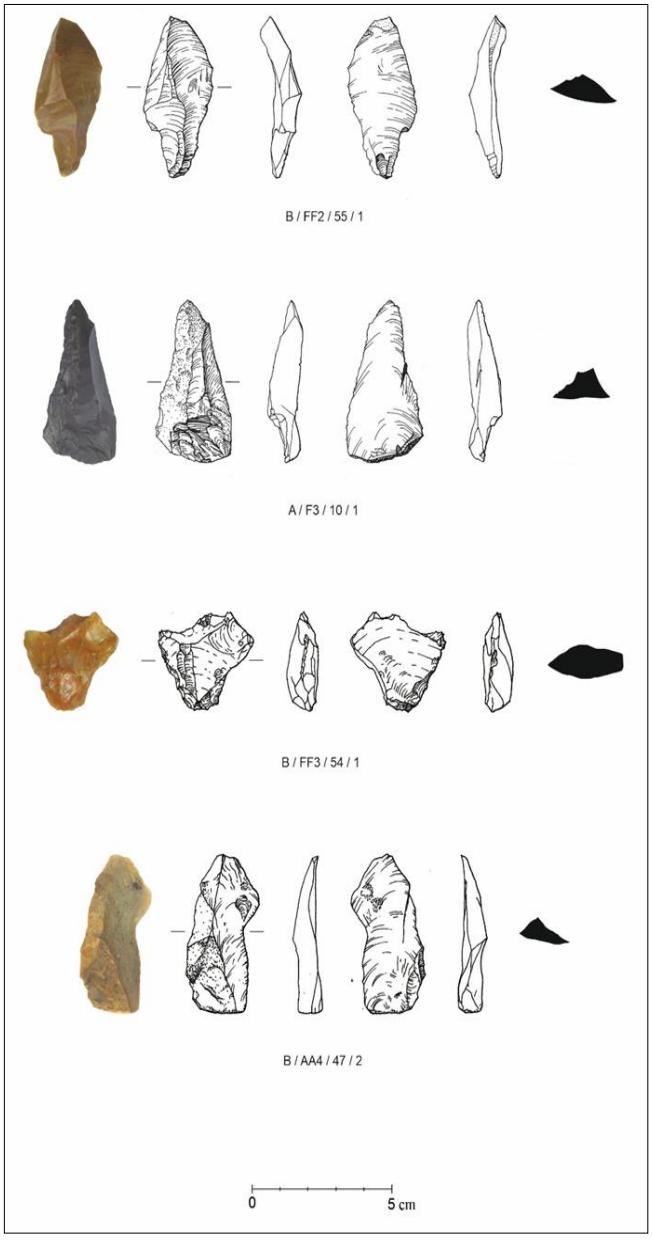

Fig 4: Examples of flints founded at Al-Ashoosh. ©Dubai Culture/Sanisera Archaeology Institute, 2016

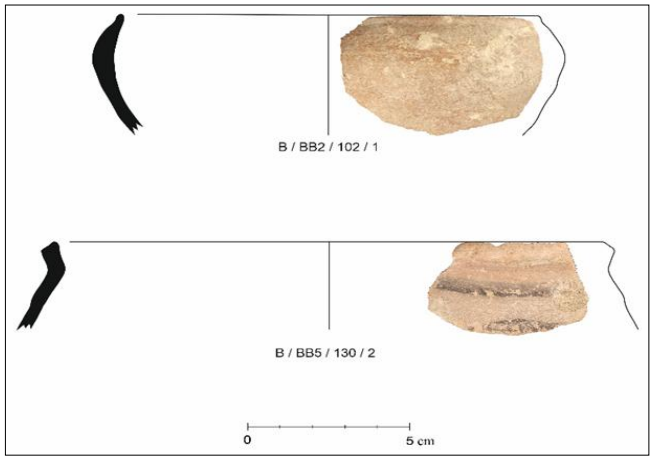

Fig 5: Pottery rims found at Al-Ashoosh. ©Dubai Culture/Sanisera Archaeology Institute, 2016

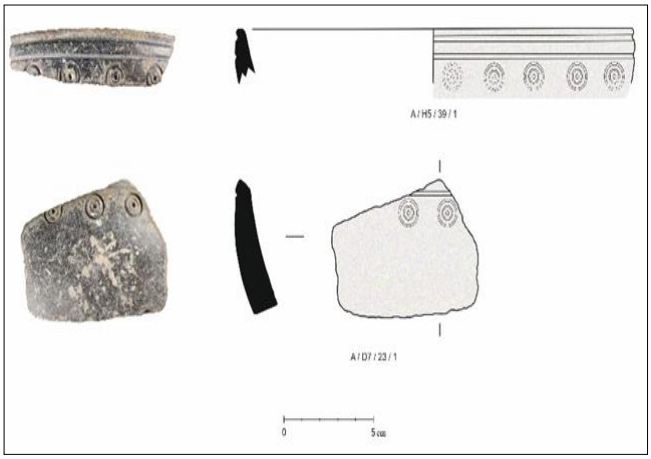

Fig 6: Fragments of soft stone found at Al-Ashoosh. ©Dubai Culture/Sanisera Archaeology Institute, 2016

Fig 7: Tannours or ovens. Part of context 207 half excavated (right) and complete view of Context 222 (left). ©Dubai Culture/Sanisera Archaeology Institute, 2016

The rocks, faunal remains and lithic fragments are the main materials that we have recovered from the site. Regarding quantities: 1837.77 kilograms of rocks (around 78% of the material), 287.05 kilograms of faunal remains (around 12% of the material) and 140.88 kilograms of lithic fragments (about 6% of the material).

Initial analysis of Al-Ashoosh suggests seasonal habitation of a small group in temporary and perishable structures. This type of settlement reflects human settlement patterns during this period, as it would have been established in an area with resources for subsistence. According to geophysical and satellite studies, the site would have been established near a source of freshwater, which would have ensured the formation of a community in this area. This would have attracted populations of nomadic hunter-gatherers and various fauna, who would have taken advantage of these resources. The faunal material analyzed thus far does not support or refute the hypothesis that the Rub' al Khali experienced a moist period during the third millennium, as all the species recovered thrive in arid/semi-arid environments (Hermann, 2012, pp. 118-130) [5].

The analysis of animal bones found in Al-Ashoosh is important because it helps us understand how communities used the interior of the desert after the Holocene Climatic Optimum (HCO). The material recovered is relevant because it allows us to observe how these communities interacted with their environment. Thanks to the large number of animal bones found at the site, we can analyse these aspects in greater depth.

Analysing animal remains

This concentration of fauna remains was present outside the hearths. The analysis of the recurrent faunal elements (Figure 8) reveals a minimum of twenty-three artiodactyls, including seven camels, these of those two juvenile camels, ten oryx, one of these is a juvenile specimen, two gazelles and the remains of one goat/sheep and three bovids.

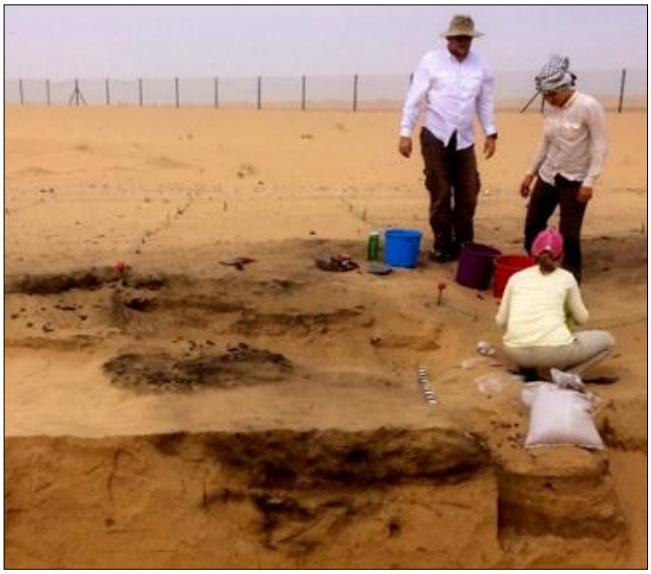

Fig 8: Archaeologists working at the site in 2016. ©Dubai Culture/Sanisera Archaeology Institute, 2016

Table 1: Number of Identified Specimens (NISP) for known taxa, presented as count and weight (grams). ©Dubai Culture/Sanisera Archaeology Institute, 2016

Common Name	Scientific Name	Count	Weight (g)	Adult	Juvenile	Indeterminate
Camel	Camelus dromedarius	228	3137.3	77 1508.8 g	76 611.1 g	75 1017.4 g
Oryx	Oryx leucoryx	174	2091.9	133 1768.0 g	8 60.1 g	33 263.8 g
Gazelle	Gazella sp. sp.	19	47.1	9 29.1 g	0	10 18.0 g
Goat/Sheep	Capravine	13	98.2	6 49.9 g	0	7 48.3 g
Unidentified Cattlle/Goat/Sheep	Bovid	19	259.3	19 259.3 g	0	0
Dog	Canid	3	4.2	3 4.2 g	0	0
Bird	Aves	1	0.7	1 0.7 g	0	0

With regard to the age of the animals, all age ranges, sizes and species have been identified. Some individuals may have lived well into adolescence before dying. This diversity is mainly evident in the vertebrae, as they show different bone fusion with different sizes, indicating such variety. The youngest individuals identified so far are a camel and an oryx that were about one year old. The other juvenile individuals are in the lower age range of 3.5-4 years.

As for the use marks present on the bones, combustion patterns were observed and analysed on the bones with temperature variations of 200, 300, 350, 420, 500 and 700 degrees Celsius. About butchery marks, three cases of cut marks were observed on bones, specifically on two ribs and a vertebral fragment, but the taxa could not be identified. Samples of green stem fractures and spiral fractures were found, but no other types of fractures such as compression or puncture fractures.

The preservation of the faunal assemblage found was varied, with some large fragments and identifiable specimens found alongside other very small and unidentifiable ones. The good preservation of the burnt bones stands out in contrast to the unburnt bones, which showed signs of damage from environmental fluctuations or exposure to sunlight. Finally, there was a set of bones that had begun to fossilise/mineralise, probably due to the presence of water in the form of aquifers or surface water.

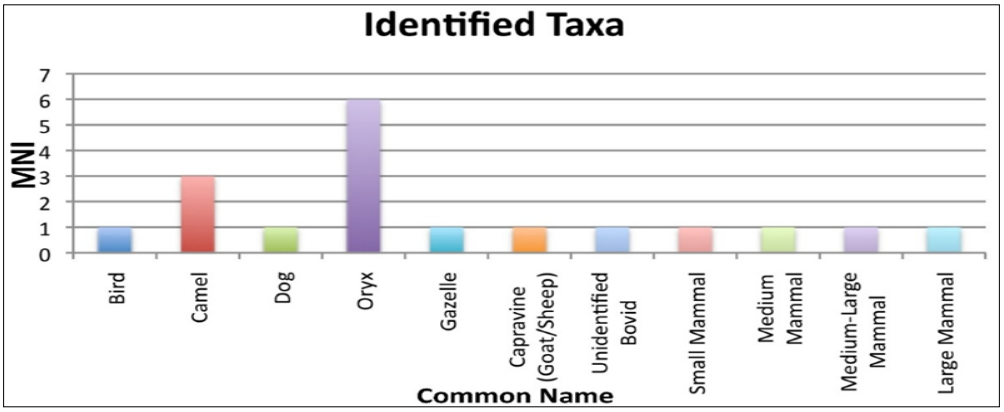

Fig 9: Taxa identified. Graph is based on minimum number of individuals (MNI). ©Dubai Culture/Sanisera Archaeology Institute, 2016

Of the taxa identified from Al-Ashoosh, only cattle, goats, and sheep are known domesticates within the region during this period. Archaeologists detect domestication by analyzing of the age and sex distribution of the herd, identifying pathologies and interpreting stress indicators and other changes in bone morphology associated with domestic activities. While no clear signs of animal domestication have been found in the faunal assemblage, one bovid (cattle, goat/sheep) specimen has pathologies that would severely inhibit its survival in the wild.

Although extremely tentative, this suggestion of human-animal interaction similar to those seen among domesticated populations today is the strongest indicator of nomadic pastoralism yet identified in the faunal material from Al-Ashoosh. The remains of cattle, goats, and sheep represent only 4% of the total assemblage. This suggests that, if these animals were domesticated, their primary use would be for labor, wool, milk and, when the animal became less productive, meat (Uerpmann and Uerpmann, 2012, p. 80) [12].

Evidence from Al-Ashoosh supports the hypothesis that wild camels were hunted for food during the third millennium. Overrepresentation of very young and elderly animals indicates domestication in the archaeological record. However, this model does not represent the faunal assemblage at Al-Ashoosh. Only one camel, aged less than ten months, has been identified. Most of the material recovered thus far is from older juveniles, aged three- to four-years. At this age, dromedaries appear fully-grown and desirable to hunters (Uerpmann and Uerpman, 2012, p. 82) [12]. It is also the age when the animals would be highly valuable to a herding community, since they are both strong and sexually mature, potentially carrying heavy burdens or producing milk and offspring. No pathologies or stress indicators associated with domestication have been observed. Therefore, it is likely that the occupants at Al-Ashoosh exploited wild camels.

Reconstructing the diet of the inhabitants of Al-Ashoosh

During the site's occupation, people brought and prepared game and/or livestock for food and possibly other products, such as hides. Identified species include camel, oryx, goat/sheep, gazelle and other medium-large sized animals, along with a medium-sized bird and a canid (e.g. dog, jackal, fox).

Figure 9 illustrates a minimum number of individuals (MNI) for each identified taxon. Spiral fractures, cut marks (Figure 10) and burn patterns indicate that these animals were

butchered and cooked with the meat still on the bone, potentially in the tannours found at the site. Discarded bones were later used for fuel. The bird and canid remain show no signs of modification.

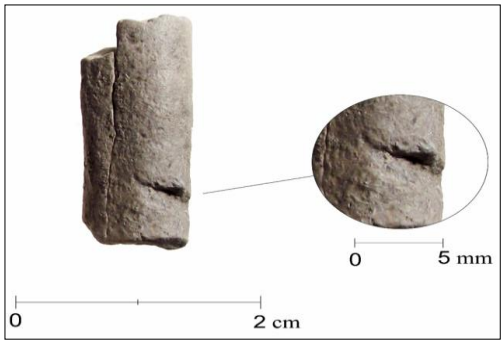

Fig 10: Rib with cut marks and evidence of burning with flint blade recovered from site. ©Dubai Culture/Sanisera Archaeology Institute, 2016

No bones from other smaller animals such as rabbits or rodents were found. Apart from the absence of these smaller bones, there is also a notable absence of bones from larger animals such as equids. This could be due to the poor environmental conditions in the area for this type of animal to live (Magee, 2014, p. 54) [7].

Another noteworthy aspect that tells us about how these animals were consumed can be observed from the charred bones. There are a large number of bones that have been subjected to high temperatures for long periods of time. In addition, these bones show no signs of predator marks, which would indicate that they were thrown into the fire immediately after being stripped of flesh in order to prevent scavengers from entering the settlement.

The hypothesis of animal butchering (Figure 11) is supported by the presence of cut marks on three bones, a vertebral fragment and two ribs belonging to unknown taxa. The lack of further fragments reflecting this cutting must be due to the poor preservation of the bones or the intentional avoidance of leaving cut marks on the bones to prevent knife wear. If the latter were the case, it would be an indication of the occupant's good knowledge of animal processing (Roberts *et al*., 2018, p. 124) [11].

Fig 11: Flint blade recovered from Al-Ashoosh. ©Dubai Culture/Sanisera Archaeology Institute, 2016

Big game haunting in Rub al´Khali: an archaeozoological approach

Based on the variety of faunal material found at Al-Ashoosh, it can be established that the animals were brought whole to the settlement and their meat was processed there. This shows a typical pattern in semi-nomadic societies such as those that settled at this site. Two of the species recovered at the site support hunting as a fundamental activity for the settlement's economy: the oryx and the gazelle. These two species accounts for almost half of the taxa identified at Al-Ashoosh and have never been domesticated.

Apart from gazelles and oryx, there are also wild camels, which would be very valuable for hunting due to their milk and meat production (Uerpmann & Uerpmann, 2012, p. 82) [12].

Most of the recovered taxa belong to camels between three and four years old (Figure 12), which would already be fully developed. It cannot be confirmed that they were also used for labour or as beasts of burden work due to the absence of pathologies related to exertion. Therefore, it can be assumed that these camels would have been hunted for food. The domestication of camels in this area probably took place at the end of the second millennium BCE. As in the case of Al-Ashoosh, the Neolithic site of Buhais 18 (Sharjah, UAE), excavated between 1996 and 2004 by the Directorate of Antiquities and the University of Tübingen (Germany), co-directed by Hans Peter and Margarethe Uerpmann, where sets of animals remain were found mixed with stone tools in an area believed to have been used for food preparation. This site is another example that highlights the importance of this type of animal for meat consumption in settlements (de Beauclair, 2008, pp. 143-144.) [4].

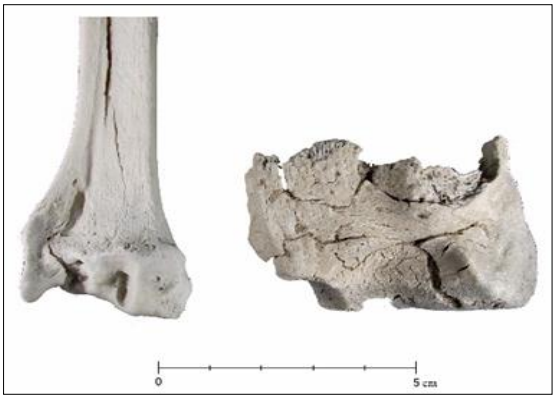

Fig 12: Juvenile distal camel radius (right), aged less than 3.5-4 years. A modern adult goat (left) has been used for comparison Juvenile distal camel radius (right), aged less than 3.5-4 years. A modern adult goat (left) has been used for comparison. ©Dubai Culture/Sanisera Archaeology Institute, 2016

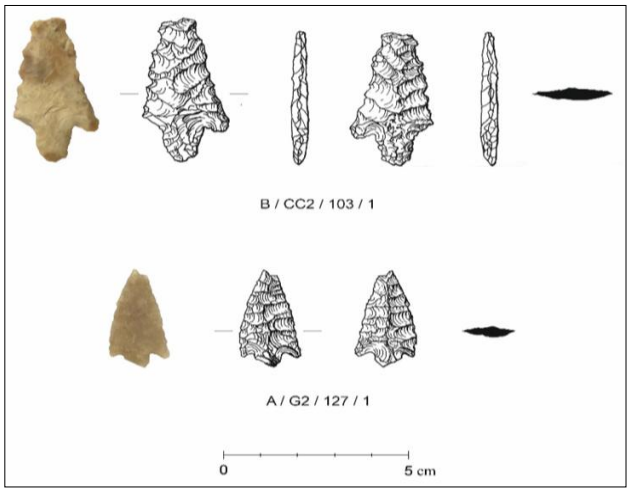

Fig 13: Arrowheads founded at Al-Ashoosh (Top Area B, Bottom Area A). ©Dubai Culture/Sanisera Archaeology Institute, 2016

Other sites include al-Sufouh 2 (Dubai), a coastal site where various excavation campaigns were carried out between 2001 and 2004, led by members of the Institute for Near Eastern Studies at the University of Munich, in collaboration with the former Dubai Department of Tourism and Commerce Marketing. These campaigns yielded large quantities of bone remains from at least 123 dromedaries, along with remains of other mammals and marine fauna, including fish, molluscs and crustaceans (von der Driesch *et al*., 2024, p. 488). The Baynunah site (Abu Dhabi, UAE), with camel bone remains dating from the second half of the fifth millennium BC, according to radiocarbon analysis carried out by Mark Beech and Marjan Mashkour in 2008. At least forty camel skeletons have been found at this site, spread over an area of 100 x 90 metres. Of the total number of skeletons, only one belongs to an immature individual; all the others belong to adult camels with no signs of slaughter or disease. (Beech *et al*., 2009, pp. 19-20) [1]. Both sites are noteworthy, where the presence of camel bones is very high and that represent sites of specialised camel hunting in the Bronze Age (Power, 2024, p. 691) [9].

The presence of such a complete set of individuals raises questions about the logistics of transporting them to the site. In adittion, no evidence of specific hunting techniques has been found at the site. The only items found that can provide us with minimal information about the type of hunting practised are some stone arrowheads (Figure 13), but it does not allow us to be more specific. It is therefore difficult to establish whether the animals transported to the settlement were already dead or were brought alive by herding them. Due to the presence of a large number of juvenile specimens, it could be surmised that the animals were probably dead when transported to the site. This raises logistical questions as to how the animals were transported to Al-Ashoosh, particularly in regards to dromedary camels, which can weigh 300 to 690 kilograms. Also, transporting raw meat would greatly limit the distances over which the bodies could be moved due to health and hygiene risks (Magee, 2014, p. 200) [7].

Early domestication: companions or resources?

There are many indicators that allow us to observe the domestication of animals in the faunal remains. Mainly the analysis of pathologies and indicators of bone stress or changes in bone morphology due to domestic activities. Statistical studies can also be carried out based on the age and sex distribution of the herd, but these latter indicators have not been possible to study due to the fragmentation and mixing of the bones found.

Four, possibly five, pathological bones were recovered. One or perhaps two of them show healed fractures, with bone callus formation indicating that the individual survived for at least two weeks after the injury (Figure 14). These bones appear to be fractured ribs from an unidentified species. In Figure 14, the pathological rib (left) exhibits a notable increase in circumference and a misalignment of the fractured segments. Another rib fragment, not illustrated here, shows signs of a chronic bacterial infection, most likely of respiratory origin.

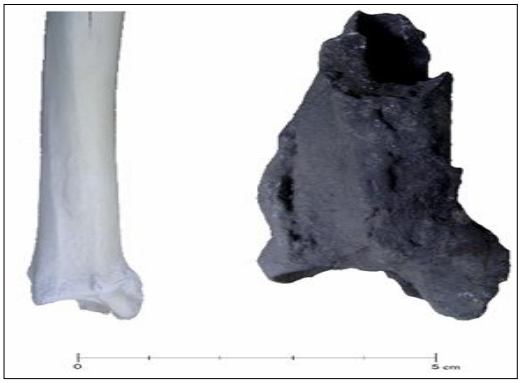

Fig 14: A pathological distal bovid tibia (right) shows evidence for burning. A modern, wild gazelle tibia (left) with no pathologies has been used of comparison. ©Dubai Culture/Sanisera Archaeology Institute, 2016

Figure 14 presents a pathological distal oryx tibia (right), whose condition appears to be chronic and would have affected the animal's gait. Despite these impairments, a wild animal could still have survived with such pathologies. Therefore, these conditions alone should not be taken as evidence of domestication.

Cattle, sheep, and goats are the only domesticated animal taxa found at Al-Ashoosh. No bone pathologies indicative of domestication has been identified in the site's fauna, but a distal bovine tibia was found with pathologies that would have prevented its survival in the wild. The evidence of domestication in Al-Ashoosh is minimal, as the cattle, goats and sheep found only represent 4% of the total.

This limited presence of indicators of domestication in the bone record follows the general trend in the south-east Arabian Peninsula that comprises mixed systems dedicated to hunting and herding, but with hunting as a fundamental element (Makarewicz, 2020, pp. 173-174) [8].

On the other hand, no burnt or dismembered remains have been found for other types of animals such as birds and canids. This could indicate that these animals were intended to accompany the inhabitants of Al-Ashoosh or could be the remains of scavenging.

Conclusions

From the bone material found at Al-Ashoosh, we can observe different aspects that governed the lives of these communities that lived in the second half of the third millennium BC. The species recovered from the site support the theory that Al-Ashoosh was in an arid/semi-arid environment during the third millennium BC, like that of today. Modern day camels, oryx, and gazelles forage for thorny plants, grasses and shrubs over large areas. The evidence in the bone record at Al-Ashoosh indicates the importance of hunting for these societies that were transitioning to pastoralism. Therefore, the clear absence of domestication pathologies in the bones, the low percentage of domesticated animals in the region during this period (cattle and sheep/goats) and the young age of most of the animals are factors that determine the seasonal nature of occupation at Al-Ashoosh. This archaeological site is one of the key examples of the diet, economy and habitat in the Rub al-Khali desert during the third millennium BC.

The community of hunter-herders who lived seasonally in Al-Ashoosh would have used perishable structures and the settlement to produce stone tools and as a dumping ground

for various items from their daily lives, including large concentrations of faunal remains (Contreras, 2016, pp. 5-6) [3].

The analysis of the skeletal remains found in Al-Ashoosh provides a better understanding of the dynamics of occupation of the Rub al-Khali desert and how the communities that settled their exploited resources. It also provides a better understanding of the impact of the post-optimum climate on these societies and how they organised their resources. The study reveals the great capacity of the Al-Ashoosh communities to adapt to the ecosystem and the subsistence strategies they employed in an environment with limited resources, focusing on the exploitation of ruminants. This allows us to see how these communities that settled in the interior desert had a diet focused especially on mammals that they exploited in the area, something that completely differentiates these communities from those that settled on the coast, which would have had a much higher consumption of marine species including molluscs.

In conclusion, this site provides insight into the ways of life in the Rub' Al-Khali desert during the third millennium BC and the logistics of these societies at this time of transition from nomadism to sedentarism. Research on Al-Ashoosh is in its preliminary stages and requires more specific studies. All of this will provide a broader view of the site's occupants and answer questions surrounding this interesting enclave.

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