Research Article

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Enigmatic Bones: A Few Archaeological, Bioanthropological, and Historical Considerations Regarding an Atypical Deposit of Skeletonized Human Remains Unearthed in Khirbat al-Dusaq (Southern Jordan)

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Abstract: This article presents the results of the archaeological, bioanthropological, and historical analysis of an atypical human bone deposit found at the medieval Islamic desert site of Khirbat al-Dusaq in southern present-day Jordan. This site has yielded several human remains deposits, most of which appear to be either ordinary or reorganised burials with a clearly identifiable sepulchral function. However, one particular deposit (labelled "Structure no 1 (Pièce 5)") displays several atypical features which complicate its interpretation. As such, radiocarbon dating of this particular deposit indicates a chronological range extending from the second half of the seventeenth century CE to the end of the eighteenth century CE. In addition, the human bones contained within this deposit tend to show unusual osteological characteristics, such as possible cut marks resembling *peri-mortem* lesions inflicted upon the deceased by third parties armed with sharp objects. The precise historical contextualisation of this deposit enables us to discuss different scenarios that could explain the circumstances of its inception. In this sense, the spectrum of possible explanatory interpretations ranges from the conjecture that the remains under study represent one or several victims of an inter-tribal conflict, a brigandage or retaliation attack, a crushed popular uprising, or even individuals who died during one of the violent raids perpetrated by local Bedouin tribes against the Mecca pilgrimage caravans during the Ottoman period.

Keywords: interpersonal violence, southern Jordan, bioanthropology, archaeothanatology, osteoarchaeology, Islamic archaeology

1 Introduction

This article presents the results of the archaeological, bioanthropological, and historical assessment of a selected human remains deposit unearthed in 2015 at the medieval archaeological site of Khirbat al-Dusaq

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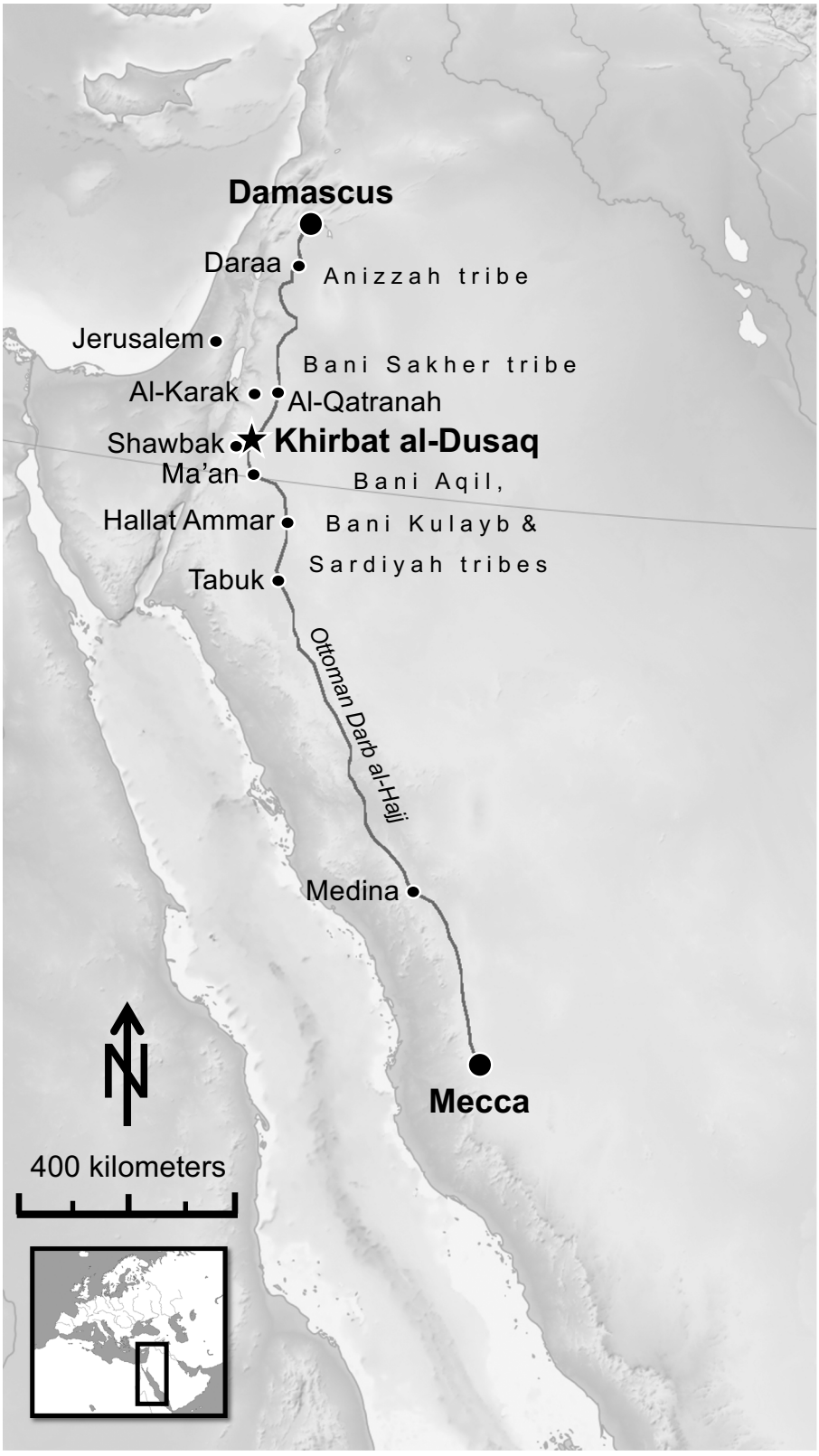


Figure 1: Map of the approximate path of the Ottoman *Darb al-Hajj*, also showing the localisation of the main sites mentioned in the text. Based on commons.wikimedia.org, reworked by Hofstetter (2022).

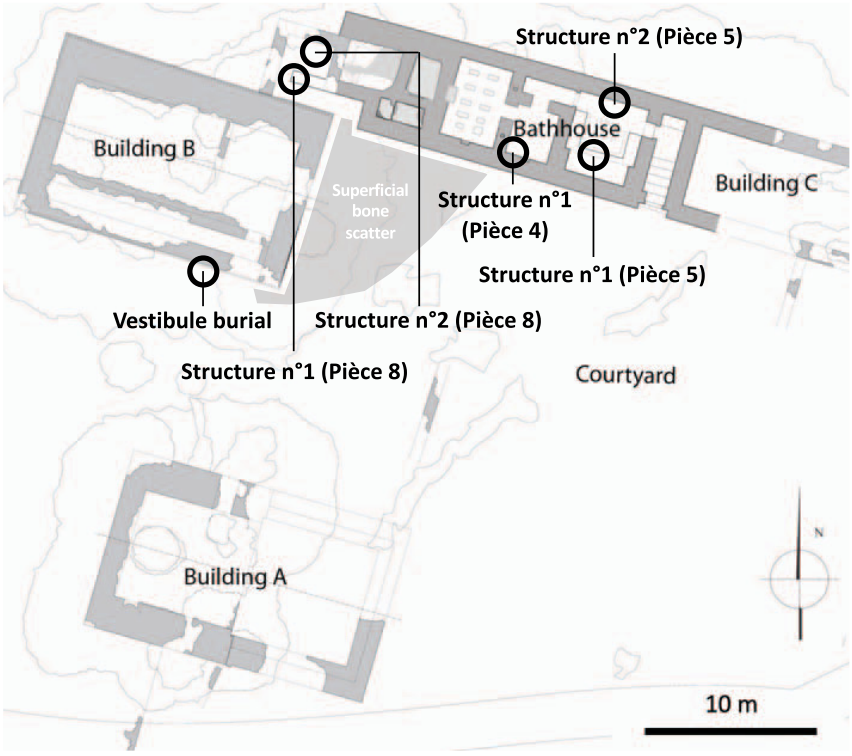
in southern present-day Jordan (Figure 1). Since some of these remains present an ambiguous osteological signature and could possibly have been subject to violent acts materialised by cut and chop marks, it seemed appropriate – in our view – to propose a more in-depth study as well as some interpretative leads regarding the origin of this deposit and its subsequent evolution. To do so, this article seeks to present and combine – on a broad spectrum – the archaeological, bioanthropological, and historical data that may help to contextualize this human remains deposit in local geographical, chronological, and socio-cultural terms. Epistemologically speaking, this integrated multidisciplinary approach derives its relevance from the fact that it aims to put into practice valuable forensic, archaeothanatological, and taphonomical inputs regarding funerary treatment and violence, as advocated for by various authors (e.g., Armit et al., 2006, pp. 4–6; Boulestin & Duday, 2005; Duday, 1990, 2009; Duday, Courtaud, Crubézy, Sellier, & Tillier, 1990; Knüsel & Robb, 2016; Sołtysiak, 2021; Walker, 2001b; Zammit, 2003).

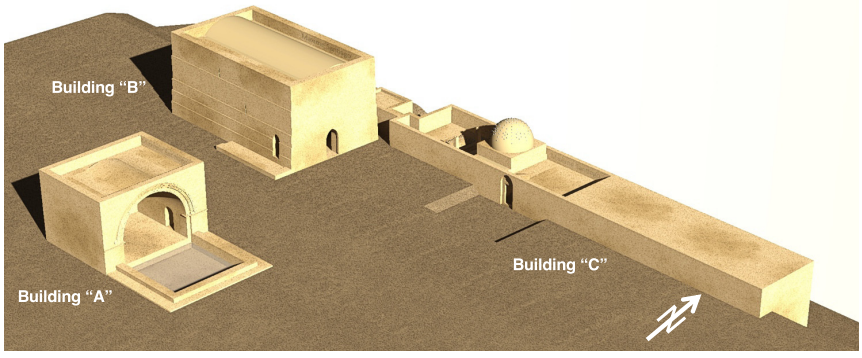
2 Context, Research History, and Current State of Knowledge

Hereafter, a brief overview of the archaeological site of Khirbat al-Dusaq is exposed. For any further information, we refer the interested reader to the specific publications written on the topic (Alby, Vigouroux, & Elter, 2019; Imbert & Vigouroux, 2020; Vigouroux & Elter, 2019; Vigouroux, Elter, Pascual, & March, 2015). The remains of Khirbat al-Dusaq are located in the high-plateau desert of southern Jordan, approximately 5 km to the east of the Shawbak fortress, also referred to as the "*Krak de Montréal*" by the Crusaders (Pringle, 1997). The Khirbat al-Dusaq ruins represent a medieval building compound – the construction of which dates back to the thirteenth century CE – composed of three different buildings (designated "A," "B," and "C") and arranged around a central courtyard (Figure 2). This ensemble is installed on a rocky outcrop overlooking the surrounding desert plain by about 50 m (Imbert & Vigouroux, 2020; Vigouroux & Elter, 2019, pp. 253–255; Vigouroux et al., 2015). The function of this complex was addressed by various scholars and travellers since the end of the nineteenth century CE and during the early twentieth century CE. The latter successively proposed to see in this building complex the remains of a Byzantine church, a caravanserai, a palace, a fort, or even a mosque (Brünnow & Domaszewski, 1904; Hill, 1897; Imbert & Vigouroux, 2020; Meistermann, 1909; Vailhé, 1898; Vigouroux & Elter, 2019; Vigouroux et al., 2015).

More recently, French archaeological research carried out onsite by the *Institut Français du Proche-Orient* (IFPO) under the direction of the late J.-P. Pascual (from 2008 till 2009), and subsequently under É. Vigouroux and R. Elter (since 2014), revealed the site of Khirbat al-Dusaq to be a sort of leisure settlement, commissioned by the Ayyubid Sultan al-Malik al-Mu'azzam 'Isa – a nephew of An-Nasir Salah ad-Din Yusuf ibn Ayyub, the Sultan Saladin (1138–1193 CE) – and inaugurated in 1223 CE (Imbert & Vigouroux, 2020; Vigouroux & Elter, 2019). The whole site seems thus erected either for the attention of an elite or as a relay station on the *Darb al-Hajj*; the pilgrimage route to Mecca (present-day Saudi Arabia) (Dauphin, Ben Jeddou, & Castex, 2015; Imbert & Vigouroux, 2020; Vigouroux & Elter, 2019; Vigouroux et al., 2015). In fact, archaeological evidence such as material finds, architectural and decorative elements, but also the fragmented foundation inscription of the compound, suggest – at present – an occupation period extending at least from the Ayyubid to the Mamluk eras. Thereafter, the site was reoccupied – presumably on a sporadic basis – until at least the early twentieth century CE. In this sense, it notably served as a sporadic burial ground during the sixteenth to nineteenth centuries CE and as a garrison during the Great Arab Revolt of 1916–1918 CE (Falls, 1930; Hofstetter, 2017, 2018; Murphy, 2008).

Today, the overall understanding of the original purpose of this desert complex is derived from the functional interpretation of its various components. Thus, building "A" has the typical architectural characteristics of an *iwan* – i.e., a quadrangular vaulted reception room with a single opening towards a reflecting pool (Grabar, 1997) – while building "C" displays the characteristic features of a *hammam*, i.e., a bathing complex (Benkheira, 2003; Écochard & Le Cœur, 1942–1943). Here again, this interpretation results from *in situ* identification of diagnostic architectural elements. Among these, one might mention in particular a hypocaust-type floor heating system and an associated furnace as well as the remains of





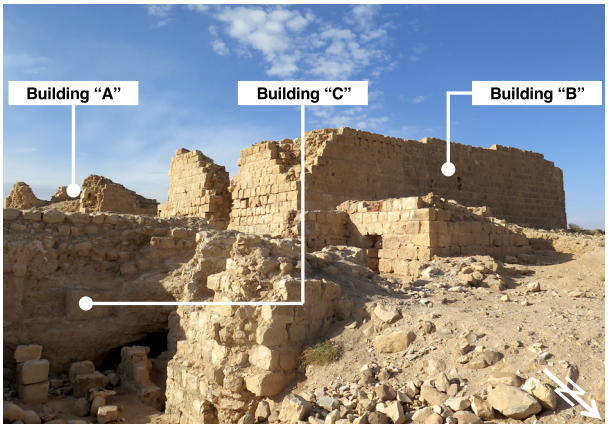


Figure 2: Map (top), 3D restitution (centre) and photography (bottom) of the Khirbat al-Dusaq desert complex. Based on Vigouroux & Elter (2019), Alby et al. (2019), reworked by Hofstetter (2022).

cisterns and a basin. Furthermore, the general layout of this specific building is close to that of other *hammams* known throughout the medieval Arab world. Building "B" on its part, has been interpreted as a possible residential structure (Vigouroux & Elter, 2019; Vigouroux et al., 2015). Finally, it is noteworthy that Khirbat al-Dusaq yielded several fragmented Arabic inscriptions (amongst which a door lintel bearing the complex's foundation date). Hence, the confrontation of material remains and inscriptions with palaeographic and onomastic data retrieved through the study of selected available historical sources allowed to place Khirbat al-Dusaq within the wider socioeconomic and political panorama of the reign of Sultan Al-Mu'azzam 'Isa (Imbert & Vigouroux, 2020).

Furthermore, in addition to archaeological materials such as ceramics and small- to medium-sized architectural elements, the detailed archaeological investigation of the post-abandonment occupation levels of this building complex (*circa* sixteenth to twentieth century CE) led to the discovery of six distinct deposits of human remains (in addition to the weathered and commingled remains of at least five further individuals scattered throughout the complex's courtyard). Likely, this reflects the occasional re-use of the abandoned complex as an intermittent burial ground by local Bedouin tribes due to its convenient location on a rocky ridge that stands out from the surrounding landscape; a recurrent implantation choice for Bedouin tombs (Mustafa & Abu Tayeh, 2013; Petersen, 2013; Schultz, 2006).

3 Methods and Terminological Aspects

As far as human remains are concerned, indicators of cranial gracility and robustness were scored according to Acsádi and Nemeskéri (1970). Sex was determined based on the evaluation of pelvic morphology, using methods developed by Bruzek (1991, 2002), Bruzek, Castex, and Majo (1996) and Murail, Bruzek, Houët, and Cunha (2005). The age at death in juvenile subjects was established according to the comparative tables published by AlQahtani, Hector, and Liversidge (2010), Cardoso (2007), Moorrees, Fanning, and Hunt, (1963a,b), Schaefer, Black, and Scheuer (2009), Scheuer and Black (2000), Schour and Massler (1941), Schwarz (2007), and the International Forensic Center of Excellence ("INFORCE") (2007) and by means of Schmitt's method for adults (2001, 2005). In the case of infants and neonates, we adopted the morphometric methods for age estimation developed by Adalian (2001) and Fazekas and Kosa (1978). Adult stature was estimated using Trotter's method (1970). In the case of immatures, Olivier's method (1969) was used, while Olivier and Pineau's method for stature estimation (1960) was applied to individuals younger than 1 year.

In cases where several individuals were placed within the same funerary structure, we established a minimum number of individuals (MNI) in terms of frequency and exclusion based on the identifiable bone fragments. This calculation was refined by the elaboration of the most likely number of individuals. This was achieved by following a methodology developed by Adams and Konigsberg (2004), Demangeot (2008), Parmentier (2010), and Poplin (1976, 1981).

The classification of bone alterations or lesions followed a comparative approach based on reference works in terms of palaeopathology (Aufderheide & Rodriguez-Martin, 1998; Roberts & Manchester, 2007) and forensic and lesional anthropology (Beauthier, 2011; Quatrehomme, 2015). Given the heterogeneous state of preservation of the bones and the relatively low percentage of total skeletal elements recovered, these approaches are meant to be primarily illustrative of the diversity of skeletal features encountered at Khirbat al-Dusaq. Indeed, the dry state of preservation of the bones under study as well as the stony and sandy desertic climate of Khirbat al-Dusaq renders the reading, differentiation and interpretation of skeletal injuries, and taphonomic alterations rather problematic. Therefore, we sought to develop an essentially descriptive approach to the main observable skeletal anomalies, since an in-depth etiological approach and the elaboration of differential diagnoses appeared to be a rather complex task. In this sense, we first tried to distinguish *ante-mortem* and *peri-mortem* bone alterations or lesions from *post-mortem* damage (Aufderheide & Rodriguez-Martin, 1998; Beauthier, 2011; Cunha & Pinheiro, 2013, pp. 76–79; Fernández-Crespo, Ordoño, Llanos, & Schulting, 2020; Kanz & Grossschmidt, 2006; Kemp, 2016; Lewis, 2008;

MacCardle & Stojanovsky, 2018; Quatrehomme, 2015; Tumler, Paladin, & Zink, 2019; Vachirawongsakorn et al., 2021; Vazzana et al., 2018; Wallduck & Bello, 2016). Anatomical positioning and contextualisation efforts were also undertaken to shed light on how and what might have caused the observed alterations or lesions, as well as – given the case – how they might have been perpetrated.

Terminologically speaking, to describe the arrangement and funerary treatment of the individuals exhumed at Khirbat al-Dusaq, we mobilised the following descriptive terminology (Figure 3), which is inspired by the seminal work of Duday (1990, 2009), Duday et al. (1990), and Boulestin and Duday (2005).

4 Bioanthropological Study Results

4.1 Structure no 1 (Pièce 4): Taphonomic, Archaeothanatological, and Osteological Analysis

Structure no 1 (Pièce 4) was found during the excavation work in Pièce 4 (French for "room"), during fieldwork operations conducted in 2015. It represents a primary single deposit, i.e., a small funeral structure embedded in the post-abandonment layers of the bathing complex, covered in vault and ceiling debris. It is set into the southwestern angle of Pièce 4. Two subrectangular stones delimit its northern and eastern sides, thus forming a small quadrangular grave (Figure 4). The bottom of this burial is slightly higher (roughly 15 cm) than the original floor of the room.

In osteological terms, the strongly commingled remains of a close to term or neonate child were uncovered within this grave. Bioanthropological data show that the age at death ranges from 9.5 to 10 lunar months (based on tooth eruption (AlQahtani et al., 2010) and long limb bone measures (Cardoso, 2007; Schaefer et al., 2009; Scheuer & Black, 2000). Accordingly, a mean estimation of the body size around 48.36 ± 2.49 cm was achieved (Adalian, 2001; Scheuer & Black, 2000; Fazekas & Kosa, 1978). The sepulchral character of this deposit appears rather clearly in the effort undertaken to delimit the grave with two subrectangular stones. No grave goods were found within this structure.

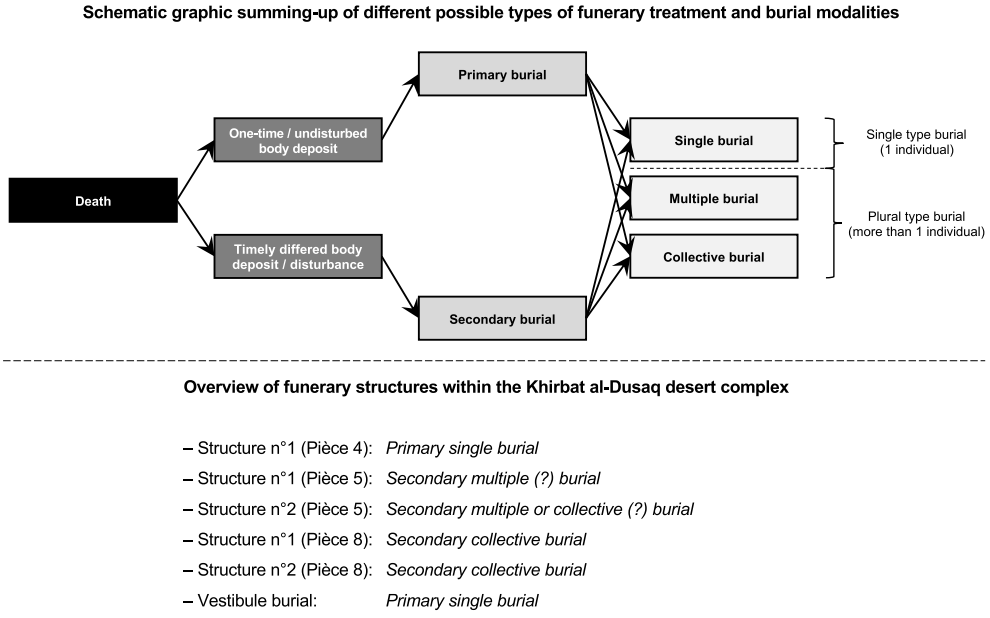


Figure 3: Schematic graphic summing-up of different possible types of funerary treatment and burial modalities. Compiled by Hofstetter (2022).

Figure 4: Field photographic documentation of Structure no 1 (Pièce 4) after excavation. Photograph by Vigouroux (2015).

4.2 Structure no 1 (Pièce 5): Taphonomic Archaeothanatological and Osteological Analysis

Structure no 1 (Pièce 5) was uncovered in 2015, in Pièce 5, in the middle of what appear to be the remains of a changing or "locker" room linked to the *hammam* (Vigouroux & Elter, 2019; Vigouroux et al., 2015). This bone assemblage was found embedded into the post-abandonment layers of this room and totally sealed off by vault collapse debris. Its overall dimensions are as follows: 75 cm in length, 50 cm in width, and 35 cm in depth (Vigouroux et al., 2015). Furthermore, no archaeological sign of a specific ritual practice whatsoever (such as a surface marking or grave deposits) was identified. However, a chronological attribution through radiocarbon dating, retrieved from a cranial vault sample contained within the structure, yielded a calibrated date ranging from 1662 to 1781 CE.

Structure no 1 (Pièce 5) is compact and well delimited (Figure 5). These characteristics – as well as the fact that it was totally covered by the debris of the collapsed ceiling – lead to the assumption that all bones were deposited simultaneously and that a constraining structure had held them together, allowing for little or no post-depositional bone movements. However, the possibility of a sturdy pit burial is ruled out by the fact that certain bones reach out beyond the limits of the clearly delineated central compacted heap of remains. Likewise, decomposition within an uncluttered space can also be excluded due to the overall very compact aspect of the deposit. Moreover, one observes a total absence of anatomic connections between the bones, thus indicating that they were most probably placed into the structure in a dry state, and leaving us to conclude that these bones were gathered into Structure no 1 (Pièce 5) once body decomposition had

Structure n°1 (Pièce 5): field documentation

Structure n°1 (Pièce 5) before excavation (note the vault debris visible to the left)

Structure n°1 (Pièce 5) during excavation (note the compact aspect of the deposit)

Figure 5: Field photographic documentation of Structure no 1 (Pièce 5) before excavation (top) and after excavation (bottom). Photographs by Vigouroux (2015).

already been underway for a certain amount of time. This phenomenon can take place anytime between a few weeks or months after the death, depending on the environment, cause of death, and if the deceased is naked or not (Bonnabel, 2012; Boulestin & Duday, 2005; Duday et al., 1990; Duday, 1990, 2009; Sorg & Haglund, 1997, pp. 151–163). In the case of Structure no 1 (Pièce 5), no discriminating features, which would have enabled us to determine the precise elapsed amount of time between the death of these individuals and their final deposition into this specific structure, were found (safe for the estimated dislocation times of labile and persistent anatomical connections (*cf. infra*)).

The focus was first set on the estimation of the MNI enclosed in Structure no 1 (Pièce 5), based on the $n_{tot} = 204$ retrieved bones (Table 1). Final results indicate that at least 11 individuals were deposited into this structure. Eventually, among these 11 individuals, 4 immatures (2 aged between 5 and 9 years and 2 aged between 16 and 25 years) and 7 adults (age at death ranging from 26 to 60 years) were identified. Amongst the adults, three individuals' sex could not be determined, while two are male and two are female (Figure 6).

In addition, the palaeopathological analysis revealed few signs of severe visible diseases on these bones (Figure 7). Most of them even show no pathological modification at all. No typical distribution of specific health issues was observed (such as skeletal markers of respiratory conditions for instance), which could have supported the epidemic mass burial perspective. As such, only fractures and isolated manifestations of either osteophytic and lytic activity or degenerative lesions were recorded, mainly on the axial skeleton. A single occurrence of an antero-posterior lumbar vertebral collapse was also identified, as well as a single occurrence of an atrophied left femur and tibia, possibly resulting from pain-induced leg disuse (Akechi et al., 2021; Aufderheide & Rodriguez-Martin, 1998; Marshall & Crisp, 2000).

4.3 Structure no 1 (Pièce 5): Traces of Interpersonal Violence and/or Specific *Post-Mortem* Treatments (?)

The thorough examination of the previously presented bone assemblage further led to the discovery of ambiguous marks, taking on certain morphological traits of skeletal trauma. As previously exposed, the state of preservation and the weathering of the bones under study render the reading, differentiation, and interpretation of lesions and taphonomic alterations rather problematic. Still, forensic anthropological methods were used to try and determine the origin and type of the observed lesions (Beauthier, 2011; Cattaneo, 2007; Kanz & Grossschmidt, 2006; Quatrehomme, 2015; Tumler et al., 2019; Vazzana et al., 2018; Wallduck & Bello, 2016).

In this sense, the supposedly *peri-mortem* lesions which were observed within this bone assemblage all take the form of cut marks with clean, slightly darkened edges, and appear to be the result of sharp force trauma (Cunha & Pinheiro, 2013, pp. 76–79; Lewis, 2008; MacCardle & Stojanovsky, 2018; Quatrehomme, 2015; Vachirawongsakorn et al., 2021; Vazzana et al., 2018). On the other hand, the observed *post-mortem* lesions are morphologically more diverse, yet their careful study still appeared of interest in the reconstruction of the possible *post-mortem* treatment of these bones (*cf. infra: sections* "Historical data" and "Data synthesis [...]").

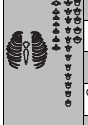
More particularly, *peri-mortem*-like lesions (Figure 8) were observed on a right adult scapula: one identifies a cut mark and bone defect on the inferior and posterior portion of the acromial process – possibly consequential to a blow inflicted vertically in the coronal plane. A second similar mark extends from the acromial spine to the lateral border: possibly the result of a powerful vertical hit in the sagittal plane. Another potential *peri-mortem* cut mark was identified on a left adult rib: located medially and on the superior edge, most probably subsequent to an antero-posterior blow (or contrariwise) delivered in the transversal plane. In addition, two further ribs (one left and one right) present very similar marks.

Even though their true nature remains unclear at this point, these features still share certain common forensic characteristics: they could potentially all result from forceful penetrating trauma inflicted by means of a sharp object such as a sword blade (or the more local traditional Arabian scimitar) (Lewis, 2008; Ögel, 1948). This observation is corroborated by the morphology and the locations of the lesions, since, in order to strike at these places in a still-living or freshly deceased human, one has to cut through

Table 1: Osteological inventory of Structure no 1 (Pièce 5)

Structure n°1

Pièce 5

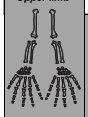
Anatomical region	Bone	Inventory nb. / Tot. amount (mult. lots)	Laterality	Bone maturation	Sex / Gracility and Robustness	Osteological features (patho., trauma, anatomic. var.)	Remarks	MNI (by anatomical region)
Cranium and mandible 	Cranium (**complete,** teeth *in situ*)	**Cr-1**		Adult (*Schwartz 2007 ; INFORCE*)	Indetermined (*Acsádi & Nemeskéri 1970*)		Matchable with **Mand-1**	**7 individuals (2 immatures)**
		Cr-2		Adult (*Schwartz 2007 ; INFORCE*)	Indetermined (gracile tend.) (*Acsádi & Nemeskéri 1970*)		Matchable with **Mand-2**	
		cr-3		Immat.: 5-9 yrs. (*Schour & Massler 1941; Schwartz 2007; INFORCE*)			Matchable with **mand-4**	
	Cranium (**frag.,** teeth *in situ*)	**cr-4**		Immat.: 5-9 yrs. (*Schour & Massler 1941; Schwartz 2007; INFORCE*)			Matchable with **hmand-3**	
	Hemimandible (teeth *in situ*)	**HMax-1**	Right	Adult (*Schwartz 2007; INFORCE*)			Controlateral of **Max-2** / Matchable with **Mand-3**	
		HMax-2	Left	Adult (*Schwartz 2007; INFORCE*)			Controlateral of **Max-1** / Matchable with **Mand-3**	
	Mandible (teeth *in situ*)	**Mand-1**		Adult (*Schwartz 2007; INFORCE*)			Matchable with **Cr-1**	
		Mand-2		Adult (*Schwartz 2007; INFORCE*)			Matchable with **Cr-2**	
		Mand-3		Adult (*Schwartz 2007; INFORCE*)			Matchable with **HMax-1** and **HMax-2**	
		mand-4		Immat.: 5-9 yrs. (*Schour & Massler 1941; Schwartz 2007; INFORCE*)			Matchable with **cr-3**	
	Hemimandible (teeth *in situ*)	**HMand-1**	Right	Adulte (*Schwartz 2007; INFORCE*)				
		HMand-2	Right	Adulte (*Schwartz 2007; INFORCE*)				
		hmand-3	Right	Immat.: 5-9 yrs. (*Schour & Massler 1941; Schwartz 2007; INFORCE*)			Matchable with **cr-4**	
Shoulder girdle 	Scapula	**Scap-1**	Right	Adult (*Schwartz 2007; INFORCE*)		*Peri-mortem* cut marks (?) (post. side, sup. angle of the ext. border)		**4 individuals (1 immature)**
		Scap-2	Right	Adult (*Schwartz 2007; INFORCE*)		Coracoid notch		
		Scap-3	Right	Adult (*Schwartz 2007; INFORCE*)		Coracoid notch		
		Scap-4	Right	Adult (*Schwartz 2007; INFORCE*)		Coracoid notch		
		Scap-5	Left	Adult (*Schwartz 2007; INFORCE*)		Coracoid notch		
		Scap-6	Left	Adult (*Schwartz 2007; INFORCE*)		Coracoid notch		
		Scap-7	Left	Adult (*Schwartz 2007; INFORCE*)				
	Clavicle	**Clav-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
		Clav-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		clav-3	Right	Immature: 17-19 yrs. (*Schwartz 2007; INFORCE*)			Matchable with **clav-7**	
		Clav-4	Left	Adult (*Schwartz 2007; INFORCE*)				
		Clav-5	Left	Adult (*Schwartz 2007; INFORCE*)				
		Clav-6	Left	Adult (*Schwartz 2007; INFORCE*)		Oblique fracture with healing callus		
		clav-7	Left	Immature: 17-19 yrs. (*Schwartz 2007; INFORCE*)			Matchable with **clav-3**	
Axial skeleton 	1st rib	**PCôt-1**	Right	Adult (*Schwartz 2007; INFORCE*)				**6 individuals (2 immatures)**
		PCôt-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		PCôt-3	Left	Adult (*Schwartz 2007; INFORCE*)		Generalized osteophytic manifestations		
		PCôt-4	Left	Adult (*Schwartz 2007; INFORCE*)		Osteolytic manifestations (posterior ridge and head)		
		PCôt-5	Left	Adult (*Schwartz 2007; INFORCE*)				
	Ribs nb. II-XII	**30**	Right	Adult (*Schwartz 2007; INFORCE*)		Dispersed osteophytic, arthrosic and traumatic manifestations		
		29	Left	Adult (*Schwartz 2007; INFORCE*)		Dispersed osteophytic, arthrosic and traumatic manifestations		
	Ribs nb. I-XII	**8**	Right	Immature: at least 2 bone matur. stages (*Schwartz 2007; INFORCE*)				
		2	Left	Immature: at least 2 bone matur. stages (*Schwartz 2007; INFORCE*)				
	Cervical vertebra nb. I ("Atlas")	**Atlas-1**		Adult (*Schwartz 2007; INFORCE*)				
	Cervical vertebra nb. II ("Axis")	**Axis-1**		Adult (*Schwartz 2007; INFORCE*)				
	Cervical vertebr. nb. III-VII	**4**		Adult (*Schwartz 2007; INFORCE*)				
	Thoracic vertebr. nb. I-XII	**22**		Adult (*Schwartz 2007; INFORCE*)		Osteophytic and arthrosic manif., bony spurs and Pott's disease		
	Lumbar vertebr. nb. I-V	**19**		Adult (*Schwartz 2007; INFORCE*)		Osteophytic and arthrosic manif., bony spurs and Pott's disease		
	Thoracic vertebr. (immat.), nb. I-XII	**1**		Immature: less than 14 yrs. (*Schwartz 2007; INFORCE*)				
	Lumbar vertebr. (immat.), nb. I-V	**1**		Immature: less than 14 yrs. (Schwartz 2007; INFORCE)				

(*Continued*)

Table 1: *Continued*

Structure n°1

Pièce 5

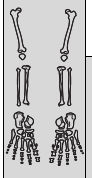
Anatomical region	Bone	Inventory nb. / Tot. amount (mult. lots)	Laterality	Bone maturation	Sex / Gracility and Robustness	Osteological features (patho., trauma, anatomic. var.)	Remarks	MNI (by anatomical region)
Upper limb 	Humerus	**Hum-1**	Right	Adult (*Schwartz 2007; INFORCE*)		*Post-mortem* (?) perforation below humeral head		6 individuals (3 immatures)
		Hum-2	Right	Adult (*Schwartz 2007; INFORCE*)		*Post-mortem* (?) olecranon perforation		
		Hum-3	Left	Adult (*Schwartz 2007; INFORCE*)		*Post-mort.* (?) perf. below hum. head and *peri-mort.* (?) cut on capitulum		
		Hum-4	Left	Adult (*Schwartz 2007; INFORCE*)		*Post-mortem* (?) perforation below humeral head		
		Hum-5	Left	Adult (*Schwartz 2007; INFORCE*)		Post-mortem (?) perforation below humeral head		
		hum-6	Right	Immature: less than 12 yrs. (*Schwartz 2007; INFORCE*)				
		hum-7	Right	Immature: less than 19 yrs. (*Schwartz 2007; INFORCE*)				
		hum-8	Left	Immature: less than 12 yrs. (*Schwartz 2007 ; INFORCE*)				
	Radius	**Rad-1**	Right	Adult (*Schwartz 2007; INFORCE*)		*Post-mortem* (?) alteration (proximo-distal end)		
		Rad-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		Rad-3	Right	Adult (*Schwartz 2007; INFORCE*)				
		Rad-4	Left	Adult (*Schwartz 2007; INFORCE*)				
		Rad-5	Left	Adult (*Schwartz 2007; INFORCE*)				
		rad-6	Left	Immature: less than 17 yrs. (*Schwartz 2007; INFORCE*)			At least 3 different bone maturation stages (*Schwartz 2007; INFORCE*)	
		rad-7	Right	Immature: less than 17 yrs. (*Schwartz 2007; INFORCE*)				
		rad-8	Right	Immature: less than 17 yrs. (*Schwartz 2007; INFORCE*)				
		rad-9	Left	Immature: less than 17 yrs. (*Schwartz 2007 ; INFORCE*)				
	Ulna	**Uln-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
		Uln-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		Uln-3	Right	Adult (*Schwartz 2007; INFORCE*)				
		Uln-4	Left	Adult (*Schwartz 2007; INFORCE*)				
		Uln-5	Left	Adult (*Schwartz 2007; INFORCE*)				
		uln-6	Right	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)				
		uln-7	Right	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)			At least 2 different bone maturation stages (*Schwartz 2007; INFORCE*)	
		uln-8	Left	Immature: less than 16 yrs (*Schwartz 2007 ; INFORCE*)				
	2nd Metacarpal	**DMetac-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
	3rd Metacarpal	**TMetac-1**	Left	Adult (*Schwartz 2007; INFORCE*)				
		TMetac-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		TMetac-3	Left	Adult (*Schwartz 2007; INFORCE*)				
	4th Metacarpal	**QMetac-1**	Left	Adult (*Schwartz 2007; INFORCE*)				
	5th Metacarpal	**CMetac-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
		CMetac-2	Left	Adult (*Schwartz 2007; INFORCE*)				
	Phalanges (**manual**)	**8**	Right & left	Adult (*Schwartz 2007; INFORCE*)		Several osteophytic, traumatic and *post-mortem* (?) alterations		
Pelvic girdle (and sacrum) 	Coxal bone	**Cox-1**	Right	Adult: 30-59 yrs. (*Schmitt 2001, 2005*)	Male (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)			5 individuals (1 immature)
		Cox-2	Right	Adult: 20-39 yrs. (*Schmitt 2001, 2005*)	Female (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)	*Post-mortem* (?) perforation of the iliac crest		
		Cox-3	Right	Adult: 20-49 yrs. (*Schmitt 2001, 2005*)	Female (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)	*Post-mortem* (?) perforation of ilium's internal face	Matchable with **Cox-7** and **Sac-1**	
		Cox-4	Left	Adult: 20-39 yrs. (*Schmitt 2001, 2005*)	Male (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)	*Post-mortem* (?) *alteration* (ant.-sup. marg. of great. sciat. notch)		
		Cox-5	Left	Adult: 20-49 yrs. (*Schmitt 2001, 2005*)	Female (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)	*Post-mortem* (?) perforation of ilium's internal face		
		Cox-6	Left	Adult: less than 60 yrs. (*Schmitt 2001, 2005*)	Male (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)			
		Cox-7	Left	Adult: 20-49 yrs. (*Schmitt 2001, 2005*)	Female (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)		Matchable with **Cox-3** and **Sac-1**	
		cox-8	Right	Immature: less than 9 yrs. (*Schwartz 2007; INFORCE*)		*Post-mortem* (?) perf. of ilium's internal face and sup. ridge	Matchable with **cox-9**	
		cox-9	Left	Immature: less than 9 yrs. (*Schwartz 2007; INFORCE*)			Matchable with **cox-8**	
	Coxal bone (**fragmented**)	**Cox-10**	Right	Adult: over 40 yrs. (*Schmitt 2001, 2005*)	Male (*Bruzek 1991, 2002; Bruzek et al. 1996*)		Matching ilium and pubis	
	Sacrum	**Sac-1**		Adult (*Schwartz 2007; INFORCE*)			Matchable with **Cox-3** and **Cox-7**	

(*Continued*)

Table 1: *Continued*

Structure n°1

Pièce 5

Anatomical region	Bone	Inventory nb. / Tot. amount (mult. lots)	Laterality	Bone maturation	Sex / Gracility and Robustness	Osteological features (patho., trauma, anatomic. var.)	Remarks	MNI (by anatomical region)
Lower limb 	Femur	**Fem-1**	Right	Adult (*Schwartz 2007; INFORCE*)				11 individuals (4 immatures)
		Fem-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		Fem-3	Right	Adult (*Schwartz 2007; INFORCE*)				
		Fem-4	Left	Adult (*Schwartz 2007; INFORCE*)		General. left lower limb patho. (atrophied femur and tibia)	Matchable with **Tib-6**	
		Fem-5	Left	Adult (*Schwartz 2007; INFORCE*)				
		Fem-6	Right	Adult (*Schwartz 2007; INFORCE*)				
		fem-7	Right	Immature: less than 15 yrs. (*Schwartz 2007; INFORCE*)			At least 2 diff. bone maturation stages (*Schwartz 2007; INFORCE*), respect. matchable with **fem-9** and **fem-10**	
		fem-8	Right	Immature: less than 15 yrs. (*Schwartz 2007; INFORCE*)				
		fem-9	Left	Immature: less than 15 yrs. (*Schwartz 2007; INFORCE*)		*Post-mortem* (?) cut mark on trochanter	At least 2 diff. bone maturation stages (*Schwartz 2007; INFORCE*), respect. matchable with **fem-7** and **fem-8**	
		fem-10	Left	Immature: less than 15 yrs. (*Schwartz 2007; INFORCE*)				
	Femur (**fragmented**)	**Fem-11**	Right	Adult (*Schwartz 2007; INFORCE*)			Sup. ⅗ of bone, no overlap with **Fem-12** = indep. bone	
		Fem-12	Right	Adult (*Schwartz 2007; INFORCE*)			Inf. ¼ of bone, no overlap with **Fem-11** = indep. bone	
	Tibia	**Tib-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Lateral *post-mortem* (?) perforation of sup. epi- and diaphysis junction		
		Tib-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		Tib-3	Right	Adult (*Schwartz 2007; INFORCE*)				
		Tib-4	Right	Adult (*Schwartz 2007; INFORCE*)				
		Tib-5	Right	Adult (*Schwartz 2007; INFORCE*)				
		Tib-6	Left	Adult (*Schwartz 2007; INFORCE*)		General. left lower limb patho. (atrophied femur and tibia)	Matchable with **Fem-4**	
		Tib-7	Left	Adult (*Schwartz 2007; INFORCE*)				
		Tib-8	Left	Adult (*Schwartz 2007; INFORCE*)				
		tib-9	Right	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)				
		tib-10	Right	Immature: less than 8 yrs. (*Schwartz 2007; INFORCE*)				
		tib-11	Left	Immature: 18-20 yrs. (*Schwartz 2007; INFORCE*)				
		tib-12	Left	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)				
	Fibula	**Fib-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Osteophytic manifestations on proximal and distal epiphysis		
		Fib-2	Droit	Adult (*Schwartz 200 ; INFORCE*)		Osteophyt., enthesopath. and osteoblast. manif. at tibio-fibulary lig. insert		
		Fib-3	Droit	Adult (*Schwartz 2007; INFORCE*)				
		Fib-4	Droit	Adult (*Schwartz 2007; INFORCE*)				
		Fib-5	Left	Adult (*Schwartz 2007; INFORCE*)		Osteophytic manifestations on proximal and distal epiphysis		
		Fib-6	Left	Adult (*Schwartz 2007; INFORCE*)		Osteophytic manifestations on proximal and distal epiphysis		
	Fibula (**fragmented**)	**Fib-7**	Left	Adult (?) (*Schwartz 2007; INFORCE*)			No proximal epiphysis but overlap = indep. bone	
		Fib-8	Left	Adult (?) (*Schwartz 2007; INFORCE*)			Diaphysis only, overlap = indep. bone	
		Fib-9	Left	Adult (?) (*Schwartz 2007; INFORCE*)			Diaphysis only, overlap = indep. bone	
		Fib-10	Left	Adult (?) (*Schwartz 2007; INFORCE*)			Sup. ½ present, overlap = indep. bone	
		Fib-11	Left	Adult (?) (*Schwartz 200 ; INFORCE*)			Inf. ½ present, overlap = indep. bone	
		fib-12	Right	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)			Matchable with **fib-13**	
		fib-13	Left	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)			Matchable with **fib-14**	
		fib-14	Left	Immature: 20-25 yrs. (*Schwartz 2007; INFORCE*)				
		fib-15	Left	Immature: 20-25 yrs. (*Schwartz 2007; INFORCE*)				
	Calcaneus	**Calc-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Osteophyt. manif. on inf. surf. and ossif. calcaneo-fibular lig. insert		
		Calc-2	Left	Adult (*Schwartz 2007; INFORCE*)				
		Calc-3	Left	Adult (*Schwartz 2007; INFORCE*)				
		Calc-4	Left	Adult (*Schwartz 2007; INFORCE*)				
	Cuboid	**Cub-1**	Right	Adult (*Schwartz 2007; INFORCE*)				

(*Continued*)

Table 1: *Continued*

Structure n°1

Pièce 5

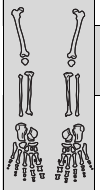
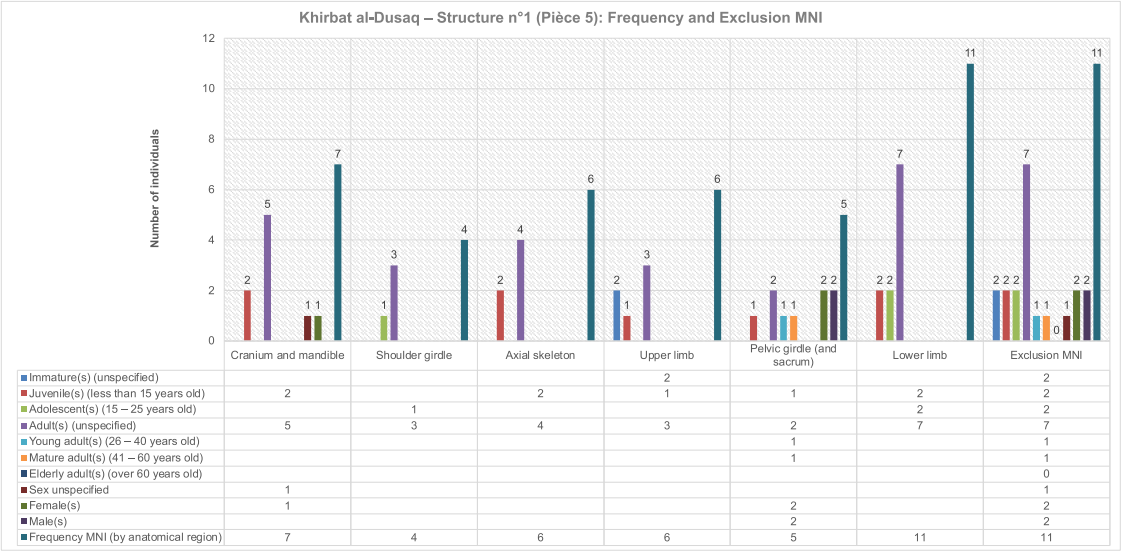
Anatomical region	Bone	Inventory nb. / Tot. amount (mult. lots)	Laterality	Bone maturation	Sex / Gracility and Robustness	Osteological features (patho., trauma, anatomic. var.)	Remarks	MNI (by anatomical region)
Lower limb (continued) 	Talus	**Tal-1**	Right	Adult (*Schwartz 2007; INFORCE*)				11 indviduals (4 immatures)
		Tal-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		Tal-3	Right	Adult (*Schwartz 2007; INFORCE*)				
		Tal-4	Right	Adult (*Schwartz 2007; INFORCE*)				
	1st Metatarsal	**PMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
		PMetat-2	Left	Adult (*Schwartz 2007; INFORCE*)				
		PMetat-3	Left	Adult (*Schwartz 2007; INFORCE*)				
		PMetat-4	Left	Adult (*Schwartz 2007; INFORCE*)				
		PMetat-5	Left	Adult (*Schwartz 2007; INFORCE*)				
		pmetat-6	Left	Immature: less than 12 yrs. (*Schwartz 2007; INFORCE*)				
	2nd Metatarsal	**DMetat-1**	Right	Adult (*Schwartz 200 ; INFORCE*)				
		DMetat-2	Left	Adult (*Schwartz 2007; INFORCE*)				
		DMetat-3	Left	Adult (*Schwartz 2007; INFORCE*)				
	4th Metatarsal	**QMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
		QMetat-2	Left	Adult (*Schwartz 2007; INFORCE*)				
	5th Metatarsal	**CMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
		CMetat-2	Right	Adult (*Schwartz 2007; INFORCE*)				
		CMetat-3	Right	Adult (*Schwartz 2007; INFORCE*)				
		CMetat-4	Right	Adult (*Schwartz 2007; INFORCE*)				
		CMetat-5	Left	Adult (*Schwartz 2007; INFORCE*)				
		CMetat-6	Left	Adult (*Schwartz 2007; INFORCE*)				
		CMetat-7	Left	Adult (*Schwartz 2007; INFORCE*)				
		CMetat-8	Left	Adult (*Schwartz 2007; INFORCE*)				
	Phalanges (**pedal**)	**3**	Right & left	Adult (*Schwartz 2007; INFORCE*)		Several osteophytic manifestations		

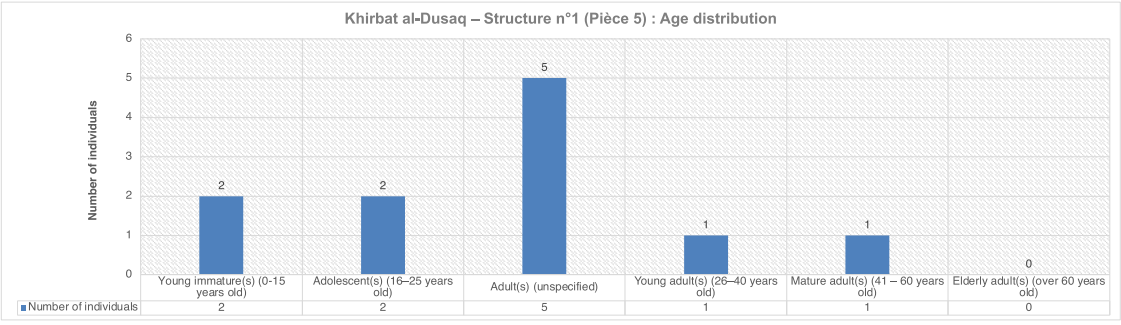
Figure by Hofstetter (2017).

other anatomical and skeletal structures. Owing to this fact, one is provided with an appreciation of the energy which would have been needed to perpetrate these blows. In addition, the lesions to the rib cage might well be the result of an intended deadly strike (Beauthier, 2011; Martini, Timmons, & Tallitsch, 2015; Quatrehomme, 2015; Schwarz, 2007). Pattern analysis further reveals that these strikes are not the result of self-inflicted injuries due to their specific location and morphology. This led us to consider that they possibly result from interpersonal violence (Beauthier, 2011; Quatrehomme, 2015).

As previously mentioned, *post-mortem* alterations were also identified on the bones under study, although – again – in some cases, taphonomic changes (e.g. desiccation or animal gnawing) could not be excluded (Aufderheide & Rodriguez-Martin, 1998; Cunha & Pinheiro, 2013, pp. 76–79; Lewis, 2008; Quatrehomme, 2015; Vazzana, et al., 2018; Wallduck & Bello, 2016).

The traces of *post-mortem* alterations take essentially two forms. The first form resembles cut marks on dry bone. These were observed on a left adult humerus' capitulum, resulting in the complete severing of the lateral condylar region. Likewise, a right adult radius' head appears to split in half lengthwise, leaving only





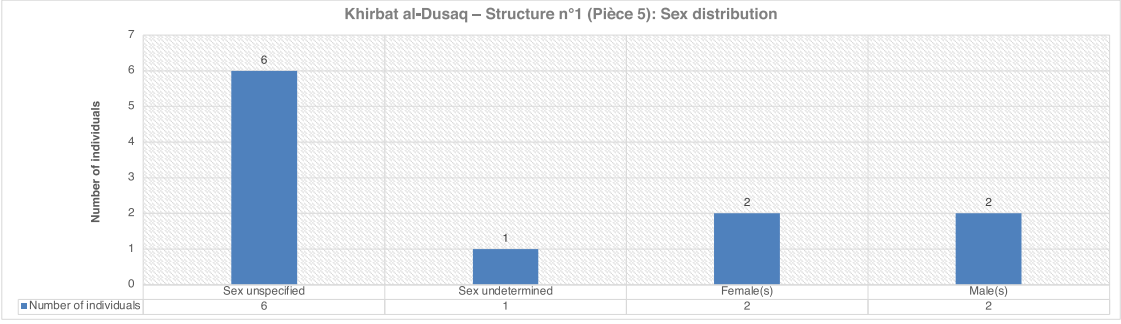


Figure 6: Structure no 1 (Pièce 5): frequency and exclusion MNI graph (top), age distribution graph (centre), and sex distribution graph (bottom). Figures by Hofstetter (2022).

half of the radial tuberosity *in situ*. Furthermore, a left young male's coxal bone displayed at least two distinct blows in the region around the greater sciatic notch, one of which seems to have separated the inferior posterior iliac spine from the coxal body. In both cases, the object responsible for this damage seems to have embedded itself deeply into the ischial body. The second form of *post-mortem* alterations was identified on four adult humeral heads, all of which show subquadrangular or slightly rounded perforations of the periosteum, in a size range varying from 5 to 10 mm and up to 2 cm in depth. Similar perforations were further observed on three (both adult and juvenile) coxal bones. Moreover, an intermediate adult manual phalanx and a juvenile femur's trochanter bear, respectively, a longitudinal split and

Figure 7: All structures: palaeopathological overview. Photographs by Hofstetter (2016).

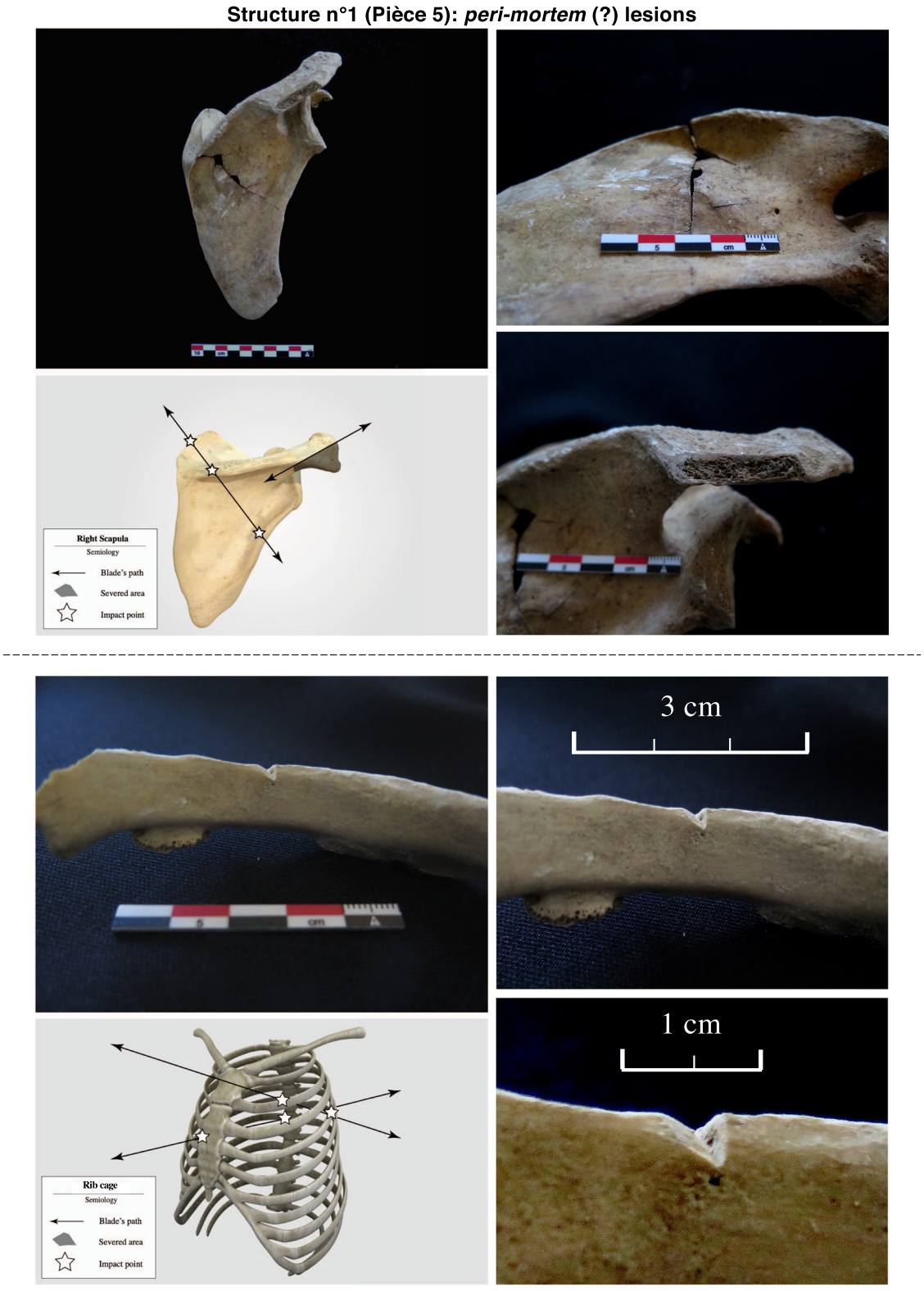


Figure 8: *Peri-mortem* (?) lesions on an adult right scapula (top) and an adult left rib (bottom). Photographs by Hofstetter (2016).

an elongated rectangular perforation. These alterations all seem closely related, morphologically speaking; they appear to be the result of possible shovel and pitchfork strikes inflicted posthumously on the bone deposit. However, as these damages did not occur during their archaeological excavation, it remains unclear when they were inflicted on the assemblage.

In sum, evidence gathered on Structure no 1 (Pièce 5) enables us to propose certain hypotheses regarding its inception and subsequent evolution. Since the bone deposit contains the remains of several people; it can be assumed that they either died roughly at the same time or were collected into a single grave at some point in time following their death. The compact aspect of the deposit tends to let one argue that this gathering effort took place in one sitting. However, due to the possibly violent treatment inflicted upon certain bones (roughly 2% of the total bone sample displays such features), one is left to question whether this treatment was inflicted on the whole group of people forming the deposit. In fact, and as far as one can judge by MNI count for instance, the wounded bones could well belong to one or several individuals. Further, some of the buried individuals might not bear any skeletal cut marks, either because none were inflicted on them or because the involved bone elements are weathered or not preserved to date. Another alternative is, of course, to consider that the mutilated remains were mixed up with uninjured individuals later on. Whether the bodies were left to decompose on the spot, or if they were first deposited within other graves, remains another open end at this point. However, it appears that once the bodies had decomposed to the point where most anatomical connections started to dislocate (*cf. infra: section* "Funerary recruitment and treatment [...]"), the remaining skeletal parts were then moved, all at once, into the bone deposit which we know today as Structure no 1 (Pièce 5), which would make it a secondary multiple burial. It is further to be noted that none of the missing or severed bone defects were uncovered within the deposit, hence leaving their whereabouts another open question at this point. Conclusively, bone displacement was probably done using shovels and pitchforks, therefore inflicting the observed, characteristic *post-mortem* lesions.

4.4 Structure no 2 (Pièce 5): Taphonomic, Archaeothanatological and Osteological Analysis

This structure was also found within Pièce 5 during the 2015 fieldwork operations. It appears as a rather loose deposit of bones, set against the northern wall of this room. It measures 50 cm in length, and 20 cm both in width and depth. It is embedded into the post-abandonment layers of the bathing complex. The remains' arrangement shows no sign of the existence of a constraining structure or specific funerary treatment whatsoever, and they remain in a state of complete absence of anatomical connections.

MNI assessment shows that this deposit comprises at least three individuals, one of which is a male, whilst the other two did not yield any sex evaluation. Age at death could be estimated for all three individuals: one is aged less than 20 years; the two others are aged 20–59 (Figure 9; Table 2). A palaeopathological analysis revealed osteophytic activity mainly on the axial skeletons of the two adult individuals. An occurrence of a possible osteochondritis was also observed, as well as a severe humero-clavicular-scapular fracture on the immature's left shoulder (Aufderheide & Rodriguez-Martin, 1998).

It thus appears that this bone deposit is the possible result of a one-time or gradual dispersion of older graves against the northern wall of Pièce 5, or in other words: a secondary multiple or collective deposit. This reorganisation work might have been undertaken to gain space for the implementation of further burials or due to the fortuitous intersecting of older graves.

4.5 Structures no 1 and no 2 (Pièce 8): Taphonomic, Archaeothanatological, and Osteological Analysis

The first of these two deposits – Structure no 1 (Pièce 8) – was identified and subsequently excavated in 2016, in the course of the archaeological investigation of Pièce 8. The latter forms the base of a tower, contiguous to the

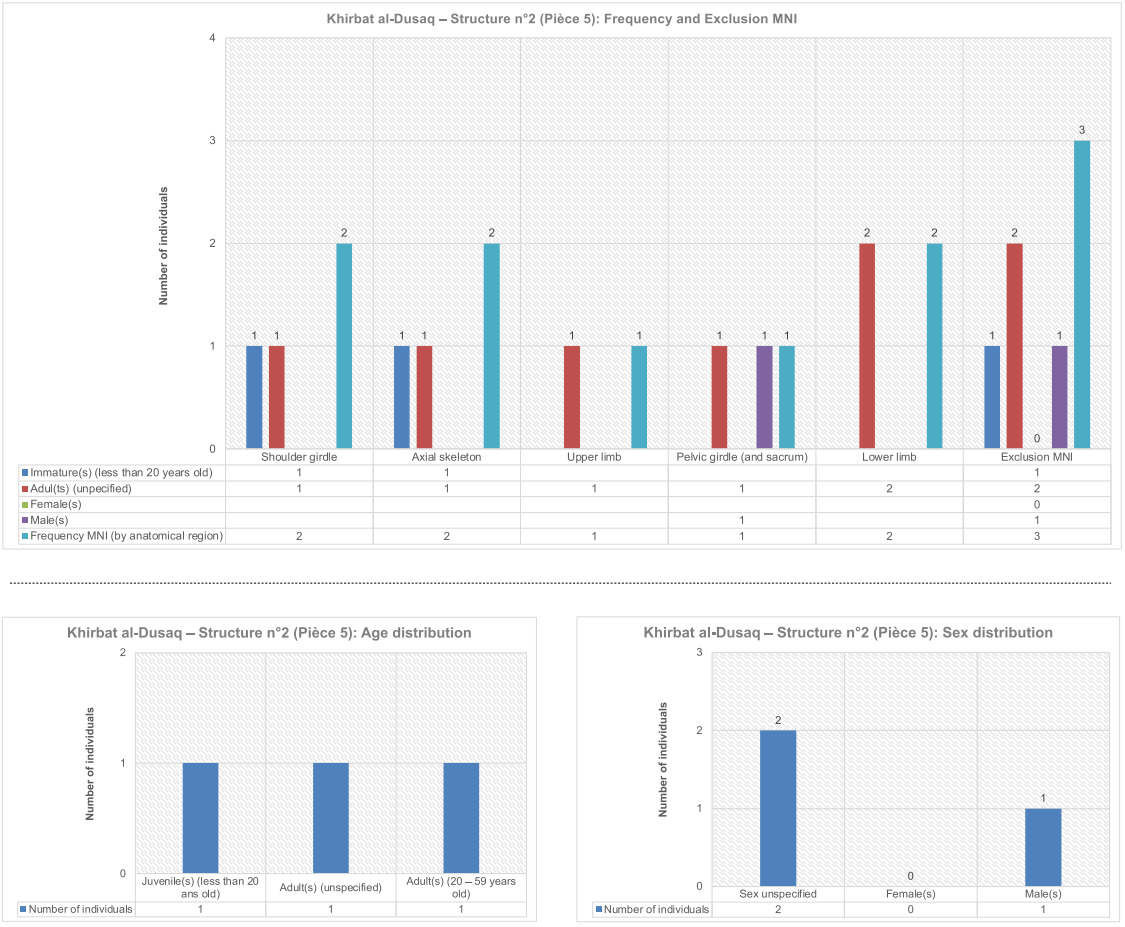


Figure 9: Structure no 2 (Pièce 5) frequency and exclusion MNI graph (top), age distribution graph (bottom left), and sex distribution graph (bottom right). Figures by Hofstetter (2022).

heating system of the *hammam* (at its northwestern extremity), and which also happens to shelter latrines. More precisely, Structure no 1 (Pièce 8) is set against the southern wall of this room and is embedded in the post-abandonment levels of the thermal complex, within a darker soil layer characterised by charcoal inclusions. Architecturally speaking, it appears to be some sort of funerary structure set into an excavated pit, whose borders are materialised by large boulders. Its dimensions come close to a meter in length, 50 cm in width, and *circa* 30 cm in depth. It yielded the remains of several commingled individuals showing no preserved anatomical connections and mixed with bones of small rodents. A single sling ball was found within this burial. The collective character of this funerary structure is suggested by the apparent successive deposition of several individuals within its limits. Thus, it seems to have originally been intended to accommodate one or more adult subjects. Later, the bones of at least one immature subject seem to have been deposited within it. This intervention probably resulted in the re-arrangement of one or several of the subjects already buried within this grave, eventually turning it into a secondary collective deposit. This disturbance was seemingly carried out in parallel sequence with that of the adjacent Structure no 2 (Pièce 8) (*cf. infra: section* "Structure no 2 (Pièce 8): [...]").

4.6 Structure no 2 (Pièce 8): Taphonomic, Archaeothanatological, and Osteological Analysis

The second deposit within Pièce 8 (Structure no 2 (Pièce 8)) was also discovered and excavated in 2016. Structurally, it resembles a simple pit deposit, with no particular features or grave goods. It is set against the

Table 2: Osteological inventory of Structure no 2 (Pièce 5)

Structure n°2

Pièce 5

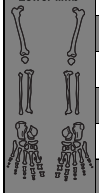
Anatomical region	Bone	Inventory nb. / Tot. amount (mult. lots)	Laterality	Bone maturation	Sex / Gracility and Robustness	Osteological features (patho., trauma, anatomic. var.)	Remarks	MNI (by anatomical region)
Shoulder girdle 	Scapula	**Scap-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Coracoid notch		**2 individuals (1 immature)**
	Scapula (**fragmented**)	**scap-2**	Left	Immature: less than 20 yrs. (*Schwartz 2007; INFORCE*)		Left shld. traum. sublux. (ankyl. call. of hum. head and acrom.)	Fused with **hum-1**	
	Clavicle	**Clav-1**	Left	Adult (*Schwartz 2007; INFORCE*)		Supraclavicular nerve foramen		
Axial skeleton 	Sternum (**Manubrium**)	**Ster-1**		Adult (*Schwartz 2007; INFORCE*)				**2 individus (1 immature)**
	Ribs nb. I-XII	**2**	Right	Adult (*Schwartz 2007; INFORCE*)		Several osteophytic and arthrosic manifestations		
		3	Left	Adult (*Schwartz 2007; INFORCE*)		Several osteophytic and arthrosic manifestations		
		1	Right	Immature: less than 20 yrs. (*Schwartz 2007; INFORCE*)				
	Thoracic vertebr. nb. I-XII	**3**		Adult (*Schwartz 2007; INFORCE*)				
	Lumbar vertebr. nb. I-V	**4**		Adult (*Schwartz 2007; INFORCE*)		Several osteophytic and arthrosic manifestations		
Upper limb 	Humerus (**fragmented**)	**hum-1**	Left	Immature : less than 20 yrs. (*Schwartz 2007; INFORCE*)		Left shldr. traum. sublux. (ankyl. call. of hum. head and acrom.)	Fused with **scap-1**	**2 individuals (1 immature)**
	Radius	**Rad-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
Pelvic girdle (and sacrum) 	Coxal bone	**Cox-1**	Left	Adulte: 20-59 ans (*Schmitt 2001, 2005*)	Male (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)		Matchable with **Sac-1**	**1 individual**
	Sacrum	**Sac-1**		Adult (*Schwartz 2007; INFORCE*)			Matchable with **Cox-1**	
Lower limb 	Femur	**Fem-1**	Right	Adult (*Schwartz 2007; INFORCE*)			Matchable with **Fem-2**	**2 individuals**
		Fem-2	Left	Adult (*Schwartz 2007; INFORCE*)		Int. fem. condyle osteochondritis (feat. cartilag. inflammation (?))	Matchable with **Fem-1**	
	Tibia	**Tib-1**	Right	Adult (*Schwartz 2007; INFORCE*)			Matchable with **Tib-2**	
		Tib-2	Left	Adult (*Schwartz 2007; INFORCE*)			Matchable with **Tib-1**	
		Tib-3	Left	Adult (*Schwartz 2007; INFORCE*)				
	Fibula	**Fib-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Osteophyt., enthesopath. and osteoclast. manif. on tibio-fibular lig. insert	Matchable with **Fib-1**	
	Fibula (**fragmented**)	**Fib-2**	Left	Adult (*Schwartz 2007; INFORCE*)		Enthesopath. and osteoblast. manif. on proximal extremity	Matchable with **Fib-2**	
		Fib-3	Left	Adult (*Schwartz 2007; INFORCE*)				
	Calcaneus	**Calc-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
		Calc-2	Left	Adult (*Schwartz 2007; INFORCE*)				
	Cuboid	**Cub-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
	Talus	**Tal-1**	Left	Adult (*Schwartz 2007; INFORCE*)				
	Navicular	**Nav-1**	Left	Adult (*Schwartz 2007; INFORCE*)		Several osteophytic manifestations		
	1st Metatarsal	**PMetat-1**	Left	Adult (*Schwartz 2007; INFORCE*)				
	2nd Metatarsal	**DMetat-1**	Left	Adult (*Schwartz 2007; INFORCE*)				
	3rd Metatarsal	**TMetat-1**	Left	Adult (*Schwartz 2007; INFORCE*)				
	5th Metatarsal	**CMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)				
		CMetat-2	Left	Adult (*Schwartz 2007; INFORCE*)				
	Phalanges (**pedal**)	**1**	Right & left	Adult (*Schwartz 2007; INFORCE*)		Several osteophytic manifestations		

Figure by Hofstetter (2017).

northern wall of the room. Its dimensions are roughly 2 m in length and 60 cm in width, for an estimated depth of *circa* 35 cm. One observes that the bottom of the pit corresponds to the original paved floor of the room. In chronological terms, one deduces, based on stratigraphical data, that its implantation is posterior to the abandonment of the thermal complex. However, it remains difficult to propose a more precise date, except that the occupation of Khirbat al-Dusaq during the Great Arab Revolt of 1916–1918 as well as the presence – mainly in this part of the site – of rifle cartridges datable to the beginning of the twentieth century, tend to suggest the possibility of a relatively recent deposit. In this case as well, one seems to be in the presence of an original grave intended for a single person which was transformed into a collective burial, implying a reuse of the funerary structure. As such, the discovery of a relatively complete and articulated skeleton combined with the remains of other scattered individuals tends to substantiate this hypothesis. In fact, the deposit of the relatively complete individual corresponds to a plain soil burial without a coffin. This individual is roughly oriented following a west/east axis and therefore not towards the *Qibla* (a feature which is not uncommon amongst Near Eastern Islamic and notably Bedouin graves (Bailey, 1982, pp. 65–88; Kressel, Bar-Zvi, & Abu-Rabia, 2012, pp. 65–66; Petersen, 2013, pp. 847–849; Walker, 2001a)). It also appears that his head was originally facing northwest. The burial modalities of this individual can be further investigated thanks to a certain number of clues. For example, decomposition in a cluttered space seems attested due to the presence of preserved anatomical connections, both labile and persistent. In the same way, the absence of a levelling phenomenon of the bones also tends to indicate a decomposition within a cluttered space; the progressive disappearance of soft tissues having apparently been quickly compensated for by sedimentary infiltrations. Nevertheless, one ought to acknowledge the anatomically abnormal position of the head of this individual, which rests at the level of his left knee. This situation most likely results from looter interventions, who intersected through the structure to the northwest, disrupting the upper third of this individual (a phenomenon also observable on the upper axial skeleton, at the level of the ribs and vertebrae). Similarly, the hypothesis of an original funerary intention in this bizarre configuration seems unlikely, in particular, due to the absence of the mandible; a phenomenon indicative of a skull displacement after decomposition of the craniomandibular joint, i.e., well after the death and subsequent burial of this individual. Finally, the discovery of other scattered human bone remains within this structure suggests that it was partially emptied of its previous occupants to make room for the relatively complete individual (possibly in sequence with Structure no 1 (Pièce 8)), and hence turning it into a secondary collective deposit as well.

As the conjoint archaeological investigation of these two structures (Structure no 1 & 2 (Pièce 8)) evidences, there does seem to exist a synergy uniting them. As a matter of fact, bioanthropological data suggest that certain individuals are partially contained within both structures, hence implying that bone displacement and commingling happened in this room. This was substantiated thanks to the osteological characteristics of the different individuals present within the deposits (a possible restitution of the bone movements and deposit sequence is proposed in Figure 10). In this sense, osteological analysis revealed that at least five individuals were deposited into these two structures (Figures 11 and 12; Table 3). Individual no 1 is an adult male, aged 20–49 and measuring *circa* 173 cm. His main discriminating osteological attribute within this assemblage is his bone robustness. Individual no 2 is an adult female, aged 30 to 59, who appears to have suffered from a severe osteoporotic condition. Thus, her main osteological discriminating features are lightweight bones displaying generalised degenerative manifestations. Individual no 3 is another very young or stillborn subject. Size estimation ranges from 50 to 56 cm. Individual no 4 is a young subject, aged 0–4 years, and measuring close to 1 m in height. Both these individuals could be identified based on their diverging degrees of skeletal fusion. Individual no 5 appears to be an adult male, roughly accounting for the remaining bones.

4.7 Vestibule Burial: Taphonomic, Archaeothanatological, and Osteological Analysis

During the 2017 fieldwork operations, the excavation of the area between building “A” and building “B” uncovered wall remains originally linking these two buildings and thus closing off a sort of inner courtyard

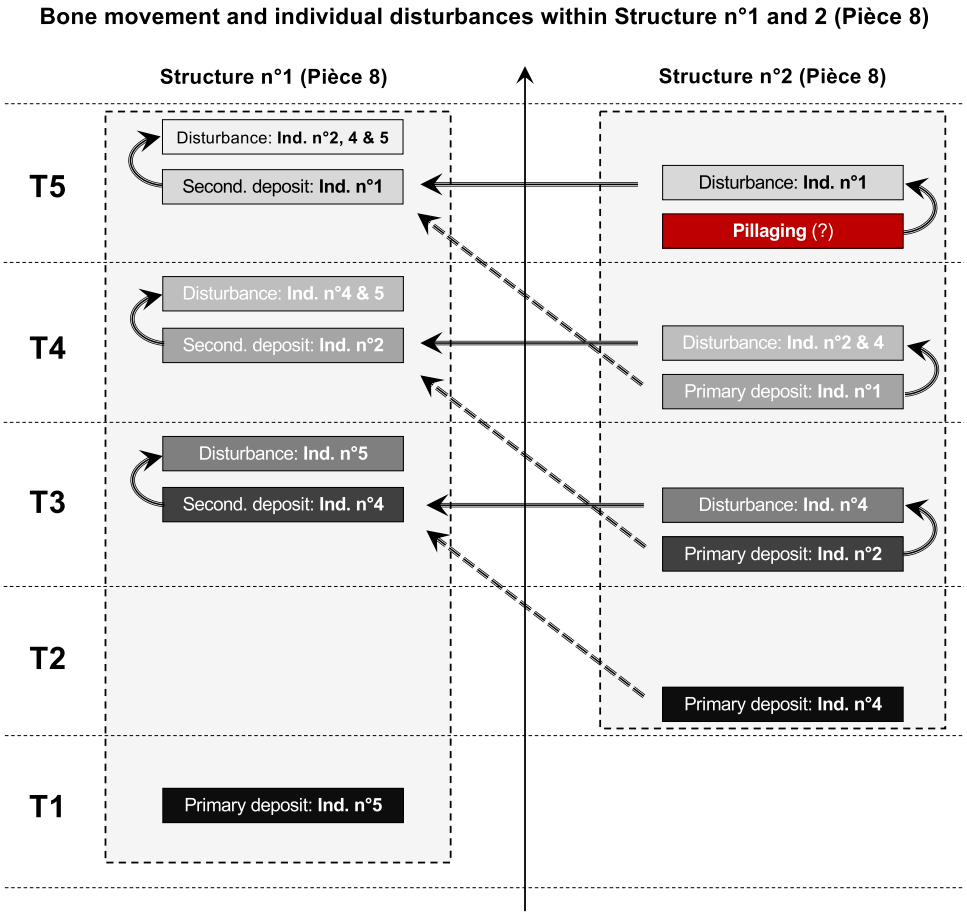


Figure 10: Schematic graphic restitution of bone movement and individual disturbances within Structure no 1 and 2 (Pièce 8). Figure by Hofstetter (2016).

to the west. A vestibule granting access to building "B" was also identified in the southern margin of this construction. Within this foyer, an unarchitectured pit grave was discovered, also inserted into the post-abandonment levels of the bathing complex (Hofstetter, 2018, pp. 72–76). This pit represents a primary individual burial, since a single, rather complete, and well-preserved skeleton (except for the skull and the extremities of the upper and lower limbs) was discovered. Decomposition evidence argues in favour of body decay within a cluttered space, since most anatomical connections, both labile and persistent, are strictly preserved. Cluttered space decomposition is also evidenced due to the lack of a levelling phenomenon of the skeleton. On the contrary, the individual appears to have been laid to rest in a right lateral decubitus position (following a west/east alignment), a position that is still readable in the twisting of the axial skeleton and in the elevation of the bones of the left flank, which are still partly pressed against the façade of building "B." As for the lower limbs, they remain in extension, while the upper limbs lay laterally and were crossed at the level of the forearms, the left passing over the right. Finally, one notes the cranium's absence; this is likely due to the construction or remodelling of the wall closing the courtyard to the west of the pit; it must have been destroyed or possibly reburied elsewhere on this occasion.

The only individual inhumed in this burial is an immature subject. An age at death estimate could be reached by considering, on the one hand, the dental maturation, and, on the other hand, the state of fusion of various preserved discriminating anatomical elements. Thus, and although it should be considered with caution – due to the lack of possible observations on the maxillary teeth – dental maturation places the subject in the age range of 11.5 to 15.5 years (AlQahtani et al., 2010). Correspondingly, bone maturation reveals that the individual is aged between 12 (complete fusion of the terminal ossiculum of the axis) and 14

Figure 11: Panoramas of reassembled individuals from Structure no 1 and 2 (Pièce 8). Photographs by Hofstetter (2016).

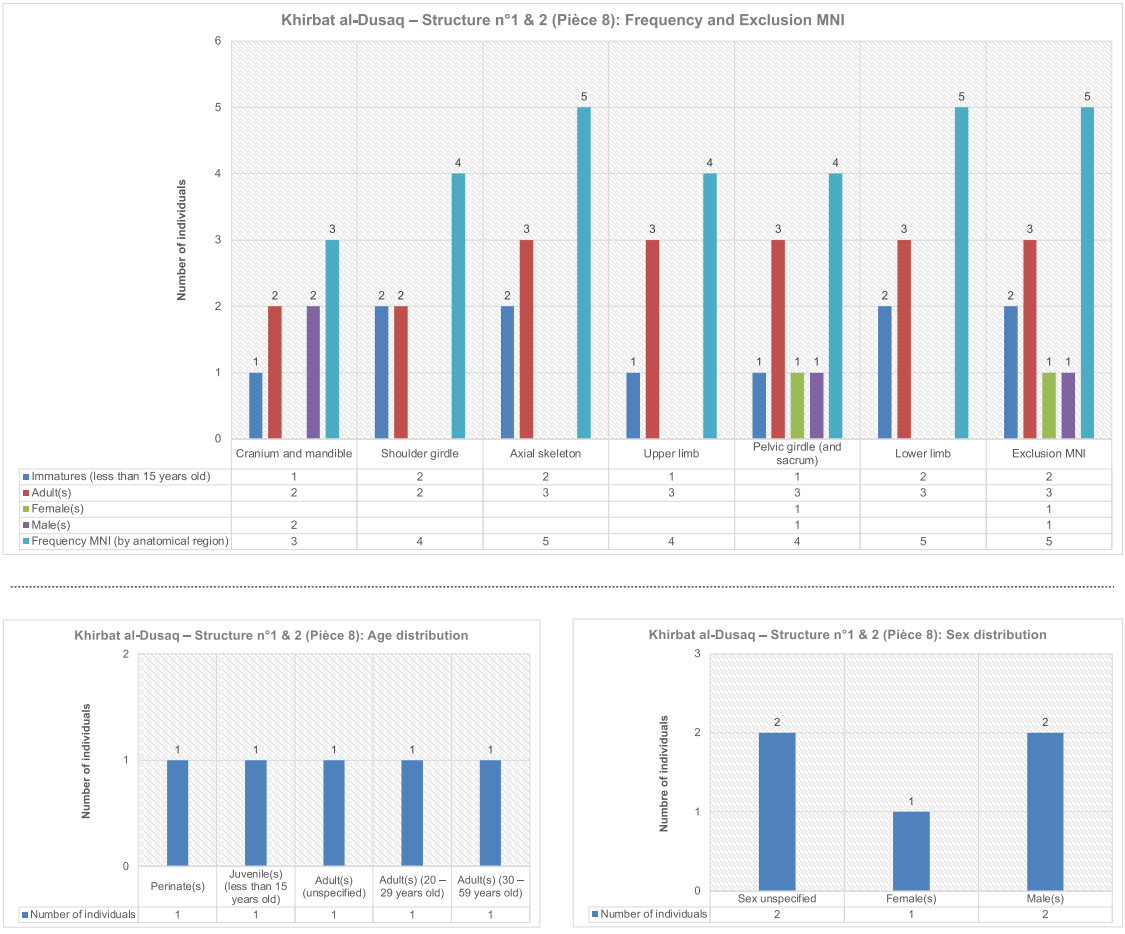


Figure 12: Structure no 1 and 2 (Pièce 8): frequency and exclusion MNI graph (top), age distribution graph (bottom left), and sex distribution graph (bottom right). Figures by Hofstetter (2022).

to 16 years (complete absence of fusion of the epiphyseal rings of the thoracic and lumbar vertebrae) (Cardoso, 2007; Schaefer et al., 2009; Scheuer & Black, 2000). In addition, stature was also calculated based on the lengths of the femoral diaphyses of the individual, yielding an average stature estimation of 145 cm. In terms of pathologies and anatomical variations, this individual displays a single occurrence of linear enamel hypoplasia on the lower incisors (Hillson, 1996, 2005; Quatrehomme, 2015).

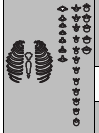
4.8 Funerary Recruitment and Treatment, Bone Element Frequencies, and Percentages: An Archaeological and Bioanthropological Appraisal

As previously exposed, the site of Khirbat al-Dusaq yielded six human remains deposits, located in four different places. While all of them seem to be embedded in the post-abandonment layers of the bathing complex, the establishment of a precise relative chronology of these deposits proved to be an arduous exercise, except for cases of proven and/or potential grave overlaps and intersecting. In fact, the rather distinct nature of each of these assemblages as well as their spatio-temporal separation suggests that they represent isolated funerary events rather than an organised group of burials. Further, the heterogeneous funerary recruitment (in the sense proposed by Sellier (2012, pp. 83–94)) practiced within each of these deposits, the inconsistent presence of funerary goods, the lack of any homogeneous funerary treatment, and surface grave markings, as well as the occurrences of deposit disturbances and reorganisations, all

Table 3: Osteological inventory of Structure no 1 & 2 (Pièce 8)

Structure n°1 & 2

Pièce 8

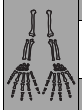
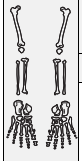
Anatomical region	Bone	Inventory nb. / Tot. amount (mult. lots)	Laterality	Bone maturation	Sex / Gracility and Robustness	Osteological features (patho., trauma, anatomic. var.)	Remarks	MNI (by anatomical region)
Cranium and mandible 	Cranium (**complete**, teeth *in situ*)	**Cr-1**		Adult (*Schwartz 2007; INFORCE*)	Robust tendency (*Acsádi & Nemeskéri 1970*)		**Individual 1, Structure 2**	3 individuals (1 immature)
	Cranium (**fragmented,** teeth *in situ*)	**Cr-2**		Adult (*Schwartz 2007; INFORCE*)	Robust tendency (*Acsádi & Nemeskéri 1970*)	Maxillary sinus infection (?)	**Individual 5, Structure 1**	
		cr-3		Immat: Foetus / 0-1 yrs (*Schour & Massler 1941; Moorees et al. 1963a/b; Fazekas & Kosa 1978; Adalian 2001; INFORCE*)			**Individual 3, Structure 2**	
	Hemimandible (teeth *in situ*)	**hmand-1**	Right	Immat.: Foetus / 0-1 yrs. (*Schour & Massler 1941; Moorees et al. 1963a/b; Fazekas & Kosa 1978; Adalian 2001; INFORCE*)			**Individual 3, Structure 2**	
	Hemimandible (teeth *in situ*)	**hmand-2**	Left	Immat.: Foetus / 0-1 ans (*Schour & Massler 1941; Moorees et al. 1963a/b; Fazekas & Kosa 1978; Adalian 2001; INFORCE*)			**Individual 3, Structure 2**	
	Canine (**isolated**)	**Csup-D**	Right / Superior	Permanent tooth (*Hillson 1996, 2005*)			**Individual 1, Structure 2**	
	Canine (**isolated**)	**Cinf-D**	Right / Superior	Permanent tooth (*Hillson 1996, 2005*)			**Individual 1, Structure 2**	
	1st premolar (**isolated**)	**P1inf-G**	Left / Inferior	Permanent tooth (*Hillson 1996, 2005*)			**Individual 1, Structure 2**	
	2nd premolar (**isolated**)	**P2sup-G**	Left / Superior	Permanent tooth (*Hillson 1996, 2005*)		Occlusal caries	**Individual 1, Structure 2**	
	3rd premolar (**isolated**)	**M3sup-G**	Left / Superior	Permanent tooth (*Hillson 1996, 2005*)			**Individual 1, Structure 2**	
Shoulder girdle 	Scapula	**Scap-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Osteoporotic manifestations	**Indvidual 2, Structure 1**	4 individuals (2 immatures)
		Scap-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 1**	
		scap-3	Right	Immature: less than 10-13 yrs. (*Schwartz 2007; INFORCE*)			**Individual 4, Structure 1**	
		scap-4	Right	Immat.: Foetus / 0-1 yrs (perinat.) (*Fazekas & Kosa 1978; Adalian 2001; INFORCE*)			**Individual 3, Structure 1**	
		scap-5	Left	Immat.: Foetus / 0-1 yrs. (perinat.) (*Fazekas & Kosa 1978; Adalian 2001; INFORCE*)			**Individual 3, Structure 1**	
	Clavicle	**Clav-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 1**	
		clav-2	Right	Immature : less than 21 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		clav-3	Left	Immature: less than 10-13 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		clav-4	Left	Immature: less than 10-13 yrs. (*Schwartz 2007; INFORCE*)			**Individual 4, Structure 1**	
Axial skeleton 	Sternum (**Manubrium**)	**Ster-1**		Adult (*Schwartz 2007; INFORCE*)		Osteophytic manifestations	**Individual 1, Structure 2**	5 individus (?) (2 immatures)
	1st rib	**PCot-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Osteoporotic manifestations	**Individual 2, Structure 1**	
		PCot-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		pcot-3	Right	Immature: less than 17 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		pcot-4	Left	Immature: less than 17 yrs. (*Schwartz 2007 ; INFORCE*)			**Individual 3, Structure 1**	
		pcot-5	Left	Immature : less than 17 yrs. (*Schwartz 2007; INFORCE*)			**Individual 4, Structure 2**	
	1st rib (**fragmented**)	**pcot-6**	Left	Adult (Schwartz 2007; INFORCE)		Osteoporotic manifestations	**Individual 2, Structure 1**	
	Ribs nb. II-XII	**15**	Right	Adult (*Schwartz 2007; INFORCE*)		Several osteoporotic manifestations	**Indivs. 1 & 2 (?), Structure 1 & Structure 2**	
		11	Left	Adult (*Schwartz 2007; INFORCE*)		Several osteoporotic manifestations	**Indivs. 1 & 2 (?), Structure 1 & Structure 2**	
		12	Right	Immat.: less than 17 yrs., at least 2 diff. bone matur. stages (*Schwartz 2007; INFORCE*)			**Indivs. 3 & 4 (?), Structure 1 & Structure 2**	
		13	Left	Immat.: less than 17 yrs., at least 2 diff. bone matur. stages (*Schwartz 2007; INFORCE*)			**Indivs. 3 & 4 (?), Structure 1 & Structure 2**	
	Ribs nb. II-XII (fragmented)	**27**	Right & left	Adult (*Schwartz 2007; INFORCE*)		Several osteoporotic manifestations	**Indivs. 1 & 2 (?), Structure 1 & Structure 2**	
	Cervical vertebra nb. I ("Atlas")	**1**		Adult (*Schwartz 2007; INFORCE*)		Several osteoporotic manifestations	**Individual 2, Structure 1**	
	Cervical vertebr. nb. III-VII	**3**		Adult (*Schwartz 2007; INFORCE*)		Several osteoporotic manifestations	**Indivs. 1, 2 & 5 (?), Structure 1 & Structure 2**	
	Thoracic vertebr. nb. I-XII	**5**		Adult (*Schwartz 2007; INFORCE*)		Several osteophytic manifestations	**Individual 1, Structure 2**	
	Lumbar vertebr. nb. I-V	**7**		Adult (*Schwartz 2007; INFORCE*)		Several osteoporot. and osteophyt. manif., Pott's disease	**Indivs. 1 & 2 (?), Structure 1 & Structure 2**	
	Immat. vertebr. (hemi-arches)	**21**		Immature: less than 1 yr. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
	Immat. vertebr. (bodies)	**8**		Immature: less than 3-6 yrs. (*Schwartz 2007 ; INFORCE*)			**Individual 3, Structure 1**	

(*Continued*)

Table 3: *Continued*

Structure n°1 & 2

Pièce 8

Anatomical region	Bone	Inventory nb. / Tot. amount (mult. lots)	Laterality	Bone maturation	Sex / Gracility and Robustness	Osteological features (patho., trauma, anatomic. var.)	Remarks	MNI (by anatomical region)
Upper limb 	Humerus	**hum-1**	Right	Immature: less than 12 yrs. (*Schwartz; INFORCE*)			**Individual 3, Structure 1**	4 individuals (1 immature)
		hum-2	Left	Immature: less than 12 yrs. (*Schwartz; INFORCE*)			**Individual 3, Structure 1**	
	Humerus (**fragmented**)	**Hum-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Distal ⅓ perserved, osteoporotic manifestations	**Individual 2, Structure 1**	
	Radius	**Rad-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 1**	
		rad-2	Left	Immature: less than 17 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
	Radius (**fragmented**)	**Rad-4**	Right	Adult (*Schwartz 2007; INFORCE*)		*Post-mortem* (?) carbonisation traces	**Individual 5, Structure 1**	
	Ulna	**Uln-1**	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 1**	
		uln-2	Right	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		uln-3	Left	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
	1st Metacarpal	**PMetac-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Osteoporotic manifestations (?)	**Indivs. 1, 2 or 5 (?), Structure 2**	
		PMetac-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 1**	
	2nd Metacarpal	**DMetac-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 2**	
	3rd Metacarpal	**DMetac-2**	Left	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 2**	
		TMetac-1	Left	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 2**	
	4th Metacarpal	**QMetac-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 2**	
		QMetac-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 2**	
		QMetac-3	Left	Adult (*Schwartz 2007; INFORCE*)			**Individu 1, 2 ou 5 (?), Structure 2**	
	5th Metacarpal	**CMetac-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 2**	
		CMetac-2	Right	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 2**	
		CMetac-3	Left	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 2**	
		CMetac-4	Left	Adult (*Schwartz 2007; INFORCE*)			**Individu 1, 2 ou 5 (?), Structure 2**	
	Phalanges (**manual**)	**18**	Right & left	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2 or 5 (?), Structure 1 & Structure 2**	
Pelvic girdle (and sacrum) 	Coxal bone	**Cox-1**	Right	Adult: 20-29 yrs. (*Schmitt 2001, 2005*)	Male (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)		**Individual 1, Structure 2**	3 individuals (1 immature)
	Coxal bone (**fragmented**)	**Cox-2**	Right	Adult: 30-59 yrs. (*Schmitt 2001, 2005*)	Female (*Bruzek 1991, 2002; Bruzek et al. 1996*)	Osteoporotic manifestations	**Individual 2, Structure 2**	
		Cox-3	Left	Adult: 20-29 yrs. (*Schmitt 2001, 2005*)	Male (*Bruzek 1991, 2002; Bruzek et al. 1996; Murail et al. 2005*)		**Individual 1, Structure 2**	
		Cox-4	Left	Adult: 30-59 yrs. (*Schmitt 2001, 2005*)	Female (*Bruzek 1991, 2002; Bruzek et al. 1996*)	Osteoporotic manifestations	**Individual 2, Structure 2**	
		cox-5	Right	Immature: less than 9-12 yrs. (*Schwartz 2007 ; INFORCE*)			**Individual 4, Structure 2**	
	Sacrum	**Sac-1**		Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		Sac-2		Adult (*Schwartz 2007; INFORCE*)		Osteoporotic manifestations	**Individual 2, Structure 1**	
Lower limb 	Femur	**Fem-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	5 individuals (2 immatures)
		fem-2	Right	Immature: less than 15 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		fem-3	Left	Immature: less than 15 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		fem-4	Left	Immature: less than 15 yrs. (*Schwartz 2007; INFORCE*)			**Individual 4, Structure 1**	
	Femur (**fragmented**)	**Fem-5**	Right	Adult (*Schwartz 2007; INFORCE*)		Distal ⅓ preserved	**Individual 5, Structure 1**	
	Patella	**Pat-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		Pat-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	Tibia	**Tib-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Osteophytic manifestations at the proximal interface with fibula	**Individual 1, Structure 2**	
		Tib-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		tib-3	Right	Immature: less than 13 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		tib-4	Left	Immature: less than 13 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
	Tibia (**fragmented**)	**Tib-5**	Right	Adult (*Schwartz 2007; INFORCE*)		Distal ⅓ preserved	**Individual 5, Structure 1**	
	Fibula	**Fib-1**	Right	Adult (*Schwartz 2007; INFORCE*)		Osteophytic manifestations at the proximal interface with tibia	**Individual 1, Structure 2**	
		Fib-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		fib-3	Right	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		fib-4	Left	Immature: less than 16 yrs. (*Schwartz 2007; INFORCE*)			**Individual 3, Structure 1**	
		fib-5	Left	Immature: less than 16 yrs. (*Schwartz 2007 ; INFORCE*)			**Individual 4, Structure 1**	
	Fibula (**fragmented**)	**fib-6**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 5, Structure 1**	

(*Continued*)

Table 3: *Continued*

Structure n°1 & 2

Pièce 8

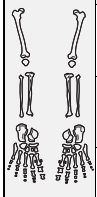
Anatomical region	Bone	Inventory nb. / Tot. amount (mult. lots)	Laterality	Bone maturation	Sex / Gracility and Robustness	Osteological features (patho., trauma, anatomic. var.)	Remarks	MNI (by anatomical region)
Lower limb (continued) 	Calcaneus	**Calc-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	5 individuals (2 immatures)
		Calc-2	Left	Adult (Schwartz 2007; INFORCE)			**Individual 1, Structure 2**	
	Talus	**Tal-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		Tal-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	Navicular	**Nav-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		Nav-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	Cuboid	**Cub-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		Cub-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	Lateral cuneiform	**CuL-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		CuL-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	Intermediary cuneiform	**CuI-1**	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	Medial cuneiform	**CuM-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	1st Metatarsal	**PMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		PMétat-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	2nd Metatarsal	**DMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		DMetat-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	3rd Metatarsal	**TMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		TMetat-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	4th Metatarsal	**QMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		QMetat-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	5th Metatarsal	**CMetat-1**	Right	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
		CMetat-2	Left	Adult (*Schwartz 2007; INFORCE*)			**Individual 1, Structure 2**	
	Phalanges (**pedal**)	**12**	Right & left	Adult (*Schwartz 2007; INFORCE*)			**Indivs. 1, 2, 3, 4 or 5 (?), Structure 1 & Structure 2**	

Figure by Hofstetter (2017).

appear as further elements in support of this assertion. Further, while the presence of several young and very young individuals might not be surprising from a palaeodemographic perspective – as a high infant mortality rate is expected for the period under study (Hassan, 1981) – it nevertheless appears as rather unusual from the funerary recruitment and treatment points of view. Indeed, the Late Ottoman cemetery in Tall Hisban (present-day central Jordan), which presents a similar archaeological context, yielded numerous infant graves buried alongside their mothers (Walker, 2001a, p. 47) and adorned with sundry grave goods. Likewise, the eighteenth-century CE Daba'a funerary complex (present-day central Jordan) displays clearly marked and organised inhumation graves (Petersen, 2013, pp. 853–854). In addition, as Srigyan et al. (2020, pp. 2–3) acknowledge, plural burials seem to rather constitute an anomaly in Near Eastern Islamic funerary treatment and might thus be seen as indicators of either a specific cultural identity expression, deviant burials, or disease-related graves. These considerations thus further highlight the non-specific nature of funerary behaviours observed at Khirbat al-Dusaq and the equivocal characteristics of Structure no 1 (Pièce 5).

More precisely, in the case of Structure no 1 (Pièce 4) and the vestibule burial, the primary and individual aspect of the deposit appears relatively distinctly, in stark contrast with the other four deposits.

Here, the study of bone element frequencies and the percentage of present bone elements allows to refine somewhat our apprehension of the latter. In the case of Structure no 2 (Pièce 5), chi-square tests revealed a statistically significant overrepresentation of lower limb bones, while the absence of skulls tends to indicate that this deposit might indeed represent a heterogeneous assemblage originating from several other burials gathered in one single deposit, without any obvious intent to collect entire individuals (hence the hypothesis of a secondary deposit following the partial intersecting of older burials) (Figure 13).

As far as Structure no 1 (Pièce 5) and Structure no 1 and 2 (Pièce 8) are concerned, the fact that they display similar bone element frequencies and percentages suggests – if not similar burial treatments – at least comparable taphonomic conditions (especially in terms of preservation of smaller bone elements) (Figures 14 and 15). In this sense, the statistically significant (chi-square tested) over-representation of axial

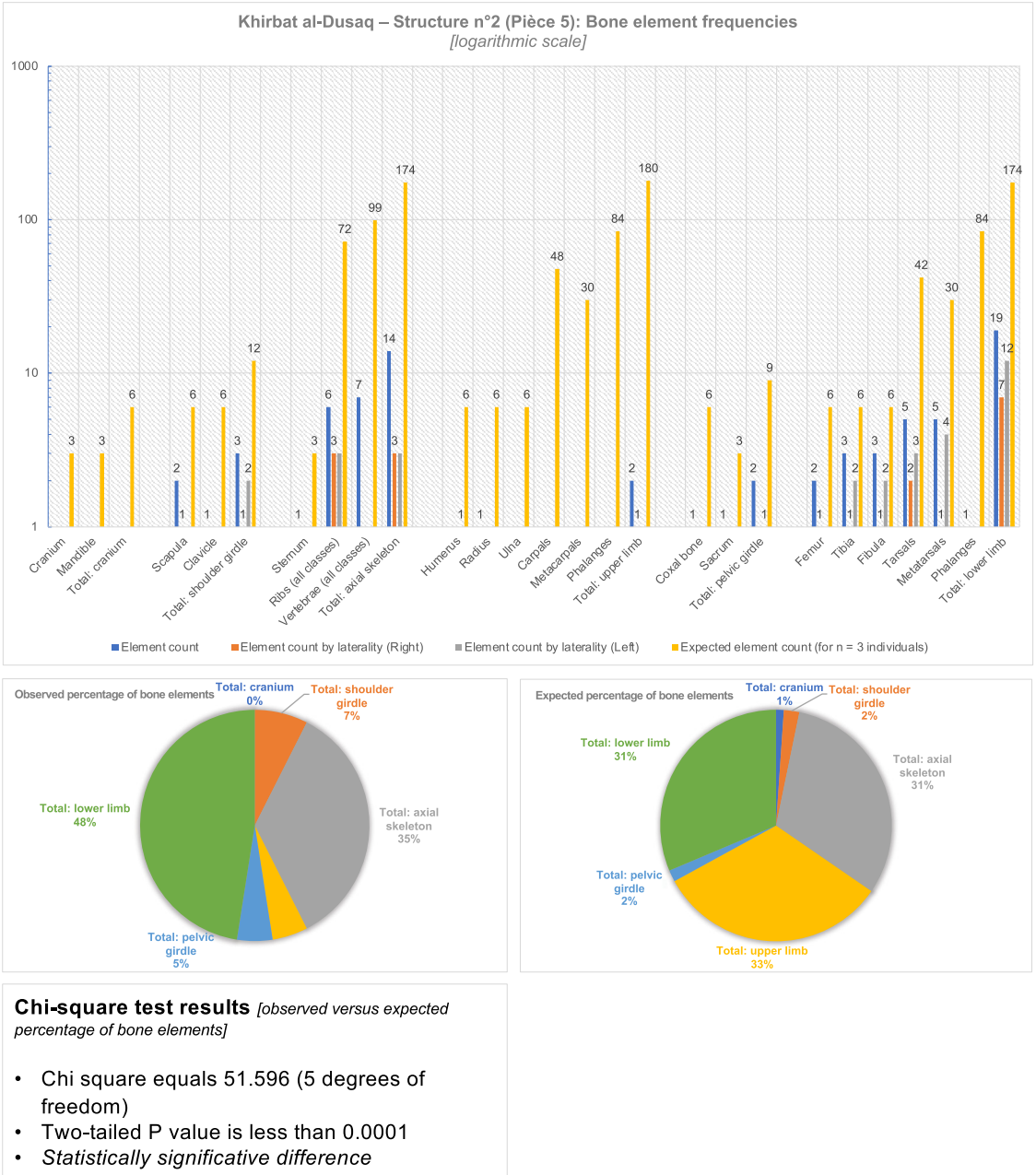
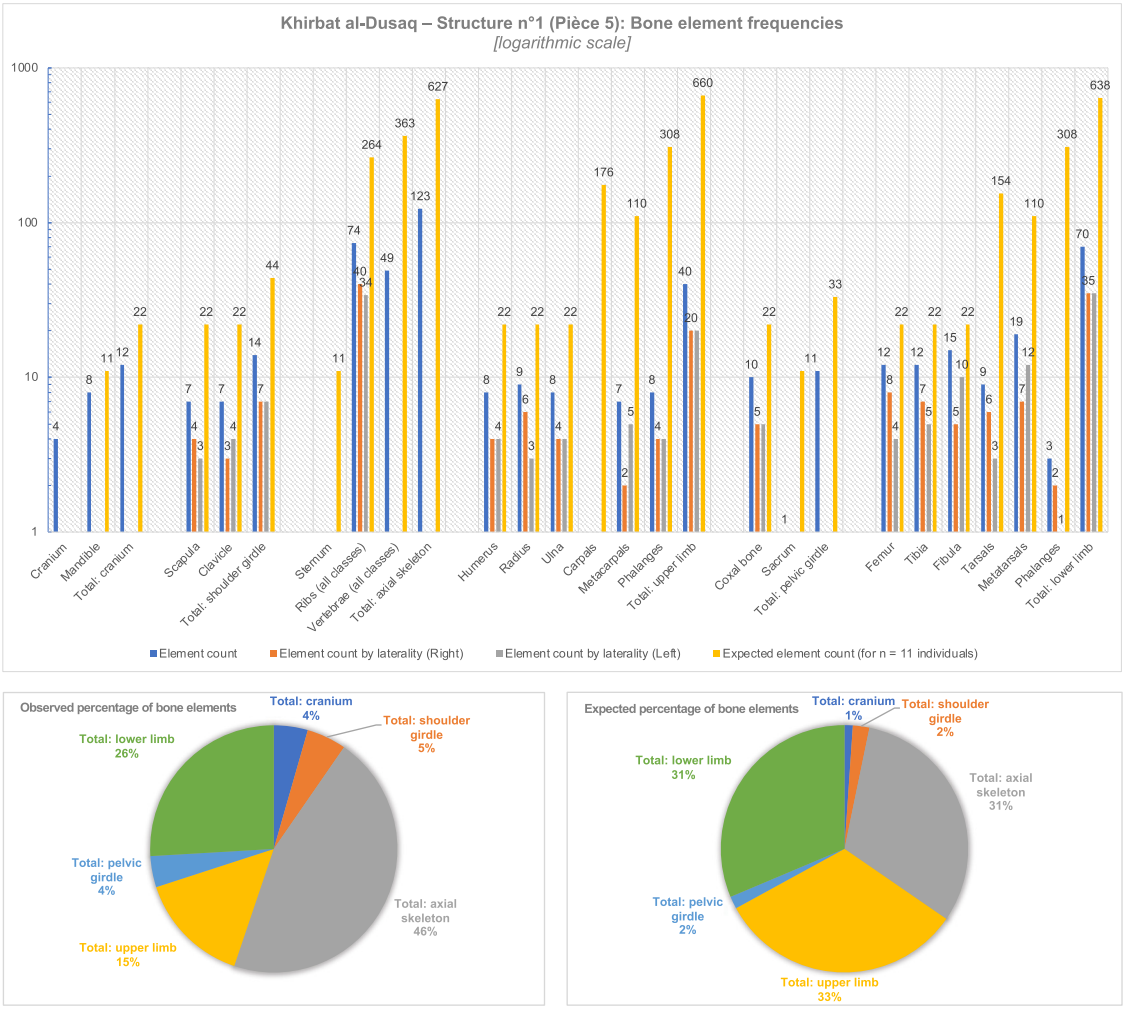


Figure 13: Structure no 2 (Pièce 5): bone element frequencies (top) and percentages (bottom). Figures by Hofstetter (2022).



Chi-square test results *[observed versus expected percentage of bone elements]*

- Chi square equals 33.383 (5 degrees of freedom)
- Two-tailed P value is less than 0.0001
- *Statistically significative difference*

Figure 14: Structure no 1 (Pièce 5): bone element frequencies (top) and percentages (bottom). Figures by Hofstetter (2022).

skeletal elements versus upper (and to a lesser extent), lower limb bones, tends to imply an inhumation – or given the case – disturbance of existing graves, once the breakdown of labile connections (e.g., cervical vertebrae, carpals, metacarpals, manual and pedal phalanges) had already happened, whilst certain persistent connections were still in place (e.g., lumbar vertebrae and tarsals) (Duday, 2012; Duday et al., 1990).

In sum and above all, these bone assemblages bear witness to the variety of funerary treatments (primary and secondary burials, grave reduction, etc.), practiced by diverse human communities in a chronological range extending from the sixteenth century CE to the beginning of the twentieth century CE, rather than displaying a form of cultural or practical unity. As such, this overview thus puts further into perspective the atypical characteristics of the deposits found in Pièce 5, since these are the only deposits of secondary and possibly multiple types to have been unearthed in Khirbat al-Dusaq. The multiple burial aspect is further reinforced in the case of Structure no 1 (Pièce 5), due to its compact morphology, definite

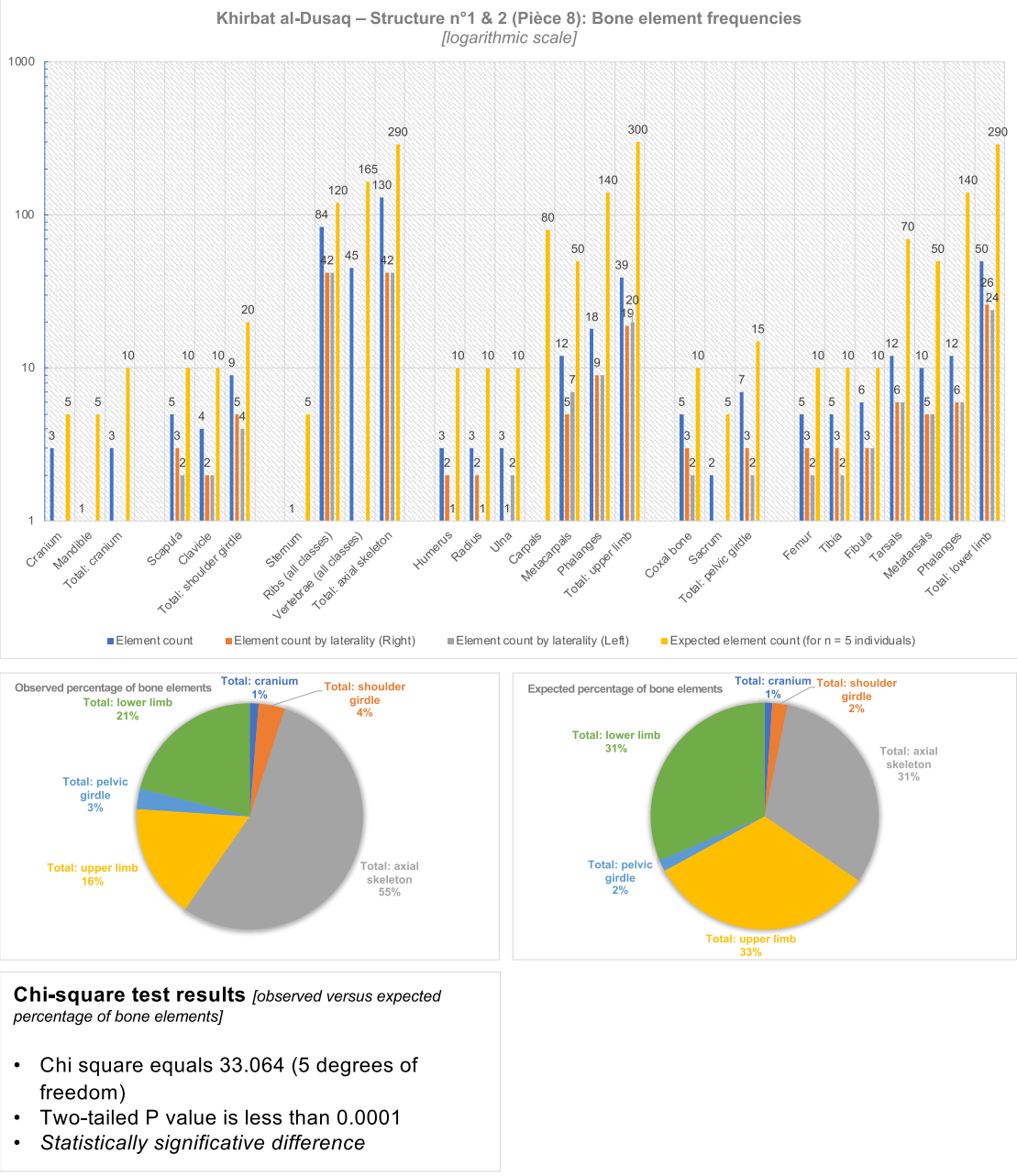


Figure 15: Structure no 1 and 2 (Pièce 8): bone element frequencies (top) and percentages (bottom). Figures by Hofstetter (2022).

limits, debris sealing, absence of any ritual treatment, and the equivocal traces found on the bones that make up this deposit.

5 Historical Study Results

The enigmatic character of Structure no 1 (Pièce 5) having caught our attention, we sought – starting with its radiocarbon dating – to further investigate it and propose a historically informed context within which to

place the origin of this atypical bone deposit. It seems important to emphasize again that the various explanatory attempts presented below remain obviously highly speculative in nature, since several elements characterizing Structure no 1 (Pièce 5) still do not allow for more precise conclusions, at present.

Thus, at first glance, the Near Eastern historical record between 1662 and 1781 CE, and in particular that of present-day southern Jordan, appears to be relatively serene and does not seem animated by any particular event that could straightforwardly explain the burial of possibly mutilated human remains within the ruins of the Khirbat al-Dusaq desert complex. It therefore appears necessary to focus on the micro-regional historical panorama to understand the origins of Structure no 1 (Pièce 5). If one looks for similar discoveries made in the vicinity, the apparent homicide perpetrated at Qasr Hallabat in the Mafraq region of Jordan during the early Islamic era is noteworthy (Perry, Parker, & Montgomery, 2015). The researcher team having dealt with this antique cold case suggested that it might well be the result of a bloody feud between members of rival nomadic tribes or else, traces of an armed raid that ended fatally. These human remains would then have been deposited in a cistern to conceal the traces of the crime (Perry et al., 2015). However, apart from a possible parallel regarding the treatment of the yielded human remains, this particular historical episode remains somewhat anecdotal, as it clearly falls outside the chronological limits provided by the radiocarbon dating of Structure no 1 (Pièce 5). However, it should be noted that Western travellers visiting the Near East during the twentieth-century CE recount episodes of interpersonal violence between rival Bedouin tribes. These accounts also highlight the common practice of brigandage and retaliation theft in this region (Butler, Frederick, & Edward, 1930, p. 39; Musil, 1928). The Ottoman state archives (*Devlet arşivleri*, nowadays *Başbakanlık Osmanlı Arşivleri*, abridged as BOA) also contain mentions of the difficulties encountered by the imperial administration in controlling the Bedouin tribes and in particular in dealing with internal conflicts between rival tribal factions (especially in remote desert areas) (Avci, 2009, pp. 970–972; Minawi, 2015). These internal conflicts were not without influence on the revenues of a particular region, which is why they sometimes found their way into official documents (Avci, 2009, pp. 970–972). It should of course be kept in mind that these writings remain political in nature and thus tend to be inherently "pro-authority biased." Nevertheless, they provide a general idea of the overall atmosphere in Ottoman-ruled southern present-day Jordan. By way of illustration, we present hereafter an account written in 1845 CE by the governor of Jerusalem: "*The bloody skirmishes between the different clans caused a state of desperate poverty and disorder in the region, and a dramatic decrease in the government's revenue*" (Basbakanlık Osmanlı Arsivi (BOA), 1845, quoted in Avci, 2009, p. 971). Furthermore, a series of more recent socio-historical studies have also focused on the mechanisms of violent dispute settlements amongst Bedouin tribes (Alhujelan, 2008; Antoun, 2000; Khalaf, 1990, 2000; Miguelez, 1993; Mohan, 2010; Murphy, 2008). In this sense, it is not inconceivable that the human remains contained within Structure no 1 (Pièce 5) might be the result of a similar localised outburst of violence in the Khirbat al-Dusaq region.

Likewise, the recent publication of a massacre pit – dated to the thirteenth century CE – in Sidon (present-day Lebanon), which archaeological evidence links to the conflictual context of the Crusades (Mikulski, Schutkowski, Smith, Doumet-Serhal, & Mitchell, 2021), could also have constituted an interesting lead to shed light on the deposit under study. However, the heteroclite age and sex distribution and the fragmented state of the individuals contained within Structure no 1 (Pièce 5), combined with the absence of any tangible archaeological signs or historical mentions of any large-scale armed conflict in southern Jordan during the chronological frame encompassed by this deposit, tends to invalidate this hypothesis.

Another possible approach, however, is to see in Structure no 1 (Pièce 5) the traces of an institutional repression of a particular group of people; as for example during the Ottoman administration's effort to forcefully settle the desert Bedouin tribes – or else during the peasant revolt and subsequent siege of nearby Al-Karak in 1834 CE (Orhonlu, 1987, pp. 39–98; Rogan, 1999, pp. 31–32; Rood, 2004, p. 139) – or even the execution of local dissidents (Chapman, 2012, pp. 91–110; Sharkey, 2017, pp. 64–114). While no examples of such repression strictly contemporary to Structure no 1 (Pièce 5)'s implementation are known to us in the region under study, the Shawbak region did indeed witness several upheaval episodes, e.g. during the popular uprisings known as the "Shoubak Revolts," which took place between 1900 and 1905 CE. On both occasions, the inhabitants of Shawbak rose up against the imperial power due to excessive fiscal pressure

exacerbated by the fact that local women were used as a slave labour force. The inhabitants of Shawbak, allied with the local Bedouin tribes, opposed the Ottoman military forces, which brutally crushed the protest movements (Salibi, 1998). The severity of the repression has since been analysed as a deliberate political action, aimed at disciplining the ever-notoriously rebellious Shawbak region (Salibi, 1998). The occupation of the ruins of the "*Krak de Montréal*" by local insurgents during these events suggests that the vestiges of Khirbat al-Dusaq might have served a similar purpose at some point between the seventeenth and eighteenth centuries CE.

Finally, in consideration of the once strategic location of Khirbat al-Dusaq along the *Darb al-Hajj* and given the probable very sporadic occupation of the site after its proper period of functionality, one is left to further question what might have possibly attracted humans to the ruins of Khirbat al-Dusaq, apart from episodes of armed mobilisation. On the basis of this reflection, we chose to focus our interest on the *Hajj* pilgrim caravans transiting nearby annually (during Ottoman times, the *Hajj* route ran along the same route as the modern Jordanian Desert Highway, located 15 to 20 km to the east of Khirbat al-Dusaq's ruins) (Petersen, 2012; Shqairat, 2020). Due to their importance and the precious goods (foodstuffs, precious metals, handicrafts, etc.), they transported from Damascus (present-day Syria) to Mecca, these caravans tended to attract the covetousness of the local Bedouin tribes and were regularly the object of raids and brigandage, and even occasionally of large-scale pillaging and man-slaughtering (Faroqhi, 1994, pp. 1–6; Rafek, 1963, pp. 271–288). As such, and in consideration of the radiocarbon dates obtained for Structure no 1 (Pièce 5), it does not seem completely irrelevant to cautiously consider the inherent unrest induced by the passage of the *Hajj* caravan in this region as another possible and pertinent reading grid to understand the circumstances that might have led to the creation of Structure no 1 (Pièce 5).

5.1 Troubled Times for *Hajj* Pilgrims?

In this sense, during the Ottoman Caliphate period (1517–1917 CE), Muslim pilgrims from the Levant and Anatolia who wished to perform the *Hajj* would gather in Damascus and travel together in a large institutional caravan (Rafek, 1963, pp. 271–288; Sato, 2014, pp. 134–135). This caravan, besides providing essential goods and food supplies to the pilgrims, was also responsible for guiding them – under the blazing sun through the treacherous rocky maze of the Hejaz desert – all the way to Mecca and back. It was set under the protection of an armed guard headed by the so-called *amir al-hajj* (the commander of the *Hajj* caravan). This armed guard was specifically designed in anticipation of recurrent raids and looting episodes by Bedouin tribes through whose territories the caravan passed (Crecelius & Bakr, 1991, pp. 20–21) and was intended to discourage the locals from attacking the caravan.

Nevertheless, such raids or looting episodes occurred regularly, usually when the Bedouin tribes in the Levant were in dire economic need. The ordinary procedure required the *amir al-hajj* to pay a tribute (known as the *sarr*) to the local Bedouin tribes in exchange for safe passage through their respective territories (Joudah, 1987, pp. 40–41). This tribute – intended exclusively to guarantee the protection and supply of the *Hajj* caravan – was levied in the province (*eyalet*) of Damascus by the *amir al-hajj* himself. Hence, usually, the *amir al-hajj* would arrange to pay half of the tribute to the most powerful and feared Bedouin tribes on the way to Mecca, and only pay the other half on the way back if the circumstances really required it. Thus, if the Bedouin tribes remained peaceful and did not intend to threaten the caravan on the return journey, the *amir al-hajj* could keep the remaining half of the tribute for himself. However, despite the payment of this tribute, the Bedouin tribes often looted the caravan all the same, although to a lesser degree (Peters, 1994, p. 161; Rafek, 1963, pp. 271–288). At the same time, the tribes also gained significant amounts of money from the sale of transport camels to pilgrims. Furthermore, the same Bedouin tribes that sometimes threatened the caravan were – on occasion – recruited as auxiliary troops to defend it, guide it or serve as translators. In sum, the *Hajj* caravan – as most commercial or transport desert convoys – represented a lucrative income opportunity for the Bedouin tribes (Joudah, 1987, pp. 40–41; Rafek, 1963, pp. 271–288; Shafir, 2020).

During the first half of the eighteenth century CE, the most influential Bedouin tribes controlling the territories between Damascus and the northern fringes of the Hejaz massif were the Bani Sakher and smaller clans such as the Bani Aqil, Bani Kulayb and Sardiyah (Ababsa, 2014; Fischbach, 2000; Peake, 1958; Rafek, 1963, pp. 271–288; Rogan, 1999). However, from the first decades of the eighteenth century CE onwards, the powerful Anizzah tribe, originally settled in the Najd (present-day Saudi Arabia), gradually penetrated the northern Jordanian and southern Syrian deserts, catalysing a chain reaction which gradually pushed the other tribes out of their traditional territories and further afar from Damascus (the onset of the pilgrimage and other major trade routes). As a consequence of this renewal of territorial organisation and settlement patterns, the Ottoman political dignitaries and military commanders in charge of the organisation of the *Hajj* gradually invested the Anizzah tribe with the tasks traditionally entrusted to the Bani Sakher and their allies. This transfer of responsibilities left the latter without a valuable source of income and incidentally also deprived them of the religiously very prestigious task of safeguarding Muslim pilgrims on their way to Mecca and back (Joudah, 1987, pp. 40–41; Peters, 1994, p. 161; Rafek, 1963, pp. 271–288; Shqairat, 2020). Very swiftly, and in retaliation, the Bani Sakher and their allies initiated a series of raids against the *Hajj* caravan (Van der Steen, 2014, p. 177). In addition to this territorial shift and subsequent redistribution of responsibilities, the financial difficulties of the Bani Sakher tribe and their allies were further aggravated by a devastating drought, which lasted from the year 1756 to 1757 CE (Hathaway & Barbir, 2014, p. 89; Joudah, 1987, pp. 40–41; Rafek, 1963, pp. 271–288).

5.2 The 1757 CE (*Hegira* 1170) Ill-fated *Hajj* Caravan

These particular historical circumstances thus form the background to the most brutal and violent attack on the *Hajj* caravan ever. In this sense, and to provide this research with a detailed description of what an attack on the *Hajj* caravan might have looked like, we present hereafter a comprehensive description of the 1757 CE attack. However, this particular event presents only a hypothetical link to Structure no 1 (Pièce 5). Thus, its presentation henceforth is intended primarily to be illustrative of the general atmosphere in the chronological range and geographical setting of interest to this study (rather than being the sole explanation for this human remains deposit).

After completing his *dawrah* (tax collection tour) in April 1757 CE, the *amir al-hajj* and *wali* of Damascus, Husayn Pasha ibn Makki (died 1765 CE), set off at the head of the pilgrim caravan towards Mecca in July of the same year (Hathaway & Barbir, 2014, p. 30; Joudah, 1987, p. 39; Rafek, 1963, pp. 271–288). The caravan arrived safely a few weeks later (Rafek, 1963, pp. 271–288; Joudah, 1987, p. 40). On the way back, however, the vanguard of the caravan, commanded by Musa Pasha, was attacked at the height of al-Qatranah (present-day central Jordan), some 100 km to the north of Khirbat al-Dusaq, by members of the Bani Sakher tribe, under the orders of Sheikh Qa'adan al-Favez. The vanguard was looted and then dispersed, with some of the routed soldiers retreating towards Ma'an (some 50 km to the south of Khirbat al-Dusaq) as well as towards Jerusalem. The commander Musa Pasha himself, seriously wounded during the attack, sought refuge in Daraa in the far south of Syria, where he arrived "*nude and barefooted*" (al-Sabbagh, quoted in Joudah, 1987, p. 40), according to the eighteenth-century CE Christian historian Abbud al-Sabbagh (El-Eid Bualan, 1999). He later succumbed to his severe wounds (Joudah, 1987, p. 40).

Meanwhile, the last surviving soldiers of the vanguard reached Damascus and informed the authorities of the ambush, who then rushed a relief unit to assist and support the main caravan. However, this unit was also ambushed halfway between al-Qatranah and Ma'an (present-day Jordan), presumably in the immediate surroundings of Khirbat al-Dusaq and thus did not manage to advance any further south. In fact, at this point, Husayn Pasha ibn Makki had been informed of the events and, in the meantime, tried to negotiate a safe passage to Damascus with Sheikh Qa'adan al-Favez. However, his efforts remained unsuccessful. Seeing the caravan's provisions diminish at an alarming rate, Husayn Pasha ibn Makki had no choice but to set off again without having been able to ensure safe passage through Bedouin territory (Joudah, 1987, p. 40). He left Tabuk (present-day northern Saudi Arabia) (Peters, 1994, p. 161; Rafek, 1963,

pp. 271–288) with the caravan, at the end of October, knowing that he was walking straight into a trap. On the third day of the caravan's march, the Bedouin Bani Sakher, Bani Aqil, Bani Kulayb, and Sardiyah tribesmen (Joudah, 1987, p. 40; Rafek, 1963, pp. 271–288) launched a surprise attack at the height of Hallat Ammar, on the present-day Jordanian-Saudi border (Rafek, 1963, pp. 271–288; Peters, 1994, p. 161). The attack was most bloody, and many pilgrims were killed in the event (including Sultan Osman III's sister) (Dumper & Stanley, 2007, p. 122; Joudah, 1987). The caravan was destroyed and looted. Among the spoils raided by the Bedouins was the *mahmal*, the richly ornamented ceremonial litter materializing the Ottoman Sultan's power and sovereignty (McGregor, 2020, pp. 52–53). It is estimated that a total of 20,000 pilgrims lost their lives in the attack or succumbed to hunger and thirst in the hostile desert environment in the aftermath of the raid (Ágoston & Masters, 2009, p. 248; Burns, 2005, p. 245; Dumper & Stanley, 2007, p. 122; Shafir, 2020). Husayn Pasha ibn Makki, although he survived the raid, never returned to Damascus, fearing for his life (Peters, 1994, p. 161). The eighteenth-century CE Damascene chronicler Ahmad al-Budairi further reports that the pilgrims – women or men without distinction – were stripped of all their possessions, including clothes, and left to die in the desert heat by the attackers (Hathaway & Barbir, 2014, pp. 89–90; Rafek, 1963, pp. 271–288).

This bloody attack left its mark from Damascus to Istanbul and even beyond in the Ottoman world (Burns, 2005, p. 245). Indeed, while Bedouin raids against the *Hajj* caravan and also against other transport convoys had been a long-lasting and recurrent problem, the 1757 CE raid truly represented an event of unprecedented scale and violence (Cohen, 1973, p. 20). Unsurprisingly, it led to a crisis within the Ottoman administration (Özyküsel, 2014, p. 61; Rafek, 1963, pp. 271–288). As such, even though Sultan Osman III passed away on 30 October 1757 CE, his successor Mustafa III immediately punished several imperial and provincial officials whom he held personally responsible in the failure to secure and protect the caravan (Burns, 2005; Joudah, 1987; Rafek, 1963, pp. 271–288).

6 Discussion

Following the presentation of the archaeological, bioanthropological, and historical data concerning Structure no 1 (Pièce 5) and its place within Khirbat al-Dusaq's funerary landscape and southern Jordan's historical panorama, it is now possible to discuss several conceivable narrative outlines to explain the origin and subsequent evolution of this bone deposit and its atypical characteristics.

Based on the bioanthropological data gathered on the human bones contained in this deposit, the possible violent nature of the circumstances surrounding the death of one or several of the individuals who make up this bone assemblage has been highlighted. At the same time, the radiocarbon dating of this assemblage provides a relatively precise chronological range within which the circumstances of the death of these individuals must fall. In addition, the absence of any distinctive form of funerary features and the location of this bone set within an abandoned building complex and relay station on the *Darb al-Hajj* outlines a form of social and geographical framework. Finally, the consideration of the historical sources relating to the chronological and socio-geographical contexts enables us to articulate a somewhat refined vision of the ambience surrounding the death of the individuals contained within Structure no 1 (Pièce 5).

With obvious interpretative caution, it is possible to understand these human bones as maybe being the mortal remains of individuals who participated, if not directly in the ill-fated pilgrimage of 1757 CE, perhaps in one of the various other pilgrim caravans attacked by the Bedouin tribes of the Khirbat al-Dusaq region during the first half of the eighteenth century CE (Faroqhi, 1994; Peake, 1958). Yet, in terms of *a priori* interpretative reserve, let us note in particular the overall relatively low number of deceased and the fact that the *Hajj* route does not seem to pass directly through Khirbat al-Dusaq at that time anymore. Even so, assuming that this bone set is indeed linked to the events of 1757 CE, in a way or another, it is possible to consider that it might contain the remains of soldiers of the main caravan vanguard, pilgrims accompanying the forehead guard, or members of the rescue unit sent by the Ottoman authorities (given that both

of these units were attacked between Ma'an and al-Qatranah, i.e., within a radius of roughly 100 km around Khirbat al-Dusaq). The precise attack location is not known, but the dispersion of the victims well beyond this radius allows us to imagine that some of them may have succumbed to their wounds while attempting to find refuge in the town of Shawbak, e.g. in the same way as the soldiers who fled towards Ma'an or Jerusalem (Joudah, 1987; Rafek, 1963, pp. 271–288).

The condition of the survivors and the pandemonium subsequent to the attack on the pilgrim caravan probably would not have allowed for the direct burial of the deceased, leading to their decay in the open air for a relatively long period of time. As it appears, they were probably only hastily buried by following passers-by (equipped with tools leaving characteristic traces on the bones?) within what we know today as Structure no 1 (Pièce 5); once the skeletons were already strongly dislocated. This event timeline would explain both the possible *peri-* and *post-mortem* wounding as well as the heterogeneous nature and absence of preserved anatomical connections within this bone deposit. The choice of burying the individuals within the ruins of Khirbat al-Dusaq can be explained – in addition to the fact that it may be the very place of their death – by the previously mentioned Bedouin tradition of burying the dead within structures that stand out from the surrounding landscape (Mustafa & Abu Tayeh, 2013; Walker, 2001a, p. 58).

7 Conclusions and Outlook

By deploying an integrated multidisciplinary approach – as advocated by Armit et al., 2006 or Sołtysiak, 2021 – we have elaborated several hypotheses describing the events which might have led to the formation of Structure no 1 (Pièce 5) within the ruins of Khirbat al-Dusaq. Of course, these narratives are obviously not the only ones that can be envisaged. Indeed, such an act of violence could have been perpetrated at any time in the chronological interval provided by our radiocarbon dating, by sporadic passers-by to the abandoned bathing complex, raiders from afar (as evidenced by the case of a thirteenth-century CE mass grave from Sidon (Mikulski et al., 2021)), local military forces or by nomadic desert tribes, amongst which repeated episodes of interpersonal violence – usually linked to the settling of vehement disputes – are known from the archaeological record (such as Qasr Hallabat's supposedly early Islamic era homicide (Perry et al., 2015)) and have also been addressed by a wealth of historical sources and documented both ethnographically and more recently in sociological terms (Alhujelan, 2008; Antoun, 2000; Khalaf, 1990, 2000; Miguelez, 1993; Mohan, 2010; Murphy, 2008). All these elaborated narratives do explain partially and through leveraged mobilisation of archaeological, bioanthropological, and historical data, the multiple atypical characteristics of this deposit. But, since both archaeology and history produce – by their very nature – partial and biased forms of knowledge, it appears extremely difficult to favour one interpretation at the expense of the other. As such, the bioanthropological study of these bones offers some additional evidence of an episode of interpersonal violence in the chronological range under study. Hence, and for the time being, we will retain only that possibly one or several instances of interpersonal violence – involving one or more individuals – led to the partial (re-)burial (?) of the involved bodies inside a compact pit containing a minimum of $n_{tot} = 11$ people, within the abandoned bathing complex of Khirbat al-Dusaq between 1662 and 1781 CE.

In this sense, and to clarify the validity of any of these possible narrative propositions, it would be of particular interest and scientific value to look for other archaeologically palpable traces of the Bedouin raid(s) against the pilgrimage caravans, especially at the recognised site of the 1757 CE attack on the main caravan at Hallat Ammar. Alternatively, it would also be interesting to screen any skeletons retrieved from archaeological contexts analogous to the one of Khirbat al-Dusaq's Structure no 1 (Pièce 5), to determine if similar bone lesions are visible, and in turn, to question the significance of such wounds if they were to be found on a broader scale across a geographic region and established chronological range.

In conclusion, rather than seeking to definitively settle the delicate question of the origin of this deposit of human remains – the difficulty of which has been thoroughly explored in the previous pages – this article merely sought to explore the possibilities and relevance offered by an integrated, multidisciplinary

approach in the enlightening of enigmatic archaeological contexts. We thus hope that this case study will help shed light onto similar osteoarchaeological finds and, given the case, catalyse further studies mobilizing an analogous methodology.

8 ملخَّص

يقدّم هذا المقال نتائج التحليل الأثريّ، البيو أنثروبولوجي والتاريخي لبقايا عظام بشريّة عثر عليها في طبقة غير مألوفة داخل مجّمع يعود للفترة الإسلامية من العصور الوسطى في موقع خربة الدّوسق، الواقع في جنوب الأردن. وقد اكتشف في هذا الموقع عدّة طبقات تحوي بقايا عظام بشريّة معظمها قبورًا عاديّة أو، على ما يبدو، أماكنَ تمّ تغيير وظيفتها الأساسية كي تستخدم للدّفن. ومع ذلك لقد تم العثور على بقايا مميزّة (سميّت "مبنى رقم 1(غرفة 5)") والتي تتضمّن بقايا غير مألوفة تعقّد تفسيرها. فتأريخ تلك البقايا بواسطة الكربون المشعّ يشير إلى فترة تتراوح بين المنتصف الثاني من القرن السابع عشر ونهاية القرن الثامن عشر ميلاديا. إضافة إلى ذلك، تتميّز هذه البقايا ذاتها بخصائص غير معهودة حيث تمّ اكتشاف آثار إصابات وتقطيع العظام المكتشفة قبل الوفاة باستخدام آدات حادّة.

ويسمحلنا تحديد السياق التاريخي الدقيق لبقيّة العظام هذه بطرح سيناريوهات مختلفة قد تمكّن من تبيين الوقائع التي جاءت بها. وهاهنا، يتراوح طيف التأويلات الممكنة بين احتمال أنّ هذه البقايا تعود إلى ضحيّة أو أكثر لصراع قَبلي أو غارة قطّاع طرق أو ثأر أو انتفاضة شعبيّة، وبين احتمال أن تعود إلى إحدى غارات النهب والسَّلب العنيفة التي ربما استهدفت بها القبائل البدويّة المحلّيّة قوافل الحجّ إلى مكّة خلال الفترة العثمانيّة.

كلمات مفاتيح:
عنف بين الأشخاص، جنوب الأردن، بيو أنثروبولوجيا، أرخيوثاناثولوجيا، دراسة العظام البشرية القديمة، علم الآثار الإسلاميّة.

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References

Ababsa, M. (Ed.). (2014). *Atlas of Jordan: History, territories and society*. Beirut: Presses de l'Institut Français du Proche-Orient. https://books.openedition.org/ifpo/4560?lang=fr.

Acsádi, G., & Nemeskéri, J. (1970). *History of human lifespan and mortality*. Budapest: Akadémiai Kiado.

Adalian, P. (2001). *Évaluation multiparamétrique de la croissance fœtale: Application à la détermination de l'âge et du sexe*. (Doctoral dissertation). Université de la Méditerranée, Aix-Marseille.

Adams, B. J., & Konigsberg, L. W. (2004). Estimation of the most likely number of individuals from commingled human skeletal remains. *American Journal of Physical Anthropology*, *125*(4), 138–151. doi: 10.1002/ajpa.10381.

Ágoston, G., & Masters, B. (2009). *Encyclopedia of the Ottoman empire*. New York: Infobase Publishings.

Akechi, Y, Miura, S., Ochi, M., Enoki, M., Matsuda, T., Kitazawa, R., … Ohyagi, Y. (2021). Unilateral lower limb atrophy associated with glomus tumors: A case report. *Journal of Medical Case Reports*, *15*(8), 1–4. doi: 10.1186/s13256-020-02616-1.

Alby, E., Vigouroux, É., & Elter, R. (2019). Implementation of survey and three-dimensional monitoring of archaeological excavations of the Khirbat al-Dusaq Site, Jordan. *International Archives of the Photogrammetry, Remote Sensing and Spatial Informations Sciences* (*27th CIPA International Symposium "Documenting the past for a better future"*), *XLII-2/W15* (pp. 41–47).

Alhujelan, N. S. (2008). *Worldviews of the peoples of the Arabian Peninsula: A study of cultural system*. Indianapolis: Indiana University Press.

AlQahtani, S. J., Hector, M. P., & Liversidge, H. M. (2010). Brief communication: The London Atlas of human tooth development and eruption. *American Journal of Physical Anthropology*, *142*(3), 481–490. doi: 10.1002/ajpa.21258.

Armit, I., Knüsel, C., Robb, J., & Schulting, R. (2006). Warfare and Violence in Prehistoric Europe: An Introduction, *Journal of Conflict Archaeology*, *2*(1), 1–11. doi: 10.1163/157407706778942349.

Antoun, R. T. (2000). Civil society, tribal process, and change in Jordan: An anthropological view. *International Journal of Middle East Studies*, *32*(4), 441–463.

Aufderheide, A. C., & Rodriguez-Martin, C. (1998). *The cambridge encyclopedia of human paleopathology*. Cambridge: Cambridge University Press.

Avci, Y. (2009). The Application of Tanzimat in the desert: The Bedouins and the creation of a new town in Southern Palestine (1860–1914). *Middle Eastern Studies*, *45*(6), 969–983. doi: 10.1080/00263200903268728.

Bailey, C. (1982). Bedouin religious practices in Sinai and the Negev. *Anthropos*, *77*(1/2), 65–88.

Basbakanlık Osmanlı Arsivi (BOA). (1845). *Sadaret Mektubi Muhimme Kalemi*, 1/89, (28 Zilkade 1261 = 28 November 1845).

Beauthier, J.-P. (2011). *Traité de médecine légale* (2nd ed.) Brussels: DeBoeck.

Benkheira, M. H. (2003). La maison de Satan: Le hammâm en débat dans l'Islam médiéval. *Revue de L'histoire des Religions*, *220*(4), 391–443.

Bonnabel, L. (2012). *Archéologie de la mort en France*. Paris: La Découverte.

Boulestin, B., & Duday, H. (2005). Ethnologie et archéologie de la mort: De l'illusion des références à l'emploi d'un vocabulaire. In C. Mordant & G. Depierre (Eds.), *Les pratiques funéraires à l'âge du bronze en France* (pp. 17–30). Paris: CTH.

Brünnow, R.-E., & Domaszewski, A. (1904). *Die Provincia Arabia auf Grund zweier in den Jahren 1897 und 1898 unternommenen Reisen und der Berichte früherer Reisender. Unter Mitwirkung von Julius Eusting*. Strasbourg: Trübner.

Bruzek, J., Castex, D., & Majo, T. (1996). Evaluation des caractères morphologiques de la face sacro-pelvienne de l'os coxal: Proposition d'une nouvelle méthode de diagnose sexuelle. *Bulletins et Mémoires de la Société d'Anthropologie de Paris*, *8*(3–4), 491–502.

Bruzek, J. (1991). *Fiabilité des procédés de détermination du sexe à partir de l'os coxal. Implications à l'étude du dimorphisme sexuel de l'homme fossile*. (Doctoral dissertation). Muséum d'Histoire Naturelle, Paris.

Bruzek, J. (2002). A method for visual determination of sex, using the human hip bone. *American Journal of Physical Anthropology*, *117*(2), 157–168. doi: 10.1002/ajpa.10012.

Burns, R. (2005). *Damascus: A history*. London: Routledge.

Butler, H. C., Frederick, A. N., & Edward, R. S. (1930). *Syria: Publications of the Princeton University archaeological expeditions to Syria in 1904–5 and 1909* (Vol. 1). Leiden, Boston: Brill Academic Publishing.

Cardoso, H. F. V. (2007). Environmental effects on skeletal versus dental development: Using a documented subadult skeletal sample to test a basic assumption in human osteological research. *American Journal of Physical Anthropology*, *132*(2), 223–233. doi: 10.1002/ajpa.20482.

Cattaneo, C. (2007). Forensic anthropology: Developments of a classical discipline in the new millennium. *Forensic Science International*, *165*(2–3), 185–193. doi: 10.1016/j.forsciint.2006.05.018.

Chapman, C. (2012). Christians in the Middle East – Past, present and future. *Transformation: An International Journal of Holistic Mission Studies*, *29*(2), 91–110. doi: 10.1177/0265378812439955.

Cohen, A. (1973). *Palestine in the eighteenth century: Patterns of Government and administration*. Jerusalem: Magnes Press.

Crecelius, D., & Bakr, A-W. (1991). *Al-Damurdashi's chronicle of Egypt, 1688–1755*. Leiden, Boston: Brill Academic Publishing.

Cunha, E., & Pinheiro, J. (2013). Bone pathology and antemortem trauma. In J. A. Siegel & P. J. Saukko (Eds.), *Encyclopedia of forensic sciences* (Vol. 1, pp. 76–82). Cambridge: Academic Press.

Dauphin, C., Ben Jeddou, M., & Castex, J.-M. (2015). To Mecca on pilgrimage on foot and camel-back: The Jordanian Darb al-Hajj. *Bulletin for the Council for British Research in the Levant*, *10*(1), 23–36. doi: 10.1179/1752726015Z.00000000029.

Demangeot, C. (2008). *Le dénombrement des défunts dans les ensembles funéraires: Problèmes théoriques, paramètres quantitatifs. Application à la sépulture collective néolithique du Dolmen des Peirières à Villedubert* (*Aude, France*). (Doctoral dissertation). University of Bordeaux, Bordeaux.

Duday, H., Courtaud, P., Crubézy, É., Sellier, P., & Tillier, A.-M. (1990). L'Anthropologie "de terrain": Reconnaissance et interpretation des gestes funéraires. *Bulletins et Mémoires de la Société d'Anthropologie de Paris, Nouvelle Série*, *2*(4), 29–49.

Duday, H. (1990). Observations ostéologiques et décomposition du cadavre: Sépulture colmatée ou en espace vide. *Revue Archéologique du Centre de la France*, *29*, 193–196.

Duday, H. (2009). *The archaeology of the dead*. Barnsley: Oxbow Books.

Duday, H. (2012). L'archéothanatologie: Une nouvelle manière de penser l'archéologie de la Mort. In S. de Beaune & H.-P. Francfort (Eds.), *L'archéologie à découvert: Hommes, objets, espaces et temporalités* (pp. 62–71). Paris: CNRS Éditions.

Dumper, M. R. T., & Stanley, B. E. (2007). *Cities of the Middle East and North Africa: A historical encyclopedia*. Santa Barbara: ABC Clio.

Écochard, M., & Le Cœur, C. (1942–1943). *Les bains de Damas*. Damas: Presses de l'Institut français de Damas, 2 volumes.

El-Eid Bualan, H. (1999). Abbud al-Sabbag and his biography of Daher al-Umar. *Paroles de l'Orient: Revue Semestrielle des Études Syriaques et Arabes Chrétiennes: Recherches Orientales: Revue D'études et de Recherches sur Les Églises de LANGUE SYriaque*, *24*, 339–356.

Falls, C. (1930). *Official history of the great war based on official documents by direction of the historical section of the committee of imperial defence; Military operations Egypt & Palestine from June 1917 to the end of the war* (Vol. 2). London: H. M. Stationary.

Faroqhi, S. (1994). *Pilgrims and Sultans: The Hajj under the Ottomans, 1517–1683*. London: I. B. Tauris.

Fazekas, I. G., & Kosa, F. (1978). *Forensic fetal osteology*. Budapest: Akadémiai Kiado.

Fernández-Crespo, T., Ordoño, J., Llanos, A., & Schulting, R. J. (2020). Make a desert and call it peace: Massacre at the Iberian Iron age village of La Hoya. *Antiquity*, *94*(377), 1245–1262. doi: 10.15184/aqy.2020.161.

Fischbach, M. R. (2000). *State, society and land in Jordan*. Leiden, Boston: Brill Academic Publishing.

Grabar, O. (1997). *Iwān*. In E. Van Donzel & L. Pellat (Eds.), *Encyclopaedia of Islam IV*. Leiden, Boston: Brill Academic Publishing.

Hassan, F. A. (1981). *Demographic archaeology*. New York: New York Academic Press.

Hathaway, J., & Barbir, K. (2014). *The Arab lands under Ottoman Rule: 1516–1800*. London: Routledge.

Hill, G. (1897). A journey to Petra. *Quarterly Statement of the Palestine Exploration Fund*, *29*, 34–44.

Hillson, S. (1996). *Dental anthropology*. Cambridge: Cambridge University Press.

Hillson, S. (2005). *Teeth*. 2nd ed. Cambridge: Cambridge University Press.

Hofstetter, T. (2017). *Bioanthropological assessment and investigation of funerary treatment in human bone remains from Khirbat al-Dusaq* (*Southern Jordan*). Unpublished field report.

Hofstetter, T. (2018). *Étude bioanthropologique et analyse du traitement funéraire des restes osseux humains exhumés à Khirbat al-Dūsaq* (*Jordanie*). Unpublished field report.

Imbert, F., & Vigouroux, É. (2020). Les inscriptions ayyoubides de Khirbat al-Dusaq: Histoire d'un puzzle épigraphique. *Bulletin d'Études Orientales*, *LXVII*(2018–2019), 111–131.

INFORCE (2007). *International Forensic Center of Excellence*. http://www.inforce.org.uk.

Joudah, A. H. (1987). *Revolt in Palestine in the eighteenth century: The era of Shaykh Zahir Al-'Umar*. Malvern: Kingston Press.

Kanz, F., & Grossschmidt, K. (2006). Head injuries of Roman gladiators. *Forensic Science International*, *160*(2–3), 207–216. doi: 10.1016/j.forsciint.2005.10.010.

Kemp, W. L. (2016). Postmortem change and its effect on evaluation of fractures. *Academy of Forensic Pathology*, *6*(1), 28–44. doi: 10.23907/2016.004.

Khalaf, S. N. (1990). Settlement of violence in bedouin society. *Ethnology*, *29*(31), 225–242.

Khalaf, S. N. (2000). Shaykhs, peasants and party comrades: Political change in Northern Syria. In M. Mundy & B. Musallam (Eds.), *Transformation of nomadic society in the Arab East* (pp. 110–122). Cambridge: Cambridge University Press

Knüsel, C. J., & Robb, J. (2016). Funerary taphonomy: An overview of goals and methods. *Journal of Archaeological Science: Reports*, *10*, 655–673. doi: 10.1016/j.jasrep.2016.05.031.

Kressel, G. M., Bar-Zvi, S., & Abu-Rabia, A. (2012). The world of the dead as viewed among the Negev Bedouin. *Anthropology of the Middle East*, *7*(2), 57–70. doi: 10.3167/ame.2012.070205.

Lewis, J. E. (2008). Identifying sword marks on bone: Criteria for distinguishing between cut marks made by different classes of bladed weapons. *Journal of Archaeological Science*, *35*, 2001–2008. doi: 10.1016/j.jas.2008.01.016.

Marshall, A. T., & Crisp, A. J. (2000). Reflex sympathetic dystrophy. *Rheumatology*, *39*(7), 692–695. doi: 10.1093/rheumatology/39.7.692.

Martini, F. H., Timmons, M. J., & Tallitsch, R. B. (2015). *Human anatomy* (8th ed.). Boston: Pearson Press.

MacCardle, P., & Stojanovsky, E. (2018). Identifying differences between cut marks made on bone by a machete and Katana: A Pilot Study. *Journal of Forensic Sciences*, *63*(6), 1813–1818. doi: 10.1111/1556-4029.13754

McGregor, R. (2020). *Islam and the Devotional Object: Seeing Religion in Egypt and Syria*. New York: Cambridge University Press.

Meistermann, B. (1909). *Guide du Nil au Jourdain par le Sinaï et Pétra sur les traces d'Israël*. Paris: Alphonse Picard.

Minawi, M. (2015). Beyond rhetoric: Reassessing Bedouin-Ottoman relations along the route of the Hijaz telegraph line at the end of the nineteenth century. *Journal of the Economic and Social History of the Orient*, *58*, 75–104.

Miguelez, R. (1993). *L'émergence de la sociologie*. Ottawa: Presses de l'Université d'Ottawa.

Mikulski, R. N. R., Schutkowski, H., Smith, M. J., Doumet-Serhal, C., & Mitchell, P. D. (2021). Weapon injuries in the crusader mass graves from a thirteenth century attack on the port city of Sidon (Lebanon). *Plos One*, *16*(8), 1–17.

Mohan, H. (2010). *Jordanian tribal violence: Historical context and current problems*. Center for Strategic Studies (University of Jordan Papers) (pp. 1–12). https://www.files.ethz.ch/isn/139093/107.pdf

Moorrees, C. F. A., Fanning, E. A., & Hunt, E. E. (1963a). Age variation of formation stages for ten permanent teeth. *Journal of Dental Research*, *42*, 1490–1502. doi: 10.1177/00220345630420062701.

Moorrees, C. F. A., Fanning, E. A., & Hunt, E. E. (1963b). Formation and Resorption of Three Deciduous Teeth in Children. *American Journal of Physical Anthropology*, *21*, 205–213. doi: 10.1002/ajpa.1330210212.

Murail, P., Bruzek, J., Houët, F., & Cunha, E. (2005). DSP: Un outil de diagnose sexuelle probabiliste à partir des données métriques de l'os coxal. *Bulletins et Mémoires de la Société d'Anthropologie de Paris*, *17*(3–4), 167–176.

Murphy, D. D. (2008). The Arab Revolt*: 1916–18. Lawrence sets Arabia Ablaze*. London: Osprey Press.

Musil, A. (1928). *The Manners and Customs o f the Rwala Bedouins*. New York: Czech Academy of Sciences and Arts.

Mustafa, M. H., & Abu Tayeh, S. N. (2013). Comments on bedouin funeral rites in the writings of Western traverlers and explorers from the Late 19th and Early 20th centuries. *Mediterranean Archaeology and Archaeometry*, 14(1), 51–63. http://maajournal.com/Issues/2014/Vol14-1/Full5.pdf.

Ögel, B. (1948). Türk Kılıcının Menşe ve Tekâmülü Hakkında. *The Journal of the Faculty of Languages and History-Geography*, *6*(5), 431–460. http://dtcfdergisi.ankara.edu.tr/index.php/dtcf/article/view/2308

Olivier, G., & Pineau, H. (1960). Nouvelle détermination de la taille fœtal d'après les longueurs diaphysaires des os longs. *Année de Médicine Légale*, *40*, 141–144.

Olivier, G. (1969). *Practical anthropology*. Springfield: Charles C. Thomas.

Orhonlu, C. (1987). *Osmanlı İmparatorluğunda Aşiretlerin İskânı*. Istanbul: Eren Yayıncılık.

Özyüksel, M. (2014). *The Hejaz railway and the Ottoman Empire: Modernity, industrialisation and Ottoman decline*. London: I. B. Tauris.

Parmentier, S. (2010). *Une nouvelle méthode d'estimation du Nombre Minimum d'Individus* (*NMI*) *par une approche allométrique: Le NMI par exclusions. Applications aux series ostéologiques de la region Provence-Alpes-Côtes d'Azur* (Doctoral dissertation). Université de la Méditerranée, Aix-Marseille).

Peake, F. G. (1958). *A History of Jordan and its tribes*. Coral Gables: University of Miami Press.

Perry, M., Parker, K., & Montgomery, T. R. (2015). An early Islamic Homicide at Qasr Hallabat, Jordan. *Near Eastern Archaeology*, *78*(4), 274–284.

Peters, F. E. (1994). *The Hajj: The muslim pilgrimage to Mecca and the Holy places*. Princeton: Princeton University Press.

Petersen, A. (2012). *The Medieval and Ottoman Hajj Route in Jordan: An archaeological and historical study* (*Levant supplementary series*). Oxford: Oxbow Books.

Petersen, A. (2013). The archaeology of death and burial in the Islamic world. In L. N. Stutz & S. Tarlow (Eds.), *The oxford handbook of the archaeology of death and burial* (pp. 824–878). Oxford: Oxford University Press.

Poplin, F. (1976). A propos du nombre de restes et du nombre d'individus dans les échantillons d'ossements. *Cahiers du Centre de Recherches Préhistoriques*, *5*, 61–74.

Poplin, F. (1981). Un problème d'ostéologie quantitative: Calcul d'effectif initial d'après appariements: Généralisation aux autres types de remontages et à d'autres matériels archéologiques. *ArchéoSciences – Revue d'Archéométrie*, *5*, 159–165.

Pringle, D. (1997). *Secular buildings in the crusader kingdom of Jerusalem: An archaeological Gazetteer*. Cambridge: Cambridge University Press.

Quatrehomme, G. (2015). *Anthropologie medico-légale*. Brussels: DeBoeck.

Rafek, A.-K. (1963). *The Province of Damascus From 1723 to 1783 with special reference to the Azm Pashas*. (Doctoral dissertation). University of London, London.
Roberts, C. & Manchester, K. (2007). *The Archaeology of Disease, Third Ed*. Ithaca: Cornell University Press.
Rogan, E. L. (1999). *Frontiers of the State in the Late Ottoman Empire, Transjordan, 1850–1921*. Cambridge: Cambridge University Press.
Rood, J. M. (2004). *Sacred law in the Holy city: The Khedival Challenge to the Ottomans as seen from Jerusalem*. Leiden, Boston: Brill Academic Publishing.
Salibi, K. (1998). *A modern history of Jordan*. London: Bloomsbury Academic Press.
Sato, T. (2014). *Sugar in the social life of medieval Islam*. Leiden–Boston: Brill Academic Publishing.
Schaefer, M., Black, S., & Scheuer, L. (2009). *Juvenile osteology: A laboratory and field manual* (p. 369). Amsterdam: Elsevier.
Scheuer, L., & Black, S. (2000). *Developmental Juvenile Osteology*. Amsterdam: Elsevier Academic Press.
Schmitt, A. (2001). *Variabilité de la senescence du squelette humain. Réflexions sur les indicateurs de l'âge au décès: À la recherche d'un outil performant*. (Doctoral dissertation). Université de Bordeaux, Bordeaux.
Schmitt, A. (2005). Une nouvelle méthode pour estimer l'âge au décès des adultes à partir de la surface sacro-pelvienne iliaque. *Bulletins et Mémoires de la Société d'Anthropologie de Paris, Nouvelle Série*, *17*(1–2), 89–101.
Schour, I., & Massler, M. (1941). The development of the human dentition. *Journal of the American Dental Association*, *28*, 1153–1160.
Schultz, B. (2006). The qumran cemetery: 150 years of research. *Dead Sea Discoveries*, *13*(2), 194–228.
Schwarz, J. H. (2007). *Skeleton keys: An introduction to human skeletal morphology* (2nd ed.). Oxford: Oxford University Press.
Sellier, P. (2012). Tous les morts? Regroupement et sélection des inhumés: Les deux pôles du "recrutement funéraire". In D. Castex, P. Courtaud, H. Duday, F. Le Mort, & A.-M. Tillier (Eds.), *Le regroupement des morts: Genèse et diversité archéologique* (pp. 83–94). Bordeaux: Maison des Sciences de l'Homme d'Aquitaine.
Shafir, N. (2020). *In an Ottoman Holy land: The Hajj and the road from Damascus, 1500–1800*. History of Religions, 60(1), 1–36.
Shahid, I. (1995). *Byzantium and the Arabs in the sixth century*. Washington, DC: Dumbarton Oaks.
Sharkey, H. J. (2017). *A history of muslims, christians and jews in the Middle East*. Cambridge: Cambridge University Press.
Shqairat, M. (2020). Facilities along the Syrian Hajj Route in Southern Jordan with special reference to the Fort of Fassou'ah and its water system. *Mediterranean Journal of Social Sciences*, *11*(2), 101–115. doi: 10.36941/mjss-2020-0023.
Sołtysiak, A. (2021). Towards a historical bioarchaeology: The use of textual sources in research on human remains from the Near East and Eastern Mediterranean. *Journal of Archaeological Science: Reports*, *38*, 1–15. doi: 10.1016/j.jasrep.2021.103006.
Sorg, M. H., & Haglund, W. D. (1997). *Forensic taphonomy: The postmortem fate of human remains*. Boca Raton: CRC Press.
Srigyan, M., Bólivar, H., Ureña, I., Santana, J., Petersen, A., Iriarte, E., … Valdiosera, C. (2020). Bioarchaeological analysis of one of the earliest Islamic burials in the levant. *BioRxiv*, *2020*, 1–26. doi: 10.1101/2020.09.03.281261.
Trotter, M. (1970). Estimation of stature from intact long limb bones. In T. D. Stewart (Ed.), *Personal identification in mass disasters* (pp. 71–83). Washington D.C: National Museum of Natural History, Smithsonian Institution,
Tumler, D., Paladin, A., & Zink, A. (2019). Perimortem sharp force trauma in an individual from the early medieval cemetery of Säben-Sabiona in South Tyrol, Italy. *International Journal of Paleopathology*, *27*, 46–55. doi: 10.1016/j.ijpp.2019.07.005.
Vachirawongsakorn, V., Painter, J., & Márquez-Grant, N. (2021). Knife cut marks inflicted by different blade types and the changes induced by heat: A dimensional and morphologcial study. *International Journal of Legal Medicine*, *136*, 29–342. doi: 10.1007/s00414-021-02726-5.
Vailhé, S. (1898). Voyage à Pétra. *Échos d'Orient: Revue Bimestrielle D'histoire, de Géographie et de Liturgies Orientales*, *1*, 3–11.
Van der Steen, E. (2014). *Near eastern tribal societies during the ninetheenth century: Econonmy, society and politics between tent and town*. London: Routledge.
Vazzana, A., Traversari, M., Scalise, L. M., Figus, C., Apicella, S. A., Buti, L., … Benazzi, S. (2018). A multianalytic investigation of weapon-related injuries in a late antiquity Necropolis, Mutina, Italy. *Journal of Archaeological Science: Reports*, *17*, 550–559. doi: 10.1016/j.jasrep.2017.12.009.
Vigouroux, É., Elter, R., Pascual, J.-P., & March, C. (2015). Le complexe médiéval de Khirbat al-Dusaq (Shawbak). *Syria*, *92*, 189–221.
Vigouroux, É., & Elter, R. (2019). The medieval Hammām of Khirbat ad-Dawsaq: An archaeological and historical investigation. *Studies in the History and Archaeology of Jordan*, *2019*, 243–256.
Walker, B. J. (2001a). The Late Ottoman cemetery in field L, Tall Hisban. *Bulletin of the American Schools of Oriental Research*, *322*, 47–65. doi: 10.2307/1357516.
Walker, P. L. (2001b). A bioarchaeological perspective on the history of violence. *Annual Review of Anthropology*, *30*, 573–596. doi: 10.1146/annurev.anthro.30.1.573.
Wallduck, R., & Bello, S. M. (2016). Cutting decaying bodies: Micro-morphometric analysis of cut-marks on Mesolithic-Neolithic human remains from Lepenski Vir and Vlasac, Serbia. *Journal of Archaeological Science: Reports*, *2016*, 1–12.doi: 10.1016/j.jasrep.2016.06.036.
Zammit, J. (2003). Pratiques mortuaires et traitement du cadavre ancien (plaidoyer pour une nécro-archéologie). *Revue Archéologique de Picardie*, *21*, 185–194.