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Revisiting the Middle Neolithic cremated remains from a unique crypt from Stein, the Netherlands

Barbara VESELKA

Abstract

Excavations in the 60s yielded a unique Middle Neolithic crypt in Stein, containing over 30 kg of burnt human bone. New osteoarchaeological analysis showed the remains to belong to at least 42 individuals, consisting of all age groups and both sexes, and the relatively large number of individuals suggested the repetitive use of the crypt. The total weight of the cremation deposit indicated that not all the cremated bone material from each individual was buried in the crypt, and the two bone concentrations on the crypt floor combined with the relatively large proportion of cranial fragments suggested selective deposition was practiced. This study has shown the value of revisiting cremated skeletal collections that were excavated and partially analysed in the 60s and yielded new insights in the Middle Neolithic burial practice in the Netherlands.

Keywords: cremation, Middle Neolithic, stone crypt, selective deposition.

Résumé

À Stein (Pays-Bas), des fouilles menées dans les années 1960 ont livré une chambre funéraire exceptionnelle du Néolithique moyen, composée de plus de 30 kg d'ossements humains calcinés. De récentes analyses anthropologiques ont montré que ces restes étaient composés d'au moins 42 individus, de sexe masculin et féminin et de différentes classes d'âge. Le nombre relativement important d'individus suggère un usage répété de la chambre. Le poids total des os indique que les individus ont été enterrés de façon partielle. Les deux concentrations d'ossements sur le sol de la chambre et le nombre important de fragments crâniaux suggèrent également un dépôt sélectif rituel. Cet examen a démontré l'intérêt de la ré-étude de collections archéologiques anciennement fouillées et a permis d'apporter de nouvelles informations sur les pratiques funéraires du Néolithique moyen des Pays-Bas.

Mots-clés : crémation, Néolithique moyen, chambre funéraire, dépôt sélectif.

1. Introduction

During an excavation campaign in 1963 around Stein, the Netherlands (see Figure 1), an unusual feature was encountered. A relatively large megalithic crypt floor was discovered with a relatively large amount of burnt human bone fragments, divided in two concentrations as can observed on the field drawing from Modderman (VERHART & AMKREUTZ, 2017) on Figure 2. Based on the typology of the grave goods, such as bone arrowheads and a collar neck bottle, the grave was classified as Robenhausien, which dates to the Middle Neolithic (BECKERS & BECKERS, 1940). In 2001, radiocarbon dating confirmed a Middle Neolithic date of 3425 – 3325 BC (HENDRIX, 2001).

Fig. 1 - Map of the Netherlands with the location of Stein.

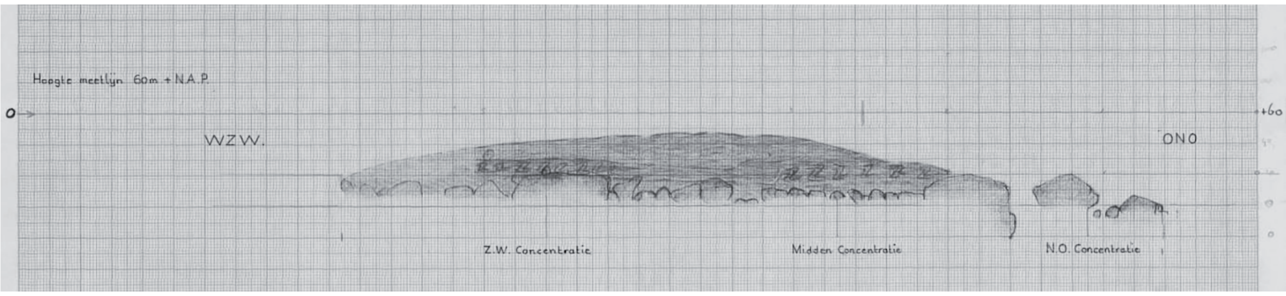

Fig. 2 - Location of the two cremated bone concentrations (see hatched patches) on the stone crypt floor (VERHART & AMKREUTZ, 2017).

Unfortunately, the cremated bone material was collected as a whole, thus, hindering the analysis of the separate concentrations. One of the concentrations was reported to contain a relatively large amount of cranial fragments (VERHART & AMKREUTZ, 2017). Only a small part of the actual remains (about 4 kg) were sent to Leiden University and analysed, including long bones, parts of the axial skeleton, and cranial fragments (MAAT, 1979). It is unclear why only a small amount of bone fragments was sent in for analysis, but in 2017, the Stein burial chamber and all the finds were re-evaluated.

The aim of this paper is to investigate the full amount of the burnt human remains. Results of the macroscopic osteoarchaeological analysis will aid in the reconstruction of the burial ritual that was applied in the unique crypt of Middle Neolithic Stein.

2. Materials and Methods

The original crypt floor was preserved and is currently visible in its reconstructed state in the Museum voor Grafcultuur in Stein. Figure 3 shows the reconstructed crypt.

A total of 33.5 kg of cremated human remains were analysed. The remains were sieved dividing the cremated bone into three fractions: 10+ mm, 3–10 mm, and < 3 mm. The total weight was noted, consisting of the weights of the large fraction (10+ mm) and the small fraction (3–10 mm). The residue, < 3 mm, was briefly checked, but since this fraction consist mostly of soil and stones, the weight of this fraction is not part of the total weight of the cremation deposit. The total weight can provide information on the completeness of the interred individual(s). The weight of the fractions can provide information on the degree of fragmentation, which may improve our understanding of taphonomic degradation and other processes affecting the quality of the burnt fragments. After sieving, the fragments were divided into categories, as presented in Table 1.

In this stage, animal bone was separated from human bone, based on differences in morphology (HILLIER & BELL, 2007). If the fragments are too small, it is not possible to make the distinction between human and animal bone macroscopically, implying that the category 'Indeterminate' may still contain animal bone fragments.

Fig. 3 - Reconstructed original crypt floor (photo : Museum voor Grafcultuur).

Skeletal category		*Bone fragments*
Cranium	Neurocranium	Frontal, Parietal, Temporal, Sphenoid, Ethmoid, Occipital
	Viscerocranium	Zygomatic, Maxilla, Mandibula, Vomer, Hyoid, Teeth
Axial skeleton		Clavicles, Scapulae, Vertebrae, Ribs, Os Coxae
Extremities	Diaphyses	Upper and lower limb bones, small skeletal elements, including patella and bones from hands and feet
	Epiphyses	Upper and lower epiphyses
Indeterminate		All fragments that could not be determined

Tab. 1 - Skeletal categories.

Dividing the bone fragments into skeletal categories will provide information on the proportion of the various skeletal parts. Combined with the total weight, this may aid in the assessment of the completeness of the individuals that were buried in the crypt. In this phase of the analysis, the Most Likely Number of Individuals (MLNI) is determined. The presence of multiple unique skeletal elements, such as the dens axis or the left or right petrous part, provides information on the number of individuals buried together. An additional way to determine the MLNI can be the assessment of differences in bone robusticity, enabling the distinction between adult and nonadult bones.

The combustion degree was assessed macroscopically by considering several variables: colour, texture, fracture, and deformation. Figure 4 provides an overview of combustion degrees with estimated temperatures, and changes in colour and texture. This is an approximated indication, since especially colour may be influenced by other factors, such as the amount of oxygen available or the soil in which the cremated remains were buried.

The overall degree of combustion was noted as well as the degree of combustion for each skeletal category. This way, the homogeneity of the burning process can be determined, which may provide information on other aspects of the cremation process, such as the position of the body on the pyre.

The cremation process alters the bone, making it difficult to assess all features used for age-at-death and sex estimation in burnt human bone. Generally, the same methods are used for aging and sexing cremated individuals as inhumed

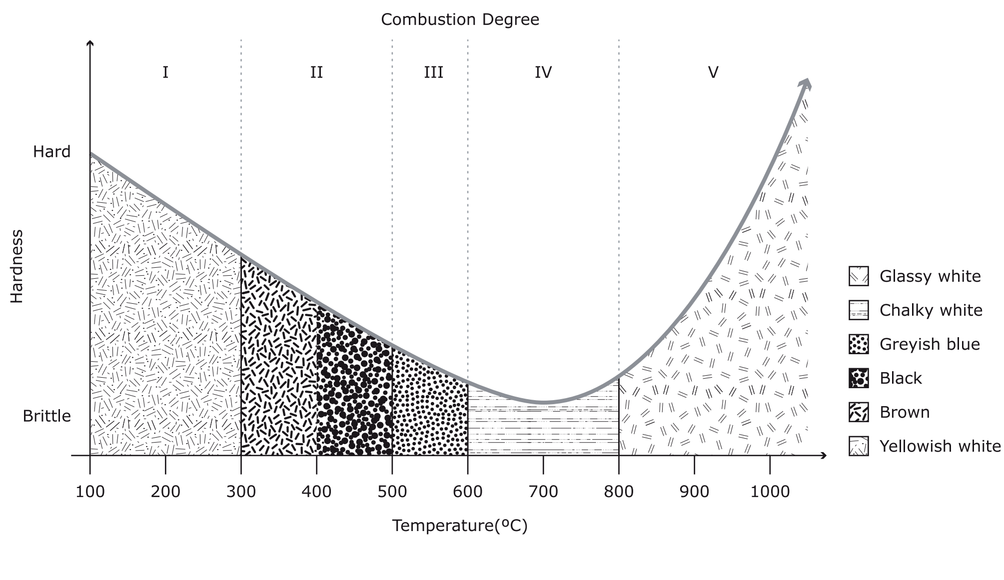

Fig. 4 - Combustion degree (Veselka, 2018).

individuals, although age ranges become broader since not all features needed for these estimations may be observable. Age-at-death in nonadults was estimated using a combination of several methods: dental development of deciduous teeth (DEMIRJIAN, GOLDSTEIN & TANNER, 1973), dental development of permanent teeth (GUSTAFSON & KOCH, 1974), and dental measurements (LIVERSIDGE, HERDEG & RÖSING, 1998). If the nonadult teeth were unobservable, age was estimated by measuring various cranial parts (FAZEKAS & KOSA, 1978), and assessing the stage of long-bone epiphyseal fusion (SCHAEFER, BLACK & SCHEUER, 2009). Nonadults were assigned to following age categories: < 0 year, 0–6 years, 7–15 years, 15+ years, and 15–18 years. If a narrower age range could not be applied, the category 'nonadult' was used.

Adult age-at-death was estimated by combining several methods: assessing changes to the pubic symphysis (BROOKS & SUCHEY, 1990), and auricular surface (BUCKBERRY & CHAMBERLAIN, 2002), and evaluating the degree of cranial suture closure (MEINDL & LOVEJOY, 1985). As stated before, the cremation process may alter the morphology of skeletal fragments. Therefore, also the adults were assigned to broader age categories, and either one of the following age categories were applied: 18+ years, 19–40 years, 22+ years, 25+ years, and 40+ years. If age could not be assessed, the category 'Indeterminate' was used.

Only sex of adult individuals was estimated, since the current macroscopic methods for nonadult sex information do not provide sufficiently accurate results (LEWIS, 2007). The sex of adult individuals was estimated using methods outlined in the Workshop of European Anthropologists (WEA, 1980). In addition, the Phenice (PHENICE, 1969) traits of the os pubis were assessed, and metric measurements were taken, if present, from the mandible, dens axis, humerus, radius, lunate, femur, and patella (GONÇALVES, 2011; CAVAZZUTI *et al.*, 2019). Individuals were assigned to the following categories: Female (F), Probable Female (PF), Probable Male (PM) and Male (M). Adult individuals whose sex could not be determined were assigned to the category 'Indeterminate (I)'.

All bone fragments were assessed for pathological anomalies that may occur in the skeleton. Descriptions were based on the standard works (see AUFDERHEIDE & RODRIQUEZ-MARTIN, 1998; ORTNER, 2003; WALDRON, 2009).

3. RESULTS

Weight

Table 2 provides an overview of the weights of each skeletal category in grams and in percentage of the total weight. The last column shows the weight of nonadult remains. It was not possible to distinguish all nonadult fragments, therefore, no percentage for the nonadult remains is provided. The MLNI was 42, which was based on 36 right adult and 6 left nonadult petrous parts.

Combustion degree

Most fragments were fully calcined, which is usually attributed to relatively high temperatures and sufficient oxygen. Some parts, such as cranial fragments and diaphyses, seem to have been less well burned, visible as greyish and black coloured bone. It was not possible to

Skeletal category	*Weight (g)*	*Percentage of total weight (%)*	*Of which nonadult weight (g)*
Cranium	8888.5	26.6	286.9
Axial skeleton	4115.1	12.3	493.9
Extremities	12990.3	38.8	494.0
Indeterminate	7463.9	22.3	
Total	*33457.8*	*100.0*	*1360.7*

Tab. 2 - Overview of weight per skeletal category in grams and percentages, and the weight of nonadult remains.

determine if all the darker coloured fragments belonged to the same individual or to determine if less well burned bone was related to sex or age. Future analysis with more recently developed techniques that evaluate the crystallographic structure of bone due to temperature, such as X-ray powder diffraction or Fourier transform infrared spectroscopy FTIR, may improve our understanding of the cremation temperature (Greiner *et al.,* 2018).

Animal bone was observed among the human burnt remains, such calcined bone from middle-sized mammals and fish bone, and arrowheads made of unidentifiable animal bone. Due to financial and time constraints, it was not possible to fully analyse all the animal remains. The animal bone material displayed a similar combustion degree as the human bone, which may be indicative of burning the animal remains together with the human remains. The arrowheads (made from animal bone) that were included as grave goods (Modderman, 1964) were not fully calcined, indicative of being burned at lower temperatures.

Age estimation

Estimating age is preferably based on the combination of several skeletal fragments. However, the cremation deposit from Stein consists of at least 42 commingled individuals, which impairs combining several skeletal fragments per individual. Table 3 provides an overview of age estimations based on specific skeletal elements and the minimum number of individuals (MNI) that were observed with this element. Considering the number of nonadult petrous parts (n = 6), the remains of at least six nonadults were buried at Stein.

<table>
<tr><th>Age</th><th>Skeletal element</th><th>Stage/size</th><th>MNI</th></tr>
<tr><td>16-18 wks in utero</td><td>Zygomatic</td><td>12.8 mm breadth, 10.5 mm length</td><td>1</td></tr>
<tr><td>26-28 wks in utero</td><td>Pars petrosa</td><td>20.8 mm length and 20.2 mm lenght</td><td>2</td></tr>
<tr><td>Perinate</td><td>Molar 5.5</td><td>Crown ¼</td><td>1</td></tr>
<tr><td rowspan="3">≥ 2 months</td><td>Incisor 6.1</td><td>Length 5.93 mm</td><td rowspan="3">3</td></tr>
<tr><td>Molar 6.4</td><td>Crown ¼</td></tr>
<tr><td>Molar 5.4</td><td>Crown ¼</td></tr>
<tr><td rowspan="2">≥ 3 months</td><td>Incisor 5.2</td><td>Apex complete</td><td rowspan="2">2</td></tr>
<tr><td>Incisor 5.3/6.3</td><td>Crown ¼, Crown ½</td></tr>
<tr><td>≥ 4 months</td><td></td><td>Crown ¼, Crown ½</td><td>1</td></tr>
<tr><td>≥ 6 months</td><td>Mandibular molar</td><td>Crown complete</td><td>1</td></tr>
<tr><td>≥ 9 months</td><td>Incisor 6.2</td><td>Length 4.31 mm</td><td>1</td></tr>
<tr><td rowspan="2">≥ 2 years</td><td>Mandibular molar</td><td>Crown complete</td><td rowspan="2">2</td></tr>
<tr><td>Incisor 5.3/6.3</td><td>Apex open</td></tr>
<tr><td rowspan="2">≥ 3.5 years</td><td>Mandibular premolar</td><td>Crown ½</td><td rowspan="2">2</td></tr>
<tr><td>Incisor 5.3/6.3</td><td>Apex closed</td></tr>
<tr><td>< 4.5 years</td><td>Incisor 1.2/2.2</td><td>Crown ¾</td><td>1</td></tr>
<tr><td>≥ 4.5 years</td><td>Incisor 2.1</td><td>Crown complete</td><td>1</td></tr>
<tr><td>< 25 years</td><td>Sternal clavicle end</td><td>Unfused</td><td>3</td></tr>
<tr><td>< 40 years</td><td>Auricular surface</td><td>Sharp and smooth</td><td>3</td></tr>
<tr><td>15+ years</td><td>Various epiphyses</td><td>Fused</td><td>4</td></tr>
<tr><td>17+ years</td><td>Various epiphyses</td><td>Fused</td><td>6</td></tr>
<tr><td>18+ years</td><td>Cranial sutures</td><td>Partially fused</td><td>1</td></tr>
<tr><td>22+ years</td><td>Iliac crest</td><td>Fused</td><td>1</td></tr>
<tr><td>23+ years</td><td>Ischial tuberosity</td><td>Fused</td><td>1</td></tr>
</table>

Tab. 3 - Observed ages with attributed elements and the stage or size.

Sex estimation

Sex estimation is also performed by combining as many sexually dimorphic elements as possible. In the case of Stein, it was not possible to combine the elements. Instead, in Table 4 an overview is provided of all available elements that can be sexually dimorphic and the number of observable fragments. Based on the number of skeletal elements observed, the (partial) remains of at least five males and five females were buried in the crypt.

Pathologies

Several pathological anomalies were observed in some of the skeletal elements. A number of skeletal elements showed lesions that can be attributed to periods of malnutrition and/or disease. In the large fraction, 13 cranial fragments displayed diffuse porosity (MNI = 1), as displayed in Figure 5. This cribra cranii can result from various pathological conditions and/or inadequate diet, but the rounded edges of the pores are indicative of an inactive state of the lesion, suggesting the period of disease and/or malnutrition was overcome.

Two nonadults displayed porosity of the orbits (cribra orbitalia), as shown in Figure 6, another non-specific stress marker, which can also result from several pathological conditions and/or malnutrition. The lack of woven bone and the rounded edges of the pores suggest cribra orbitalia was not active at the time of death.

Two of the mandibles presented dental pathologies, such as ante mortem tooth loss and a dental abscess. Figure 7 shows a dental abscess in the process of healing at the right mandibular canine with porosity surrounding the abscess.

Three vertebrae (MNI = 1) displayed osteophyte formation and degenerative porosity of the articular facets that can be associated with osteoarthritis, a degeneration of

Skeletal element	*Characteristics*	*Sex*	*Number of elements*
Mastoid process	Broad and long	M	3
	Small and long Short and broad	PF	2
	Small and short	F	2
External occipital protuberance	Robust	M	1
	Smooth ridge	PM	1
Glabella	Flat and smooth	F	3
	Bulging	M	1
Supraorbital margin	Sharp and thin	F	2
	Rounded and thin	PF	2
	Rounded	PM	2
	Rounded and thick	M	2
Zygomatic	Broad and rugose	M	5
	Medium and rugose	PM	1
	Small and smooth	F	3
Mandible	Small chin, thin margin and large gonial angle	F	1
Mental eminence	Broad and robust	M	4
	Broad	PM	2
	Medium to small	PF	1
	Small	F	5
Ischial tuberosity	Thin and smooth	F	1

M = male, F = female, PM = probable male, PF = probable female.

Tab. 4 - Overview of sex estimates based on specific skeletal elements.

the synovial joints mostly due to age and/or activity (WALDRON, 2009). Other lesions in the vertebrae included Schmorl's nodes (SN), which was observed in four vertebrae (MNI = 1), and degenerative disc disease (DDD), observed in two vertebrae (MNI = 1). In both cases, the intervertebral disc is affected, whereby DDD generally results from older age, while SN are associated with an increase of pressure on the vertebral column, see Figure 8.

Fig. 5 - Cribra cranii of a parietal fragment.

4. Discussion and conclusion

The burial crypt of Stein is a unique funerary monument in the Netherlands dating to the Middle Neolithic (VERHART & AMKREUTZ, 2017). The total weight of the cremated humans remains was 33.5 kg. Considering that the MLNI was 42 (at least 36 adults and 6 nonadults), the

Fig. 6 - Cribra orbitalia in one of the orbits of a nonadult individual (see arrows).

Fig. 7 - Dental abscess with surrounding porosity.

Fig. 8 - Schmorl's nodes on lumbar vertebra.

adult bone material alone should have weighed at least 45 kg, since the total weight of an adult skeleton after cremation ranges from 1272 grams for a female skeleton to 3379 grams for a male skeleton (MCKINLEY, 1993; BASS & JANTZ, 2004; CHIRACHARIYAVEJ *et al.*, 2007; GONÇALVES *et al.*, 2013b). However, this is not the case in Middle Neolithic Stein, since the total weight of all 42 individuals was just 33.5 kg.

Post-depositional processes and taphonomic factors can influence the total weight of a cremation deposit. Generally, cremated remains that were buried in an urn have larger fragments than burnt skeletons interred without an urn. In the case of Stein, the cremated individuals were buried without an urn, but in a crypt. The cremated bone material was deposited in two separate concentrations on the stone crypt floor, separated by a thin layer of soil (see Fig. 2). Wooden walls and roof covered the floor, that must have largely shielded the cremated bones from taphonomic processes, even after the decay of the wood and filling in of the crypt with soil, and no signs of intrusion of the crypt were observed (see VERHART & AMKREUTZ, 2017: 39 for the model of the crypt). Other variables, such as choices in the collecting of the cremated fragments from the pyre, can further reduce the total weight. As shown in Table 2, all skeletal categories were represented, implying all types of skeletal fragments were collected. It is, however, not possible to determine if each skeletal element from each individual was collected or whether a specific preference in the collection of bone material existed, which may have been related to factors that are difficult to observe, such as social status or gender roles.

It is clear that the process of cremation and post-depositional degradation may destroy a portion of the skeleton, whereby, in general, bone with a large proportion of cortical bone (e.g. diaphyses and cranium) is more likely to survive than bone with a large proportion of trabecular bone (e.g. vertebrae and os coxa). The possibility exists that the process of deliberate selection and deposition also contributed to the difference in expected and excavated total weight of the cremation deposit. Some parts may be buried outside the grave hills on special locations (e.g. near rivers or on top of hills), some may be kept by family, kin and friends as a means to remember the deceased, and eventually the rest could be buried (REBAY-SALISBURY, 2010). With the 'pars pro toto' or token burial ritual, only a small amount of bone or even a single fragment is buried. It is commonly observed in many different cultures through time (FONTIJN *et al.*, 2013; GONÇALVES *et al.*, 2010; MILLAIRE, 2004; STRATOULI *et al.*, 2010; VESELKA & LEMMERS, 2014). It is possible that some form of deliberate selection of fragments was made in the collection of Stein before burying the remains.

McKinley (1989: 68) observed the following proportions in skeletal elements: cranium makes up for 18 %, axial parts for 23 %, and extremities for 59 % (upper limbs 23 %; lower limbs 36 %). Although these proportions are based on unburnt, dry bone skeletons, it provides a rough estimate of the proportions of these skeletal elements within cremation deposits. Considering the proportion of cremated bones attributed to each skeletal category in Stein (see Table 2), the weight of the cranial fragments is relatively larger than what would be expected, 26.6 % vs. the expected 18 %. This is a common finding, due to cranial fragments being relatively robust and easily identifiable. The percentage of axial elements is much lower than would be expected (12.3 % vs. 23 % respectively). Again, a common observation, because in general, these skeletal parts (e.g. vertebrae and os coxae) are more fragile than cranial fragments, and collection and movement as well as post-depositional stress are likely to cause more damage. Hence, some of the axial fragments may be too small to identify and may be part of the category 'Indeterminate'.

The extremities make up only 38.8 %, which should be around 59 %. Apart from the epiphyses, these skeletal elements generally withstand the cremation process well, although some of the fragments may be too small to identify and are part of the 'Indeterminate' category. However, the proportion of cranial fragments is still higher than what would be expected. In the study of Modderman (1964), two burnt bone concentrations were observed, one of them containing mostly cranial fragments. It is possible that the cranial parts of the individuals were deposited separately, but the relatively high percentage of the category "Cranium" suggests that relatively more cranial elements were deposited than other skeletal elements. The relatively high percentage of cranial elements, as mentioned by Modderman (1964) and the relatively low percentage of axial elements, and upper and lower extremities may suggest that the practice of selective deposition contributed to the difference in total weight of the cremated remains.

The large number of individuals seems to suggest that the crypt was used repeatedly, and throughout the years the remains of other deceased individuals were deposited. Due to its commingled nature, it is not possible to provide an estimate of the proportion of males vs. females, but the remains of at least five males and 5 females were buried in the crypt. The age estimates yielded ages-at-death from about 26-30 weeks in utero to 40+ years. The observed pathological anomalies are considered to be the most frequently observed.

Cribra cranii and cribra orbitalia are considered to be non-specific stress markers caused by a wide range of pathological conditions (e.g. malaria, vitamin D and iron deficiency) and/or periods of malnutrition. Especially the availability of foods may not have been stable during the Middle Neolithic, and likely contributed to the development of both types of stress markers. Since these lesions seem to have been inactive prior to death, health and/or diet of the affected individuals seems to have improved. Dental abscesses may have resulted from severe caries, whereby not only the tooth was infected but also the mandible causing ante mortem tooth loss. The pathological anomalies to the spine, osteoarthritis, DDD, and SN, are considered to be among the most commonly observed lesions in the human skeleton. Both osteoarthritis and DDD are generally considered to result from age, while SN are associated with increased pressure on the spinal column (WALDRON, 2009). However, not only age contributes to the development of osteoarthritis and DDD, also repetitive and strenuous activities may exacerbate the lesions. It is not possible to determine the proportion of influence age and activity had on the development of these lesions.

The unique site of Stein yielded over 30 kg of burnt human bone material consisting of all age groups and both sexes, suggesting a large variety of individuals being buried in the crypt. The two separate bone concentrations combined with the relatively large number of cranial fragments seems to imply selective deposition of cremated bone material was part of the funerary ritual. It is unclear how many years the crypt was being used, but the large number of individuals interred in this crypt indicates the repetitive use of the burial chamber. This study has demonstrated the value of osteoarchaeological analysis of the burnt human remains in understanding the burial rite practiced in Stein, and aids in our understanding of Middle Neolithic funerary rituals in the Netherlands.

Bibliography

AUFERHEIDE A. C. & RODRÍGEUZ-MARTÍN C., 1998. *The Cambridge Encyclopedia of Human Paleopathology*. Cambridge.

BASS W. M. M. & JANTZ R. L., 2004. Cremation weights in East Tennessee. *Journal of Forensic Sciences,* **49**: 901-904.

BECKER H. J. & BECKERS G. A. J., 1940. *Voorgeschiedenis van Zuid-Limburg*. Maastricht.

BLACK S. & SCHEUER L., 1996. Age changes in the clavicle: from the early neonatal period to skeletal maturity. *International Journal of Osteoarchaeology,* **6**: 425-434.

BROOKS S. & SUCHEY J. M., 1990. Skeletal age determination based on the os pubis: a comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods. *Human Evolution,* **5**: 227-238.

BUCKBERRY J. L. & CHAMBERLAIN A. T., 2002. Age estimation from the auricular surface of the ilium: a revised method. *American Journal of Physical Anthropology,* **119**: 231-239.

CAVAZUTTI C. BRESADOLA B. D'INNOCENZO C. INTERLANDO S. & SPERDUTI A., 2019. Towards a new osteometric method for sexing ancient cremated human remains. Analysis of Late Bronze Age and Iron Age samples from Italy with gendered grave goods. *PLoS ONE,* **14**: 1-21.

CHIRACHARIUAVEJ T., LIMBURANASOMBAT S. & TIENSEWAN M., 2007. The relationship between boen and ash weight to body weight and body length of Thai corpses in Bangkok and central part of Thailand after cremation. *Journal of the Medical Association of Thailand,* **90**: 1822-1877.

DEMIRJIAN A., GOLDSTEIN H. & TANNER J. M., 1973. A new system of dental age assessment. *Human Biology,* **45**: 211-227.

FAZEKAS I. G. & KÓSA F., 1978. *Forensic fetal osteology*. Akadémiai Kiadó. Budapest.

FONTIJN D., JANSEN R., VAN DER VAART S., FOKKENS H. & VAN WIJK I., 2013. Conclusion, the seventh mount of seven mounts - long-term history of the Zevenbergen barrow landscape. *In:* D. FONTIJN, S. VAN DER VAART, R. JANSEN, (eds), *Transformation through destruction: a monumental and extraordinary Early Iron Age Hallstatt C barrow from the ritual landscape of Oss-Zevenbergen*. Leiden: 303-312.

GONÇALVES D., 2011. The reliability of osteometric techniques for the sex determination of burned human skeletal remains. *HOMO* **62**: 351-358.

GONÇALVES D., CUNHA, E. & THOMPSON T. U., 2013b. Weight references of burned human skeletal remains from Portuguese samples. *Journal of Forensic Sciences,* **58**: 1134-1140.

GONÇALVES D., DUARTE C., COSTA C., MURALHA J., CAMPANACHO V., COSTA A. M. & ANGELUCCI D. E., 2010. The Roman cremation burials of Encosta de Sant'Ana (Lisbon). *Arqueologia,* **13**: 125-144.

GREINER M., KOCSIS B., HEINIG M. F., MAYER K., TONCALA A., GRUPE G. & SCHMAHL W. W. 2018. Experimental Cremation of Bone: Crystallite Size and Lattice Parameter Evolution. *In*: K. ENDO, T. KOGURE & H. NAGASAWA, *Biomineralisation, from molecular and nano-structural analyses to environmental science*, Springer Open: 31-38

GUSTAFSON G. & KOCH G., 1974. Age estimation up to 16 years of age base on dental development. *Odontologisk Revy,* **25**: 297-306.

HENDRIKX W. P. A. M., 2001. De Neolithische grafkelder van Stein. *Publications de la Société Historique et Archéologique dans de le Duché de Limbourg,* **136-137**: 327-352.

HILLIER M. L. & BELL L. S., 2007. Differentiating human bone from animal bone: a review of histological methods. *Journal of Forensic Sciences*, **52**: 249-163.

LEWIS M. E., 2007. *The Bioarchaeology of Children. Perspectives from biological and forensic anthropology*. New York.

LIVERSIDGE H.VM., HERDEG B., RÖSING F. W., 1998. Dental age estimation of non-adults. A review of methods and principles. *In*: K. W. ALT, RÖSING F. W. & M. TESCHLER-NICOLA (eds), *Dental Anthropology, Fundamentals, Limits and Prospects*, Springer, Vienna: 419-442.

MAAT G. J. R., 1979. *Onderzoek van crematieresten van een Neolithische grafkelder te Stein (Z.L.)*. Leiden.

MCKINLEY J. I., 1989. Cremations: expectations, methodologies, and realities. *In:* C. A. ROBERTS, F. LEE, J. BINTLIFF (eds), *Burial Archaeology, current research methods and developments, British Archaeological Reports, British series,* **211**: 65-76.

MCKINLEY J. I., 1993. Bone fragments size and weights of bone from modern British cremations and the implications for the interpretation of archaeological cremations. *International Journal of Osteoarchaeology,* **3**: 283-287.

MEINDL R.vS. & LOVEJOY C. O., 1985. Ectocranial suture closure: a revised method for the determination of skeletal age at death based upon the lateral-anterior sutures. *American Journal of Physical Anthropology,* **68**: 57-66.

MILLAIRE J. F., 2004. The manipulation of human remains in Moche Society: delayed burials, grave reopening, and secondary offerings of human bones on the Peruvian North Coast. *Society for American Archaeology,* **15**: 371-388.

MODDERMAN P. J. R., 1964. The Neolithic burial vault at Stein. *Analecta Praehistorica Leidensia,* **1**: 3-16.

ORTNER D. J., 2003. *Identification of pathological conditions in human skeletal remains*. New York.

PHENICE T. W., 1969. A newly developed visual methods of sexing the os pubis. *American Journal of Physical Anthropology,* **30**: 297-302.

REBAY-SALISBURY K., 2010. Cremations: fragmented bodies in the Bronze and Iron Ages. *In:* K. REBAY-SALISBURY, M. L. STIG SØRENSEN, J. HUGHES (eds), *Body parts and bodies whole changing relations and meanings*. Ofxord: 64-71.

SCHAEFER M., BLACK L. & SCHEUER S., 2009. Juvenile Osteology: A Laboratory and Field Manual. Academic Press: 384 p.

STRATOULI G., TRIANTAPHYLLOU S., BEKIARIS T. & KATSIKARIDIS N., 2010. The manipulation of death: a burial area at the Neolithic settlement of Aygi, NW Greece. *Documenta Praehistorica,* **XXXVII**: 95-104.

VERHART L. & AMKREUTZ L., 2017. *Een nieuwe blik op de grafkelder van Stein*. Stein.

VESELKA B., 2018. *Crematieresten Hoge Wal, fysische antropologische rapportage*. Leiden.

VESELKA B. & LEMMERS S. A. M., 2014. Deliberate selective deposition of Iron Age cremations from Oosterhout (prov. North-Brabant, the Netherlands): a 'pars pro toto' burial ritual. *LUNULA. Archaeologica protohistorica,* **XXII**: 151-158.

WALDRON T., 2009. *Palaeopathology*. New York.

WORKSHOP OF EUROPEAN ANTHROPOLOGISTS. 1980. Recommendations for age and sex diagnoses of skeletons. *Journal of Human Evolution,* **9**: 517-549.

Authors' addresses:

Barbara VESELKA
Vrije Universiteit Brussel
Department of Art, Sciences, and Archaeology
Maritime Cultures Research Institute, Belgium
Barbara.Veselka@vub.be