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Monumental Tomb and Simple Pit-Graves at Khirbat adh-Dharīḥ (Nabataean Period, Jordan): An Archaeo-Anthropological Study

Introduction

The site of Khirbat adh-Dharīḥ is located in south-western Jordan, ca. 100 km north of Petra. It was found in 1818 and explored several times during the twenty century. The excavations directed by F. Villeneuve and Z. Al-Muheisen (from 1984) has shown that the site included a village and a sanctuary dating from the 1st to fourth centuries AD; it was abandoned around the time of the major 363AD earthquake and reoccupied during the sixth-eighth centuries AD. Two cemeteries were discovered on the slopes to the east of the village and temple. The elements excavated in the Southern cemetery are three: a monumental tomb (Tomb C1), a small shaft-tomb (Tomb C3) and eight simple pit-graves (Sounding C2). In the Northern cemetery (NC) nine graves were excavated (FIG. 1) (Al-Muheisen and Villeneuve 1994; Lenoble *et al*. 2001; Villeneuve and Al-Muheisen 1988, 2000). That of course represents only a very small part of both cemeteries, but the detailed survey of the whole area (without geophysical survey, but with the «help» of systematic clandestine excavations earlier than the project) makes probable that C1 was the only monumental tomb.

The upper part of the monumental tomb C1 has been almost completely destroyed but the buried part, which measures about 6,6 x 6,6m, was preserved. It is composed of six shafts divided up into two contiguous sets of three, placed side by side. The shafts are arranged according to a roughly west-east axis. Each shaft has five ledges on each side and contains five superposed graves. The number of graves is thus thirty, of which only five were found intact. The C1 tomb was built around 100-110AD and was in use until the time of the 363AD earthquake (Lenoble *et al*. 2001) (FIGS. 2 and 3).

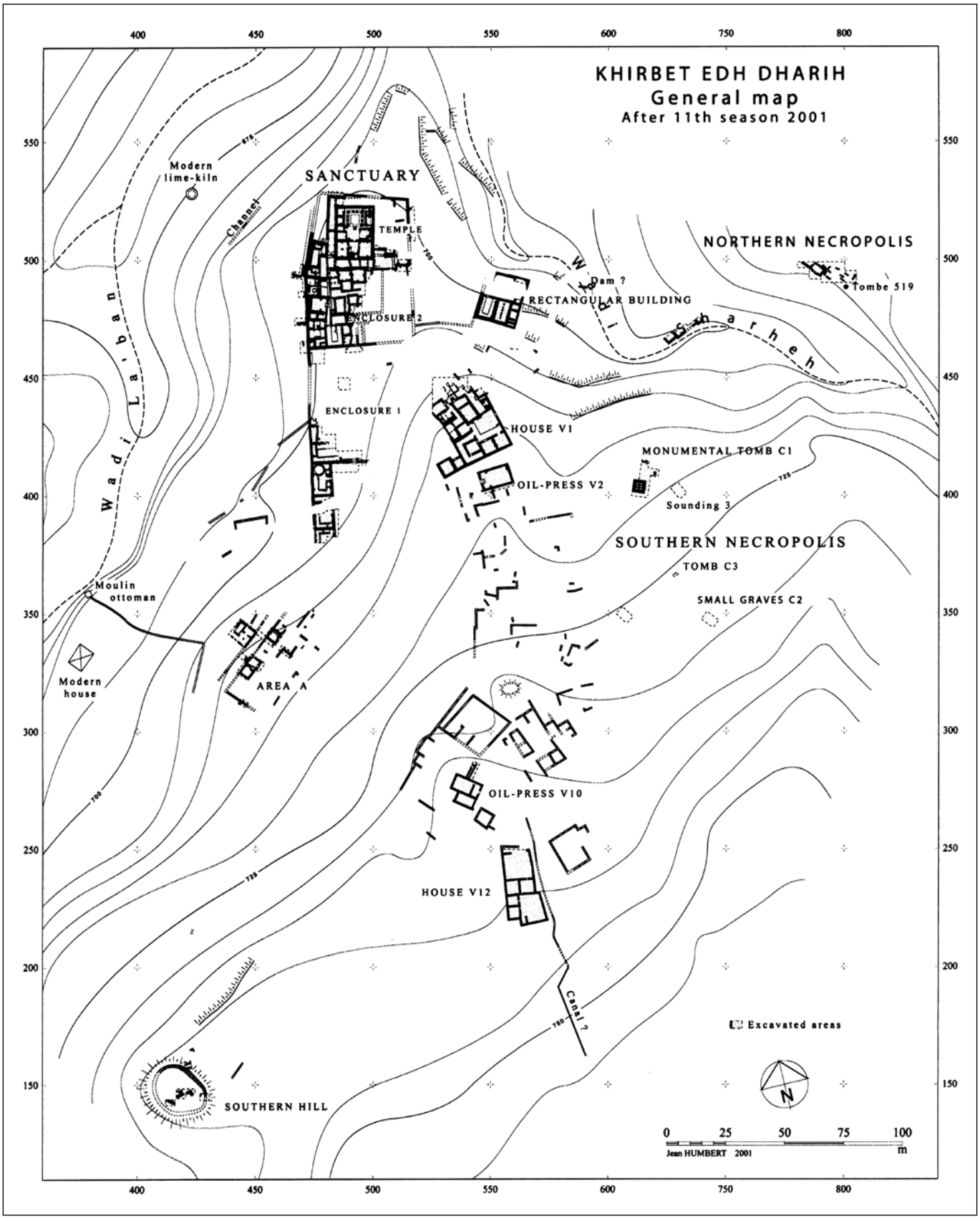
No material or bone remains were discovered in the small shaft-tomb C3 that was completely plundered. This tomb, located south of the monumental tomb C1, might have contained two superposed graves (Lenoble *et al*. 2001).

The graves C2 were discovered at the time of a test pit (FIG. 4). They are simple pits delimited by blocks and covered with stone slabs. These graves are difficult to date. According to Lenoble *et al*. (2001), the similarities in the funerary practices between the C1 monumental tomb and those simple graves (same orientation, same position of the bodies, and same standard of furniture) makes it possible to think that they also belong to the Nabataean period. However, one glass vessel, among the very few artefacts discovered in these graves, is now considered to be clearly Early Islamic, eighth or ninth century (Dussart 2007: 216, fig. 11.8), thus suggesting that at least one of these graves, grave F, should be dated in Early Islam.

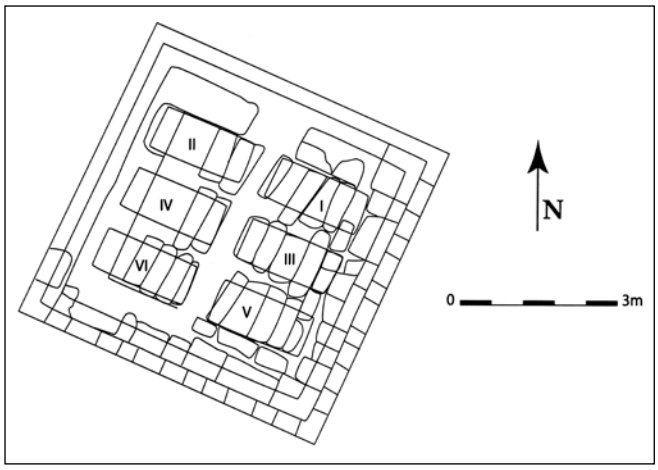
Finally, in the Northern cemetery, the tombs are similar to the C2 graves (FIGS. 5 and 6). They are simple pits delimited and covered by stone slabs, directed east west except for one. They could be dated thanks to the discovery of a drachma of Trajan struck between 102 and 117AD in one of the tomb (Al-Muheisen and Villeneuve 1994).

Methods

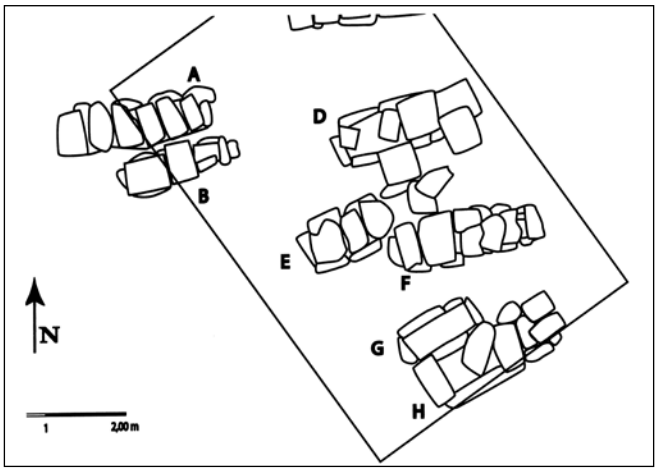
F. Le Mort has previously done a preliminary study of the anthropological sample from the Southern cemetery in the late eighties (Lenoble *et al*. 2001). The present study attempts to complete this investigation by further description of anatomic variations



1. Plan of Khirbat adh-Dharīḥ (Lenoble *et al*. 2001).



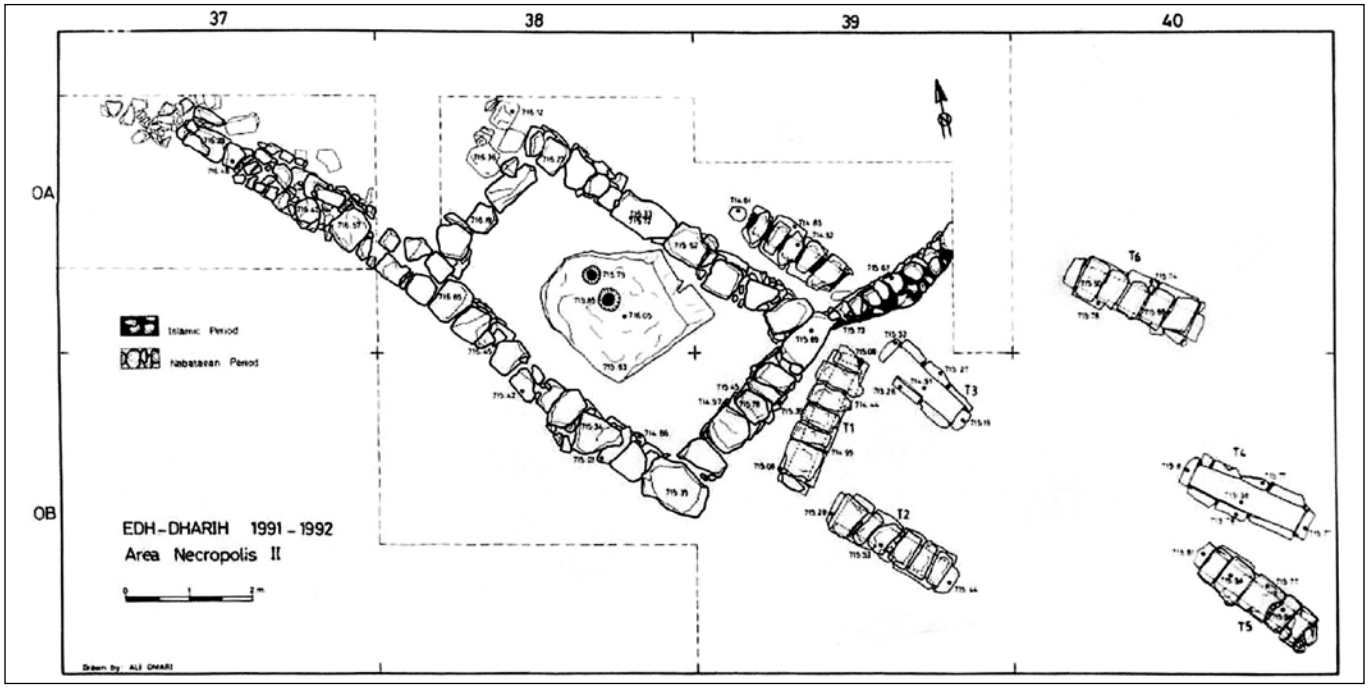
2. Plan of tomb C1.



4. Plan of graves C2 (Lenoble *et al.* 2001).

3. Tomb C1 (French-Jordanian mission of adh-Dharīḥ).

6. Sounding in Northern cemetery (French-Jordanian mission of adh-Dharīḥ).



5. Plan of sounding in Northern cemetery (French-Jordanian mission of adh-Dharīḥ).

and metric data, and additional remarks on the funerary assemblages.

A-Understanding the Bone Deposits from Field Archives

In the last two decades, methods and operational procedures have been developed on the field in order to understand the circumstances of body deposition and to reconstruct mortuary practises. The multiplication of the observations during the excavation is an essential approach to the archaeological analysis of burial architecture, the understanding of both the circumstances of body decomposition and relationships between the grave architecture and the deceased (Duday 2005, 2006).

At Khirbat adh-Dharīḥ the excavation of the burials was conducted in the eighties and nineties and field observations on the position of the respective skeletal elements, for instance, were not accurately recorded. Thus, our approach of the funerary deposits relies on the excavation's archives.

For this purpose we employed black and white photographs and layouts made during the excavation of the tombs C1, C2 and NC. Using the methods of field anthropology, we attempt to identify the conditions of body deposits, funeral structures, burial orientations, position of individuals and grave goods, in order to enrich our knowledge of the funeral assemblages recovered from Khirbat adh-Dharīḥ.

B-Biological Identity of the Deceased

Measurements were collected on the skull, the infra-cranial skeleton and teeth following standard osteometric techniques applied to adult and immature skeletons (Bräuer 1988; Duday *et al*. 1995; Fazekás and Kósa 1978).

In the study of funeral assemblages, from a technical point of view, accurate anthropological methods are employed to estimate the age at death of the deceased (immature and adult individuals) and the sex. A second step consists of searching indicators that might reveal non-specific stress episodes during growth, pathological alterations and traumatic lesions. Such observations are useful to address the question of growth disturbance during childhood and to investigate the health status of the individuals buried. We present here observations regarding biological aspects; the interpretation of bone and tooth defects and diseases will require further analysis.

- *Age and Sex Estimation*: Age estimation of child skeletal remains is based on different reference standards deriving from the dental maturation and development (Moorrees *et al*. 1963a; Moorrees *et al*. 1963b), bone maturation using ossification points and secondary fusion (Scheuer and Black 2000). In the case of infant skeletal remains (less than 1 year) additional elements on bone maturation are brought by bone lengths themselves (Fazekás and Kósa 1978; Scheuer and Black 2000). It is widely accepted that there are no reliable techniques to assign a sex to a child skeleton of unknown identity (Bruzek *et al*. 2005).

Estimates of age on adult skeletal remains rely on bone maturation. However, between 20 and 30 years old, two bones are still regarded as immature: the clavicle and hipbone. Indeed, the iliac crest fuses between 20 and 25 years old and the sternal end of the clavicle begins to fuse at 25 (Owings Webb and Suchey 1985). In some situations, we were able to use a method based on the auricular surface configuration of hip bone (Schmitt 2005). This method was employed to distinguish three adult categories: 20-29, 30-59, 60 and over, with more than 80% of reliability

Sex assessment of adult individuals can be made through the data collected on the hip bone, by morphological (Bruzek 1991, 2002) and probabilistic methods (Murail *et al*. 2005), that allow to reach the greatest reliability possible. Sex determination from skull morphology remains more problematic in the lack of accurate population data.

- *The search for anatomic variations in dentition and skeletal remains:* Anatomic variations that are not related to pathology allow comparative studies between members of the same group (family traits) or between distinct populations. They can be found on the skull, the dentition as well as on the infra-cranial skeleton (Hauser and De Stefano 1989; Ossenberg 1976; Scott and Turner 1997).

Finally, in a demographical perspective, a comparison of the mortality profiles between the monumental tomb C1 and the simple pit-graves C2 and reference to the profile of theoretical mortality (Ledermann 1969) were attempted, in order to see whether the population discovered in the Southern cemetery reflected a natural population or not (Sellier 1996).

Results

A-Study of Graphic Documents

Type of burial: The burials, which could be ana-

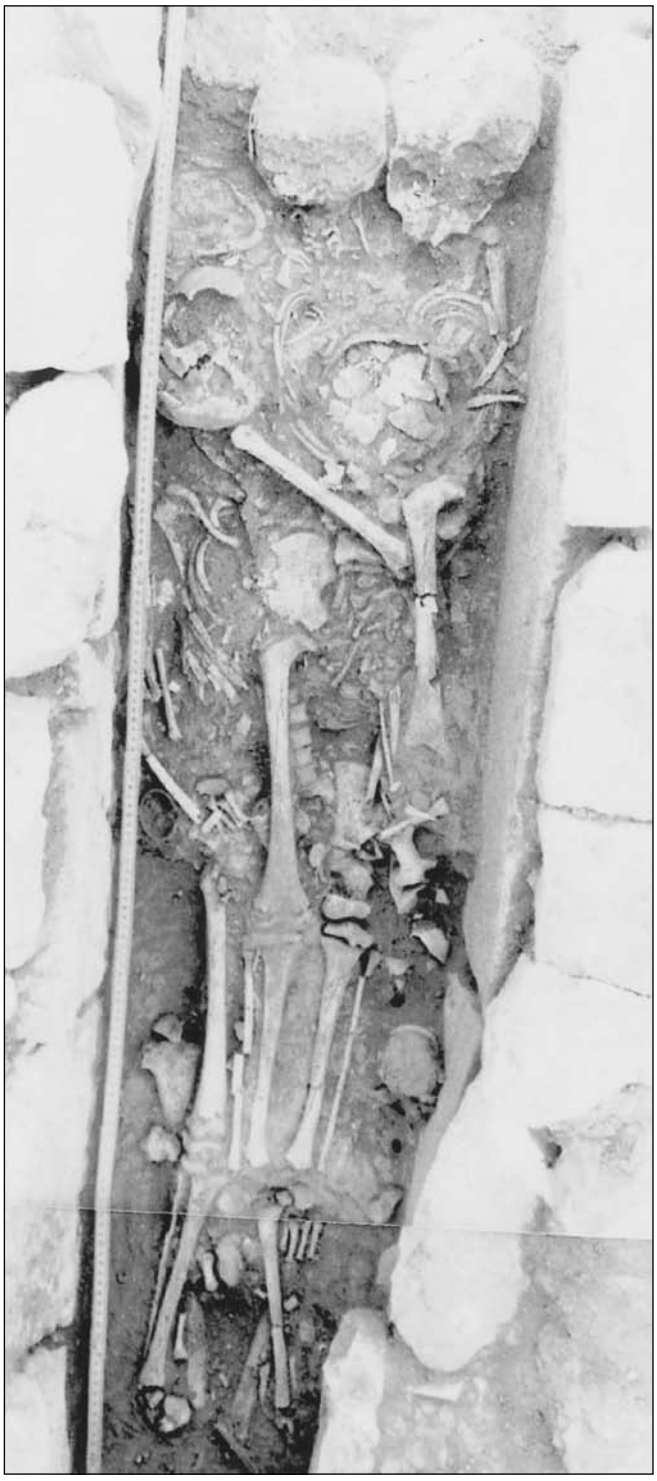
lyzed, are primary. They may be individual, consecutive (deposits were spaced over time), contemporary (the dead were buried simultaneously), or multiple (it is not possible to define the sequence of deposits) (TABLE 1).

For the tomb C1, thirteen graves were revealed containing a single individual: one teenager (I-4) and twelve adults (II-2, II-3, II-4, II-5, IV-4, IV-5, V-1, V-3, V-4, V-5, VI-3 and 4). We can note that the majority of individual burials were discovered in the inferior graves of the monumental tomb. Five of these graves were still sealed with their slabs stone (II-4, II-5, IV-5, V-4, V-5). We also noticed that children are always buried with other individuals. The grave, which has received most individuals, is the II-1 grave with seven adults, two teenagers and three other children. It is not possible to distinguish between consecutive or contemporary burials due to the upheaval caused by looters who have smashed open the graves. Indeed, to distinguish these two types of graves it is necessary to observe the extent of displacement of the bones.

Of the eight graves in the sounding C2 containing bones, three have revealed one individual: two adults (A and E) and a child (G). It is interesting to note that grave G, which contains a child, is smaller compared to the others (FIG. 4). It is the only grave, which contains a child alone (Lenoble *et al*. 2001). The grave that had received the most individuals is grave F with an adult, the first person deposited, and five children (FIG. 7). It is therefore a collective burial. Indeed, the introduction of new individuals has disrupted the other skeletons.

For the North cemetery, the study is not complete but, according to the available documents, all individuals are adults. The graphic documentation is available for six graves of the nine graves of the cemetery. Three graves are individual; two are consecutive, with two to three individuals at most in a single tomb, and a contemporary grave where two individuals were discovered in the same coffin (FIGS. 8a and 8b).

Funeral structure: Signs of the presence of shrouds represented by pieces of leather, and traces of a



7. Grave F (Sounding C2)with one adult and five children (French-Jordanian mission of adh-Dharīḥ).

TABLE 1. The different types of burials discovered at adh-Dharīḥ (MNI=Minimum Number of Individuals).

Tombs	MNI	Number of tombs	Individual	Contemporary	Consecutive	Multiple
C1	62	30	13	-	-	14
C2	19	8	3	-	3	1
NC	7	6	3	1	-	2

coffin documented by amorphous fragments and fittings such as iron nails (Lenoble *et al.* 2001), were discovered in the tomb C1. The study of the graphic material enabled us to suggest that individuals in the unspoiled graves (II-4, II-5, IV-5, V-4 and V-5) were buried in shrouds. For the individual V-5, no fragment of shroud was found but the study of graphic material enabled us to assert the presence of a container. Indeed, we noticed lateral restraining effects (illustrated by constriction of the shoulders and "vertical" clavicles, humerus appearing on their lateral side, alignment of arm bone and left pelvis, and finally no collapsing of the pelvis), which are not induced by the grave but by a container (FIG. 9). Such observations allow us to infer the presence of a funeral shroud or a tight coffin. We noticed that pieces of leather are located in the lower grave and traces of coffins are mainly in the upper graves.

Regarding the graves C2, there is no indication of any leather or pieces of wood, which would suggest the presence of a coffin or shroud. However, the study of graphic material leads us to assume the presence of a shroud or a coffin for the individual in the tomb A, Indeed, as we noted for the individual V-5 from the tomb C1, the clavicle is in a vertical orientation, and the same observation can be made for one of the children of the burial F.

For the North cemetery, individuals were found in coffins (graves 1 and 2) and shrouds (graves 4 and 6).

Orientation of the deceased and body position: All individuals, with the exception of one in the in the North cemetery, are oriented east west, with the head to the west. They were buried in a similar position, a dorsal position, and the lower limbs in extension while the position of hands are variable: on the pubis, the abdomen, along the thighs. The corpse of individual II-5 from the tomb C1 lies on its left side. This position can be attributed to movements during transport in the shroud but on condition that the shroud is not too tight.

B- Biological Identity of the Deceased

State of preservation: The bones from the graves in C1 and C2 are fragmented, very fragile and the skeletons were incomplete. The state of bone preservation can be explained by "weathering", i.e. deterioration of bones after desiccation and temperature changes (Lyman 1994). However, bones from the North cemetery are better preserved.

Minimum Number of Individuals (MNI): The minimum number of individuals in tomb C1 graves C2 and from the Northern cemetery was estimated (TABLE 2). In the tomb C1, 62 individuals were counted and 19 individuals in the graves C2. For the Northern cemetery, according to the documents, at least 14 individuals were buried in this necropolis, but only seven skeletons could be studied.

Age at death: The distribution of age of the deceased can determine if there was a selection of buried individuals according to age. The age assessment of the individuals in each area is given in TABLE 3.

Of all the cemeteries in adh-Dharīḥ, the age of 11 adults has been clarified (TABLE 4).

TABLE 2. Minimum Number of Individuals in tomb C1, graves C2 and Northern cemetery.

Tombs	MNI	Adults	Immature
C1	62	36	26
C2	19	8	11
NC	7[1]	7	-
[1] Number of individuals available for present study.			

TABLE 3. Distribution of individuals by age group in C1, C2, NC.

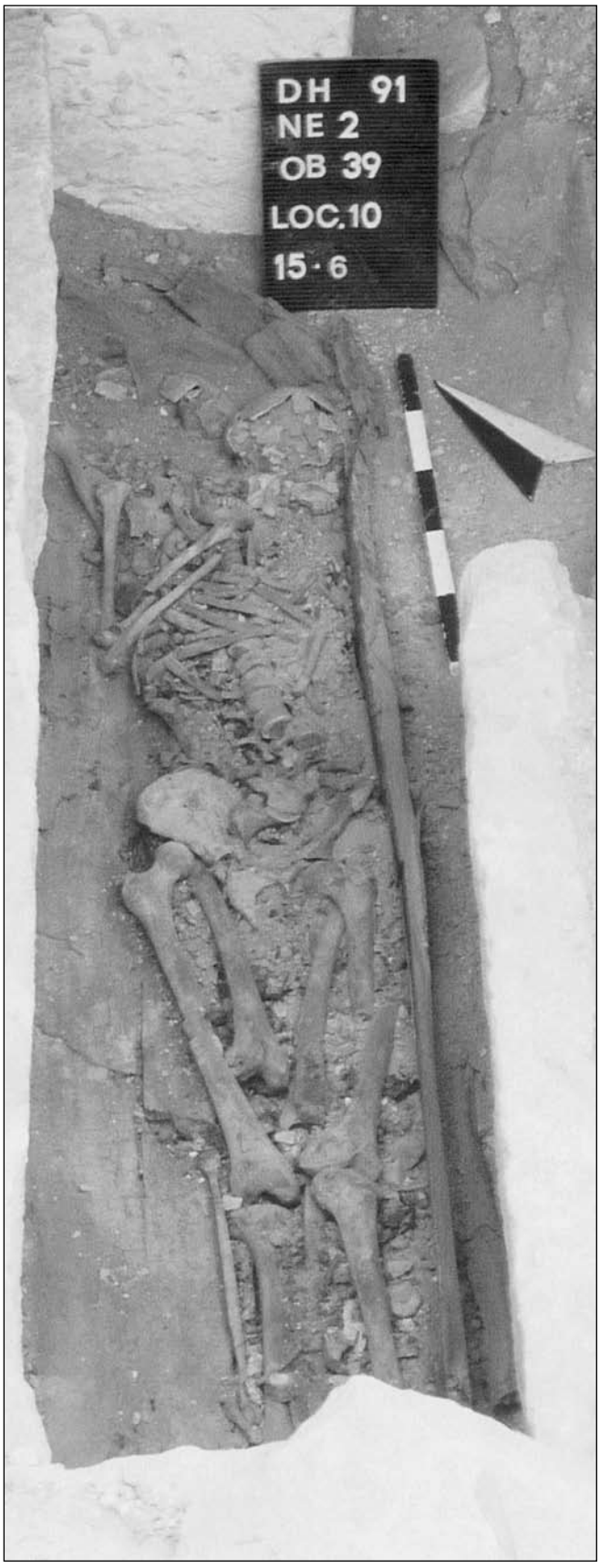
Age group	C1	C2	NC
0	6	0	0
1-4	9	4	0
5-9	4	4	0
10-14	2	1	0
15-19	5	2	0
≥ 20	36	8	7
Total	62	19	7

TABLE 4. Distribution of adults by age group in C1, C2, NC.

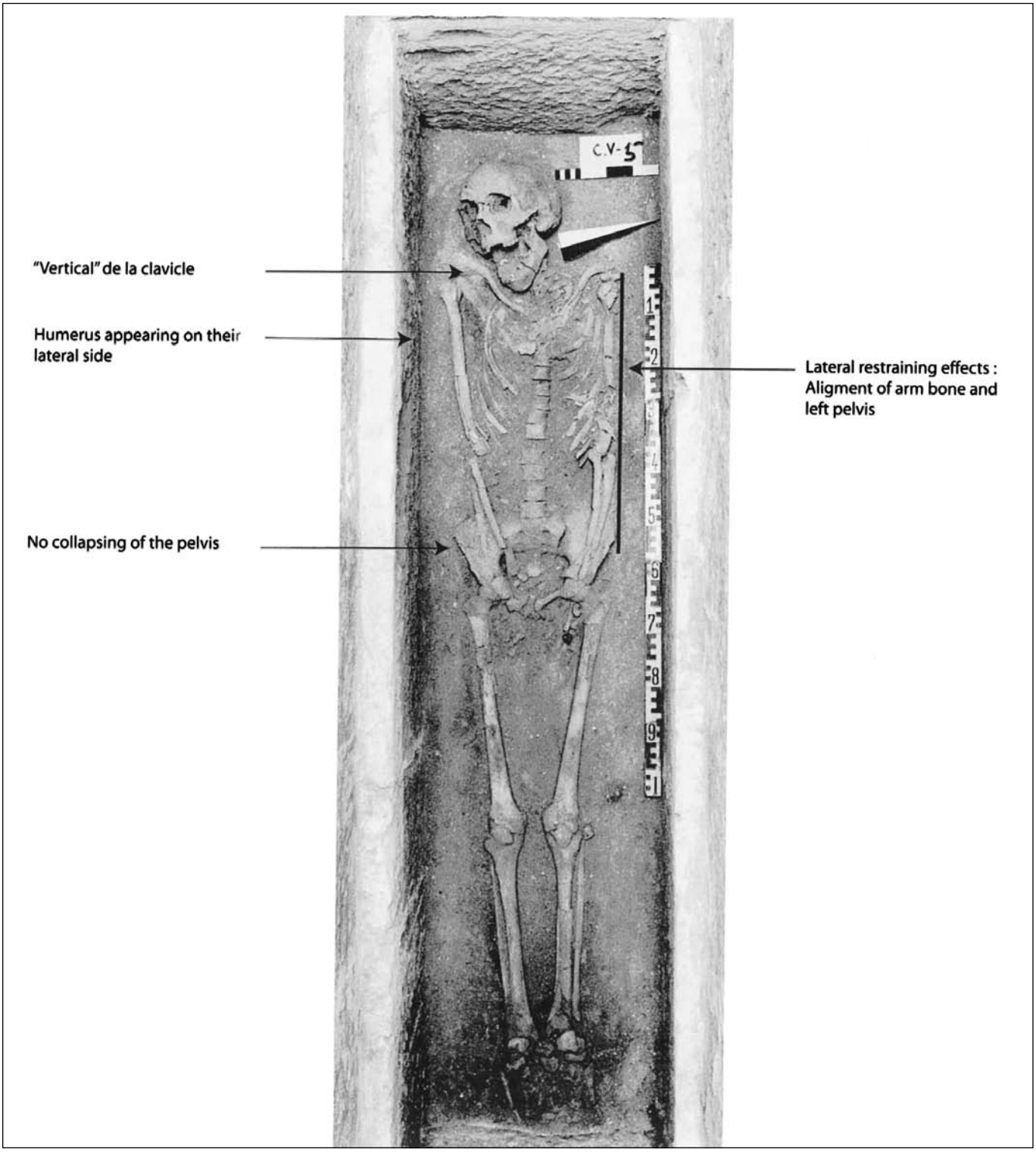
Age group	C1	C2	NC
20-29	2	2	1
30-59	2	-	3
≥60	-	-	1

Sex: Sex determination was made on 11 individuals over the site in accordance with the criteria previously given (TABLE 5).

From the low number of individuals with as-



8a and 8b. Grave 1 (Northern cemetery) with two adults in coffin (French-Jordanian mission of adh-Dharīḥ).



9. Individual V-5 (Tomb C1): presence of a container (French-Jordanian mission of adh-Dharīḥ).

sessed sex no conclusion can be drawn about the sex ratio. However, we can point out that for the graves C2 and NC, the distribution between men and women is equal for the subjects whose sex has been determined.

Archaeological sample representation: We have thus to calculate the age-at-death of the individuals and to carry out a mortality profile for the graves in C1 and C2. In the Northern cemetery, the seven studied individuals are adults.

TABLE 5. Distribution of adults by sex in C1, C2, NC.

Tombs	Men	Female	Unknown	Number of individuals	% estimated
C1	5	0	31	36	13%
C2	1	1	6	8	25%
NC	2	2	3	7	57%
Dharih	8	3	40	51	21,5%

The curve of mortality of C1 and C2 shows demographic anomalies with regard to the dead children between the age of 0-5 and 5-9 for C2 only (FIG. 10). The quotients of the other age groups correspond to a natural mortality and follow the curve of mortality of the antique populations.

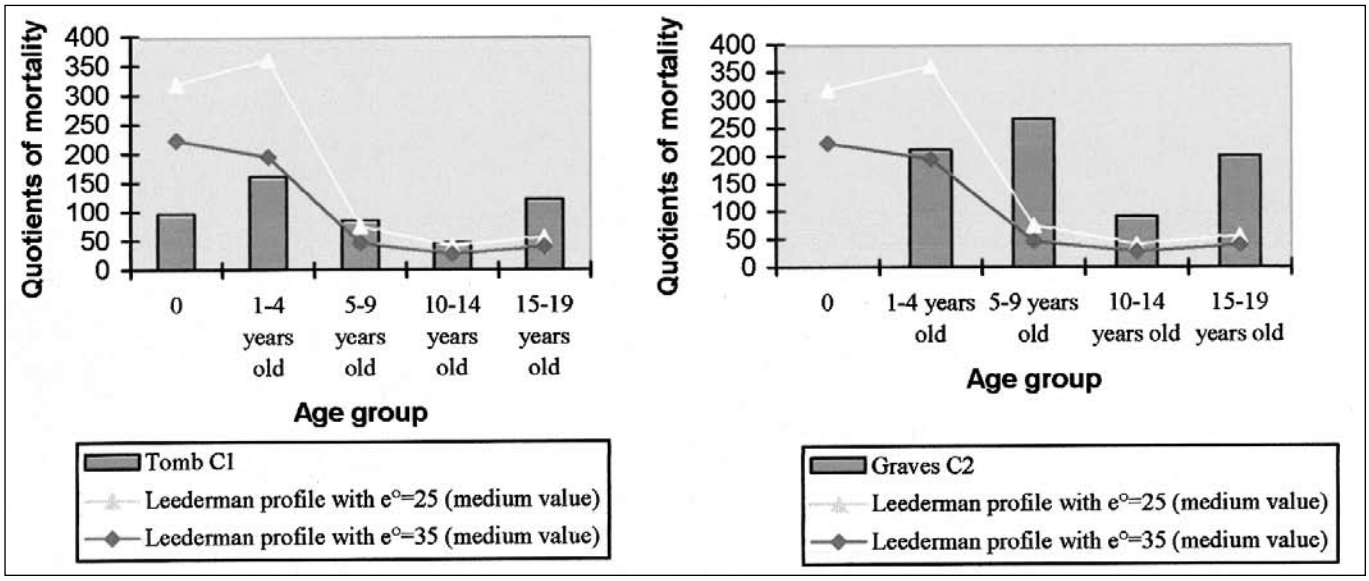
In order to evaluate the importance of the deficit noted in the first age group, we calculated what should be the theoretical distribution of the immature ones. In the C1 tomb misses at least eight children of less than 1 year old and three from 1 to 4 years old. In the C2 tombs it misses at least four children of less than 1 year old (FIG. 11).

Discrete or non-metric traits: We chose to observe fifty-five discrete cranial traits (Hauser and De Stefano 1989), thirty-one sub-cranial (Ossenberg 1976) and sixteen on the dentition (Scott and Turner 1997) (TABLES 6, 7, 8 and 9).

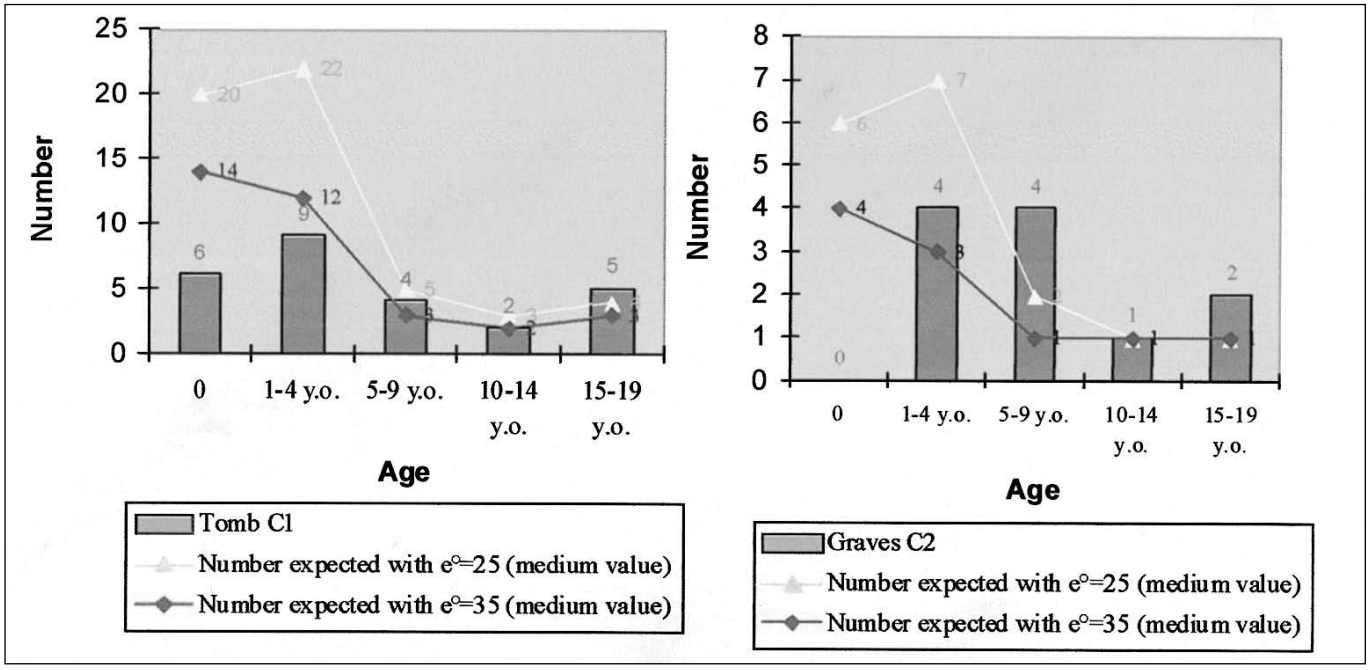
Several discrete traits are recurring in various necropolises (TABLES 10, 11 and 12). The prevalence of some traits, such as the notch of the patella or Carabelli's trait on upper molars, should be noticed in C1 and C2. In the sounding C2, two individuals in the same grave (grave C) shared several discrete traits (TABLE 11) that cannot be found elsewhere in the cemetery. In the same way, two individuals (grave 1) in the same coffin in the northern cemetery shared several discrete traits (TABLE 12). We also notice that individuals from the tomb C1 share a large number of discrete characters (TABLE 10).

Metric: Forty-nine measurements were collected on the skull and fifty-five on the infra-cranial adult skeletons. The data can be used to estimate the stature (Cleuvenot and Houët 1993) and calculate seven indexes. Here we present only the results for stature, estimated for 20 of 51 adults.

The stature of women, known for three individuals, varies from 1.45m to 1.60m, and for six men from 1.65 to 1.80m. We notice that on average men are taller (TABLE 13).



10. Comparison of the quotients of mortality of the age group 0 to 19 years old of tomb C1 and graves C2 with a reference to the profile of theoretical mortality (Ledermann 1969).



11. Comparison of deceased persons of tomb C1 and graves C2 with number expected (e°=25 years old and e°=35 years old).

Discussion

It should be noticed that individuals in the lower graves of the tomb C1 are only adult males. We can therefore assume that a change in burial practices took place with first a tomb reserved for men individually buried with shrouds, and later the same tomb re-used for the general population with the dead buried in the same grave as for the upper II-1 grave, and use of coffin.

It is more difficult to discuss the evolution for the graves of C2 and NC, as we are unable to determine the sequential use of graves. However, we can wonder whether, as in C1, there has not been a change in burial practices with the abandonment of shrouds to be replaced with wooden coffins in the Northern cemetery. We note indeed, that the wooden coffins were discovered in graves 1 and 2 and shrouds in the graves 4 and 6.

Taking into account the low number of sexed individuals we are unable to conclude on the distribution of individuals and to evaluate sex related funerary practises in the cemeteries.

We noticed that the burial practices in the tomb C1 and in the graves C2 and NC were homogeneous: same orientation of the body and quite similar positions. The difference of architecture of the tomb C1 and the graves C2 have led Lenoble *et al.* (2001) to assign the C1 tomb to the main family of the village and the simpler grave-pits to the poorer inhabitants of adh-Dharīḥ. The study of discrete traits seems to support such a hypothesis. We indeed noticed that some individuals from the C1 tomb might have family ties and also those for C2 and NC.

The lack of children for the two first age-classes (0 year and 1-4 years) allows us to conclude that there was probably an age-related selection for the children. It appears currently that young children can be buried in selected areas; however it is important to notice that in the sounding C2, one grave (G) was reserved for a child aged between 1 and 4 years and the real meaning of such an isolated case remains unknown.

Conclusions

In conclusion, we noticed that the burial practices in adh-Dharīḥ are homogeneous, with primary burials, individual or multiple. Despite the poor preservation of bones, the study conducted on the anthropological documentation brings new results on the Nabataean population in terms of biological aspects and age distribution. Indeed, there are few children buried in comparison to the adults, men and women. Additional data are collected on forensic anthropology and mortuary gestures.

The progress in the knowledge of burial practices allowed comparative studies throughout the Nabataean kingdom, and capital Petra, where re-

TABLE 6. Discrete cranial traits (L: left, R: right) in tomb C1, graves C2 and NC.

Discrete cranial traits	Side	C1		C2		NC		Dharih	
		Present	Number of individuals observable	Present	Number of individuals observable	Present	Number of individuals observable e	Present	Number of individuals observable
Ossicle at bregma		0	5	0	0	0	1	0	6
Lambdoid ossicles	L.	2	4	1	1	0	1	3	6
Lambdoid ossicles	R.	0	4	1	1	0	1	1	6
Ossicle at lambda		1	4	0	0	0	0	1	4
Inca bone		1	4	1	1	1	1	3	6
Ossicle at asterion	L.	0	3	0	0	0	1	0	4
Ossicle at asterion	R.	1	4	0	1	0	1	1	6
Occipito-matoid ossicle	L.	0	3	0	0	0	1	0	4
Occipito-matoid ossicle	R.	0	3	0	1	0	1	0	5
Coronal ossicle	L.	0	6	0	0	0	1	0	7
Coronal ossicle	R.	0	6	0	0	0	1	0	7
Sagittal ossicle		0	8	0	0	0	1	0	9
Parietal notch bone	L.	0	5	0	0	0	1	0	6
Parietal notch bone	R.	0	7	0	0	0	1	0	8
Parietal foramen	L.	0	7	0	0	0	1	0	8
Parietal foramen	R.	0	7	0	0	0	1	0	8
Symmetrical thinness of parietal bones	L.	0	11	0	1	0	2	0	14
Symmetrical thinness of parietal bones	R.	0	10	0	0	0	1	0	11
Condylar facet double	L.	0	10	0	4	1	1	1	15
Condylar facet double	R.	2	9	0	6	1	2	3	17
Pharyngeal fovois		2	11	1	5	1	1	4	17
Divided hypoglossal canal	L.	3	11	1	5	1	1	5	17
Divided hypoglossal canal	R.	3	9	2	5	0	1	5	15
Sutura Mendosa	L.	0	6	0	0	1	1	1	7
Sutura Mendosa	R.	1	7	0	1	1	1	2	9
condylar canal	L.	1	4	1	1	0	1	2	6
condylar canal	R.	2	5	2	2	0	1	4	8
Intermediate condylar canal	L.	0	5	0	1	0	0	0	6
Intermediate condylar canal	R.	0	5	0	1	0	0	0	6
Paracondylar process	L.	0	0	0	0	0	1	0	1
Paracondylar process	R.	0	0	0	0	0	1	0	1
Pharyngeal tubercle		3	11	0	5	0	1	3	17
Foramen of Huscke	L.	5	12	0	4	0	1	5	17
Foramen of Huscke	R.	3	14	1	5	0	1	4	20
Variations of the pterion	L.	0	0	0	0	0	0	0	0
Variations of the pterion	R.	0	0	0	0	0	0	0	0
Mastoid foramen	L.	2	5	0	2	0	0	2	7
Mastoid foramen	R.	5	6	0	1	0	0	5	7
Squamomestoid suture	L.	5	11	0	2	1	1	6	14
Squamomestoid suture	R.	4	11	0	9	1	1	5	21
Molar foramen	L.	0	7	0	3	0	0	0	10
Molar foramen	R.	4	12	0	3	0	0	4	15
Marginal tubercle	L.	0	8	0	1	0	0	0	9
Marginal tubercle	R.	0	7	0	1	0	0	0	8
Zygomaticofacial foramen	L.	0	9	0	1	0	0	0	10

Discrete cranial traits	Side	C1		C2		NC		Dharih	
		Present	Number of individuals observable	Present	Number of individuals observable	Present	Number of individuals observable e	Present	Number of individuals observable
Zygomaticofacial foramen	R.	0	9	1	3	0	0	1	12
Bipartite zygomatic bone	L.	0	4	0	1	0	0	0	5
Bipartite zygomatic bone	R.	0	4	0	0	0	0	0	4
Metopic suture		1	20	0	6	0	2	1	28
Trochlear spine	L.	0	4	0	1	0	1	0	6
Trochlear spine	R.	0	5	0	1	0	1	0	7
Canalis opticus accessorium	L.	0	3	0	0	0	0	0	3
Canalis opticus accessorium	R.	0	3	0	0	0	0	0	3
Oval foramen	L.	0	4	0	2	0	1	0	7
Oval foramen	R.	0	5	0	1	0	1	0	7
Spinous foramen	L.	0	4	0	2	0	1	0	7
Spinous foramen	R.	0	5	0	1	0	1	0	7
Foramen of Vesallus	L.	2	5	1	2	0	1	3	8
Foramen of Vesallus	R.	1	5	0	1	0	1	1	7
Pterygoalar spine	L.	0	4	1	1	0	0	1	5
Pterygoalar spine	R.	0	3	0	1	0	0	0	4
Pterygoalar bridge	L.	0	3	1	1	0	0	1	4
Pterygoalar bridge	R.	0	3	0	1	0	0	0	4
Pterygospinous spine	L.	1	3	0	1	0	0	1	4
Pterygospinous spine	R.	1	3	0	1	0	0	1	4
Pterygospinous bridge	L.	0	3	0	1	0	0	0	4
Pterygospinous bridge	R.	0	3	0	1	0	0	0	4
Accessory infraorbital foramen	L.	0	8	0	2	0	1	0	11
Accessory infraorbital foramen	R.	1	7	0	2	0	2	1	11
Divided infraorbital foramen	L.	0	8	0	1	0	1	0	10
Divided infraorbital foramen	R.	0	7	0	1	0	2	0	10
Palatine torus		4	11	0	2	0	2	4	15
Maxillary torus	L.	1	9	0	2	0	1	1	12
Maxillary torus	R.	1	11	0	2	0	2	1	15
Patent premaxillary suture		1	11	1	2	0	2	2	15
Infraorbital suture	L.	0	6	0	1	0	1	0	8
Infraorbital suture	R.	0	6	0	1	0	1	0	8
Mandibular torus	L.	0	11	0	2	0	1	0	14
Mandibular torus	R.	0	11	0	3	0	2	0	16
Mylohyoid bridge	L.	1	9	0	1	0	1	1	11
Mylohyoid bridge	R.	2	10	0	1	0	0	2	11
mentale foramen double	L.	0	13	0	3	0	1	0	17
mentale foramen double	R.	1	11	0	5	0	2	1	18
mentale foramen accessory	L.	1	13	0	2	0	1	1	16
mentale foramen accessory	R.	2	11	0	4	0	2	2	17
Retromolar foramen	L.	0	10	0	2	0	1	0	13
Retromolar foramen	R.	0	12	0	2	0	2	0	16
Robinson's foramen	L.	0	10	0	1	0	1	0	12
Robinson's foramen	R.	0	12	0	2	0	2	0	16

TABLE 7. discrete sub-cranial traits (L: Left, R: Right) in tomb C1, graves C2 and NC.

Discrete sub-cranial traits			C1		C2		NC		Total	Total
	Bones	Side	Present	Number of individuals observable	Present	Number of individuals observable	Present	Number of individuals observable	Present	Number of individuals observable
Atlas facet form	Vertebrae	L.	4	18	1	4	1	4	6	26
Atlas facet form	Vertebrae	R.	3	15	2	4	1	5	6	24
Posterior bridge of the atlas.	Vertebrae	L.	0	13	0	2	0	4	0	19
Posterior bridge of the atlas.	Vertebrae	R.	0	11	0	2	0	4	0	17
Lateral bridge of the atlas	Vertebrae	L.	1	13	0	2	0	4	1	19
Lateral bridge of the atlas	Vertebrae	R.	1	11	0	2	0	4	1	17
Retroarticular bridge	Vertebrae	L.	0	8	1	2	0	4	1	14
Retroarticular bridge	Vertebrae	R.	0	6	1	2	0	4	1	12
Incomplete costal process	Vertebrae	L.	0	10	0	2	0	4	0	16
Incomplete costal process	Vertebrae	R.	0	10	0	2	0	4	0	16
Cervical transverse foramen double	Vertebrae	L.	0	11	0	2	0	4	0	17
Cervical transverse foramen double	Vertebrae	R.	0	10	0	2	0	4	0	16
Cervical transverse foramen double	Vertebrae	L.	1	11	2	4	0	3	3	18
Cervical transverse foramen double	Vertebrae	R.	2	11	2	3	0	3	4	17
Rhomboid pit development	Clavicle	L.	4	17	1	4	0	4	5	25
Rhomboid pit development	Clavicle	R.	7	11	2	3	1	5	10	19
Circumflex sulcus	Scapula	L.	1	1	0	1	1	1	2	3
Circumflex sulcus	Scapula	R.	0	3	0	1	0	0	0	4
Suprascapular foramen	Scapula	L.	0	4	0	1	0	2	0	7
Suprascapular foramen	Scapula	R.	0	5	0	1	0	0	0	6
Acromial bone	Scapula	L.	0	0	0	0	0	0	0	0
Acromial bone	Scapula	R.	0	0	0	0	0	0	0	0
Sternal aperture	Sternum		1	6	0	0	0	1	1	7
Sacralisation5VL	Sacrum		1	2	0	0	0	2	1	4
Perforation xyphoïde	Coccys		0	1	0	0	0	1	0	2
Septal aperture	Humerus	L.	2	21	1	2	1	4	4	27
Septal aperture	Humerus	R.	1	15	2	3	2	6	5	24
Supratrochlear spur	Humerus	L.	0	16	0	2	0	4	0	22
Supratrochlear spur	Humerus	R.	0	13	0	1	0	6	0	20
Pectoralis major and teres major fossa	Humerus	L.	0	13	0	4	0	4	0	21
Pectoralis major and teres major fossa	Humerus	R.	0	11	0	4	0	6	0	21
Acetabular mark	Pelvis	L.	0	5	0	2	2	4	2	11
Acetabular mark	Pelvis	R.	1	5	2	2	2	4	5	11
Allen's fossa	Femur	L.	1	9	0	3	0	3	1	15
Allen's fossa	Femur	R.	1	9	0	5	0	4	1	18
Poirier's facet	Femur	L.	0	5	1	4	0	3	1	12
Poirier's facet	Femur	R.	0	8	0	4	0	3	0	15
Third trochanter	Femur	L.	0	2	0	4	0	3	0	9
Third trochanter	Femur	R.	0	5	0	4	0	3	0	12
Hypotrochanteric fossa	Femur	L.	0	3	0	4	0	4	0	11
Hypotrochanteric fossa	Femur	R.	0	5	0	5	0	3	0	13
Lateral tibial squatting facet	Tibia	L.	8	10	0	1	1	3	9	14
Lateral tibial squatting facet	Tibia	R.	4	10	0	1	0	2	4	13
Medial tibial squatting facet	Tibia	L.	3	10	0	1	0	3	3	14
Medial tibial squatting facet	Tibia	R.	3	11	0	1	0	2	3	14
Vastus notch	Patella	L.	6	25	2	4	0	4	8	33
Vastus notch	Patella	R.	6	20	4	5	1	4	11	29

Discrete sub-cranial traits			C1		C2		NC		Total	Total
	Bones	Side	Present	Number of individuals observable	Present	Number of individuals observable	Present	Number of individuals observable	Present	Number of individuals observable
Emarginate patella	Patella	L.	0	25	0	4	0	4	0	33
Emarginate patella	Patella	R.	0	19	0	4	0	4	0	27
Bipartite anterior calcaneal facet	Calcaneus	L.	5	16	2	4	3	3	10	23
Bipartite anterior calcaneal facet	Calcaneus	R.	6	17	1	3	3	4	10	24
Anterior-medium calcaneal notch	Calcaneus	L.	1	15	0	3	0	3	1	21
Anterior-medium calcaneal notch	Calcaneus	R.	2	16	0	2	0	3	2	21
Calcaneus emarginatus	Calcaneus	L.	0	3	0	0	0	3	0	6
Calcaneus emarginatus	Calcaneus	R.	1	5	0	0	0	3	1	8
Os trigonum	Talus	L.	9	25	2	6	0	3	11	34
Os trigonum	Talus	R.	7	27	1	2	0	5	8	34
Lateral talar facet	Talus	L.	3	17	0	3	1	3	4	23
Lateral talar facet	Talus	R.	5	20	0	3	1	4	6	27
Medial talar facet	Talus	L.	1	17	0	3	0	3	1	23
Medial talar facet	Talus	R.	2	18	0	2	0	4	2	24
Facet navicular-cuboid	Cuboid	L.	11	15	1	1	3	3	15	19
Facet navicular-cuboid	Cuboid	R.	10	11	1	1	4	4	15	16
Bipartite facet	Metatarsal	L.	1	9	0	4	0	3	1	16
Bipartite facet	Metatarsal	R.	0	12	0	4	0	2	0	18

cent excavations occurred in different sites: Wādī Farasa, Renaissance Tomb (Schmid and Barmasse 2006), Wādī Mūsā and Ridge Charch (Perry 1998, Perry 2002), and in Madā'in Ṣāliḥ — Hégra — (documenting the end of the Nabataean kingdom). At the stage of the field process, we can see similarities in funerary practises: individual and collective graves, primary burials, and under-representation of children under 5 years.

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TABLE 8. dental discrete traits (upper teeth) (L: left, R: right) in tomb C1, graves C2 and CN.

Teeth	Discrete traits		C1		C2		NC		Dharih	
		Side	Present	Number of individuals observable	Present	Number of individuals observable	Present	Number of individuals observable	Présent	Number of individuals observable
I1	Incisor rotation	L	0	3	0	2	1	1	1	6
I1	Incisor rotation	R	0	2	0	2	1	1	1	5
I1	Shoveling	L	2	7	3	6	0	0	5	13
I1	Shoveling	R	2	8	1	4	0	2	3	14
I1	Double-shoveling	L	0	6	0	4	0	0	0	10
I1	Double-shoveling	R	0	6	0	3	0	2	0	11
I2	Incisor rotation	L	0	1	0	2	0	0	0	3
I2	Incisor rotation	R	0	1	0	2	0	1	0	4
I2	Shoveling	L	1	8	1	4	0	0	2	12
I2	Shoveling	R	1	6	1	4	0	1	2	11
I2	Double-shoveling	L	0	6	0	3	0	0	0	9
I2	Double-shoveling	R	0	4	0	3	0	1	0	8
I2	Lateral incisor variants	L	0	1	0	2	0	0	0	3
I2	Lateral incisor variants	R	1	3	0	2	0	1	1	6
PM1	Premolar odontomes	L	1	9	0	7	0	1	1	17
PM1	Premolar odontomes	R	0	5	0	8	0	2	0	15
PM1	Premolar accessory marginal tubercles	L	1	9	0	7	0	1	1	17
PM1	Premolar accessory marginal tubercles	R	0	5	0	7	0	2	0	14
PM2	Premolar odontomes	L	0	10	0	5	0	1	0	16
PM2	Premolar odontomes	R	0	2	0	5	0	2	0	9
PM2	Premolar accessory marginal tubercles	L	0	10	1	5	0	1	1	16
PM2	Premolar accessory marginal tubercles	R	0	2	0	6	0	2	0	10
M1	Cusp 5	L	0	12	1	8	0	2	1	22
M1	Cusp 5	R	1	15	1	10	0	1	2	26
M1	Carabelli's trait	L	1	11	8	10	0	2	9	23
M1	Carabelli's trait	R	7	16	7	10	0	1	14	27
M1	Enamel extensions	L	0	10	0	6	0	2	0	18
M1	Enamel extensions	R	0	10	0	5	0	1	0	16
M1	Mesial accessory tubercle	L	0	11	0	10	0	2	0	23
M1	Mesial accessory tubercle	R	0	13	0	11	0	1	0	25
M1	Paramolar tubercle	L	0	11	0	9	0	2	0	22
M1	Paramolar tubercle	R	0	14	0	10	0	1	0	25
M2	Cusp 5	L	0	8	0	7	0	1	0	16
M2	Cusp 5	R	0	6	0	7	0	1	0	14
M2	Carabelli's trait	L	0	8	0	8	0	1	0	17
M2	Carabelli's trait	R	0	6	0	7	0	1	0	14
M2	Enamel extensions	L	1	6	1	4	0	2	2	12
M2	Enamel extensions	R	1	5	0	6	0	2	1	13
M2	Mesial accessory tubercle	L	0	8	0	8	0	1	0	17
M2	Mesial accessory tubercle	R	0	6	0	6	0	1	0	13
M2	Paramolar tubercle	L	0	8	0	8	0	1	0	17
M2	Paramolar tubercle	R	0	5	0	7	0	1	0	13
M3	Cusp 5	L	0	6	0	5	0	2	0	13
M3	Cusp 5	R	0	3	0	3	0	1	0	7
M3	Carabelli's trait	L	0	7	0	4	0	2	0	13
M3	Carabelli's trait	R	0	3	0	3	0	1	0	7
M3	Enamel extensions	L	0	6	0	3	0	2	0	11
M3	Enamel extensions	R	0	3	0	2	0	1	0	6
M3	Mesial accessory tubercle	L	0	7	0	4	0	2	0	13
M3	Mesial accessory tubercle	R	0	3	0	3	0	1	0	7
M3	Paramolar tubercle	L	0	7	0	4	0	2	0	13
M3	Paramolar tubercle	R	0	3	0	3	0	1	0	7

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TABLE 9. dental discrete traits (lower teeth) (L: left, R: right) in tomb C1, graves C2 and CN.

Teeth	Discrete traits		C1		C2		NC		Dharih	
		Side	Present	Number of individuals observable	Present	Number of individuals observable	Present	Number of individuals observable	Présent	Number of individuals observable
I1	Shoveling	L	0	5	0	6	0	1	0	12
I1	Shoveling	R	0	7	0	5	0	2	0	14
I2	Shoveling	L	0	6	0	8	0	2	0	16
I2	Shoveling	R	0	8	0	8	0	2	0	18
PM1	Premolar odontomes	L	0	11	0	11	1	3	1	25
PM1	Premolar odontomes	R	3	12	0	7	1	2	4	21
PM1	Multiple lingual cusps	L	0	11	0	11	0	3	0	25
PM1	Multiple lingual cusps	R	3	12	0	7	0	2	3	21
PM2	Premolar odontomes	L	0	3	0	6	0	3	0	12
PM2	Premolar odontomes	R	0	8	0	8	0	1	0	17
PM2	Multiple lingual cusps	L	0	3	0	5	0	3	0	11
PM2	Multiple lingual cusps	R	1	8	0	7	0	1	1	16
M1	Protostylid	L	0	11	1	10	0	3	1	24
M1	Protostylid	R	0	12	1	6	0	1	1	19
M1	Cusp 6	L	0	9	0	9	0	3	0	21
M1	Cusp 6	R	0	12	0	7	0	1	0	20
M1	Cusp 7	L	0	9	0	10	0	3	0	22
M1	Cusp 7	R	0	12	0	7	0	1	0	20
M2	Protostylid	L	0	12	0	8	0	2	0	22
M2	Protostylid	R	0	11	0	9	0	1	0	21
M2	Cusp 6	L	0	9	0	7	0	2	0	18
M2	Cusp 6	R	0	8	0	9	0	1	0	18
M2	Cusp 7	L	0	9	0	8	0	2	0	19
M2	Cusp 7	R	0	8	0	9	0	1	0	18
M3	Protostylid	L	0	4	0	3	0	3	0	10
M3	Protostylid	R	0	7	0	4	0	2	0	13
M3	Cusp 6	L	0	3	1	3	0	3	1	9
M3	Cusp 6	R	0	6	1	3	0	2	1	11
M3	Cusp 7	L	0	4	0	3	0	3	0	10
M3	Cusp 7	R	0	6	0	3	0	2	0	11

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TABLE 10. Recurrent discrete traits in tomb C1.

Bones	Discrete traits	Number of bones observed	Number of variation observed	Individual with variation
Skull	Lambdoid ossicles	4	2	II-Pillage, VI-2
Skull	Pharyngeal fovois	11	2	V-5, II-1
Skull	Divided hypoglossal canal	11	3	II-4, II-a1, II-1
Skull	condylar canal	5	2	IV-5, V-4
Skull	Pharyngeal tubercle	11	3	IV-5, IV-4, II-1-a1
Skull	Foramen of Huscke	14	5	IV-5, I-5-a1, II-a1, II-a2, II-1
Skull	Squamomestoid suture	11	5	II-5, IV-5, V-4, V-5, II-1-PEa1
Skull	Molar foramen	12	4	IV-5, V-4, V-5, II-1-Pei2
Skull	Foramen of Vesallus	5	2	II-4, IV-5
Skull	Palatine torus	11	4	II-4, II-5, IV-5, V-4
Skull	Mylohyoid bridge	10	2	V-4, II-1-D,
Skull	mentale foramen accessory	11	2	II-5, V-5
Vertebrae	Atlas facet form	18	4	II-5, IV-5, V-5, II-2
Vertebrae	Cervical transverse foramen double	11	2	II-1-PEa1, II-1-PEa5
Clavicle	Rhomboid pit development	17	4	V-4, I-5-a2, I-5-a3, II-3
Humerus	Septal aperture	21	2	II-3, IV-1
Tibia	Tibial squatting facet	10	8	II-4, IV-5, V-5, II-Pa1, II-1-PEC, II-1-PEa1, II-1-PEa2
Patella	Vastus notch	25	8	II-4, II-5, IV-5, V-4, V-5, I-4, II-1-PEa1
Calcaneus	Bipartite anterior calcaneal facet	16	5	V-4, II-Pi1,III-PEa3,II-1Pei1,V-3
Calcaneus	Encoche antero-médiale calcanéenne	16	2	II-1-Pei1,V-4
Talus	Os trigonum	27	9	II-4, IV-5, V-4, I-5a1, II-Pa1,III-Pea1, III-Pei2, II-3, V-VI-a1
Talus	talar facet	20	5	II-4, V-5, II-1-Pea2, VI-2, VI-3
I1	Shoveling	8	2	V-5, II-1-Pei1
M1	Carabelli's trait	16	7	I1/2-i5, I-1/2i6, I-3-a1, I5-i2, II-Pa1, II-Pi5, II-1-D
PM1	Premolar odontomes	12	3	II-1-PEC, II-1-PEa1, II-1-PEa 3
PM1	Multiple lingual cusps	12	3	II-1-PEC, II-1-PEa1, II-1-PEa 3

TABLE 11. Recurrent discrete traits in tomb C2.

Bones	Discrete traits	Number of bones observed	Number of variation observed	Individualwith variation
Skull	Divided hypoglossal canal	2	5	C1-C2
Skull	Condylar canal	2	2	C1-C3
Vertebrae	Atlas facet form	2	4	C1-C2
Vertebrae	Cervical transverse foramen double	2	4	C1-C2
Humerus	Septal aperture	2	3	C1-C2
Pelvis	Acetabular mark	2	2	C1-D2
Patella	Vastus notch	4	5	A1-C2-E1-H1
Calcaneus	Bipartite anterior calcaneal facet	2	4	E1-H1
Talus	Os trigonum	2	6	C1-H1
I1	Shoveling	3	6	E1-F1-F3
M1 upper	Carabelli's trait	8	10	C1-C3-E1-F1-F3-F4-F6-H2

TABLE 12. Recurrent discrete traits in Northern cemetery.

Bones	Discrete traits	Number of bones observed	Number of variation observed	Individual with variation
Humerus	Septal aperture	2	6	T1-1, T1-2
Pelvis	Acetabular mark	2	4	T1-1, T6
Calcaneus	Bipartite anterior calcaneal facet	4	3	T1-1, T1-2, T6

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TABLE 13. Estimated of the stature for individuals of C1, C2 et NC (M: male, F: female, I: indeterminated).

Individual	Sex	Humerus L (±4,83cm)	Humerus R (±4,83cm)	Radius L (±5cm)	Radius R (±5 cm)	Ulna L (±5,09 cm)	Ulna R (±5,09cm)	Femur L (±4,13cm)	Femur R (±4,13cm)	Fibula L (±4,04cm)	Fibula R (±4,04cm)
C1-II-4	M	-	-	-	171,69	-	-	-	-	-	-
C1-II-5	M	-	178,78	-	-	-	-	-	-	-	-
C1-IV-5	M	-	-	-	-	-	178,15	-	-	-	-
C1-V-4	M	172,29	175,24	-	181,17	-	-	-	-	-	-
C1-I-4	I	-	-	-	-	-	-	163,46	-	-	-
C1-II-P-a3	I	144,93	-	-	158,57	-	-	-	-	-	-
C1-II-P-a4	I	-	-	142,67	-	-	-	-	-	-	-
C1-II-1-PEa1	I	-	-	-	-	-	-	-	-	-	163,73
C1-II-1-PO-a1	I	-	-	-	147,44	-	-	-	-	-	-
C1-II-3	I	-	-	158,57	-	-	-	-	-	-	-
C1-IV-1	I	-	-	175	-	-	-	-	-	-	-
C1-VI-2	I	-	166,66	-	-	-	-	-	-	-	-
C1-V-VIa1	I	-	-	161,75	-	163,644	-	-	-	-	-
C2-A1	I	-	-	155,39	158,57	-	-	-	-	-	-
C2-C1	F	158,01	160,94	161,40	160,80	160,087	157,27	152,02	151,74	158,27	157,24
NC-Tomb 6	M	168,95	165,41	167,47	-	167,302	170,40	168,62	167,48	-	-
NC-Tomb 5	F	-	-	159,60	162,00	-	160,65	-	-	-	-
NC-Tomb 1B	F	145,86	147,95	151,18	151,18	151,642	155,58	150,3	150,58	152,08	151,39
NC-Tomb 1A	I	-	149,67	150,62	149,56	150,694	-	154,05	-	155,44	-
NC-Tomb 7	M	-	164,63	-	-	-	-	-	-	-	-

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