

Symbolic or Functional Astragali from Tell Mardikh-Ebla (Syria)

CLAUDIA MINNITI & LUCA PEYRONEL
Italian Archaeological Mission at Tell Mardikh-Ebla - MAIS

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ABSTRACT: Worked and unworked knuckle-bones (astragali) were found in several contexts from the Early Bronze Age to the Iron Age at Tell Mardikh-Ebla (Syria). Usually these were caprid bones, occasionally cut lengthwise with one or two smoothed sides.

Groups of astragali have been found also in several additional Syro-Palestinian settlements, pointing out at some ritual of funerary significance, since they were stored in sacred buildings as offerings or buried as funerary assemblages. One of the most important discoveries comes from Megiddo, where a group of ca. 700 astragali was collected inside a bowl in a room dating from the beginning of the Iron Age.

The Eblaic evidence seems to confirm the ritual hypothesis and the symbolic nature of the astragali: a child-burial dating from the Middle Bronze II was accompanied by c. 150 knuckle-bones together with a faience vessel. The storing of large amounts of these bones in vessels or caches suggests that prior to being eventually offered, astragali were the 'property' of private citizens and therefore they could also be considered as objects reflecting the wealth of the owners. At the same time the scattered presence at Ebla of smaller groups of knuckle-bones from private houses and fortresses located on the Middle Bronze Age rampart also suggests an utilitarian function as game items, which is supported by ethnographic data and by their documented use during Classical times.

KEYWORDS: SYRIA, EBLA, BRONZE AGE, IRON AGE, KNUCKLE-BONE, ASTRAGALUS, BURIAL, FUNERARY OFFERINGS

RESUMEN: Se estudian las colecciones de tabas (astrágalos) trabajadas y sin trabajar que se hallaron en distintos contextos de la temprana Edad del Bronce hasta la Edad del Hierro en el yacimiento sirio de Tell Mardikh-Ebla. Generalmente se trataba de huesos de cápridos ocasionalmente cortados longitudinalmente que presentaban una o dos facetas pulidas. Otros grupos de astrágalos han sido también encontrados en diferentes yacimientos sirio-palestinos. Su presencia apunta a algún uso de tipo ritual o funerario ya que aparecieron almacenados en edificios que se supone sagrados a modo de ofrendas o bien enterrados como depósitos funerarios. Uno de los descubrimientos más importantes procede de Megido en donde un grupo de unos 700 astrágalos se recuperó dentro de un cuenco en una habitación que databa de los comienzos de la Edad del Hierro.

La evidencia de Ebla parece confirmar la hipótesis ritual y la naturaleza simbólica del astrágallo. Así el enterramiento de un niño fechado en la segunda Edad del Bronce apareció acompañado de unas 150 tabas junto con un recipiente de cerámica decorada. El almacenaje de estas cantidades de huesos en vasijas sugiere que con anterioridad a ser ofrecidas como ofrendas las piezas eran la propiedad de ciudadanos por lo que podrían ser consideradas como objetos que indicarían la riqueza de sus propietarios. La presencia en Ebla de pequeños grupos de tabas aparecidos en casas particulares y fortalezas localizadas en la rampa de la Edad del Bronce medio sugiere también un uso utilitario como instrumentos de juego que se apoya en datos etnográficos y en la documentación de tal uso por las fuentes clásicas.

PALABRAS CLAVE: SIRIA, EBLA, EDAD DEL BRONCE, EDAD DEL HIERRO, TABA, ASTRÁGALO, ENTERRAMIENTOS, OFRENDAS FUNERARIAS

INTRODUCTION¹

In recent times a fair amount of worked and unworked knuckle-bones (astragali) has come to light from the Early Bronze Age to the Iron Age levels at Tell Mardikh-Ebla (Syria). Groups of knuckle-bones have been also found in several contemporary sites of Anatolia, Syria-Palestine, Cyprus and the Aegeum, pointing out at some ritual or funerary practice, since they were stored in sacred buildings as offerings or buried as funerary assemblages.

During the Classical Period knuckle-bones had probably both a ritual function linked to the practice of divination and a profane use as instruments for games of both infants and adults.

The aim of this paper is to interpret the Bronze Age assemblage from Ebla from several points of view. It is within the economy and environment of Ebla that the knuckle-bone sample must be interpreted. The analysis of the material has been carried out from its archaeological and zooarchaeological perspectives. In addition, results of the techno-functional analysis of the sample have been discussed (see Appendix A).

The sample from Ebla has been compared with those from other contemporary sites of the Mediterranean to define possible differences and similarities and to contribute to our understanding of the use of knuckle-bones during the Bronze Age².

MATERIAL AND METHODS

(See Appendix A)

Material

A sample of 202 worked and unworked knuckle-bones from the excavations at Tell Mardikh-Ebla (Northern Syria) carried out between 1992 and 2000 is presented (Figure 1, Table 1). The specimens were dated to the Middle Bronze Age I-II (c. 2000-1600 BC) and originate from different functional and architectural contexts. The main

group (147 astragali) was found in the pit-burial (D.7274) of an infant located on the inner slope of the Acropolis fortification in Area CC (Matthiae, 2000: 572-576). The funerary assemblage included also a beautiful faience juglet, which dated the burial to the MB II (c. 1800-1600 BC) (cf. Mazzoni, 1987)³. In spite of the very poor condition of the human bones (only part of the skull, some ribs and vertebrae plus fragments from the limbs remained), the anthropological analysis revealed that the infant was 18-24 months old. The astragali were apparently grouped together near the body and the juglet was placed near the head although it is difficult to reconstruct the precise position of the body.

Some astragali came from the Western Fort (L.7108, L.7112, M.7419), lying directly on the floors sealed by the destruction layers (collapsed, burnt, mud-bricks and ashes). These can be safely dated to the last phase of the Middle Bronze Age (Mardikh IIIB2, c. 1700-1650/1600 BC). The Western Fort is a huge public complex built on the top and on the inner slope of the central part of the Western rampart (Matthiae, 1997: 10-12; 1998: 572-588; 2000a: 1032-1035; 2000b: 580-600; Peyronel, 2000).

A scattered sample of knuckle-bones was also recovered in a large patrician house (the so-called Western Residence) in Area Z (Matthiae, 2000: 600-608) at the foot of the western rampart, just 30 m North to the Western Fort, and in a pit dug under a room in the Northern Palace P (Matthiae, 1998: 568). Finally, a number of specimens come from two large waste pits in Areas P North (De Grossi Mazzorin & Minniti, 2000) and EE (Peyronel, in press), respectively dating from the MB IIA (c. 1800-1700 BC) and from the MB IA (c. 2000-1900 BC). These astragali are all unworked and they may be considered food refuse, as testified by the other animal remains found around them. The former specimens, on the other hand, constitute items deliberately preserved: some of them are worked (cut, smoothed, polished) and all appear to have been manipulated. Their spatial and stratigraphical location evidences that they were grouped in isolation of any other animal remains inside specific buildings or burials.

¹ C. Minniti wrote §§ Animal Exploitation Strategy at Tell Mardikh-Ebla, Zooarchaeological analysis of the knuckle-bones (astragali) from Ebla and Astragali from the Aegean in the Bronze and Iron Ages and L. Peyronel wrote §§ Material and Astragali from Syria-Palestine in the Bronze and Iron Ages.

² The following codes are used to define the chronology and the phases from Early Bronze Age to Iron Age: EB = Early Bronze Age; MB = Middle Bronze Age; LB = Late Bronze Age; IA = Iron Age; MH = Middle Helladic; Myc. = Mycenaean; LC = Late Cypriote; CG = Cypro-Geometric; CA = Cypro-Archaic.

³ Simple burials in pits concentrated on the inner slopes of the southern and western sides of the rampart and were dated to the MB I; other inhumations seem to be concentrated on the southern slope of the Acropolis dating between the MB IB and the MB II. Finally some burials were found under the floors of private houses, attesting to a ritual very common in the ancient Near East (Baffi Guardata, 1988, 2000).



FIGURE 1
Ground plan of Ebla.

<i>Context</i>	<i>Area</i>	<i>Period</i>	<i>Locus</i>	<i>Unworked</i>	<i>Polished</i>	<i>Smoothed</i>	<i>Pierced</i>
Refuse pit	EE	MB IA	Lev. 3	8 O, 10 C			
Public	P - Northern Palace	MB IB	Lev. 4 under L.4022	1 O, 1 C			
Refuse pit	P - Northern Palace	MB IIA	F.5861/5701	10 O, 7 C			
Domestic	Z	MB IIA-B	L.7153	2 O			
Funerary	CC	MB IIB	D.7274	104 O, 1 P	18 O, 1 D	22 O, 1 D	
Public	V- Western Fort	MB IIB	L.7112 L.7108 M 7419	1 O 10 O		1 O 3 O	1D

TABLE 1

Astragali from Tell Mardikh (Key: O = ovicaprid; C = cattle; P = pig; D = fallow deer; chronology: MB IA = Middle Bronze Age IA - c. 2000-1900 BC; MB IB = Middle Bronze Age IB - c. 1900-1800 BC; MB IIA = Middle Bronze Age II - c. 1800-1700 BC; MB IIB = Middle Bronze Age IIB - c. 1700-1650/1600 BC).

The functional analysis of the archaeological contexts suggests different implications for this material. The presence of a large group of astragali in a burial assemblage could be regarded as an indication of ideological/symbolic phenomena related to the mortuary ritual practice, but one cannot exclude alternative hypotheses. The limited number of astragali in the residential areas and the defensive buildings on the Western rampart lend support to this last hypothesis.

Worked astragali are attested during most of the Middle Bronze Age sequence, spanning from MB IB (Area P) to the end of the period (Western Fort); the astragali from the pit in Area EE (beginning of MB I) most probably constitute food remains. However, the sample under review was retrieved in the 1992-2000⁴ excavations and does not take into consideration the zooarchaeological materials from EB IVA (c. 2400-2300 BC) found at the Royal Palace G⁵.

METHODS

The separation of sheep and goat was attempted using the criteria described in Boessneck *et al.* (1964). The fusion of the epiphyses and eruption and wear stages of teeth were recorded for cattle and sheep/goat following Silver (1969), Payne (1973) and Bullock & Rackham (1982).

⁴ Excavations at Ebla begun in 1964; for a synthesis of the archaeological discoveries see Matthiae (1985, 1989), Matthiae *et al.* (1995).

⁵ 50 knuckle-bones from the Persian levels on the Acropolis (Area E) are used in the zooarchaeological analysis as a comparative sample for the MB specimens. They were found together, attesting to the continuity in the use of astragali as objects also during the I Mill. BC at Tell Mardikh.

Measurements (in millimetres) follow von den Driesch (1976) and are listed in Appendix B. Withers height (in centimetres) was calculated on ovicaprid knuckle-bones following Teichert (1975).

RESULTS: ZOOARCHAEOLOGICAL ANALYSIS OF THE ASTRAGALI FROM EBLA WITHIN THE ANIMAL EXPLOITATION STRATEGY AT THE SETTLEMENT AND COMPARISON WITH ASTRAGALI FROM SYRIA-PALESTINE AND THE AEGEAN DURING THE BRONZE AND IRON AGES

Animal exploitation strategy at Tell Mardikh-Ebla

Zooarchaeological analysis from Tell Mardikh-Ebla is still in progress⁶. The data available, nevertheless, provide some information about the economy, husbandry and other uses of the animals by the people from Tell Mardikh during the Bronze Age.

Three different faunal samples are noteworthy. The first one is located on the Acropolis in Area G and dates to the EB III phase (c. 2600-2400 BC), shortly preceding the faunas from the Royal Palace G. A second sample comes from a pit located on the Eastern rampart in Area EE and used as a dump yard of the domestic sectors of the city at the beginning of the MB I phase (c. 2000/1950-1900 BC). The third sample derives from a second pit (F.5861/5701), probably related to cer-

⁶ As of this date only the animal remains from the 1990 and 2000 excavations have been studied.

	EB III	MB I	MB II
	G	EE	P north
Horse – <i>Equus caballus</i> L.	-	22	76
Wild Ass/Donkey – <i>Equus hemionus/asinus</i>	1	-	12
Cattle – <i>Bos taurus</i> L.	37	77	87
Sheep/Goat – <i>Ovis/Capra</i>	142	800	96
Sheep – <i>Ovis aries</i> L.	16	76	15
Goat – <i>Capra hircus</i> L.	3	36	4
Pig – <i>Sus scrofa dom.</i> L.	2	13	1
Dog – <i>Canis familiaris</i> L.	-	5	8
Roe deer – <i>Capreolus capreolus</i> L.	-	5	-
Hare – <i>Lepus capensis</i> L.	6	14	2
Bird – <i>Aves</i> indet.	1	20	-
Weasel – <i>Mustela nivalis</i> L.	-	2	-
Fish – <i>Pisces</i> indet.	-	10	-
Total identified	208	1080	301
Ribs	62	546	41
Vertebrae	27	269	300
Unidentified specimens	118	3360	161
Total	415	6313	803

TABLE 2

Number of identified specimens (NISP) per species at Tell Mardikh.

emotional activities at the nearby Northern Palace P and dating back to the MB II phase (c. 1800-1700 BC) (De Grossi Mazzorin & Minniti, 2000).

In all these areas most of the bones belong to domestic animals while game animals, mainly roe deer, hare and weasel represent marginal sectors of the assemblage (Table 2).

Sheep and goat constitute the main taxa in all cases. During EB III and MB I they represent 77% and 85% of the identified specimens respectively, although in MB II this percentage decreased to 56%. The sheep to goat ratio seems to be one of 5:1 favouring sheep in EB III, of 2:1 in MB I and of 4:1 in MB II.

Mortality inferred by epiphyseal fusion data and dental eruption, replacement and wear revealed that in all periods most of the animals were older than 4 years. This could indicate that there was an interest in wool production at Ebla. However, almost 20% of the animals during EB III and 36% during MB I-II were killed at the age of 2 or 3 years suggesting that meat production could have been important as well. Moreover, almost 10-20% of the animals were killed during their first year of life. These animals could have been slaughtered to obtain tender meat but also to reduce the amount of lambing in a single flock, in order not to detract too much milk from human consumption. Cattle follow in importance. They represent 18% and 7% respectively during the EB III and MB I, increasing to 42% during the MB II.

Mortality data indicate that adult cattle were slaughtered after they had been used for agricultural

activities, milk production and reproduction, while calves and animals under two years are scarce.

Pig husbandry never gained much importance in the Old Syrian town.

Horse and small equids, such as donkeys or wild asses, were well represented during the MB I-II. Their absence during the EB III might be due to the residential context (the materials were found directly on the Palace floors), since the former remains all came from refuse pits.

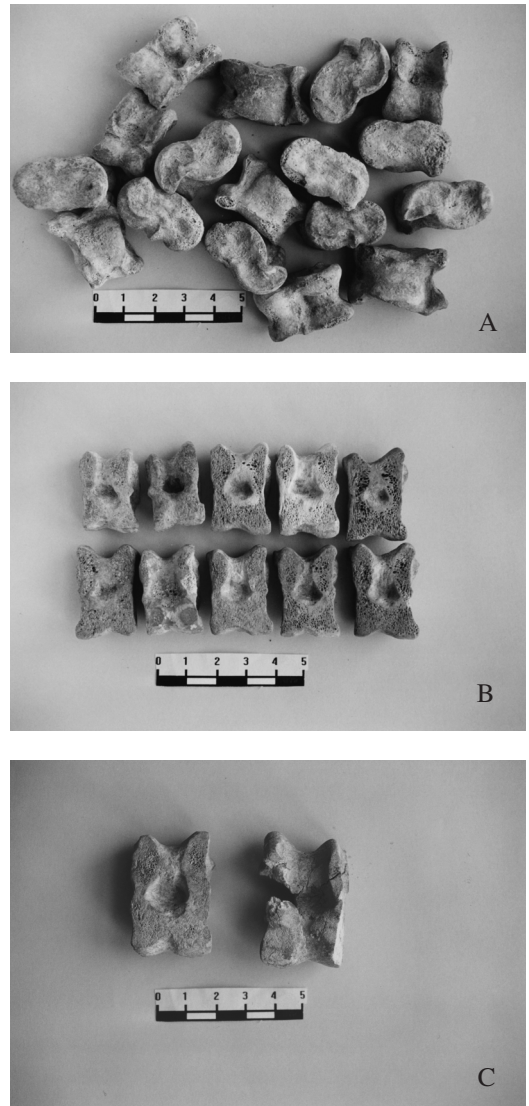


FIGURE 2

Samples of worked (B), (C) and unmodified (A) knucklebones from burial D.7274. A, B: ovicaprid; C: cervid.

Animal exploitation in contemporary settlements in Northern Syria is similar to Tell Mardikh. Analysis of the relative percentages of sheep and goat, cattle and pig shows that during the Bronze Age stock-raising was prevalent throughout the whole region, followed by cattle breeding, while the low percentage of pig remains might be due to the arid conditions of the area (Clason & Buitenhuis, 1998).

Zooarchaeological analysis of the knuckle-bones (astragali) from Ebla

147 unworked and worked knuckle-bones (Figure 2) were found in the D.7264 infant burial. Most of them are intact, although a number of specimens presented poor bone surface conditions due to post-depositional events (see Appendix A).

144 astragali belong to sheep/goat: 2 left astragali can be attributed to goat and 84 to sheep (37 left and 47 right), following Boessneck *et al.* (1964). Withers height was calculated on 56 unworked sheep knuckle-bones (Figure 2, A) and ranges from 61 to 74.3 cm. Measurements were compared with those from other Bronze Age set-

tlements of Northern Syria, particularly from the EB site of Tell Sweyhat (Weber, 1997) and the MB/LB site of El Qitar (Buitenhuis, 1988). These are plotted in Figure 3. No substantial difference in size could be noted between the Ebla and the Tell Sweyhat specimens. There is slight variation in the size of the El Qitar specimens. In fact, ovicaprid astragali from Ebla appear to be smaller than those from El Qitar. Unfortunately it was not possible to define morphological differences between the sexes that could explain these size differences.

Two astragali (1 left and 1 right) belong to a cervid, probably a fallow deer. Species identification is based on size and geographical data. Measurements are compared with those of bovid and cervid astragali from other Bronze Age sites of the region (Figure 3, D).

The pig astragalus is only a fragment of the distal end.

The two fallow deer knuckle-bones (Figure 2, C) and forty of the ovicaprid astragali are worked (Figure 2, B): twenty-two of these are smoothed and ten are modified on both their dorsal and plantar surfaces. Eight ovicaprid astragali are lightly

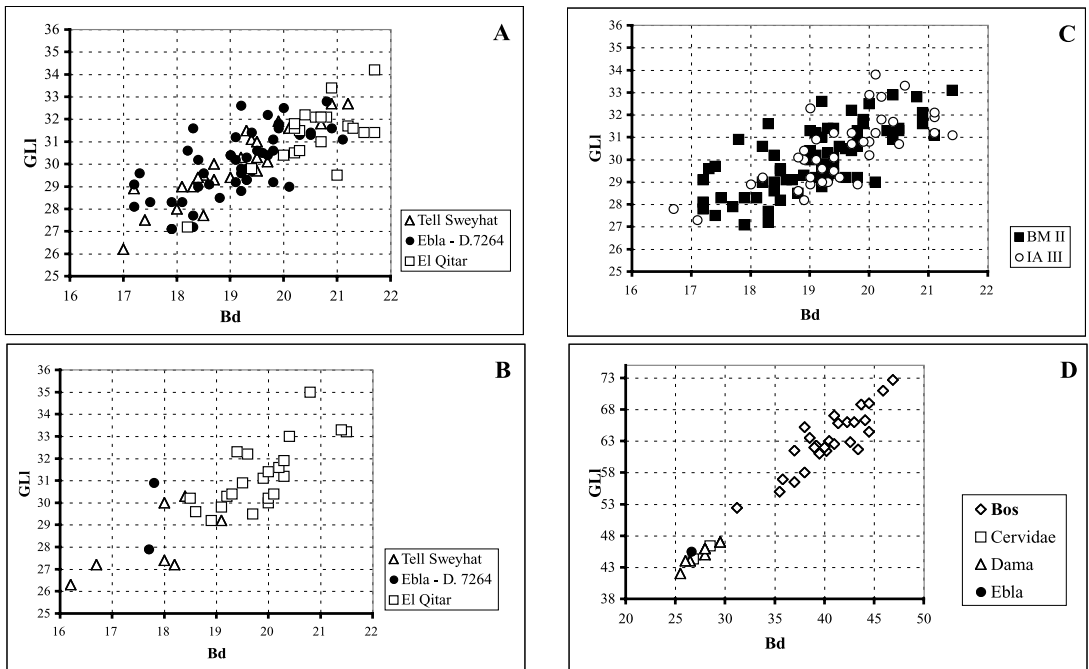


FIGURE 3

A-B: Comparison of sheep/goat measurements from Ebla, Tell Sweyhat and El Qitar; C: size of the ovicaprid astragali at Ebla during the Middle Bronze Age (MB) and Iron Age (IA); D: size of the cervid astragali at Ebla in comparison with those from the Bronze Age settlements of Northern Syria.



FIGURE 4

Location of the sites mentioned in the text.

cut on their dorsal surface and four little smoothed spots can be observed on them.

Another group of 50 astragali were found in a context dating to the Persian Period (Area E). They are well preserved and have been identified as caprines. All are unworked but some of them have one or more cut marks on the distal surface, probably made when the animal was being skinned.

Distinction between sheep and goat indicates that six astragali (2 left and 4 right) could be attributed to goat and 39 to sheep (15 left and 24 right). Withers height is slightly higher than that from burial D.7264: it ranged from 61,9 to 76,7 cm (Figure 3, C).

Astragali from Syria-Palestine: Middle and Late Bronze Age

If we look at the published documentation of astragali from Syro-Palestinian settlements during the Bronze Age (Figure 4, Table 3, A), the only evidence of worked specimens from the same period of the Eblaic sample comes from Megiddo. More data are available from the Late Bronze Age, when groups of worked astragali appear at Lachish, Beth Shan, Tell el-Ajjul, Tell Abu Hawam and Ras Shamra. In the Anatolian region a worked specimen from Tarsus dated back to the EB II represents the oldest example of modified astragali in the area under analysis.

A group of 70 sheep astragali (apparently only 2 smoothed and polished) was found in Tomb 251

SITE	TIMESPAN	CONTEXT	Unworked	Polished	Smoothed	Pierced	Smoothed/Pierced	Replicas
1. TARSUS	EB II-LB				n.s.			
2. TELL MARDIKH-EBLA	MB I-II	EE, Lev. 3 P-Northern Palace, Lev. 4 under L.4022 P-Northern Palace, F.5861/5701 Z. L.7153 CC, D.7274 V-Western Fort. L.7112 V-Western Fort. L.7108 V-Western Fort. M. 7419	8 O, 10 C 1 O, 1 C 10 O, 7 C 2 O 104 O, 1 P	18 O, 1 D	22 O, 1 D 1 O 3 O		1 D	
3. MEGIDDO	MB II	Tomb 251 Tomb 258	68 O	2 O				1 faience
4. KULTEPE KANISH	MBII	Private House Grave		2 O 1 O				
5. TEL EL-AJJUL	MB-LB				1	1 (with copper)		
6. ALISHAR HOYUK	LB-IA					n.s. (with lead)		
7. RAS SHAMRA-UGARIT	LB II	Royal Palace-Courtyard 5				1 C (with lead)		
8. LACHISH	LB II	Fosse Temple I	n.s.					
9. BAQ'AH VALLEY	LB II	Cave B3	13 O		3 O			
10. BETH SHAN	LB II-III	Egyptian-style Temple – Stratum VIII-VII		1 D	5 D			
11. TELL NEBI MEND	LB		n.s.					
12. TELL ABU HAWAM	LB	Western Complex-Terrace L	n.s.					

SITE	TIMESPAN	CONTEXT	Unworked	Polished	Smoothed	Pierced	Smoothed/Pierced	Replicas
13. KILISE TEPE	IA I	Stele Building – Room 3 Stele Building – Room 7	22 O 96 O, 2D					
14. TELL TA'ANNEK	IA I	Cultic Structure-Room 1	140 O					
15. TELL QASILE	IA I	Cultic Area	20 C					
3. MEGIDDO	IA IB	Governor's Residence - Courtyard 2081	649 O, 21 G, 3 D			11 O		
16. TELMIQNE EKRON	IA IB	Field III	c.40 O		n.s.			
17. TELL EL-HAMMAH	IA I-II	Terrace L - Western Complex, Room 406	several					
1. TARSUS	IA II	House						1 lead
18. HAMA	IA II	Funerary deposit GIV41 Funerary deposit GIV338 Funerary deposit GVIII521 Funerary deposit GVIII629 Funerary deposit GIV99 Funerary deposit GVIII131 Funerary deposit GVIII250 Funerary deposit GXII15 Funerary deposit GVIII101 Funerary deposit GX38 Building II-Room A		2 O 9 O 9 O 1 O 1 G 2 O 1 O		2 O		
8. LACHISH	IA	Pit 137		1	1			

TABLE 3

Astragali from anatolian and syro-palestinian sites (Key: O = ovicaprid; C = cattle; P = pig; D = fallow deer; chronology: MB IA = Middle Bronze Age IA - c. 2000-1900 BC; MB IB = Middle Bronze Age IB - c. 1900-1800 BC; MB IIA = Middle Bronze Age II - c. 1800-1700 BC; MB IIB = Middle Bronze Age IIB - c. 1700-1650/1600 BC). See Figure 4 for locations of sites.

at Megiddo (Guy, 1938: 177, plate 115:11), together with ceramic vessels, a gold ear-ring, a bronze pin and a bone pin. The symbolic value of knuckle-bones placed as funerary gifts in burials is suggested by the discovery of a pierced astragalus faience model in Tomb 258 (Guy, 1938: plate 115:24). Both burials can be dated to the MB II.

During the Late Bronze Age the link between astragali and funerary context is evidenced in the Levant by 16 ovicaprid specimens (3 with smoothed sides) found in Cave B3 in the Beqa' Valley (McGovern, 1986: 317-319).

Another kind of modification was observed at Ras Shamra-Ugarit, where a cattle astragalus filled with lead was found in the sunken pool located in courtyard 5 of the Royal Palace. It was considered by C.F.A. Schaeffer as a game item, but its mass of 280g fits well in the local metrological system based on a shekel of 9,4g (280 = 30 x 9,4), suggesting that it was also used as a weight (Schaeffer, 1962: 103-105, figures 64-65).

A cultic use is inferred from the archaeological context of the astragali from Lachish and Beth

Shan. In the first case an unspecified 'large number' of knuckle-bones (not illustrated) was found near the *Fosse Temple* altar (Phase I) together with several vessels and scattered animal bones. According to O. Tufnell (1940: 94) they should be considered as items for devination during the Late Bronze Age in Palestine⁷. In the second case five modified fallow deer and one red deer astragali were discovered in the Egyptian-style temple of Stratum VIII-VII (James & McGovern, 1993: 198, figures 137:1, 139:1).

Scatters of worked astragali are also attested at Tell el-Ajjul (Petrie, 1933: 11, nn. 71-72, one pierced and filled with copper), Tell Abu Hawam and Tell Nebi Mend (Pézard, 1931: 59, figure 1:1,4); they are briefly mentioned in the publication and consequently can be used only for a chronological analysis in Syria-Palestine during the Late Bronze Age.

⁷ The lack of information, such as number of specimens, their zooarchaeological identification, their condition (worked or unworked), prevents a complete evaluation of this important discovery.

A									
SITE	TIMESPAN	CONTEXT	Unworked	Polished	Smoothed	Pierced	Smoothed/Pierced	Replicas	
19. PYLOS	Myc III B-C	Main Building - Corridor S-E, section 45 Main Drain South-Western Building - Room 60 and 71	2 (small size) 1 (small size) n.s.						
20. NICHORIA	MH I	Grids L23 FGop	11 O						
21. LAPITHOS	LC II	Tomb II	12						
22. APLIKI	LC	House A - Room A4	6 O						
23. AYIA PARASKEVI	LC	Tomb 6	2 O						1 bronze
24. ENKOMI	LC IIA-LC IIB	Area III - House, under Room 30, floor VI			1 O				
24. ENKOMI	LC IIC	Area III - Room 47, floor IV Area III - Room 5, floor IV Area III - Room 26, floor IV, pit B Area III - Room 79, floor IV	1 C			1	1 O		
24. ENKOMI	LC IIIA	Area I - Ashlar Building, Room 12				1			
25. TAMASSOS	LC III	Tomb VI	8 O, 2 W						
26. KITION	LC IIIA-LC IIIB	Sacred Area (II) - Courtyard C, floor II and III Room 35B, floor III Courtyard D, floor II	1 C 1 C, 3 O 2 O			1 C (with lead)			
27. HALA SULTAN TEKKE	LC II-III	Area 8 - Layer 5 and 22 Area 23 - Well 7012	5 D 3 D		2 D				
27. HALA SULTAN TEKKE	LC IIIA	Tomb 23	1 O						
28. KOUKLIA	LC III	Well TE III			76 (O, C, D)				
29. PALAEPAPHOS	LC	Tomb 105-Chamber B Pit C Well			1 C, 1 D 1 C, 1 O 1 C, 1 O	1 C			
			1 O						

B									
SITE	TIMESPAN	CONTEXT	Unworked	Polished	Smoothed	Pierced	Smoothed/Pierced	Replicas	
30. SALAMIS	CG	Tomb I				1 O			
31. KITION	CG I	Courtyard B, floor I	3 O						
32. AMATHONTE	CG	Tomb 310/36	1 O						
32. AMATHONTE	CG-CA	Tomb 321/161 Tomb 346/8 Tomb 378/25 Tomb 378/30	1 O 1 O, 1 D 1 O 1 O						

TABLE 4

Astragali from Cyprus and the Aegeum: A: MB and LB sites; B: IA sites (Key: O = ovicaprid; C = cattle; W = wild ovicaprid; D = cervid - red deer, fallow deer; n.s. = not specified; chronology: MH = Middle Helladic; Myc. = Mycenaean; LB = Late Bronze Age; LC = Late Cypriote; CG = Cypro-Geometric; CA = Cypro-Achaic). See Figure 4 for location of sites.

In the Anatolian region the oldest evidence of worked astragali appears in the western regions of the Near East. They are known at Tarsus from the EB II onwards (Goldman, 1956: 311, 318, figure 440:115-118). The EB and MB specimens are slightly cut and smoothed and the LB example is pierced. The same kind of modified knuckle bones are present at Alishar Höyük during the LBA and IA, with the holes filled with lead (von der Osten, 1938a: 243, 250, 427, figure 276; 1938b: 101, figure 101). Three polished astragali come from a private house and a grave at Kültepe-Kanish dating from the MB II (Özguç, 1950: 207, plate 65:411), attesting to their presence in funerary assemblages in the northern region at the same period of the Eblaic material.

Astragali from Syria-Palestine: Iron Age

During the 1st Millennium BC the presence of knuckle-bones seems to become more consistent with groups of worked specimens from funerary, public, private and ritual contexts (Figure 4, Table 3, B).

Several funerary deposits from the cremation graveyard at Hama exhibit knuckle-bones. Most graves were related to burned bones of infants,

though the astragali are connected also with adults. The specimens belong to sheep and goat or gazelle, are usually polished and in two cases pierced, with groups ranging from 1 to 10 specimens⁸.

Two smoothed ovicaprid astragali come from Building II (Room A), found in the destruction level dating to the end of the VIII BC (720 BC).

The same funerary evidence can also be recognized during the IA III/Persian period at Kamid el-Loz, where 3 astragali are associated with graves 2, 24, and 29 (Poppa, 1978: 33, 61).

The largest sample of astragali during the Iron Age comes from Megiddo (Stratum VA-IVB; *c.* X

⁸ The astragali come from the following deposits dating from *Periods I-IV* (*c.* 1200-720 BC): *Period I*: GIV 41 (infant; 2 O together with 2 gold disks and 1 bronze bowl); GIV 338 (infant; 4 O together with 1 painted jar); GVIII521 (infant; 9 O together with 1 vessel); GVIII629 (infant and adult; 1 O and 1 vessel). *Period II*: GIV99 (adult; 1 G and 1 vessel) GVIII9 (infant; 1 O and 1 vessel); GVIII131 (adult; 2 O together with 5 bone buttons and 1 vessel); GVIII250 (infant; 1 O together with 2 bowls and 1 jar); GXII15 (infant and adult; 5 G and 5 O (2 pierced) together with 3 gaming pieces, 1 vessel, 2 bronze rings, a cylinder-seal, 1 scarab, 1 faience ring, several beads, 1 pendant). *Period III*: GVIII101 (adult; 6 O and 1 G together with 4 gaming pieces, 1 bone button, 1 bone vessel, 4 amulets and several beads, 2 cylinder-seals, 1 scarab, some bronze or iron rings and bracelets, some iron pins, 1 gold plaque). *Period IV*: GIX38 (sub-adult; 1 O and 2 vessels).

cent. BC). 684 specimens were collected together in a deep bowl found *in situ* in a recess of the forecourt of Building 2081 located near the northern city gate (Area AA) (Loud, 1948: 44-45, figures 100-102, plate 285, figure 388)⁹. Initially considered as pig bones, they have now been identified by B. Hesse as ovicaprid (660), gazelle (21), and fallow deer (3) (Hesse, 1990: 214-215)¹⁰.

Additional evidence for astragali in a religious context comes from Tell Ta'anek, where 140 specimens were discovered in the 'cultic structure' (Lapp, 1964: 26-32, 35-39) of the X century BC, associated with 80 ceramic vessels, 58 loom-weights, grinding stones, stone weights, spindle-whorls, beads, iron and bronze implements, three small stelae, a figurine mold and several other small finds. Their distribution has revealed the presence of three different groups on the floor: the first one (76 specimens) from a layer of ashes around a flattened flint stone, the second (44) immediately south of the block and the third group (20) in a cooking ware jug 90cm SO of the block (Lapp, 1964: 35, figure 12). These specimens also were initially thought to be from pigs and are now identified as sheep or goat (Glock, 1992: 289).

Other religious contexts have revealed evidence of worked knuckle-bones inside the buildings: a smoothed and polished astragalus was found inside a *favissa* (Pit 137) linked with the sanctuary of Lachish III (Aharoni, 1975: 87, plate 30:3-3A); 20 specimens were found scattered in some rooms of the Sanctuary of Tell Qasile (Mazar, 1985: 150, table 2) and an unspecified 'large number' of astragali were collected from the Western Complex on Terrace L (Room 406) at Tell el-Hammah (Cahill & Tarler, 1993: 562)¹¹.

Evidence from Tel Miqne-Ekron (Gilmour, 1997: 168, figure 1) with c. 40 worked sheep astragali from Field III in levels dating from the XI-X centuries BC also supports an association of the knuckle-bones with private or utilitarian contexts.

⁹ In the same recess a large amount of peculiar objects and pottery was also found, leading the American archaeologists to suggest a ritual function for the room (Loud, 1948: 45-46, 161-162, fig. 101).

¹⁰ In the Megiddo excavation report we find mention of 640 pig and 3 sheep astragali. However, the exact number is 684. 11 are pierced and 2 have traces of bronze in the holes. For an interesting discussion on the problem of pig prohibition and zooarchaeological evidence see Hesse (1995: 217-230).

¹¹ Room 406 is a large rectangular room paved with cobblestones with a presumed ritual function; it yielded 40 vessels (among which 3 are surely ritual equipment), a molded figure, gypsum paxides, a faience amulet, and a stone stamp seal.

To conclude, we would like to mention the recently published information on the discovery of a large number of astragali from the Stele Building at Kilise Tepe in Anatolia dating from the Early Iron Age (Levels IIc-b) (Postgate, 1998: 14): 98 specimens (96 of sheep/goat and 2 of deer) were found in Room number 7 together with 12 copper studs in a small pit on the floor and 22 specimens come from Room 3, near a hypothetical altar.

Astragali from the Aegean: Middle and Late Bronze Age

The published documentation of astragali from Aegean settlements during the Bronze Age seems to suggest that the oldest record comes from the Peloponnese where unmodified astragali were found at Pylos and Nichoria¹². Still, the most important discoveries come from Cyprus and are dated to the Late Cypriot period: groups of unmodified and worked astragali are attested in several settlements at Enkomi, Hala Sultan Tekké, Kition, Kouklia and Apliki and also in several necropolis (at Ayia Anastasia, Ayia Paraskevi, Politiko and Palaepaphos-Teratsoudhia), in graves of both infants and adults (Figure 4, Table 4, A).

An unspecified number of knuckle-bones were found in the Palace of Nestor at Pylos, in western Messenia (Blegen & Raouf, 1966a: 196, 234, 244, 266). They were in various rooms of the main and south-western buildings and are associated with pottery dating to the Mycenaean IIIb-IIIc (c. 1300-1050 BC). Unfortunately, these findings are accompanied by sketchy documentation (no archaeological context and association, no state of preservation of the bones, etc.). There is only an illustration of a small knuckle bone (Blegen & Raouf, 1966b, figure 294).

Excavations at Nichoria brought to light 11 ovicaprid astragali in the Middle Helladic I settlement (Reese, 1992a: 775-776), that were associated with other sheep/goat bones. D. Reese believes that these astragali should not be considered food debris because they are far more common than the most common hind leg bones¹³.

¹² Sebesta (1999: 211, fig.1) mentions a worked (smoothed and pierced) knuckle bone coming from the neo-palatial levels of Knossos, exhibited in the Museum of Heraklion, from which no archaeological documentation appears in the published report.

¹³ D. Reese also suggests a similar hypothesis for another group of astragali coming from the Dark Age (c. 975-850 BC) settlement. Although the astragali were found with a considerable amount of animal bones (Sloan & Duncan, 1978: 26), they are represented by a high percentage (20%) of identified remains.

Several astragali are mentioned in the archaeological reports of the Enkomi excavations, considered by P. Dikaios as toys (Dikaios, 1969: 241, 256; 1971: 631, 642, 647, 660, 710). An ovicaprid worked knuckle bone derives from levels IIA corresponding to LC IIA-IIB (c. 1425-1300 BC). It was polished and covered with green pigment. Many sheep and oxen astragali were also found in different rooms of the level IIB building, dated to LC IIC (c. 1300-1250 BC): a group of 5 from Room 5 and other 20 from Room 79. Some of them have artificial shaping on their surfaces, others were artificially thinned and perforated through the body or feature several perforations in their sides. Two other ovicaprid smoothed astragali come from Room 8. One final smoothed astragalus was found in Room 12 of the Ashlar level IIIA building, dated to LC IIIA (c. 1220-1190 BC).

Other groups of astragali linked to a private context are attested at Hala Sultan Tekké, where 2 polished specimens belonging to Persian fallow deer and other 8 of cervids were found in different areas and layers of the LC IIIA settlement (Jonsen, 1983: 223, 243).

Similar amounts of cattle and ovicaprid astragali, dated to the LC IIIA-IIIIB, are attested at Kition (Reese, 1985: 382). They come from different contexts: 3 unworked ovicaprid and 1 cattle, discovered together on the floor of room 35B, and 2 other ovicaprid, collected in Courtyard D of Area I, presumably come from private or public buildings; another group, from Area II is linked to ritual structures, the most important piece being a cattle astragalus characterized by complex modifications. It was smoothed on its lateral and medial surfaces and, subsequently, perforated and filled with lead. It weighs 64,84g. This specimen was associated with fragments of notched bovine scapulae, probably used for divination (scapulomancy), a bronze model of liver and a group of *Conus mediterraneus* shells, suggesting a sacral function for the area¹⁴.

An abundant presence of astragali is also attested in the same period at Kouklia (Halstead, 1977: 271 bones (of which 56 ovicaprid, 16 cervid and 4 cattle), most smoothed on one or more surfaces.

A group of 6 sheep knuckle-bones is briefly mentioned in the excavation report of LC Apliki

(Cornwall, 1952: 167). They were associated with a few scattered objects: a plain bowl, a pebble polisher, a loop handle, several loom weights, pestle rubbers, a piece of pumice and fragments of bronze drills (Joan Du Plat Taylor, 1952).

A scattered presence of astragali is documented in several funerary contexts in Cyprus, dating to the LC III.

A group of 2 ovicaprid astragali and one bronze copy were found at Ayia Paraskevi (Nicosia) in Tomb 6 (Krumholz, 1982: 278, 281, 299-301). The grave had many adult burials and almost one complete immature individual. It was used throughout the Late Cypriot Period and the great quantity of archaeological material found inside is lacking stratification.

In the necropolis of Politiko (Tamassos) the large chamber tomb VI produced 15 knuckle-bones of domestic and wild goat and fallow deer (Ducos, 1965: 28-29). The tomb was used for numerous burials but two very important groups of graves, each of them including also infants, featured precious objects, such as silver and lead spiral rings and an amphora made in glass-paste (Karageorghis, 1964: 314).

The cemeteries of Hala Sultan Tekké (Tomb 23) and Laphitos-Ayia Anastasia (Tomb II) revealed the presence of unmodified knuckle-bones: in the former one ovicaprid (Niklasson, 1983: 172) from the rich grave of an adult man, in the latter a group of 12 unidentified large and small specimens (Pieridou, 1966: 10).

The final group (all smoothed, except for one pierced and one unmodified), belong to several species (cattle, sheep/goat and deer) and was found associated with ceramics dated to the LCI-LCIIC/IIIA and other materials, such as terracotta figurines, ivory and faience objects, stone and metal tools at Palaepaphos-Teratsoudhia in a tomb used from the LC to the Archaic Period as a grave, refuse pit and for other unspecified functions (Reese, 1990: 144-145).

Astragali from the Aegean: Iron Age

The evidence for astragalus use during the Iron Age is attested mostly in Cypriot funerary contexts (Figure 4, Table 4, B).

During the Cypro-geometric Period (c. 1050-1000 BC) knuckle-bones are recorded on the cemeteries of Amathonte and Salamis. The first necropolis exhibited a large number (193) of worked and unworked specimens. It must be stressed that the necropolis was used for a long

¹⁴ A similar association between worked astragali and marine shells was discovered in the Korykeion Cave near Delphi, dated from the VI to the III centuries BC (Amandy, 1984).

time stretching from the Iron to the Roman Age and in most graves it is not possible to distinguish between the IA specimens from those of Classical Time. This paper only considers 4 tombs used up to the Cypro-Archaic Period (c. 1050-475 BC). They produced 6 unworked astragali belonging to sheep and fallow deer (Reese, 1992b: 138-139). The cemetery of Salamis produced one perforated and not specified astragalus from a tomb that belonged to a woman (Chavane, 1975: 188).

The specimens from Kition (3 ovicaprid astragali) found on floor I of Courtyard B are the only evidence from a private building for this period (Reese, 1985: 382-383).

During the Archaic Period (c. 700-550 BC) the presence of astragali in funerary contexts has been documented in other islands of the Aegean.

Groups of astragali were found in several cemeteries in Rhodes, dating from the VII to the V BC. At Jalisso knuckle-bones came from many tombs of infants and adults in groups of twenty-two, twenty-four, and six (Jacopi, 1929: 164-214, 254, 218)¹⁵. At Macri Langoni an unspecified number of specimens was found in two tombs of an infant and an adult, as well as in a pithos with an infant skeleton (Jacopi, 1931: 113, 175, 225)¹⁶. At Papatishires 11 knuckle-bones were placed inside the pithos of an infant (Jacopi, 1932-33: 56-57)¹⁷ and, finally, at Marmaro a sarcophagus with eighteen knuckle-bones and two replicas in lead was brought to light (Laurenzi, 1936: 182-183)¹⁸. Unfortunately, they are all barely mentioned in the archaeological reports and consequently we do not know if they were modified.

Other unworked, smoothed and perforated astragali came from the more recent Acropolis of Lindos (Bhinkenbergh, 1931: 749-750)¹⁹ and the Riverside Cemetery of Olynthus, where one thousand specimens were collected in 33 graves of infants and 8 of adults (Robinson, 1946: 177-198),

¹⁵ Knuckle-bones come from the following graves: tomb 164 (sub-adult; 22 astragali); tomb 200 (sub-adult; 24 astragali); tomb 233 (6 astragali); tomb 208 (adult; number of astragali not specified).

¹⁶ Astragali were found in tomb 31 of an adult, in tomb 76 belonging to a sub-adult and in the pithos-burial 149 of an infant. We do not know the number of specimens, their zooarchaeological determination and their condition (worked or unworked).

¹⁷ Tomb 13. The infant was 1 year old.

¹⁸ Tomb 68.

¹⁹ The following specimens are mentioned: 1 ovicaprid unworked astragalus, 1 smoothed astragali from a victual deposit; 4 smoothed astragali from the Acropolis; 1 pierced astragali with two holes.

but the most important discovery is at the entrance of the Korykeion Cave, near Delphi, dated from the VI to the III century BC. Over two thousand knuckle-bones were found, most of them modified: smoothed, perforated, filled with lead, marked and inscribed with the names of Heracles, Thetis, Achilles, Ajax, Nyx and Nike (Amandry, 1984). They belong mostly to caprines, but cattle, red deer, roe deer, and probably ibex as well as chamoix and pig are also attested (Poplin, 1984). The cave was dedicated to the cult of Pan and the Nymphs and this large deposit of astragali certainly had a ritual meaning. However, it is difficult to establish whether astragali represent ritual offerings to the gods or are items used in divination. P. Amandry suggests that they could have also been used as toys and that the deities' names on the bones were inscribed in order to bring luck.

DISCUSSION AND CONCLUSIONS: FUNCTIONS AND MEANINGS OF THE ASTRAGALI BEFORE CLASSICAL TIMES

Our knowledge on the use of astragali in antiquity is mainly related to the iconographical, epigraphical and archaeological evidence coming from the Greek world during the Classical and Hellenistic periods²⁰. At that time knuckle-bones had probably both a ritual function linked to the practice of divination (*astragalomanteia*)²¹ and a profane use as toys²². However, it is difficult to decide if the religious meaning was developed before the profane, and the opinions of the scholars are often in conflict. For example the most important evidence for ritual use during Classical times, which is surely represented by the thousands of knuckle-bones discovered in the Korykeion Cave on Parnassus near Delphi (Amandry, 1984; Poplin, 1984), cannot be used in an unequivocal way to prove the divination function. The astragali may have been thrown inside

²⁰ The invention of the game where astragali are thrown is attributed to the Lydian people by Herodotus (*Hist.* I, 94) and it is mentioned for the first time in the Iliad (XXIII, 88). The divination function is described especially by Pausanias VII: 25.1.

²¹ Several scholars have described the use of astragali as games in the Greek and Roman world. See in particular Becq de Fouquières (1873: 325-356), Lovett (1901), Rohlfis (1965), and, more recently, De Nardi (1991), Schädler (1996) and Fasnacht (1997).

²² See Amandry (1984: 377) and references therein.

the cave as offerings to the deities or as amulets originally used for play.

In this respect, it is interesting to quote the study by Sebesta (1993, 1999) on the astragali from the Iron Age contexts of the Alpine region. He suggests a ritual origin of their use linked to the overcoming of critical situations, resolving the contradiction between a religious and a profane function in the Greek world. According to Sebesta, the priest played the role of knuckle-bone collector (together with other parts of the sacrificed animals, such as skins, skulls and the lower extremities of legs) and this is probably why a large number of astragali are found in temples or in sacred areas.

A different hypothesis suggests a link between ancient metrology and astragali in societies with strong stock-raising economy, mirrored by the similarity between the term *talus* and talent (Alinei 1960-61; see also Sebesta, 1999: 213-220) and indicated by the discovery of metal weights in the shape of an astragalus. We believe these peculiar objects could be considered as weights linked to the sacred buildings with the same specific symbolic meanings as knuckle-bones.

Accurate analysis of Bronze materials from Anatolia, Syria-Palestine, Cyprus and the Aegeum needs to start with investigations concerning the typology and the archaeological contexts.

We have recognized modifications which allow us to propose the following types of knuckle-bones:

- Type 1: unworked
- Type 2: unworked but manipulated
- Type 3: polished
- Type 4: smoothed or cut lengthwise
- Type 5: pierced
- Type 6: pierced and filled with metals
- Type 7: replicas in precious or semi-precious materials

Smoothed/polished and manipulated astragali are the first types attested from the EB in Anatolia and from the MB in Syria-Palestine, and they are collected together with groups of unworked specimens without any deliberate distinction. Pierced examples and replicas in precious or semi-precious materials also appear during the MB in Syria-Palestine. Finally, perforated and metal filled astragali are found in contexts dating from the LB both in the Levant and in the Aegean.

Generally speaking, knuckle bones belong to different animal species in all of the studied regions. It seems that the choice of the animal

depends on the specificities of the animal exploitation in settlements. Small ruminants (mostly caprines followed by gazelle) prevail while other species, such as pig and cattle, are less common.

Functional analysis of contexts suggests that the oldest types come from private buildings and burials, while present data only show a link between astragali and ritual areas beginning with the LB. During the LB and IA several shrines and temples of Syro-Palestinian settlements yielded groups of astragali. At Cyprus knuckle-bones are the most frequent discovery in funerary assemblages, even if the Kition evidence suggests that ritual use was also present on the island. Quantitative evaluation of knuckle-bones evidences that larger amounts (from 20 to 700 specimens) are always linked to cultic, funerary or public spheres whereas small groups are related to all kinds of archaeological contexts.

Although we must be very cautious regarding any kind of 'diffusionist' hypothesis, the chronological distribution of the evidence points to a priority of the Anatolian and Syro-Palestinian regions over Cyprus and the Aegean. It is also difficult to evaluate the presence of knuckle-bones in the Peloponnesus during the Bronze Age and deliberate preservation of worked or unmodified astragali without connection to other animal remains becomes well-documented only from the Classical period onwards. Generally speaking, the Levant shows a development of symbolic meanings for the astragalus in the urban society at the beginning of the MB Age, though it is possible to assume more ancient roots for this custom²³.

Ever since the discoveries of the large assemblages from Megiddo and Ta'anek, the idea of a specific and unequivocal 'ritual' or 'religious' significance of knuckle-bones became the most popular interpretation for this material (Lapp, 1964: 26-32). In addition, the misidentification of the astragali as belonging to pigs created a false link with the problem of pig prohibition in Biblical texts (see the discussion in Hesse, 1990, 1995). U. Hübner (1992: 44-60) suggests a prevailing use of astragali as objects for play in his monograph on games in Israel and Palestine. In a recent article, G.H. Gilmour (1997) offers a useful synthesis of the most important discoveries of astragali in ancient times and reports the main hypotheses

²³ L. Bartosiewicz (1999: 37) mentioned the existence of modified ovicaprid astragali from the EB levels at Arslantepe, and worked astragali are known from Tarsus during the EB II.

regarding their function. He demonstrates not only the existence of several functionally diversified contexts but also the presence of different types of worked astragali. The link between parameters such as type, number of specimens and context is very important in order to understand the sphere of meaning to which one should ascribe the specific evidence under analysis.

The data from Ebla show that in the infant burial we have: a) a large number of specimens, b) astragali types 2-3-4, and c) a burial assemblage entirely made up of astragali and a precious faience vessel. The age of the infant (under 2 years) indicates that it is difficult to consider the astragali as his toys. Secondly, small groups are found in defensive buildings or private houses. They are related to types 2-3-4-5. Types 3 and 4 are always associated.

In relation to the general data from Syria-Palestine, the Eblaic sample confirms the absence of type 6 during the MB period and does not attest type 7 (replicas in other materials). At Ebla, worked astragali are not found in ritual contexts. However, a preliminary zooarchaeological study of the large sample of animal bones found in the *favissae* of the Sacred Area of Ishtar in the Northern Lower Town (Area P)²⁴ indicates that unworked (ovicaprid, gazelle) astragali were present inside the two main *favissae* of the Middle Bronze Age even if they were not separate from the other parts of the skeleton²⁵.

At present, worked astragali from Tell Mardikh, together with those from Megiddo, represent the oldest evidence from stratified and well-dated contexts. Moreover, the largest group of specimens from a funerary assemblage in the Levant comes from the Mardikh burial in Area CC. It is more difficult to understand the simultaneous presence of worked (smoothed and polished) and unworked astragali in the same group. Micro-wear traces related to manipulation could be considered the “physical” result of “prophylactic” uses (amulets, votive objects, etc).

Generally speaking, the continuity of the link between astragali and funerary contexts is a hallmark of the Syro-Palestinian and Cypriot regions from the MB to the IA. It suggests some kind of ‘ritual’ significance, which could differ in relation to the number of specimens, since here we have graves with few astragali and others with a large number of them.

The single pierced astragalus from the Western Fort could be interpreted as an amulet or a toy; the latter hypothesis is supported by other worked astragali from the same building where smoothed/cut or intact polished specimens could be regarded as two series of items for play.

In conclusion one should stress the importance of considering all of the archaeological and archaeozoological data in order to achieve the most complete range of clues to interpret this class of objects, which undoubtedly had diversified and interconnected meanings that changed through time. Cultural behaviour must always be kept in mind in order to avoid mistaking contexts that may appear comparable yet are not (e.g. the Palestinian Iron Age shrines/ritual areas and the Greek temples).

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²⁴ For the Cultural evidence of the Cisterns' Square in the Ishtar's Sacred Area see Marchetti & Nigro (1997, 1999).

²⁵ The upper filling of another presumed *favissa* (not excavated) yielded a large number of unworked astragali not associated with animal bones (Marchetti & Nigro, pers. comm.), suggesting that astragali could have been removed from the sacrificed animals or left in anatomical connection with the body, in relation with specific ritual events.

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APPENDIX A

Emanuela Cristiani

(University of Rome "La Sapienza")

TECHNO-FUNCTIONAL ANALYSIS

A techno-functional analysis of a sample of astragali from Tell Mardikh-Ebla (D.7264) has been carried out at the Museo delle Origini laboratory of the University of Rome "La Sapienza".

Rounding, abrasion, striations, polishes and other traces left on bone surfaces by manufacture and use have been identified and described by means of a reflected light microscope (Nikon ZM) under low magnifications (0.74X-70X) and with a reflected light metallographic microscope (Nikon M) under high magnifications (150X-600X).

Archaeological surfaces have been deeply exfoliated by post-depositional agents which have erased diagnostic technological traces or use-wears from most of the specimens. On the altered bone portions, only small spots of polished surface are still visible. A total of forty four astragali have been sectioned on their dorsal and plantar faces using a metal blade (Figure 5, A). Technological analysis by reflected light stereomicroscopy allows for the identification of a longitudinal cutting action carried out from the distal and/or proximal end of the bone. In a few cases the astragalus has not been split into two portions but was lightly smoothed, producing four small circular facets on the most prominent parts of the bone.

The spongy tissue beneath the laminar bone and most of the lateral surfaces show an intensive polishing due to the contact with a soft material. Moreover, on the upper surfaces, a peculiar polishing, typical of prolonged manipulation, has been identified (Figure 5, B).

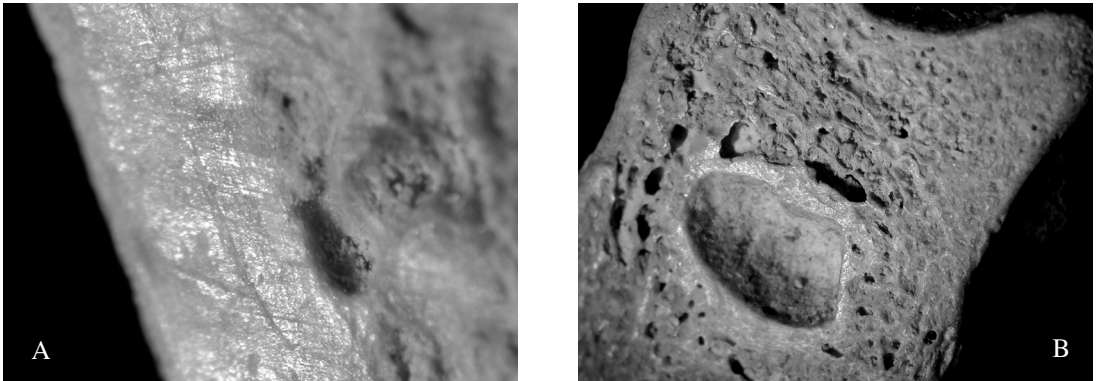


FIGURE 5

Techno-functional analysis of astragali from Ebla – D.7274. A: technological striations caused by a metal tool; B: rounded and shining surface caused by prolonged manipulation.

APPENDIX B
TECHNO-FUNCTIONAL ANALYSIS

Burial D. 7274:

GLI	GLm	DI	Bd	Species	GLI	GLm	DI	Bd	Species
29,2	27,5	14,9	19,8	Ovis aries	29,6	28,4	16,1	18,5	Ovis aries
27,9	26,9	14,9	16,1	Ovis aries	32,8	31,5	18,8	20,8	Ovis aries
32,6	30,4	17,2	(19,2)	Ovis aries	29,6	28,8	16,4	16,1	Ovis aries
30,6	28,9	16,1	18,2	Ovis aries	32,1	29,9	17,4	17,4	Ovis aries
28,3	-	-	(17,9)	Ovis aries	30,6	28,9	17	19,8	Ovis aries
32,5	30,5	17,3	(20)	Ovis aries	31,6	30,3	17,4	20,9	Ovis aries
(29,9)	-	(16,6)	(16,8)	Ovis aries	29,2	28,5	16,1	19,1	Ovis aries
27,2	27,1	15,8	18,3	Ovis aries	31,1	29,2	17,5	21,1	Ovis aries
30,2	28,9	15,9	18,4	Ovis aries	31,1	29,8	17,8	19,8	Ovis aries
27,7	27,1	15,7	18,3	Ovis aries	31,3	30	18,2	20,5	Ovis aries
27,1	26,6	15,8	17,9	Ovis aries	32,2	30,2	17,5	19,7	Ovis aries
(30,4)	29,6	18,1	19	Ovis aries	31,6	29,9	16,5	18,3	Ovis aries
30,1	27,7	16,5	14,9	Ovis aries	30,3	29,3	17,1	19,3	Ovis aries
29,6	-	16,9	17,3	Ovis aries	29,1	27,8	16,5	17,2	Ovis aries
31,8	30	17,1	19,9	Ovis aries	29	28,1	-	18,4	Ovis aries
29,3	28,3	-	19,3	Ovis aries	28,8	27,4	16,2	19,2	Ovis aries
(29,5)	28,4	-	(16,7)	Ovis aries	29,6	29,4	-	19,2	Ovis aries
31,4	30,1	17,5	19,4	Ovis aries	29	28,5	16,1	20,1	Ovis aries
30,5	28,7	16,9	19,6	Ovis aries	28,3	26,9	15,9	18,1	Ovis aries
29,3	27,9	15,9	19,3	Ovis aries	30,4	29,7	17,8	19	Ovis aries
30,6	28,5	-	19,5	Ovis aries	28,5	27	15,8	18,8	Ovis aries
(29,5)	-	16,5	(16,8)	Ovis aries	29,8	28,7	16,9	19,3	Ovis aries
30,2	29,6	16,1	19,1	Ovis aries	29,8	-	17,1	19,2	Ovis aries
30,4	30,6	16,6	19,7	Ovis aries	29,7	28,8	16,7	19,4	Ovis aries
(28,1)	27,9	15,6	17,2	Ovis aries	29,1	28,1	15,8	18,6	Ovis aries
28,3	15,8	15,6	17,5	Ovis aries	27,1	26,5	15,6	17,9	Ovis aries
31,2	29,5	17,6	19,1	Ovis aries	31,3	-	17,3	20,3	Ovis aries
31,4	29,7	18,3	20,5	Ovis aries	30,9	29,5	16,8	17,8	Capra hircus
31,6	29,9	16,4	19,9	Ovis aries	27,9	26,7	15,3	17,7	Capra hircus
45,5	42,4	-	26,6	Dama mesop.	42,3	-	-	-	Dama mesop.

Burial D. 7274:

GLI	GLm	DI	Bd	Species	GLI	GLm	DI	Bd	Species
33,3	31,6	18,9	20,6	Ovis aries	32,9	31	18,4	20	Ovis aries
30	28,3	16,6	20	Ovis aries	30,7	29,5	17,5	19,7	Ovis aries
30,8	29,2	16,8	17,2	Ovis aries	(28,2)	27,6	16,2	18,9	Ovis aries
31,2	28,7	17,3	19,7	Ovis aries	29,2	27,7	16,3	19,5	Ovis aries
29	-	(16,3)	19,3	Ovis aries	30,8	29,5	17,6	19,9	Ovis aries
31,2	29,7	17,7	20,1	Ovis aries	29	28,2	16,8	19,2	Ovis aries
(30,7)	29,1	17,2	-	Ovis aries	30	27,2	17,2	18,9	Ovis aries
29,2	27,6	16,2	-	Ovis aries	27,3	26,5	15,2	17,1	Ovis aries
30,1	28,8	16,3	19,4	Ovis aries	30,7	28,8	17,2	20,5	Ovis aries
28,9	27,6	16,2	(19,8)	Ovis aries	30,1	-	17,5	18,8	Ovis aries
30	27,1	16,8	18,9	Ovis aries	(31,8)	(30,6)	17,9	(20,2)	Ovis/Capra
31,7	30,5	17,8	20,4	Ovis aries	(29,6)	-	16,3	-	Ovis/Capra
29,2	-	16,5	18,2	Ovis aries	30,2	28,5	16,7	20	Ovis aries
(30,2)	-	-	-	Ovis aries	30,4	28,7	16,1	18,9	Ovis aries
(29)	-	-	-	Ovis aries	31,1	31,1	18,2	21,4	Ovis aries
32,1	29,9	18,4	21,1	Ovis aries	32,3	30,2	17,3	19	Ovis aries
28,9	27,9	16,1	18	Ovis aries	-	28,6	-	19,9	Ovis aries
31,7	21,7	15,2	16,7	Ovis aries	31,9	29,4	18,4	21,1	Capra hircus
30,9	28,4	16,9	19,1	Ovis aries	32,8	30,9	17,3	20,2	Capra hircus
29,5	28,4	16,8	19,4	Ovis aries	28,9	27,7	16	19	Capra hircus
28,6	28,3	16,6	18,8	Ovis aries	31,2	28,9	16,9	21,1	Capra hircus
27,8	27,2	15,4	16,7	Ovis aries	31,2	30,4	16,1	19,4	Capra hircus
29,6	29,1	16,9	19,2	Ovis aries	33,8	32,5	16,7	20,1	Capra hircus