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Monumentality, Social Memory, and Territoriality in Neolithic–Chalcolithic Northwestern Arabia

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ABSTRACT

Recent excavations undertaken by the Aerial Archaeology in the Kingdom of Saudi Arabia (AAKSA) project have recovered significant skeletal material, evidence for funerary offerings, including jewelry, and the earliest chronometrically dated domestic dog in the Arabian Peninsula. Despite being heavily disturbed by recent looting, these monumental funerary structures were found to be collective burials dating to the 5th and 4th millennia B.C. The evidence recovered from these graves provides new insight into the social and funerary landscapes of northwestern Arabia during the Neolithic and Chalcolithic periods, shedding light upon issues of social memory, territoriality, and monumentality in the Middle Holocene of the Arabian Peninsula.

KEYWORDS

remote sensing; aerial photography; collective burial; funerary practice; Saudi Arabia; AlUla; Middle Holocene

Introduction

Northwestern Arabia is characterized by a rich and varied archaeological landscape spanning millennia, with the region marked by hundreds of thousands of monumental stone structures collectively known as the "Works of the Old Men" (Kennedy 2011; Guagnin et al. 2017; Hausleiter and Eichmann 2018; Munoz et al. 2020; Petraglia et al. 2020). Amongst these are tens of thousands of funerary features. These range in size and form from simple cairns and tower tombs to complex pendant burials, comprising a main cairn and associated tail structure of varying forms (Kennedy 2011, 3189). Despite the size and scale of this monumental landscape, Saudi Arabia has received limited attention in comparison to the more intensely investigated areas to the north (the Levant), south (Yemen), and the east (the United Arab Emirates [UAE] and Oman). This scenario is beginning to change as more archaeological work is both conducted and published. Currently, the available pre-1st millennium B.C. data suggests that the cultural horizon of the region was overwhelmingly local in origin, diverging significantly from its neighbors (Crassard and Khalidi 2017; Thomas et al. in press).

In 2018 and 2019, the Aerial Archaeology in the Kingdom of Saudi Arabia (AAKSA) project identified two recently looted collective burials dating to the 5th and 4th millennia B.C. in AlUla county. Although disturbed, the remains recovered from these burials provide valuable insights into the demography and funerary practices of the region during the late Neolithic and early Chalcolithic periods. Moreover, significant similarities are discernible between the two burials, despite them being located in vastly different environmental and geological settings: the upland basalt landscape of the Harrat 'Uwayrid (site IDIHA-0001825) and the eastern sandstone badlands (site IDIHA-0018980; Figure 1). Such similarities suggest that these tombs are a part of a larger and more cohesive funerary tradition present across northwestern Arabia during the Middle Holocene (ca. 6500–2800 B.C.). This tradition was marked by monumentality and deliberate visibility in the landscape, with the latter potentially indicative of nascent territoriality. Furthermore, at least one of these tombs functioned as a long-lived collective burial site, suggesting that a strong sense of social memory permeated the region during this period. Moreover, the earlier appearance of these systems suggests a significant cultural and ideological divergence from contemporary communities in the eastern and southern Arabian Peninsula.

AKKSA Project and Methodology

AAKSA project is a multi-disciplinary analysis focused on the hinterland of AlUla county, encompassing approximately 20,000 km² of remote landscapes. The project, run by the University of Western Australia, is part of the large-scale archaeological survey and excavation of the region recently commissioned by the Royal Commission for AlUla (henceforth RCU). The AAKSA project began in 2018 and was originally designed to analyze the AlUla hinterland through satellite remote sensing techniques and helicopter aerial photography. Subsequent variations to the project saw the inclusion of both ground survey and excavation, effectively allowing the project to view the hinterland of AlUla on both macro and micro levels. All data is uploaded to an online relational database based off the ARCHES platform, at both a site (Catalogue: IDIHA-*) and feature (Catalogue: IDIHA-F-*) level.

Site IDIHA-0001825

IDIHA-0001825 is a complex, multi-component site, consisting of both superimposed and discrete stone structures running northwest-southeast along a gently sloped ridge, overlooking a series of low valleys on the Harrat 'Uwayrid. The Harrat 'Uwayrid is a basalt volcanic upland in the northwest of Saudi Arabia, west and northwest of the

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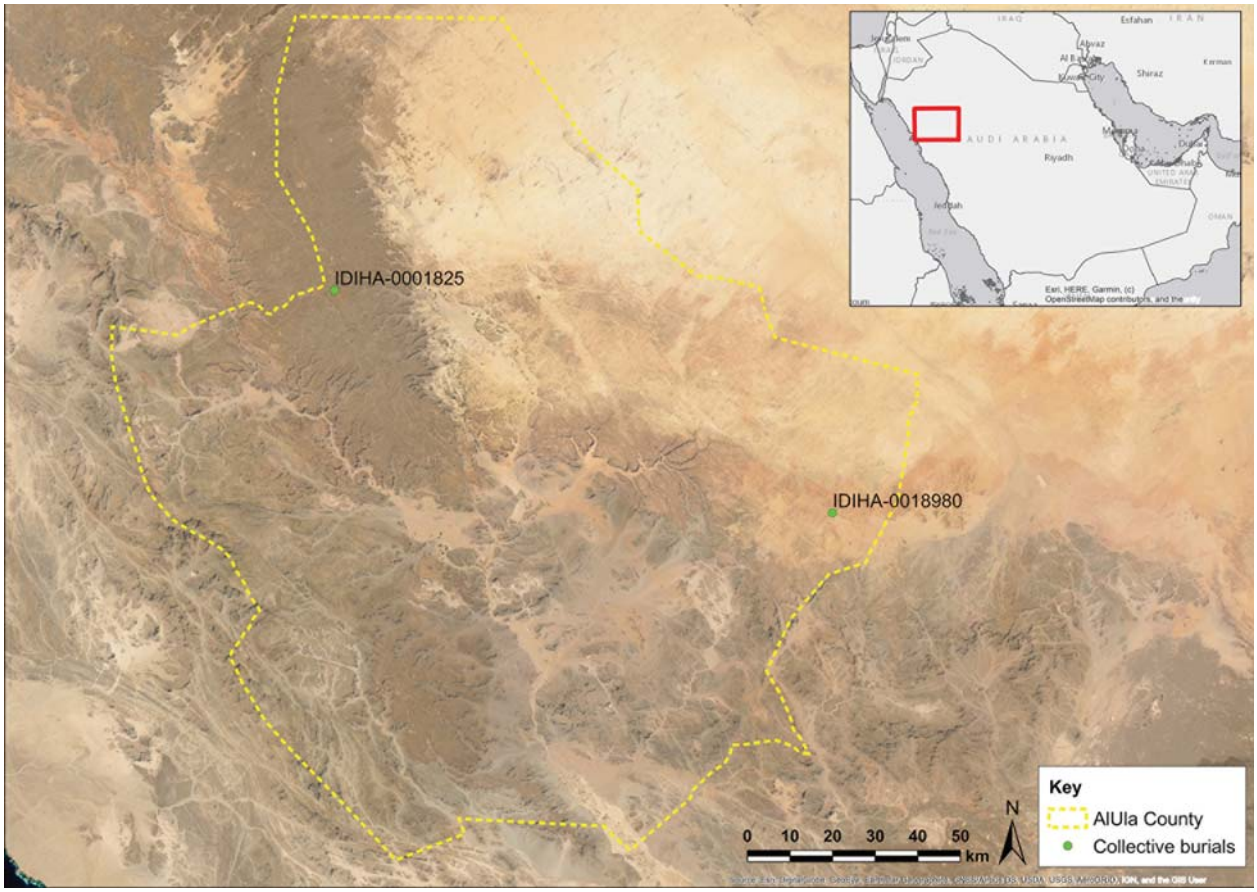

Figure 1. Location of sites IDIHA-0001825 and IDIHA-F-0018980.

AlUla valley. The gently undulating plateau covers >4,000 km² at elevations of 1000–1920 masl. Measuring approximately 0.8 km² (or 500 × 50 m), IDIHA-0001825 consists of common types of funerary monuments, such as simple cairns, large tower tombs, and pendants, which overlie earlier Standing Stone Circle structures—circular enclosures constructed of 1–2 concentric rings of locally quarried upright stones with either a single or multiple standing stones positioned in the center (Figure 2).

Standing Stone Circles are often found in isolated clusters, like at IDIHA-0001825. Here, 27 of these structures have been identified, concentrated in the northern portion of the site. The function of these features is currently unknown, but, based on the findings of ground survey and preliminary excavations at this site and others across the Harrat 'Uwayrid, use as funerary monuments or interments has been discounted. Furthermore, unpublished AAKSA radiocarbon evidence suggests that these structures were constructed during the 6th millennium B.C. (5800–5000 CAL B.C.). Later phases of funerary use are also present at the site. This is indicated by a series of simple cairns, associated rectangular platform structures, and pendant tombs, often constructed by robbing stone from earlier structures or overlying and reusing them to create new forms. Whilst secure dating of the funerary structures at IDIHA-0001825 is limited, similar monuments across the Levant and northwestern Arabia date from the late Neolithic through to the Bronze and Iron Ages (Abu-Azizeh et al. 2014, 167; Guagnin et al. 2017; 2020, 8–9; Munoz et al. 2020, 613). As such, IDIHA-0001825 functioned as a focal point of activity on the Harrat 'Uwayrid for millennia.

Tomb IDIHA-F-0000132

On the western edge of IDIHA-0001825 is a monumental cist burial, IDIHA-F-0000132. Ground survey revealed that IDIHA-F-0000132 had been heavily impacted by recent looting, with substantial quantities of diagnostic human remains evident within and around the feature (Figure 3A–C). Based on the preservation of the human remains, it is estimated that the tomb was looted within the last decade. During initial survey, the structure was recorded and photographed, with diagnostic human remains collected for analysis and scientific dating. These included: a left parietal, right maxilla, right humeral diaphysis, left and right proximal phalanges, a right ilium, partial proximal left femur, a left fourth metatarsus, and right first proximal phalanx (Figure 3D). A single sample, IB00051, was initially sent to the Oxford Radiocarbon Accelerator Unit (ORAU) for dating but failed to yield enough collagen for testing. The rapid hydrolyzation of collagen in arid environments, such as the Arabian Peninsula, is well known (Saliège, Person, and Paris 1995; Zazzo et al. 2012). Therefore, the sample was sent to the Muséum national d'Histoire naturelle, France, where bioapatite radiocarbon analysis revealed an early 4th millennium B.C. date (Table 1).

The early date of this sample and the significant quantities of diagnostic bone present justified full-scale excavation of this feature. Unlike other funerary monuments at the site, IDIHA-F-000132 is entirely discrete. The upright stones of the structure are clearly visible across the gentle camber of the ridgeline. The feature is characterized by a monumental, aboveground stone-built cist surrounded by a circular platform of basalt slabs (see Figure 3A). The platform measured

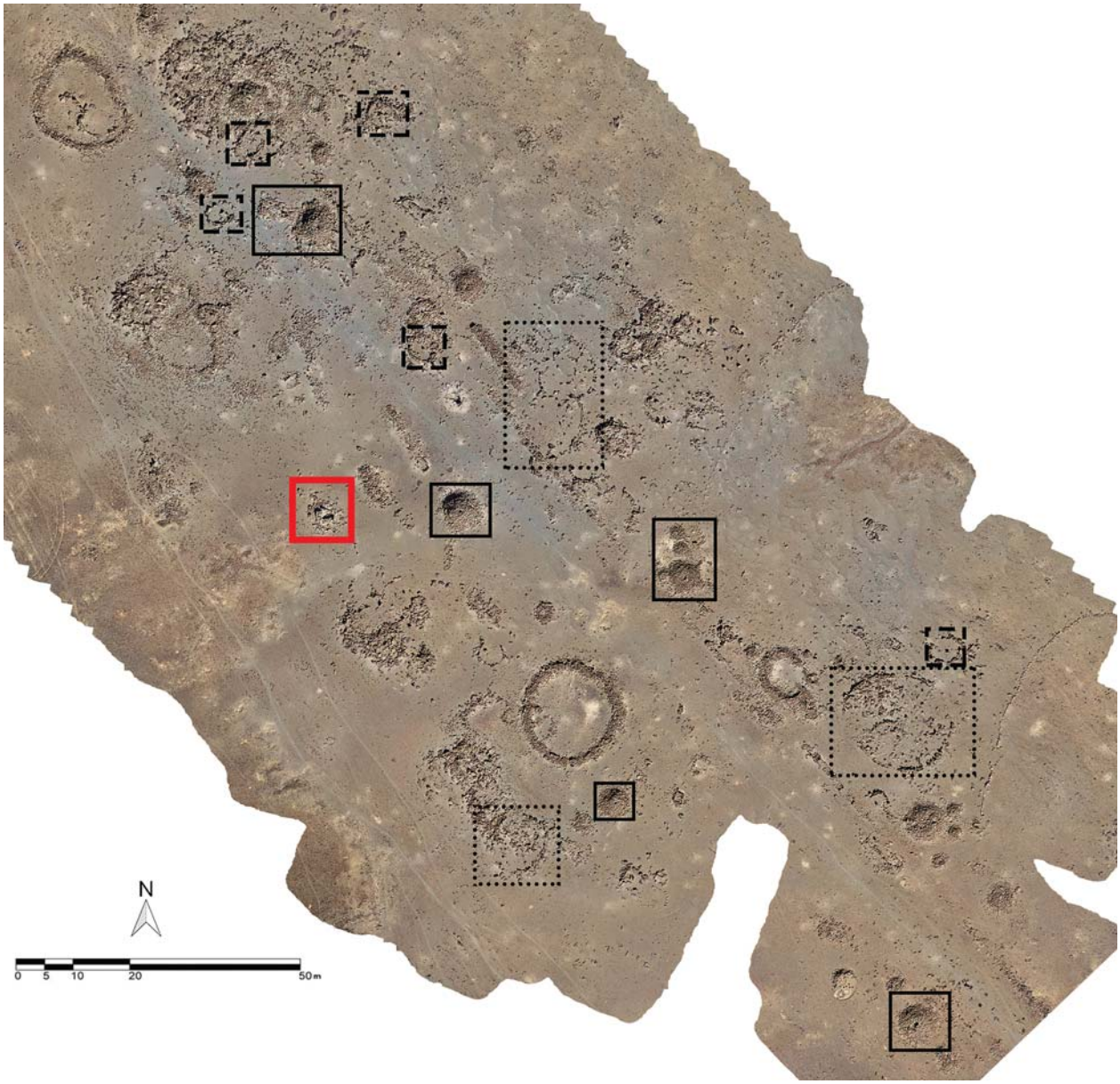

Figure 2. Annotated orthophoto of IDIHA-0001825. IDIHA-F-0000132 is marked by the thick, red square. A selection of simple Standing Stone Circles is marked by dashed squares, complex Standing Stone Circles by dotted squares, and cairns, tower tombs, and pendant burials are marked by black boxes.

6.68 m (east-west) × 6.50 m (north-south) and consists of large, horizontal slabs laid in diffuse concentric circles (see Figure 3B). These stones vary in size, with the largest measuring 1.0 × 0.9 m. Much of the southern part of the platform was obscured by two out of situ monumental stones that were originally part of the outer cist wall.

The tomb is orientated east-west, with the vertical slabs of the cist forming an elongated ovoid burial chamber with the maximum internal dimensions of 2.87 × 1.20 m. The wall of the cist is composed of 3–4 concentric rows of upright standing basalt slabs with rubble packed between the rows to ensure structural integrity of the feature. This effectively created a wall 1–1.25 m in width. The external and internal faces of the cist are composed of large slabs, the largest of which measured 1.1 × 0.4 × 0.9 m, with an estimated weight of 1,200 kg. In the eastern extent of the cist, a single prominent standing stone is present; this stone stands significantly higher than the surrounding stones and is visible across the site. The prominence of this feature suggests that it may have functioned as a grave marker. On the outer face of the stone, a T-shaped (later) carving is perceptible (Figure 4).

The loose stones present around the structure do not appear to have functioned as capstones. However, a significant quantity of smaller stones surrounding the structure, and several larger stones present within the cist, suggests a layer of stones was placed on top of the burial as capping. There is no evidence that the cist was covered by a tumulus (Figure 5).

Excavations within the cist revealed deposits of disturbed yellowish-brown sandy-loam fill. Deposition was higher in the west, likely the result of the looters piling fill in this corner. In the east, several large basalt stones were present, most probably the remains of capping. The remaining fill within the tomb was excavated, and all deposits surrounding the tomb were collected and sieved using a 2 mm mesh. Using a 100% collection policy, both diagnostic and non-diagnostic fragments were collected. Artifacts, including human remains, were bagged according to find locale, with a division maintained between the finds from the interior and exterior of the cist. Excavations within the cist continued until the natural soil profile was identified, with a maximum depth of 0.56 m reached in the western extent of the tomb.

Figure 3. IDIHA-F-0000132: A) during initial survey; B) orthophotograph prior to excavation; C) human remains present on surface; and, D) fragments collected during initial survey (not to scale).

Human remains were present throughout the fill, although none were found in situ. However, a partial mandible was discovered in a small hollow between two large stones in the northwestern corner of the structure. This positioning appears to predate the recent looting episode and is suggestive of ancient post-interment disturbance.

In the northeastern extent of the cist, a roughly circular patch of gray discoloration was identified, 30 cm in diameter and extending under the wall of the cist. This deposit had the appearance of burning, but no charcoal was found. It may represent decayed organic material. Only a single artifact was recovered from this feature, a mother-of-pearl pendant, in the eastern lower fill deposits (see below).

Human Remains

The human remains recovered from IDIHA-F-0000132 represent multiple commingled, disarticulated, and fragmented individuals. Exposure to the elements is associated with macroscopic evidence of taphonomic alteration, including bleaching, flaking, and post-mortem breakage. Fragmentation and limited access to the material facilitated only a basic anthropological analysis. Accordingly, these results are preliminary and primarily relate to determining the minimum number of individuals, achieved by a combination of skeletal age assessment and identification of duplicated elements. Human and animal bones were found in and around the central cist; no skeletal elements were found in articulation. Approximately 1,500 human skeletal fragments represent a minimum of 11 individuals: six adults, one adolescent, and four children.

Adult remains. The most frequently recurring bone in the sample was the distal right humerus; six were identified, all of which deemed to belong to skeletally mature adults (Figure 6A). Measurements taken on the distal humerus were applied to discriminant functions developed in an Egyptian population (Ali and Abd Elbaky 2016). Anthropological assessment of those six individuals indicates that the cist likely contained the remains of three male and three female adults. The largest humeral fragment (IB0001) presents macroscopic evidence of bone spurs on the distal third of the diaphysis, approximately 40 mm from the lateral, and 50 mm from the medial, condyles (see Figure 6A). This hypertrophy could be associated with repetitive use of the brachialis muscle, the primary elbow flexor (Abrahams et al. 1998). No further gross evidence of pathologies was identified in the six specimens.

Sub-adult remains. All diagnostic fragments presenting evidence on skeletal immaturity were analyzed, specifically to deriving age estimates relative to developmental stage. An additional five individuals were identified: one adolescent and four children.

At least one adolescent individual is represented, as evidenced by an immature proximal phalanx and femoral head. The distal epiphysis of a proximal phalanx presents macroscopic evidence of partial fusion to the diaphysis

Table 1. Radiocarbon dates for IDIHA-F-0000132 and IDIHA-F-0011166.

Sample ID	Laboratory ID	Age ^{14}C (B.P.)	CAL B.C. DATE 68.2% (1σ)	CAL B.C. DATE 95.4% (2σ)
IDIHA-F-0000132				
IB0001 (Adult)	UGAMS#46485	5430 ± 20	4332–4322 (14.6%) 4292–4260 (53.7%)	4340–4250 (95.4%)
0261 (Canine)	UGAMS#51029	5310 ± 20	4230–4216 (9.1%) 4206–4194 (7.2%) 4168–4160 (4.8%) 4135–4087 (31.6%) 4082–4056 (15.6%)	4238–4187 (27.1%) 4176–4050 (68.4%)
IB0009 (Juvenile, 13–14 years)	UGAMS#46486	4850 ± 20	3648–3632 (68.2%)	3698–3693 (0.8%) 3655–3627 (77.9%) 3560–3535 (16.8%)
IB0051 (Adult)	MNHN#19021	5125 ± 45	3981–3938 (30.4%) 3872–3808 (37.8%)	4041–4018 (4.6%) 3994–3796 (90.9%)
IDIHA-F-0011166				
IB0013 (Adult)	UGAMS#46482	5560 ± 20	4442–4420 (29.9%) 4398–4382 (18.1%) 4371–4356 (20.3%)	4446–4351 (95.4%)
IB0014 (Adult)	UGAMS#46483	5580 ± 25	4446–4438 (8.7%) 4427–4416 (58.1%) 4408–4364 (47.9%)	4455–4352 (95.4%)

(IB0009; Figure 6B). As it is not possible to reliably assign sex, the estimated age range varies: 14 years for male and 13 years for female sex (Tanner, Whitehouse, and Healy 1962; Scheuer and Black 2000; Schaefer, Black, and Scheuer 2009). The femoral head is unfused and, despite significant post-mortem damage to the borders, the fovea capitis is identifiable and presents a posterior beak-like projection (IB0012; Figure 6C). This gross developmental morphology of the femoral head relative to full maturity indicates that this bone also represents a young adolescent individual (Scheuer and Black 2000; Schaefer, Black, and Scheuer 2009).

Anthropological assessment indicates the remains of at least four children: these are accordingly described below relative to assessed age (3–12 years of age). It is not possible to reliably estimate sex in any of the individuals.

The youngest individual is represented by a fragment of the right mandibular corpus, broken in the symphysis anteriorly and at the distal margin of the second deciduous molar (FDI #85) posteriorly (IB0008; Figure 6E). There is evidence of post-mortem loss of the deciduous right and left central incisors (#41; 51) and the right deciduous lateral incisor (#52) and canine (#53); a crypt is present for the first permanent molar (#46). Dental development (root and/or crown structure) indicates that this individual was likely 3–4 years of age at death (Moorrees, Fanning, and Hunt 1963).

A second individual is represented by bilateral femoral head epiphyses found in direct association and deemed to belong to the one individual based on morphological assessment of size and development (IB0007; Figure 6D). The epiphyses present a beak-like projection on the posterior side but are devoid of a flattened margin; the latter relative to full maturity indicate an estimated age at death of 4–7 years (Schaefer, Black, and Scheuer 2009).

Individual IB0010 is represented by a single unfused sternebra body segment measuring 24 × 19 mm (height/width); there is no gross evidence of fusion with contiguous body segments (IB0010; Figure 6F). The relative morphological development of the segment implies an age at death of approximately 8–9 years (Scheuer and Black 2000; Schaefer, Black, and Scheuer 2009).

The final individual is represented by the base of a right first proximal foot phalanx (IB0011; Figure 6G). The proximal surface appears smooth with a slight inferior ridge; the inferior side is slightly flattened as compared to the superior edge. Given this morphology and the appearance of the secondary epiphysis, age at death was assessed between 10 and 12 years (Scheuer and Black 2000; Schaefer, Black, and Scheuer 2009).

Faunal Remains

One hundred and twenty-nine faunal fragments (424 g) were recovered from the disturbed fill of IDIHA-F-0000132. Sixty-five NISP (Number of Identified Specimens, corresponding to 242 g) belong to the following taxa: domestic sheep and goat, domestic cattle, canid, and equid (Table 2). Despite severe fragmentation (only 11.6% of the remains were complete, predominantly compact bones), anthropic marks could be observed on the surface. Measurements follow the standards of von den Driesch (1976), Eisenmann and Beckouche (1986) for equid, and Mallet and Guadelli (2013) for petrosal bone. The age of fusion is based on Barone (1976) and Habermehl (1985).

Caprines. Sheep, goat, and undistinguished sheep/goat represent 53.9% of the total NISP (35 remains; 73 g; cf. Boessneck, Müller, and Teichert 1964; Mallet 2010–2011; Mallet and Guadelli 2013 for identification, morphological and metrical criteria, and age indication). Sheep was identified by a left petrosal bone and a metapodial, goat by a right coxal bone. The bones are severely fragmented: the only entire element is a caudal vertebra, all other (34) remains are partial (97.1%), and in 23 cases (68.6%), less than half the element is preserved. Regarding anatomical representation (Table 3), the axial skeleton is the most frequent part (rachis and ribs comprise 62.9% of the NISP), and elements from the head (skull fragments, petrosal bone, and the body of a mandible) represent 11.4%. The appendicular skeleton is present in a smaller proportion (forelimb and hindlimb, 25.7%). The minimal number of elements (MNE) is 24. The following anatomical elements were present: one head, four cervical vertebrae, four thoracic vertebrae, four ribs, two humeri, one ulna, one coxal bone, one femur, one metapodial, one first phalanx, and two second phalanges. Age at death is determined by the epiphyseal fusion. Four vertebrae with fused centra

Figure 4. A) Possible grave marker with later T engraving. B) Ground photograph of IDIHA-F-0000132.

indicate an age at death over 4–5 years, one fused femur indicates an adult older than 20–26 months, the unfused sheep metapodial an individual younger than 16–18 months, and one unfused sheep/goat distal humerus younger than 3–4 months. The sheep petrosal bone pertains to an animal older than 3–6 months (cf. Mallet 2010–2011).

Sex estimation of the goat coxal bone indicates a male. The estimated minimal number of individuals (MNI) is two: one adult male goat (represented by the coxal bone and possibly the fused vertebrae) and one sheep younger than 3–4 months (represented by the petrosal bone and possibly the unfused humerus).

Anthropic marks were observed on two specimens: a sheep/goat femur with two cut marks on the caput area and the goat coxal, which had a deep cut mark on the lip of the acetabulum. Both traces occur in the same articulation and are produced on bones when separating the femur from the coxal with a knife. Rodent tooth marks were observed on seven specimens and carnivore tooth marks on two. Combining the MNI of two with the 35 remains and the MNE of 24, it appears that each individual is poorly represented. In addition to the recorded cut marks, such data suggest that only portions, derived from butchery, were present.

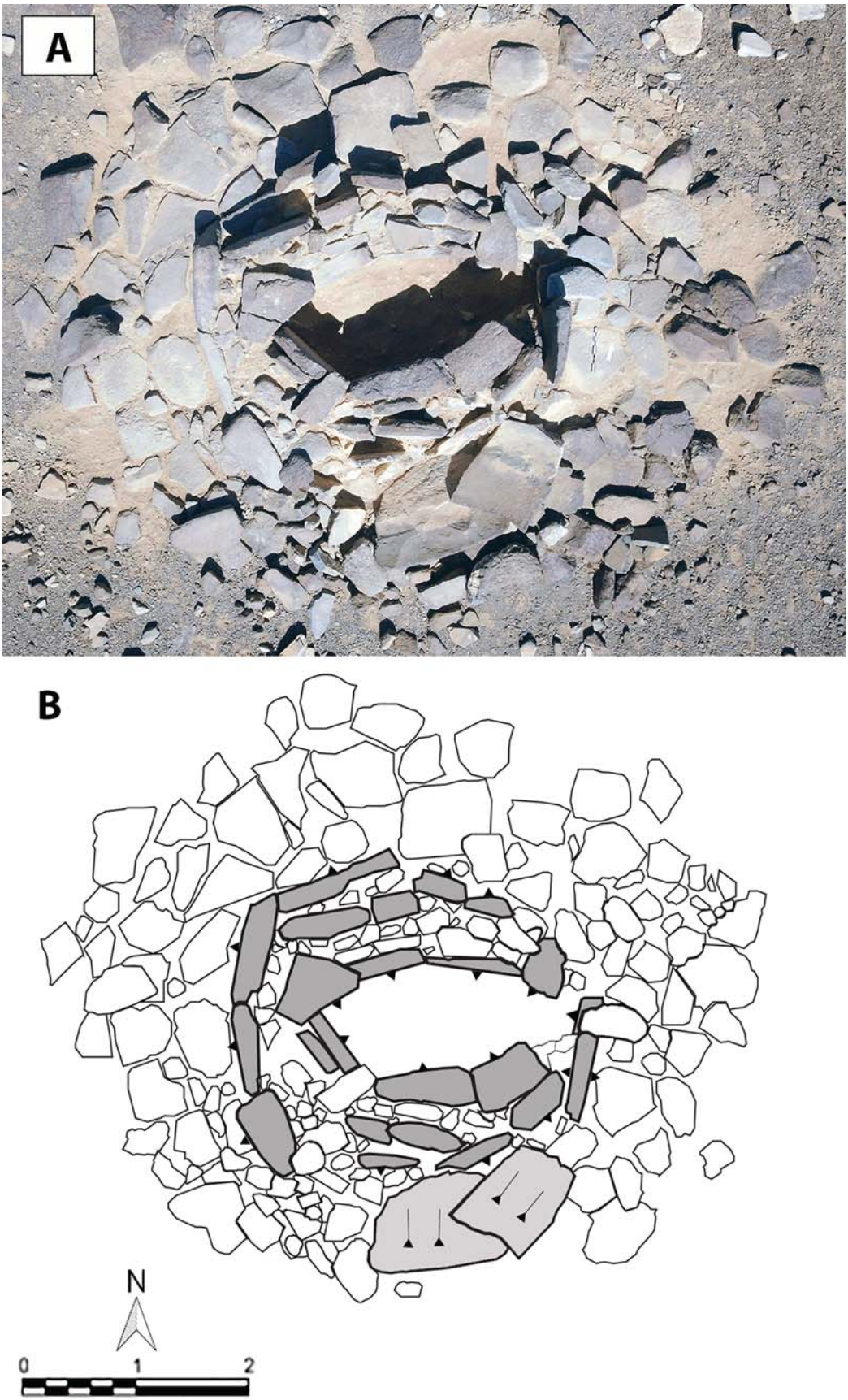

Figure 5. A) Aerial photograph of IDIHA-F-0000132. B) Plan of IDIHA-F-0000132 (plan by Kate Burnett).

Canid. The assemblage includes 26 remains (40% of total; 108 g; 1 MNI) of a medium–large canid species. Anatomical elements from all body portions are present. The head is represented by both sides of the mandible; the rachis by six vertebrae, a sacrum, and both sides of the coxal bone; and, the appendicular skeleton by a distal radius, a fragmented fibula, a distal femur, seven metapodials, three phalanges, and compact bones from the carpal and tarsal (see Table 3; Figure 7A). As for fragmentation, 53.9% of the canid remains were complete. No anatomical element is repeated, and the

Figure 6. Human bone recovered from IDIHA-F-0000132 (MNI 11). A) Distal portions of adult humeri. B) Sub-adult distal epiphysis. C) Sub-adult femoral head. D) Sub-adult femoral heads. E) Sub-adult right mandible portion. F) Sub-adult sternebra segement. G) Sub-adult base of a right first proximal foot phalanx.

bilateral elements, such as the mandible and coxal, symmetrically correspond in terms of size and morphology. The following elements directly correspond in anatomical connection: right fourth and fifth metatarsal, the coxal bone and sacrum, and two lumbar vertebrae. All specimens indicate complete epiphyseal fusion, corresponding to an age above 1 year (Barone 1976; Habermehl 1985). No anthropic marks were observed. Four bones have pathological deformations: a lumbar vertebra has exostoses on the left lateral side of the spinous process associated with an inclination of the latter to the right of the animal, another lumbar vertebra has a similar inclination to the left, and the sacrum has an exostose on the right side of the spinous process with inclination to the left.

Species determination is based on the measurements of the post-cranial skeleton. The golden jackal (*Canis aureus*) can be excluded, as it is smaller than the specimens retrieved from IDIHA-F-0000132, based on the osteological collection of the Muséum d'Histoire naturelle, Geneva. Other large canids in this geographical area are the domestic dog (*C. familiaris*), as well as the wolf (*C. lupus*), its southern subspecies *C. lupus pallipes* (the Indian wolf, whose southernmost distribution is limited to the northern fringe of the Peninsula; see Mendelssohn and Yom-Tov 1999), and the Arabian subspecies (*C. lupus arabs*), which is distributed across the Peninsula (Harrison and Bates 1991). All the measurements (see Table 3) are consistent with the metrical range of dogs, evidenced by other examples from the Middle East and the Arabian Peninsula (Tchernov and Valla 1997; Blau and Beech 1999; Chaix 1999; Martin 2002; Tomé 2003; Maini and Curci 2011).

Table 2. Quantification of identified faunal remains from IDIHA-F-0000132.

Taxa	NISP	% NISP	Weight (g)	% Weight	MNI
Sheep/goat	35	53.9%	73	30.2%	2
Dog/wolf	25	38.5%	103	42.6%	0
Dog	1	1.5%	5	2%	1
Cattle	3	4.6%	25	10.3%	1
Equid	1	1.5%	36	14.9%	1
Total	65	100%	242	100%	5
Sheep	2	33.3%	9	56.2%	1
Goat	1	66.7%	7	44.8%	1
Total	3	100%	16	100%	2

The shoulder height, following Clark (1995), is 53.6 cm, calculated on the second metatarsal, 53.7 cm on the fourth metatarsal, and 53.8 cm on the fifth metatarsal. These values correspond to a medium–large sized animal and are comparable with the shoulder heights of the ancient dog remains from Unar 2 (Blau and Beech 1999), Qal'at al-Bahreïn (Tomé 2003), Kerma (Chaix 1999), Gilat (Grigson 2006, 238), and Upper Mesopotamia (Vila 1998).

Nevertheless, the difficulty of distinguishing between dog and wolf lies in the size of wolves living in arid environments. Indeed, as a general pattern, a north-south decrease in the size of the animals is observed (cf. Bergmann 1847; Davis 1981; Mendelssohn 1982; Dayan 1994; Tchernov and Valla 1997). In the Middle East, the Arabian wolf (*C. lupus arabs*) is the most reduced in size (Mendelssohn 1982; Harrison and Bates 1991), approximately 20% smaller than those from the northern regions (cf. Nowak 1991; Tchernov and Valla 1997; Mendelssohn and Yom-Tov 1999). Therefore, on the basis of the available osteometrical data, it is not possible to ascertain if the remains recovered from IDIHA-F-0000132 belonged to the dog or to the desert subspecies of wolf, except for one specimen. The preserved left radius has a distal breadth of 21.0 mm (see Table 2). Other measurements for the radius distal breadth in ancient Middle Eastern dogs are 19.51 mm at Gilat (Grigson 2006, table 6.23), 22.8 mm at Qal'at al-Bahreïn (Tomé 2003), 23.0 mm at Unar 2 (Blau and Beech 1999), and 20.7 mm and 21.5 mm at Hayonim Terrace (Tchernov and Valla 1997, fig. 19).

Tchernov and Valla (1997, fig. 19) compare the measurements of Natufian dog bones with measurements taken on recent wolves from the Middle East, including the smaller desert wolves. The plot on the distal breadth of the radius presented indicates that the range of values for wolves is ca. 24.7–26.0 mm, forming a separate cluster. The dimensional gap between wolves and dogs is pronounced and neat (Tchernov and Valla 1997, 89). As such, this measurement can be used as a discriminating criterion. Moreover, the larger size of ancient wolves compared to modern ones (Davis and Valla 1978) increases the confidence level of the attribution of the radius to *C. familiaris*. Indeed, anatomical connection, size-homogeneity, and fusion stage, further combined with the pathological conditions on the rachis, suggest that the recovered canid remains likely belong to a

Table 3. Anatomical representation per species and metrical data from IDIHA-F-0000132 (MNE = minimal number of elements).

				Measurements (mm)						
Taxon	Anatomy	NISP	MNE	Ddv	Drc	DdvMAI	DrcMAI	DrcCP		
Sheep	petrosal	1	1	10.6	10.8	3.9	4.2	4.2		
Sheep	metapodial	1	1							
				LA	LAR					
Goat	coxal R	1	1	28.3	23.9					
Sheep/goat	cranium	2	0							
Sheep/goat	mandible	1	1							
				PL	BFcr	HFcr	HFcd			
Sheep/goat	cerv vert	4	4							
Sheep/goat	thor vert	5	4							
Sheep/goat	caud vert	1	1	15.4	8.11	7.6	6.6			
Sheep/goat	rib	12	4							
Sheep/goat	hum.	2	2							
Sheep/goat	ulna	1	1							
				DC						
Sheep/goat	fem.	1	1	21.8						
				Bd						
Sheep/goat	phal. I	1	1	10.5						
Sheep/goat	phal. II	1	1	8.3						
Sheep/goat	phal. II	1	1	11.7						
Total sheep/goat		35	24							
Dog/wolf	mandible	2	2							
				PL	BFcr	BFcd	HFcr	HFcd		
Dog/wolf	lumb. vert.	1	1	23.1	19.2	19.5	12.2			
Dog/wolf	lumb. vert.	1	1	26.9			10.1			
Dog/wolf	lumb. vert.	1	1	28.5	19.0	21.2	ca 13.5	12.2		
Dog/wolf	lumb. vert.	1	1	27.5						
Dog/wolf	lumb. vert.	2	2							
				GL	PL	GB	BFcr	HFcr		
Dog/wolf	sacrum	1	1	39.4	35.5	ca 37.4	20.1	10.3		
				GB						
Dog/wolf	pisif	1	1	16.9						
				GL						
Dog/wolf	metacarpal I	1	1	21.1						
				GL	LAR	LA	SH	SB	SC	Lfo
Dog/wolf	coxal L	1	1	>141.0	23.4	20.7	19.0	9.2	5.2	28.4
Dog/wolf	coxal R	1	1		23.3	20.8		9.2	5.2	
Dog/wolf	femur	1	1							
Dog/wolf	fibula	1	1							
				GL						
Dog/wolf	astragalus	1	1							
				GL	Bd					
Dog/wolf	metatarsal II	1	1	64.7	8.2					
Dog/wolf	metatarsal IV	1	1	75.3	8.5					
Dog/wolf	metatarsal V	1	1	68.3	7.4					
Dog/wolf	metapodial 3/4	1	1		8.9					
Dog/wolf	metapodial 3/4	1	1		8.0					
Dog/wolf	metapodial	1	1							
				GL	Bp	SD	Bd			
Dog/wolf	phal. I	1	1	25.8	8.5	5.6	6.9			
Dog/wolf	phal. I	1	1	21.2	8.5	5.6	6.8			
Dog/wolf	phal. II	1	1	12.7	7.7	5.1	6.4			
				Bd						
Dog	radius	1	1	21.0						
Total dog/wolf		26	26							
Cattle	petrous	1	1							
Cattle	rib	2	2							
Total cattle		3	3							
				M10 Bd	M11 BFd	M13 dTm	M14 DTm			
Equid	metatarsal III	1	1	41.8	42.3	26.0	29.5			
Total equid		1	1							
Total		65	54							

unique adult individual. The combination of known fusion ages for this taxon indicates that the animal was more than 1.5–2 years old (based on the fusion age of vertebral centra; see Barone 1976; the distal femur indicates an adult over 1 year old). The exostoses suggest a more advanced age, as they typically develop in senile individuals (Bartosiewickz and Gál 2013).

Cattle. The assemblage preserved three remains of cattle (corresponding to 25 g; 1 MNI) that constitute 4.6% of the total NISP count and 10.3% of the total weight (see Table 2). Regarding the anatomical elements (see Table 3), only bones from the cranium and the thoracic cage are present, that is, one left petrosal bone and two left ribs (with fused proximal epiphysis). No anthropic traces were observed.

Figure 7. A) A representative selection of the canid remains from IDIHA-F-0000132. B) Equid distal left third metatarsal with anthropic marks. C) Cut marks visible on the medial view, scrapings on the medial and cranial view.

Equid. A single equid remain was retrieved: a fragment of the left third metatarsal in the hindfoot (1.5% of total NSP; 36 g; 1 MNI). This fragmentation is recent; therefore, a larger portion of this bone may have been present originally.

The identification of the species is achievable using standard metrical data. Each equid species has a specific morphology and overall size that can be illustrated by comparing measurements on a logarithmic scale (Eisenmann and Beckouche 1986, following Simpson 1941). The logarithm (base 10) of the ratio of each measurement of the third metatarsal from IDIHA-F-0000132 to the corresponding measurement on third metatarsal of *E. hemionus onager* is plotted in the ratio diagram in Figure 8, and the differences among measurements are visualized by a broken line.

The measurements on the metatarsal from IDIHA-F-0000132 (see Table 3) correspond to a medium-sized

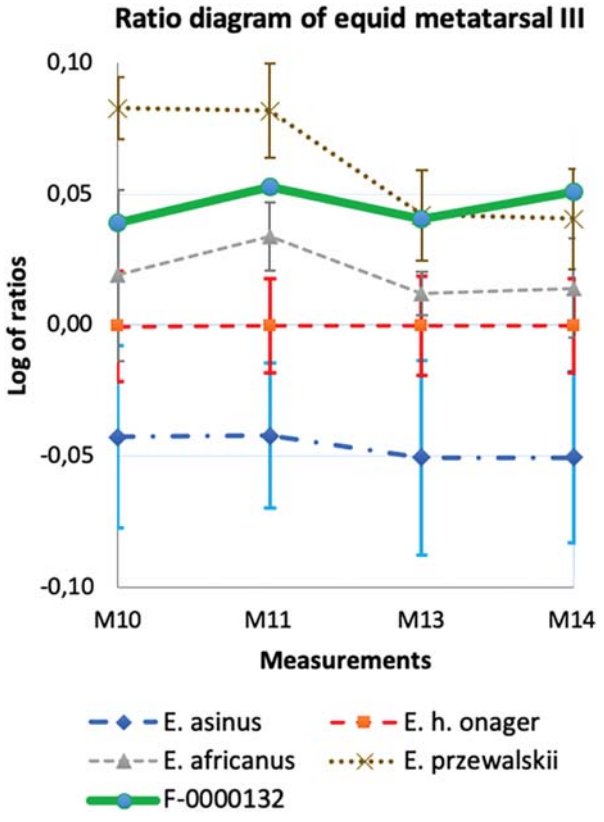

Figure 8. Ratio diagram of the dimensions of the equid third metatarsal from IDIHA-F-0000132 and of the mean dimensions of *Equus africanus* (NR = 7), *E. przewalskii* (NR = 29), and *E. asinus* (NR = 14), using *E. hemionus onager* (NR = 16) as reference. All the ratios take as standard reference the corresponding measurement on *E. hemionus onager* (line 0 in the logarithmic scale of the graph). For each set of measurements, the average value and the standard deviation are given, the latter arising from measurement errors but above all from the natural variation of dimensions. For each species, the average level in the diagram is related to the overall size typical of the species. Measurements M10, M11, M13, and M14 after Eisenmann and Beckouche 1986.

equid. They fall far below the range of horse (*Equus caballus*) and far above that of donkey (*E. asinus*). The ratio diagram shows that the values of our metatarsal have a broken line pattern which closely follows only the wild ass (*E. africanus*) and lies slightly above it. It is therefore possible to attribute this metatarsal to the wild ass, but a larger one in comparison to the reference set. The ancient distribution of wild ass in the Arabian Peninsula is indicated by a series of archaeozoological findings (Uerpmann 1991; Uerpmann and Uerpmann 2000). Scenes of equid hunting are also depicted in rock art (Guagnin et al. 2015).

The weight estimated after Eisenmann (2009) is around 245 kg. The weight estimated on wild ass metatarsal measurements is 198–250 kg; as such, it includes the range for the current specimen. Epiphyseal fusion indicates an animal older than 15 months (after Barone 1976). Interestingly, this specimen bears multiple cut marks, some of which are deeper, on the medial aspect of the trochlea in the distal articulation (Figure 7B). This location indicates the disarticulation of the first phalanx from the metapodial. Moreover, its surface presents a series of parallel scrapings, running diagonally on a wide portion of the medial and cranial views of the shaft (Figure 7C). These marks are the result of anthropic modification, a striation deriving from the use of the bone as an object or tool, or a possible partial working of the surface. The presence of these marks on different aspects of the specimen better fits anthropic modification rather than an accidental abrasion.

Discussion of the faunal remains. The presence of a juvenile caprine is of note, as young animals were often a selected category in mortuary assemblages (Horwitz 2001). Taking as reference that the kidding season for caprines in semi-arid environments runs from November–February (Noy-Meir and Seligman 1979), the age of this juvenile (less than 3–4 months) suggests that death occurred between winter and the end of spring.

In terms of the canid remains, archaeological context is fundamental for interpretation: in all likelihood, the remains represent an entire dog buried with the deceased. This interpretation would appear to be supported by the archaeozoological study. Firstly, the metrical coherence of all the remains can be correlated to a domestic dog, in addition to the slenderness of the radius. Moreover, the presence of pathologies better suits domestic species, which are more prone to osteological deformations than wild animals (Grigson 2006, 237–238; Bartosiewicz and Gál 2013). Indeed, although rare, the association of dogs and humans in funerary contexts has been identified in the Arabian Peninsula and across the Middle East, such as at the 3rd millennium B.C. sites of Al Hajjar in Bahrain (Rice 1994) and Unar 2, UAE (Blau and Beech 1999), as well as the earlier Natufian graves at Mallaha (Valla 1975; Davis and Valla 1978) and Hayonim Terrace, Israel (Davis and Valla 1978; Tchernov and Valla 1997). Contemporary dog burials have also been identified at the Chalcolithic site of Gilat, Israel, with the excavators ascribing a ritual function for these deposits and suggesting that these animals perhaps fulfilled a totemistic role at the sanctuary (Grigson 2006, 239; Levy et al. 2006, 126–127, 134). The inclusion of a dog reflects their special relationship with humans, a facet also illustrated in the rock art of northwestern Arabia, where dogs were used for hunting and herding (Guagnin et al. 2015; Guagnin, Perri, and Petraglia 2018). Bioapatite radiocarbon dating of the mandible revealed a 2σ date of 4176–4050 CAL B.C., making this canid the earliest chronometrically dated domestic dog in the Arabian Peninsula (cf. Biagi and Nisbet 1999; Martin 2002; Uerpmann and Uerpmann 2003; Fedele 2008, reporting Bökönyi 1990; Maini and Curci 2011; Borgi et al. 2012).

Analysis also revealed differing treatment of the animals depending on taxon. Sheep, goat, cattle, and equid are heavily fragmented and represent portions (altogether, 39 NISP for 4 MNI, with tooth marks), while the dog remains correspond to a single whole individual (36 NISP for 1 MNI). The ruminant remains can be interpreted as the remnants of food offerings or a funerary meal/feasting for either the deceased or the living participants. Such practices are present across the Arabian Peninsula and the Middle East (Fröhlich 1986; Braemer et al. 2001; Horwitz 2001; Phillips 2002; Salvatori 2007; Abu-Azizeh et al. 2014). However, due to disturbances, this function cannot conclusively be asserted.

The worked equid metatarsal presents a number of interesting questions. The first concerns taxonomical estimation: the attribution of wild ass suggests that it is not intrusive but contemporary with the interment. It also attests to the hunting of this species and to its importance in funerary contexts. Secondly, the observed anthropic marks indicate that the specimen may have functioned either as an object itself or a portion discarded in the manufacture of another object; as such, the marks may be related to this process, rather than an offering practice. Indeed, animal bone was frequently used as a raw material, with metapodials often selected for their density and straight shape. Finally, if this object was intentionally deposited, the symbolic

meaning of the artifact may have been enhanced by the wild status of the animal. Trophies of exceptional animals obtained by hunting are often attested in burials (Horwitz 2001). This artifact may therefore represent a pars pro toto. Conversely, if the metatarsal was considered an object, independent from the species, it may have been deposited as a grave good. Evidence for the intentional deposition of an equid metapodial was identified in a late Neolithic funerary tumulus (T29) at Ramat Saharonim in the Negev (Horwitz, Rosen, and Bocquentin 2011). The fact that the distal third metacarpal from Ramat Saharonim was found in a secure stratigraphic context, roughly corresponding to the date of IDIHA-F-0000132, may support the ritual interpretation of the current specimen. Furthermore, Horwitz, Rosen, and Bocquentin (2011) include among the possible species wild ass and, as in the case of IDIHA-F-0000132, an individual larger than the known reference sample.

Notably absent are teeth, the most resistant tissues in the skeleton. As the context was significantly disturbed, fragmented, and intermingled, aspects may have been lost, including teeth that can be dislodged easily from the alveoli. As such, based on the available data, it cannot be excluded that crania were deposited.

Despite the aforementioned uncertainties, it is hypothesized that all of the faunal remains were associated with IDIHA-F-0000132. The archaeozoological evidence is composed of different faunal categories, potentially accumulated over multiple events: a burial associated with humans or a grave good indicative of property/ownership (a dog), offerings or remains of funerary meals (portions of sheep, goat, and cattle), and a possible trophy of a hunted animal or an object intentionally deposited (wild ass metatarsal), all of which may correspond to different depositional concepts and ritual functions. The domestic ruminants may be indicative of the importance of sustenance in the afterlife, as well as highlighting the bond between domestic livestock and early pastoral communities. Likewise, the inclusion of the dog underlines the role and importance of this species, whilst the identification of wild ass testifies to hunting and the symbolic value of game.

Artifacts

Excavations within IDIHA-F-0000132 revealed a nacre, or mother-of-pearl (*Pinctada sp.*), pendant. Measuring 50 × 30 mm, the pendant is leaf-shaped with a single pierced hole and incised decoration (Figure 9A). Damage is evident across the piece, the presence of which suggests the pendant may have originally been circular or ovoid in shape.

As yet, no direct parallels have been identified for the pendant. However, broad parallels of form are present across the Neolithic of the Arabian Peninsula. In eastern Arabia, ovoid mother-of-pearl pendants have been identified at Jebel al-Buhais, UAE (Kiesewetter, Uerpmann, and Jasim 2000, fig. 2:12, 14, 15). However, these examples are marked by a more elongated, ovoid form rather than a circular or leaf-shaped one. Likewise, an incised ovoid pendant carved from dugong ivory was also recovered from FAY-NE15 (Uerpmann et al. 2012, figs. 11, 396); although crafted from a different material, this pendant is almost identical in size to the one recovered from IDIHA-F-0000132. Excavations farther south at Ra's al-Hamra 5 and Suwayh in Oman have also revealed a series of necklaces composed of leaf-shaped mother-of-pearl pendants with incised decoration on the edge, similar to that evidenced on the pendant from IDIHA-F-0000132 (Salvatori 2007, 59–201; Charpentier and Méry 2010, fig. 2:10).

Site IDIHA-0018980

IDIHA-0018980 is located in the eastern sandstone badlands. The site consists of three discrete Standing Stone Circles, undisturbed by later constructions. These features were constructed on a valley floor in close proximity to the curving face of a cliff. Although processes of sand abrasion or deposition have left much of the original form obscured, these structures appear typologically similar to those at IDIHA-0001825 and elsewhere on the Harrat 'Uwayrid, albeit with some variations. A small number of non-diagnostic worked flint, quartz, and chert was identified during ground survey and excavation, with these suggestive of a late prehistoric date. Located above these structures on a series of rock platforms overlooking the valley were a series of cist and cairn burials, one of which is IDIHA-F-0011166.

Tomb IDIHA-F-0011166

As with IDIHA-F-0000132, the tomb had been recently looted, with a significant number of poorly preserved diagnostic and non-diagnostic human bone fragments visible. The bones were heavily bleached and in much poorer condition than those recovered from IDIHA-F-0000132, potentially indicating they had been exposed for a longer period of time and/or were exposed to more extreme variations in climate. Due to typological similarities between the two burials, IDIHA-F-0011166 was chosen for excavation and subsequently visited again by helicopter. Unfortunately, due to the limited availability of the helicopter and remoteness of the site, excavation was restricted to a single day.

IDIHA-F-0011166 was constructed in a similar manner to IDIHA-F-0000132. A circular platform of stones, albeit smaller, encircled a large stone-built cist, characterized by several rings of unworked monumental sandstone slabs set vertically into the ground. The cist is orientated roughly northwest-southeast and measures 2.47 × 1.70 × 1.20 m (Figure 10). The largest stone recorded was 1.25 × 1.20 × 0.10 m, estimated to weigh 350 kg. The tomb also had a large standing vertical stone built into the southwestern end of the cist, potentially functioning as a grave marker. The eastern side of the structure had been badly damaged, probably from looting. The tomb fill and the bulk of the disturbed human remains were located in the east of the structure, along with several large stones likely associated with the eastern cist wall.

The tomb was excavated using the same methodology as at IDIHA-F-0000132. The fill consisted of orange-brown aeolian sand, which was higher in the east. The tomb was excavated to bedrock, where a large north-south running split/crevice in the bedrock was revealed.

In contrast to IDIHA-F-0000132, in situ human remains were identified. Several articulated vertebrae were discovered against the southwestern cist wall, suggesting post interment disturbance of the vertebrae, whilst soft tissue was still in place (Figure 11). However, only a single artifact, a carnelian bead, was recovered during sieving (Figure 9B).

Human Remains

More than 1,000 fragments of human bone were recovered from both the interior and exterior of the cist; all skeletal elements were disarticulated and highly commingled. The majority of the bones recovered present post-mortem

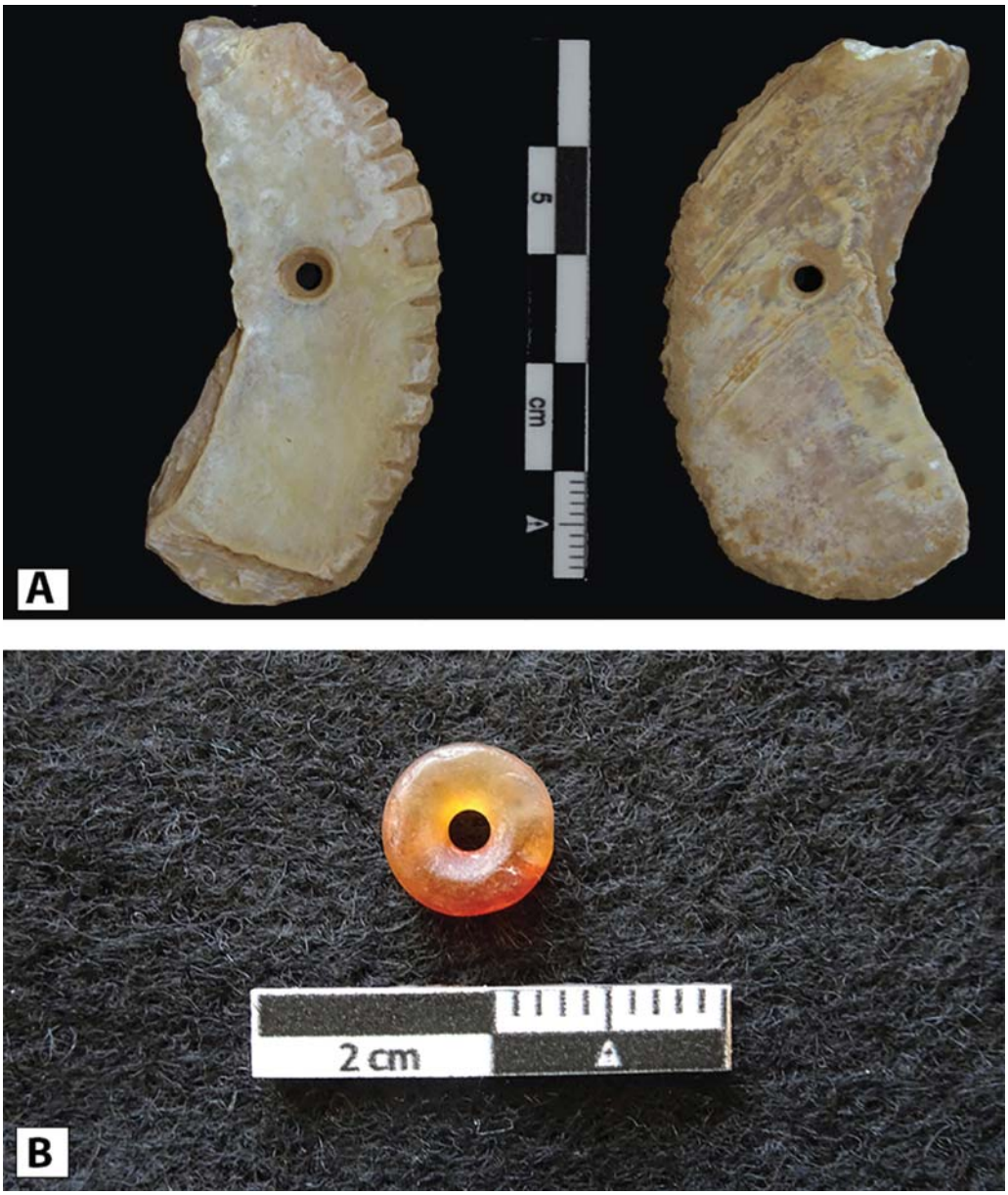

Figure 9. A) Mother-of-pearl pendant from IDIHA-F-0000132. B) Carnelian bead from IDIHA-F-0011166.

damage and fragmentation, with the exception of five articulated vertebrae (Figure 12). Based on the results of the anthropological assessment, it is estimated that the skeletal assemblage represents a minimum of seven individuals (five adults, one adolescent, and one child).

Adult remains. The most frequently recurring bone was the left calcaneus. A total of three complete and two highly eroded (weathered) elements were recovered (Figure 12A); all five calcanei present normal adult morphology, with no obvious evidence of pathological alteration. Maximum calcaneal length measurements were taken and applied according to Zakaria and colleagues (2010). Anthropological assessment of those three individuals indicates that the cist likely contained the remains of two male and one female adults.

Sub-adult remains. Subadult individuals, represented by three unfused epiphyses, are present in this assemblage. A proximal radial epiphysis and two proximal epiphyses of hand phalanges indicate a minimum of two individuals.

A single proximal radial epiphysis (IB0018; Figure 12B) is characterized by significant post-mortem erosion. The fragment is circular shaped with one concave (articular) surface and one metaphyseal surface. Morphological assessment indicates an age of approximately 10–11 years (Scheuer and Black 2000; Schaefer, Black, and Scheuer 2009). One adolescent individual is represented by two epiphyses of proximal hand phalanges with overlapping age estimates of 12–14 years: a first (IB0020; Figure 12C) and fourth or fifth (IB0019; Figure 12D) proximal hand phalanx epiphysis.

Artifacts

A single carnelian (chalcedony) bead was recovered from IDIHA-F-0011166. This bead measured 10 × 10 mm and is best described as a disc bead (see Figure 9B). Disc beads are common from the Neolithic onwards, with examples found throughout the Middle East and the Arabian Peninsula (Kiesewetter, Uerpmann, and Jasim 2000; Braemer et al. 2001, fig. 13; de Beauclair, Jasim, and Uerpmann 2006, 175; Kiesewetter 2006, 121–125; Brunet 2009; Bar-Yosef Mayer 2013, 134; Gebel and Mahasneh 2013, 135).

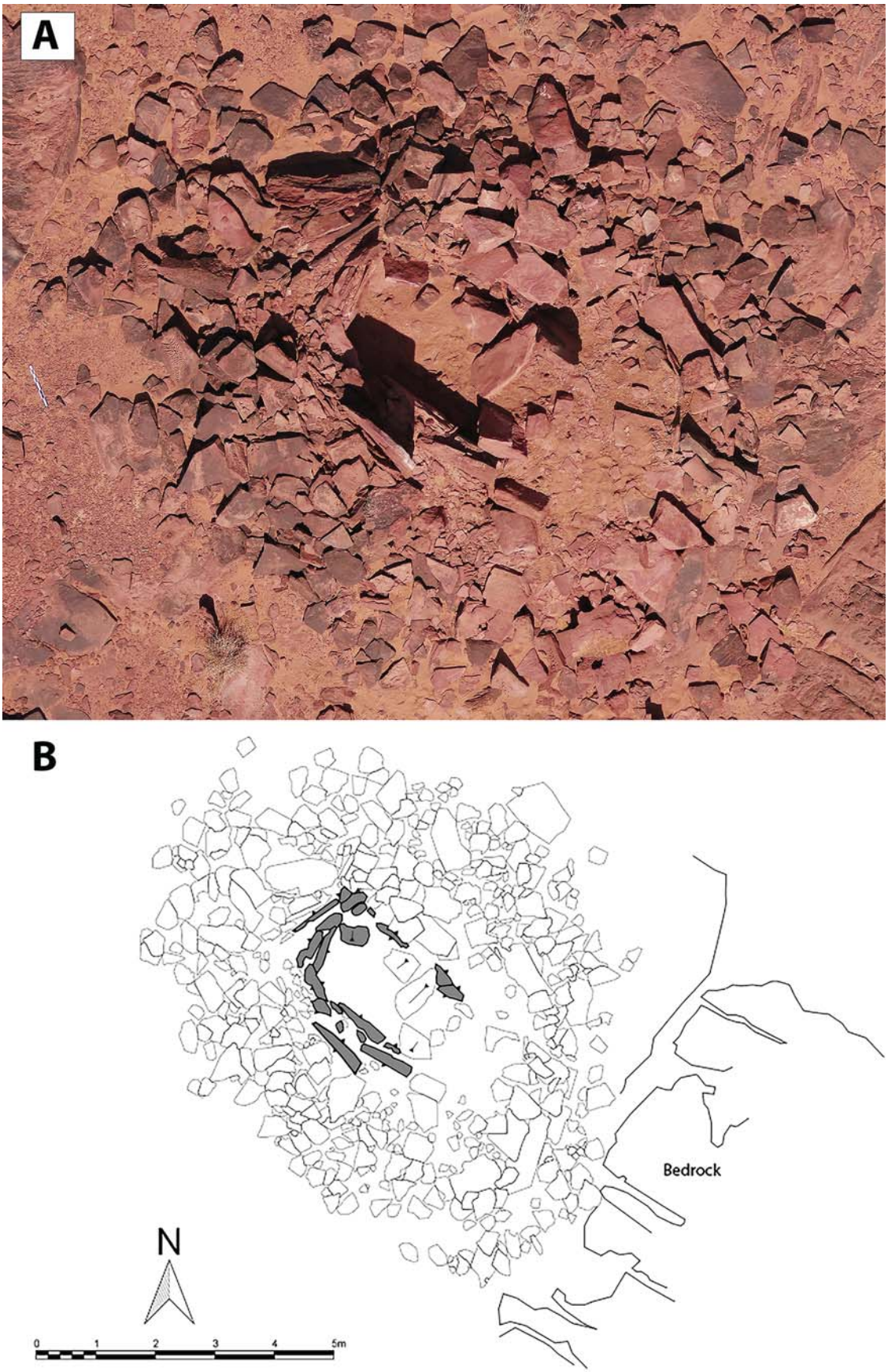

Figure 10. A) Orthophoto of IDIHA-F-0011166. B) Plan of IDIHA-F-0011166 (plan by Kate Burnett).

Excavations at Tayma, to the east of the *sabkha* (mudflat), have revealed the remains of a carnelian bead workshop which has been dated to the late 5th to early 4th millennium B.C. (4223–3964 CAL B.C.; Purschwitz 2017, 290; Hausleiter and Eichmann 2018, 15–16). Interestingly, the earliest date for this workshop roughly corresponds with the radiocarbon evidence from IDIHA-F-0011166; as such, it is possible that this bead may have originated from the Tayma workshop,

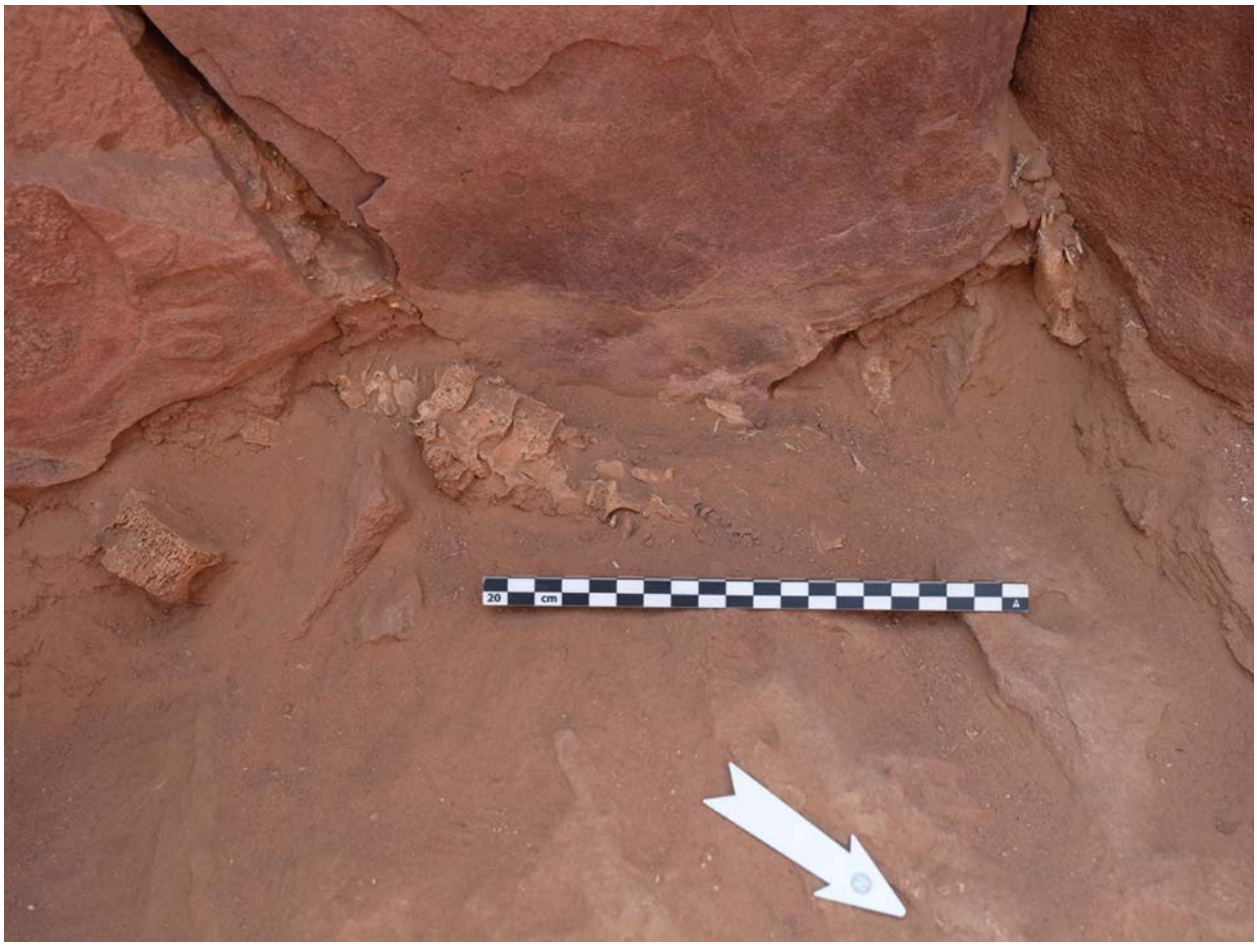

Figure 11. Vertebrae found in IDIHA-F-0011166.

130 km to the north. Minor deposits of chalcedony are believed to exist in the Hijaz mountains, as well as further afield in Oman and the UAE (Tosi 1980, 448, fig. 2; Brunet 2009, 60; Quenet 2018, fig. 1, 196). As such, a local origin for the stone can be postulated. However, as yet, little archaeological exploration has been done on the chalcedony deposits of western Arabia, particularly those located in the Hijaz.

Radiocarbon

A total of six bioapatite radiocarbon assays were obtained from the human and faunal remains present within IDIHA-F-0000132 and IDIHA-F-0011166 (see Table 1, Figure 13). All samples were sourced from distinct individuals, with three of the 11 individuals dated from IDIHA-F-0000132, as well as the canid, and two of the seven individuals from IDIHA-F-0011166. The first of these samples (IB00051) from IDIHA-F-0000132 was processed at the Muséum national d'Histoire naturelle, Paris (MNHN). The remaining five samples were processed at the Centre for Applied Isotope Studies, University of Georgia (UGAMS).

Following the chronology/nomenclature recently proposed by Hausleiter and Eichmann (2018, 24), these burials date to the late Neolithic/Chalcolithic periods, although it should be noted that such terminology borrows heavily from the Levant and as such is not without issue, with direct links between the two regions tenuous. Although the four samples analyzed from IDIHA-F-0000132 suggest the feature functioned as a long-lived collective burial spanning almost 600 years, the absence of any overlap between the dates indicates at least four distinct phases of interment. Interestingly, the canid does not correlate to the three individuals analyzed. Conversely, at least two of the seven of the individuals interred in IDIHA-F-0011166 were deposited in close succession, suggesting this feature may have been a more discrete chronological event (see Table 1, Figure 13).

Monumentality, Social Memory, and Territoriality in Neolithic–Chalcolithic Northwestern Arabia

The identification of two, large collective burials dating to the 5th–4th millennia B.C. in the AlUla hinterland offers fresh insights into the socio-cultural landscape of northwestern Arabia during the Neolithic–Chalcolithic. The best typological parallels for IDIHA-F-0000132 and IDIHA-F-0011166 can be found to the north at Qulban Beni Murra in the eastern Jafr of Jordan, Rasif and Rajajil in northwestern Arabia, and to the south in Yemen. Work at Qulban Beni Murra, Rasif, and Rajajil revealed aboveground, ashlar-lined chamber cairns/graves (Gebel and Mahasneh 2013, 134; Gebel 2019, fig. 4). These tombs are positioned in places of heightened visibility and are generally marked by a d-shape form surrounded by a stone pavement (Gebel and Mahasneh 2013, 136). Unfortunately, no radiocarbon determinations have been obtained from these graves, although the excavators have dated them to the 5th–4th millennia B.C. based on radiocarbon/OSL dates recovered from other structures at the sites (see Gebel and Mahasneh 2013, 136; Zielhofer et al. 2018). In Yemen, surveys in the Wadi Harib, Wadi Wash'ah, and Wadi Sarr have revealed what have been

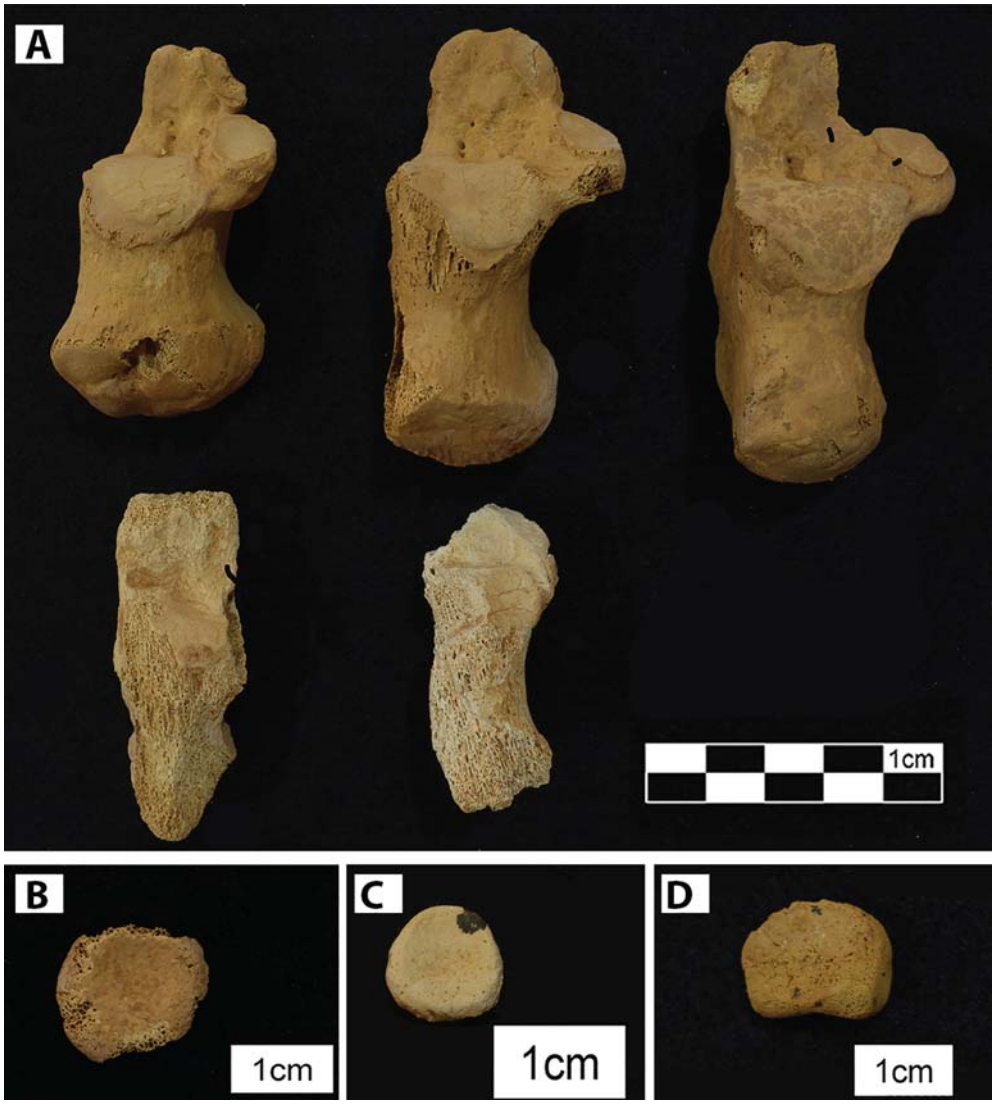

Figure 12. Human bone excavated from IDIHA-F-0011166 (MNI 7). A) Adult calcanei. B) Sub-adult proximal radial epiphysis. C) Sub-adult epiphysis of the first proximal hand phalanx. D) Sub-adult epiphysis of the fourth or fifth proximal hand phalanx.

described as "dolmen-like" structures (Braemer, Cleuziou, and Steimer 2003, 169). These structures are perhaps best classified as elaborate cists graves, as recent work on dolmens in the Levant has begun to restrict the definition of the term "dolmen" to the standard trilithon type (Fraser 2018, 65). These structures consist of a large, stone-lined elliptical or rectangular base or platform with a central cist composed of standing stone slabs and a slab roof (Braemer, Cleuziou, and Steimer 2003, 171, figs. 4, 10). Unfortunately, human remains were only identified in one of these structures. However, Braemer, Cleuziou, and Steimer (2003, 178), have hypothesized that these tombs functioned as collective burials, tentatively dated to the 3rd–2nd millennia B.C. (Braemer, Cleuziou, and Steimer 2003, 178–179). Although there is no demonstrable socio-cultural link between these tombs and IDIHA-F-0000132 and IDIHA-F-0011166, it suggests that these monumental cist-graves can be linked to a broader culture of "megalithism" across the Arabian Peninsula during the Middle Holocene.

Although it cannot be discounted that the inhumations of IDIHA-F-0000132 represent unrelated phases of reuse, the apparent prolonged and repeated use of the structure points

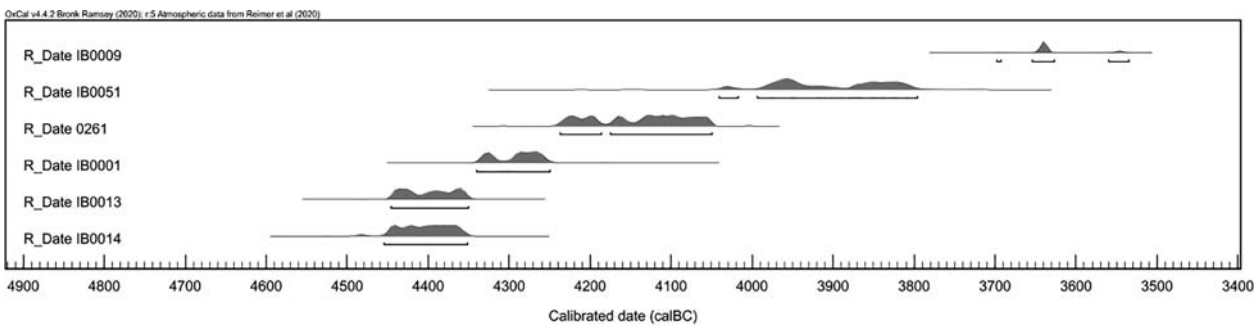

Figure 13. Radiocarbon dates for IDIHA-F-0000132 and IDIHA-F-0011166.

to the existence of a significant and strong social memory. Collective, multi-period burials are present across the Arabian Peninsula from the Neolithic onwards (Uerpmann and Uerpmann 2003; Salvatori 2007, 30–32; Kutterer 2010; Magee 2014, 62). The fact that IDIHA-F-0000132 demonstrates at least four phases of interments over a period of almost 600 years is so far unparalleled in northwestern Arabia. This strong sense of social memory, and perhaps even ancestor veneration, may indicate that IDIHA-F-0000132 functioned like a charnel house or an ancestor repository. Indeed, ancestor veneration has been posited at a number of Neolithic sites, such as Ramat Saharonim in the Negev (Rosen 2007, 23). Furthermore, it suggests that the bonds of kinship, either real or imagined, spanned generations, and that the concept of "kinship" or "household" was broader and more complex than the standard nuclear family (see Gailey 1987). Indeed, social memory is used in the creation and negotiation of identity (Chesson 2001, 2–3): therefore, the continued reuse of this tomb may have been a means of social and territorial legitimization, with the concepts of "land" and "kinship" inextricably bound together. IDIHA-0001825 may therefore have functioned as a long-lived commemorative place like Rajajil (Zarins 1979; Wilkinson 2003, 64–65, 177; Gebel et al. 2016, 90–92).

Unfortunately, none of the Standing Stone Circles have been radiometrically dated from IDIHA-0018980. However, three such structures have been dated to the Neolithic at IDIHA-0001825 (ca. 5500–5300 CAL B.C.), suggesting this site was used over several millennia. Regardless of temporality, the construction of IDIHA-F-000132 and IDIHA-F-0011166 on the periphery of what are most probably existing sites and structures may imply a deliberate correlation between these monumental non-funerary structures and later inhumations. Similar relationships are discernible at sites in Yemen, as well as at Rajajil, Qulban Beni Murra, and Wadi Sahad al-Asmar 9 (Zarins 1979; Braemer, Cleuziou, and Steimer 2003, 178; Gebel et al. 2016). The positioning of these tombs may therefore be indicative of some form of connection, real or imagined, between the individuals interred in this cist and the earlier inhabitants of the site. Such funerary reuse as a means of social legitimization or territoriality is prevalent throughout the Arabian Peninsula (Harrower 2008, 505–506; Magee 2014, 83–84; Luciani 2016; Munoz et al. 2020, 613).

Indeed, the beginnings of territoriality in the Arabian Peninsula is believed to have its origins in the late 4th millennium B.C. (Magee 2014, 83–84), although this assertion has recently begun to be challenged (see Munoz et al. 2020; Thomas et al. in press). At present, comparatively few Neolithic burials (pre-4000 B.C.) have been excavated: those that have been, such as those identified in eastern Arabia at Jebel al-Buhais, UAE, and Gorbat al-Mahar, Oman, were subterranean with no visible grave markers (Charpentier, Marquis, and Pellé 2003; Charpentier and Méry 2010, 21, 12; Kutterer 2010, 3). In contrast, both IDIHA-F-0000132 and IDIHA-F-0011166 are marked by heightened visibility in the landscape. IDIHA-F-0000132 is visible across the entirety of the site, while IDIHA-F-0011166 is positioned on the edge of a ridge overlooking an open valley. This heightened visibility represents a deliberate choice to mark the landscape, potentially indicating a significant ideological distinction from the roughly contemporary Neolithic communities in eastern Arabia. As such, it is possible that the concept of territoriality in the Arabian Peninsula has origins earlier, during the 6th–5th millennia B.C. (see Munoz et al. 2020). If the origins of territoriality in this region can in fact be traced as far back as this, it would bring the emergence of this ideology into line with the beginnings of territoriality in the southern Levant. Indeed, the visible cemeteries at Adeimah (Stekelis 1935) and Shiqmim (Levy 1995, 235) have been viewed as manifestations of nascent territoriality (Rowan and Golden 2009, 56). However, whether these contemporaneous developments were in fact linked remains unknown and beyond the scope of the current discussion.

The identification of partially articulated vertebrae against the inner face of IDIHA-F-0011166 suggests at least two phases of interment were present. Although there is no evidence to suggest that this grave was utilized for as long as IDIHA-F-0000132, the positioning of the vertebrae suggests that an earlier interment was pushed aside to accommodate a new burial. This practice is attested across the Arabian Peninsula in later periods, such as the Umm an-Nar (Braemer et al. 2001, 32; Magee 2014, 120). Examples are also present in the large collective burials of the Levantine Chalcolithic and Early Bronze Age (Kenyon 1960, 126–128; Chesson 1999; Gal, Shalem, and Smithline 2011, 200; Rowan and Ilan 2012, 101). This "depersonalization" may have been a means of maintaining a corporate identity, with an individual effectively lost within the mass of the group (Kennedy 2020, 339). A similar, smaller-scale scenario may be present here; as such, it is possible that being buried within a family tomb was more important than having the primary inhumation preserved.

Finally, the identification of a long-lived (intermittently used), collective burial dating to a period that corresponds to the so-called Dark Millennium is of note. The Dark Millennium, dated to ca. 5900–5300 CAL B.P., has been identified primarily in southeastern Arabia and is characterized by significant settlement abandonment (Uerpmann 2003; Salvatori 2007; Marcucci et al. 2011; Preston et al. 2012, 127; Magee 2014, 76–77). This episode is linked to climatic and environmental deterioration associated with the end of the Early Holocene pluvial period (Parker et al. 2006a, 472–473; 2006b, 129; Preston et al. 2012, 127; 2015, 10–14). Although our understanding of the potential impact of this phase on northwestern Arabia is currently in its infancy (Dinies, Neef, and Kürschner 2016; 2018, 130, 134–135; Petraglia et al. 2020, 2867), recent research suggests that its conclusion corresponds to an era of heightened aridity and regionally specific changes in occupation patterns (Engel et al. 2018, 75; Petraglia et al. 2020, 2867). At present, the only other securely dated funerary evidence correlating to this period in northwestern Arabia has been recovered from Jebel Oraf in the Nefud (Guagnin et al. 2020, 8; Petraglia et al. 2020, 8267) and some of the cairns surrounding Dûmat al-Jandal (Munoz et al. 2020, 612–613). Therefore, the utilization of IDIHA-F-0000132 across a period of potential environmental stress suggests that whatever pressures were present, links with earlier ancestral traditions were maintained. Indeed, resilience in the face of changing environmental realities has come to be viewed as a key hallmark of the Early–Middle Holocene cultures of the Middle East (see Kolata 2006; Schwartz 2006; Yoffee 2006; Rosen 2007).

Conclusion

Despite the fact that both IDIHA-F-0000132 and IDIHA-F-0011166 were heavily disturbed, a significant amount of

material was recovered. The inclusion of what was likely a complete domestic dog in IDIHA-F-0000132 represents the earliest chronometrically dated example of this species in the Arabian Peninsula. The inclusion of this animal also points to the importance of dogs to the early pastoral communities of northwestern Arabia, a relationship that is also highlighted in the rock art of the region (Guagnin et al. 2015; Guagnin, Perri, and Petraglia 2018). The addition of a possible pars pro toto offering of an equid is also of note, with scenes of equid hunting involving dogs also represented in rock art. The combination of these two animals within a single tomb context may therefore be a funerary manifestation of this hunting practice.

Furthermore, analysis of these tombs has revealed that large collective burials were present in northwestern Arabia during the Neolithic and Chalcolithic, with at least one of these burials (IDIHA-F-0000132) reused at least four times over a 600 year period. The continued reuse of this tomb indicates that a strong sense of social memory and territoriality was present in northwestern Arabia prior to the Bronze Age, or the late 4th millennium B.C. (cf. Magee 2014, 84). These facets were marked by the reuse of earlier sites, as well as the heightened visibility and monumentality of the graves themselves. Interestingly, this earlier appearance of territoriality corresponds to developments in the Levant, where this concept had also begun to be expressed through the construction of monumental, highly visible funerary structures. The roughly contemporaneous emergence of these ideologies is of note, suggesting a significant departure from the earlier Neolithic funerary mindset, which was characterized by subsurface and unmarked interments. As such, although the archaeology of northwestern Arabia has a distinctly local form, IDIHA-F-0000132 and IDIHA-F-0011166 indicate that the region may have followed a roughly similar developmental trajectory as other parts of the Middle East and as such should not be viewed as peripheral but instead as a region characterized by a unique and complex cultural horizon.

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